

Television cameras comprise *inter alia* a camera housing, an objective and a storage plate, hereafter referred to as a target, which is provided for generation of the video signal. On the target there is produced by means of the optical system a picture field from which the video signal is generated by scanning with an electron beam or other form of scanning according to a television raster.

Particularly in the case of small portable cameras there is a danger in practice that the picture will be impaired, i.e. blurred, by a strong undesirable acceleration of the camera housing. This means that for example the desired picture field falls partially outside the area of the target and parts of the desired picture are temporarily lost.

Such judders can be excluded to the greatest possible extent or reduced by disposing the camera housing on a stand or by means of accessories with which the camera is held on the body. However, in practice such means cannot always be used or also are often not sufficient.

The object of the invention is, in the case of a television camera, to reduce the effects of undesirable strong accelerations of the camera housing on the video signal which is produced with the camera.

This object is achieved by the invention described in Claim 1. Advantageous further developments of the invention are described in the subordinate claims.

Thus in the invention a strong undesirable acceleration of the camera housing is detected using measuring techniques and converted into an electrical control value. This control value acts on the position of the scanning raster on the target in such a way that the movement of the picture field caused by the undesirable acceleration is compensated for in both of the orthogonal directions in the plane of the target. The determination of the strong acceleration of the camera housing is also possible in that the signals generated by the camera from each two chronologically successive pictures are compared. When the difference between these signals or a part thereof exceeds a specific threshold value, then this can be interpreted as an indication that an undesirable acceleration is occurring. A threshold value is preferably introduced into the path of the control value in order to distinguish the undesirable strong accelerations and movement of the camera housing due to judder from the desired slower accelerations and movements during panning when following a specific scene. It is also possible for the signal of a picture supplied by the camera to be initially fed into a store and only evaluated when no judder is registered during the scanning of the picture field on the target. As soon as a judder is registered during scanning of the picture field, the entire picture is not evaluated

but is replaced by a stored picture from a preceding time period. The slight influence on the movement phase is less disruptive than a judder of the entire picture.

The invention is explained below with the aid of the drawings, in which:

Figure 1 shows the position of the picture field on the target,

Figure 2 shows a basic diagram of a circuit according to the invention, and

Figure 3 shows a further development of the circuit according to Figure 2.

In Figure 1a a picture detail is reproduced with the objective of the camera on the target 1. The entire target 1 is homogeneously constructed and is adapted to generate the video signal. However, scanning of the target 1 only occurs line by line over the region of the desired picture field 2 with the starting point S on the upper left-hand picture margin in the form of a television raster. Thus the picture area between the outer margin of the picture field 2 and the margin of the target 1 is not scanned and is not utilised for generating the video signal. Thus the video signal which is generated only represents the picture detail of the picture field 2. The two orthogonal directions in the plane of the target 1 are designated by x and y. Thus the data from x and y indicate the position of the picture field 2 within the target 1.

In Figure 1b the picture field 2 is displaced on the target 1 in the positive x direction by a judder, and in fact by a jerky undesirable displacement of the camera housing and thus of the target 1. This displacement is detected and accordingly the starting point S of the raster deflection is displaced by the amount $+ \Delta x$ so that in spite of the judder the scanning of the target 1 again begins at the point S, that is to say at the beginning of the desired picture field 2. As a result the judder of the camera housing does not have an effect on the video signal which is generated. Thus in spite of the judder the video signal again accurately represents the picture of the displaced picture field 2.

In Figure 1c the picture field 2 is displaced on the target 1 in the negative x direction and in the positive y direction by a judder. Accordingly the starting point S of the raster scanning of the target 1 is also displaced. Thus in all cases the desired picture field 2 is always scanned, beginning from the starting point S, irrespective of the direction and the extent of the judder.

In Figure 2 the camera housing 3 contains an acceleration

sensor 4 for the direction x and an acceleration sensor 5 for the direction y. These sensors supply the following voltages which indicate the acceleration of the housing 3 in the two directions x and y:

$$U_x \sim d^2x/dt^2 \text{ and} \\ U_y \sim d^2y/dt^2.$$

In the integrators 6, 7 these voltages are converted by mathematical integration into voltages which represent the speed of the movements of the camera housing 3:

$$U_{vx} = dx/dt \cdot K_1 \\ U_{vy} = dy/dt \cdot K_2 \\ K_1, K_2 : \text{constants of proportionality}$$

These voltages are delivered to the processor 8. From them the processor generates an address signal $Adr.$ which represents a movement vector in terms of magnitude and direction. On the target 1 which is constructed as a CCD circuit this address signal controls the starting point S of the scanning raster of a picture field 2 in the manner described in Figure 1.

Moreover, the voltages from the outputs of the integrators 6, 7 are delivered to the threshold value circuit 9 which only transmits voltages to the OR stage 10 above a threshold value. In the case of a desired panning movement of the camera 3, that is to say low values for the acceleration and the speed, the stage 10 generates a voltage with the value "0", by means of which the processor 8 is locked out. The address signal at the output does not then appear, because there is no undesirable jerky movement and thus the correction is not necessary. If one or both of the voltages at the input of the threshold value circuit 9 exceed the threshold value and thus the existence of an undesirable strong acceleration of the housing 3 is registered, the voltage at the output of the stage 10 changes to "1" and activates the processor 8 in the described manner.

Figure 3 shows two variants of the arrangement according to Figure 2. First of all the mechanical acceleration sensors 4, 5 are replaced by an electronic circuit. The signal of a picture is delivered one directly and once via a time-delay stage 12 for the duration of a picture to the comparator 13. The comparator 13 compares the signals of two or more chronologically successive pictures or of defined parts of or extracts from the pictures. In normal operation, including a desired panning movement, this difference does not exceed a threshold value. In the case of an undesirable jerky movement, that is to say wobbling of the housing 3, this threshold value is exceeded. In this way the control value Us which indicates the judder is generated by means of the threshold value circuit 9.

The second variant is as follows: The pictures supplied by the camera 3 are initially delivered to the store 15 which can for instance store the signals of two to three pictures. During the scanning of a picture the generated video signal is not initially passed to the output terminal 11 but is stored in the store 15. If at the end of scanning of a picture no undesirable movement of the camera 3, that is to say no judder, has been registered, a voltage U1 occurs which effects the read-out of the stored picture signal of this picture, so that this signal appears at the terminal 11. If during scanning of the picture, irrespective of the time within the picture, a judder is registered, a voltage U2 occurs. The effect of the voltage U2 is that the signal of this picture which is subject to the judder is not evaluated. Instead the signal of a chronologically preceding picture without judder which has previously been stored in the store 15 is read out and delivered to the terminal 11. Thus disturbed pictures in which a judder is registered by the circuit 13, 9 are not evaluated in each case and are replaced by undisturbed pictures from a previous time period.

The control value or the address signal at the output of the processor 8 contains, for example, a new starting address for the starting point S of the raster scanning of a picture field in CCD arrays. The output voltage of the processor can also be an analogue correcting voltage in a tube camera. The comparison of the signals of successive pictures in the comparator 13 in Figure 3 can also extend to certain selected picture areas. In this case a comparison is possible over several successive frames, a so-called two-dimensional autocorrelation. By such means it is also possible to determine a movement vector, that is to say a control value or an address voltage, which indicates the extent and the direction of the undesirable movement of the camera 3 and displaces the starting point S accordingly.



Claims

1. Television camera with a target onto which a desired picture field (2) is projected by means of an optical system and which is scanned along a raster in order to produce the video signal, wherein the target (1) is larger than the picture field (2) and from a movement of the camera (3) a control value (Uvx, Uvy) is obtained which makes it possible to shift the starting point (S) of the scanning raster on the target, characterised in that when the control value (Uvx, Uvy) occurs the signal of the picture which has just been scanned is not utilised and is replaced by the signal of a preceding picture.
2. Television camera according to Claim 1, characterised in that two acceleration sensors (4, 5) are provided on the camera housing for two orthogonal directions (X, Y) in the target plane, the output voltages (Ux, Uy) of the said sensors being passed to two integrators (6, 7) and the control value (Us) being obtained from the output voltages (Uvx, Uvy) of the said integrators which represent the speeds.
3. Camera according to Claim 1, characterised in that the output voltages (Uvx, Uvy) of the integrators (6, 7) are passed to a threshold value circuit (9) which prevents the shifting of the starting point (S) below a threshold value.
4. Camera according to Claim 1, characterised in that in each case the signals supplied by the camera (3) are read into a store (15) and a picture is only read out and utilised when no jerky movement is registered during scanning of this picture.
5. Camera according to Claim 1, characterised in that the control value is obtained in a comparator (13) or a correlator which compares the picture signals of successive pictures or parts thereof and produces the control value (Us) in the event of a signal difference above a threshold value.