

CONTINUOUS SCANNING MODULE, SCANNING SYSTEM COMPRISING SAID MODULE AND RELATED SCANNING METHOD

Main Technological Area —→ Optronics

Keyword —→ Image Acquisition /Lens / Infrared Sensors /Thermal cameras

The solution described in this patent can be adopted in image acquisition systems in case is required to compose an image that covers an angle greater than 70°.

Normally the scanning is based on the "step and stare" method, that involves the acquisition of portions of the image which are composed in sequential steps defined by the rotation of a drum with reflecting faces. Each portion is then stored, composed in a memory and sent for presentation.

The solution presented by the patent aims to solve the problems of presentation of the complete image to a high frame rate ($\geq 10\text{Hz}$), problems arising either from a "jerky" drum rotation (causing very high dynamic stresses) or from a constant angular speed (causing a "forward image movement" effect).

A synchronous secondary drum with reflective faces to the main drum reduces/cancels the "forward movement" effect allowing optimal image viewing and the use of a high frame rate.


TECHNICAL FEATURES

To acquire images from particularly wide fields of view, for instance 70° or more, that the lens and the detector are unable to observe, scanning modules are often necessary, which acquire sequential portions of the field of view.

In some known devices, scanning is based upon the "step and stare" method. Step and stare scanning modules are provided with a rotating drum with reflecting faces rotating in a stepped manner. The drum stops at each step, so that the sensor can acquire the image. This is due to the fact that the sensor or detector has a finished integration time. At high frame rate, typically equal to or greater than 10 Hz, accelerations on the components of these scanning modules are significantly high, greater than $20,000 \text{ rad/s}^2$. These accelerations cause very high dynamic stresses.

To avoid problems due to the dynamic stresses, scanning modules have been produced wherein the scanning drum rotates at constant angular speed. However, this function mode leads to a problem of image forward motion. In fact, the sensor has a finished integration time, during which the image reflected by the face of the rotating drum moves angularly, and this results in image forward motion.

To overcome this further problem, Leonardo's solution includes, in addition to the main scanning drum, also a compensation module associated with a secondary drum that also rotates at a constant speed. In this way, the phenomena of image advancement are strongly eliminated/reduced.

The system shall comprise at least

- A continuous scanning module
- Focusing Lens

- At least one sensor

The continuous scanning module comprises :

- A polygonal scanning drum, configured to rotate at constant speed and provided with a plurality of first reflecting side faces
- A second polygonal forward motion compensation , having a polygonal cross-section and rotates synchronously with the scanning drum.

The faces of the second drum are reflective. Each reflective face of the compensation drum receives an image from the corresponding reflecting face of the main scanning drum and reflects it towards a scanning path.

It is important that each reflective face of the compensation drum corresponds to an active face of the scanning drum.

The device is then scanned so as to project, towards the optical path of the device, an image of a portion of the field of view.

scanning, identifying a scanning direction. In this way the effect of forward motion due to the

The scanning drum is compensated by the synchronous and coordinated movement of the compensating drum.

INNOVATION/BENEFITS

- *Removal of dynamic stress caused by the step and stare technique*
- *Reduces the problem of forward image movement*

AREAS OF USE

Optical Devices	<u>Thermal Sensors</u>
	<u>Infrared Sensors</u>

PATENT INFORMATION

Priority Date – 2012/01/11

Priority Number - FI2012A000001

IPC Codes – G01C11/02; G01S7/481; G02B26/12; H04N1/113; H04N3/09; H04N3/14; H04N5/232; H04N5/33

Active Worldwide Extensions

Italy - IT1409527; Filing date: 2012/01/11; Grant Date 2014/08/08

EPO - EP2802923B1; Filing Date: 2013/01/09; Grant Date 2016/01/06

France – Germany – United Kingdom – Poland - Turkey

USA - US9176321; Filing date: 09/01/2013; Grant Date 03/11/2015

WIPO PCT/IB2013/050166 Filing Date: 2013/01/09

Leonardo internal code

LDO-0322

Leonardo References

Emanuela Barbi (emanuela.barbi@leonardocompany.com)

Giorgio Assenza (giorgio.assenza@leonardocompany.com)

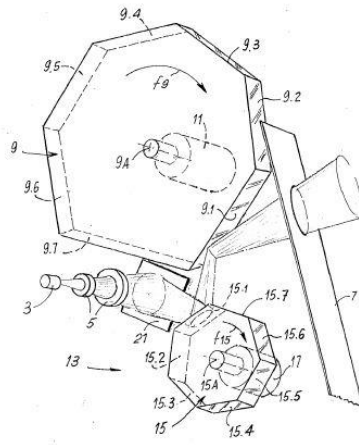


Figure 1 Structure of the two reflecting drums

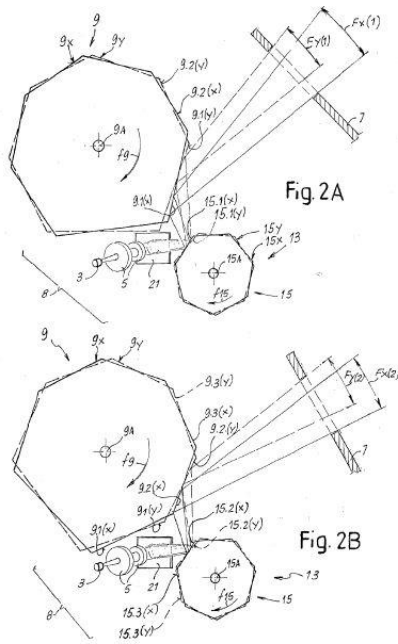


Figure 2 Operating mode