

PATENT SPECIFICATION

(11) 1371374

1371374

- (21) Application No. 44345/71 (22) Filed 23 Sept. 1971
 (31) Convention Application No. 75458 (32) Filed 25 Sept. 1970 in
 (33) United States of America (US)
 (44) Complete Specification published 23 Oct. 1974
 (51) International Classification H04N 9/02 5/84
 (52) Index at acceptance

H4F D12K9 D1B9 D1P4 D1P5 D1P9 D1T D27G D27L
 D27M2 D27M6 D27M7 D27S D27T1 D53C D81P
 D82S2 D83X

(72) Inventor CLARK NELSON KURTZ



(54) APPARATUS FOR DERIVING VIDEO SIGNALS

(71) We, EASTMAN KODAK COMPANY, a Company organized under the Laws of the State of New Jersey, United States of America of 343 State Street, Rochester, New York 14650, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to apparatus for deriving a set of video signals from a record medium having stored component images.

A device is described in U.S. Patent No. 3,044,358 in which an electric beam charge pattern forms three superimposed diffraction gratings simultaneously on a thermoplastic film. The gratings correspond point-by-point to the red, green and blue component colours of a televised picture to be reproduced. The televised picture appears on a projection screen when the optical projector transmits a light beam through a first light mask thereby splitting the beam into a plurality of beams. A second light mask limits the area through which these beams pass to a frame on the film containing the gratings after which a third light mask bars unwanted light, allowing the first orders of the diffracted colours to be focused on a screen to form a colour representation of the televised picture.

A device has also been described in which monochrome phase holograms are read out with a laser produced light beam and picked up on a vidicon tube in an expensive and complicated television system in which increased bandwidth is needed to separate the colour channels.

Typical of such a prior art device is the RCA Selectavision in which a chosen subject film is first copied with an electron beam recorder to produce a "colour master" film which is then developed and converted by a laser and separate diffraction gratings into a hologram on a plastic film coated with photoresist, a material that hardens to varying

degrees, depending on the intensity of light striking it. After processing into phase hologram, the photoresist film is then coated with nickel after which the photoresist film is stripped away to expose a nickel "master" which is used thereafter to impress the hologram into a clear, vinyl plastic tape.

In this television system, two side bands are required to process the blue and green colour information which is extracted with electronic filters from the original image since the vidicon views a single colour image produced by a narrow band monochromatic laser produced light beam passing through the hologram. The two side bands appear as fine lines on the face of the vidicon, which must have an extended bandwidth to resolve them.

The prior art systems are characterized by storage mediums relatively inefficiently used compared to those of the present invention, and wherein relatively little information is stored for the space utilized. Expensive and long complicated procedures are involved in storing and reading out the information.

According to the present invention there is provided apparatus for deriving a set of video signals from a record medium containing diffraction grating modulated images of the type herein described, said apparatus comprising scanning means whereby the record medium is raster scanned with a constant intensity light beam, optical means which direct the light transmitted by the record medium and modulated in intensity by passage therethrough to photoelectric pickup means, characterised in that the optical means includes an optical selection device to select at least one first or higher order diffraction image, corresponding to each of the diffraction images in the record medium, and whereby each selected diffraction image is directed respectively to separate photoelectric pickup means which together provide the set of video signals.

The record medium for use with the apparatus according to the invention consists of a support carrying two or more superposed

[Price 25p]

Price 33p

images modulated with respective regular diffraction grating patterns. The diffraction grating patterns may be of the same spatial frequency but oriented along different axes or of different spatial frequencies and oriented along the same axis or the two arrangements in combination.

A flying spot scanner or other raster generating device can be used in conjunction with spatial filtering systems to produce a composite set of video signals from stored, monochromatic component images in the record medium which are each representative of a colour component of the full colour scene. The scanning raster is projected through a transparency containing stored information, i.e. the above mentioned scene components. Superposed with each scene component in the transparency are diffraction gratings, each such grating corresponding to a scene component, which diffract the beam. From the diffracted beam, pre-selected light images of an aperture of the desired order, e.g., first order, are then caused to impinge upon photoelectric transducers, as for example, photocells. The electrical signals generated by the photocells as a result of the preselected order images impinging thereon are then transmitted to an output receiver and image reconstruction device, as for example, the display tube of a colour or black and white television receiver.

One advantage of the present invention is that no registration problems are experienced. Because only one scanner is used, synchronization is automatic. Registration problems appear in prior art systems wherein multiple stored images are scanned simultaneously by several scanners which must be externally synchronized.

Another advantage of the invention is that economical storage or relatively large amounts of colour scene information in a relatively small amount of monochromatic storage space is obtained. Another advantage of the invention is that it is easily operable within a wide range of scanning raster frequencies.

The invention will be described with reference to the accompanying drawings in which:

Figure 1 is a schematic representation of an optical information readout system embodying the present invention;

Figure 2 is a block diagram of a preferred embodiment of the invention;

Figure 3 is a perspective view of an alternative photoelectric readout system;

Figure 4 is a front view of still another photoelectric readout system;

Figure 5 is a front view of yet another photoelectric readout system;

Figure 6 is a schematic cross-section of a transparency bearing scene information recorded as an amplitude modulated phase diffraction grating exposed on an emulsion;

Figure 7 is a schematic representation of a cross-section of an amplitude modulated amplitude diffraction grating exposed on an emulsion;

Figure 8 is a schematic front view of an emulsion exposed to three diffraction gratings angularly disposed with respect to one another.

A full colour composite image similar to the image seen by the normal human eye in viewing a scene in life can be provided from the video signals of the present invention. Before describing further the present invention a brief description of the storage media will be provided.

This composite image referred to above is the resultant image constructed by combining component images corresponding to three component colours of a scene. Such component images can be recorded on, for example, a multilayer photographic recording medium in which the layers are sensitive respectively to red, green and blue, the three chosen component primary colours. Photographic processing is carried out to provide monochrome images in each layer. Each layer in the medium records a separate scene component after being pre-exposed to a corresponding diffraction grating. Thus, three diffraction gratings of preselected frequencies in parallel or angularly disposed with respect to one another can be pre-exposed on the multilayer emulsion in a superposed relationship to minimize image overlap and crosstalk.

A single layer mixed grain (grains of differing colour sensitivities) monochromatic photographic storage medium can also be used to record superposed component images after the medium is pre-exposed to gratings of correspondingly differing colours angularly disposed with respect to one another.

Suitable transparencies are described in United Kingdom Application 44347/71 (Serial No. 1370453) and U.S. Patent No. 3,425,770. In the phase image embodiments, modulation can be caused by the variations in optical path due to (1) image relief, (2) internal variations in index of refraction and (3) a combination of (1) and (2).

Referring to Figure 1 a scanning raster of light, for example, the screen of a cathode ray tube 10 is imaged on a transparency 12 containing a grating 18 and a recorded scene which is not shown since a cross sectional view of a grating cannot be clearly drawn. The grating 18 can be a phase modulating grating as shown in Figure 6 as 18' or it can be amplitude modulating as shown in Figure 7 as 18'' with alternating areas of optically dense regions 19 and less optically dense regions 21. A combination phase and amplitude modulating grid can also be used as can be a phase modulating grating provided by variable indices of refraction therethrough. It will be appreciated that other diffraction

producing media of refracting and reflecting characteristics can be freely substituted by those skilled in the art.

A first imaging lens system 14 is used, in conjunction with a suitable mask 16 having a stationary aperture 17 upon which the beam of flying spot scanner 10 is caused to impinge, to form an image of the flying spot raster on the transparency 12. Due to the grating structure 18, on the transparency 12, the scanning light beam is diffracted by passage through the transparency 12. For the single grating 18 on the transparency 12, two first order diffraction beams 20 and 22 for each illumination wavelength appear on each side of the normal or zero order beam 24 diverging at an angle θ symmetrical with the optic axis. It is recognized that higher order beams may exist, these will be of lower intensity and for purposes of simplicity of illumination the higher order beams are not shown in the drawing. It will be appreciated that in some cases higher order beams, i.e., above the first order, can be used in practicing the present invention. The first order beam is used in the preferred embodiment since its intensity is higher than that of any higher order beam and it can therefore be more readily used.

A second converging lens system 26 focuses the first order beams 20 and 22 in an aperture image plane 28 as images 31 and 33 of the aperture 17, one appearing on either side of the normal or zero order beam 24. The aperture plane 28 contains an aperture plate 38 which is perforated only to allow passage of the desired first order beams. The zero order beam 24 is blocked in the plane 28 by the centre of the plate 38. It is to be understood that aperture 17 need not be a single aperture. It could be an array of apertures or some other form of multiple aperture or an aperture of oval, square, triangular or other shape as long as the zero and first order images are separate in the aperture image plane.

The separation of the first order aperture images 31 and 33 and their relative angular positions on the image plane 28 depends respectively on the spatial frequency and angular orientation of the grating 18 on the transparency 12. For purposes of illumination, only two first order aperture images 31 and 33 are shown in the figure. A stationary photoelectric cell 36 receives light of varying intensity from the aperture images 31 and 33. The first order beams 20 and 22 are thus transmitted to the photocell 36 which generates an electrical signal corresponding in amplitude to their relative intensities.

It will be appreciated that images of the transparency 12 are not formed by the lens system 26 at plane 28. Rather, the aperture 17 is imaged, enabling a fixed aperture and fixed photocell location to be used thereby establishing a simple system.

The bounds of the transparency 12 define the scene's perimeters. The only portion of the system needing extended bandwidth to accommodate more channels is the film containing the transparency. The bandwidth and band shape of the film depends upon its acutance and resolving power of the film as is well known.

For reproduction of a single scene at a time, such as is required for monochrome television, only one of the photocells need be used. First or higher order image selection is carried out by appropriately perforating the aperture plate 38. A number of images will be present at the plane 28, two for each grating on the transparency 12. However, the intensity of the light diffracted by the grating 18 varies with the amplitude of the grating, i.e., with the scene information recorded. Separate photocells are used to monitor each of the first order aperture images generated by each of three gratings, they simultaneously generate synchronized electrical signals corresponding in amplitude to the point-by-point intensities of the three component scenes recorded as the raster scans the transparency 12. These electrical signals can be used one at a time or simultaneously to form a colour television picture when the images are derived from three separate component colour scene images on the screen of a television receiver having a raster synchronized with the flying spot scanner raster 10 by a beam synchronizing signal.

The aperture plate 38 is not limited to preselected openings corresponding to both the respective component images of a certain order. For example, a single first order could be the only passed image, or if desired, other orders could be used.

In the embodiment shown in Figure 1 the first order aperture images do not overlap the zero order image. It is to be understood that if other sets of aperture images are used there should preferably be no overlap of the aperture images chosen for pickup by the photocells and other images of intensity sufficient to effect detection. Electrical noise in the system due to photocells can be minimized by constructing the device in accordance with known principles so that chosen image overlap with blocked images is minimal.

As shown in Figure 1, the angle subtended by the first order beam θ_d must be equal or greater than that of the zero order beam θ for the desired results. For small angles and assuming a wavelength for the light raster generated by the cathode ray tube screen 10 of approximately 500nm, the condition $\theta_d \geq \theta$ is satisfied approximately when

$$v_c \geq (2000/f\#_{eff}) + v_{max} \quad (3)$$

where ν_c is the carrier frequency (grating spatial frequency) in cycles/mm, $\nu_{\max}$ is the maximum scene spatial frequency recorded in the transparency 12 and $f\#_{\text{eff}}$ is the effective f-number of the cone of light illuminating the transparency 12. Since more than one grating 18 is present in the transparency 12, it is important that the first order aperture images of each grating do not overlap each other or the zero order aperture image of any grating. For such a device it may be necessary to use grating frequencies higher than indicated by the relationship (3).

When the transparency 12 fulfils the conditions set out in relationship (1), no crosstalk exists when there is no image overlap and the photocell receiving information from one component scene does not receive any information from any other component scene.

For transparencies of the form described in (2a) and (2b) crosstalk can occur if γ_1 and γ_2 are too large. Essentially, γ_1 and γ_2 must each be small enough to produce zero order images of a strength independent of scene information such as is discussed in United Kingdom Application 44347/71 (Serial No. 1370453), referred to above. For this latter type of transparency, it is also desirable to select grating angles and/or frequencies such that any higher order images of the aperture used do not overlap the first order images since overlap can result in a visible Moiré grating pattern on the display tube of the television receiver.

It is desirable that the flying spot scanner raster 10 be able to resolve 525 lines/frame for standard television resolution so that it can be used with a standard U.S. television receiver for readout or 625 lines/frame for standard European receivers. Such flying spot scanners are readily available. The lens system 14 which can be a plurality of lenses or a single lens, insures the same raster resolution per line on the transparency 12 so that the gratings structure, which is finer than the bandwidth is not resolved. The resulting diffraction by a plurality of gratings causes automatic separation of the channels for readout by suitably located photocells. Consequently, no part of the electrical signal handling system need have a bandwidth greater than a conventional television set since the gratings are not required to be resolved as is required in several prior art systems. Addition of another scene simply results in the generation of another output channel by the scanner. A signal separation using the gratings is carried out optically.

It is to be understood that the transparency 12 can represent a negative of the scene rather than the scene itself; reversal can be accomplished by suitable processing of the electrical signals.

Furthermore, although transmission type 65 transparencies are discussed, it is readily

apparent that equivalent systems could use a reflection type photographic print.

Referring to Fig. 2 a system incorporating the present invention for producing a three colour television picture using three channels is shown schematically. This system embodies the principles set forth in the explanation of Figure 1 and shown therein. The system includes a standard flying spot scanner such as the Radio Corporation of America Colour Slide Scanner M1-40514 which includes a high voltage power supply 44 for a cathode ray tube 42 and deflection and blanking control circuitry shown as the block 46. In use the red, green and blue filters of the original scanner are removed and aperture plates are introduced into the system instead as the color information is to be separated by diffraction rather than wavelength. Plates 56, 58 and 60 are placed in front of each pickup photocell 48, 50 and 52, in planes optically conjugate to an aperture 49 in a plate 51 imaged by the lens 54. Partially transmitting mirrors 53 and 55 split the light transmitted by the scanned transparency 62 beam into three parts and aperture plates 56, 58 and 60 each pass the appropriate pair of first order images. The aperture plate 56 passes first order images corresponding to red scene information to the photocell 48, the aperture plate 58 passes first order images corresponding to green scene information to the photocell 50 and the aperture plate 60 passes first order images corresponding to blue scene information to the photocell 52. All zero order and unwanted higher order images are blocked by each of the aperture plates. It should be noted that, as stated hereinabove, the invention is not limited to the use of first order images but other usable order images can be passed. It is not necessary to have a cathode ray tube 42 with a screen which generates light having components of red, green and blue as normally required for a colour slide scanner. In fact it is preferable for the screen to provide a narrow wavelength band.

Where the three scenes represent the colour components of an original colour scene, each modulated carrier grating can have the same spatial frequency, such as 125 cycles/mm and be positioned with the grating lines at differing angles to each other. For example, gratings with lines at 0°, 45° and 90° with respect to a reference axis centre line 71, as shown in Fig. 8. This figure illustrates a layer of a photographic emulsion 63 with gratings 65, 67 and 69 having axes 71, 73 and 75 respectively, pre-exposed thereon and as fully disclosed in United Kingdom Application 44347/71 (Serial No. 1370453). The objective lens 54 images the flying spot raster through the aperture 49 on the monochromatic transparency 62. The orientation of the gratings associated with the three scene components in the transparency 62 determines

the respective orientation of the aperture plates 56, 58 and 60, in front of each of the pickup photocells; the size and spacing of each hole in a particular aperture plate is the same as the size and spacing of the first order images of the aperture 49 in plate 51. Lenses 64, 68, 70 and 72 can be used to obtain images of aperture 49 in the plate 51 of the desired resolution at the aperture plates 56, 58 and 60. The choice of locations and lenses is well known in the art.

Transmission to a television receiver 82 containing display tube 83 is accomplished by a well known television system comprising three channel colour signal processing circuit 74 which receives the electrical signals from the photocells 48, 50 and 52, and transmits the processed signals to television receiver 82 in a form useable by the receiver in accordance with well known principles of television which are not part of this invention. The pickup photocells 48, 50 and 52 need not be of the same sensitivity although this is preferred, since the signals are separately amplified and otherwise treated in the television circuitry. They preferably have the same spectral response with a peak matched to the peak emission of the cathode ray tube 42. Although the above system, for purposes of illustration, demonstrates the principles of the present invention, it is realized that other systems utilizing these same principles can be devised.

An optical signal separating device for use in the embodiment of Figure 1 is shown in Figure 3. A slightly modified device may be used in the embodiment of Fig. 2. All the first order images are formed in a single optical plane and shown as points 84 on an aperture plate 86 located in the plane. The appropriate pairs of images are selected for transmission to the appropriate pickup photocells 88 by means of, for example, fibre optical paths 90 which conduct the light from the points 84 to the photocells and combine each pair of first order images optically. In this case, there would strictly be no need for aperture plates since the inherent selectivity of the fibres themselves would perform the function of the aperture plates however such a plate is a convenient structure to locate and anchor the fibre optics. Alternatively as shown in Fig. 4, an array of small photodetectors 39 could be placed coinciding with the first order images directly on a supporting plate 38', in which case the array itself functions selectively as an aperture plate. The photocells need not be of different sensitivities, but in a preferred realization would all be of the same type with a spectral response peak matching the peak emission wavelength of the scanning light source.

If in the optical arrangement shown in Figures 1 and 2, it is so desired, a multilayer emulsion with parallel superposed diffraction

gratings can be used. In this case the gratings have different frequencies and for Fig. 1 an aperture plate containing a set of pickup photocells displaced in a single line with respect to one another to receive selected images of preferably the first order as shown in Figure 5 can be used. With the embodiment of Fig. 2 each aperture plate 48, 50 and 52, will be of the type shown in Fig. 5 but only one pair of poles 98, 96 or 94 will be used. Plate 92 contains photocell pickups at points 94, 96 and 98, each pair of points being the loci of the pair of first order images generated by each grating. Naturally care must be taken in the harmonic relationships between the spatial frequencies of the gratings so that the higher order images do not overlap any of the first order images. In operation, a flying spot scanner such as that described with respect to figure 2 generates a beam which passes through the aperture plate 51 containing the aperture 49, through the objective lens 54 and then through the transparency 62 containing the grating modulated images. The lens systems 64, 68, 70 and 72 in conjunction with the partially transparent mirrors 53 and 55 split the light into three portions each of which is passed through a respective one of the aperture plates 56, 58 and 60 to the corresponding photocells 48, 50 and 52. The electrical signals generated by the photocells 48, 50 and 52 are transmitted to the previously described colour signal processing circuit 74 having a channel corresponding to each colour component i.e., the output of each photocell. These colour signals are then fed to the television receiver 82 which reproduces the composite image stored as three monochrome component scenes on the transparency 62 in full colour.

Further advantages are that standard bandwidth television receivers can be used. Where a plurality of component scenes are stored in superposition, some components are automatically separated into separate channels so that no single channel requires more than standard television bandwidth.

Another important advantage of the present invention is that a plurality of component scenes can be stored superposed on a single transparency in the form of amplitude modulated phase gratings, amplitude modulated amplitude gratings, or a combination of these embodiments. One scanning operation retrieves all the superposed composite scenes in register. Such component scenes can represent the colour components of a composite scene. Thus, a colour composite scene can be stored as superposed composite scenes on a single layer monochromatic storage medium or on a multilayer monochromatic emulsion.

WHAT WE CLAIM IS:—

1. Apparatus for deriving a set of video signals from a record medium containing

the respective orientation of the aperture plates 56, 58 and 60, in front of each of the pickup photocells; the size and spacing of each hole in a particular aperture plate is the same as the size and spacing of the first order images of the aperture 49 in plate 51. Lenses 64, 68, 70 and 72 can be used to obtain images of aperture 49 in the plate 51 of the desired resolution at the aperture plates 56, 58 and 60. The choice of locations and lenses is well known in the art.

Transmission to a television receiver 82 containing display tube 83 is accomplished by a well known television system comprising three channel colour signal processing circuit 74 which receives the electrical signals from the photocells 48, 50 and 52, and transmits the processed signals to television receiver 82 in a form useable by the receiver in accordance with well known principles of television which are not part of this invention. The pickup photocells 48, 50 and 52 need not be of the same sensitivity although this is preferred, since the signals are separately amplified and otherwise treated in the television circuitry. They preferably have the same spectral response with a peak matched to the peak emission of the cathode ray tube 42. Although the above system, for purposes of illustration, demonstrates the principles of the present invention, it is realized that other systems utilizing these same principles can be devised.

An optical signal separating device for use in the embodiment of Figure 1 is shown in Figure 3. A slightly modified device may be used in the embodiment of Fig. 2. All the first order images are formed in a single optical plane and shown as points 84 on an aperture plate 86 located in the plane. The appropriate pairs of images are selected for transmission to the appropriate pickup photocells 88 by means of, for example, fibre optical paths 90 which conduct the light from the points 84 to the photocells and combine each pair of first order images optically. In this case, there would strictly be no need for aperture plates since the inherent selectivity of the fibres themselves would perform the function of the aperture plates however such a plate is a convenient structure to locate and anchor the fibre optics. Alternatively as shown in Fig. 4, an array of small photodetectors 39 could be placed coinciding with the first order images directly on a supporting plate 38', in which case the array itself functions selectively as an aperture plate. The photocells need not be of different sensitivities, but in a preferred realization would all be of the same type with a spectral response peak matching the peak emission wavelength of the scanning light source.

If in the optical arrangement shown in Figures 1 and 2, it is so desired, a multilayer emulsion with parallel superposed diffraction

gratings can be used. In this case the gratings have different frequencies and for Fig. 1 an aperture plate containing a set of pickup photocells displaced in a single line with respect to one another to receive selected images of preferably the first order as shown in Figure 5 can be used. With the embodiment of Fig. 2 each aperture plate 48, 50 and 52, will be of the type shown in Fig. 5 but only one pair of poles 98, 96 or 94 will be used. Plate 92 contains photocell pickups at points 94, 96 and 98, each pair of points being the loci of the pair of first order images generated by each grating. Naturally care must be taken in the harmonic relationships between the spatial frequencies of the gratings so that the higher order images do not overlap any of the first order images. In operation, a flying spot scanner such as that described with respect to figure 2 generates a beam which passes through the aperture plate 51 containing the aperture 49, through the objective lens 54 and then through the transparency 62 containing the grating modulated images. The lens systems 64, 68, 70 and 72 in conjunction with the partially transparent mirrors 53 and 55 split the light into three portions each of which is passed through a respective one of the aperture plates 56, 58 and 60 to the corresponding photocells 48, 50 and 52. The electrical signals generated by the photocells 48, 50 and 52 are transmitted to the previously described colour signal processing circuit 74 having a channel corresponding to each colour component i.e., the output of each photocell. These colour signals are then fed to the television receiver 82 which reproduces the composite image stored as three monochrome component scenes on the transparency 62 in full colour.

Further advantages are that standard bandwidth television receivers can be used. Where a plurality of component scenes are stored in superposition, some components are automatically separated into separate channels so that no single channel requires more than standard television bandwidth.

Another important advantage of the present invention is that a plurality of component scenes can be stored superposed on a single transparency in the form of amplitude modulated phase gratings, amplitude modulated amplitude gratings, or a combination of these embodiments. One scanning operation retrieves all the superposed composite scenes in register. Such component scenes can represent the colour components of a composite scene. Thus, a colour composite scene can be stored as superposed composite scenes on a single layer monochromatic storage medium or on a multilayer monochromatic emulsion.

WHAT WE CLAIM IS:—

1. Apparatus for deriving a set of video signals from a record medium containing



diffraction grating modulated images of the type herein described, said apparatus comprising scanning means whereby the record medium is raster scanned with a constant intensity light beam, optical means which direct the light transmitted by the record medium and modulated in intensity by passage therethrough to photoelectric pickup means, characterised in that the optical means includes an optical selection device to select at least one first or higher order diffraction image, corresponding to each of the diffraction images in the record medium, and whereby each selected diffraction image is directed respectively to separate photoelectric pickup means which together provide the set of video signals.

2. Apparatus as claimed in claim 1 in which the optical selection device includes lens means for forming real images of the aperture of the scanning raster at an image plane and a blocking plate located at the image plane which is perforated so as to allow passage only of light from first order diffracted images of the aperture.

3. Apparatus as claimed in claim 2 in which the first order image light passed by the blocking plate is directed to the photoelectric pickup means by a light guide.

4. Apparatus as claimed in claim 2 in which each photoelectric pickup means is located with its sensitive surface at the aperture image plane where the first order aperture image passes the blocking plate.

5. Apparatus as claimed in claim 1 in which the optical selection device comprises beam splitting means to separate the light passed by the record medium into as many portions as there are images on the record medium and thereafter separating a different first order diffraction image from each portion.

6. Apparatus for deriving a set of video signals from a record medium as claimed in claim 1 and as herein described with reference to the accompanying drawings.

L. A. TRANGMAR, B.Sc., C.P.A.,
Agent for the Applicants.

Printed for Her Majesty's Stationery Office, by the Courier Press, Leamington Spa, 1974.
Published by The Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

