AUSTRALIA

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REQUEST FOR A STANDARD PATENT

636308

AND NOTICE OF ENTITLEMENT

The Applicant identified below requests the grant of a patent to the nominated person identified below for an invention described in the standard complete patent specification accompanying application 44264/89.

[70,71] Applicant and Nominated Person:

GENERAL ELECTRIC COMPANY of Two Independence Way, CN 5312, Princeton, New Jersey 08540, UNITED STATES OF AMERICA.

[54] Invention Title:

TECHNIQUE FOR ACTV SIDE-PANEL NOISE REDUCTION

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Basic Convention Application Details:

[31]	Application Number	:	8826463.5
[33]	Country	:	Great Britain
	Country Code	:	GB
[32]	Date of Application	:	11 November 1988

Applicant states the following:

The nominated person has entitlement from the actual inventor by assignment.

The nominated person has entitlement from the applicant of the basic application by consent.

The basic Convention application(s) was/were the first made in a Convention country in respect of the invention the subject of the application.

DATED: 11 February, 1993.

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
GENERAL ELECTRIC COMPANY
By:

David B Fitzpatrick

Our Ref.: IRN 213255

[redacted]orm 8

Australia
RCA 85,394
(Docket Number)
PCT/US89/04564

COMMONWEALTH OF AUSTRALIA
PATENTS ACT 1952-69

Regulation 12(2)

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of a Convention Application made for a Patent for invention entitled:

TECHNIQUE FOR ACTV SIDE-PANEL NOISE REDUCTION
(Title of Invention)

I, Eric P. Herrmann, Vice President of GE and RCA Licensing Management Operation, Inc. of Two Independence Way, CN 5312, Princeton, New Jersey 08540, United States of America do solemnly and sincerely declare as follows:—

1. I am authorized by GENERAL ELECTRIC COMPANY, of 1 River Road, Schenectady, New York 12345, United States of America, the applicant for the patent, to make this declaration on its behalf.

2. The basic application~~(s)~~ as defined by section 141 of the Act was/~~were~~ made in

Great Britain *(Name of Priority Country)* on 11 November 1988 *(Date Filed)*

by General Electric Company *(Full Name(s) of Inventor(s), or Assignee if First Filed in Great Britain)*

in *(Name of Second Priority Country)* on *(Date Filed)*

by *(Full Name(s) of Applicant(s) Inventor(s) or Assignee)*

3. (1) Joshua Lawrence Koslov, 32 Sheffield Road, East Windsor, New Jersey, United States of America; and
(Full Name and Address of First Inventor)

(2) Joel Walter Zdepski, 220A Pleasant View Drive, Lebanon, New Jersey, United States of America
(Full Name and Address of Second Inventor)

(3)
(Full Name and Address of Third Inventor)

(4)
(Full Name and Address of Fourth Inventor)

~~is~~/are the actual inventor(s) of the invention and the facts upon which GENERAL ELECTRIC COMPANY is entitled to make the application are as follows: The said GENERAL ELECTRIC COMPANY is the assignee of the said inventor(s) named in Paragraph 3 of this declaration in respect of said invention

4. The basic Application~~(s)~~ referred to in Paragraph 2 of this declaration was/~~were~~ the first application~~(s)~~ made in a Convention country in respect of the invention the subject of the application.

Declared at Princeton, New Jersey, United States of America, this 20th *(Date)* day of MARCH *(Month)*, 19 91 *(Year)*.

Eric P. Herrmann
Vice President
GE and RCA Licensing Management Operation, Inc.

To:
The Commissioner of Patents
Commonwealth of Australia

(No Attestation of any Kind Needed)

GENERAL ELECTRIC COMPANY
Patent Operations
CN 5312
Princeton, New Jersey 08540
U.S.A.

JBH/ajl
Pat. 3363-GE 3/90

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(56) Prior Art Documents
GB 2203012
AU 589610 54612/86 H04N 5/213

(57) Claim

1. A video signal processing system for reducing the effect of transmission channel noise on transmitted video signals, comprising:

amplitude compressor means for compressing the amplitude of video signals in accordance with a given nonlinear transfer function;

predictive means responsive to an output signal from said compressor means for producing a predictive signal as a function of the magnitude of a video signal received at the receiver, said predictive means including amplitude expander means having a transfer function substantially the inverse of said given transfer function; and

means for providing a difference signal, indicating difference in magnitude between an input video signal and said predictive signal, to an input of said amplitude compressor.

2. Apparatus for receiving signals transmitted by the system of claim 1, comprising:

receiver amplitude expander means for receiving said transmitted signals, said expander means having a

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transfer function substantially the inverse of said given transfer function;

combining means having a first input for receiving output signals from said receiver amplitude expander means, a second input, and an output,

further predictive means responsive to signals from said output of said combining means for producing a further predictive signal as a function of the magnitude of a previous video signal sample; and

means for coupling said further predictive signal to said second input of said combining means.

OPI DATE 28/05/90 APPLN. ID 44264 / 89
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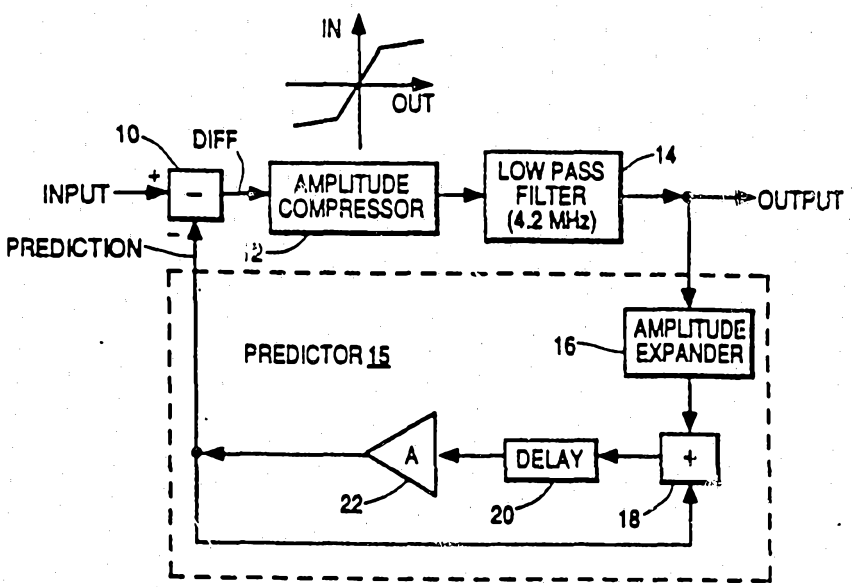
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With international search report.
With amended claims and statement.

AUSTRALIAN PATENT OFFICE

636308

(54) Title: TECHNIQUE FOR ACTV SIDE-PANEL NOISE REDUCTION



(57) Abstract

A video signal processing system employs an amplitude compander for reducing the effects of transmission noise. The compander includes a transmitter nonlinear amplitude compressor (12) for amplifying small signals and compressing large signals. A receiver includes an amplitude expander with an inverse transfer function. The nonlinear compressor (12) generates out-of-band frequencies which are removed by a transmitter output filter (14), producing signal distortion. To compensate for such distortion, the transmitter duplicates certain receiver processing circuits, including the receiver amplitude expander (16) and a filter (18, 20, 22) for generating a prediction signal. The prediction signal is subtracted (10) from the transmitter input video signal before the video signal is amplitude compressed at the transmitter, producing an error signal which is transmitted. The error signal is small if the prediction is good, whereby noise reduction results from compressor gain at the transmitter.

TECHNIQUE FOR ACTV SIDE-PANEL NOISE REDUCTION

This invention concerns a video signal noise reduction system employing companding and predictive signal processing.

Transmitting a video signal such as a television signal over a potentially noisy channel typically involves considerations of how to prevent channel noise from degrading the signal-to-noise ratio of the video signal and the quality of a reproduced picture. Companding is one way to improve the quality of a video signal conveyed in a noisy environment. In companding, the amplitude of a video signal is compressed at the transmitter, thereby raising its average-to-peak power ratio and hence its immunity to noise. The signal is amplitude expanded at the receiver with the inverse transfer function of the transmitter compression function, to restore the original video signal amplitude distribution so as to obtain a correct signal for display. When non-linear compression is performed at the transmitter, the signal is modified by means of a combination of small signal expansion and large signal compression. Complementary functions are performed at the receiver.

Nonlinear amplitude compression at the transmitter can produce unwanted out-of-band high frequency signal components, e.g., above 4.2 MHz in the case of a television type video signal. These unwanted high frequency components can be removed by a transmitter output low pass filter. It is herein recognized, however, that such a filter can also introduce unwanted signal distortion which can compromise the quality of the video signal at the receiver after amplitude expansion at the receiver. The disclosed system is directed to compensating for video signal distortion products of the type mentioned, while maintaining good signal-to-noise characteristics. This may be accomplished by incorporating in the transmitter a model of a given portion of the receiver, including the receiver portion of the companding function (i.e., the amplitude expander). Thus the transmitter may have access to information

AUSTRALIAN PATENT OFFICE

as to the characteristics of the video signal as processed at the receiver. In the disclosed system, the transmitted signal may be a signal representing the difference between the transmitter input signal and a version of an estimate, or prediction, of the signal received at the receiver. This signal is small if the prediction is good, whereby noise immunity is enhanced through companding gain at the transmitter.

According to one aspect of the present invention there is provided a video signal processing system for reducing the effect of transmission channel noise on transmitted video signals, comprising:

amplitude compressor means for compressing the amplitude of video signals in accordance with a given nonlinear transfer function;

predictive means responsive to an output signal from said compressor means for producing a predictive signal as a function of the magnitude of a video signal received at the receiver, said predictive means including amplitude expander means having a transfer function substantially the inverse of said given transfer function; and

means for providing a difference signal, indicating difference in magnitude between an input video signal and said predictive signal, to an input of said amplitude compressor.

According to a preferred embodiment of the present invention there is provided a video system for processing a widescreen television-type signal containing a main panel image component and a side panel image component and having an image aspect ratio greater than that of a standard television image, said system including means for time compressing prescribed portions of said side panel component, wherein

said amplitude compressor means compresses the amplitude of the prescribed portions of said side panel component in accordance with a given transfer function;

said predictive means is responsive to an output signal from said compressor means for producing a

AUSTRALIAN PATENT OFFICE MJP

predictive signal as a function of the magnitude of a previous side panel component sample, and

said difference signal providing means provides a difference signal, indicative of a difference in magnitude between an input side panel component and said predictive signal, to an input of said amplitude compressor.

According to a further aspect of the present invention there is provided apparatus for receiving widescreen signals transmitted by the above system comprising:

receiver amplitude expander means for receiving said transmitted signals, having a transfer function substantially the inverse of said given transfer function;

combining means having a first input for receiving output signals from said receiver amplitude expander means, a second input, and an output;

further predictive means responsive to signals from said output of said combining means for producing a further predictive signal as a function of the magnitude of a previous video signal sample;

means for coupling said further predictive signal to said second input of said combining means; and

means for time expanding signals from said output of said combining means.

According to a still further aspect of the present invention there is provided in a system for receiving a widescreen television-type signal containing a main panel image component and a side panel image component and having an image aspect ratio greater than that of a standard television image, side panel image component processing apparatus comprising:

amplitude expander means having a nonlinear transfer characteristic responsive to said side panel image component;

combining means having a first input for receiving output signals from said amplitude expander means, a second input, and an output;

predictive means responsive to signals from said

39
MJP

output of said combining means for producing a predictive signal as a function of the magnitude of the video signal received;

means for coupling said predictive signal to said second input of said combining means; and

means for time expanding signals from said output of said combining means.

A preferred embodiment of the present invention will now be described with reference to the accompanying drawings wherein:-

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~~as to the characteristics of the video signal as processed~~ at the receiver. In the disclosed system, the transmitted signal is a signal representing the difference between the transmitter input signal and a version of an estimate, or prediction, of the signal received at the receiver. This signal is small if the prediction is good, whereby noise immunity is enhanced through companding gain at the ~~transmitter.~~

Figure 1 shows a block diagram of a transmitter encoder portion of apparatus in accordance with the present invention.

Figure 2 depicts a block diagram of a receiver decoder portion of apparatus in accordance with the present invention.

Figure 3 is a block diagram of a transmitter portion of a widescreen television signal processing system including apparatus according to the invention.

Figure 4 is a block diagram of a portion of a widescreen television receiver employing apparatus according to the present invention.

In the transmitter arrangement of Figure 1, an input video signal is applied to one input of a signal subtracter 10, the other input of which receives a signal from a signal predictor network 15 as will be discussed. An output difference signal (DIFF) from subtracter 10 is subjected to nonlinear amplitude compression by means of an amplitude compressor 12 having a nonlinear transfer function as illustrated above block 12. Compressor 12 amplitude compresses large signals greater than a given amplitude threshold and amplitude expands (amplifies) small amplitude signals. Compressor 12 constitutes a component of a companding system together with an amplitude expander, having a complementary transfer function, at a receiver.

The nonlinear transfer characteristic of compressor 12 can generate unwanted high frequency components (e.g. harmonics) which extend above the 4.2 MHz upper limit of the video signal band in this example. These out-of-band high frequency components are filtered by

AUSTRALIAN PATENT OFFICE LS

a low pass filter 14 before the OUTPUT signal is transmitted over a channel likely to include signal corrupting noise. Filter 14, however, is likely to introduce unwanted signal distortion of its own. This filter distortion, as well as distortion associated with a mismatch between the compression and expansion functions at the transmitter which may appear in practice, particularly in the case of image motion for example, are reduced or eliminated with the cooperation of predictor network 15.

Predictor 15 is a replica of an amplitude expander and predictor network found in a receiver which receives a signal transmitted by the apparatus of Figure 1. Referring to Figure 2 for the moment, the received input signal, which had been nonlinearly amplitude compressed at the transmitter, is amplitude expanded with the inverse of the transmitter nonlinear transfer function by means of an amplitude expander 216. Expander 216, like Compressor 12 at the transmitter, provides an instantaneous transfer function and may be implemented in the form of a ROM look-up table.

The remaining structure of Figure 2 is an infinite impulse response (IIR) filter including an adder 218, a pixel storage delay element 220 and an amplifier 222 with a signal gain of "A", all arranged as shown. Delay element 220 for example is a frame delay when processing television-type information since television video information spaced a frame apart is typically highly temporally correlated. Delay 220 and amplifier 222 develop a prediction signal at the output of amplifier 222. In the case of a frame delayed signal from unit 220, the prediction signal at the output of amplifier 222 is simply the same image pixel from the previous frame scaled by amplification factor A, which is less than unity (e.g., 0.75). The prediction process could also involve a function of multiple pixels from multiple fields. In this example scaling factor A is less than unity to prevent noise from propagating around the loop including elements 218, 220 and 222 without decaying. Thus noise in the

output signal will decay by a factor of A each time around the loop. The output signal, which is subjected to additional video signal processing in the receiver, is formed by summing the nonlinearly amplitude expanded signal from unit 216 with the prediction signal from amplifier 222.

Returning to Figure 1, the prediction signal from the output of predictor 15 represents an estimate of the delayed receiver output signal, scaled by factor A. Unit 10 subtracts the prediction signal from the input signal to produce a difference signal which is processed by units 12 and 14 to produce the output signal which is transmitted.

At the transmitter apparatus of Figure 1, the difference signal is the difference between the input signal and prediction signal. The output of adder 18 is a model of the receiver's output. It can be shown that the signal at the receiver's output is similar to the signal applied to the transmitter input. If the difference signal produced by subtracter 10 at the transmitter is small (indicating a good prediction), nonlinear amplitude compressor 12 will amplify the difference signal and thereby advantageously enhance its signal-to-noise characteristics prior to transmission.

With the disclosed system operating with respect to a 4.2 MHz luminance signal a noise reduction of 2.7 db was observed with a scaling factor A of 0.75 and with a μ-law compandor having a companding parameter (μ) of 11. A noise reduction of 4.1 db was obtained for A of 0.90 and μ of 40.

Figure 3 shows a block diagram of an encoder for a compatible widescreen television system, e.g. for processing a 5:3 wide aspect ratio signal, including compression and prediction networks of the type depicted by Figure 1. With the exception of such networks, the system of Figure 3 is disclosed in greater detail in U.S. Patent 4,816,899 - Strolle et al.

In Figure 3 a source of widescreen television signals 310 provides widescreen television color video

components Y (luminance) and I, Q (color difference) in digital form. Source 310 also illustratively includes matrix, analog-to-digital converter and low pass filtering circuits. The signals from source 310 are processed by a side-center panel signal separator and processor 318 to produce three groups of output signals: YE, IE and QE; YO, IO and QO; and YH, IH and QH. The first two groups of signals (YE, IE, QE and YO, IO, QO) are processed to respectively develop a signal containing a center panel component, and side panel low frequency luminance information (luminance lows) time compressed into horizontal image overscan regions. The third group of signals (YH, IH, QH) is processed to develop a signal containing side panel high frequency information (side panel highs). When the center and side panel signal components are eventually combined, an NTSC compatible widescreen signal with a 4:3 display aspect ratio is produced. Signals YO, IO and QO provide the low frequency side panel information, exclusive of side panel high frequency information, which is inserted into the left and right horizontal overscan regions. Signals YO, IO and QO are individually processed by amplitude compression and prediction networks (of the type shown in Figure 1) within block 322 before being combined with signals YE, IE and QE by a side-center signal combiner 328, eg. a time multiplexer. Combiner 328 produces signals YN, IN and QN with a standard 4:3 image aspect ratio.

A signal processor and NTSC encoder 336 processes signals YN, IN and QN to develop an NTSC compatible composite output signal C/SL comprising center panel information, and side panel low frequency information compressed into horizontal overscan regions. Unit 336 includes luminance and chrominance filters, a chrominance modulator, and conventional NTSC encoding circuits for encoding luminance and chrominance information.

Side panel high frequency components YH, IH and QH are additionally processed by a unit 343 after being time expanded by unit 321. In unit 343 the side panel

highs modulate an auxiliary suppressed subcarrier with a phase that reverses at the field rate. The modulated subcarrier is subjected to amplitude compression and bandpass filtering to develop a side panel highs signal SH. This signal is combined with signal C/SL in a combiner 340 to produce a widescreen compatible signal NTSC. Signal NTSC is converted to analog form by a digital-to-analog converter (DAC) 354 before being applied to an RF modulator and transmitter network 355 for broadcast via an antenna 356.

Amplitude compression and prediction network 322 can be similarly situated in an enhanced image definition version of the illustrated widescreen encoder system disclosed in the Strolle et al. patent. Such an enhanced definition system is disclosed in U.S. patent 4,855,824 of J.S. Fuhrer titled "Compatible Television System with Companding of Auxiliary Signal Encoding Information."

Figure 4 depicts a block diagram of a widescreen receiver decoder for the compatible widescreen television signal developed by the transmitter encoder of Figure 3. With the exception of expansion and prediction network 442, the system of Figure 4 is disclosed in greater detail in the aforementioned Strolle et al. patent.

The transmitted compatible widescreen signal is received by an antenna 410 and demodulated by an input demodulating and signal processing unit 422 to develop signals YN, IN, QN and side panel highs signal SH. Unit 422 includes filtering and amplitude expanding networks for recovering signal SH, and signal combining, filtering and chrominance demodulation networks for recovering signals YN, IN and QN. A processor 454 responds to side highs signal SH for producing signals YH, IH, and QH. In processor 454 the auxiliary subcarrier is demodulated, luminance and chrominance side panel highs components are separated, and the luminance side panel highs are time compressed to produce side panel highs signal components YH, IH and QH.

Signals YN, IN and QN are separated into low frequency side panel components YO, IO, QO and center panel components YE, IE, QE by means of a side-center separator (de-multiplexer) 440. Signals YE, IE, QE are time compressed by a unit 444 to occupy the prescribed center panel display region. Signals YO, IO, QO are individually subjected to amplitude expansion and predictive signal processing in network 442 before being time expanded by a unit 445 to occupy the prescribed side panel display region. Network 442 contains circuits of the type shown in Figure 2 for respectively processing signals YO, IO and QO.

Side panel lows signals from time expander 445 and side panel highs signals from processor 454 are combined in a unit 446 to produce side panel luminance and chrominance signals YS, IS and QS. Reconstructed side panel signals YS, IS, QS are spliced to reconstructed center panel signals YC, IC, QC from time compressor 444 by means of a splicer 460 to form a fully reconstructed widescreen signal containing components Y, I and Q.

Widescreen signals Y, I, Q are converted to analog form by means of a digital-to-analog converter (DAC) 462 before being applied to a video signal processor and matrix amplifier 464. The video signal processor component of unit 464 includes signal amplifying, DC level shifting, peaking, brightness control, contrast control and other video signal processing circuits of a conventional nature. Matrix amplifier 464 combines luminance signal Y with color difference signals I and Q to produce color image representative video signals R, G and B. These color signals are amplified by display driver amplifiers in unit 464 to a level suitable for directly driving a widescreen color image display device 470, eg., a widescreen kinescope.

As noted above, the encoder arrangement of Figure 3 encodes low frequency side panel information in time compressed form. Illustratively, luminance information from DC to 700 KHz is time compressed approximately 6:1 so that the side panel low frequency information occupies a

4.2 MHz bandwidth. The receiver (Figure 4) performs a corresponding time expansion as mentioned. The process of nonlinear amplitude compression at the transmitter is particularly likely to generate unwanted out-of-band frequencies when, as in this example, the time compression process produces a signal exhibiting frequencies at or near the upper limit of the desired frequency band (eg., 4.2 MHz).

Because of time compression and expansion, the side panel low frequency component contains much more noise energy under noisy channel conditions than the same frequency band of center panel information. This condition manifests itself as an objectionable difference in the noise between displayed center panel and side panel images. Specifically, side panel images exhibit horizontally "streaky" low frequency noise which contrasts with the broader bandwidth noise in the center panel image and is more objectionable. Side panel information therefore appears visibly different from center panel information, particularly for transmission channels with signal-to-noise ratios below about 35 db. Thus the apparatus of Figures 1 and 2 are advantageously used to enhance the signal-to-noise characteristic of the time compressed side panel low frequency information. The disclosed apparatus alternatively can be employed in the transmitter system of Figure 3 between unit 318 and time compressor 320, in which case the output signal path of the Figure 1 apparatus would be low pass filtered to 700 KHz for luminance lows compressed 6:1.

The disclosed signal companding and prediction apparatus also can be used for processing time expanded side panel high frequency signals YH, IH and QH from unit 321 in Figure 3. In this regard it is noted that, with the Figure 3 system as illustrated, the side panel high frequency information obtains a signal-to-noise improvement due to time expansion by expander 321. However, this improvement is compromised by the amplitude attenuation which unit 343 imparts to the side highs modulated

auxiliary subcarrier to make the modulated auxiliary subcarrier less visible when the widescreen television signal is received by a standard television receiver having a standard 4:3 aspect ratio. The disclosed noise reduction apparatus can be used to enhance the noise immunity of the side highs information, depending on the requirements of a particular system.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A video signal processing system for reducing the effect of transmission channel noise on transmitted video signals, comprising:

amplitude compressor means for compressing the amplitude of video signals in accordance with a given nonlinear transfer function;

predictive means responsive to an output signal from said compressor means for producing a predictive signal as a function of the magnitude of a video signal received at the receiver, said predictive means including amplitude expander means having a transfer function substantially the inverse of said given transfer function; and

means for providing a difference signal, indicating difference in magnitude between an input video signal and said predictive signal, to an input of said amplitude compressor.

2. Apparatus for receiving signals transmitted by the system of claim 1, comprising:

receiver amplitude expander means for receiving said transmitted signals, said expander means having a transfer function substantially the inverse of said given transfer function;

combining means having a first input for receiving output signals from said receiver amplitude expander means, a second input, and an output,

further predictive means responsive to signals from said output of said combining means for producing a further predictive signal as a function of the magnitude of a previous video signal sample; and

means for coupling said further predictive signal to said second input of said combining means.

3. Apparatus according to claim 2, wherein said further predictive means includes:

signal attenuating means; and

means for delaying signals for an interval over which video signal information is substantially correlated.

4. A video system according to claim 1, for processing

AUSTRALIAN PATENT OFFICE 39 LS MJP

a widescreen television-type signal containing a main panel image component and a side panel image component and having an image aspect ratio greater than that of a standard television image, said system including means for time compressing prescribed portions of said side panel component, wherein

said amplitude compressor means compresses the amplitude of the prescribed portions of said side panel component in accordance with a given transfer function;

said predictive means is responsive to an output signal from said compressor means for producing a predictive signal as a function of the magnitude of a previous side panel component sample, and

said difference signal providing means provides a difference signal, indicative of a difference in magnitude between an input side panel component and said predictive signal, to an input of said amplitude compressor.

5. A system according to claim 1 or 4, wherein said amplitude compressor means exhibits a nonlinear transfer function wherein small amplitude signals are expanded and large amplitude signals are compressed.

6. A system according to claim 5, and further comprising:

means for filtering output signals from said amplitude compressor means; and wherein

said predictive means responds to an output signal from said amplitude compressor means after filtering by said filtering means.

7. A system according to claim 6 wherein said filtering means comprises a low pass filter.

8. A system according to claim 1 or 4, wherein said predictive means comprises:

an input node corresponding to an input of said amplitude expander means, and an output node coupled to said difference signal providing means;

combining means having a first input for receiving a signal from said amplitude expander means, a second input, and an output; and

translating means for providing an attenuated time

AUSTRALIAN PATENT OFFICE 39 MJP

delayed version of signals from said output of said combining means to said output node and to said second input of said combining means.

9. A system according to claim 8, wherein said translating means includes means for delaying signals for an interval over which video signal information is substantially correlated.

10. A system according to claim 8, wherein said delaying means exhibits an image frame delay interval.

11. Apparatus for receiving widescreen signals transmitted by the system of claim 4, comprising:

receiver amplitude expander means for receiving said transmitted signals, having a transfer function substantially the inverse of said given transfer function;

combining means having a first input for receiving output signals from said receiver amplitude expander means, a second input, and an output;

further predictive means responsive to signals from said output of said combining means for producing a further predictive signal as a function of the magnitude of a previous video signal sample;

means for coupling said further predictive signal to said second input of said combining means; and

means for time expanding signals from said output of said combining means.

12. In a system for receiving a widescreen television-type signal containing a main panel image component and a side panel image component and having an image aspect ratio greater than that of a standard television image, side panel image component processing apparatus comprising:

amplitude expander means having a nonlinear transfer characteristic responsive to said side panel image component;

combining means having a first input for receiving output signals from said amplitude expander means, a second input, and an output;

predictive means responsive to signals from said output of said combining means for producing a predictive

AUSTRALIAN PATENT OFFICE

signal as a function of the magnitude of the video signal received;

means for coupling said predictive signal to said second input of said combining means; and

means for time expanding signals from said output of said combining means.

13. A video signal processing system substantially as herein described with reference to the accompanying drawings.

14. Apparatus for receiving widescreen signals substantially as herein described with reference to the accompanying drawings.

DATED: 20 January, 1993.

PHILLIPS ORMONDE & FITZPATRICK
Attorneys for:
GENERAL ELECTRIC COMPANY

David B Fitzpatrick

426lu

AUSTRALIAN PATENT OFFICE
39
MJP

STATEMENT UNDER ARTICLE 19

Claim 1 has been amended to clarify that the claim is directed to reduction of transmission channel noise through a technique which includes the recited use of amplitude compression and expansion. This is in contrast to the bit reduction to conserve bandwidth scheme disclosed in the GE, A, 2203012 reference cited in the International Search Report.

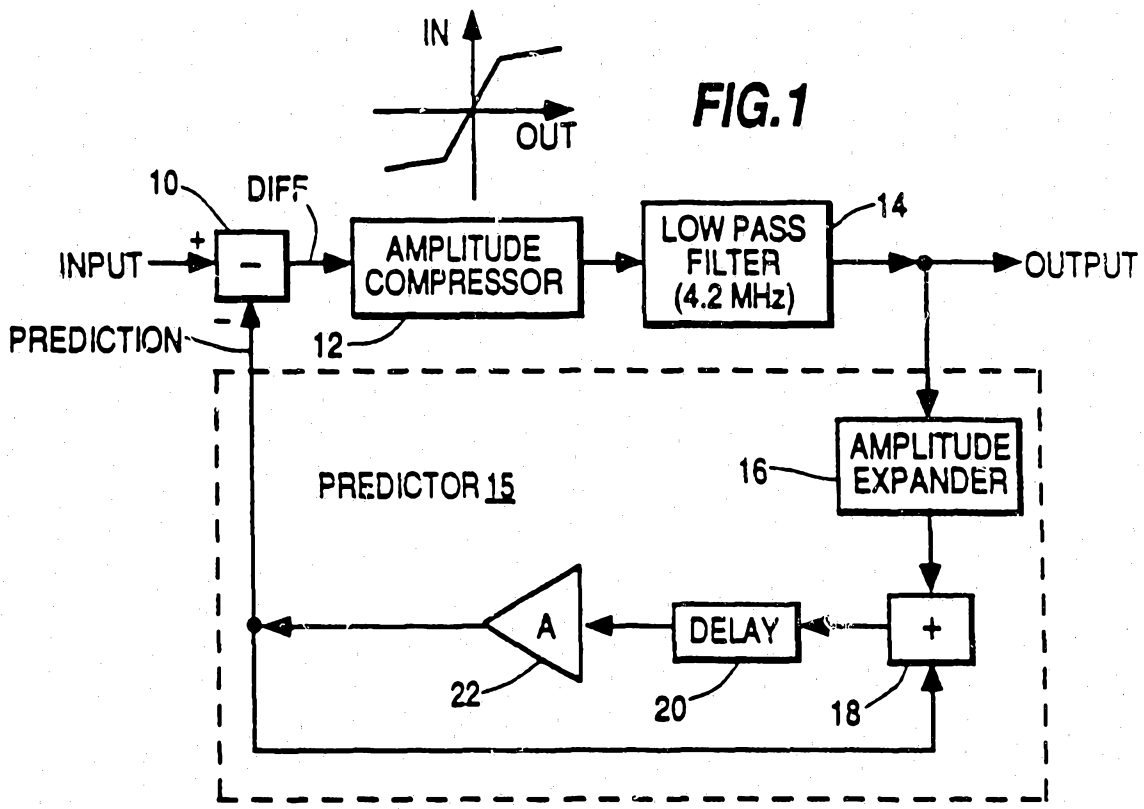

IN
OUT
10
DIFF
INPUT
+
−
AMPLITUDE COMPRESSOR
LOW PASS FILTER (4.2 MHz)
14
OUTPUT
PREDICTION
−
12
PREDICTOR 15
16
AMPLITUDE EXPANDER
A
DELAY
+
22
20
18

FIG. 1

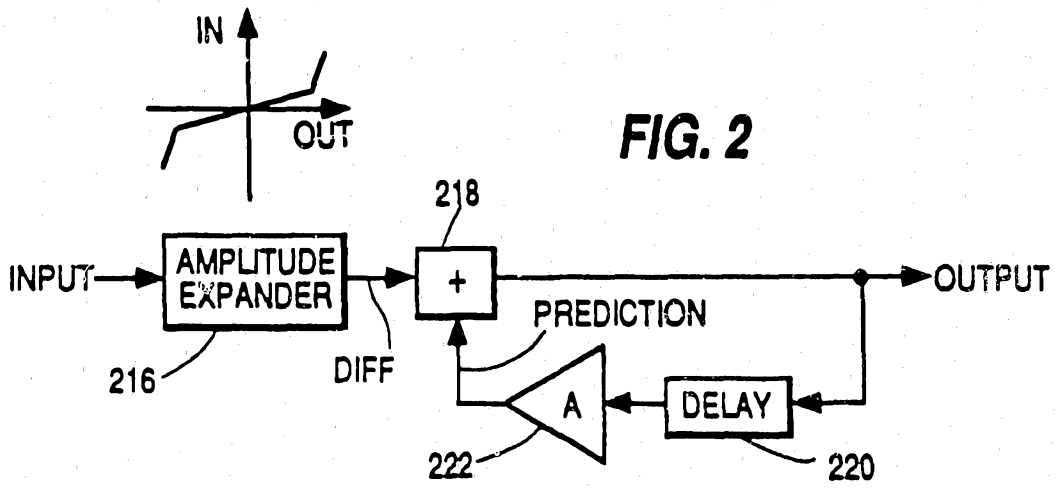

IN
OUT
218
INPUT
AMPLITUDE EXPANDER
+
OUTPUT
PREDICTION
216
DIFF
A
DELAY
222
220

FIG. 2

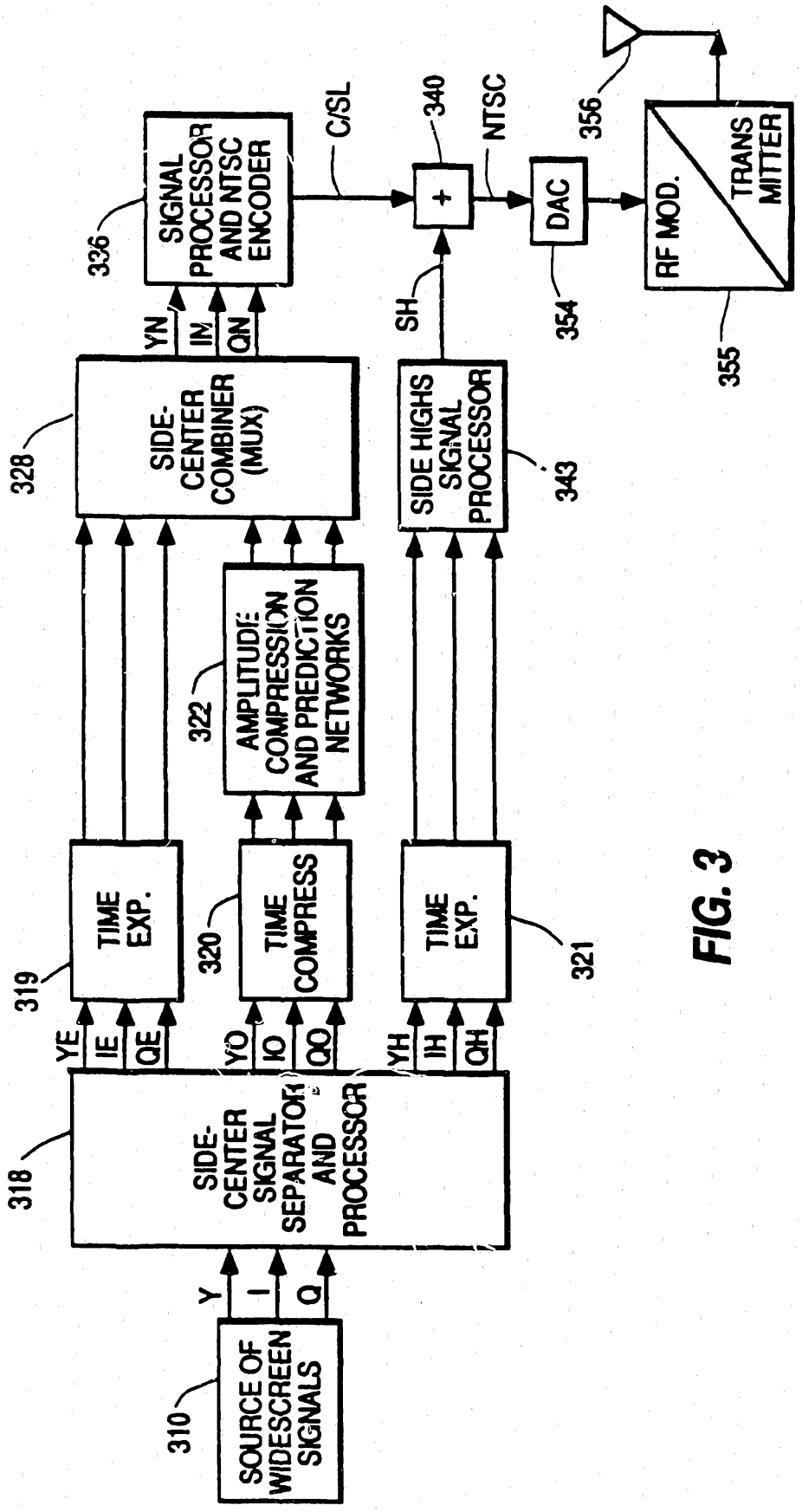

SOURCE OF WIDESCREEN SIGNALS
310
Y
I
Q
SIDE-CENTER SIGNAL SEPARATOR AND PROCESSOR
318
YE
IE
QE
YO
IO
QO
YH
IH
QH
TIME EXP.
319
TIME COMPRESS
320
TIME EXP.
321
AMPLITUDE COMPRESSION AND PREDICTION NETWORKS
322
SIDE-CENTER COMBINER (MUX)
328
SIDE HIGHS SIGNAL PROCESSOR
343
YN
IN
QN
SIGNAL PROCESSOR AND NTSC ENCODER
336
C/SL
+
340
SH
NTSC
DAC
354
RF MOD.
TRANS MITTER
355
356

FIG. 3

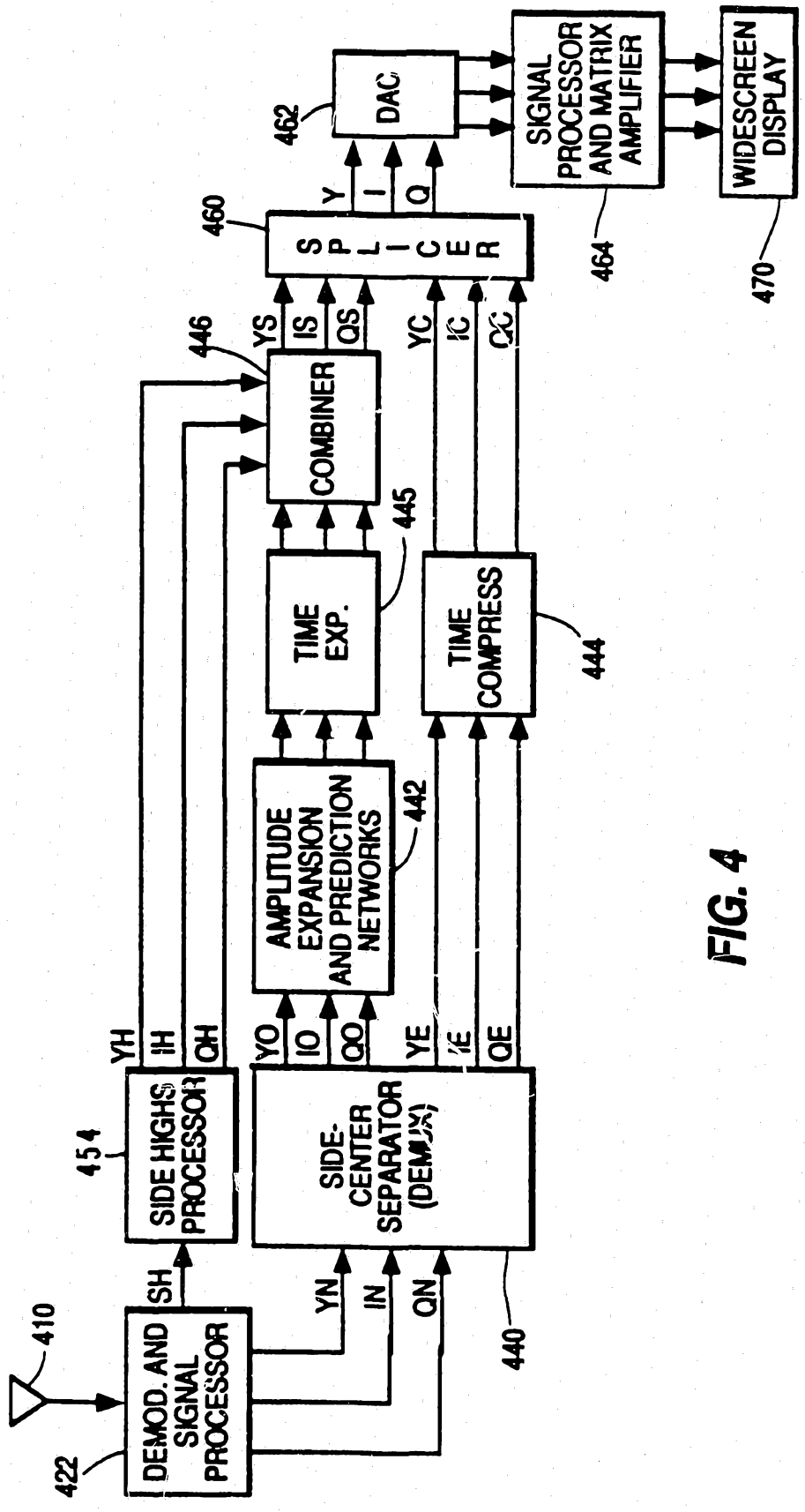

410
422
DEMOD. AND SIGNAL PROCESSOR
SH
YN
IN
QN
440
454
SIDE HIGHS PROCESSOR
SIDE-CENTER SEPARATOR (DEMUX)
YH
IH
QH
YO
IO
QO
YE
IE
QE
AMPLITUDE EXPANSION AND PREDICTION NETWORKS
442
TIME EXP.
445
TIME COMPRESS
444
446
COMBINER
YS
IS
QS
YC
IC
QC
460
SPLICER
Y
I
Q
462
DAC
SIGNAL PROCESSOR AND MATRIX AMPLIFIER
464
WIDESCREEN DISPLAY
470

FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 89/04564

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H04N7/137

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	H04N

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category °	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	GB,A,2203012 (SONY) 05 October 1988 see page 1, line 17 - page 2, line 18; figure 1	1
A	---	8
A	WO,A,8807800 (I.B.A.) 06 October 1988 see page 1, lines 9 - 19 see page 2, lines 27 - 30 see page 4, lines 13 - 15 see page 5, line 28 - page 6, line 9 see page 18, line 16 - page 19, line 19; figures 2, 3	1, 3-7

A	GB,A,2196205 (B.B.C.) 20 April 1988 see page 1, line 40 - page 2, line 17; figure 1	1, 2, 4

	-/--	

° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"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)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"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.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24 JANUARY 1990	23.02.90
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	T.K. WILLIS

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

PCT/US 89/04564
SA 31871

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information. 14/02/90

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-2203012	05-10-88	DE-A- 3810916	13-10-88
		FR-A- 2613559	07-10-88
		JP-A- 63253786	20-10-88
WO-A-8807800	06-10-88	None	
GB-A-2196205	20-04-88	None	

EPO FORM P0479

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	IEEE TRANSACTIONS ON CONSUMER ELECTRONICS. vol. 34, no. 1, February 1988, NEW YORK US pages 111 - 120; M.A. Isnardi et al.: "Decoding issues in the ACTV system" see page 114, right-hand column, lines 6 - 8 ---	4, 5
A	IEEE TRANSACTIONS ON BROADCASTING. vol. BC-33, no. 4, December 1987, NEW YORK US pages 188 - 196; T. Takegahara et al.: "Sound transmission for HDTV using baseband multiplexing into MUSE video signal" ---	