PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 3 :		(11) International Publication Number: WO 84/ 00657
H04N 9/32	A1	(43) International Publication Date: 16 February 1984 (16.02.84)

(21) International Application Number: PCT/GB83/00186

(22) International Filing Date: 29 July 1983 (29.07.83)

(31) Priority Application Number: 8222055

(32) Priority Date: 30 July 1982 (30.07.82)

(33) Priority Country: GB

(71) Applicant *(for all designated States except US):* INDEPENDENT BROADCASTING AUTHORITY [GB/GB]; 70 Brompton Road, London S.W.3 (GB).

(72) Inventor; and
(75) Inventor/Applicant *(for US only) :* MORCOM, Richard [GB/GB]; 134 Stockbridge Road, Winchester, Hampshire (GB).

(74) Agents: CRAWFORD, Andrew, Birkby et al.; A.A. Thornton & Co., Northumberland House, 303-306 High Holborn, London WC1V 7LE (GB).

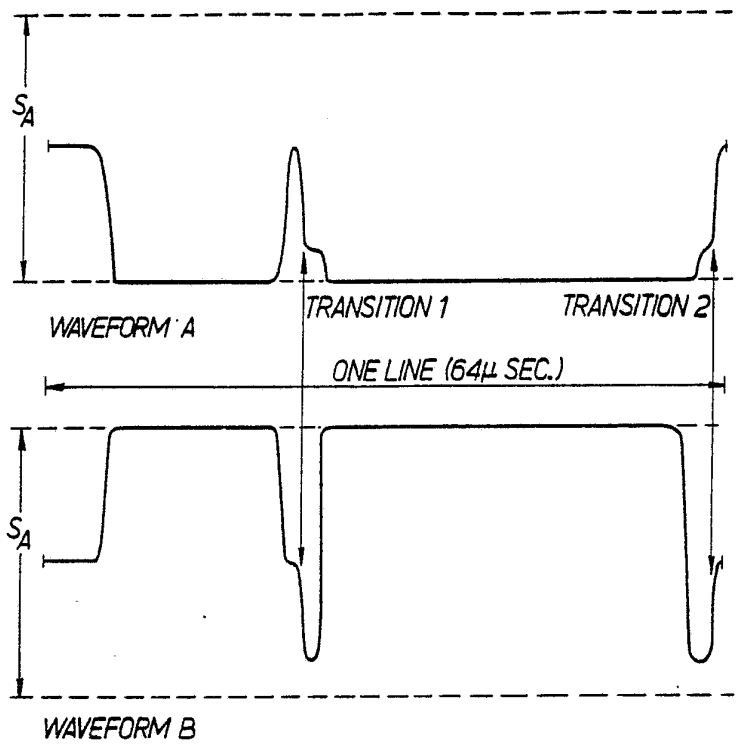
(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.

Published
With international search report.

(54) Title: TRANSMISSION AND/OR RECEPTION OF TELEVISION PICTURES

(57) Abstract

Vertical synchronisation information in a multiplexed analogue component (MAC) television signal is included in a line scan period, the amplitudes of the waveform being chosen so as to represent a position in the colour space outside that occupied by the picture signal; preferably, the amplitudes are chosen the be at the limits of the picture signal amplitude. By these means, the normal horizontal synchronisation information can still be included in the form of transitions (1 and 2), and the chance of the synchronisation and picture signals interfering with each other is minimised.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**LI**	Liechtenstein
AU	Australia	**LK**	Sri Lanka
BE	Belgium	**LU**	Luxembourg
BR	Brazil	**MC**	Monaco
CF	Central African Republic	**MG**	Madagascar
CG	Congo	**MR**	Mauritania
CH	Switzerland	**MW**	Malawi
CM	Cameroon	**NL**	Netherlands
DE	Germany, Federal Republic of	**NO**	Norway
DK	Denmark	**RO**	Romania
FI	Finland	**SE**	Sweden
FR	France	**SN**	Senegal
GA	Gabon	**SU**	Soviet Union
GB	United Kingdom	**TD**	Chad
HU	Hungary	**TG**	Togo
JP	Japan	**US**	United States of America
KP	Democratic People's Republic of Korea		

TRANSMISSION AND/OR RECEPTION OF TELEVISION PICTURES

The present invention relates to the transmission and/or reception of television pictures.

In our co-pending International Patent Application No. PCT/GB83/00022 (Publication No. WO) there are disclosed a method and system for transmitting and/or receiving colour television signals which we have called MAC (Multiplexed Analogue Component). In this system, the chrominance and luminance components of the picture are separated and transmitted in time compressed form. Information must be encoded on the compressed signal to provide timing data for horizontal and vertical synchronisation of the received picture.

Unlike convention television coding systems (e.g. PAL) MAC does not have an exclusive voltage level for synchronisation transmission. The chrominance waveform uses the full voltage range of the signal. Thus different methods of synchronisation coding are required.

Horizontal synchronisation information ('linesync') is decoded by detection of the fixed position voltage changes (transitions) at the start and end of the time-compressed luminance information. These transitions remain constant and using 'flywheel' methods can reliably be detected in the presence of other similarly-spaced transitions in the picture information.

However, there is no equally-apparent way to encode vertical or field synchronisation information.

The present invention involves the provision of a vertical synchronisation signal which can be used with separated component signal transmission systems such as the MAC system.

BUREAU OMPI WIPO INTERNATIONAL

The present invention provides a transmission system for transmitting television signals of the type including separate chrominance and luminance components within individual line periods, the system comprising means for separating the chrominance and luminance components from a picture signal to provide line scan periods having said separated components, characterised in that there are provided means for inserting a vertical synchronisation signal within each field of television signals, said vertical synchronisation signal having a duration of one line period and an amplitude component greater than that of a corresponding component of the separated picture signal.

The present invention also provides a receiving system for receiving signals having a vertical synchronisation signal as abovedescribed.

BUREAU OMPI WIPO INTERNATIONAL

In order that the present invention may be more readily understood, an embodiment thereof will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 shows the basic form of a MAC signal;

Figure 2 shows a diagram for use in explaining the present invention;

Figure 3 shows two waveforms provided by apparatus according to the present invention;

Figure 4 shows a block diagram of part of transmitting apparatus wherein the synchronisation waveforms of Figure 3 are inserted in the signal for transmission; and

Figure 5 shows a block diagram of part of receiving apparatus arranged to detect the synchronisation waveforms of Figure 3.

Referring to Figure 1, there is shown a representation of a basic MAC signal of one line length (64 μ sec) from which it will be seen that the chrominance waveform uses the full voltage range or available signal amplitude S_A of the signal. There is no exclusive voltage level for synchronisation, as previously stated, and therefore other methods must be utilised. Transitions 1 and 2 occurring at beginning and end of the luminance component can readily be detected to provide horizontal synchronisation information. Further details of the basic MAC signal and its transmission and reception can be obtained from the aforementioned International (PCT) Application.

Due to the nature of the MAC signal, transmission of luminance (Y) and colour difference (U,V) signals is achieved without any interaction between these signals. In addition, there is no restriction on the relative amplitudes fo the Y and U or V signals provided they remain within their allotted envelopes. Therefore the limits of the colour signal that may be transmitted

BUREAU OMPI WIPO INTERNATIONAL

by the MAC system can be represented in three dimensions as shown in Figure 2 by a truncated cube A. Note that the luminance (Y) may be transmitted at a slightly lower level than the two chrominance components (U,V).

The video signal to be encoded by the MAC encoder is produced in R,G,B, (Red, Green, Blue) and then 'matrixed' to Y,U,V by a linear transformation. As the signal is derived from an 'RGB' source, the video signal is constrained to remain in a solid B inside the truncated cube A as shown in Figure 2. This solid, a 'parallelepiped', is smaller in volume than the truncated cube A. The corners of the parallelepiped B represent the 100% Colour Bar colours, White, Yellow, Green, Cyan, Red, Magenta, Black and Blue, abbreviated to Wh, Yl, Gn, Cy, Rd, Mg, Bk and Bu respectively.

There are many points outside the parallelepiped B yet inside the truncated cube A which could be chosen to encode vertical synchronisation information.

As was mentioned earlier, the amplitude of the luminance signal (Y) is reduced compared to the chrominance signals (U,V); this is done so as to restrict bandwidth occupancy in the satellite RF channel. This reduction is only necessary at high baseband frequencies. If only low frequencies were required to be transmitted by the luminance channel, an increase in amplitude could be tolerated. This increase is represented in Figure 2 by the extension of the truncated cube A to a full cube including portions A'. The bandwidth required for synchronisation is low and hence can be permitted to enter this extra area outside the truncated cube A yet within the full cube. The optimum positions for synchronisation data are therefore within the full cube but as far as possible from the RGB parallelepiped B. Two such points are marked *p* and *q* on Figure 2. The waveforms A and B corresponding to these points are shown in Figure 3. Use of such wave-

BUREAU OMPI WIPO INTERNATIONAL

forms to encode vertical synchronisation information ensures that picture information can never be erroneously detected as synchronisation information, which is the aim of any synchronisation coding scheme.

Preferably, one of the waveforms shown in Figure 3 will be used with one of the interlaced fields while the other waveform will be used with the other of the interlaced fields so as to distinguish between the two fields.

Detection of the vertical synchronising waveform described can be achieved by integration of the MAC signal over one line period (64 microseconds). This ensures that the correct level for both Y and U/V signals is obtained. In addition, as horizontal (line) synchronisation information is not required for vertical synchronisation detection, the vertical information may be used to accelerate correct detection of the horizontal synchronisation.

Detection of the synchronisation signals described here can be achieved using simple circuits of the type presently used to detect synchronisation waveforms in the PAL systems.

Figure 4 shows a circuit for inserting the synchronisation signal into the MAC video signal so as to generate the waveform described.

Digital samples corresponding to the levels of the waveform to be produced are stored in a Read-only Memory 10. Readout of data from the memory 10 is controlled by a synchronisation input 11 so as to provide samples which generate the required waveform at the correct time. The waveform, in the form of the digital samples, is then read out on to data bus 12 as an alternative to the compressed picture signal from MAC coder 13 which at other times processes the video signal fed to its picture input 14. The combination of signals is converted to an analogue

BUREAU OMPI WIPO INTERNATIONAL

signal by the digital-to-analogue converter 15 and low-pass filter 16, and the analogue signal present at output 17 is then suitable for transmission.

Figure 5 shows a circuit for detecting the synchronisation signal within the received signal.

The MAC waveform containing the synchronisation signal is fed to input 20 and thence to low-pass filter 21. The output of the filter 21 goes to an analogue-to-digital converter 22 and MAC picture decoder 23 for decoding the normal picture information. The output of the filter 21 also goes to a level comparator 24 which compares the input signal to a reference voltage at input 25. The reference voltage is set at a level to detect the described synchronisation signal, i.e. its level should be near to the maximum signal amplitude S_A. The output of comparator 24 will also contain detections of high level picture information, but these detections are effectively removed by integrator 26 which only provides a detection output in the presence of a synchronisation signal as shown in Figure 3. The detection output is then used to control the decoder 23 and the vertical synchronisation information allows the decoder 23 to provide a suitable picture signal at output 27.

Thus it will be seen that in the preferred system, vertical synchronisation information is included in a single line scan period per field, which line period can conveniently be provided during the blanking period. The amplitude of the waveform is chosen to lie outside that of the luminance component of the picture signal. By use of such a signal, the normal horizontal synchronisation information can still be included in the form of the transitions normally occurring between chrominance and luminance components, and the chance of the synchronisation and picture signals interfering with each other is minimised.

Advantageous features of this system include:-

BUREAU OMPI WIPO INTERNATIONAL

1. Horizontal synchronisation by use of fixed-position transitions in the waveform within the video signal amplitude range.

2. Accelerated horizontal synchronisation by use of vertical synchronisation information.

3. Use of levels in the MAC waveform representing video signals outside the normal range of pciture information to code synchronisation information.

4. Detection of signals in the waveform by mathematical integration.

5. The clamping periods of the basic MAC signal are retained in the sync waveforms.

BUREAU OMPI WIPO INTERNATIONAL

CLAIMS:

1. A transmission system for transmitting television signals of the type including separate chrominance and luminance components within individual line periods, the system comprising means for separating the chrominance and luminance components from a picture signal to provide line scan periods having said separated components, characterised in that there are provided means for inserting a vertical synchronisation signal within each field of television signals, said vertical synchronisation signal having a duration of one line period and an amplitude component greater than that of a corresponding component of the separated picture signal.

2. A transmission system according to claim 1, wherein the luminance component of the television signal has an amplitude limit less than that of the chrominance component, characterised in that the vertical synchronisation signal providing means generates a signal having a component corresponding to the luminance component but with a greater amplitude.

3. A transmission system according to claim 2, characterised in that the amplitude of said vertical synchronisation signal component corresponding to the luminance component has an amplitude equal to that of the amplitude limit of the chrominance component.

4. A transmission system according to claim 1, wherein transitions are provided in the picture signal between chrominance and luminance components for horizontal synchronisation information, characterised in that said vertical synchronisation signal providing means is arranged to provide similar transitions in the vertical synchronisation signal, so as to accelerate horizontal synchronisation.

BUREAU OMPI WIPO INTERNATIONAL

5. A transmission system according to claim 1, characterised in that first and second uniquely identifible vertical synchronisation signals are provided alternately by said means, thereby to identify alternate interlaced fields of the television signal.

6. A transmission system according to claim 1, characterised in that components of the vertical synchronisation signal have a constant amplitude over substantially the whole of their duration.

7. A transmission system according to claim 1, characterised in that the timing of the components of the vertical synchronisation signal corresponds to the timing of the components of the picture signal.

8. A receiving system for receiving television signals having vertical synchronisation signals as transmitted by the system according to claim 1, characterised in that level sensing means are provided to detect the amplitude component of the vertical synchronisation signal which is greater than that of the corresponding component of the picture signal.

9. A receiving system according to claim 8, characterised in that the level sensing means comprises a comparator for comparing the amplitude level of the received signal with a reference level.

10. A receiving system according to claim 9, characterised in that the level sensing means further includes an integrator for integrating the output of the comparator.

BUREAU OMPI WIPO INTERNATIONAL

11. A transmission/receiving system for transmitting and receiving television signals of the type including separate chrominance and luminance components within individual line periods of a picture signal, the system comprising transmitting means arranged to transmit within a field of the television signals a vertical syncrhonisation signal having a duration of one line period and amplitude components representing a position in chrominance/luminance space outside that occupied by the picture signal, and receiving means arranged to receive the television signals including the vertical synchronisation signal and to identify the vertical synchronisation signal by amplitude analysis of the received signal when the amplitude components represent a position in the chrominance/luminance space outside that occupied by the picture signal.

BUREAU OMPI WIPO INTERNATIONAL

1/3

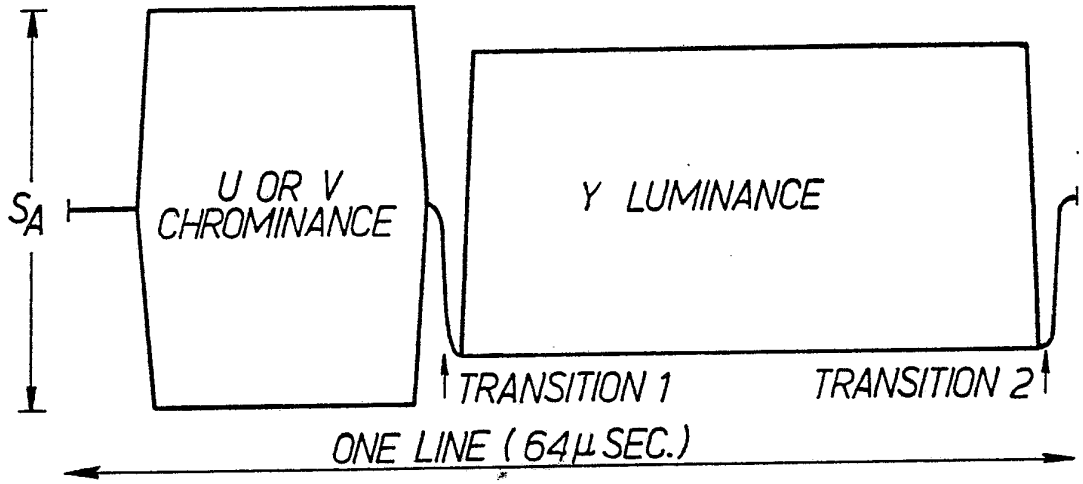


FIG. 1.

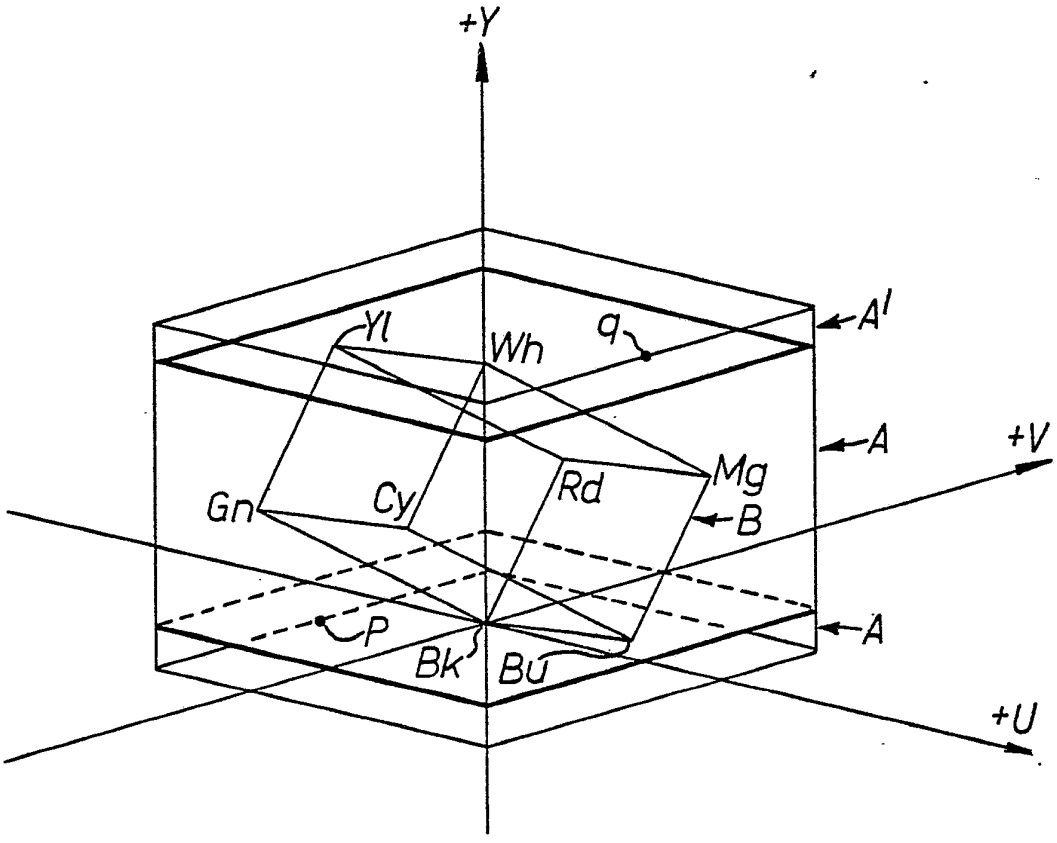


FIG. 2.

BUREAU OMPI WIPO INTERNATIONAL

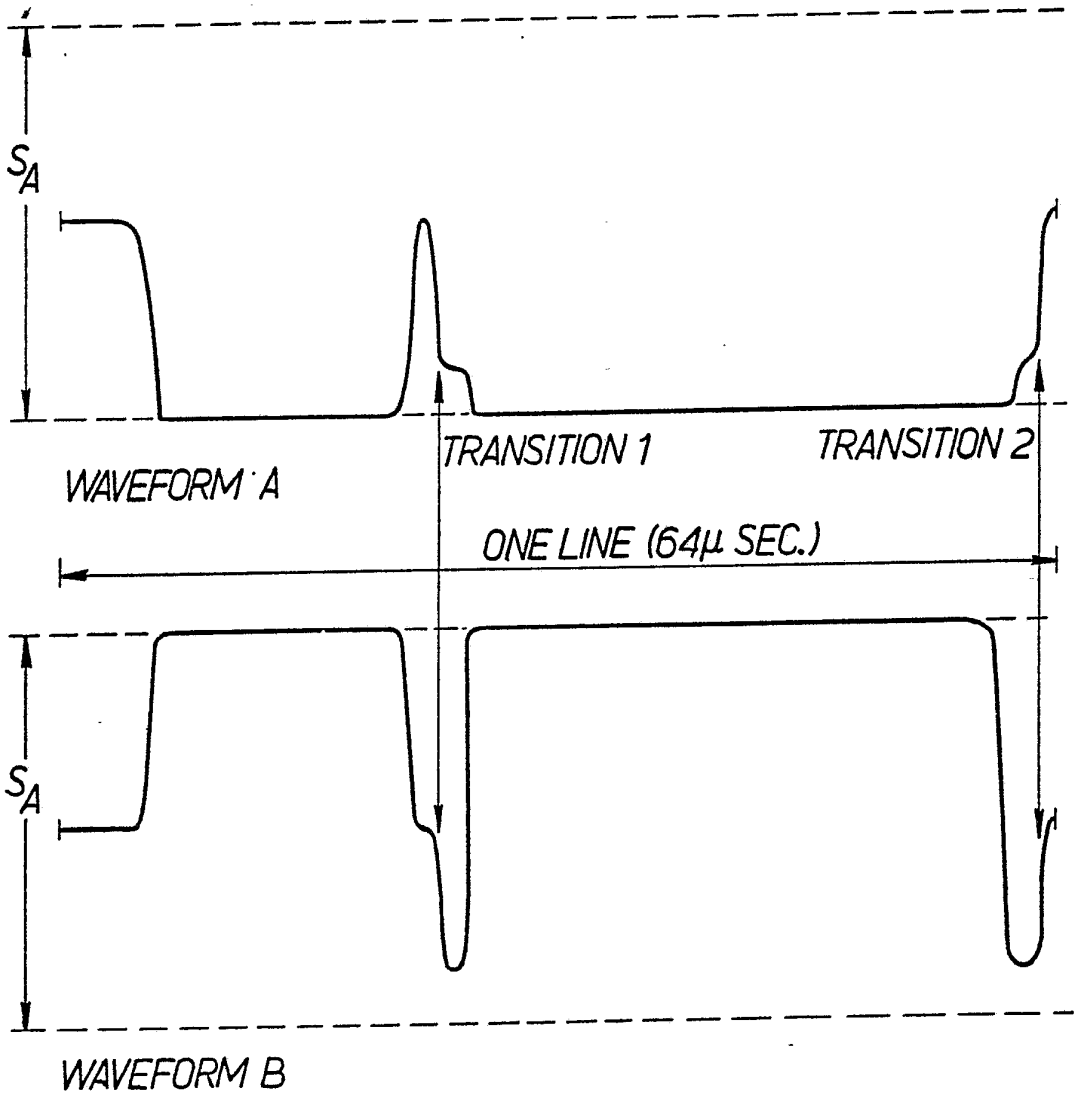


FIG. 3.

BUREAU OMPI WIPO INTERNATIONAL

3/3

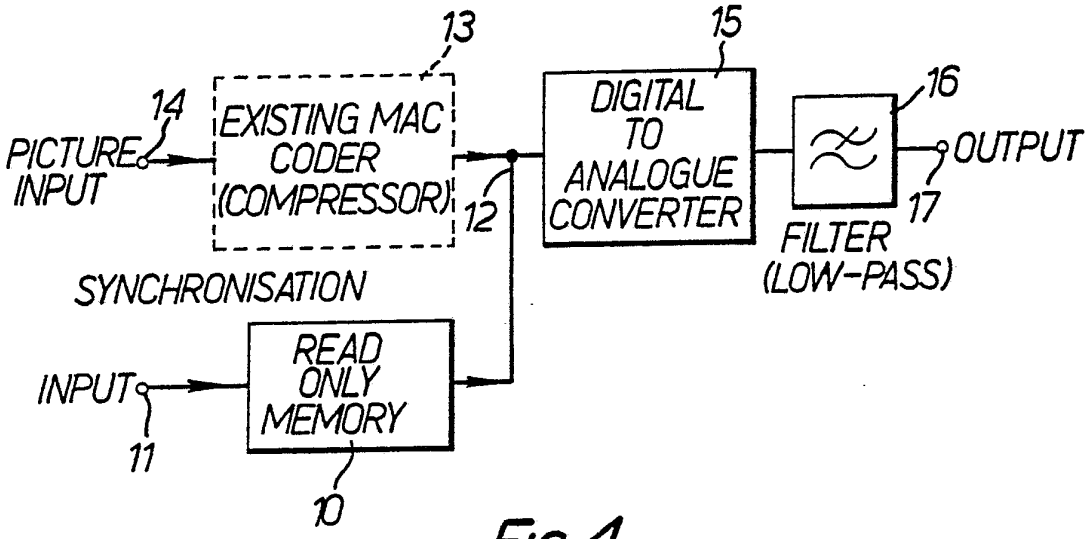


FIG. 4.

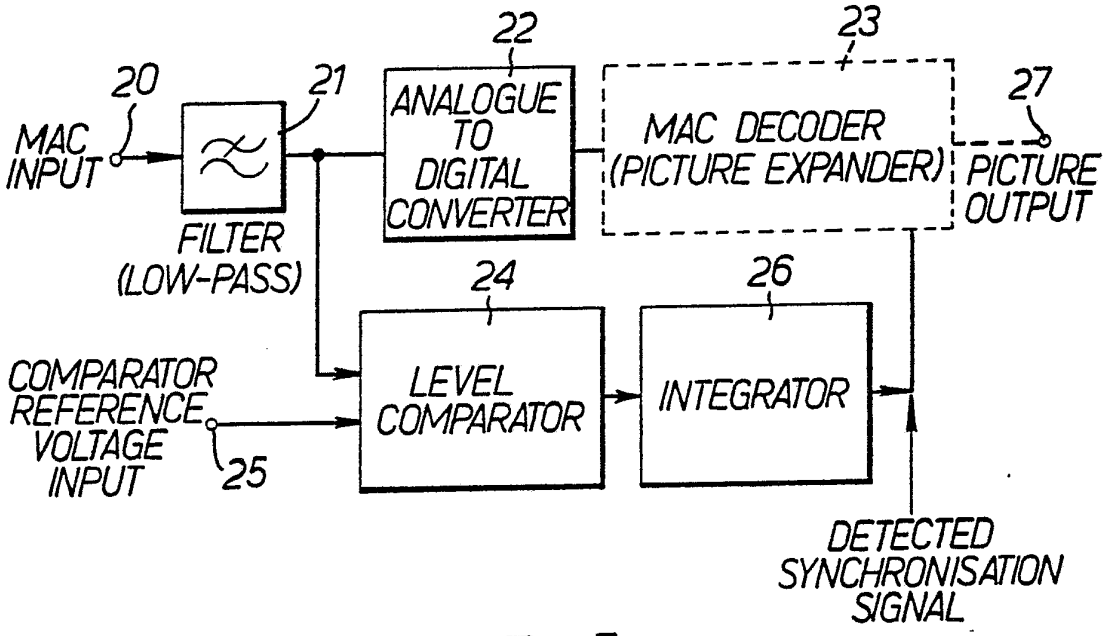


FIG. 5.

BUREAU OMPI WIPO INTERNATIONAL

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 83/00186

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [3]

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

IPC[3]: H 04 N 9/32

II. FIELDS SEARCHED

Minimum Documentation Searched [4]

Classification System	Classification Symbols
IPC[3]	H 04 N

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [14]

Category *	Citation of Document, [16] with indication, where appropriate, of the relevant passages [17]	Relevant to Claim No. [18]
A	The Radio and Electronic Engineer, vol. 52, no. 7, July 1982 (London, GB) "F.W.S., television System for DBS", pages 311-313, see page 312, paragraph "MAC"	1

* Special categories of cited documents: [15]

"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 [3]	Date of Mailing of this International Search Report [3]
2nd November 1983	24 NOV. 1983
International Searching Authority [1]	**Signature of Authorized Officer [20]**
EUROPEAN PATENT OFFICE	G.L.M. Kruydenberg

Form PCT/ISA/210 (second sheet) (October 1981)