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**Datasheet for the decision
of 7 July 2017**

Case Number: T 2132/11 - 3.5.07

Application Number: 05819171.9

Publication Number: 1815600

IPC: H03M13/29

Language of the proceedings: EN

Title of invention:
Turbo-fountain code and its application for reliable wireless
broadcast

Applicant:
Siemens Aktiengesellschaft

Headword:
Turbo-fountain code/SIEMENS

Relevant legal provisions:
EPC Art. 123(2), 84

Keyword:
Amendments - added subject-matter (yes)
Claims - clarity (no)

Case Number: **T 2132/11 - 3.5.07**

D E C I S I O N
of Technical Board of Appeal 3.5.07
of 7 July 2017

Appellant: (Applicant)	Siemens Aktiengesellschaft Wittelsbacherplatz 2 80333 München (DE)
Representative:	Pezelj, Eduard Andrej Siemens AG Corporate Intellectual Property Postfach 22 16 34 80506 München (DE)

Decision under appeal:	**Decision of the Examining Division of the European Patent Office posted on 20 July 2011 refusing European patent application No. 05819171.9 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman	R. Moufang
Members:	M. Jaedicke
	P. San-Bento Furtado

Summary of Facts and Submissions

I.   The applicant (appellant) appealed against the decision
        of the Examining Division refusing European patent
        application No. 05819171.9, filed as international
        application PCT/EP2005/056102 and published as
        WO 2006/056559 A1.

II.   In the contested decision, the Examining Division held
        that the subject-matter of independent claims 1 and 5
        of the sole request filed with letter of 20 April 2011
        did not meet the requirements of Article 84 EPC.

III.   With the statement of grounds of appeal, the appellant
        maintained the sole request underlying the contested
        decision and requested that the decision be set
        aside and that the appeal fee be at least partly
        reimbursed.

IV.   In a communication under Article 15(1) RPBA
        accompanying a summons to oral proceedings, the Board
        inter alia expressed its provisional opinion that the
        subject-matter of claims 1 and 5 of the sole request
        was not clearly defined, lacked support and contained
        added subject-matter.

V.   With a letter dated 12 June 2017, the appellant
        informed the Board that it would not be attending the
        oral proceedings. No arguments concerning the Board's
        provisional opinion were submitted.

VI.   Oral proceedings were held as scheduled in the absence
        of the appellant. At the end of the oral proceedings,
        the chairman pronounced the Board's decision.

VII.   Claim 1 of the sole request reads as follows:

"Apparatus for encoding a finite sequence (u) of information symbols ($u_1,...,u_k$) into a potentially infinite sequence (c) of code symbols (c_1, c_2, c_3, ...) , consisting of
- at least one concatenated encoder, which consists of at least two component encoders and of at least one interleaver and
- at least one further interleaver,
whereby the interleavers form at least two interleaver branches and whereby the bits from each interleaver branch are mapped successively onto the sequence of code symbols."

Claim 5 reads as follows:

"Apparatus for decoding a potentially infinite sequence (c) of received code symbols (c_1, c_2, c_3,...) into a finite sequence (u) of information symbols ($u_1,...,u_k$), consisting of
- at least one concatenated decoder, which consists of at least two component decoders and of at least one interleaver, such as a parallel concatenated Turbo decoder, and
- at least one further interleaver,
whereby the interleavers form at least two interleaver branches and whereby the received code symbols are distributed to different branches inversly [*sic*] to the procedure at the output of the apparatus of the preceding claims."

The further claims are not relevant to the present decision.

VIII.   The appellant's arguments relevant to the decision are
         discussed in detail below.

Reasons for the Decision

Admissibility of the appeal

1.   The appeal complies with the provisions referred to in
         Rule 101 EPC and is therefore admissible.

The invention

2.   The application relates to reliable wireless
         broadcasting (see section I of the description of the
         published application). While many types of multimedia
         data tolerate residual errors to some extent, some data
         (for example, files containing executable software) has
         to be downloaded error-free (see page 1, lines 9
         to 15). For such error-free downloads via wireless
         broadcasts a channel code, denoted as fountain code,
         with potentially limitless redundancy (rateless code)
         was proposed.

3.   According to the application, practical approximations
         of a digital fountain have been obtained in the prior
         art by the introduction of LT-Codes and Raptor codes
         (see page 2, first paragraph). Fountain codes offer
         advantages such as allowing multiple receivers to
         recover from different loss patterns or enabling an
         asynchronous start of data reception among the
         receivers (see page 3, third paragraph).

4.   The application proposes as an alternative to the known
         approximations of a digital fountain a so-called turbo-
         fountain, which approximates a digital fountain by

applying turbo codes. The application describes two
different realisations of turbo-fountains (TF) in
section III, pages 6 to 11 and Figures 1 to 4: parallel
turbo codes (TF-A) and multiple turbo codes (TF-B).

Added subject-matter - Article 123(2) EPC

5.   Claim 1 is directed to an apparatus "for encoding a
        finite sequence (u) of information symbols $(u_1,...,u_k)$
        into a potentially infinite sequence (c) of code
        symbols $(c_1, c_2, c_3, ...)$". The apparatus consists of
        the following features as itemised by the Board:
        (a) at least one concatenated encoder, which consists
            of
            (i)   at least two component encoders and of
            (ii)   at least one interleaver and
        (b) at least one further interleaver,
        (c) whereby the interleavers form at least two
            interleaver branches and
        (d) whereby the bits from each interleaver branch are
            mapped successively onto the sequence of code
            symbols.

6.   The expression "at least one" means "one or more".
        Hence, in the Board's opinion, feature (b) specifies
        that the apparatus consists, in addition to the one or
        more interleavers defined in feature (a)(ii), of one or
        more _further_ interleavers. It follows that an encoding
        apparatus comprising a total of two interleavers, one
        interleaver according to feature (a)(ii) and one
        further interleaver according to feature (b), is
        covered by the wording of claim 1. Feature (c) refers
        to "the interleavers" and hence to at least two
        interleavers, but does not specify whether it refers
        only to interleavers defined in feature (b) or also to
        the interleavers defined in feature (a)(ii). In the

case of an apparatus having only a single further
interleaver according to feature (b), feature (c) has
to be interpreted as also referring to an interleaver
according to feature (a)(ii).

7. Features (c) and (d) were not present in the apparatus
of claim 1 as originally filed. Hence, it has to be
assessed whether there is a basis in the original
application for these features. In particular, there
must be a basis for adding feature (c) to original
claim 1, i.e. for an apparatus having at least two
interleaver branches formed by two interleavers, one
according to feature (b) and one according to
feature (a)(ii) which is part of the concatenated
encoder (see feature (a) of claim 1). Moreover,
according to feature (d), the bits from each
interleaver branch are mapped successively onto the
sequence of code symbols.

8. In the proceedings before the Examining Division, the
appellant cited Figure 1, claim 2, and page 7, lines 24
to 26, as a basis for feature (c). Below the Board
analyses whether any of the cited passages - or the
alternative embodiment shown in Figure 3 - can be
accepted as a basis for amended claim 1.

9. Originally filed Figure 1 (reproduced below) shows a
block diagram of the turbo-fountain encoder based on
two parallel concatenated convolutional codes (TF-A).
The two component encoders labelled "RSC" in Figure 1
are recursive systematic convolutional encoders. To the
left of the lower RSC encoder is a random interleaver,
labelled π, which is interpreted as the interleaver of
feature (a)(ii) of claim 1. Figure 1 depicts on the
right a potentially limitless number of random
interleavers (π_1, π_2, π_3,...) at the output. As it is

immediately clear from Figure 1 that only the random
interleavers (π_1, π_2, π_3,...) at the output form
interleaver branches, Figure 1 cannot be a basis for
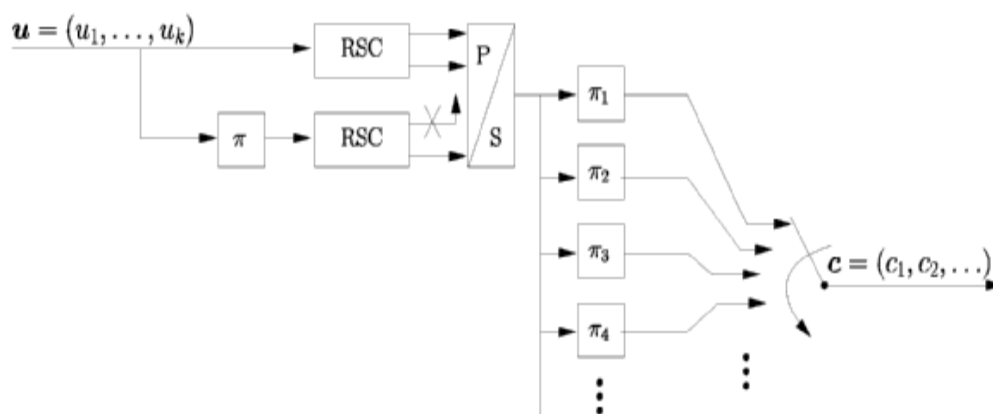feature (c) in the context of claim 1.

Fig. 1. Encoder structure for turbo-fountain TF-A based on
parallel concatenated convolutional codes and infinite number of
random interleavers at the output.

Originally filed Figure 3 (reproduced below) depicts
the proposed encoder structure for the turbo-fountain
(TF-B) based on an infinite parallel concatenation of
recursive systematic convolutional codes. The Board
identifies the concatenated encoder according to
feature (a) as consisting of the two component encoders
RSC_0 and RSC_1 and the interleaver π_1, which thus
represents in Figure 3 the interleaver according to
feature (a)(ii) of claim 1, for the case of a single
concatenated encoder consisting of two component
encoders and one interleaver (see point 6 above).
Interleaver branches are formed by random interleavers
π' on the right of Figure 3. These interleavers π' are
described on page 9, lines 17 to 18, as follows: "After
random interleaving with π'_i, the bits from all
branches i are mapped consecutively onto the output *c*."

In the Board's opinion, features (c) and (d) of claim 1
can only refer to the interleavers π' in Figure 3, as
only the bits from these branches are mapped
successively onto the sequence of code symbols. Hence,
Figure 3 does not provide a basis for interleaver
branches directly related to the output of code symbols
which are formed by an interleaver π_i of the
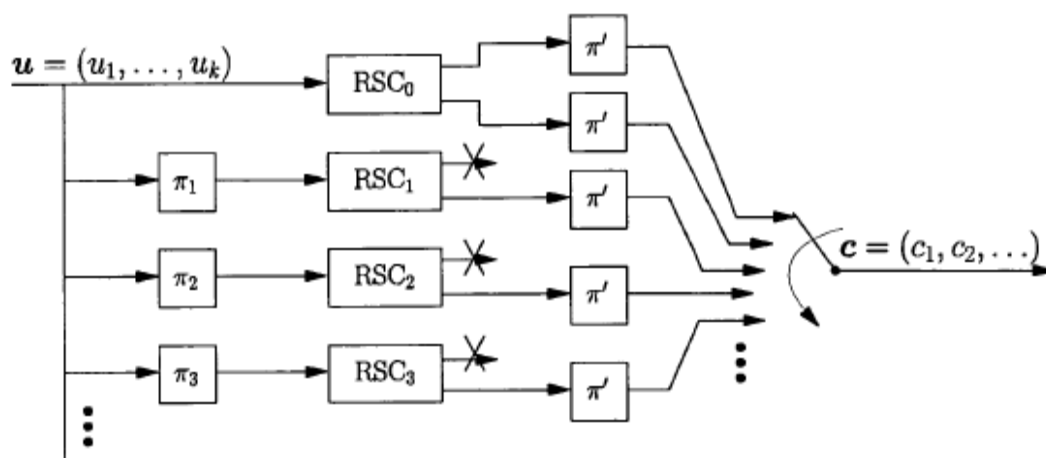concatenated encoder.

Fig. 3. Encoder structure for turbo-fountain TF-B based on
infinite parallel concatenation of recursive systematic
convolutional codes.

10.   Originally filed claim 2 reads as follows:
        "Apparatus according to claim 1, whereby the
        interleaver(s) follows the concatenated encoder(s) to
        spread the generated code symbols."

        In the Board's view, original claim 2 cannot be a basis
        for feature (c), as the expression "the interleaver(s)
        follows the concatenated encoder(s)" clearly means that
        original claim 2 refers not to an interleaver according
        to feature (a)(ii), but only to the interleavers
        according to feature (b).

The passage of the original description, page 7,
lines 24 to 26, that the appellant cited as a basis
reads:

> "[In practice, the number of required interleavers]
> depends on the number of required redundancy.
> Finally, the interleaved bits from each interleaver
> branch are mapped successively onto the output c."

The Board has no doubt that this passage, which
describes Figure 1, refers not to the at least one
interleaver defined in feature (a)(ii) of claim 1, but
only to the further interleavers according to feature
(b), since only these interleavers map bits to the
output (c).

The appellant has not submitted further relevant
arguments in reply to the Board's communication.

11.   As the Board has not been able to find any other basis
       for feature (c) in the context of present claim 1 in
       the application as originally filed, it follows that
       claim 1 contains added subject-matter, contrary to the
       requirements of Article 123(2) EPC.

Clarity - Article 84 EPC

12.   As the last feature of the apparatus for decoding,
       claim 5 recites the feature
       "whereby the interleavers form at least two interleaver
       branches and whereby the received code symbols are
       distributed to different branches inversly [*sic*] to the
       procedure at the output of the apparatus of the
       preceding claims".

       This last feature of claim 5 lacks clarity, since the
       apparatus of claim 1 does not specify any "procedure".

Feature (d) of claim 1 recites that "the bits from each interleaver branch are mapped successively onto the sequence of code symbols". This apparatus feature describes the function of the apparatus as a mapping, but does not define a "procedure".

12.1   The appellant has not submitted any arguments as to this objection, which was raised in the Board's communication.

12.2   As the technical features which are defined by the last feature of claim 5 cannot be understood, claim 5 lacks clarity.

13.   The Board expressed further concerns in its provisional opinion, but in view of the negative findings above it is not necessary to elaborate on them.

Procedural violation

14.   In the statement of grounds of appeal, the appellant requested at least partial reimbursement of the appeal fee because the decision was apparently based on a continuous misinterpretation of the claimed subject-matter and because the Examining Division had forced the appellant to bear higher costs due to either oral proceedings before the Examining Division or appeal proceedings, without having exhausted the informal possibilities for discussion and examination in the first-instance proceedings.

15.   According to Rule 103(1)(a) EPC, the appeal fee is to be reimbursed where the board of appeal deems an appeal to be allowable, if such reimbursement is equitable by reason of a substantial procedural violation.

16.   As the appeal is not allowable, one of the conditions
        for reimbursement of the appeal fee is not fulfilled.
        Hence, the request for reimbursement of the appeal fee
        is refused.

Conclusion

17.   As the appellant's sole request cannot form the basis
        for the grant of a patent, the appeal is to be
        dismissed.

Order

For these reasons it is decided that:

1.   The appeal is dismissed.

2.   The request for reimbursement of the appeal fee is
        refused.

The Registrar: The Chairman:

I. Aperribay   R. Moufang

Decision electronically authenticated