US005444184A

United States Patent [19]

Hassel

[11] Patent Number: 5,444,184

[45] Date of Patent: Aug. 22, 1995

[54] **METHOD AND CABLE FOR TRANSMITTING COMMUNICATION SIGNALS AND ELECTRICAL POWER BETWEEN TWO SPACED-APART LOCATIONS**

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[21] Appl. No.: **16,065**

[22] Filed: **Feb. 10, 1993**

[30] **Foreign Application Priority Data**

Feb. 12, 1992 [NO] Norway 920544

[51] **Int. Cl.**[6] **H01B 7/00**

[52] **U.S. Cl.** ..... **174/113 R**; 174/113 C; 174/121 A; 340/854.9; 379/90

[58] **Field of Search** ..... 174/113 R, 113 A, 113 C, 174/115, 116, 110 R, 261, 121 R, 121 A, 107, 121 SR; 379/90, 397; 307/11, 13, 14, 16–18, 21, 24, 28, 37, 42; 340/850, 854.9

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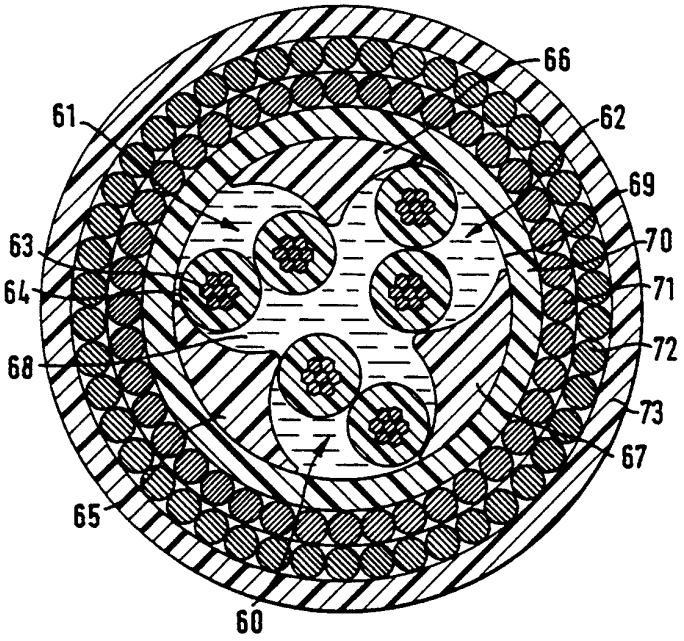
[57] **ABSTRACT**

This invention relates to a method for transmitting communication signals and electrical power on a cable between two spaced apart locations, for example between a land based control center and an offshore installation. The communication signals are transmitted over at least two twisted pairs The conductors of each twisted pair are connected in parallel to constitute a power conductor. The communication and power transmissions are separated by transformers. The invention also relates to a cable for performing the method. The cable includes at least two power conductors, each being constituted by one pair of twisted insulated conductors, enclosed within an insulation sheath and outer armor and corrosion protection.

12 Claims, 3 Drawing Sheets



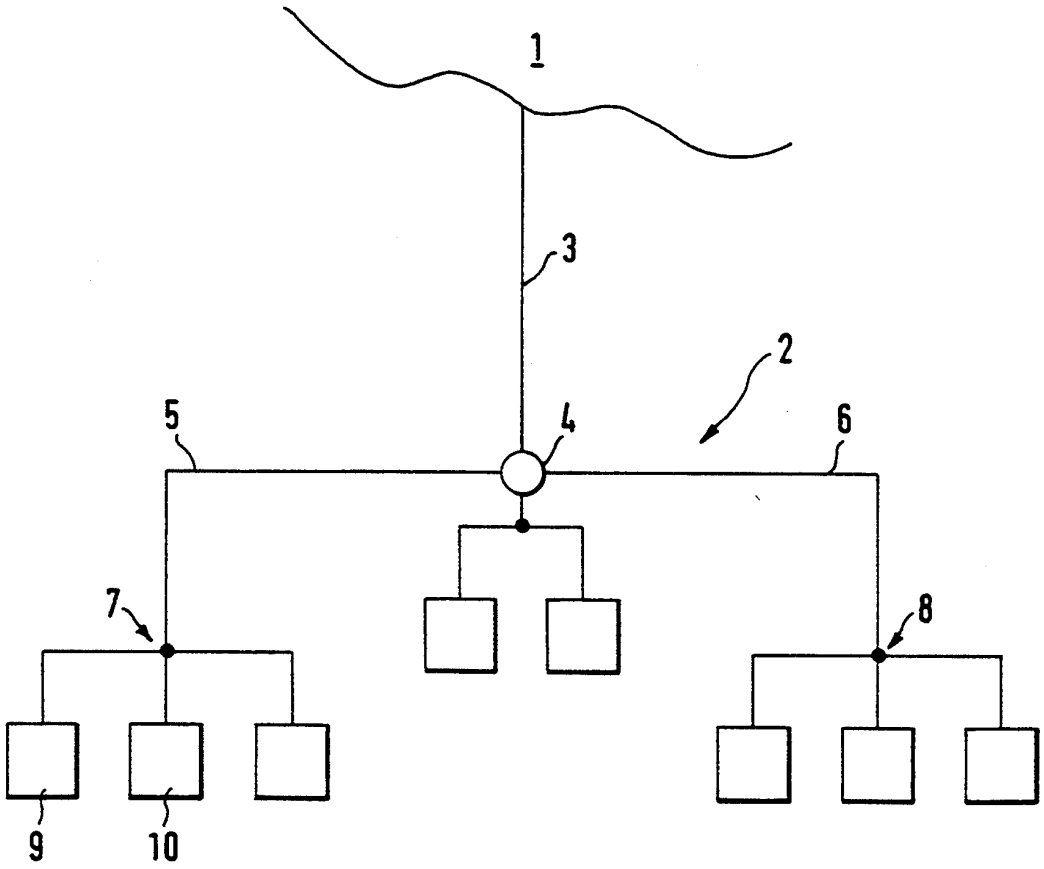


FIG. 1

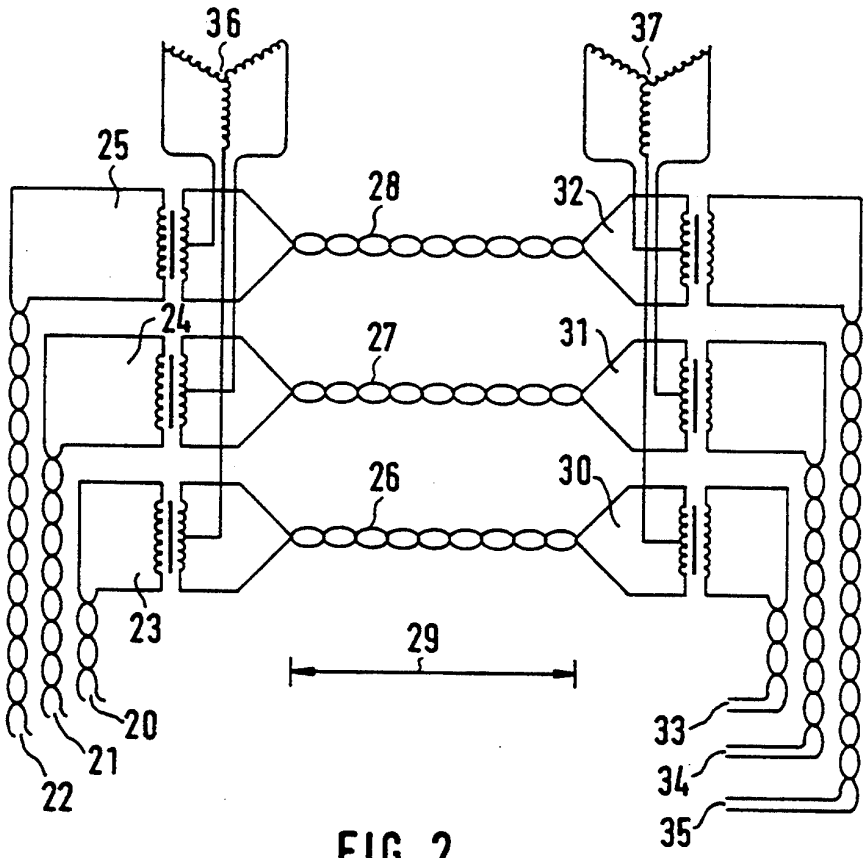


FIG. 2

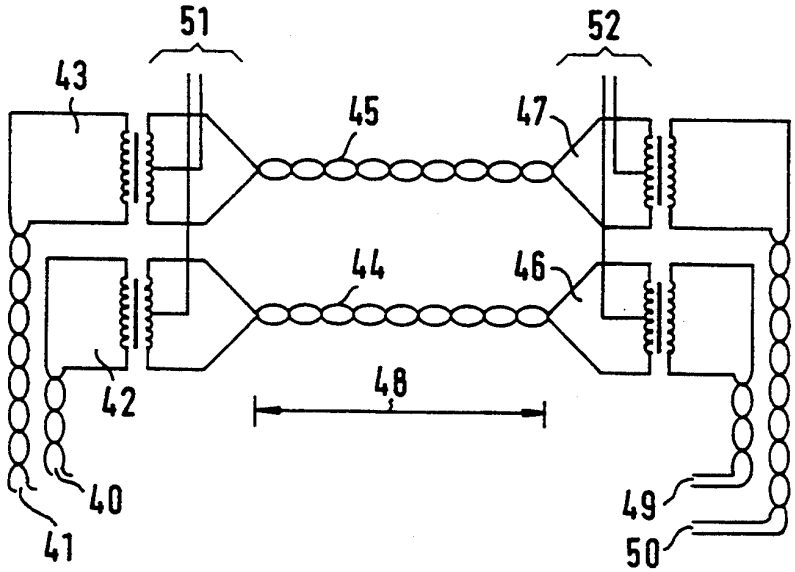


FIG. 3

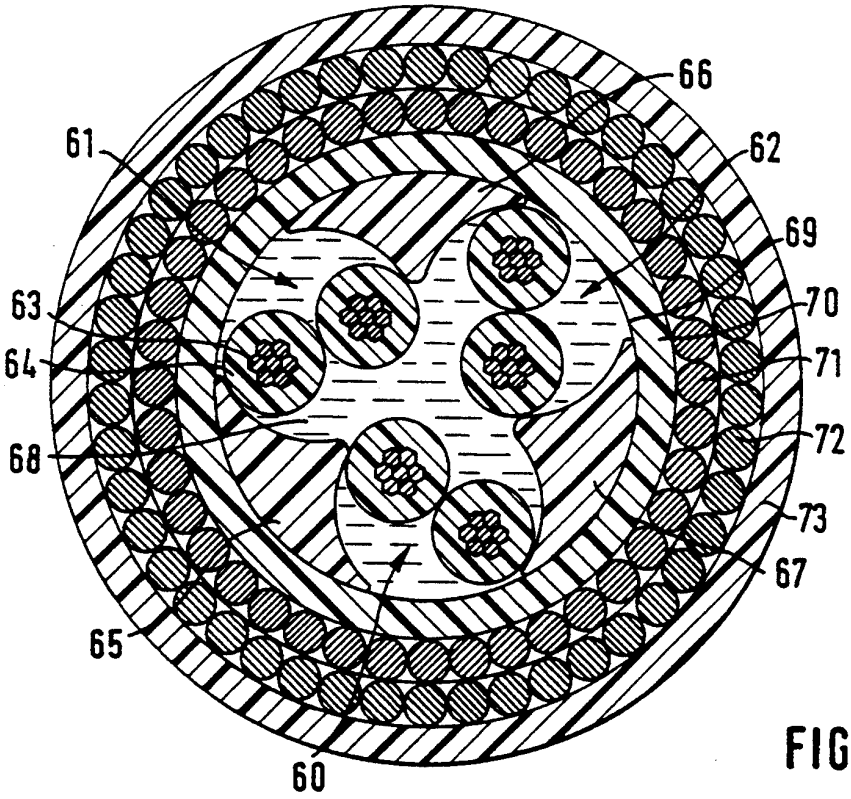


FIG. 4

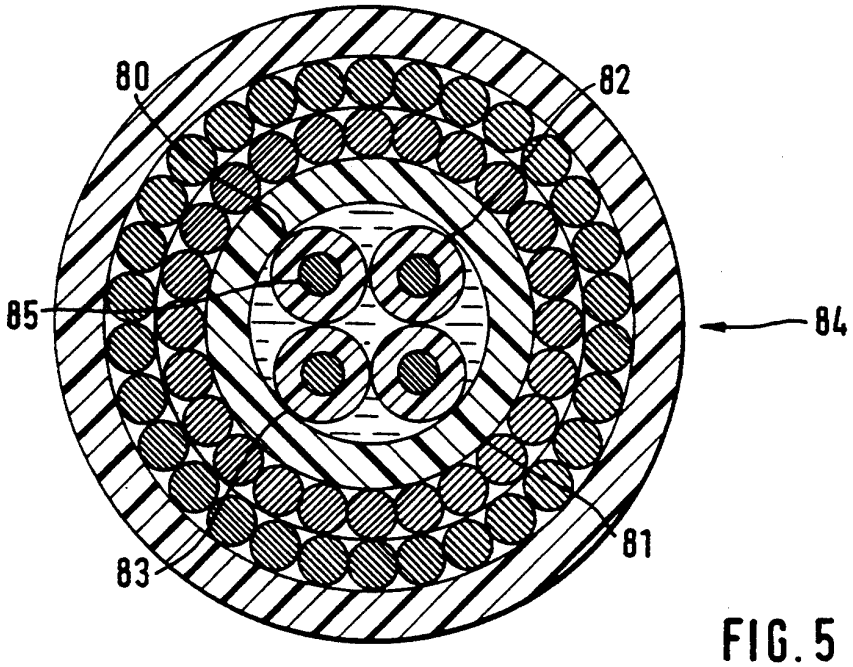


FIG. 5

METHOD AND CABLE FOR TRANSMITTING COMMUNICATION SIGNALS AND ELECTRICAL POWER BETWEEN TWO SPACED-APART LOCATIONS

The present invention relates to a method for transmitting communication signals and electrical power on a cable between two spaced apart locations, in particular from a land based control center or an offshore installation, to a subsea installation. The invention also relates to cables for performing the method.

DESCRIPTION OF RELATED ART

When new offshore oil and gas fields are developed, certain installations can be made subsea in order to avoid costly platform investments. It has been shown that well control can be performed over long distances.

SUMMARY OF THE INVENTION

The present invention is to provide a method for operating wellhead controls from a shore based control center to a subsea well system with a distance up to 170 km and more.

In connection with a particular field it seems feasible to arrange a manifold center approx 130 km from land. The different wells can be tied in to this manifold. The wells can be arranged in templates each having 3–5 wells. The distance from the manifold center can be 20–40 km.

It is estimated that each template will require electrical power in the order of 2 kW, and that a main cable leading from shore to the manifold should be capable of transferring power loads in the order of 20 kW. The basic load will be power supply for electronics. In addition, each template will have a local hydraulic supply which will be powered with electric motors. The electric motors will run only when the accumulator pressure falls below a preset value. This will cause variations in the actual power demand. The communication signal transmission rate should be minimum 1200 baud.

Basically we have tried to find a solution comprising a cable which can transmit both electrical power and electrical signals over the required distance. Signal transmission over very large distances combined with power transmission is, however, a very challenging task, and raises a number of questions.

Several systems have been studied for dealing with the above requirements, such as pure DC systems. An alternative solution is to use an AC cable with fiber optic signal transmission. Still another alternative was to superimpose communication signals on the power voltage. A better solution is however provided with the present invention.

According to the present invention, communication and electrical power are provided on a cable between two spaced-apart locations, wherein the communication signals are transmitted over at least two twisted pairs, the conductors of each twisted pair being connected in parallel to constitute a power conductor, and wherein the communication and power transmissions are separated by transformers.

In further accord with the present invention, the cable for transmitting the communication signals and electrical power between the two spaced-apart locations includes at least two power conductors, each being constituted by one pair of twisted insulated conductors, and closed within an insulation sheath and outer armour, and having corrosion protection.

In still further accord with the present invention, the cable comprises three paired power conductors for transmission of three-phase power, the three pairs being used for transmitting three communication channels.

In further accord with the present invention, each of the conductors of the cable is multi-stranded or solid annealed copper.

In still further accord with the present invention, the cable conductor insulation comprises thermoplastic polyethylene with a thickness required for transmission of the rated power voltage.

Further in accord with the present invention, the cable core is laid with insulating fillers filled with a filling compound, such as a petroleum jelly and wrapped with a polyester tape.

Further still in accord with the present invention, the armour comprises two layers of galvanized steel wires laid in opposite directions.

Experiments and studies have shown that the present invention provides for a method which solves the many questions raised. Neither the common mode signals nor the transformed power voltage need to be filtered or eliminated at the communication terminals. Transformers and electronics are used in order to achieve the simplest total system.

These and other objects, features and advantages of the present invention will become more apparent in light of the detailed description of a best mode embodiment thereof, as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates a typical field layout,
FIGS. **2** and **3** illustrate wiring diagrams, and
FIGS. **4** and **5** illustrate crossection of two cables.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. **1** is illustrated how a subsea field installation **1** is connected to a shore installation **2** via a cable **3**. The installation on shore is not shown. The cable **3** leads to a manifold center **4** from which cables **5** and **6** lead respectively to templates **7** and **8** having a number of wells **9**, **10** also.

The cables **3**, **5** and **6** shall as mentioned transmit electrical power as well as electrical control signals. The basic idea is to use three insulated twisted pairs as a three phase cable,—or two insulated pairs as a none phase cable. Each pair is connected in parallel for the power transmission, and each pair is used as a signal pair for signal transmission.

A wiring diagram for the three phase circuit is illustrated in FIG. **2**, the shore side being on the left side of the drawing, or vice versa. Three signalling pairs **20**, **21**, **22** are connected respectively to the low voltage side of transformers **23**, **24** and **25**. One of the pairs **20** may be used for transmitting signals to the offshore side on the right hand side of the drawing. A different pair **21** may be used for transmitting signals from a subsea installation to a shore installation, and the third pair **22** may be a spare pair. Alternatively, at least one of the pairs may be used for semi-duplex transmission of signals.

The transformed signals pass respectively over three twisted cable pairs **26**, **27** and **28** of a cable **29** to the high voltage side of a second set of transformers **30**, **31** and

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