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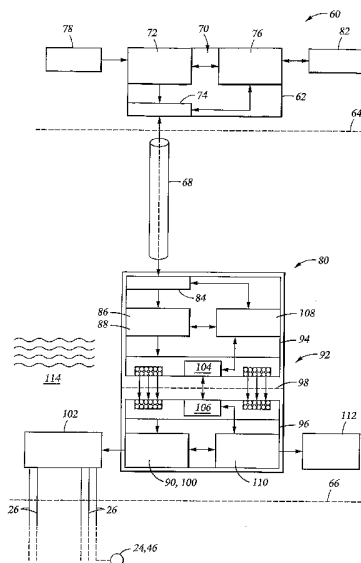
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRIC CONTROL AND SUPPLY SYSTEM



(57) Abstract: A system supplies electrical power to a remote electrical device. The system includes an AC/DC voltage converter coupled to the AC voltage source for converting an AC voltage from the AC voltage source to a high DC voltage output at a first location. The AC/DC voltage converter comprises a plurality of AC/DC voltage converter components which, on the input side thereof, are connected in parallel with the AC voltage source and which, on the output side thereof, are connected serially to an electric conductor. The electric conductor extends to a plurality of voltage converters at a remote location having inputs connected serially to the electrical conductor and having outputs providing an appropriate voltage to the electrical device.

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A. CLASSIFICATION OF SUBJECT MATTER IPC: H02J 1/10 (2006.01), 3/38 (2006.01); F16K 11/07 (2006.01), 31/04 (2006.01), 31/53 (2006.01) H02J 3/46 (2006.01) USPC: 307/82;251/129.11;137/625.68 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 307/82;251/129.11;137/625.68 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Related US and PCT application file wrappers Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) US-PGPUB, USPAT, USOCR, EPO, JPO, DERWENT, IBM_TDB		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 97/38479 A1 (POOLE et al) 16 October 1987 (16.10.1987), page 5, ln 10-17; page 7, ln 14-20; and figures 1-3	1-7 and 9
Y	US 6,385,057 (BARRON) 7 May 2002 (07.05.2002), col 2, ln 21-24; col 4, ln 6-8; col 7, ln 14-20; and Figures 1-3	1-4, 6, 7
Y	US 5,297,015 A (MIYAZAKI et al) 22 March 1994 (22.03.1994), col 6, ln 40-44; col 8, ln 1-6; and figures 1, 4A, 4B, 24, and 46	1-7 and 9
A	US 5,731,969 A (SMALL) 24 March 1998 (24.03.1998), see the whole document	1-7 and 9
X	US 5,301,096 A (KLONTZ et al) 05 April 1994 (05.04.1994), col 14, ln 48-51 and 56-59; col 20, ln 27-39 and 59-65; and figures 12, 14, and 17	11
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Y		6, 12, 18-26, 28-33 and 35-37
Y	US 2,387,800 A (LELAND et al) 30 October 1945 (30.10.1945), col 2, ln 11 - col 3, ln 46; col 4, ln 10-14; and figures 1 and 2	12 and 18-25
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents:		
"A"	document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"E"	earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed	
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Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of any additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

- Remark on Protest**
- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - ☐ No protest accompanied the payment of additional search fees.

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C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 6,095,487 A (WABER) 01 August 2000 (01.08.2000), col 1, ln 18-21	24-26 and 28-33
Y	FR 1,390,757 (SULZER FRERES SOCIETE ANONYME) 15 April 1964 (15.04.1964), see the whole document	18, 19, 26, 29, 30, and 33
Y	US 6,494,257 A (BARTLETT et al) 17 December 2002 (17.12.2002), col 9, ln 46-49; col 16, ln 33-34	20, 21, 31, and 32
Y	US 5,573,032 A (LENZ et al) 12 November 1996 (12.11.1996), col 10, ln 43-46; col 11, ln 20-22; and figure 9	22 and 23
Y	US 1,979,425 A (VAN DER WOUDE) 12 August 1931 (12.08.1931), page 1, ln 70 - page 2, ln 26 and figures 1-3	28 and 37
Y	US 3,738,183 (BALL JR. et al) 12 June 1983 (12.06.1983), col 1, ln 30-35 and col 5, ln 29-33	28 and 37
Y	DE 90 05 411 (MISSLING) 05 December 1990 (05.12.1990), pages 7-9 and figure 1	35
Y	US 4,436,280 (GEISOW) 13 March 1984 (13.03.1984), col 6, ln 24 - col 7, ln 4; col 9, ln 36-38; and figures 1-3	36

BOX III. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group I, claim(s) 1-7 and 9, drawn to electrical power transmission systems.

Group II, claim(s) 8 and 10, drawn to electrical communication systems.

Group III, claim(s) 11-34, drawn to an electrical device with an electric-starting motor.

Group IV, claim(s) 11, 35-37, and 44-54, drawn to a valve and valve actuation system with an electrical control system for controlling the valve actuator.

Group V, claim(s) 1 and 38, drawn to a hydraulic pump for operation of a subsurface valve.

Group VI, claim(s) 39-43, drawn to a subsea wellhead assembly.

The requirement of unity of invention referred to in PCT Rule 13.1 shall be fulfilled only when there is a technical relationship among those inventions involving one or more of the same or corresponding special technical features, where a "special technical feature" is on that defines a contribution which an invention, considered as a whole, makes over the prior art.

The claimed special technical features of invention I are AC/DC converters coupled to an AC voltage source, an electrical conductor, and DC/DC converters coupled to a load device. The claimed special technical features of invention II are data coupling devices coupled to the conductor or to the two controllers. The claimed special technical features of invention III are an electric motor, a rotating spindle, an actuator element, and an enclosure. The claimed special technical features of invention IV are a valve body, a longitudinal slide, an actuator, a connecting line connecting the longitudinal bore and the inlets or outlets, the inlet and outlet opening directly into another longitudinal bore in which the longitudinal slide may be displaced by the actuator, an adjusting element, a turning spindle, a drive device, and a transmission device. The claimed special technical features of invention V are a hydraulic pump and the electrical device being movably connected to the piston of the piston cylinder of the hydraulic pump. The special technical features of invention VI are a subsea tree and a plurality of electrically actuated actuators on the subsea tree. Inventions I-VI do not share any special technical features.

Inventions III-V lack unity a posteriori. The system of independent claim 11 is known in the prior art. The US patent of Klontz (5,301,096), drawn to a submersible contactless power delivery system, discloses, in Figures 1-3, a power control and supply system for underground electrical devices read on the claimed system, comprising: at least one voltage supply and control device (332) above sea level (see column 20, lines 27-34); a subsea cable (340) connecting the voltage supply and control device (332) with the electrical devices (314-316) (see column 20, lines 35-39 and 63-65); a control and actuating device (344) arranged in situ with the electrical devices (314-316) (see column 20, lines 59-65); and a connecting line connecting the control and actuating device (344) to the electrical devices (314-316) (see Figure 17); wherein the voltage supply and control device (332) comprises at least one AC/DC converter (38,338) and is adapted to produce a first DC voltage that is fed into the subsea cable (340) (see column 14, lines 48-51 and 56-59; column 20, lines 35-39; and Figures 12 and 17); and wherein the control and actuating device (344) comprises at least one DC/DC or DC/AC converter (44).

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for converting the DC voltage transmitted by the subsea cable (340) into a second voltage such that the second voltage can be transmitted to

the electrical devices (314-316) via the connecting line (see column 16, lines 14-17; column 20, lines 59-65; and Figures 14 and 17).