(54) Title: TRANSMITTING DATA WITH A VIDEO SIGNAL
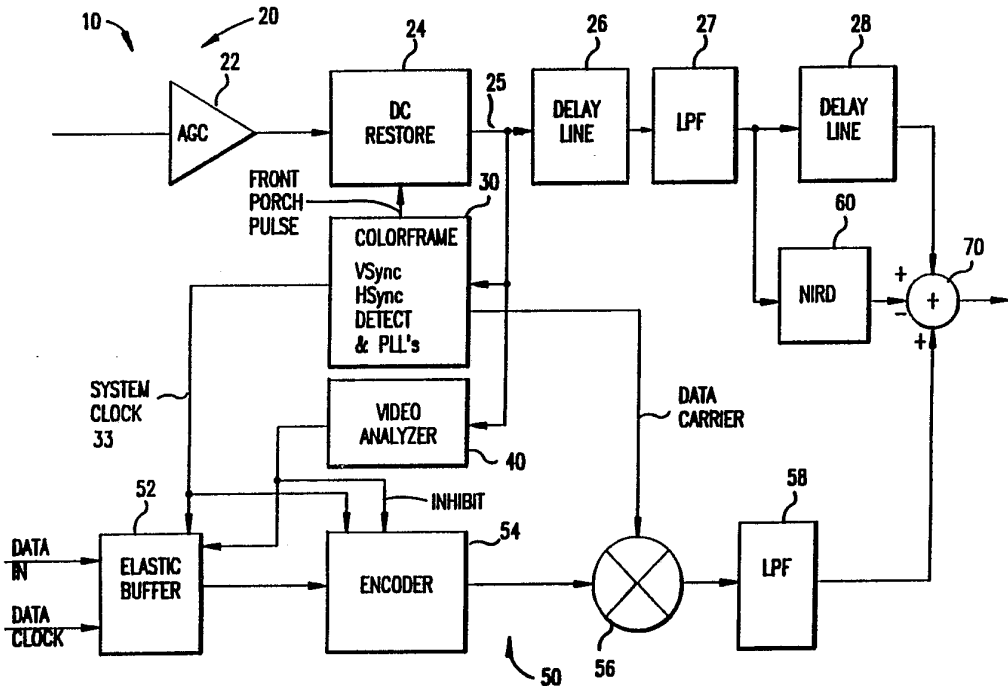
(57) Abstract

Signal processors for permitting the transparent, simultaneous transmission and reception of a secondary data signal with a video signal in the video band is disclosed. The signal processor in the transmitter rasterizes the data at the horizontal scanning rate and modulates the data with a data carrier at a non-integral multiple of the horizontal scanning rate to obtain frequency interleaving. The data is transmitted during the active video portion of each video line.

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TRANSMITTING DATA WITH A VIDEO SIGNAL

Background of the Invention

   Field of the Invention

5   This invention relates to transmitting two signals
on one communication channel and more particularly
transmitting data during the active video portion of a
video signal.

   Description of the Prior Art

10   Several techniques have been developed to allow
the transmission of two signals on the same
communications channel.   When the communications
channel is a specified bandwidth of the spectra, these
methods include time division multiplexing,
15 transmitting orthogonally polarized waves, transmitting
by two transparent methods, each transparent to the
other and frequency interleaving.

       In the case of video signals, such as NTSC and PAL
signals, several different methods have been used for
20 transmission of additional information in the band.
For example, a chrominance (color) signal is
transmitted by frequency interleaving the chrominance
signal with the luminance (black and white) signal.
In particular, for the NTSC standard, the luminance
25 signal and the chrominance signals are frequency
interleaved.   Of course, the chrominance signals are
closely related to the luminance signal and the signals
exhibit a high degree of correlation.

       There are also intervals where no picture
30 information is being transmitted such as during the
vertical and horizontal blanking intervals.   In some
systems, for example close captioned television for the
hearing impaired, the close captioned information is
transmitted during the vertical blanking intervals.   Of
35 course, the data rate of transmission systems using the
blanking period is relatively low, typically about

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20,000 bits per second. Although such transmission
rates may be suitable for close caption television,
this is far too low for the suitable transmission of
large volumes of information such as the 1.544 megabits
5   per second for T1 transmission.

Therefore, it is a first object of this invention
to permit transmission at a higher data rate than those
permitted during the blanking period. It is a second
object of this invention to permit transmission at the
10   higher data rate without causing any noticeable
interference from the transmitted information to
conventional television receivers. It is yet a third
object of this invention to achieve such transmission
using frequency interleaving.

Summary of the Invention

These and other objects are achieved through the use of transmission of secondary data during the active primary video interval when pixel information is being

5   transmitted rather than during the horizontal or vertical sync blanking intervals. The transmitted data is preferably frequency interleaved with the chrominance and luminance signal.

The signal processor for use by the transmitter

10 for the novel communications system disclosed herein has five portions. A primary video portion, a timing portion, and a video analyzer portion receive the primary video signal. The timing portion produces a non-integral multiple of the video horizontal scanning

15 frequency for use by a data portion for modulation. In addition, the timing portion produces a composite blanking pulse so that the data portion may rasterize the data to be transmitted.

Another portion, a noise interference reduction

20 portion receives an output from the video portion and provides a noise signal representing noise in the frequency gaps for interleaving of the primary video signal. That noise signal may be subtracted from the video signal to reduce the noise imposed on the

25 modulated data signal when the video and data signals are combined.

A secondary data portion receives the secondary data signal, which may be analog or digital. The secondary data portion rasterizes the data signal and

30 modulates the data signal so that the modulated data signal is frequency interleaved with the primary video signal.

The data portion rasterizes the data signal to include vertical and horizontal blanking periods that

35 will coincide with those blanking periods in the primary video signal when the modulated data signal and

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the primary video are combined. The rasterized data
signal is then modulated by a data carrier so that the
modulated data spectral envelope interleaves with the
primary video envelope. The resultant combined signal
5   may be received by ordinary video receivers without
noticeable interference in the video receiver.

The data signal may be recovered by a receiver
incorporating a specialized signal processor. A filter
passing those frequencies containing the secondary data
10   supplies a data signal to a phase compensator. The
phase compensator eliminates phase shifts induced by
the filter. The output of the compensator may then be
demodulated, decoded and derasterized. To accomplish
the demodulation, a timing circuit should be included
15   that generates the data carrier and generates a system
clock including a blanking interval.

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Description of the Drawings

Figure 1 is a block diagram for a signal processor incorporating an embodiment of the instant invention for use in a transmitter.

5   Figure 2 is a block diagram for a signal processor incorporating an embodiment of the instant invention for use in a receiver.

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Detailed Description of the Preferred Embodiments

Figure 1 shows an embodiment of the signal
processor 10 of the transmitter that may be used for
transmitting secondary digital data at the T1 rate of
5   1.544 Megabits per second through a transmitter with a
primary NTSC color video signal. Other embodiments of
the invention may be used for transmitting digital data
at other data rates or analog data with either an NTSC
video signal or another video format signal.

10   The embodiment 10 comprises five different
sections. These sections are a primary video section
20, a timing section 30, a video analyzer section 40,
a secondary data modulation section 50 and a noise
reduction section 60. An analog summer or adder 70

15   combines the outputs of the data modulation section 50,
the noise reduction section 60 and the primary video
section 20. It should be noted, however, that the
video section 20, the video analyzer section 40 and the
noise reduction section 60 may not be needed depending

20   upon the data rate of the data signal, the quality of
the primary video signal and channel noise.

A primary video signal, which in this embodiment
may be an NTSC color signal having a horizontal
blanking frequency of 15,734.264 hertz and a vertical

25   blanking frequency of 59.940052 hertz is received. The
primary video signal comprises luminance and
chrominance signals. The NTSC signal also has vertical
and horizontal blanking intervals determined by the
vertical and horizontal sync pulses and an active video

30   interval between blanking intervals. During the active
video intervals, the pixel information for a line of
the video picture is transmitted. However, it should
be understood that the primary video signal may be any
rasterized video signal including video formats

35   commonly used in other countries such as PAL. The
primary video signal, which is at baseband, is supplied

to the primary video section 20, the timing section 30
and the video analyzer 40.

The peak to peak amplitude of the primary video
signal is limited to a predetermined standard by an
5   automatic gain control amplifier 22 and the blanking
level of the video signal is set to a predetermined
voltage by a DC restore circuit 24. If the primary
video signal is an NTSC signal, the function of the DC
restore circuit 24 and the automatic gain control
10   amplifier 22 is to supply a signal at an output 25 that
complies with the RS 170A standard. If the primary
video signal meets the RS 170A standard, the amplifier
22 and the restore circuit 24 may be eliminated.

The output 25 is supplied to a first analog delay
15   line 26. The length of the first analog delay line 26
should at least be equal to the time period required by
the video analyzer section 40 to analyze a group of
pixels of the primary video signal as will be described
below. The output of the delay line 26 is supplied to
20   a low pass filter 27 that reduces noise in the upper
band of the video signal. The output of the filter 27
is supplied to a second delay line 28, which provides
a delay equal to the delay of the noise interference
section 60. The output of the primary video section 20
25   is supplied to a non-inverting input of the summer 70.

The noise interference section 60 comprises a band
pass/comb filter and is preferably the same as the
filter 123 in the processor 100 for the receiver. That
filter is called a noise interference reduction device.
30   That filter blocks the frequency bands containing the
luminance and chrominance signal information. The
output of the noise interference section 60 comprises
the noise component of the video signal lying in the
frequency bands to be occupied by the modulated data.
35   The noise component is then supplied to an inverting

input of the adder 70 to remove that noise component present in the primary video section 20 output.

5   The input data is supplied to a first in first out elastic buffer 52 along with an external clock signal. The data clock controls the rate at which data is stored in the buffer 52. The rate at which data is outputted by the elastic buffer 52 is controlled by two signals, a second, system clock/rasterizing signal 33 provided by the timing section 30 and an inhibit signal

10   supplied by the video analyzer section 40.

The elastic buffer 52 only outputs data at a predetermined rate during the active video portions of the signal as indicated by the system clock signal 33. The system clock 33 is used for rasterizing the data

15   output of the elastic buffer 52 to create blanking intervals.

No data is outputted from the elastic buffer 52 during blanking intervals. The blanking intervals when no data is outputted from the buffer are adjusted

20   sufficiently to synchronize the blanking periods of the output of the video portion 20 and the data portion 50 to the summer 70.

Further, in high speed data transmission such as T1, the elastic buffer 52 is inhibited from outputting

25   data during portions of the video line having sharp transitions as will be explained in more detail below. When the video analyzer section 40 does not inhibit the elastic buffer, the output of the elastic buffer 52 is a rasterized version of the input secondary data; i.e.,

30   the data has the same duration blanking intervals and those blanking intervals coincide at the output of the data section 50 with the blanking intervals in the video signal at the output of the video section 20 when they arrive at the adder 70.

35   The rasterized, secondary data signal from the buffer 52 is supplied to the encoder 54, which also

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receives the system clock 33 and the inhibit signal
from the video analyzer 40. The encoder 54 encodes the
data to limit the bandwidth. The encoder 54 may be a
NRZ encoder, an FM encoder, an MFM encoder, a
5   Manchester encoder, a 1,7 RLL encoder, a 2,7 RLL
encoder or any other encoder that limits the bandwidth
of the rasterized data signal output from the elastic
buffer 52. In addition, data scramblers and block
error correction coders may be included to provide
10   security or to improve the bit error rate.

          The output of the encoder is supplied to a
multiplier 56 for modulating the encoded data on a data
carrier. The encoded data is phase synchronized with
a data carrier and is amplitude modulated by the
15   multiplier 56. In this particular embodiment, the
modulated carrier is either present or is not present
depending upon whether the encoded data is a one or
zero. Preferrably, no carrier is transmitted during
the blanking interval.

20   However, in other embodiments, different
modulation schemes may be used. For low secondary data
rate transmissions, the encoded data need not be
synchronous with the modulated data and one data bit
may be transmitted over several cycles of the data
25   carrier. For higher data rates, where the encoded data
is synchronous with the data carrier, more than two
levels may be permissible for higher data rate
transmission. For example, a half cycle may have a
zero level peak, a 1/3 maximum level peak, a 2/3
30   maximum level peak and a maximum level peak so that two
data bits may be transmitted in one half cycle. Other
techniques may be used for increasing the data rate
such as quadrature amplitude modulation, quadrature
phase shift keying and phase modulation where the data
35   and the data carrier are synchronized. Data rates of

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280 kilobits per second have been found not to require such multibits per half cycle modulation techniques.

The modulated data carrier including the encoded data is passed through a low pass filter 58 that attenuates the higher sideband. The lower sideband of the data carrier is transmitted by the filter 58.

The output of the low pass filter 58 is supplied to a noninverting input of the adder 70 for combining the modulated, rasterized secondary data with the processed video. The timing of the data portion 50 and the video portion 20 is such that the blanking intervals in the video signal supplied to the adder 70 coincide with the inhibited intervals of the rasterized modulated data signal. The combined signal from the video portion 20 and the data portion 50 is a signal at the baseband frequency with the information for the data signals and the information for the video signals frequency interleaved into separate bands respectively with minimal overlap. The interleaved signal may then be transmitted at normal data rates.

The timing section 30 comprises a vertical sync detector, a horizontal sync detector, a color frame detector and phase lock loops that use the detected signals for generating various timing signals. In particular, the data carrier is generated in this embodiment by dividing the horizontal scanning rate of the primary video signal by four and then multiplying the scanning rate by one thousand and forty three through the use of a phase lock loop to generate a data carrier at 4,102,708 hertz. Since the data signal has been rasterized and then modulated at a non-integral multiple of the horizontal frequency at the modulator 56, the spectral envelope of the video signal, when combined by the adder 70 to the video signal, is frequency interleaved with the video signal. Further,

the data carrier should have a known phase relationship with the color frame.

Although a specific example has been selected for the data carrier, other non-integral multiples may be used. The criteria for the data carrier are that the data carrier: (1) should be a non-integral multiple of the horizontal scanning frequency, (2) should be preferably greater than the chrominance carrier, and (3) should be preferably outside the luminance band but be well enough within the video channel bandwidth so that there is not likely to be interference with aural channels.

In addition, the timing section uses phase lock loops to generate a system clock rasterizing signal 33 for outputting data from the elastic buffer 52. The system clock frequency should be either a submultiple or a multiple of the horizontal scanning frequency. The selection of the system clock frequency should be based upon the maximum data transmission rate during an active video line and the data clock rate. The clock should be inhibited for a period equal to each video and horizontal blanking interval so that no modulated data is combined with the video signal at the adder 70 during blanking intervals of the primary video signal; i.e. the blanking intervals in the output of the video 20 and data portion 50 should be synchronized. Further, the system clock rate should be sufficiently high so that the elastic buffer will not overflow.

The use of phase lock loops for generating both the system clock and the data carrier means that the two signals are phase related. This allows for transmission by a modulator at higher data rates by, for example, having each half cycle of the data carrier representing one data element for transmission.

A third output of the timing section is a pulse indicating the occurrence of the front porch of the

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horizontal sync pulse.   This front porch pulse is
provided by using any of several front porch pulse
detector circuits (not shown) and is used by the DC
restore circuit 24 to set the blanking level to be
5   compatible with the RS 170A standard.

In higher data rate transmission systems, a video
analyzer 40 may also be included. The video analyzer
40 includes a digital signal processor that analyzes
the active portion of the video signal for information
10   representing a group of pixels in a line representing
a sharp transition. The video analyzer searches for
signal information representing a sharp transition that
would generate strong high frequency clusters of the
luminance or chrominance signals. Then, an inhibit
15   signal is sent to both the elastic buffer 52 and the
encoder 54. The inhibit signal is time shifted so that
no secondary data is supplied to the adder 70 when the
primary video information representing the sharp
transition is being outputted by the video portion 20.
20   The use of the video analyzer 40 further reduces the
possibility of interference between the secondary data
and the primary video.   The video analyzer may also
insert start and stop codes into the data stream so
that the receiver will recognize when data transmission
25   has been inhibited to avoid interference.

The video analyzer 40 is only believed to be
necessary in high data rate systems such as T1 and
above. For lower data rate systems, the video analyzer
40 and the inhibit signal may be eliminated. In those
30   systems that have the video analyzer, the delay line 26
in the primary video section 20 must delay the primary
video signal sufficiently for the time period for
processing of a group of pixels by the analyzer 40. If
the data transmission rate is relatively low such as
35   two hundred eighty kilobits per second, however, the

video analyzer 40 and the delay line 26 may be
eliminated.

5   The result at the output of the summer 70 is that
the primary video signal and the data are frequency
interleaved. In addition, the combined signal from the
summer 70 still has the same type of blanking intervals
found in the standard NTSC signal. Therefore, the
video signal may be received by a standard NTSC
receiver without detecting the secondary transmitted
10   data.

           To further ensure against interference, the output
signal levels of the noise interference section 60 and
the secondary data section 50 should be scaled. The
scaling should set the injection level of those two
15   sections to the adder 70 to avoid interference. The
output level of the noise interference section 60,
should be adjusted to minimize noise on the received
data signal at a receiver. The output level of the
data section 50 should be adjusted so that there is no
20   noticeable interference on a video monitor coupled to
the output of the adder 70.

           In certain applications, it may be desirable to
transmit an additional low frequency signal such as an
audio signal. For example, an audio signal may be
25   sampled using compression techniques such as in U.S.
Patent No. 5,021,786 and be transmitted during the
horizontal sync intervals. If the secondary data is
for example compressed video, the audio signal for both
a right and a left audio channel for the compressed
30   video may be sampled twice during each active interval
and added during the horinzontal sync pulses. A
multiplexer controlled by the timing signal may be used
for adding the compressed digital data during the
horizontal sync pulses.

35   Figure 2 shows a signal processor 100 for a video
receiver that separates the transmitted data from the

signal transmitted by a video transmitter incorporating
the processor 10 of Figure 1. Again, although this
embodiment is shown for receiving a primary NTSC signal
having secondary digital data frequency interleaved
5   with the video, other embodiments may use for other
video signals and primary data.

In Figure 2, the received baseband signal,
containing both video and digital information is
processed by two sections, a video section 120, a
10   timing circuit 130 and a video analyzer section 140.
The video section 120 processes the received baseband
signal through an automatic gain control amplifier 122
and a DC restore circuit 124. The output of the DC
restore circuit is supplied to a band pass/comb filter
15   123. The output of the band pass/comb filter 123 in
the receiver 110 is to pass the interleaved frequencies
containing the transmitted data signals but to block
the primary video signal. The output of the band
pass/comb filter 123 is supplied to a phase compensator
20   125 that adjusts for phase distortion due to the band
pass/comb filter 123. The phase compensator 125 may be
a second filter restoring phase linearity with
frequency to adjust for the phase distortion introduced
by the band pass/comb filter 123.

25   The phase compensated output signal is a
reproduction of the rasterized and modulated data
signal supplied to the adder 70 by the data portion 50.
The rasterized modulated data signal is supplied to a
data detector 126, which also receives a system clock
30   signal. The data detector 126 comprises a peak
detector that detects the peak signal in each period of
the system clock and an envelope detector. For a data
receiver compatible with a data transmitter of Figure
1, the data detector output is preferably a digital
35   signal that represents a one when a data carrier half
cycle is present and a zero when a data carrier half

cycle is not present. For lower data rates, the processor 100 may look for the presence of a data carrier over several cycles.

Although the above mentioned data detector 126 is designed for the transmitter 10, it should be understood that the data detector may be of any other format that has been chosen to be compatible with the data transmission or modulation format of the transmitter 10. For example, the data detector may be a phase detector if the data is phase modulated, or a quadrature amplitude detector if the transmitter uses quadrature amplitude modulation for the data. Further, if the data rate is sufficiently low where a bit of data is transmitted over several cycles, for example 64 kilobits per second, the data detector may be the aforementioned envelope detector.

At high data rates, a circuit for detecting synchronously modulated data may be needed. A clock recovery circuit may be used for recovering the clock from the data. That recovered clock may be used for sampling the modulated data. That sampled, modulated data may be provided to an analog to digital converter to produce a digital signal. Alternatively, a low pass filter, a rotator and a slicer may be used with the data detector.

The output of the data detector 126 is supplied to a data separator and decoder 128 that provides the digital data as an output. The data separator and decoder 128 receives from the timing circuit 130 a time adjusted composite blanking signal, and a regeneration of the data carrier outputted by the timing circuit 30. The data separator and decoder 128 also receives a video inhibit signal from a video analyzer 140. The data decoder 128 uses the data level bits for each clock period, the data carrier, the blanking composite signal and the inhibit signal to provide data at the

same clock rate at the output as the data provided to the elastic buffer 52 of the transmitter. The data decoder and separator 128 will also remove the encoding provided by the encoder 54 in the transmitter 10.

5   The output of the separator 128 is provided to an first in first out elastic buffer 129. The rate at which data is inputted to the buffer 129 is controlled by the system clock from the timing block 130. The data may be outputted from the buffer by a second clock

10   (not shown) at any desired data rate that prevents the buffer from overflowing.

The video analyzer 140 and the timing block 130 operate in the manner of the timing section 30 and the video analyzer 40 in the transmitter 10. The analyzer

15   140 and the timing block 130 prevent the data decoder and separator 128 from reading blanking intervals in the rasterized data or inhibit periods transmitted in the data. So that the data signal will be properly recovered a delay line (not shown) should be included

20   before the data detector, where the delay line compensates for the processing period of the video
·   analyzer 140.

It should be noted however, that if the video analyzer 40 of Figure 1 inserts start/stop codes in the

25   data stream when data transmission is inhibited due to interference considerations, the receiver does not need a video analyzer 140. Instead, the data detector and separator 128 may detect these start/stop codes as part of the decoding function.

30   Although the foregoing embodiment is designed for a primary video signal that is in the NTSC format and transmitting secondary digital data for frequency interleaving, other embodiments of the instant invention may be used. The primary video signal for

35   transmission may be for example a signal in the PAL or the SECAM format, any rasterized HDTV signal, or any

other signal that has been rasterized. Further, the
data may be analog or digital data and the transmission
and reception formats may be synchronous or non-
synchronous depending upon the secondary data rate. A
5   particular useful application for the disclosed
invention is to transmit a compressed video signal,
ACTV signal or HDTV signal as the secondary data
signal.

By using the disclosed signal processors, the
10   received video signal may be demodulated and recovered
by an ordinary video receiver without the transmitted
data causing noticeable interference on the television
picture generated by the receiver. The transmitted,
secondary data may also be readily separated. It
15   should be understood that the secondary data provided
to the signal processor may differ from the primary
video signal in a number of different aspects. Before
being rasterized, the secondary data signal has a low
cross-correlation with the video signal as the two
20   signals may be completely unrelated. Therefore, a wide
variety of data may be transmitted and is particularly
useful in systems where one way communications is
preferred.

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We claim:

1.   A signal processor for combining data in the
same communications channel as a video signal for an
image, the video signal having a video bandwidth and
having horizontal and vertical blanking interval
5   defined by sync pulses and an active video intervals
between blanking intervals, the data being uncorrelated
to the image, the signal processor comprising:
        means for receiving a video signal and the data
signal;
10   means for detecting the frequency of at least one
of the blanking and active video intervals and the sync
pulses; and
        means responsive to the detecting means for
modulating the data within the video bandwidth; and
15   means for combining the modulated data with the
video signal such that the modulated data signal is
present during at least some parts of each active video
interval.

2.   The signal processor described in claim 1,
wherein the spectral envelope of the video signal has
gaps, and wherein the modulating means comprises:
        means for generating a data carrier based upon the
5   frequency of at least some of the sync pulses for
modulating the data; and
        means responsive to the data carrier for frequency
interleaving the data with the video information.

3.   The signal processor described in claim 2,
wherein the means for modulating further includes means
for rasterizing the data signal with the blanking
interval of the video signal.

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4.   The signal processor of claim 3, wherein the modulating means further includes means for limiting the bandwidth of the rasterized data.

5.   The processor of claim 4, wherein the means for limiting the bandwidth of the rasterized data comprising an encoder for encoding rasterized data in one of the formats of the group comprised of NRZ, RLL, FM, Manchester and MFM coding data formats.

6.   The signal processor of claim 1, wherein the video and the modulated data signals have signal levels and wherein the ratio of the video signal level and the modulated data level is controlled to reduce interference from modulated data on the video signal.

7.   A method for transmitting data other than a video signal in the same communications channel as a video signal being transmitted in a given frequency band, the video signal having a video bandwidth and active and blanking intervals, and the video signal and the data being uncorrelated with respect to each other, the method comprising:
        detecting the active video intervals; and
        transmitting the data at frequencies within the band during at least some of the active video intervals.

8.   The method of claim 7, wherein the method for detecting the active video intervals comprises detecting the blanking intervals of the video signal.

9. The method of claim 8, wherein the intervals are defined by sync pulses, and wherein the video spectrum envelope has gaps and the step of transmitting the data comprises:

5   generating a data carrier for modulating the data based upon one of at least some of the intervals between sync pulses; and

modulating the data carrier with a data signal corresponding to the secondary data to fall within the

10   gaps of the video signal when modulated by the data carrier, whereby frequency interleaving is obtained.

10. The method of claim 8, wherein the step of transmitting the data further includes blanking the data signal other than during the active video period whereby the data signal is rasterized.

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11. A system for interleaving a secondary data signal with a video signal having horizontal sync pulses at a predetermined rate, the system comprising:

a timing circuit responsive to the sync pulses, the timing circuit producing a data carrier at a frequency that is a non-integral multiple of rate and a timing signal at an integral multiple or submultiple of the rate;

a combiner having at least two inputs;

a video portion providing the primary video signal to one input of the combiner;

a secondary data portion providing a second input to the combiner;

a blanking interval detector producing a blanking signal indicating the time periods of the blanking interval;

the secondary data portion including:

a data buffer receiving the secondary data and providing rasterized data at an output based upon the blanking signal and the secondary data;

a modulator for providing a modulated data signal responsive to the data carrier, the modulated data signal being coupled to the second input of the combiner.

12. The system of claim 11, the secondary data portion further including a scrambler coupling the rastorized data to the modulator, wherein the rastorized data received by the modulator is scrambled.

13. The system of claim 11, wherein the secondary data signal includes a clock that controls the rate at which data is stored in the buffer.

14.   The signal processor of claim 11, wherein the signal processor section further includes an encoder for limiting the bandwidth of the rasterized data.

15.   The signal processor of claim 11, wherein the primary video signal is an NTSC signal and the secondary data signal is a digital signal.

16.   The signal processor of claim 11, wherein the secondary data signal is a compressed video signal.

17.   The signal processor of claim 11, wherein the buffer is an elastic buffer.

18.   The signal processor of claim 11, wherein the signal processor further includes a filter receiving the video signal and producing as an output a signal that is a reduced portion of the spectra of the video
5   signal containing the video information and the output of the filter being supplied to an inverting input of the combiner, whereby noise in the data signal is reduced.

19.   The signal processor of claim 11, wherein the signal processor further includes means for detecting at least one of luminance and chrominance transitions in the video signal above a predetermined limit and for
5   inhibiting data transmission such that no modulated data is provided to the combiner while the portion of the primary video signal containing those transitions reaches the combiner.

20. The signal processor of claim 11, wherein the
signal processor further includes means for detecting
at least one of luminance and chrominance transitions
in the video signal above a predetermined limit and for
5   inserting a unique code in the modulated data to inform
a receiver that transmission of secondary data will be
halted temporarily.

21. A signal processor for separating a data
signal frequency interleaved with a rasterized video
signal having horizontal and vertical blanking
intervals at predetermined intervals, the processor
5   comprising
a timing circuit generating a timing signal at a
predetermined frequency based upon the rate of the
horizontal and vertical intervals;
a band pass/comb filter passing as an output the
10   frequencies for the data signal;
a data separator responsive to the timing signal
and the output of the filter for outputting the data
signal.

22. The signal processor of claim 21, wherein
transmission of the data signal has been inhibited
during intervals when the video signal represents
relatively sharp transitions between pixels and the
5   processor comprises a video processor for detecting
information in the signal representing sharp
transitions, and the separator further includes a data
synchronizer responsive to the video processor.

23. The processor of claim 22, wherein the timing
circuit outputs a pulse representing the blanking
intervals and the separator uses the composite signal
to recognize the blanking intervals in the transmitted
5   data signal.

24.

24. The processor of claim 21, further including a phase compensator for compensating the data signal for any phase distortion of the filter, and the data separator further includes a synchronous data detector
5 for detecting data in the phase compensated data signal.

25. A system for adding a secondary data signal to a primary video signal blanking intervals defined by sync pulses and a frequency band, the data signal being uncorrelated to the video signal, the system
5 comprising:
means for detecting at least some of the sync pulses in the video signal;
means for modulating a data carrier based upon the detected
10 sync pulses with the data to provide a modulated data signal having the frequency band of the modulated data carrier at least partially overlapping the video band of the video signal; and
means for combining the modulated data signal with
15 the video signal such that the data signal is transparent to a receiver designed to receive the video signal.

26. The system of claim 25, wherein the data signal synchronously modulates a data carrier.
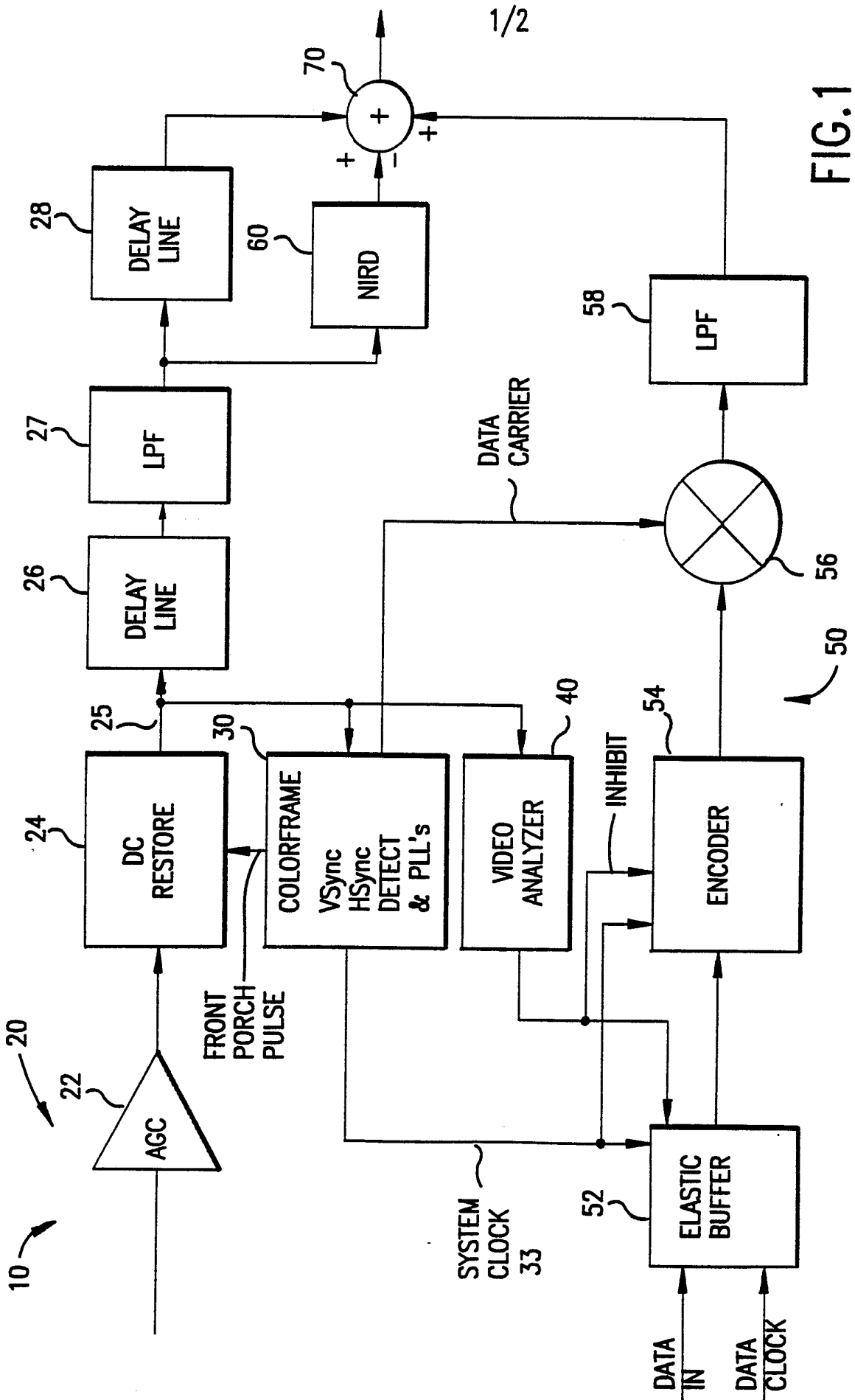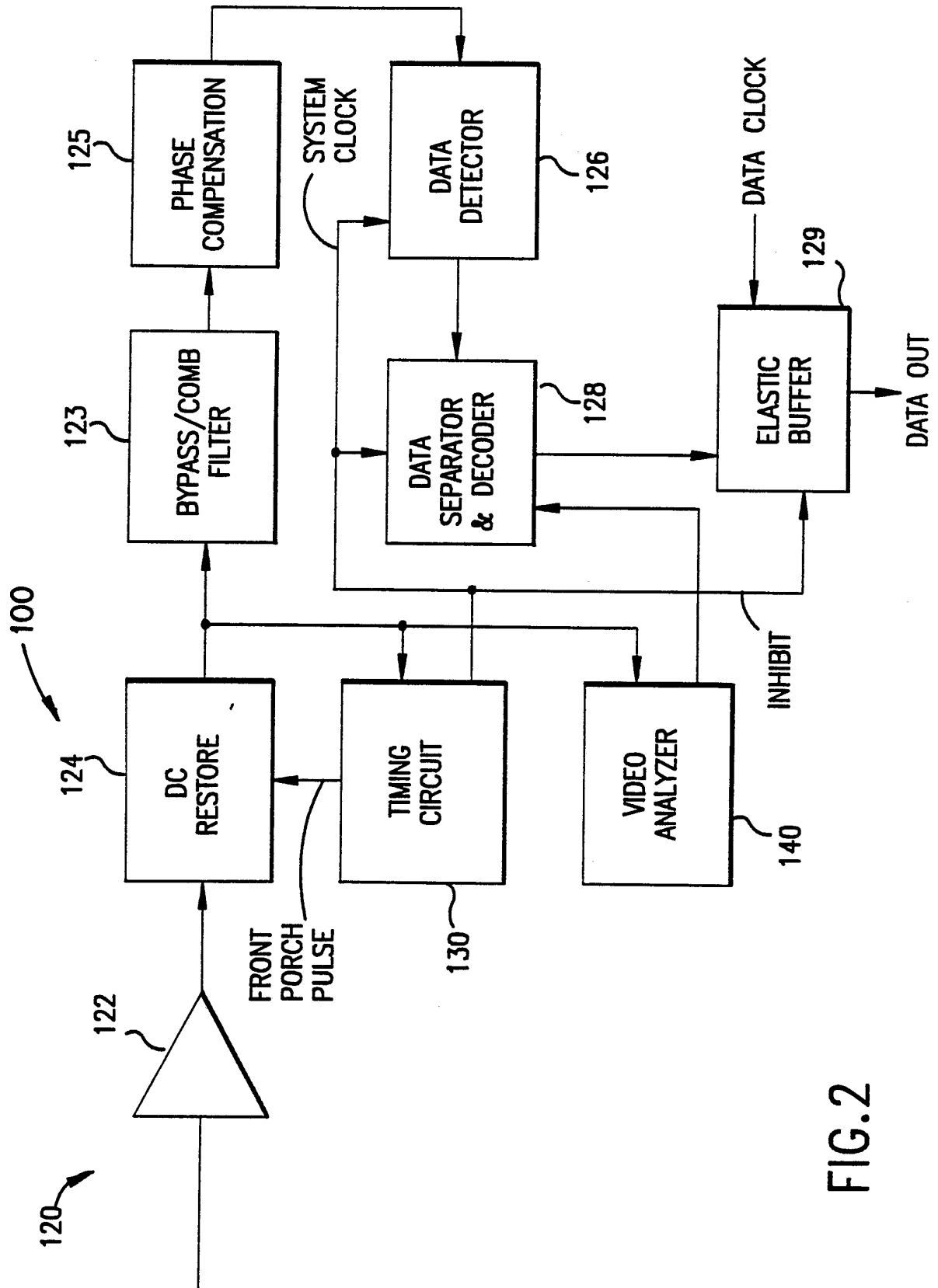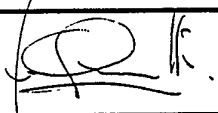
1/2

FIG.1

2/2

FIG.2

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 H04N7/08

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	JOURNAL OF THE SOCIETY OF MOTION PICTURE AND TELEVISION vol. 83, no. 1, January 1974, SCARSDALE US pages 10 - 13 P.T.KING 'A novel television add-on data communication system'	1-18,25, 26
Y		19
A	see the whole document	20
X	US,A,4 958 230 (JONNALAGADDA ET AL.) 18 September 1990	21
Y		22-24
A	see abstract;\ figure 4	1-11,18, 25,26

-/--

° Special categories of cited documents :[10]

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

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"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
22 SEPTEMBER 1992	29. 09. 92

International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	GIANNOTTI P.

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.
Y	EP,A,0 356 903 (FAROUDJA) 7 March 1990 see abstract; figures 3,7,8,11 see column 6, line 28 - column 7, line 38 see column 8, line 26 - column 9, line 16 see column 10, line 51 - column 11, line 15 ---	19,22-24
A	EP,A,0 263 449 (BAYERISHE RUNDFUNKWERBUNG) 13 April 1988 see abstract; figures 2.1,2.2 see column 3, line 48 - column 4, line 27 ---	1-3,7-10
A	NHK LABORATORIES NOTE. no. 151, February 1972, TOKYO JP pages 2 - 9 A.MAEBARA ET AL. 'A television facsimile system employing an additional carrier' see page 2 - page 4; figure 2 ---	1,4-7,14
A	JOURNAL OF THE INSTITUTION OF ELECTRONIC AND RADIO ENGINEERS. vol. 57, no. 1, January 1987, LONDON GB pages 27 - 35 M.CHRISTIANSEN ET AL. 'A video scrambler/descrambler concept for the PAL format' see abstract; figure 4 ---	12
A	US,A,3 700 793 (BORSUK ET AL.) 24 October 1972 ---	
A	EP,A,0 278 192 (ETAT FRANCAIS ET AL.) 17 August 1988 ---	
A	EP,A,0 365 431 (THOMSON-CSF) 25 April 1990 -----	

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
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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
US-A-4958230	18-09-90	AU-A-	6165290	11-03-91
		CN-A-	1049586	27-02-91
		EP-A-	0485478	20-05-92
		WO-A-	9102431	21-02-91
EP-A-0356903	07-03-90	US-A-	4943849	24-07-90
		JP-A-	2210992	22-08-90
EP-A-0263449	13-04-88	DE-A-	3633882	14-04-88
US-A-3700793	24-10-72	DE-A,B,C	2128227	23-12-71
		NL-A-	7107636	13-12-71
		SE-B-	358067	16-07-73
EP-A-0278192	17-08-88	FR-A-	2609228	01-07-88
		JP-A-	63253738	20-10-88
		US-A-	4884139	28-11-89
EP-A-0365431	25-04-90	FR-A-	2638305	27-04-90
		FR-A-	2638306	27-04-90
		AU-A-	4506989	14-05-90
		EP-A-	0439539	07-08-91
		WO-A-	9004893	03-05-90
		JP-T-	4501348	05-03-92

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