

Related Applications & Priority Documents

5 This invention is related to British Patent
Application Serial No. 9102995.9, entitled Electronic
Billboard: A Method of Advertising Using Existing
Television Transmission Facilities, filed February 13,
1991 by Roy J. Rosser & Martin Leach, which
10 application is based upon a provisional application
filed February 14, 1990. In addition, this
application is related to British Patent Application
Serial No. 9019770.8, entitled Audio Enhanced
Electronic Billboard, filed September 10, 1990 by Roy
15 J. Rosser.

Technical Field

20 The present invention relates to a method of
advertising using conventional television transmission
facilities. In particular, the invention relates to
methods for merging or inserting a chosen image into a
preselected existing image portion of a television
service.

25 Background Art

 The conventional methods for merging video
images include the "blue screen" or "chromo-key"
techniques. For example, these techniques are used in
the broadcast industry to show weather forecasters
30 positioned in front of weather maps. In this
technology, the forecaster is filmed in front of a
screen having a particular pre-determined color. The
screen color is usually blue, hence, the name of this
technique. The technique calls for substituting the

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the blue color. The result is that the image on the
map and forecaster will appear to merge. However,
5 this method has two short comings. First, the
forecaster must not have any item on his person that
is the same color as the blue color of the screen. If
he does, and the second image is merged with the first
image, any item on the forecaster having the
10 predetermined blue color will appear as a hole.
Second, this technique does not provide for the
integration of the two images. That is, the two
images are merely superimposed. That is why the
forecaster must make sweeping and general motions to
15 indicate positions on the map. This limitation is
important when considering this technique for an
advertising application.

There are of course other techniques which
enable the insertion of video images into an existing
20 image which are basically employed at the studio and
which utilize complicated console devices to
superimpose a video picture on another video picture.
Essentially the present technique involves a
completely different approach with great applicability
25 to television advertising. As will be explained, the
present application relates to a method of advertising
using existing television transmission facilities in
which the advertiser selects predetermined areas in a
video scene. These areas are then recognized using
30 existing technology as pattern recognition techniques
and the content of these areas is replaced by
inserting an image or images of the advertisers
choosing. In order to accomplish the present
invention one must recognize the selected

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indicia is then blended into the original video image in such a way that it appears part of the television scene and cannot be otherwise discerned by a typical viewer. The inserted advertising or messages can further be highlighted to the viewer by moving the message, changing color, associating the message with sound and otherwise imparting modulation to the message to distinguish the message during the course of the television program. Such techniques will be further described. Basically, it is believed that the techniques to be described herein have extreme usefulness and applicability for the display of advertising in television sporting events such as tennis matches, boxing, baseball, football and so on. While there is particular applicability to such events the techniques described may be adapted to all formats of video presentation and have general applicability to the field of advertising.

As will be described and in order to accomplish this result, one must basically select an object or an area within a given video image. For example the area selected may be a televised tennis court. This area is then recognized in each of a subsequent stream of video images and once recognized the video content of that image is replaced with a desired content which may be an advertising commercial, logo or some other matter. The insertion and replacement of the existing video image with the new material is accomplished completely independent of the size of the image in subsequent television scenes or frames. The system described herein will always recognize the particular area selected no matter what

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5 matter is actually that subject matter which is being
televised in real time. Thus, the methods and
apparatus described enable advertisers to add or merge
images, messages or slogans to preexisting video
images in such a way that they appear to be part of
10 the original image even when the original video stream
is of a live event being distributed in real time.

Thus, the techniques described herein are
superior to prior art techniques of inserting video
information. In order to do and accomplish the
results of this particular application an electronic
15 device is required to select, recognize and substitute
images to be broadcast on live televised events. The
device detects part or all of an object or objects
within a video image and uses the position of the
object or part thereof as a reference. The device
20 then positions another still or video image into the
original image at the reference location. The still
or video image is positioned accurately so that the
final composite image appears as though it is part of
the original scene. That is, the added image is
25 seamlessly and realistically incorporated into the
original event. The appearance of the added image
will conform to the appearance of the original scene
when the scene is moved, panned, magnified, zoomed or
otherwise altered in size or perspective. The System
30 can also compensate for lens distortions by mapping
the distortions in a televised scene and using the
mapped distortions in future processing. All this
must be done in real time, or with a processing delay
being sufficiently small that it can be applied to

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computation on a video image in such a short time with
existing technology. This is a well know method of
5 processing, analyzing and/or synthesizing signals and
is described in U.S. Patent No. 4,674,125, entitled
Real-Time Hierarchy Pyramid Signal Processing
Apparatus by C.R. Carlson, et al. and issued on June
16, 1987. The Burt Pyramid is also discussed in the
10 publications entitled "Fast Algorithms for Estimating
Local Image Properties", by Peter J. Burt, Computer
Vision, Graphics and Image Processing 21, pp. 368-
382, 1983 and "Pyramid-Based Extraction of Local Image
Features with Application to Motion and Texture
15 Analysis", by Peter J. Burt, SPIE, Vol. 360, pp. 114-
124.

The "chromo-key" or "blue-screen" technology
may be used in certain applications as an adjunct to
the pattern recognition method. This technology is
20 one way of distinguishing non-replaceable, foreground
pixels from replaceable, background pixels. For
instance, in a sport such as tennis, it is usually
necessary to ensure that only the tennis court is
replaced with a message merged onto the field of
25 play. The players or their equipment should not be
affected. One way to accomplish this is to replace
only the green colored pixels that are in the merged
image and are within the color range of the court.
Alternate methods of distinguishing between
30 replaceable and non-replaceable pixels include storing
an image of the unoccupied court and subsequently
using that image as a comparison to determine which is
the player/equipment and which is the background.
Another method uses differential motion between the

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distinguish between replaceable and non-replaceable pixels.

5 Although the pattern recognition software using the "Burt Pyramid" algorithms is fast, it still takes a finite time to operate. Therefore, it may be necessary to introduce a time delay into the system. The delay may be one or two frames, or it may be longer. A frame store or other similar means can be used to temporarily locate a small number of the video screens or frames. Incorporating a time delay unit into the present invention will be discussed hereinafter.

10 Other conventional methods of processing video signals and images or the like are presented below. Some of the disclosed methods also use the Burt Pyramid.

15 An example of an apparatus that analyzes signals and the frequency spectrum for the frequency components of the signals is disclosed in U.S. Patent No. 3,731,188, Signal Analysis of Multiplicatively Related Frequency Components in a Complex Signal, which issued May 1, 1973 to S.E. Smith. Other patents disclosing subject matter related thereto are U.S. Patent Nos. 3,140,710, 3,315,222, 3,470,468, 3,473,121 and 3,582,957.

20 An example of an image processing method for reducing noise in the image is disclosed in U.S. Patent No. 4,442,454, Image Processing Method Using a Block Overlap Transformation Procedure, which issued April 10, 1984 to P.G. Powell. In the method disclosed, the image is divided into blocks of image elements which are transformed according to the linear

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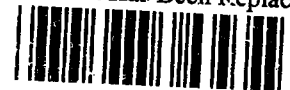
3,996,421, 4,055,756, 4,057,828, 4,134,134, 4,205,341,
4,242,705 and 4,245,248.

5 An example of a method and apparatus for
transforming numerical signal data of a video signal
is disclosed in U.S. Patent 4,447,886, Triangle and
Pyramid Signal Transforms and Apparatus, which issued
May 8, 1984 to G.W. Meeker. As disclosed in this
10 patent, the numerical signal data of the video signal
is subjected to a transform domain where the signal is
processed and reconstructed into the original domain
to provide a replica of the original data. Other
patents disclosing subject matter related thereto are
15 U.S. Patent Nos. 2,921,124, 3,051,778, 3,742,201,
4,222,076, 4,261,018, 4,261,043 and 4,286,330.

 An example of an image-processing system
employing coring techniques to reduce a noise
component of an image signal is disclosed in U.S.
20 Patent No. 4,523,230, System for Coring an Image-
Representing Signal, which issued June 11, 1985 to
C.R. Carlson, et al. The Burt Pyramid spectrum
analyzer and synthesizer (U.S. Patent No. 4,674,125)
may be employed with the system disclosed in the '230
25 patent, so that the system can operate in real time on
a video signal of a scanned television image. Other
patents disclosing subject matter related thereto are
U.S. Patent Nos. 4,163,258 and 4,463,381.

 An example of a method and an apparatus for
30 reducing image data while retaining the ability to
observe objects with high spatial resolution is
disclosed in U.S. Patent No. 4,692,806, Image-Data
Reduction Technique, which issued September 8, 1987 to
C.R. Carlson, et al. Other patents disclosing subject

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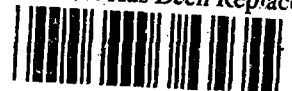
An example of an image processing method for filling in one or more void defects in an image to provide a natural looking processed image is disclosed in U.S. Patent No. 4,698,843, Method for Compensating for Void-Defects in Images, which issued October 6, 1987 to P.J. Burt, et al. This invention discloses employing The Burt Pyramid as disclosed in U.S. Patent No. 4,674,125. Other patents disclosing subject matter related thereto are U.S. Patent Nos. 3,737,855, 3,887,762, 3,973,239, 4,000,399, 4,010,446 and 4,661,986.

Thus as one will ascertain the advertising method and apparatus of this invention requires very precise positioning of a new image into an existing image. The techniques to be described employ pattern recognition apparatus which recognizes pre-selected features or portions of a typical television scene. These features can then be used to locate the position, size and perspective of an artificial electronic advertising message which is added in the exact congruency with the replaced recognized image and appears to the end user as if it were part of the original scene. The added material is inserted into the pre-selected scene independent of size of the selected feature as varying on a frame to frame basis.

Disclosure of the Invention

Apparatus for altering a video image display to provide a substituted display of desired indicia within a preselected portion of said video image display and independent of the size of said selected portion which size is strictly a function of the TV

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comprising means for selecting said portion of said display to be substituted, means responsive to said video signal display for recognizing said selected portion of said display, means for generating video signals indicative of said desired indicia to be substituted, means responsive to said desired indicia signals and said video signal for inserting said indicia into said video image display at said preselected portion.

Brief Description of the Figures

Fig. 1 is a detailed blocked diagram showing an apparatus for recognizing video image formats and inserting desired indicia therefore according to this invention.

Figs. 2, 3 and 4 are different perspective plan views of a television image of a tennis court showing how the logo is positioned by the system of Fig. 1 on the tennis court as a function of different perspective views of the court as taken by a typical television camera.

Best Mode For Carrying Out the Invention

Referring to Fig. 1, there is shown a block diagram of a general format of a system employing the apparatus to be described. Before proceeding with a description of the apparatus depicted in Fig. 1, the following comments are pertinent.

The uses of the apparatus and method relate to advertising and include but are not limited to advertising which occurs during sporting events where a field or other scene is normally depicted such as a tennis court, a baseball field, a football field and

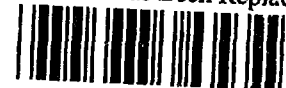
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advertising can continuously be recognized by the techniques to be described, and the advertising which is permanently painted on a fence or displayed on a fence can be replaced. In a similar manner certain areas of the playing field which do not have advertising can now include advertising such as advertising appearing on a tennis court or playing fields. By making the advertising a discrete part of the action the game does not have to be interrupted. Even in sports where there are breaks for advertising the method and apparatus to be described is of benefit to advertisers because the message can be displayed while the audience's attention is focused on the action. Apart from this particular application, which relates to advertising, one can also recognize by means of the pattern recognition schemes and boundary lines which are associated with a typical sports court such as the serve line in tennis, the foul line in basketball, the various field lines in baseball, football and so on. These lines can be further recognized and enhanced by artificially including markings for the various field or other lines or boundaries. Apart from such other items, advertising messages can be displayed and then changed and so on during a single televised event.

Referring to Fig. 1, there is shown a replica of a typical tennis court 12. The tennis court is separated by a net and has a back court designated 11 with a fore court 13. The tennis court 12 is shown in a perspective view. Shown is a television camera 14 which is in the process of recording the sporting event or tennis match. The

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embodiment of the invention, the fore court 11 as well as the back court 13 or the entire tennis court 12 is subjected to a pattern recognition algorithm whereby an advertisement is actually inserted directly on the portions of the court as shown in Fig. 2.

As shown in Fig. 3, the same advertisement or logo is depicted independent of the perspective view of the court and independent of whether the television camera 14 is employing a zoom lens or the scene is televised by an additional camera coupled to suitable equipment. The cameras provide a view of the tennis match through a different perspective or different visual planes. Thus as one can ascertain from Figs. 2, 3 and 4, the logo will appear in exact conformity with the perspective view of the court so that it will appear as if the logo were permanently imprinted on the actual court being televised. Thus, the television camera 14 is shown televising the tennis match. As will be explained, the output of the camera 14 is coupled directly to a main image television receiver 16 which receives the video signal from the camera and which provides a display of the television signal as shown on the display screen. The camera 14 is also coupled to one input of an image analyzer 17.

The equipment also includes a microphone 15 utilized to pick up sound from the area being televised with the output of the microphone coupled to an input of the image analyzer 17 and also coupled to the input of an audio analyzer processor module 26. The output from the audio analyzer processing module 26 is directed to an input of a second image source

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which may be a slogan, an image, a logo and which
advertising message will be displayed on the selected
5 portions 11 & 13 of the tennis court as shown in Figs.
2, 3 and 4 and designated as logo. The second image
source 27 has an output coupled to an image
synthesizer 20. The image synthesizer has an output
coupled to the image analyzer 17. Both the image
10 synthesizer and the image analyzer have inputs and
outputs directed to a frame storage and delay device
19 which will be subsequently explained. Also seen is
that the image synthesizer has one output coupled to
one terminal of a switch 32 which interfaces with a
15 transmission/reception system 31.

The other terminal of the switch 32 is
coupled to a television receiver 30 which as seen in
Fig. 1 has the inserted logo positioned on the
selected portions of the tennis court. The television
20 receiver 30 is indicative of a user's television as
for example used by a consumer viewing the sports
event. The operation of the system is basically as
follows. Before proceeding further it is understood
that the camera 14 and microphone 15 in conjunction
25 with the above noted equipment can directly operate to
provide a normal television signal to be transmitted
by the transmission and reception system 31 to remote
television receivers as 30 as is conventional. Hence,
it is indicated that the television camera 14 as well
30 as the microphone 15 and associated equipment are
conventional components and therefore capable of
providing a typical, normal, unaltered television
signal and display. The distribution of the television
signal is accomplished via the transmission/reception

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known. If the sender desires to insert a given
5 advertising message or a logo in a selected area of
the television display, the following operation
occurs.

The image of the event as present on the
screen of the television receiver 16 will eventually
10 be altered to incorporate the advertising message
which as indicated may be a slogan or image. The
alteration may take place at the originating site of
the event, at a network broadcast center, a local
broadcast center, at a local broadcasting station, at
15 a cable headend or any other site where video signals
are disseminated. As one will ascertain, the
equipment shown in Fig. 1 is universally adaptable to
be utilized at any particular location and is
relatively small and transportable. The added message
20 which is provided by the separate video source 27 may
be prerecorded on a tape or stored by other means and
eventually will be merged into the video stream by the
image synthesizer 20. The image synthesizer 20 uses
data from the image analyzer 17 and from the frame
25 storage and delay device 19. The essence of this
method of advertising is to incorporate the added
message from the secondary source 27 into the main
image recorded by camera 14 so that the end viewer who
is watching the television screen associated with
30 receiver 30 believes that the image is actual
imprinted or otherwise permanently located on the
tennis court at the actual site of the match.

Also, as shown in Figs. 2, 3 and 4 the logo
is actually added to the television court display even

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on the tennis court 12. This merging is seamless and
incorporates the logo or advertising message into the
5 video image from the camera 10. The hardware employed
incorporates software programs which are all known in
the prior art and examples of which have been given
above. Essentially, the merging of the advertising
message or image into the video images is accomplished
10 in the image analyzer 17. The image analyzer 17
operates in conjunction with the image storage and
delay module 19 as well as the image synthesizer 20 to
provide the composite picture as shown on the screen
of television receiver 30. The image analyzer 17, the
15 image synthesizer 20, the delay module 19 and the
video source 27 as well as the audio analyzer and
processor 26 constitute the modules which operate to
provide the merging of the advertising message with
the video signal as will be further described.

20 The image analyzer 17 includes a
conventional computer such as a PC or mini-computer
including a suitable memory such as a hard drive and
so on. The image analyzer computer 17 is programmed
to take the television signal emanating from camera 14
25 to store the signal and to process the stored signal
according to a selected pattern recognition technique
so that the incoming video image is processed in real
time. The image analyzer 17 may be associated with
suitable operating interface equipment such as a
30 keyboard, a light pen or a mouse to allow the operator
to originally select the landmarks desired in the
original scene. In this manner the operator will for
example outline the tennis court 12 as present on the
screen of the monitor receiver 16X. The monitor

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outline will be stored in memory in regard to digital
5 bits or pixels in the image analyzer. As one can
ascertain, the entire video signal as displayed on the
screen is broken up into pixels where each television
line and each position along a line is represented by
a suitable digital number corresponding to the color
10 intensity or content at the line position or to the
monochrome content of the line position.

Techniques for converting television signals
into digital signals including pixels are extremely
well known. Hence one can store the entire
15 representation of a complete television frame or image
within a conventional memory by conventional
techniques. The light pen or other marking device
which is associated with the image analyzer provides
an outline of the image which is to be recognized by
20 pattern recognition program such as described in U. S.
Patent 4,674,125 wherein the Burt Pyramid Algorithm is
employed as one well known technique. While the Burt
algorithm as indicated above is extremely useful in
implementing pattern recognition to therefore enable
25 the system to recognize the tennis court, many other
techniques for pattern recognition including other
algorithms may be used. There have been entire books
and volumes written on pattern recognition and image
processing. See for example "The Proceedings of the
30 IEE", May, 1979 issue entitled "Pattern Recognition
and Image Processing", Volume 67, Num. 5, Pgs. 705 -
880. Many of the above noted patents describe various
other techniques for performing pattern recognition.
The image analyzer 14 as well as the image synthesizer

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other pattern recognition techniques and for processing the incoming video images in real time.
5 Such algorithms such as the Burt pyramid algorithm employ a particular sampling technique analyzing a relatively high resolution video signal into a hierarchy of N (where N is a plural integer), separate component images in which each component image is a
10 Laplacian image comprised of a different octave of the spatial frequencies of the original image, plus a remnant Gaussian image.

The term "pyramid" relates to the successive reduction in spatial frequency and sample density of
15 each of the hierarchy of the component images in going from the highest octave component to the lowest octave component image. This algorithm is computationally effective and can deal with visual images that are intended for viewing by human beings within the
20 typical television frame rates. There are other techniques which can also be employed to process the image, and, as indicated, the frame and storage device 19 can for example delay many frames and hence the processing can be slowed down a great deal
25 depending on whether or not one wishes a simultaneous transmission of the actual event or a delayed version thereof. Operation of the system as indicated is basically as follows. The operator views the image as presented on the monitor television receiver 16 and
30 marks selective portions of the outlines of the court or the net area to choose or to direct that portion of the displayed image to be recognized and where the advertising indicia will be inserted. In this particular example the operator will mark the upper

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5 command the image analyzer 17 to recognize chess
markings in subsequent video images of the court 12 as
televised by the camera. The image synthesizer is now
employed to locate, position and orient, including the
correct magnification, the indicia or logo, which is
taken from the second image source 27 so that it
appears as part of the original scene. The logo which
10 is generated by the second image source 27 is made to
appear as part of the background and does not
interfere with objects or people in the foreground.
This is accomplished by allowing the logo to key over
specific colors or ranges of colors such as the color
15 of a court in the tennis match.

As one understand a tennis court for example
is a certain shade of green. Thus the areas 11 and 13
are green or some other color which completely
differentiates from the colors of the uniforms as well
20 as the skin of the players or participants. By means
of conventional RGB color processing the image
analyzer can therefore store information relating to:
1) the outline of the court as selected by the
operator and 2) the color of the court as further
25 evidenced by the detail in the video image. In this
manner the image analyzer 17 transfers information to
the image synthesizer 20. The image synthesizer
receives information relating to the position and
location of the court portions 11 and 13. The image
30 synthesizer 20 then takes the video information from
the second image source 27 and inserts this
information in the images of the court section 11 and
13. This insert appears as the logo which is depicted
in Figs. 2, 3 and 4. This insertion is done by means

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location, position and orientation including the
5 correct magnification into a stored picture which
picture is now re-routed through the image synthesizer
to the transmission and reception system 31. This
causes the display on television receiver 30 to be
shown, as indicated. The distinction between the
10 foreground and background may also be identified by
other techniques apart from color detection. It is,
of course, clear that by not keying over specific
colors such as clothing and flesh colors one will only
provide the logo in the areas 11 and 13 and the logo
15 will be obscured by the players as to only the portion
of the player that overlies the logo. Hence it
appears as if the logo is actually painted directly on
the tennis court.

Apart from color recognition, one can
20 distinguish between the tennis court and the
background of the court by other techniques such as
optical image analysis and so on. For example, motion
regarding the video content can be easily detected by
responding to frequencies present at the scanning rate
25 (horizontal). Thus, the prior was capable of
detecting motion by responding to such frequencies.
Hence this system can be used to insert the logo only
in the selected area and only when motion is not
detected. Motion can also be detected on a frame-to-
30 frame comparison of video content. The resultant
effect is to allow a viewer to watch the televised
match discreetly and completely as it is occurring
with advertising conspicuously added directly on the
court. The advertising or logo could be of any

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recognition technique can discriminate and select almost any object present in a television picture.

5 For example, the operator may select the back portion of a player's uniform and the pattern recognition algorithm will recognize that back portion of the player and the logo is inserted by means of the second image source 27 on the player's back. Thus,

10 apart from a tennis court, one can insert advertisements on the back wall of a baseball field or on the pitcher's mound or any other selected place. It is actually up to the advertiser and the user to determine where the logo is to be inserted, and the

15 system assures that the logo inserted will always be in proper perspective no matter how the particular sport event being televised is viewed.

The frame storage and delay device 19 operates to allow the analyzer 17 as well as the image synthesizer 20 to process the signal in real time. Thus, the time delay module receives the signal and, basically, is a frame store or a multi-frame store device. The frame and storage delay module 19 can utilize CCD devices or MOS technology or other frame

25 storage devices and technologies. There are virtually many devices in the prior art which can store single frames or multiple frames of video. The frame storage device, again as indicated, can be any memory medium that has relatively fast read/write times so that it

30 can compatibly operate with the video signal. The amount of delay and storage depends on the speed of the analyzer 17 as well as the quality of the image from the video camera 14. For larger and high definition video formats one would require more

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The present system utilizes the microphone 15 which as indicated is coupled to an audio analyzer processor 26 for accommodating special effects. The audio analyzer processor 26 again can be a mini-computer or a high speed PC together with a hard disc or other type memory. The audio processor 26 as well as the microphone 28 are included, and basically the microphone is a conventional component for providing sound to enable the transmission of normal television signals. The audio processor 26 monitors the audio stream emanating from the microphone 28 and the sound as processed by the processor is used to control aspects of the image as inserted by the second image video source 27. Thus, the audio processor can respond to the magnitude of the signal from the microphone 15 and alter the logo which is displayed on the court accordingly.

For example, let us assume that a point is made by one player after a rather spectacular rally. In these instances the crowd usually responds by loud clapping and cheering. In this way in order to fully emphasize the reaction of the crowd one can utilize the increased sound level to modulate the logo. For example, to turn the logo on and off, or to change the color and hence add dimensions to the overall televised presentation to further enable the advertiser to obtain maximum benefit from the advertisement. Such techniques are relatively simple to implement and are well within the ordinary ken of one skilled in the art. The audio processor can also include a voice recognition system which systems are commercially available. Thus, particular words or

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and manner the interest video can be made to respond accordingly.

5 For example, certain baseball commentators
are famous for their particular expressions such as
the expression "holy cow" when the commentator uses
this expression one knows that either a home run or
some other spectacular event has occurred. In this
10 way the indicia or logo is inserted by means of the
pattern recognition processing technique described
above and can be modulated or suitably altered in
regard to such recognized words or phrases. The
applications which are available by utilizing the
15 above described technology are too numerous to mention
as is the existing technology which can accomplish
these techniques. Thus, the extensive prior art
listed in the beginning of this application is
indicative of the various different techniques which
20 can be employed to implement the above described
operation. As one can immediately ascertain, the
potential uses of the methods and apparatus described
involve advertising, but as indicated, they can be
utilized in directing the viewer's attention to
25 particular places on the sports court such as
highlighting the outlines of the court.

 Another technique which can easily be
employed by using the techniques is the marking or
modulation of the progress of a ball being utilized in
30 for example a tennis match or during a baseball game.
As one can ascertain in many scenes which are
displayed on television, it is extremely difficult to
follow the flight of a pitched or struck ball. Based
on the real time operation of the algorithms described

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and a pitcher and catcher. In this manner the pattern recognition apparatus would recognize the ball and one can modulate the path of the ball on a frame-to-frame basis thus enabling the viewer to clearly distinguish the ball and to visualize the ball during the course of the baseball game. The ball can also be recognized in regard to that employed in a tennis match. As one can understand, in certain tennis matches such as those played on clay, it is often difficult to see the ball and hence the above techniques can be utilized in enhancing the game by recognition of the ball on a frame-to-frame basis, thereafter marking or inserting indicia indicative of the trajectory of the ball.

The applications of the above technology in regard to advertisements are many and include placing advertising in and around the court of play, placing advertising on a bowling ball or a basketball (either of which are easy to recognize) placing advertisement on the bowling alley lane or parts of a basketball or tennis court including the backboard of a basketball court or the net of a tennis court. These techniques will enable one to provide inserted patches on individual players such as on the arm or the back of the player which then can be replaced with advertisements which can be varied during the course of a match or can be different in different parts of the country or different parts of the world. One can utilize the inserted video display to provide advertising effects such as modulating the display when a particular event is achieved. One can also utilize the above described techniques to actually

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facilities do not exist.

5 While it is understood that the block
diagram and specification herein depicted in Fig. 1
are devoid of any specific examples of algorithms or
of the programs utilized to implement the technology,
it is again indicated that the pattern recognition and
10 algorithms and techniques are all well known in the
art, and any one of such algorithms can be
successfully employed and incorporated in this system
with a minimum of effort. Those listed in the many
patents and articles and other presentations cited in
15 this application are applicable. It is, of course,
understood that each and every module depicted in Fig.
1 is available and can be programmed to render the
accomplished task with a minimum of effort.

 Thus, the above described techniques are
20 well within the ken of one skilled in the art, and the
aspect of providing a desired video image within a
recognizable pattern associated with a video display
is readily achieved by these techniques. It is, of
course, understood that the pattern recognition
25 algorithm has been basically described as related to
sporting events or events where the field or other
particular object is displayed fairly often during the
televised presentation.

 It is, of course, understood that the
30 techniques described herein will have applicability to
other televised events such as contests, game shows
and so on and is not limited in any manner to sporting
events.

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disclosed prior art.

5 It is, therefore, indicated that the invention as described herein has great utility, and it is understood that alternate embodiments can be employed but the general content and scope of the invention is embodied in the enclosed claims.

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display to provide a substituted display of desired indicia within a preselected portion of said video image display and independent of the size of said selected portion which size is strictly a function of the TV camera, said TV camera operable at various different perspectives employed to create said display, comprising:

10

means for selecting said portion of said display to be substituted,

means responsive to said video signal display for recognizing said selected portion of said display,

15

means for generating video signals indicative of said desired indicia to be substituted,

means responsive to said desired indicia signals and said video signal for inserting said indicia into said video image display at said preselected portion.

2. The apparatus according to Claim 1, further including:

5

audio processing means responsive to audio signals associated with said televised scene to alter said substituted display portion according to said audio signals.

3 The apparatus according to Claim 2, wherein said display indicia is modulated according to the intensity of said audio signals, which signals exceed a given threshold.

4. The apparatus according to Claim 1, wherein said means for selecting includes a light pen for outlining said portion of said display to be selected and means for storing said selected outline.

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6. The apparatus according to Claim 1, further including:

5 delay means responsive to said recognized video signal and said video signals representative of said desired indicia for showing the same on a frame-to-frame basis to enable the insertion of said indicia on a real time basis.

7. The apparatus according to Claim 1, wherein said means responsive to said video signal display includes pattern recognition means responsive to said selected portion of said display to provide 5 signals indicative of said selected portion independent of the size of said portion with respect to said display.

8. The apparatus according to Claim 7, wherein said pattern recognition means includes means for performing a pyramid algorithm.

9. The apparatus according to Claim 1, further including means responsive to colors present in said video display to inhibit display substitution during the presence of selected colors, whereby 5 replaceable pixels can be substituted for non-replaceable pixels.

10. A method for altering a video image to provide a substituted display of desired indicia within a preselected portion of said video image display on a frame-to-frame basis and independent of 5 the size of said selected portion on a frame-to-frame basis which size is a function of the TV camera perspective employed to create said display, comprising the steps of:

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display on a frame-to-frame basis and independent of the size of said portion with respect to said display, generating a video image of said desired indicia, and

inserting said image of said desired indicia within said recognized portion of said display on a frame-to-frame basis.

11. The method according to Claim 10, wherein the step of generating a video image of desired indicia includes generating a video image of an advertising format such as a manufacturer's trademark or logo.

12. The method according to Claim 11, wherein said selected portion of said display to be substituted comprises the boundaries of a sports court, with said desired indicia including enhanced replicas of said boundaries.

13. The method according to Claim 10, further including the step of:
detecting the intensity of audio signals emanating from said televised scene and altering the inserted image according to said detected audio.

14. The method according to Claim 10, further indicates the step of:
selectively responding to a color present in said display for inhibiting the insertion of said desired indicia within said selected portion according to the presence of said color.

15. The method according to Claim 10, further including the step of:

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16. The method according to Claim 10,
wherein the step of recognizing includes,

5 applying a pattern recognition
algorithm to said video display after selecting said
portion, wherein said algorithm is a pyramid algorithm
capable of processing said displayed image enabling
recognition of said selected portion independent of
the size, location or orientation of the same with
respect to said display on a frame-to-frame basis.

17. The method according to Claim 16,
wherein said algorithm is the Burt Pyramid Algorithm.

18. The method according to Claim 10,
wherein the step of selecting includes outlining said
selected portion of said display with a light pen and
5 storing the outline of said light pen
indicative of said selected portion.

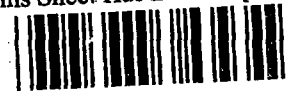
19. The method according to Claim 10,
further including the step of:

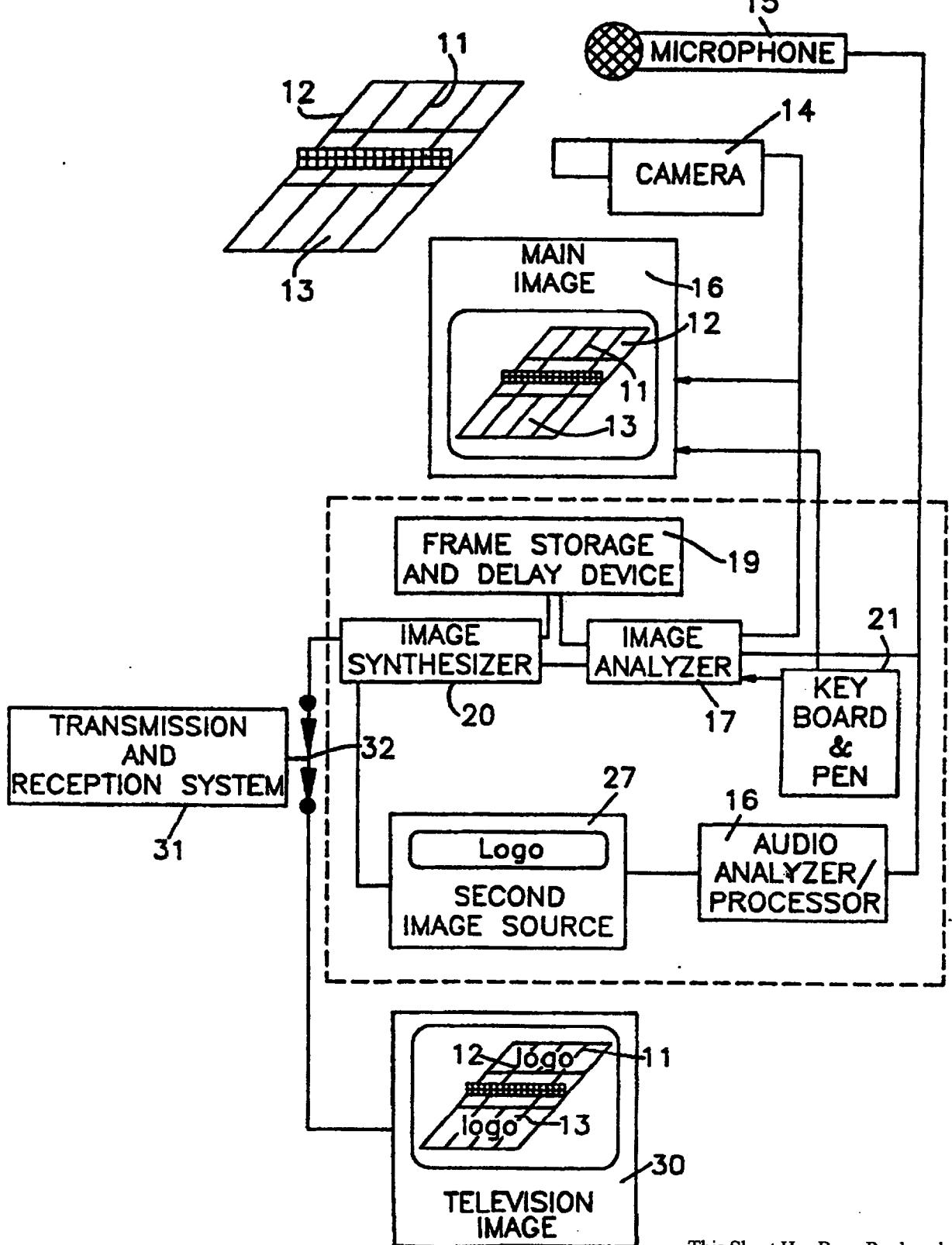
5 modulating said inserted video image
according to the sound intensity emanating from said
televised scene.

20. The method according to Claim 10,
further including the step of:

5 detecting motion in said display during a
frame and inhibiting said video image of said desired
indicia into said display according to said detected
motion.

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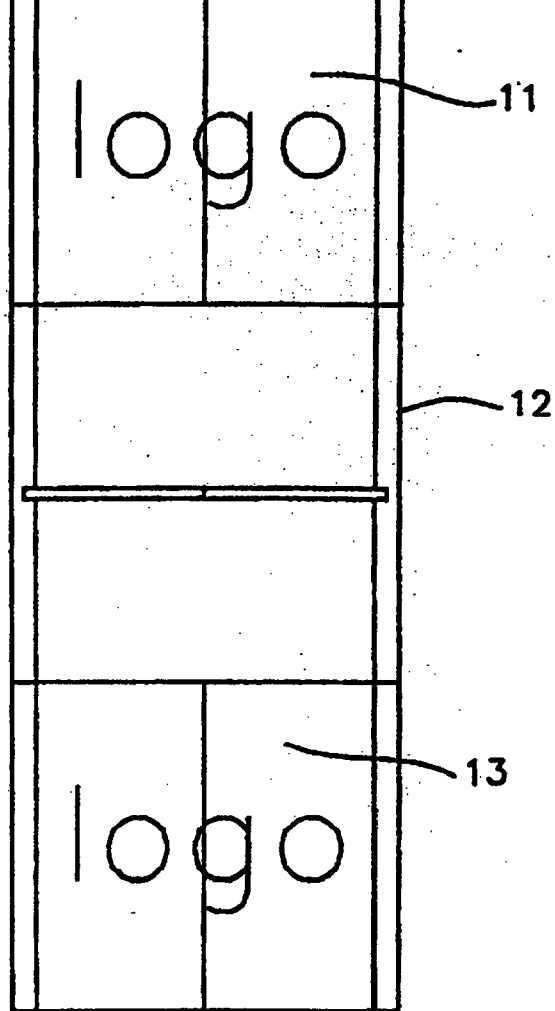
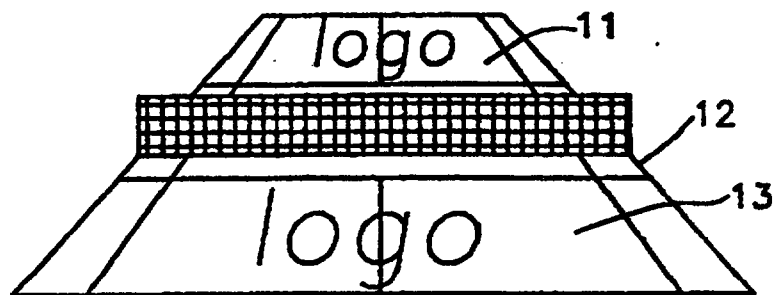


FIG. 3



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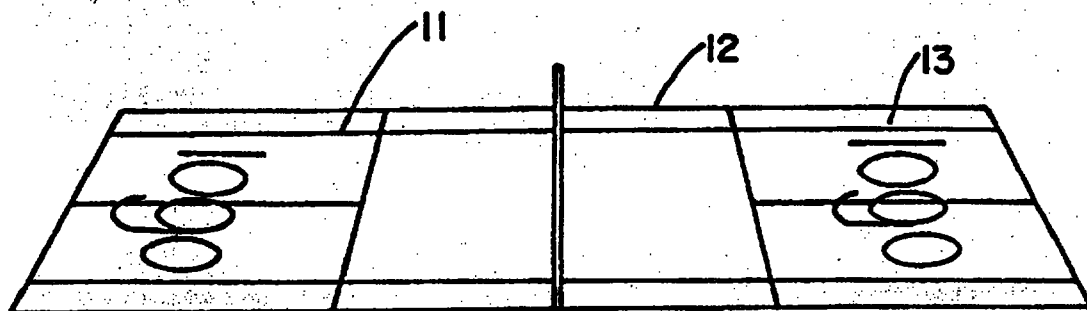


FIG. 4

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Related Applications & Priority Documents

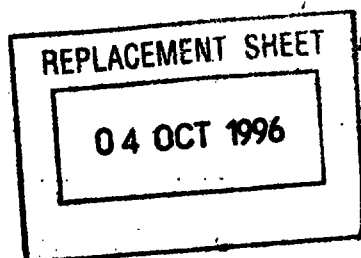
This invention is related to British Patent Application Serial No. 9102995.9, entitled Electronic Billboard: A Method of Advertising Using Existing Television Transmission Facilities, filed February 13, 1991 by Roy J. Rosser & Martin Leach, which application is based upon a provisional application filed February 14, 1990. In addition, this application is related to British Patent Application Serial No. 9019770.8, entitled Audio Enhanced Electronic Billboard, filed September 10, 1990 by Roy J. Rosser.

Technical Field

The present invention relates to a method of advertising using conventional television transmission facilities. In particular, the invention relates to methods for merging or inserting a chosen image into a preselected existing image portion of a television service.

Background Art

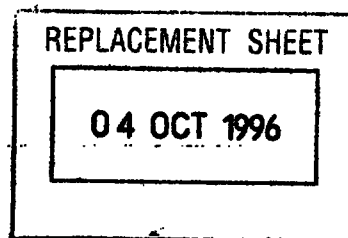
The conventional methods for merging video images include the "blue screen" or "chromo-key" techniques. For example, these techniques are used in the broadcast industry to show weather forecasters positioned in front of weather maps. In this technology, the forecaster is filmed in front of a screen having a particular pre-determined color. The screen color is usually blue, hence, the name of this technique. The technique calls for substituting the



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☒	Description	: paged 1 to paged 24
☒	Claim(s)	: paged 25 to paged 28
☒	Drawing(s)	: paged 1 to paged 3
☒	Abstract	: paged 29 to paged
DATE OF RECEIPT		4/10/76

the blue color. The result is that the image of the map and forecaster will appear to merge. However, this method has two short comings. First, the forecaster must not have any item on his person that is the same color as the blue color of the screen. If he does, and the second image is merged with the first image, any item on the forecaster having the predetermined blue color will appear as a hole. Second, this technique does not provide for the integration of the two images. That is, the two images are merely superimposed. That is why the forecaster must make sweeping and general motions to indicate positions on the map. This limitation is important when considering this technique for an advertising application.

There are of course other techniques which enable the insertion of video images into an existing image which are basically employed at the studio and which utilize complicated console devices to superimpose a video picture on another video picture. Essentially the present technique involves a completely different approach with great applicability to television advertising. As will be explained, the present application relates to a method of advertising using existing television transmission facilities in which the advertiser selects predetermined areas in a video scene. These areas are then recognized using existing technology as pattern recognition techniques and the content of these areas is replaced by inserting an image or images of the advertisers choosing. In order to accomplish the present invention one must recognize the selected



indicia is then blended into the original video image in such a way that it appears part of the television scene and cannot be otherwise discerned by a typical viewer. The inserted advertising or messages can further be highlighted to the viewer by moving the message, changing color, associating the message with sound and otherwise imparting modulation to the message to distinguish the message during the course of the television program. Such techniques will be further described. Basically, it is believed that the techniques to be described herein have extreme usefulness and applicability for the display of advertising in television sporting events such as tennis matches, boxing, baseball, football and so on. While there is particular applicability to such events the techniques described may be adapted to all formats of video presentation and have general applicability to the field of advertising.

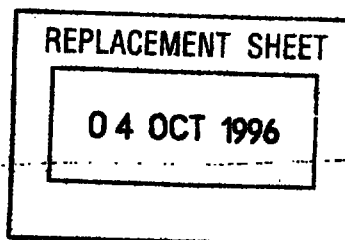
As will be described and in order to accomplish this result, one must basically select an object or an area within a given video image. For example the area selected may be a televised tennis court. This area is then recognized in each of a subsequent stream of video images and once recognized the video content of that image is replaced with a desired content which may be an advertising commercial, logo or some other matter. The insertion and replacement of the existing video image with the new material is accomplished completely independent of the size of the image in subsequent television scenes or frames. The system described herein will always recognize the particular area selected no matter what

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illusion to the viewer that the replaced subject matter is actually that subject matter which is being televised in real time. Thus, the methods and apparatus described enable advertisers to add or merge images, messages or slogans to preexisting video images in such a way that they appear to be part of the original image even when the original video stream is of a live event being distributed in real time.

Thus, the techniques described herein are superior to prior art techniques of inserting video information. In order to do and accomplish the results of this particular application an electronic device is required to select, recognize and substitute images to be broadcast on live televised events. The device detects part or all of an object or objects within a video image and uses the position of the object or part thereof as a reference. The device then positions another still or video image into the original image at the reference location. The still or video image is positioned accurately so that the final composite image appears as though it is part of the original scene. That is, the added image is seamlessly and realistically incorporated into the original event. The appearance of the added image will conform to the appearance of the original scene when the scene is moved, panned, magnified, zoomed or otherwise altered in size or perspective. The System can also compensate for less distortions by mapping the distortions in a televised scene and using the mapped distortions in future processing. All this must be done in real time, or with a processing delay being sufficiently small that it can be applied to



computation on a video image in such a short time with existing technology. This is a well know method of processing, analyzing and/or synthesizing signals and is described in U.S. Patent No. 4,674,125, entitled Real-Time Hierarchy Pyramid Signal Processing Apparatus by C.R. Carlson, et al. and issued on June 16, 1987. The Burt Pyramid is also discussed in the publications entitled "Fast Algorithms for Estimating Local Image Properties", by Peter J. Burt, Computer Vision, Graphics and Image Processing 21, pp. 368-382, 1983 and "Pyramid-Based Extraction of Local Image Features with Application to Motion and Texture Analysis", by Peter J. Burt, SPIE, Vol. 360, pp. 114-124.

The "chromo-key" or "blue-screen" technology may be used in certain applications as an adjunct to the pattern recognition method. This technology is one way of distinguishing non-replaceable, foreground pixels from replaceable, background pixels. For instance, in a sport such as tennis, it is usually necessary to ensure that only the tennis court is replaced with a message merged onto the field of play. The players or their equipment should not be affected. One way to accomplish this is to replace only the green colored pixels that are in the merged image and are within the color range of the court. Alternate methods of distinguishing between replaceable and non-replaceable pixels include storing an image of the unoccupied court and subsequently using that image as a comparison to determine which is the player/equipment and which is the background. Another method uses differential motion between the

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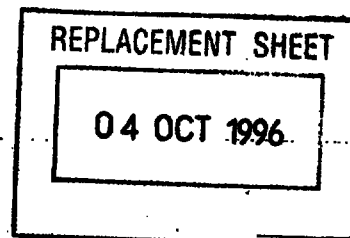
distinguish between replaceable and non-replaceable pixels.

Although the pattern recognition software using the "Burt Pyramid" algorithms is fast, it still takes a finite time to operate. Therefore, it may be necessary to introduce a time delay into the system. The delay may be one or two frames, or it may be longer. A frame store or other similar means can be used to temporarily locate a small number of the video screens or frames. Incorporating a time delay unit into the present invention will be discussed hereinafter.

Other conventional methods of processing video signals and images or the like are presented below. Some of the disclosed methods also use the Burt Pyramid.

An example of an apparatus that analyzes signals and the frequency spectrum for the frequency components of the signals is disclosed in U.S. Patent No. 3,731,188, Signal Analysis of Multiplicatively Related Frequency Components in a Complex Signal, which issued May 1, 1973 to S.E. Smith. Other patents disclosing subject matter related thereto are U.S. Patent Nos. 3,140,710, 3,315,222, 3,470,468, 3,473,121 and 3,582,957.

An example of an image processing method for reducing noise in the image is disclosed in U.S. Patent No. 4,442,454, Image Processing Method Using a Block Overlap Transformation Procedure, which issued April 10, 1984 to P.G. Powell. In the method disclosed, the image is divided into blocks of image elements which are transformed according to the linear



3,996,421, 4,055,756, 4,057,828, 4,134,134, 4,205,341, 4,242,705 and 4,245,248.

An example of a method and apparatus for transforming numerical signal data of a video signal is disclosed in U.S. Patent 4,447,886, Triangle and Pyramid Signal Transforms and Apparatus, which issued May 8, 1984 to G.W. Meeker. As disclosed in this patent, the numerical signal data of the video signal is subjected to a transform domain where the signal is processed and reconstructed into the original domain to provide a replica of the original data. Other patents disclosing subject matter related thereto are U.S. Patent Nos. 2,921,124, 3,051,778, 3,742,201, 4,222,076, 4,261,018, 4,261,043 and 4,286,330.

An example of an image-processing system employing coring techniques to reduce a noise component of an image signal is disclosed in U.S. Patent No. 4,523,230, System for Coring an Image-Representing Signal, which issued June 11, 1985 to C.R. Carlson, et al. The Burt Pyramid spectrum analyzer and synthesizer (U.S. Patent No. 4,674,125) may be employed with the system disclosed in the '230 patent, so that the system can operate in real time on a video signal of a scanned television image. Other patents disclosing subject matter related thereto are U.S. Patent Nos. 4,163,258 and 4,463,381.

An example of a method and an apparatus for reducing image data while retaining the ability to observe objects with high spatial resolution is disclosed in U.S. Patent No. 4,692,806, Image-Data Reduction Technique, which issued September 8, 1987 to C.R. Carlson, et al. Other patents disclosing subject

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An example of an image processing method for filling in one or more void defects in an image to provide a natural looking processed image is disclosed in U.S. Patent No. 4,698,843, Method for Compensating for Void-Defects in Images, which issued October 6, 1987 to P.J. Burt, et al. This invention discloses employing The Burt Pyramid as disclosed in U.S. Patent No. 4,674,125. Other patents disclosing subject matter related thereto are U.S. Patent Nos. 3,737,855, 3,887,762, 3,973,239, 4,000,399, 4,010,446 and 4,661,986.

Thus as one will ascertain the advertising method and apparatus of this invention requires very precise positioning of a new image into an existing image. The techniques to be described employ pattern recognition apparatus which recognizes pre-selected features or portions of a typical television scene. These features can then be used to locate the position, size and perspective of an artificial electronic advertising message which is added in the exact congruency with the replaced recognized image and appears to the end user as if it were part of the original scene. The added material is inserted into the pre-selected scene independent of size of the selected feature as varying on a frame to frame basis.

Disclosure of the Invention

Apparatus for altering a video image display to provide a substituted display of desired indicia within a preselected portion of said video image display and independent of the size of said selected portion which size is strictly a function of the TV

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comprising means for selecting said portion of said display to be substituted, means responsive to said video signal display for recognizing said selected portion of said display, means for generating video signals indicative of said desired indicia to be substituted, means responsive to said desired indicia signals and said video signal for inserting said indicia into said video image display at said preselected portion.

Brief Description of the Figures

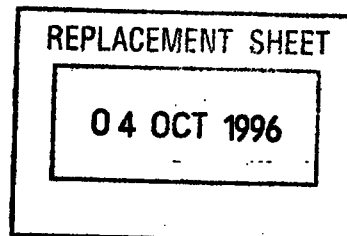
Fig. 1 is a detailed blocked diagram showing an apparatus for recognizing video image formats and inserting desired indicia therefore according to this invention.

Figs. 2, 3 and 4 are different perspective plan views of a television image of a tennis court showing how the logo is positioned by the system of Fig. 1 on the tennis court as a function of different perspective views of the court as taken by a typical television camera.

Best Mode For Carrying Out the Invention

Referring to Fig. 1, there is shown a block diagram of a general format of a system employing the apparatus to be described. Before proceeding with a description of the apparatus depicted in Fig. 1, the following comments are pertinent.

The uses of the apparatus and method relate to advertising and include but are not limited to advertising which occurs during sporting events where a field or other scene is normally depicted such as a tennis court, a baseball field, a football field and



advertising can continuously be recognized by the techniques to be described, and the advertising which is permanently painted on a fence or displayed on a fence can be replaced. In a similar manner certain areas of the playing field which do not have advertising can now include advertising such as advertising appearing on a tennis court or playing fields. By making the advertising a discrete part of the action the game does not have to be interrupted. Even in sports where there are breaks for advertising the method and apparatus to be described is of benefit to advertisers because the message can be displayed while the audience's attention is focused on the action. Apart from this particular application, which relates to advertising, one can also recognize by means of the pattern recognition schemes and boundary lines which are associated with a typical sports court such as the serve line in tennis, the foul line in basketball, the various field lines in baseball, football and so on. These lines can be further recognized and enhanced by artificially including markings for the various field or other lines or boundaries. Apart from such other items, advertising messages can be displayed and then changed and so on during a single televised event.

Referring to Fig. 1, there is shown a replica of a typical tennis court 12. The tennis court is separated by a net and has a back court designated 11 with a fore court 13. The tennis court 12 is shown in a perspective view. Shown is a television camera 14 which is in the process of recording the sporting event or tennis match. The

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embodiment of the invention, the fore court 11 as well as the back court 13 or the entire tennis court 12 is subjected to a pattern recognition algorithm whereby an advertisement is actually inserted directly on the portions of the court as shown in Fig. 2.

As shown in Fig. 3, the same advertisement or logo is depicted independent of the perspective view of the court and independent of whether the television camera 14 is employing a zoom lens or the scene is televised by an additional camera coupled to suitable equipment. The cameras provide a view of the tennis match through a different perspective or different visual planes. Thus as one can ascertain from Figs. 2, 3 and 4, the logo will appear in exact conformity with the perspective view of the court so that it will appear as if the logo were permanently imprinted on the actual court being televised. Thus, the television camera 14 is shown televising the tennis match. As will be explained, the output of the camera 14 is coupled directly to a main image television receiver 16 which receives the video signal from the camera and which provides a display of the television signal as shown on the display screen. The camera 14 is also coupled to one input of an image analyzer 17.

The equipment also includes a microphone 15 utilized to pick up sound from the area being televised with the output of the microphone coupled to an input of the image analyzer 17 and also coupled to the input of an audio analyzer processor module 26. The output from the audio analyzer processing module 26 is directed to an input of a second image source

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which may be a slogan, an image, a logo and which advertising message will be displayed on the selected portions 11 & 13 of the tennis court as shown in Figs. 2, 3 and 4 and designated as logo. The second image source 27 has an output coupled to an image synthesizer 20. The image synthesizer has an output coupled to the image analyzer 17. Both the image synthesizer and the image analyzer have inputs and outputs directed to a frame storage and delay device 19 which will be subsequently explained. Also seen is that the image synthesizer has one output coupled to one terminal of a switch 32 which interfaces with a transmission/reception system 31.

The other terminal of the switch 32 is coupled to a television receiver 30 which as seen in Fig. 1 has the inserted logo positioned on the selected portions of the tennis court. The television receiver 30 is indicative of a user's television as for example used by a consumer viewing the sports event. The operation of the system is basically as follows. Before proceeding further it is understood that the camera 14 and microphone 15 in conjunction with the above noted equipment can directly operate to provide a normal television signal to be transmitted by the transmission and reception system 31 to remote television receivers as 30 as is conventional. Hence, it is indicated that the television camera 14 as well as the microphone 15 and associated equipment are conventional components and therefore capable of providing a typical, normal, unaltered television signal and display. The distribution of the television signal is accomplished via the transmission/reception

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distributing television signals are extremely well known. If the sender desires to insert a given advertising message or a logo in a selected area of the television display, the following operation occurs.

The image of the event as present on the screen of the television receiver 16 will eventually be altered to incorporate the advertising message which as indicated may be a slogan or image. The alteration may take place at the originating site of the event, at a network broadcast center, a local broadcast center, at a local broadcasting station, at a cable headend or any other site where video signals are disseminated. As one will ascertain, the equipment shown in Fig. 1 is universally adaptable to be utilized at any particular location and is relatively small and transportable. The added message which is provided by the separate video source 27 may be prerecorded on a tape or stored by other means and eventually will be merged into the video stream by the image synthesizer 20. The image synthesizer 20 uses data from the image analyzer 17 and from the frame storage and delay device 19. The essence of this method of advertising is to incorporate the added message from the secondary source 27 into the main image recorded by camera 14 so that the end viewer who is watching the television screen associated with receiver 30 believes that the image is actual imprinted or otherwise permanently located on the tennis court at the actual site of the match.

Also, as shown in Figs. 2, 3 and 4 the logo is actually added to the television court display even

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on the tennis court 12. This merging is seamless and incorporates the logo or advertising message into the video image from the camera 10. The hardware employed incorporates software programs which are all known in the prior art and examples of which have been given above. Essentially, the merging of the advertising message or image into the video images is accomplished in the image analyzer 17. The image analyzer 17 operates in conjunction with the image storage and delay module 19 as well as the image synthesizer 20 to provide the composite picture as shown on the screen of television receiver 30. The image analyzer 17, the image synthesizer 20, the delay module 19 and the video source 27 as well as the audio analyzer and processor 26 constitute the modules which operate to provide the merging of the advertising message with the video signal as will be further described.

The image analyzer 17 includes a conventional computer such as a PC or mini-computer including a suitable memory such as a hard drive and so on. The image analyzer computer 17 is programmed to take the television signal emanating from camera 14 to store the signal and to process the stored signal according to a selected pattern recognition technique so that the incoming video image is processed in real time. The image analyzer 17 may be associated with suitable operating interface equipment such as a keyboard, a light pen or a mouse to allow the operator to originally select the landmarks desired in the original scene. In this manner the operator will for example outline the tennis court 12 as present on the screen of the monitor receiver 16X. The monitor

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outline will be stored in memory in regard to digital bits or pixels in the image analyzer. As one can ascertain, the entire video signal as displayed on the screen is broken up into pixels where each television line and each position along a line is represented by a suitable digital number corresponding to the color intensity or content at the line position or to the monochrome content of the line position.

Techniques for converting television signals into digital signals including pixels are extremely well known. Hence one can store the entire representation of a complete television frame or image within a conventional memory by conventional techniques. The light pen or other marking device which is associated with the image analyzer provides an outline of the image which is to be recognized by pattern recognition program such as described in U. S. Patent 4,674,125 wherein the Burt Pyramid Algorithm is employed as one well known technique. While the Burt algorithm as indicated above is extremely useful in implementing pattern recognition to therefore enable the system to recognize the tennis court, many other techniques for pattern recognition including other algorithms may be used. There have been entire books and volumes written on pattern recognition and image processing. See for example "The Proceedings of the IEE", May, 1979 issue entitled "Pattern Recognition and Image Processing", Volume 67, Num. 5, Pgs. 705 - 880. Many of the above noted patents describe various other techniques for performing pattern recognition. The image analyzer 14 as well as the image synthesizer

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other pattern recognition techniques and for processing the incoming video images in real time. Such algorithms such as the Burt pyramid algorithm employ a particular sampling technique analyzing a relatively high resolution video signal into a hierarchy of N (where N is a plural integer), separate component images in which each component image is a Laplacian image comprised of a different octave of the spatial frequencies of the original image, plus a remnant Gaussian image.

The term "pyramid" relates to the successive reduction in spatial frequency and sample density of each of the hierarchy of the component images in going from the highest octave component to the lowest octave component image. This algorithm is computationally effective and can deal with visual images that are intended for viewing by human beings within the typical television frame rates. There are other techniques which can also be employed to process the image, and, as indicated, the frame and storage device 19 can for example delay many frames and hence the processing can be slowed down a great deal depending on whether or not one wishes a simultaneous transmission of the actual event or a delayed version thereof. Operation of the system as indicated is basically as follows. The operator views the image as presented on the monitor television receiver 16 and marks selective portions of the outlines of the court or the net area to choose or to direct that portion of the displayed image to be recognized and where the advertising indicia will be inserted. In this particular example the operator will mark the upper

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command the image analyzer 17 to recognize these markings in subsequent video images of the court 12 as televised by the camera. The image synthesizer is now employed to locate, position and orient, including the correct magnification, the indicia or logo, which is taken from the second image source 27 so that it appears as part of the original scene. The logo which is generated by the second image source 27 is made to appear as part of the background and does not interfere with objects or people in the foreground. This is accomplished by allowing the logo to key over specific colors or ranges of colors such as the color of a court in the tennis match.

As one understand a tennis court for example is a certain shade of green. Thus the areas 11 and 13 are green or some other color which completely differentiates from the colors of the uniforms as well as the skin of the players or participants. By means of conventional RGB color processing the image analyzer can therefore store information relating to: 1) the outline of the court as selected by the operator and 2) the color of the court as further evidenced by the detail in the video image. In this manner the image analyzer 17 transfers information to the image synthesizer 20. The image synthesizer receives information relating to the position and location of the court portions 11 and 13. The image synthesizer 20 then takes the video information from the second image source 27 and inserts this information in the images of the court section 11 and 13. This insert appears as the logo which is depicted in Figs. 2, 3 and 4. This insertion is done by means

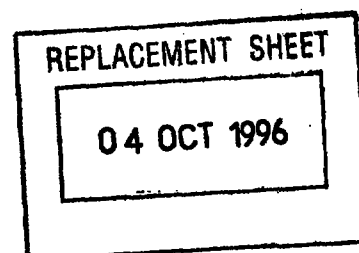
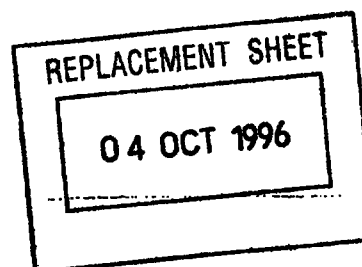


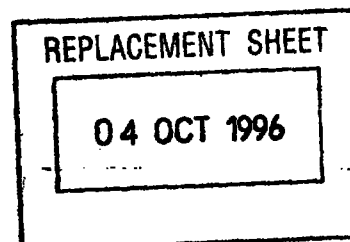
image synthesizer is now inserted in absolute proper location, position and orientation. including the correct magnification into a stored picture which picture is now re-routed through the image synthesizer to the transmission and reception system 31. This causes the display on television receiver 30 to be shown, as indicated. The distinction between the foreground and background may also be identified by other techniques apart from color detection. It is, of course, clear that by not keying over specific colors such as clothing and flesh colors one will only provide the logo in the areas 11 and 13 and the logo will be obscured by the players as to only the portion of the player that overlies the logo. Hence it appears as if the logo is actually painted directly on the tennis court.

Apart from color recognition, one can distinguish between the tennis court and the background of the court by other techniques such as optical image analysis and so on. For example, motion regarding the video content can be easily detected by responding to frequencies present at the scanning rate (horizontal). Thus, the prior was capable of detecting motion by responding to such frequencies. Hence this system can be used to insert the logo only in the selected area and only when motion is not detected. Motion can also be detected on a frame-to-frame comparison of video content. The resultant effect is to allow a viewer to watch the televised match discreetly and completely as it is occurring with advertising conspicuously added directly on the court. The advertising or logo could be of any



recognition technique can discriminate and select almost any object present in a television picture. For example, the operator may select the back portion of a player's uniform and the pattern recognition algorithm will recognize that back portion of the player and the logo is inserted by means of the second image source 27 on the player's back. Thus, apart from a tennis court, one can insert advertisements on the back wall of a baseball field or on the pitcher's mound or any other selected place. It is actually up to the advertiser and the user to determine where the logo is to be inserted, and the system assures that the logo inserted will always be in proper perspective no matter how the particular sport event being televised is viewed.

The frame storage and delay device 19 operates to allow the analyzer 17 as well as the image synthesizer 20 to process the signal in real time. Thus, the time delay module receives the signal and, basically, is a frame store or a multi-frame store device. The frame and storage delay module 19 can utilize CCD devices or MOS technology or other frame storage devices and technologies. There are virtually many devices in the prior art which can store single frames or multiple frames of video. The frame storage device, again as indicated, can be any memory medium that has relatively fast read/write times so that it can compatibly operate with the video signal. The amount of delay and storage depends on the speed of the analyzer 17 as well as the quality of the image from the video camera 14. For larger and high definition video formats one would require more



The present system utilizes the microphone 15 which as indicated is coupled to an audio analyzer processor 26 for accommodating special effects. The audio analyzer processor 26 again can be a mini-computer or a high speed PC together with a hard disc or other type memory. The audio processor 26 as well as the microphone 28 are included, and basically the microphone is a conventional component for providing sound to enable the transmission of normal television signals. The audio processor 26 monitors the audio stream emanating from the microphone 28 and the sound as processed by the processor is used to control aspects of the image as inserted by the second image video source 27. Thus, the audio processor can respond to the magnitude of the signal from the microphone 15 and alter the logo which is displayed on the court accordingly.

For example, let us assume that a point is made by one player after a rather spectacular rally. In these instances the crowd usually responds by loud clapping and cheering. In this way in order to fully emphasize the reaction of the crowd one can utilize the increased sound level to modulate the logo. For example, to turn the logo on and off, or to change the color and hence add dimensions to the overall televised presentation to further enable the advertiser to obtain maximum benefit from the advertisement. Such techniques are relatively simple to implement and are well within the ordinary ken of one skilled in the art. The audio processor can also include a voice recognition system which systems are commercially available. Thus, particular words or

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this manner the inserted video can be made to respond accordingly.

For example, certain baseball commentators are famous for their particular expressions such as the expression "holy cow" when the commentator uses this expression one knows that either a home run or some other spectacular event has occurred. In this way the indicia or logo is inserted by means of the pattern recognition processing technique described above and can be modulated or suitably altered in regard to such recognized words or phrases. The applications which are available by utilizing the above described technology are too numerous to mention as is the existing technology which can accomplish these techniques. Thus, the extensive prior art listed in the beginning of this application is indicative of the various different techniques which can be employed to implement the above described operation. As one can immediately ascertain, the potential uses of the methods and apparatus described involve advertising, but as indicated, they can be utilized in directing the viewer's attention to particular places on the sports court such as highlighting the outlines of the court.

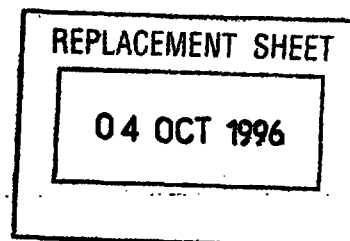
Another technique which can easily be employed by using the techniques is the marking or modulation of the progress of a ball being utilized in for example a tennis match or during a baseball game. As one can ascertain in many scenes which are displayed on television, it is extremely difficult to follow the flight of a pitched or struck ball. Based on the real time operation of the algorithms described

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and a pitcher and catcher. In this manner the pattern recognition apparatus would recognize the ball and one can modulate the path of the ball on a frame-to-frame basis thus enabling the viewer to clearly distinguish the ball and to visualize the ball during the course of the baseball game. The ball can also be recognized in regard to that employed in a tennis match. As one can understand, in certain tennis matches such as those played on clay, it is often difficult to see the ball and hence the above techniques can be utilized in enhancing the game by recognition of the ball on a frame-to-frame basis, thereafter marking or inserting indicia indicative of the trajectory of the ball.

The applications of the above technology in regard to advertisements are many and include placing advertising in and around the court of play, placing advertising on a bowling ball or a basketball (either of which are easy to recognize) placing advertisement on the bowling alley lane or parts of a basketball or tennis court including the backboard of a basketball court or the net of a tennis court. These techniques will enable one to provide inserted patches on individual players such as on the arm or the back of the player which then can be replaced with advertisements which can be varied during the course of a match or can be different in different parts of the country or different parts of the world. One can utilize the inserted video display to provide advertising effects such as modulating the display when a particular event is achieved. One can also utilize the above described techniques to actually



rence in a baseball game or elsewhere where such facilities do not exist.

While it is understood that the block diagram and specification herein depicted in Fig. 1 are devoid of any specific examples of algorithms or of the programs utilized to implement the technology, it is again indicated that the pattern recognition and algorithms and techniques are all well known in the art, and any one of such algorithms can be successfully employed and incorporated in this system with a minimum of effort. Those listed in the many patents and articles and other presentations cited in this application are applicable. It is, of course, understood that each and every module depicted in Fig. 1 is available and can be programmed to render the accomplished task with a minimum of effort.

Thus, the above described techniques are well within the ken of one skilled in the art, and the aspect of providing a desired video image within a recognizable pattern associated with a video display is readily achieved by these techniques. It is, of course, understood that the pattern recognition algorithm has been basically described as related to sporting events or events where the field or other particular object is displayed fairly often during the televised presentation.

It is, of course, understood that the techniques described herein will have applicability to other televised events such as contests, game shows and so on and is not limited in any manner to sporting events.

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disclosed prior art.

It is, therefore, indicated that the invention as described herein has great utility, and it is understood that alternate embodiments can be employed but the general content and scope of the invention is embodied in the enclosed claims.

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display to provide a substituted display of desired indicia within a preselected portion of said video image display and independent of the size of said selected portion which size is strictly a function of the TV camera, said TV camera operable at various different perspectives employed to create said display, comprising:

means for selecting said portion of said display to be substituted,

means responsive to said video signal display for recognizing said selected portion of said display,

means for generating video signals indicative of said desired indicia to be substituted,

means responsive to said desired indicia signals and said video signal for inserting said indicia into said video image display at said preselected portion.

2. The apparatus according to Claim 1, further including:

audio processing means responsive to audio signals associated with said televised scene to alter said substituted display portion according to said audio signals.

3 The apparatus according to Claim 2, wherein said display indicia is modulated according to the intensity of said audio signals, which signals exceed a given threshold.

4. The apparatus according to Claim 1, wherein said means for selecting includes a light pen for outlining said portion of said display to be selected and means for storing said selected outline.

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message.

6. The apparatus according to Claim 1, further including:

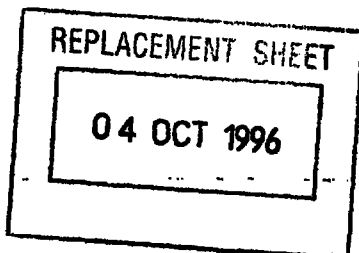
delay means responsive to said recognized video signal and said video signals representative of said desired indicia for showing the same on a frame-to-frame basis to enable the insertion of said indicia on a real time basis.

7. The apparatus according to Claim 1, wherein said means responsive to said video signal display includes pattern recognition means responsive to said selected portion of said display to provide signals indicative of said selected portion independent of the size of said portion with respect to said display.

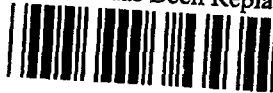
8. The apparatus according to Claim 7, wherein said pattern recognition means includes means for performing a pyramid algorithm.

9. The apparatus according to Claim 1, further including means responsive to colors present in said video display to inhibit display substitution during the presence of selected colors, whereby replaceable pixels can be substituted for non-replaceable pixels.

10. A method for altering a video image to provide a substituted display of desired indicia within a preselected portion of said video image display on a frame-to-frame basis and independent of the size of said selected portion on a frame-to-frame basis which size is a function of the TV camera perspective employed to create said display, comprising the steps of:



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recognizing said selected portion of said display on a frame-to-frame basis and independent of the size of said portion with respect to said display, generating a video image of said desired indicia, and

inserting said image of said desired indicia within said recognized portion of said display on a frame-to-frame basis.

11. The method according to Claim 10, wherein the step of generating a video image of desired indicia includes generating a video image of an advertising format such as a manufacturer's trademark or logo.

12. The method according to Claim 11; wherein said selected portion of said display to be substituted comprises the boundaries of a sports court, with said desired indicia including enhanced replicas of said boundaries.

13. The method according to Claim 10, further including the step of:

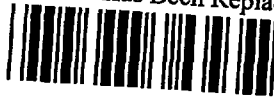
detecting the intensity of audio signals emanating from said televised scene and altering the inserted image according to said detected audio.

14. The method according to Claim 10, further indicates the step of:

selectively responding to a color present in said display for inhibiting the insertion of said desired indicia within said selected portion according to the presence of said color.

15. The method according to Claim 10, further including the step of:

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said stored selected portion.

16. The method according to Claim 10, wherein the step of recognizing includes,

applying a pattern recognition algorithm to said video display after selecting said portion, wherein said algorithm is a pyramid algorithm capable of processing said displayed image enabling recognition of said selected portion independent of the size, location or orientation of the same with respect to said display on a frame-to-frame basis.

17. The method according to Claim 16, wherein said algorithm is the Burt Pyramid Algorithm.

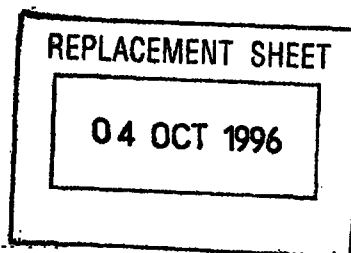
18. The method according to Claim 10, wherein the step of selecting includes outlining said selected portion of said display with a light pen and storing the outline of said light pen indicative of said selected portion.

19. The method according to Claim 10, further including the step of:

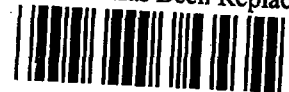
modulating said inserted video image according to the sound intensity emanating from said televised scene.

20. The method according to Claim 10, further including the step of:

detecting motion in said display during a frame and inhibiting said video image of said desired indicia into said display according to said detected motion.



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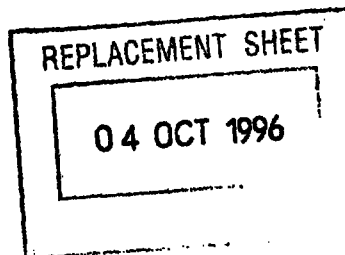


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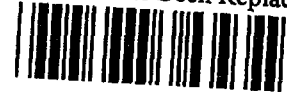
TELEVISION DISPLAYS HAVING SELECTED INSERTED INDICIA

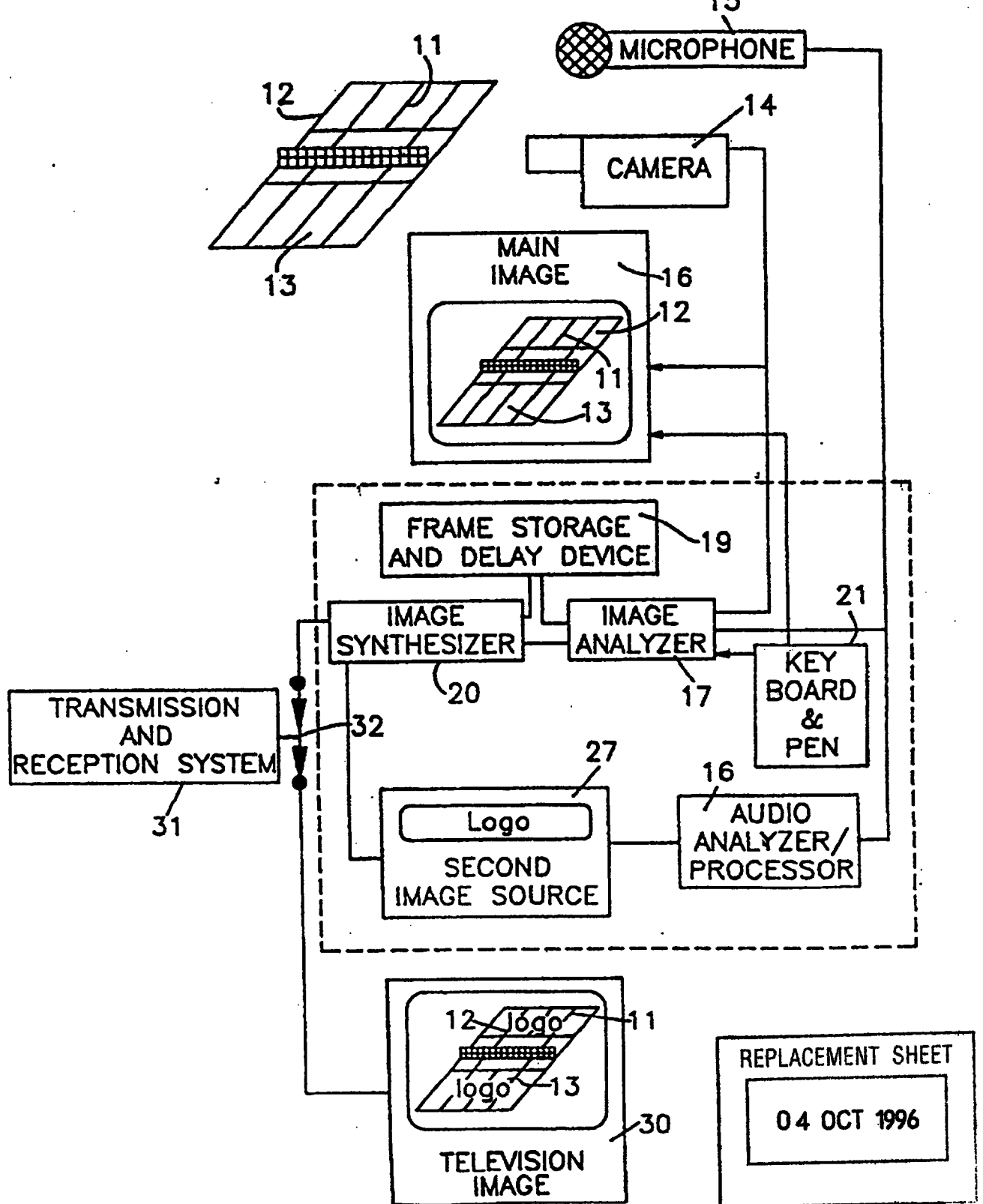
Abstract

An apparatus and method of altering video images to enable the addition of images, message, slogans or indicia in such a manner that they appear to be part of the original image as displayed. The application of the apparatus and method is particularly adapted to be used as advertising during sporting events or other events whereby an operator selects a portion of the video image display (16) such as a portion of a tennis court (12), recognizes the selected portion (17) and inserts a logo or advertising message (27) into that selected portion. The message is inserted into the selected portion of the court independent of how the scene is being panned or viewed by the television camera. The apparatus employs a pattern recognition algorithm such as the Burt Pyramid Algorithm to recognize the specific selected image portion.



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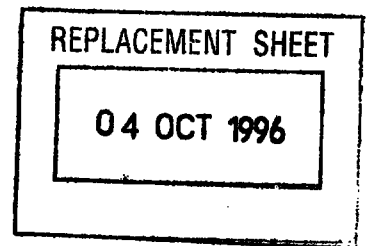
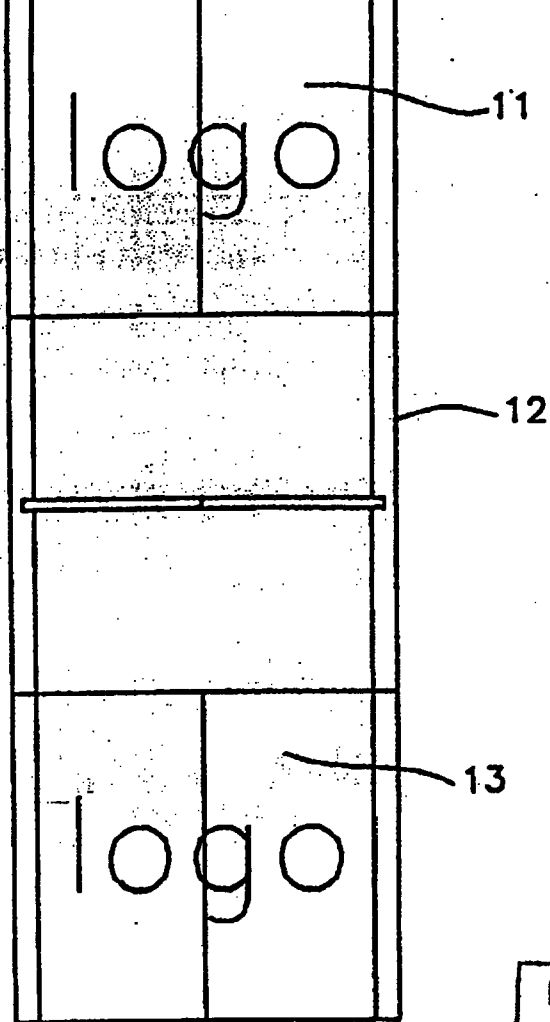
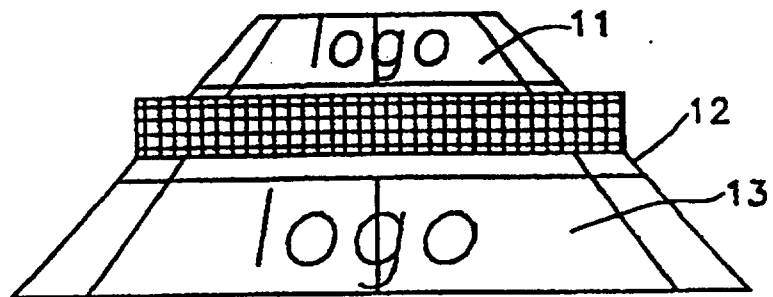


FIG. 3



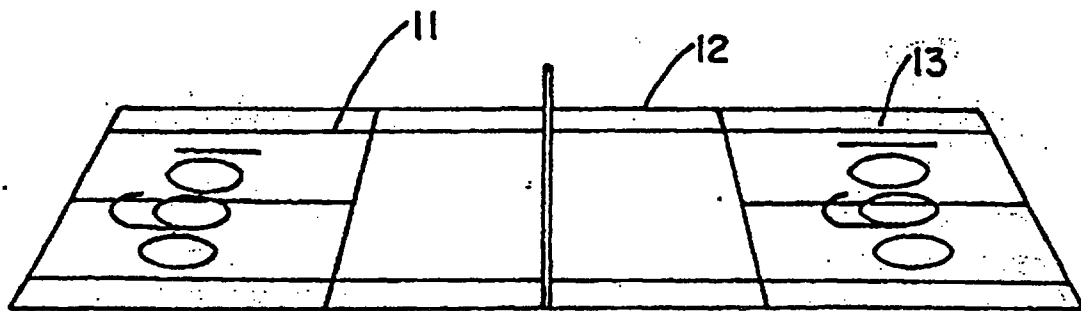
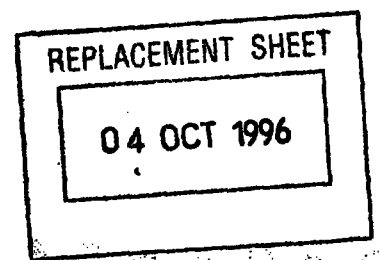


FIG. 4

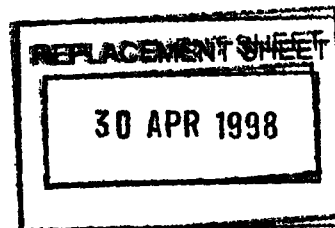


TELEVISION DISPLAYS HAVING SELECTED INSERTED INDICIA

Abstract

An apparatus and method of altering video images to enable the addition of images, message, slogans or indicia in such a manner that they appear to be part of the original image as displayed. The application of the apparatus and method is particularly adapted to be used as advertising during sporting events or other events whereby an operator selects a portion of the video image display (16) such as a portion of a tennis court (12), recognizes the selected portion (17) and inserts a logo or advertising message (27) into that selected portion. The message is inserted into the selected portion of the court independent of how the scene is being panned or viewed by the television camera. The apparatus employs a pattern recognition algorithm such as the Burt Pyramid Algorithm to recognize the specific selected image portion.

FIGURE 1



1. A method of altering a video image display to provide a substituted display of desired indicia within a portion (11, 13) of the video image display on a frame-to-frame basis in conformity with the selected portion on a frame-to-frame basis, the TV camera (14) being operable at various different perspectives and/or magnifications to create the display, the portion (11, 13) corresponding to a target in the scene, the method comprising:

creating said desired indicia by creating one or more predefined insertable images and storing said images in a memory (27);

using an operator interface (16, 21) to identify one or more landmarks in the scene from the image of the scene in the display and storing a representation of the landmarks in memory;

using the operator interface (16, 21) to select the target in the scene from the image of the scene in the display, the selection of the target being distinct from the identification of the landmarks;

using the representation of the landmarks in the memory to recognise the landmarks in the scene using pattern recognition (17), thereby to determine the location of the target, and hence recognise the position of the portion in the display; and

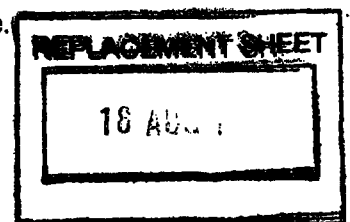
inserting (20) said desired indicia into said display to replace the portion, thereby to synthesise a modified display (30).

2. A method according to claim 1, wherein the pattern recognition (17) uses the pyramid technique.

3. A method according to claim 2, wherein the pyramid technique is the Burt pyramid technique.

4. A method according to any one of the preceding claims, wherein the target is an advertising billboard.

5. A method according to any one of claims 1 to 3, wherein the target (11, 13) is an area of a playing surface (12) or a blank area proximate such a playing surface.



6. A method according to any one of the preceding claims, wherein the desired indicia represent an advertisement.

7. A method according to any one of the preceding claims, wherein the insertion (20) of the desired indicia includes controlling the orientation, magnification and perspective of the desired indicia to conform to the shape, orientation and magnification of the portion in the display, in dependence on the orientation of the target in the scene.

8. A method according to any one of the preceding claims, wherein the desired indicia are not substituted in any part of the portion corresponding to a part of the target for which there is an object between that part of the target and the video camera (14).

9. A method according to claim 8, wherein said part of the target is determined using the difference in the colours of the target and the object.

10. A method according to claim 8, wherein said part of the target is determined using frame-to-frame comparison of the scene.

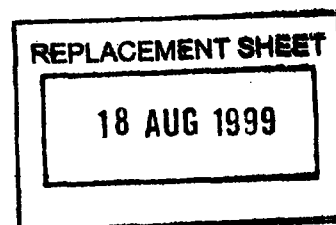
11. A method according to claim 8, wherein the part of the target is determined by using differential motion between said object and said target.

12. A method according to any one of the preceding claims, wherein a modulation is applied to the desired indicia when the desired indicia are inserted in the display.

13. A method according to claim 12, wherein the modulation is in response to a predetermined event.

14. A method according to claim 13, wherein the event is an audio event.

15. A method according to any one of the preceding claims, further including broadcasting the altered video image.



16. A method according to claim 15, further including receiving the broadcast.

17. An apparatus for altering a video image display to provide a substituted display (30) of desired indicia within a portion of the video image display on a frame-to-frame basis to conform to the size of the selected portion on a frame-to-frame basis, the TV camera (14) being operable at various different perspectives and/or magnifications to create the display, the portion corresponding to a target in the scene, the apparatus comprising:

means for creating said desired indicia by creating one or more predefined insertable images;

a memory (27) for storing said images;

means for displaying the scene to an operator, thereby to form said display;

an operator interface (16, 21) for enabling an operator to identify one or more landmarks in the scene from the image of the scene in the display and storing a representation of the landmarks in a memory, the operator interface (16, 21) also being adapted to enable the operator to select the target in the scene from the image of the scene in the display, the operator interface (16, 21) being such that the selection of the target is distinct from the identification of the landmarks;

means (17) for using the representation of the landmarks in the memory to recognise the landmarks in the scene using pattern recognition, thereby to determine the location of the target, and hence recognise the position of the portion in the display; and

means (20) for inserting said desired indicia into said display to replace the portion, thereby to synthesise a modified display (30).

18. An apparatus according to claim 17, wherein the means (20) for inserting the desired indicia includes means for controlling the orientation, magnification and perspective of the desired indicia to conform to the shape, orientation and magnification of the portion in the display, in dependence on the orientation of the target in the scene.



19. An apparatus according to claim 17 or claim 18, having means (17) for detecting when there is an object between that part of the target and the video camera (14) and the means for inserting the desired indicia is adapted not to substitute the desired indicia in any part of the portion corresponding to that part of the target.

20. An apparatus according to claim 19, wherein said detecting means (17) is arranged to detect said part of the target using the difference in the colours of the target and the object.

21. An apparatus according to claim 19, wherein said detecting means (17) is arranged to detect said part of the target using frame-to-frame comparison of the scene.

22. An apparatus according to claim 19, wherein said detecting means (17) is arranged to detect said part of the target using differential motion between said object and said target.

23. An apparatus according to any one of claims 17 to 22, having means (16) for applying a modulation to the desired indicia when the desired indicia are inserted in the display.

24. An apparatus according to claim 23, having audio processing means (15) for detecting an audio event, and for generating an output to said means (16) for applying a modulation.

