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(54) TELEVISION CAMERAS

(71) We, SONY CORPORATION, a corporation organised and existing under the laws of Japan, of 7—35 Kitashinagawa-6, Shinagawa-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to television cameras and more particularly to solid state television cameras.

According to the present invention there is provided a television camera comprising:

a solid state image sensor for generating a picture signal corresponding to a scene;

synchronization means for producing vertical and horizontal driving pulses for driving said image sensor;

a pattern generator unit for generating a pattern signal representing information not present in said scene to be inserted into said picture signal;

a mixing means to mix said picture signal and said pattern signal to form a mixed signal; and

an encoder for converting said mixed signal into a desired video signal;

said pattern generator unit being driven by the vertical and horizontal pulses which drive said image sensor.

According to the present invention there is also provided a television camera comprising:

a solid state image sensor for generating a picture signal corresponding to an image of a scene for creating a picture of said scene, said image sensor having a plurality of image pick-up elements aligned in both horizontal and vertical directions;

a synchronizing signal generator for producing vertical and horizontal synchronizing pulses of a television signal;

a clock pulse former circuit for producing transfer clock pulses for transferring said picture signal from the pick-up elements both in the horizontal and vertical directions in said image sensor;

a pattern generator unit for generating a pattern signal representing information not present in said scene to be inserted into said picture signal;

a mixture to mix said picture signal and said pattern signal to form a mixed signal; and

a circuit arrangement for driving said pattern generator unit by said vertical and horizontal synchronizing pulses and said produced transfer clock pulse by which said pattern generator unit is synchronized.

The invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a television picture;

Figure 2 is a block diagram of a previously proposed television camera with a character generator;

Figure 3 shows diagrammatically a charge transfer device usable as a solid state image sensor in the camera of Figure 2 and in embodiments of the invention;

Figure 4 is a block diagram of an embodiment of television camera according to the invention;

Figure 5 shows a pattern P_B which is inserted into a portion of a picture P_A;

Figure 6 is a block diagram of another embodiment of television camera according to the invention;

Figure 7 shows part of a charge transfer device usable in embodiments of the invention;

Figure 8 is a waveform diagram for explaining the operation of the embodiments; and

Figures 9 and 10 are block diagrams indicating alternative ways of mixing picture signals and pattern signals in the charge transfer device used in the embodiments of the invention.

Recently, solid state television cameras using a charge coupled device (CCD) or a bucket brigade (BBD) device have been

developed. As shown in Figure 1, to inert a predetermined pattern P_B representing information not present in a scene being televised, for example characters such as numerals, into a picture derived from such image sensors, it is necessary to provide a pattern generator. A television camera with such a pattern generator may be as shown in Figure 2.

In a camera unit 1 a scene 2 is projected on an image sensor 3 to derive an output, that is a picked-up picture signal S_A. The picture signal S_A is supplied to a colour encoder 5 through a processing circuit 4. In the colour encoder 5 the picture signal S_A is converted into a desired colour video signal S_B.

Usually the solid state charge coupled image sensor 3 is constructed as shown in Figure 3. The image sensor 3 uses a so-called frame transfer system, and comprises a photosensitive array 3A formed by a plurality of picture elements arranged on one surface of a semiconductor substrate in horizontal and vertical directions, and onto which an image of a scene is projected. The image sensor 3 also has a temporary storage array 3B which is substantially the same as the photosensitive array 3A and in which carriers corresponding to light information of the scene are stored at positions which correspond to the picture elements of the photosensitive array 3A. Finally, the image sensor 3 has a horizontal read out shift register 3C with an output terminal 6.

Referring also to Figure 2, a driving system for the image sensor 3 includes a synchronizing signal generator 7 to form pulses P_H and P_V, corresponding respectively to horizontal and vertical scanning frequencies, which are supplied to a pulse former 8 to form a horizontal transfer pulse ϕ_H which is supplied to drive the read out the horizontal register 3C, and a vertical transfer pulse ϕ_V to transfer carriers in the vertical direction. The pulses ϕ_H and ϕ_V are supplied to the appropriate terminals of the image sensor 3 through a drive circuit 9.

A pattern generator unit 10 comprises a pattern generator 11 and a clock generator 12 to drive the pattern generator 11.

An address counter 13 is driven by a signal which is synchronized with vertical and horizontal pulses generated by the clock generator 12, and the pattern generator 11 is driven by the output of the address counter 13. The address currently being scanned on the image sensor 3 is determined by the number of pulses derived from the clock generator 12. There is also provided a key board 14. In order to display, for example, a date on a portion of the picture P_A, a pattern signal S_C corresponding to the date set by the key board 14 is derived. The resulting pattern signal S_C is supplied to a colour encoder 15 in a fashion similar to the picture signal S_A to form a desired colour video signal S_D, and the colour video signals S_B and S_D are supplied to a mixer 16. In this example, and as shown in Figure 1, a portion of the picture P_A is removed and the pattern P_B is inserted where the portion is removed. Accordingly, the mixer 16 is a switching circuit.

A sampling control circuit 17 which derives a control signal S_E to control a clipping operation is driven by the colour video signal S_D. When the colour video signal S_D arrives, the sampling control circuit 17 is turned on and only the colour video signal S_D is derived from the mixer 16 to form an output video signal S_O which is supplied to an output terminal 18.

In the television camera of Figure 2, the camera unit 1 and the pattern generator unit 10 must be operated synchronously. The synchronizing generator 7 for the image sensor 3 and the clock generator 12 for the pattern generator 11 must therefore be synchronized, which is very troublesome. Moreover, the construction of the television camera of Figure 2 is very complicated.

An embodiment of television camera according to the invention will now be described with reference to Figure 4, and comprises a synchronizing signal generator 7 which is commonly used to drive a charge coupled image sensor and a pattern generator.

A horizontal pulse P_H and a vertical pulse P_V derived from the synchronizing signal generator 7 are supplied to a pulse former circuit 8 to form transfer pulses ϕ_H and ϕ_V which drive the solid state charge coupled image sensor 3. The pattern generator unit 10 is driven by the pulses P_H and P_V derived from the synchronizing signal generator 7, and the pulse ϕ_H formed by the pulse former circuit 8. When the pattern which is displayed on the picture is a date, the pattern generator unit 10 is arranged to generate patterns of one of ten numerals from 0 to 9 for each character display region. Accordingly, there is provided a character generator 20 which generates the patterns of numerals 0 to 9. What and when the character is generated by the character generator 20 is controlled by an output of a key board 14.

As explained previously, the horizontal and vertical pulses P_H and P_V derived from the synchronizing signal generator 7, and the horizontal transfer pulses ϕ_H are supplied to an address counter 13, and addresses in the picture P_A where the pattern P_B should be displayed as shown in Figure 1 are counted by these pulses P_H, P_V and ϕ_H. The pulse ϕ_H itself is a driving pulse for the image sensor 3. Accordingly, the number of counted pulses corresponds to the address

currently being scanned. The address of a desired pattern is represented by ϕ_H and ϕ_V, and the address on the image sensor 3 corresponds to the address of the beam scanning in the television picture.

As shown in Figure 5, to display a date on the picture P_A, it is enough to consider six regions (addresses) T1 to T6, which represent year, month and day. To display predetermined figures at the addresses T1 and T6, first an output from the address counter 13 is supplied to a timing generator 21 to check the address currently being scanned, and an output corresponding to the address T1 to T6 is derived from the timing generator 21. The above obtained output corresponding to addresses T1 and T6 are supplied to a drive circuit 22 for the character generator 20 with an output from the key board 14. The drive circuit 22 controls which numerals should be displayed and their location. The output corresponding to desired numerals selected from 0 to 9 and derived from the character generator 20 is supplied to a switching circuit 16 through a mixer 23.

The sampling control signal S_E is supplied to the switching circuit 16 to control the clipping of the picture signal S_A and insertion of the pattern signal S_C. In this embodiment, the sampling control signal S_E is a signal derived from the timing generator 21.

When a signal corresponding to an address from T1 to T6 is generated in the timing generator 21, it signifies that the pattern P_B should be displayed in a portion of the picture P_A. Accordingly, the signals corresponding to the addresses T1 to T6 derived from the timing generator 21 can be the control signals S_E.

The switching circuit 16 is provided just downstream of the image sensor 3 where the output picture signal S_A is not encoded. Accordingly, the output from the pattern generator unit 10 which is not encoded is supplied to the switching circuit 16. The output so obtained in the switching circuit 16 is supplied to a colour encoder 24 through a processing circuit 4 to be converted into a colour video signal which is supplied to a mixer 25 with a synchronizing signal and fed to the output terminal 18.

As is apparent from the above description, by commonly utilizing a synchronizing signal generator, the camera unit 1 and the pattern generator unit 10 operate completely synchronously and the possibility of missynchronisation is removed. Moreover, the construction of the camera is simplified. In the embodiment of Figure 4, the colour encoder 24 is also commonly used, so the construction is further simplified. If a signal from the timing generator 21 controls the clipping operation of the switching circuit 16, then it is not necessary to provide a control circuit 17 as shown in Figure 2. Of course, it is possible to superimpose the pattern signal S_C on the picture signal S_A instead of employing substitution.

Another embodiment of the invention will now be explained with reference to Figures 6 to 8, in which parts corresponding to those in Figure 4 are indicated by the same reference numbers and will not be further explained.

In this embodiment, the pattern signal S_C is generated in the same way as in the embodiment of Figure 4. The pattern signal S_C which is obtained is supplied to the image sensor 3 as a portion of the picture picked up by the image sensor 3. Figure 7 is an enlarged view of a part of the temporary storage portion 3B and the horizontal shift register 3C of the image sensor 3 which is driven by a two-phase clock pulse to transfer signal charges. The transfer in the vertical direction is performed by the application of two sets of clock pulses ϕ_{V1} and ϕ_{V2} which differ in phase by 180° from each other. Similarly, two sets of clock pulses ϕ_{H1} and ϕ_{H2} are applied to the horizontal shift register and differ in phase by 180° from each other.

In this embodiment, the pattern signal S_C is supplied to the horizontal shift register 3C. There is provided a gate circuit 30 at one end of the horizontal shift register 3C which is opposite to the end where the output terminal 6 is provided. As shown in Figure 7, the gate circuit 30 comprises a source region 30S, and first and second gate regions G1 and G2. The second gate region G2 always has applied thereto a predetermined voltage. Then the pattern signal S_C, which is supplied to the source region 30S through a terminal 31, is transferred successively in the horizontal shift register 3C by the application of a desired clock pulse ϕ_G to the first gate region G1. A more detailed explanation will be given with reference to Figure 8.

All the carriers stored in the last stage of the temporary storage array 3B, which corresponds to one horizontal scanning interval, are immediately transferred to the horizontal shift register 3C by the application of transfer clock voltage ϕ_{V1} and ϕ_{V2}, as shown in Figures 8B and 8C during a horizontal blanking interval W_1 in a period W_2.

After being transferred into the horizontal shift register 3C, they are transferred to the right step-by-step by the application of horizontal transfer clock signals ϕ_{H1} and ϕ_{H2} as shown in Figure 8D. Similarly, by the application of a clock pulse ϕ_G shown in Figure 8E to the first gate region G1 at a predetermined horizontal scanning

period, the pattern signal S_c which is supplied to the source region 30S is superimposed on the carrier derived from the image of the scene and transferred. Accordingly, by picking up the image of the scene when the pattern signal S_c has been transferred to the horizontal shift register S_c, the output video signal S_o, which has superimposed upon it the pattern signal S_c, is derived from the output terminal 6. Then, as shown in Figure 6, the output video signal S_o is supplied to the colour encoder 5 through the processing circuit 4, to obtain a desired video signal. By supplying the signal to a television receiver the picture is obtained in which desired numerals are displayed at the desired position. As shown in this embodiment, the pattern signal S_c generated by the pattern generator unit 10 is superimposed on the picture signal S_A of the image of the scene 2 projected on the image sensor 3. Accordingly, all the circuits after the output can be commonly used for the pattern signal S_c and the picture signal S_A.

There are other ways of superimposing the pattern signal S_c into the picture signal S_A. For example, as shown in Figure 9, the desired pattern signal S_c can be superimposed on the desired part of the picture signal S_A by providing a buffer memory 32 having the same bit number as the horizontal read out shift register 3C. The pattern signal is supplied to the buffer memory 32 and temporarily stored there and immediately transferred to the horizontal shift register 3C at a desired interval.

Furthermore, as shown in Figure 10, the same object can be achieved by providing a buffer memory 33 at the photosensitive array 3A corresponding to the first horizontal scanning line, having the same bit number and a similar gate circuit. The pattern signal S_c is supplied to the buffer memory 33 through the gate circuit as in Figure 6. Then carriers corresponding to the pattern signal S_c are superimposed on the picture signal S_A and transferred through the photosensitive array 3A and the temporary storage region 3B.

The pattern inserted into a picture need not be limited to the date. For example, the time, sub-titles, or other symbols can be inserted into a picture. Also, the solid state image sensor need not be a frame transfer type CCD. Moreover, it is possible to insert a desired signal other than a pattern signal which is to be displayed in the picture sensed by the solid state image sensor. For example, an address signal, or a key word can be inserted in a vertical blanking interval.

WHAT WE CLAIM IS:—

1. A television camera comprising:

a solid state image sensor for generating a picture signal corresponding to a scene;

synchronization means for producing vertical and horizontal driving pulses for driving said image sensor;

a pattern generator unit for generating a pattern signal representing information not present in said scene to be inserted into said picture signal;

a mixing means to mix said picture signal and said pattern signal to form a mixed signal; and

an encoder for converting said mixed signal into a desired video signal;

said pattern generator unit being driven by the vertical and horizontal pulses which drive said image sensor.

2. A camera according to claim 1 wherein said mixing means superimposes said pattern signal on said picture signal.

3. A camera according to claim 1 wherein said mixing means substitutes said pattern signal for a portion of said picture signal.

4. A camera according to claim 1, claim 2 or claim 3 wherein said pattern generator unit comprises an address counter, a timing generator and a character generator which are coupled to each other, and said address counter is driven by the output of said synchronization means.

5. A camera according to claim 4 comprising a circuit loop between said mixing means and said timing generator by which an output signal from said timing generator controls mixing of said picture signal and said pattern signal.

6. A camera according to claim 1 wherein said image sensor includes a photosensitive array, a temporary storage array and a horizontal read out shift register, and said mixing means is a gate at one end of said horizontal shift register through which said pattern signal is supplied to said horizontal read out shift register.

7. A camera according to claim 1 wherein said image sensor includes a photosensitive array, a temporary storage array and a horizontal read out shift register, and said mixing means is a buffer memory register directly connected to said image sensor and by which said pattern signal is superimposed on said picture signal.

8. A television camera comprising:

a solid state image sensor for generating a picture signal corresponding to an image of a scene for creating a picture of said scene, said image sensor having a plurality of image pick-up elements aligned in both horizontal and vertical directions;

a synchronizing signal generator for producing vertical and horizontal synchronizing pulses of a television signal;

a clock pulse former circuit for producing transfer clock pulses for transferring said picture signal from the pick-up elements

both in the horizontal and vertical directions in said image sensor;

a pattern generator unit for generating a pattern signal representing information not present in said scene to be inserted into said picture signal;

a mixer to mix said picture signal and said pattern signal to form a mixed signal; and

a circuit arrangement for driving said pattern generator unit by said vertical and horizontal synchronizing pulses and said produced transfer clock pulse by which said pattern generator unit is synchronized.

9. A television camera substantially as hereinbefore described with reference to Figures 3 and 4 of the accompanying drawings.

10. A television camera substantially as hereinbefore described with reference to Figures 3 and 6 of the accompanying drawings.

11. A television camera substantially as hereinbefore described with reference to Figures 3 and 4, or 3 and 6, as modified by Figure 9 of the accompanying drawings.

12. A television camera substantially as hereinbefore described with reference to Figures 3 and 4, or 3 and 6, as modified by Figure 10 of the accompanying drawings.

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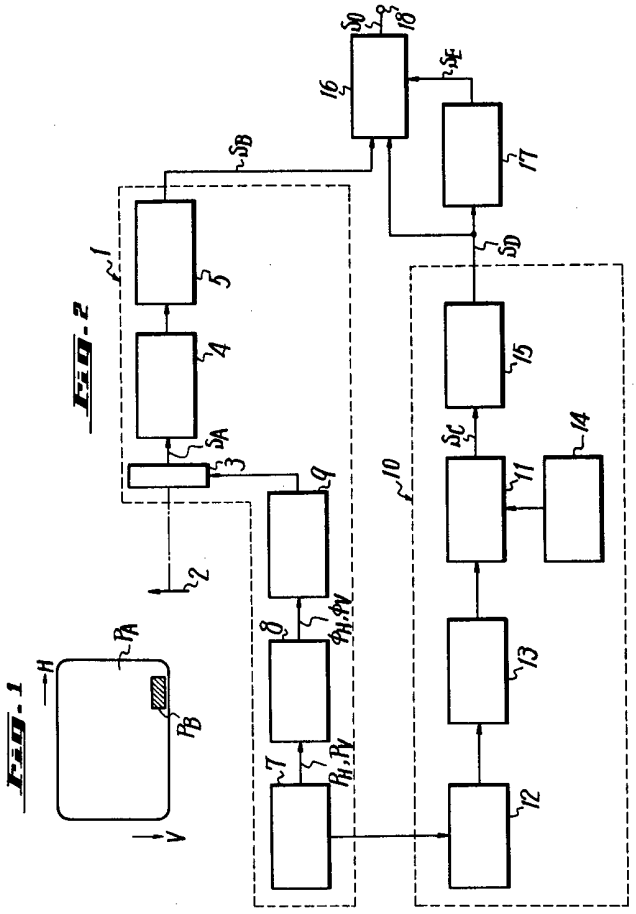
1581470 COMPLETE SPECIFICATION

4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1



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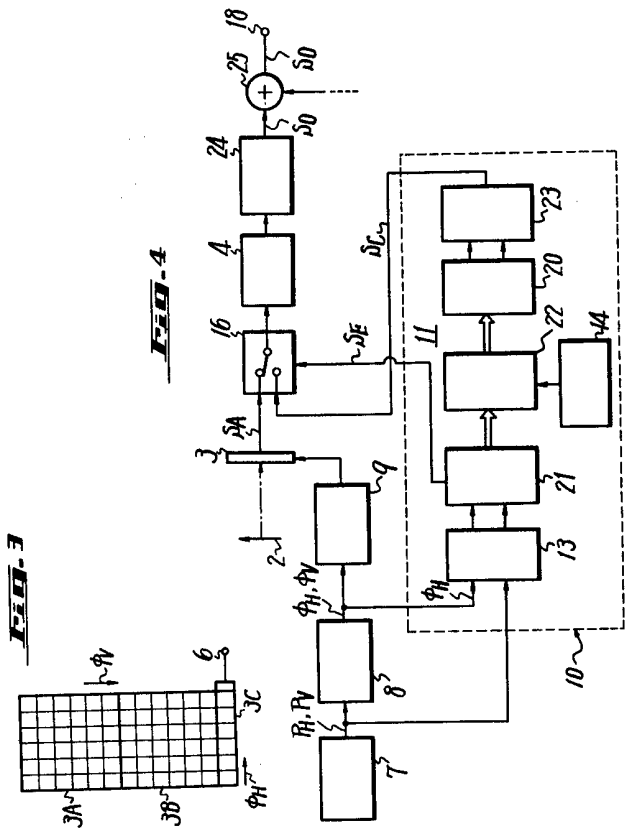

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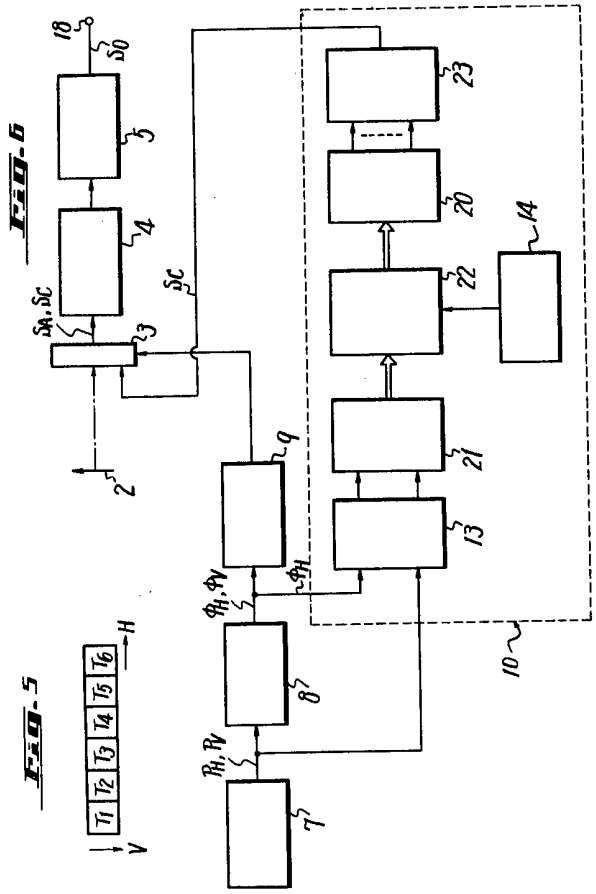
Sheet 3



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