This invention relates to multilinear charge transfer strips. It relates in particular to multilinear charge transfer strips adapted to the association of several elementary strips and operating according to the principle of integration with delaying of the charges known in English documentation under the name of "Time Delay Integration" or TDI.

Currently known multilinear strips consist of N lines of P photosensitive detectors such as photodiodes, each line receiving in turn the radiation to be detected and of devices for summing in step with the flow of the data gathered on the detectors of the same rank, the whole being integrated onto a single substrate. In this case, the integration time is multiplied by N. Now the integration time being multiplied by N and the reading noises being added quadratically, a gain is obtained on the signal to noise ratio equal to $\sqrt{N}$. This advantage is of particular interest, when these strips are used to pick up radiological images, since the increase in the signal to noise ratio allows the amount of rays used to be reduced, for a given exposure time. Similarly, strips of this type may be used to detect other radiations particularly when one wishes to detect a low level radiation.

However, the fact of integrating the TDI function directly onto the multilinear strip presents a certain number of disadvantages.

The integration of the detectors and of the devices performing the TDI function necessitates relatively large sized substrates and the production cost remains high. Furthermore, the scanning direction is dictated. In addition, at the operational level problems of thermal generation of charges are encountered, hence the necessity to make the multilinear strip operate at high frequencies and at relatively low temperatures.

Moreover, when one wishes to be able to record images of large dimensions, several multilinear strips are frequently combined so as to form a photosensitive strip of large dimensions. In this case, however, a loss of resolution and of sensitivity is observed at the level of the transition from one strip to another, losses which are due to the absence of one or of several photosensitive detectors at the ends of each line of the elementary strips. One solution to

this problem is to arrange the alignment of the disturbed zones situated at the ends of each of the lines in a direction different from that of the scan. However, it is not possible to perform such a scan when the TDI devices are integrated with the photosensitive device, since, as cumulative addition has to be done on photosensitive detectors aligned with the direction of the scan, it is then necessary to add cumulatively information situated on two different elementary strips.

The image pick-up of this invention as defined in the claims enables this disadvantage to be remedied, information coming from two different strips being capable of cumulative addition without problem. Consequently, the object of this invention is an image pick-up using at least two multilinear strips in which the photosensitive detectors are read individually and in which the TDI function, or other functions as necessary are performed outside the substrate containing the photosensitive zone. This transfer to the outside of the substrate is described in an article which appeared in IEEE Transactions on Electron Devices, vol. ED-27, no. 1, January 1980, p.175-188 entitled "CCD readout of infra-red hybrid focal plane arrays": it is proposed to transfer the function of delaying of charges and integration to the outside for considerations of improving dynamics or signal/noise ratio. The said article refers to a single multilinear strip.

According to the invention, the scanning and/or the structure of the strip are such that the combination of several strips to form one photosensitive strip of large dimensions is possible and minimises image defects due to the join(s).

Other characteristics and advantages of this invention will become apparent through reading of the description of various methods of construction given by way of example, the description referring to the attached drawings in which:

- figure 1 is a diagrammatic view of a multilinear strip with individual reading of the detectors;

- figure 2 is a diagrammatic view of a second method of constructing a multilinear strip with individual reading of the detectors;

- figure 3 is an enlarged diagrammatic view of the multiplexing and reading system integrated with the strip of figure 2; 2;

- figure 4 is a plan view of the part shown diagrammatically in figure 3;

- figures 5a to 5d are respectively a sectional view through V-V of figure 4 and representations of corresponding surface potentials in the substrate onto which the multilinear strip is integrated;

- figures 6a and 6b, 7a and 7b, 8a and 8b are respectively sectional views identical to that of figure 5a of other methods of constructing an anti-glare device and representations of the corresponding surface potentials in the substrate;

- figure 9 is a diagrammatic view similar to that of figure 3 of a second method of constructing the multiplexing and reading system;

- figures 10a and 10b are respectively a sectional view through VI-VI of figure 9 and a representation of the corresponding surface potentials;

- figure 11 is a view similar to that of figure 9 of a third method of constructing the multiplexing and reading system;

- figures 12 to 15 represent various methods of constructing an elementary multilinear strip to form a strip of large dimensions according to the invention;

- figure 16 is a diagram of a device for processing output signals from the multilinear strip.

In the various figures, the same references denote the same elements, but for reasons of clarity, the dimensions and proportions of these various elements are not respected.

The multilinear charge transfer strip shown in figure 1 is a multilinear strip in which the device for processing of the information received is not integrated onto the same substrate as the photosensitive zone.

As shown in figure 1, the strip consists mainly of a photosensitive zone comprising N lines of P detectors D_{11}, D_{12}, ...D_{1P}, ... D_{N1}, ...D_{NP}, and of a system for multiplexing and for reading of loads. The photosensitive detectors D_{11} to D_{NP} consist for example of photo-

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diodes. Furthermore, in the method of construction shown in figure 1, the system for multiplexing and for reading of charges consists mainly of N charge transfer shift registers having parallel inputs and series output each input of which is connected through a device for injection of the charges DIC and through a connection C_{N1}, C_{N2},... C_{11}, C_{12} to one of the corresponding detectors D_{11} to D_{NP} and the output of which is connected to a reading stage.

In greater detail, each line of photosensitive detectors is connected to a charge transfer shift register via a connection and via a device for injection of the charges. Thus, the Nth line of photosensitive detectors D_{N1} to D_{NP} is connected to the inputs of the shift register R_N, and the first line of detectors D_{11} to D_{1P} is connected to the shift register R_1. The signals which will be sent to the external processing device are obtained sequentially as output from the reading stages L_1 to L_N. When the multilinear strip is used, for example, to pick up radiological images, the strip progresses in direction B in front of the object of the body which is emitting the radiation to be detected. In this case, the processing device is a device for summation in step with the flow of the information gathered from the detectors of the same rank, namely, for example, from detectors D_{11}, D_{21},... D_{N1}.

According to another method of constructing a strip for individual reading of the detectors instead of using N charge transfer shift registers associated with charge injection devices, it is possible to use a single charge transfer shift register comprising N x P stages as shown in figure 2.

In fact, the choice of the number of charge transfer shift registers can be made in terms of the geometrical definition of the photosensitive detectors and of the said shift registers, in terms of the number of photosensitive lines and of the conditions adopted for utilising and processing the signals. If we consider, for example, the geometrical factors, the number of charge transfer shift registers can be given by the following equation:

n_o = N x minimum pitch of the registers/pitch of the detectors

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in which: n_o equals the number of registers and N equals the number of photosensitive lines. n_o is in fact an integer between 1 and N, these two extreme values being represented respectively in figure 2 and in figure 1. In the case of n_o registers, the number of stages p_o of each register is chosen so that $p_o \times n_o = N \times P$.

The photosensitive zone of the multilinear strip of figure 2 is identical to the photosensitive zone of the multilinear strip of figure 1 already described. As mentioned above, the charge transfer shift register R used as multiplexer in the system for multiplexing and for reading the charges of the multilinear strip of figure 2 is a register with parallel inputs and series output comprising N x P stages. Each input is connected via a device for injection of the charges DIC and via a connection C_{np} (where $a \leq n \leq N$ and $1 \leq p \leq P$) to a photosensitive detector D_{np} of the photosensitive zone. In this case, the connections are made in the following way:

the first photosensitive detectors D_{N1} to D_{11} of the N lines are connected to the first N stages of the register R starting with the diode of the line N, and so on for the other columns.

We shall now described with reference to figures 3 to 5, the structure and operation of the system for multiplexing and for reading of the charges of the multilinear strip of figure 2.

As shown in figures 3 and 4, each photosensitive detector D_{12}, D_{22}, D_{32}, is connected via a connection C_{12}, C_{22}, C_{32},... to a charge injection device DIC consisting of a diode D' and of a gate G_p connected to a potential ϕ_p which monitors the passage of the charges from the diode D' to the input of a stage corresponding to the shift register R. The DIC consists in fact of an MOS transistor M'_{12}, M'_{22}, M'_{32} the drain of which is formed by the diode D', the gate by G_p and the induced source by the input stage of the register R.

In the method of construction of figure 4, a charge transfer shift register is used each stage of which consists of a pair of electrodes connected to a control signal ϕ_1 and of a pair of electrodes connected to a control signal ϕ_2. Each pair of electrodes consists of one storage electrode and one transfer electrode. The dissymmetry in the surface potentials necessary to render the transfer unilateral is achieved, for example, by an overthickness of oxide or by an implanta-

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tion of impurities of the same type as the substrate. Other types of charge transfer shift register can be used.

In addition, the shift register R comprises a charge injection device in series consisting of a diode D_e and gates G'_1 and G'_2. This charge injection device enables a charge Q_O to be injected constituting a basic charge the function of which will be explained in detail below.

Furthermore, the shift register R performs the multiplexing of the charges integrated into the detectors of the photosensitive zone of the multilinear strip and transfer them sequentially to a charge-voltage reading stage of known type consisting for example of a gate G_S and a diode D_S connected to the source of an MOS transistor MR and to the input of an amplifier A giving as output the signal S. The drain of the MOS transistor is connected to constant voltage V_R and its gate to a potential ϕ_R.

Furthermore, as shown in figures 3 and 4, the multilinear strip additionally comprises an anti-glare device consisting of MOS transistors M_{12}, M_{22}, M_{32} the drain D_B of which is brought to a biasing potential V_{DB}, the gate G_B is brought to a fixed voltage V_B and the source consists of the diode D' for injection of the charges starting from the detectors.

We shall now explain with reference to figures 5a to 5d the operation of a stage of the multiplexing and reading system described above: As shown in figure 5a, the multilinear strip is constructed on a P type silicon substrate. However it is evident to the specialist that equivalent semiconductor substrates such as substrates of gallium arsenide or of N type silicon can also be used. The multiplexing and reading system consisting of the charge injection device, the anti-glare device and the register R is constructed on a diffusion of type N so as to perform a volume transfer at this level, this improving the quality of the transfer and reducing the noise. However, this zone may also be constructed directly onto the P-type substrate. In all cases, the diodes D_B and D' are constructed using diffusions of type N^+.

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The operation of a stage of the multiplexing and reading system is as follows:

During the integration time, the charges Q_S detected by the photosensitive detector D_{32} come to be stored on the diode D'. The potential ϕ_P of the gate G_P is at a low level which prevents the transfer of the charges Q_S to the register R. Furthermore, in the case of glare, namely if the charge Q_S is too strong, the excess charges are evacuated towards the diode D_B above the potential barrier formed under the gate G_B brought to a fixed voltage V_B chosen so that the channel potential formed under the gate G_B is higher than the channel potential formed under the gate G_P. During this integration time, a basic charge Q_O is injected in series into all of the stages of the register R as mentioned above. Once the integration has been performed, the potential ϕ_P of the gate G_P is brought to a high level whereas the control potential ϕ_1 of the register R is at low level. Thus the basic charge Q_O is transferred to the diode D' and to the gate G_P where it comes to be added to the signal charge Q_S, as shown in figure 5c. Next, as shown in figure 5d, all of the charges $Q_S + Q_O$ are transferred to the input stage of the charge transfer shift register when ϕ_1 changes to a high level. Then, as shown in broken lines in figure 5d, the potential ϕ_P of the gate G_P is brought to a low level and the following integration cycle can restart. As may be clearly seen in figures 5b to 5d, the reference level of the diode D' is given by the high level of the potential under the gate G_P.

The use of a basic charge enables the transfer of the signal to the charge transfer register to be improved. It avoids the phenomena of signal trail or remanence, and enables the level and the resolution of the output signal to be monitored.

Furthermore, the anti-glare device designed to avoid the distribution of the excess charge from an over-illuminated detector to the neighbouring detectors or to the multiplexing and reading system also makes it possible to avoid introducing into the shift register a quantity of charge exceeding the capacity of each of its stages.

This last function can also be performed by means of an anti-glare MOS transistor directly associated with each stage of the shift register. Examples of configurations of this MOS transistor associated with each stage of the register are shown in figures 6a, 6b, 7a, 7b and 8a, 8b.

In figures 6a and 6b, the anti-glare MOS transistor is formed by the diode D'_B brought to a biasing potential V'_{DB}, the gate G'_B brought to a fixed voltage V'_B and by the input stage of the register R, these various elements being constructed on the zone N. Thus when the signal charge Q_S transferred is too strong compared with the capacity of each stage of the register R, the excess charges are evacuated over the potential barrier formed under the gate G'_B.

In the figures 7a and 7b, the zone N extends only under a part of the stages of the CCD register and the anti-glare MOS transistor consists of the diode D'_B formed by a diffusion of type N^+ in the substrate P and brought to a biasing potential V'_{DB}, by the part of the gate of the register R overlapping the substrate P and by the part of the gate of the register R overlapping the zone N. In this case, the excess charges are evacuated over the potential barrier formed under the part of the gate of the register R overlapping the substrate P, owing to the difference in doping between the zone N and the substrate P.

Figure 8a and 8b show a constructional variant of figures 7a and 7b in which the diode D'_B is not brought to a biasing potential V'_{DB} but is biased by the control potential ϕ_1 of the shift register.

Figures 9 and 10 show another method of constructing the multiplexing and reading system. In this method of construction, the charges integrated by the photosensitive detectors are read directly as voltage and multiplexed using a logic shift register R'.

The conversion system shown comprises means of reading in voltage consisting of MOS transistors T_{11}, T_{12}... T_{np}... T_{NP} mounted as a follower stage. The gate G_1 of each MOS transistor T_{np} is linked by a connection C_{11}, C_{12},... C_{np}..., to a photosensitive detector D_{11}, D_{12}, ... D_{np}... formed by an N type diffusion. The drain of the MOS

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transistors T_{np} formed by the N type diffusion referenced N_2 in figure 10a is linked to a biasing voltage V_{DD}.

Furthermore, the source of the MOS transistors T_{np} referenced N_3^+ in figure 10a is connected via an MOS transistor T'_{np} acting as switch to a load TC. In the method of construction shown, a single load is used for all of the follower stages, which enables the power to be limited. However, one could also use one load for each follower stage. The load TC is constituted by a depletion-type MOS transistor the gate G_3 of which is connected to the source formed by the N-type diffusion referenced N_5^+ in figure 10a, this source being biased by a d.c. voltage V_{SS}. However, the load could consist of other types of power source or of a resistance.

Moreover, each gate G_2 of the switch MOS transistors T'_{np} is connected to one of the outputs of a logic shift register R' with series input and parallel outputs. This shift register R' enables one of the MOS transistors T'_{np} to be rendered conductive the other transistors remaining blocked. Thus a multiplexing of the various follower stages is performed.

As for the method of construction of figures 3 to 5, an anti-glare device may be provided at the level of each detector. This anti-glare device consists in the method of construction of figure 9 of an MOS transistor T''_{11}, T''_{12} the drain of which is connected to a biasing potential V_{DB}, the gate to the potential V_{GB} and the source to the corresponding connection C_{11}, C_{12}, ...

We shall now explain the operation of the system described above with reference to figure 10b which represents the surface potentials in the substrate during the reading of a detector D_{np}.

The charges created in the detector D_{np} by the radiation are stored in the junction capacity formed by this diffusion with the substrate.

Reading of the charges stored in one of the said capacities is performed when the corresponding n.p. output of the shift register R' is at logic level 1 so that the gate of the MOS transistor T'_{np} received a high voltage rendering the said transistor conductive, all of the gates of the other MOS transistors acting as switches receiving

a logic level "O" blocking the said transistors. In this case, the MOS transistor T'_{np} behaves like a resistance, the transistor TC namely the charge, finding itself connected to the follower transistor T_{np} and a conventional follower stage is thus obtained, the biasing voltage V_{DD} being chosen very much higher than the biasing voltage V_{SS} as shown in figure 10b.

The detector D_{np} being connected to the gate G_1 of the MOS transistor T_{np} a potential is obtained at the level of this gate which is representative of the quantity of charge integrated into the detector D_{np}. In fact, since the detector D_{np} is connected to the gate G_1, the potential under this gate aligns itself, taking into account the difference in potential due to the insulation, on the potential at the level of the detector.

Moreover, as in the reading case, the transistor T'_{np} is equivalent to a resistance, the potential at the level of the N_4^+ diffusion aligns itself on the potential at the level of the N_3^+ diffusion. Now the potential at the level of the N_3^+ diffusion is a function of the potential under the gate G_1, since in a follower stage the potential difference is a constant. A voltage is therefore obtained at the level of the N_4^+ diffusion which is representative of the charges stored in the detector D_{np}. This voltage is sent through the amplifier A to the output terminal S of the multilinear strip.

Furthermore, in figure 10b the potential under the gate G_2 when a logic level "O" is applied to this gate is shown in broken lines. It will be seen that, in this case, the current symbolised by the arrow e^- cannot flow from the MOS transistor of load TC to the follower MOS transistor T_{np}.

After having read the information on the n.p. input, the logic level "1" of the shift register R' is shifted by one stage under the action of the clock H and reading of the input n.p. + 1 is then performed. If the register R' is a series register, a logic level "1" is entered in the register at the start of each integration cycle. However a looped logic shift register could be used.

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Figure 11 shows a third method of constructing a multiplexing and reading system. In this method of construction, the charges integrated by the photosensitive detectors D_{11}, D_{12}, ... D_{np} are read via the current which passes through the resistance R_c situated at the output.

The demultiplexing and reading system shown comprises MOS transistors I_{11}, I_{12}, ... I_{np}, ... mounted as switches, the drains of which are connected to a d.c. voltage V_{DD} via a load resistance R_C. The sources of the MOS transistors I_{11}, I_{12}, ... I_{np}, ... are connected via connections C_{11}, C_{12}, ... C_{np}, ... to the detectors D_{11}, D_{12}, ... D_{np}, ... These detectors are also connected, as in the method of construction of figure 9, to anti-glare transistors $T"_{11}$, $T"_{12}$, ... $T"_{np}$, ...

Furthermore, the gates of MOS transistors I_{11}, I_{12}, ... I_{np}, ... are connected to the outputs of a logic shift register R' with series input and parallel outputs identical to the register R' of the method of construction of figure 9.

The operation of the system described above is as follows:

The charges created in the detector D_{np} by the radiation are stored in the capacity formed by the junction D_{np} with the substrate. Reading of the charges stored in this capacity is performed when the corresponding switch transistor I_{np} is conductive, namely when a logic level "1" is applied to its gate. This reading is obtained by the reproduction on the output by means of the amplifier A of the voltage produced by the current of the charges stored through the resistance R_C connected to the d.c. voltage V_{DD}.

Once the displacement of these charges has been completed, the voltage on the detector D_{np} reverts to a value defined by the d.c. voltage V_{DD}. The detector is then isolated by opening of the switch transistor I_{np}, by sending a logic level "O" to its gate.

It is obvious to the specialist that the elements A, R and V_{DD} may be constructed outside the multilinear strip.

Figures 1 to 11 show various methods of constructing an elementary multilinear charge transfer strip in which the detectors are read individually. As mentioned in the introduction it is

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desirable in certain applications, in particular in radiological applications, to be able to combine several elementary strips in order to obtain a lengthened multilinear charge transfer strip. In the elementary strips described above, an individual reading of the detectors is performed, the processing of the signals obtained, in particular the TDI function, being removed to the outside of the device. For this reason, it is possible to modify the structure of the elementary strip or to perform a scan which is not perpendicular to the lines of the photosensitive zone, to solve the problem mentioned above, in such a way as to associate during the processing, detectors located on different elementary strips, this making it possible to reduce or even to eliminate defects in the joining of images.

Thus, as shown in figure 12, the various elementary strips M-1, M and M+1 are formed by multilinear strips of the type of that described with reference to figure 2. In this case the various lines of the photosensitive zone are aligned with one another but in order to avoid the joining defects at the level of the ends of each strip, the scan takes place obliquely in direction B. For this reason, at the level of the processing of the detectors provided at the ends, the detector referenced A' of the last line of the strip M-1 is associated with the detector referenced A of the first line of the strip M.

According to another method of construction shown in figure 13, each line of detectors is offset by one detector with respect to the adjacent lines. Because of this, the line of the missing detectors is made in the direction of the oblique arrow F in broken lines. In this case, the scan B is performed perpendicularly to the photosensitive lines. Thus, at the level of the ends of each strip, the detector referenced A of the strip M-1 is processed with the detector referenced A' of the strip M. It is obvious to the specialist that each line of detectors may also be offset by several detectors with respect to the adjacent lines.

According to another method of construction shown in figure 14, each line of detectors of an elementary strip is offset by a half-detector with respect to the adjacent lines. In this case,

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the direction of the missing detectors namely the edge of the strip is represented by the arrow F in broken lines and the direction of the scan B is oblique, the detector referenced A on the strip M-1 being processed with the detector referenced A' on the strip M. It is obvious to the specialist that each line of detectors may also be offset by a part of a detector with respect to the adjacent lines.

However, we would point out that in the configurations of figures 12 to 14, the number of detectors to be composed to perform the TDI operation remains smaller at the level of the ends of the strips than elsewhere. In fact, as shown in these various figures comprising solely by way of illustration four lines, two or three detectors are associated at the ends of the strip whereas in the middle of the strip four detectors B_1, B_2, B_3, B_4 are associated.

To remedy this disadvantage, the configuration shown in figure 15 may be adopted. As shown in this figure, there are added locally at the level of the two lateral ends of an elementary strip, one or two additional lines of N detectors, N corresponding to the number of lines of the strip.

We shall now explain, with reference to figures 13 and 16, a principle which may be used to perform the TDI function outside the elementary strips M-1, M, M+1.

To consider for example the arrangement of figure 13 in which the elements of the four lines a, b, c, d are identified by the numbers of their positions along the line:

a_i, b_i, c_i, d_i, the elements to be composed having the same numbering, the sequence at the output from the shift register will be as follows:

a_1, b_2, c_3, d_4, a_2, b_3, c_4, d_5, a_3, b_4, c_5, d_6, a_4,....

For example, cumulative adding of the signals of the elements of the fourth column will be obtained by performing the operation:

$$V_4 = d_4\ (3T) + c_4\ (2T) + b_4\ (T) + a_4$$

in which T is the time of displacement of the image from one line to the next.

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The delays and the above sum may be obtained by analog or digital means according to the principle shown in figure 16.

In this figure, the elements of the various lines to be composed are denoted by contactors d, c, b, a. The signal from the element d, after being passed into a register Re delaying it by T, is sent to an adder Σ which receives on its other input the signal from the element c. The output c + d, after being passed onto a register Re giving it a delay T is sent on to an adder Σ the other input of which receives the signal from the element b. The sum b + c + d, after having been delayed by a time T is sent on to an adder Σ the other input of which receives the signal from the element a and the output S gives the composed signal.

Furthermore, the output from an elementary strip can be connected to the following strip by a switch so as to compose elements situated on different strips.

It is obvious that figure 16 represents only a principle for performing the TDI function.

The methods of construction described above have been given by way of illustration only and may be modified in many ways. In particular, in the case of figure 1, the charge transfer shift registers may be positioned on either side of the photosensitive zone or else laterally or even optionally folded back upon themselves.

Furthermore, a multilinear strip can also be designed in which only a certain number of detectors provided at the ends of each line are read individually using a structure as described above, the TDI function being integrated into the strip for the central detectors.

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CLAIMS

1. Pick-up for images enabling the function of integration with delaying of charges (TDI) to be performed comprising at least two elementary multilinear charge transfer strips each consisting of N lines of P photosensitive detectors ($D_{11}...D_{1P}$, $D_{21}...D_{2P}$, ... D_{N1} ... D_{NP}) placed end to end so as to increase the length of the line of photodetectors, the N lines being scanned sequentially by the radiation to be detected during the analysis and the signals obtained at the output from the strip being sent via a multiplexing and reading system (DIC, R_1, L_1;... DIC, R_N, L_N; DIC, R, L; T_{np}, T'_{np}, R') to a processing device external to the strip, each detector (Dnp) being linked directly by a connection (Cnp) to the said multiplexing and reading system and the scanning direction (B) forming an angle which is not zero with respect to the alignment (F) of the detectors of equal rank of the various lines.

2. Pick-up according to claim 1, characterised in that each line of detectors (a, b, c, d; fig. 13), is offset by one or several detectors with respect to the adjacent lines, the direction of the scanning (B) being perpendicular to the lines.

3. Pick-up according to claim 1, characterised in that each line of detectors is offset by a half or by a part of a detector with respect to the adjacent lines.

4. Pick-up according to claim 1, characterised in that the lines of detectors are aligned.

5. Pick-up according to any of claims 1 to 4, characterised in that the strip comprises at the level of the two lateral ends, at least one additional line of N detectors.

6. Pick-up according to claim 1, characterised in that the multiplexing and reading system comprises at least one multiplexing device having parallel inputs and series output (R_1 to R_N, R, R' and T'_{np}).

7. Pick-up according to any of claims 1 to 5, characterised in that the multiplexing and reading system consists of n_o charge transfer shift registers having parallel inputs and series output comprising p_o stages, n_o being a whole number chosen so that n_o =

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N x minimum pitch of the registers/pitch of the detectors and p_o being chosen so that $p_o \times n_o = N \times P$ each connection (C_{np}) coming from a detector (D_{np}) being connected to one input of one of the shift registers via a charge injection device (DIC) and the outputs from the registers each being connected to the external processing device via a charge-voltage reading stage (L, L_1 to L_{no}).

8. Pick-up according to claim 7, characterised in that, n being equal to 1, the multiplexing system comprises a charge transfer shift register (R) having N x P stages, the connections between each detector and the corresponding input of the register being made so that the detectors of equal rank (D_{1P}, D_{2P}...D_{NP}) are connected to contiguous inputs.

9. Pick-up according to claim 7, characterised in that, n being equal to N, the multiplexing system comprises N charge transfer shift registers (R_1 to R_N) having P stages, each line of photodetectors being connected to a shift register.

10. Pick-up according to any of claims 7 to 9 characterised in that each stage of the shift register is associated with an anti-glare device (D'_B, G'_B).

11. Pick-up according to any of claims 7 to 10, characterised in that each charge injection device (DIC) consists of :

- a diode (D') for injection of the charges connected to a detector by a connection, and

- an injection gate (G_p) which controls the passage of the charges towards the input of a stage of the charge transfer shift register.

12. Pick-up according to claim 11, characterised in that the charge injection device is associated with an anti-glare device.

13. Pick-up according to claim 12, characterised in that the anti-glare device consists of a diode (D_B) separated from the injection diode (D') by a screen grid (G_B) brought to a fixed voltage (V_B).

14. Pick-up according to any of claims 7 to 13, characterised in that it comprises means for superimposing on the signal charges (Q_S) coming from each detector a basic charge (Q_O) enabling

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the level and/or the resolution of the output signal to be monitored or improved.

15. Pick-up according to claim 14, characterised in that the means for superimposing a basic charge on the signal charges consists of a charge injection stage (De, G'_1, G'_2) injecting in series the basic charge into the charge transfer register or registers.

16. Pick-up according to any of claims 1 to 5 characterised in that the multiplexing and reading system consists of means of reading by voltage (T_{np}, TC) each connected to a connection coming from a detector and of at least one means of addressing (R') for sequentially addressing one of the means of reading so as to perform the reading of each detector in turn.

17. Pick-up according to claim 16, characterised in that the means of reading by voltage consists of a follower stage (T_{np}) the input of which is connected by a connection (C_{np}) to a detector (D_{np}).

18. Pick-up according to any of claims 16 and 17, characterised in that the means of addressing (R') consists of a logic shift register having parallel outputs, each output of which is connected via a switch (T'_{np}) to a means for reading so as cyclically to unblock the means of reading when a logic level "1" is present.

19. Pick-up according to claim 16, characterised in that each means for reading by voltage consists of an MOS transistor (I_{np}) the source of which is connected to the corresponding detector (D_{np}) the gate to the means for addressing consisting of a logic shift register (R') and the drain to a load resistance (R_C) connected to a d.c. voltage (V_{DD}).

20. Pick-up according to any of claims 16 to 19, characterised in that an anti-glare device (T'_{np}) is associated with each detector.

21. Pick-up according to claim 1, characterised in that, when each line of the strip receives in turn the radiation to be detected, the external processing device is a device performing the summing in phase of the information collected on the detectors occupying the same position with respect to the scanning direction on the various lines.

22. Pick-up according to claim 21, characterised in that the device performing summing in phase of the information collected on the detectors is an analog or digital device.

* C L M S *