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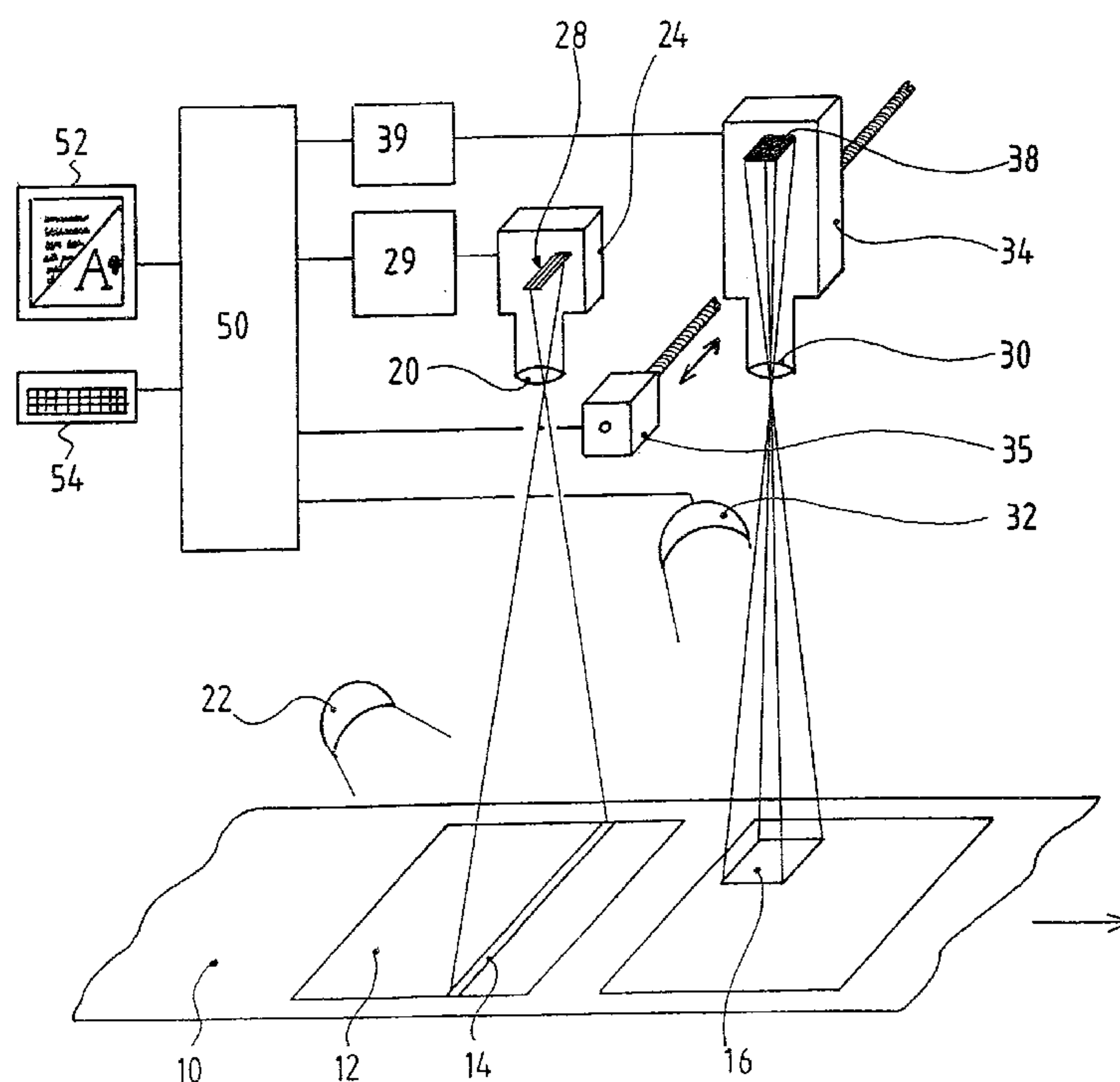
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(54) **DISPOSITIF SERVANT A DECELER DES DEFAUTS DE
REPERAGE D'IMPRESSION, DISPOSE DANS UNE MACHINE
A IMPRIMER ROTATIVE**

(54) **DEVICE FOR DETECTING PRINT MISREGISTERS,
ARRANGED IN A ROTARY PRINTING MACHINE**



(57) The device for detecting print misregisters is arranged in a rotary printing machine and comprises at least a first camera (34) snapping an image of a sample area (16) of the print (12) on a travelling web (10) according to a first resolution, as well as an electronic and computer appliance (39, 50) for digitalizing the image and comparing it with a pre-registered reference image. The said camera (34) is associated with a second camera (24) snapping the global print (12) according to a second, lower, resolution, the comparative results issued by the second camera (24) being used in the counter-reaction loop of the function control of the first camera (34).

ABSTRACT

The device for detecting print misregisters is arranged in a rotary printing machine and comprises at least a first camera (34) snapping an image of a sample area (16) of the print (12) on a travelling web (10) according to a first resolution, as well as an electronic and computer appliance (39, 50) for digitalizing the image and comparing it with a pre-registered reference image. The said camera (34) is associated with a second camera (24) snapping the global print (12) according to a second, lower, resolution, the comparative results issued by the second camera (24) being used in the counter-reaction loop of the function control of the first camera (34).

(Unique figure)

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**DEVICE FOR DETECTING PRINT MISREGISTERS,
ARRANGED IN A ROTARY PRINTING MACHINE**

The present invention is related to a device for detecting print misregisters or the like, arranged in a printing machine such as used for printing packages or newspapers.

For the detection of such print misregisters, the man skilled in the art is aware of devices including a camera associated with a flash-light located above the web or sheet having been processed by, and travelling out of, one or several colour-printing stations, the said camera being capable of sampling four or five interest areas per second with an image resolution of 512×512 points. By modifying the focal distance of the camera lens, it is obvious that the vision field and hence the analysis area can be modified from 25×25 mm to 40×40 cm, which action will induce, for a stationary image, a maximum detection of a spot of $5/100$ mm with a diameter of 2 mm. However, due to the high travelling speeds of the web, say 10 metres per second, such cameras may leave up to 1.5 metres of web unexplored until the subsequent subsequent activation of the flash-light occurs.

In fact, an analysis of the potential print misregisters puts forth two kinds of distinct misregisters: a first kind of fleeting and too severe misregisters necessitating the removal of the printed matter from the other proper ones, and a second kind of long-lasting misregisters temporarily remaining at the beginning of the tolerance limit but signaling a further deterioration. Examples such as major flaws in cardboard or paper, a lack, an overdose or a projection of ink, stains of oil emanating from a machine

component, a plate coming off the cylinder or even a maladjustment of the electric shaft wedging several colour-plates, the ones with regard to the others could make up the list of misregisters of the first kind. The second kind of misregister is often caused by the progressive wear and tear of several components of the rotary printing machine such as, as often, the ink scraper, the printing form, the pressing roller and so on. Such misregisters can also be caused by temporary dust deposits which may easily be eliminated.

10 As mentioned above, the present devices based on video cameras snapping an image during a flash-light illumination cannot cover in real time the entire print with a resolution sufficient for the immediate detection of the various misregisters mentioned. Moreover, an improvement of the camera technology by a factor of, say 1.000, is barely envisageable, even at long-term, for the achievement of these aims.

The object of this invention is to solve the above-mentioned problems through a device capable of detecting and analysing quickly every print misregisters in view of an appropriate
20 correction.

In accordance with the present invention, there is provided device for detecting print misregisters, arranged in a rotary printing machine and comprising at least a first camera snapping an image of a sample area of the print on a travelling web according to a first resolution, an electronic and computer appliance for digitalizing the image and comparing it with a pre-registered reference image, and a second camera snapping the global print according to a second, lower
30 resolution, characterized by the fact that the second camera for global scanning comprises several rows of photosensitive elements placed next to one another, electric charges generated in a first said row by the scanning of a cross strip of the print being successively transferred to the following rows in

synchronism with the travelling motion of the web in order to integrate the supplementary charges generated in every following row by the constant scanning of the said strip.

Owing to this kind of camera, a print cross strip is scanned successively by 16 or 64 rows, which augments its contrast and hence the resolution of the video image snapped. Here again, the technology of this kind of camera can develop and, consequently, the number of rows too. Moreover, when the first row has transferred its scanning result for a given cross
10 strip, it immediately begins the scanning of the following strip and so on, thereby causing the entire print to be snapped as it goes along. By the fact that this camera may comprise up to 2,000 photosensitive elements per row and that its charge integration time per row may be fixed to a value lower than 100 micro-seconds, the image snapped by this second camera may have a resolution of, say a mm² of print.

Usefully, in the start-up phase of the rotary machine, the global image snapped by the second camera with low resolution can allow the definition of non-printed as well as printed
20 areas of uniform colour by means of the electronic and computer appliance, the said areas being no longer checked systematically by the first camera with high resolution, the latter first camera being controlled by the same electronic and computer appliance.

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Usefully again, the electronic and computer appliance can shift automatically or under the control of an operator the first camera with high resolution crosswise to the travelling motion of the web in order to scan with enhanced precision an area including a gross misregister detected by the second camera with low resolution.

Usefully again, the electronic and computer appliance can modify the activation of the flash-light illuminating the area scanned by the first camera with high resolution with regard to the instant modifications of the print position caused by temporary variations of tension occurring on the web and detected by the second camera with low resolution.

The invention as well as its advantages will be better understood at the reading of the following description of a mode of realization taken as a non-limitative example and schematically illustrated in the enclosed figure.

This figure shows a travelling web 10 on which successive motifs 12 have been printed. The device comprises a first, so called CCD, colour camera 34 provided with a lens 30 with variable focal distance which projects an analysis area 16 on to the CCD matrix scanning element 38 including, for instance, three interwoven matrices of 512×512 photosensitive points, which is to say one matrix for every fundamental colour, ie red, gree and blue. This camera is connected to a unit 39 digitalizing the video signal, which digitalized signal is sent to a memory area of a processor 50 for ulterior analysis and comparison. The camera is movable across the width of the web 10, its position being changeable at will, for instance by a motor 35 driving an endless screw that crosses a nut of the camera's frame. The area 16 scanned by the camera 34 is, though only when snapped, illuminated by a flash-light 32 creating a temporary high luminous energy.

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The device includes, moreover, a second, so called TDI, camera 24, ie with transfer of integration synchronized with the travelling motion of the web or the sheets. This camera 24 is preferably mounted upstream the camera 34 with regard to the travelling direction of the web 10. Its scanning unit 28 comprises 8, 16, or 64 rows of 2000 photosensitive elements. The characteristic of this camera 24 is that it works continuously along with the permanent illumination of one or several spot lights 22. In fact, this camera is synchronized by means of a control circuit 29 with the travelling speed of the web 10 in such a way that when the web travels, a cross strip 14 is scanned a first time very quickly by the first row of photosensitive elements and then, further to a slight shift toward the right, due to the travelling motion of the web, on the first hand, and to the transfer of the first data of the first row to the second neighbouring row, on the other hand, this same strip is scanned again by this second row and so on, this process making up in the last row a video line sufficiently contrasted to be representative of the image on the strip 14. In between, the following print strip has also been scanned by the precedent rows after immediate reinitialization. The successive video lines of the last row are also sent to a memory of the processor 50 after pre-amplification and digitalization.

The processor 50 can display on the visualization screen 52 the global image of the print 12 such as scanned by the camera 24 and, at the operator's request expressed on the keyboard 54, make the comparison with a pre-registered reference image. Any difference between these two images showing the existence of a gross misregister can be automatically detected by the processor 50 or visually seized by the operator.

In a similar way, the operator can display on the visualization screen 52 the image, such as scanned by the CCD camera 34, of an interest area 16 to be checked, the said image being also comparable with the corresponding pre-registered reference image in order to immediately put forth the fine misregisters.

Having detected a difference incomprehensible during the global analysis of the print 12 effectuated by the DTI camera 24, this device can operate the motor 35 by remote control in order to shift the CCD camera 34 and to synchronize the flash-light 32 so as to position the areas 16 to be scanned with high resolution on the error detected precedently. The operator is then in a position to decide whether this difference is effectively a print misregister and, in most cases, is able to determine its cause due to his experience. This possibility is all the more interesting by the fact that the operator, in the start-up phase of the rotary machine, will have excluded from the check, a priori by the CCD camera with high resolution, areas which have a lesser interest and are such as discovered at the consideration of the first images taken by the TDI camera for gross scanning.

In other respects, it may happen that when images are snapped by means of a CCD camera associated with flash-lights, the successive images flicker although the flash-light 32 is rigorously in synchronism with the travelling speed of the web 10. This phenomenon may be caused by the fact that slight variations of web tension create differences in the frequency of images 12 travelling through the field of the camera 34.

It is then possible to turn to account the detection of the upstream front of the print 12 effectuated by the camera 24

with low resolution in order to activate as precisely as possible the flash-light 32 with regard to the area to be checked.

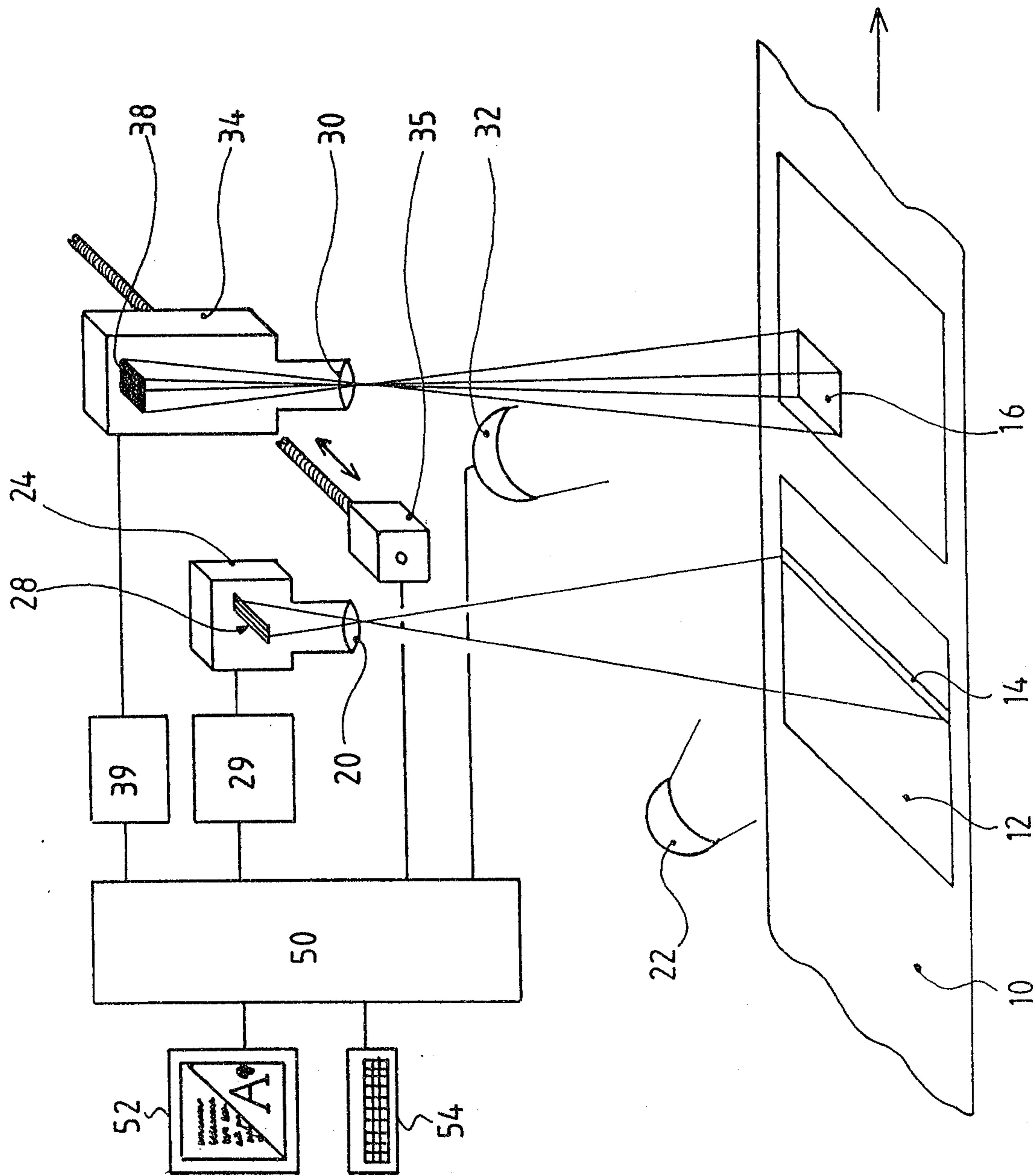
As may have been understood at the reading of this description, the device according to the invention proves to be particularly efficient by the fact that it allows the simultaneous detection of gross print misregisters as well as of fine print misregisters in a particularly effective way through the repercussions of the global image analysis on the fine scanning optimisation. Moreover, this detection is achieved in a specially short time due to the quick scanning action of the cameras and to the quick processing of the processor. Numerous improvements can be added to this device within the limits of this invention.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. Device for detecting print misregisters, arranged in a rotary printing machine and comprising at least a first camera snapping an image of a sample area of the print on a travelling web according to a first resolution, an electronic and computer appliance for digitalizing the image and comparing it with a pre-registered reference image, and a second camera snapping the global print according to a second, lower resolution, characterized by the fact that the second camera for global scanning comprises several rows of photosensitive elements placed next to one another, electric charges generated in a first said row by the scanning of a cross strip of the print being successively transferred to the following rows in synchronism with the travelling motion of the web in order to integrate the supplementary charges generated in every following row by the constant scanning of the said strip.
2. Device according to claim 1, characterized by a start-up phase, in which the global image snapped by the second camera allows the definition of non-printed as well as printed areas of uniform colour by means of the electronic and computer appliance, the said areas being no longer checked systematically by the first camera, the latter first camera being controlled by the same electronic and computer appliance.
3. Device according claim 1 or claim 2, characterized by the fact the electronic and computer appliance shifts automatically or under the control of an operator, the first camera crosswise to the travelling motion of the web in order to scan with enhanced precision a new area including a misregister detected by the second camera.
4. Device according to any one of claims 1 to 3, characterized by the fact that the electronic and computer appliance modifies

the activation of a flash-light illuminating the area scanned by the first camera with regard to the instant modifications of the position of the print caused by temporary variations of tension occurring on the web and detected by the second camera.

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