A PROTOTYPE OF A RAIL STAND FOR MEASURING GEOMETRIC PARAMETERS OF OVERHEAD TRAVELLING CRANE TRACKS

Wojciech Anigacz
Opole University of Technology

1. INTRODUCTION

Measurements of geometric parameters of crane tracks should be characterised by a relatively high accuracy (ISO 8306.1985., PN-91/M-45457.1991., MPC 1982). Achieving the required accuracy values with the use of standard equipment is very difficult. The author's many years' experience in this type of surveys allows to claim that reaching the appropriate tripod stability is the most decisive factor influencing accuracy of a survey check as a whole. This type of measurement is mainly carried out at the height where the vibrations of the supporting structure of the crane track are quite considerable. The weakest element of the standard measuring equipment is the tripod, in most cases situated on the crane track and on the portal bridge and hence sensitive to vibrations and of low stability. The problem of achieving the required measurement accuracy could be solved by ensuring stability of the measuring position over the whole period of measurement. Below an innovation has been presented to ensure stability of the measuring position while carrying out survey checks of crane tracks and cranes (Anigacz W., Raszka A. 2005).

2. THE RAIL STAND

The main target of this project was to construct a device which would bear the role of a traditional survey tripod and which would, at the same time, ensure high stability of the measuring position. The structure of the crane track does not ensure a constant positioning to tripod legs in the measuring process. Hence it was decided to fix the stand to the rail head in the way it would embrace it tightly enough to make it impossible for the stand to incline in the direction transverse to the rail axis which was the main failure of previously applied solutions (Anigacz W. 1991). Drawing 1 shows a scheme of the designed and realised rail stand.
The prototype is composed of the following elements:

- **the body basing on the upper part of the rail head, fig. 1 and 3,**
- **two arms embracing the rail head on the sides. The arms can move in two directions with use of a roman screw depending on the rail head width, fig. 1 and 2,**
- **8 vertically movable chucks located in the arms and embracing the rail head from the bottom side, fig. 1,2 and 3,**
- **A movable plate located on the device body. It can move in the direction transverse to the rail axis within the scope of ± 60 mm from the rail axis, fig. 4. The plate is moved with use of a knob located at the body side.**

- a threaded bolt located on the movable plate, designed for fixing measuring instruments, fig. 1,
- scales located on the body and the movable plate defining the scope of relocation of the bolt axis towards the rail axis, fig. 5.

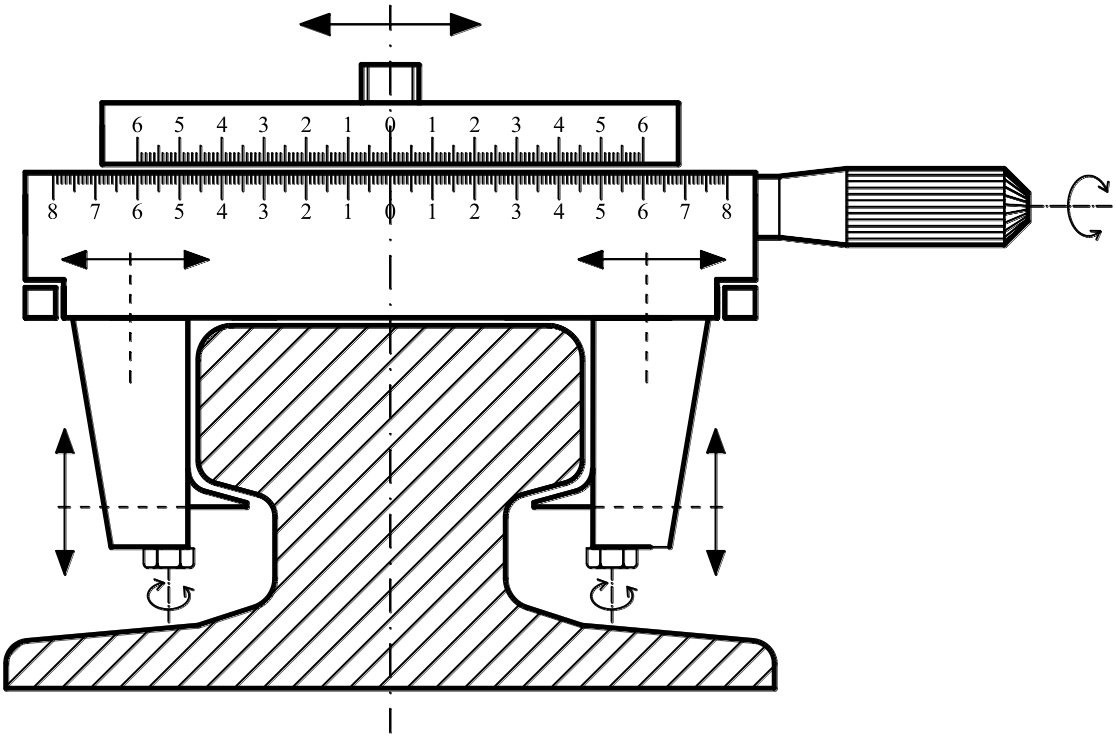

Fig. 1. The rail stand scheme according to (Anigacz W., Raszka A. 2005).
The arrows show directions of displacement of the movable elements.

a) b)

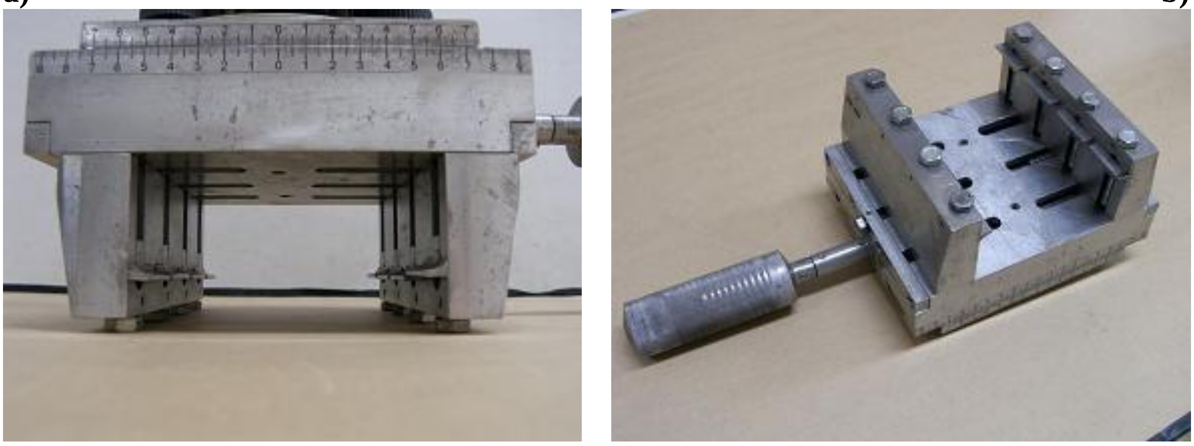

Fig. 2. The view of the device a) from the front and b) from the bottom.

The upper plate of the rail stand can move in the direction transverse to the rail axis within the scope of ± 60 mm, which is shown in fig. 5. This is very important as it makes it possible to move the vertical axis of a measuring instrument beyond the outline of the rail head of any width (for instance SD 100). While setting out (putting) a rail it is advisable to move the tachymeter vertical axis to the rail head edge, which at the same time determines location of the rail in the horizontal network. The millimeter scales on the body and the movable plate (Fig. 4 and 5) make it possible to determine the

a) b)

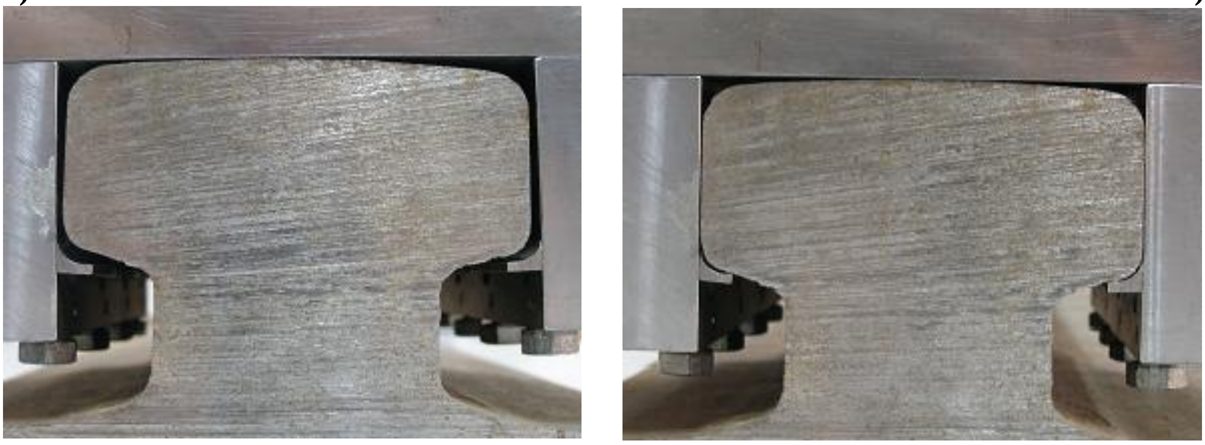

Fig. 3. The principle of fixing the device to the rail head: a) prior to fixing – gaps visible, b) after fixing – no gaps visible.

a) b)

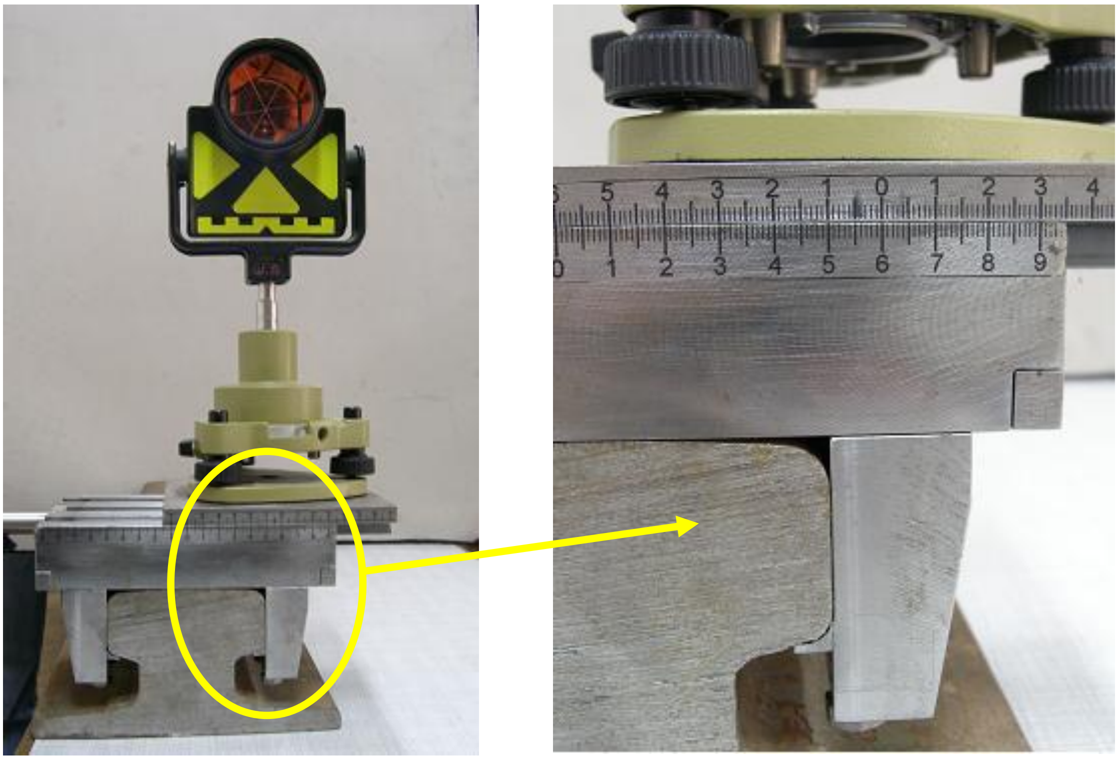

Fig. 4. The maximum displacement of the rail stand head a) a general view, b) and example relocation.

accuracy of displacement of the plate axis towards the rail axis with accuracy up to 0,5 mm. An additional advantage of the presented rail stand is a small (of about 30 cm) vertical distance of the axis of rotation of the telescope from the upper surface of the rail head. It should also be noted that reducing the vertical angle increases measuring accuracy, which is obtained through using the device according to the invention.

a) b)

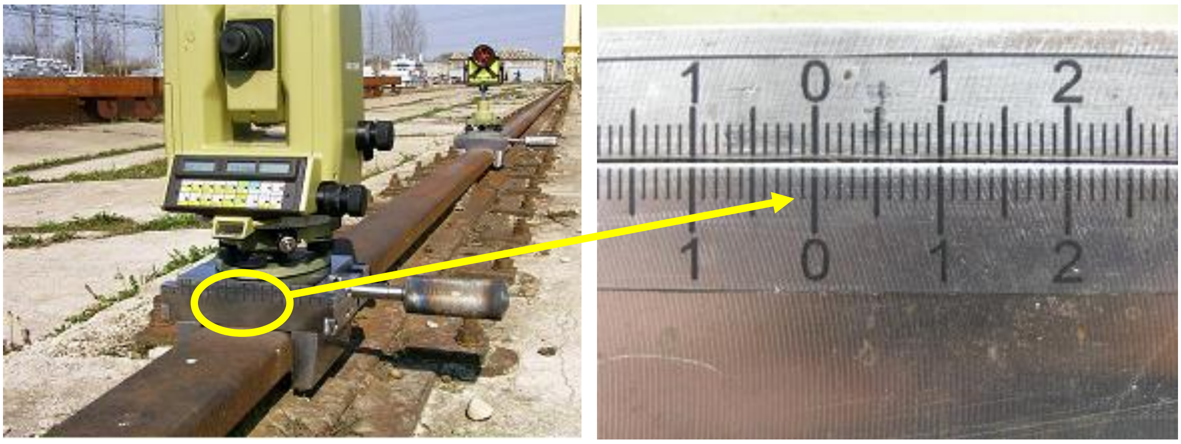

Fig. 5. Views of: a) rail stands in the process of examination and b) the detail of the body and the movable plate scales.

3. CONCLUDING REMARKS

The designed and realised prototype of a rail stand has been subject of a patent application at the Polish Patent Office (Anigacz W., Raszka A. 2005). It was tested on site within the framework of several degree theses (Raszka A. 2005) and research works carried out in the Chair of Geotechnology and Geodesy, Building Engineering Department, Opole University of Technology. The roman screw moving the device arms ensures that its axis is always within the axis of the rail regardless rail type, i.e. the rail head width and the scope of the head displacement. Lab and site tests have proved full usability of the presented rail stand for measuring displacements and strains of crane tracks in accordance with regulations in force PN and ISO.

REFERENCES

Anigacz W 1991. Geodezyjny statyw szynowy. Urząd Patentowy RP. Prawo ochronne nr W49399 z dnia 3 czerwca 1991 r.
Geodesic Rail Stand. Polish Patent Office. Protection Law no W 49399 of 3rd June 1991.

Anigacz W., Raszka A 2005. Statyw szynowy. Urząd Patentowy RP. Zgłoszenie z dnia 2005-05-16. P 375122.
A Rail Stand. Polish Patent Office. An Application of 2005-05-16. P 375122.

ISO 8306. 1985. Cranes. Overhead traveling cranes and portal bridge cranes – Tolerances for cranes and tracks. International standard. First edition 1985-12-15.

Ministerstwo Przemysłu Ciężkiego. 1982. WPM „WEMA" - Wytyczne wykonania pomiarów suwnic i jezdni suwnicowych. - Załącznik nr 15 do Instrukcji Geodezyjnej resortu przemysłu ciężkiego. Warszawa 1982.
The Ministry of Heavy Industry. 1982. WPM "WEMA" – Instructions for surveying cranes and tracks. – Appendix No 15 to Survey Instruction of the Heavy Industry Department. Warsaw 1982.

PN-91/M-45457. 1991. Dźwignice. Tory jezdne suwnic pomostowych. Wymagania. PKN.
PN-91/M-45457.1991. Cranes. Tracks for portal bridge cranes. Requirements. PKN.

Raszka A. 2005. Analiza dokładności montażu jezdni suwnicowych. Praca dyplomowa. Wydział Budownictwa, Politechnika Opolska. Opole, maj 2005.
Analysis of accuracy of crane track assemblage. A degree thesis. Building Engineering Department, The Technical University of Opole. Opole, May 2005.