

Videomeasuring Hydrostatic System

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SUMMARY

Work of video measuring hydrostatic system is based on property of a free surface of a liquid to be established is horizontal and serves for measurement of mutual high-altitude position of parts of a construction.

The level of a liquid in containers of hydrostatic system is measured with the help of video level measurement - Measurement by the computer, processing video sources of images of light reflected from a level of a liquid, which is measured. The video measuring hydrostatic system is established on the base of the Victoria's Memorial on Poklonnoj Mountain in Moscow and functions in system of tool monitoring fluctuations of the Monument with 1996 year. It is characterized by high accuracy and reliability of work. The error of measurements makes less than 20 microns in a range of changes of level up to 50 mm.

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The videomeasuring hydrostatic system intend for measurement of mutual high-altitude position of elements and units of constructions. Measurement of a level of a liquid in measuring vessels of hydrostatic system is carried out by contactless way with the help of a video level gauge which work on computer processing of video images of the light sources reflected from a level of a liquid. The error of measurements less than 20 microns in a range up to 50 mm.

In the state project institute of Ministry of Atomic Energy of Russia there are works for automation of hydrostatic systems for the control of high-altitude position of the equipment of engineering constructions [1]. The big achievement in this area is creation of video level gauges for measurement of a level of a liquid in vessels of hydrostatic system. Work of video level gauges is based on computer processing of video images of the light sources reflected from a level of a liquid [2-5].

On fig. 1, as an example, the video measuring hydrostatic system containing two vessels, connected with each other by tubes for a liquid and for air is submitted. In vessels the nonfreezing liquid is filled. In the top part of vessels glass windows for hermetic hydrostatic system are established. At these windows a video level gauge are established. Signals of video gauges are transferred in registrations centre containing the analog switchboard, the video processor and a computer.

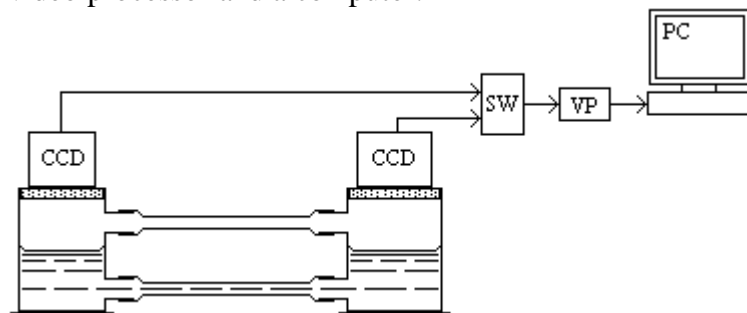


fig.1

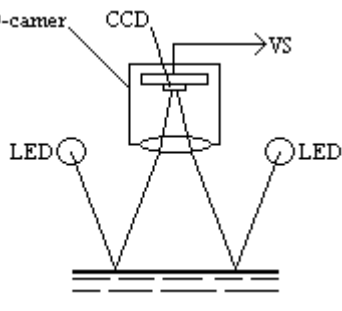


fig.2

At change of mutual high-altitude position of vessels of hydrostatic system the liquid from one vessel flows in another, the level them varies and it is the basis for measurements.

Work of a video level gauge is explained fig. 2 on which are represented LED the round form. Between them the video gauge as the CCD-chamber is established. Images LED reflected from a level of a liquid, are projected on the CCD-chamber and in video signal there is video image LED. At change of a level of a liquid in a vessel of hydrostatic system the distance centre to centre video images LED varies and it is basis for measurements.

Video signals of video gauges will be transformed in the video processor from the analog form to the digital form, entered in a computer and the level of a liquid in each vessel under the formula is calculated:

$$h = \frac{C}{\sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2}} - h_0$$

where: C - metrological constant, X1, X2, Y1, Y2-coordinates of the centres of video images LED, h0-initial level of a liquid in a vessel.

Results of calculations automatically is remembered, documented and deduced on the display of a computer. They also can be transferred on liaison channels any distance.

Thus, the video level gauge is the hardware - program complex constructed and can be increased and programmed according to problem.

The video level Gauge with CCD-camera SK 1004 Sony (f=16 mm), LED L-934SET, video processor VS-56/1 and an IBM-computer, has the following parameters:

Range of measurement, mm

50

Measurements error, mm

0,02

Time of measurement, with

10

Dimensions of the video gauge, diameter / height, mm

80/40

The Video measuring hydrostatic system in structure of system of tool monitoring deviations and fluctuations of top of the Main monument of the Monument of the Victory on Poklonnaya mountain in Moscow works with 1996r. and has shown high reliability.

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BIOGRAPHICAL NOTES

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