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(71) Applicant (for all designated States except US): **ABB TECHNOLOGY AG** [CH/CH]; Affolternstrasse 44, CH-8050 Zürich (CH).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **YOUNGER, Harold, R.** [US/US]; PO Box 474, Halifax, VA 24558 (US). **STRYKEN, Egil** [NO/NO]; Olleveien 5, 3057 Solbergelva (NO). **WALLUMROD, John** [NO/NO]; Thorshaugveien 20, 3090 Hof (NO).

(74) Agents: **SAMUELS, Steven, B.** et al.; Woodcock Washburn LLP, One Liberty Place, 46th Floor, Philadelphia, PA 19103 (US).

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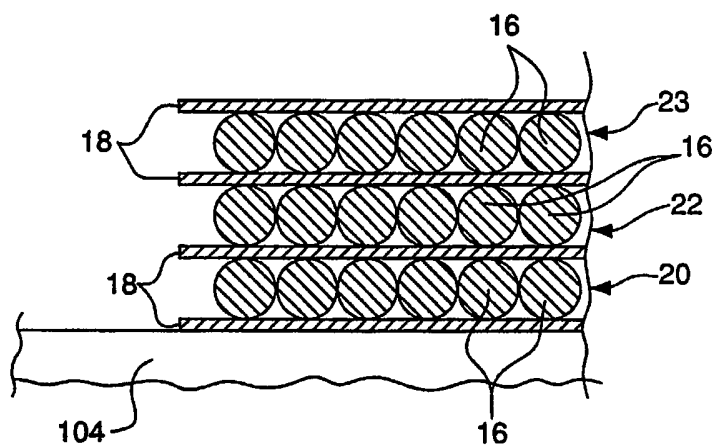
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(54) Title: THREE-PHASE TRANSFORMER



(57) Abstract: A preferred embodiment of a three-phase transformer (100) includes a first (104), a second (106), and a third winding leg (108), and a first, a second, and a third winding positioned around the respective first, second, and third winding legs. The first, second, and third windings (10) each includes an electrical conductor (16) wound into a plurality of overlapping layers each formed by a plurality of adjacent turns of the electrical conductor, and an insulating material (18) without end fill positioned between each of the overlapping layers. The electrical conductor has a transition portion formed therein between a first and



a second of the overlapping layers. The transition portion is at least one of bent to form an offset in the electrical conductor, and secured to at least one of the plurality of adjacent turns.

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/19830

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> IPC(7) : H01F 7/06; H01F 27/30 US CL : 29/602.1, 605, 606, 868; 336/182, 199, 221 According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) U.S. : 29/602.1, 605, 606, 868; 336/182, 199, 221 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 3,368,176 A (RECHEL) 6 February 1968 (06.02.1968), Figure 3 and column 2, lines 15-25.	1-3, 5-8
Y	US 4,521,954 A (RADEMAKER et al) 11 June 1985 (11.06.1985), column 19, lines 43-52.	1-3, 5-8
Y	JP 3-70109 (SONY CHEM COPR) 26 March 1991 (26.09.1991), see Abstract.	4
Y	US 3,504,431 A (GUILBAULT et al) 7 April 1970 (07.04.1970), column 6, lines 5-12.	9
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> 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		
Date of the actual completion of the international search 07 December 2005 (07.12.2005)	Date of mailing of the international search report <b>03 FEB 2006</b>	
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (571) 273-3201	Authorized officer  A. Dexter Tugbang Telephone No. 571-272-4380 	

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US04/19830

## 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.: 1-9
- 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.

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US04/19830

## 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) 1-9, drawn to a winding that includes covering a portion of the first layer of turns with a layer of insulating material without end fill.

Group II, claim(s) 10-16, drawn to bending a first portion of the electrical conductor upwardly and laterally in relation to the first layer of turns so that a second portion of the electrical conductor immediately following the first portion of the electrically conductor overlies the first layer of turns.

Group III, claim(s) 17-22, drawn to a transformer that includes an insulating material without end fill positioned between each of the overlapping layers.

The inventions listed as Groups I, II and III, each do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons.

Group I lacks the corresponding special technical features of: 1) bending a first portion of the electrical conductor upwardly and laterally in relation to the first layer of turns so that a second portion of the electrical conductor immediately following the first portion of the electrical conductor overlies the first layer of turns, as required by Group II; and 2) an insulating material without end fill positioned between each of the overlapping layers, as required by Group III.

Group II lacks the corresponding special technical features of: covering a portion of the first layer of turns with a layer of insulating material without end fill, as required by Group I; and 2) an insulating material without end fill positioned between each of the overlapping layers, as required by Group III.

Group III lacks the corresponding special technical features of: 1) bending a first portion of the electrical conductor upwardly and laterally in relation to the first layer of turns so that a second portion of the electrical conductor immediately following the first portion of the electrical conductor overlies the first layer of turns, as required by Group II; and covering a portion of the first layer of turns with a layer of insulating material without end fill, as required by Group I.