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OPTIMIZATION OF THE PRESSURE TRANSDUCER
OPTIMALIZACE TLAKOVÉHO SNÍMAČE

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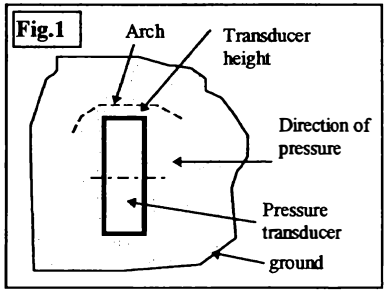
This paper deals with the shape arrangements of the axial dynamometr in order to obtain a small size to protect from arching when applieted to the ground; regulation optimum sensibility; and the minimum product cost.

INTRODUCTION

Optimization of a pressure strain gauge design determined for the application to the strein measurement of ground, depends first of all on a small size of the strain gauge; further on the pressure measuring possibility in a given direction; on changebility of its measuring range; on both great reliability and lifetime; and all combined with a low cost.



As the gauge size must not influence a natural pressure distribution in the ground, the gauge shape must be very thin with the possibility measuring presure in the perpendicular direction to its even side. A very low height of the transducer (Fig.1) prevent practically the creation of an arch in the surrouding ground which is unfavourable for the pressure measuring for it could to substitute extend influenced and thus distort the pressure distribution.

CHOSEN METHOD OF OPTIMIZATION

When selecting the transducer external shape we got out of strain gauges having circular or rectangular shapes, i.e. very thin body being stuck to the transducer internal face. The suitable lenslike shape of the transducer (Fig.2) was made up of two spherical caps which

were manufactured as steel stampings ground a stuck together along their contact surfaces. There was a cable drawn from the transducer (placed in the cavity) and the cavity was tighten with an elastic cement (Fig.3).

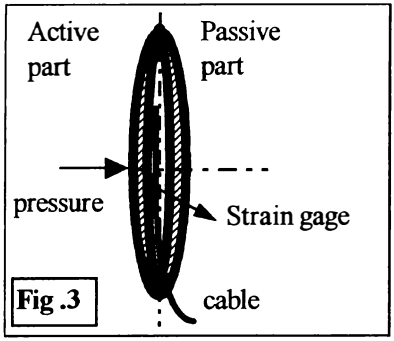


Fig .3

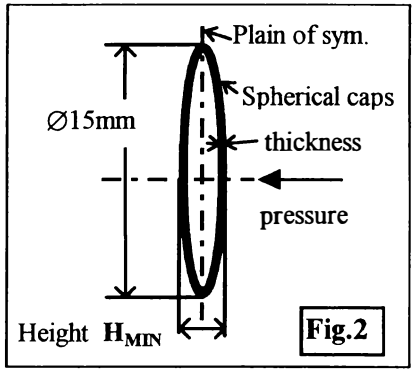
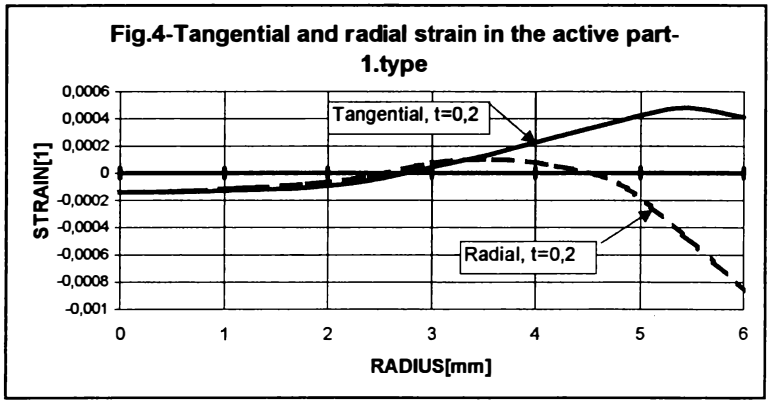


Fig.2

The transducer range can be, according to its minimum size given by the strain gauge size and the cabel thickness, regulated by the steel sheet. The radial and hoop principal stresses' distributions, for the sheet thickness of 0.2 mm and the pressure of 0.2 MPa, are shown in Fig.4.



The second type of the structure was carried out by mashining accordind to the shape shown in Fig.5. The transducer active half - a thin membrane with the stuck strain gauge - can be (using a different sheet hickness) set-up to a demanded pressure measuring range and, if need be, regulated later. Solved by FEM were the radial and hoop strain distributions along the active range of the transducer steel membrane having the thickness of 0,1mm-0,2mm and subjected to the pressure of 0.2 MPa (Fig.7).

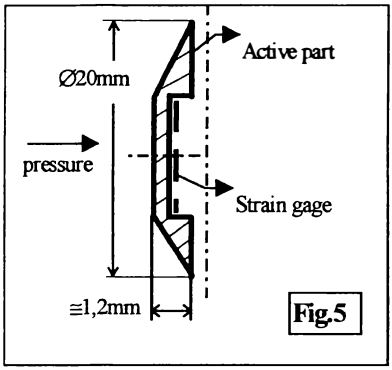


Fig.5

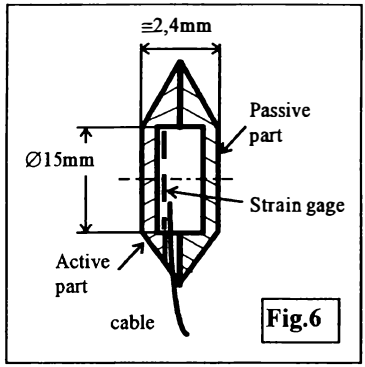
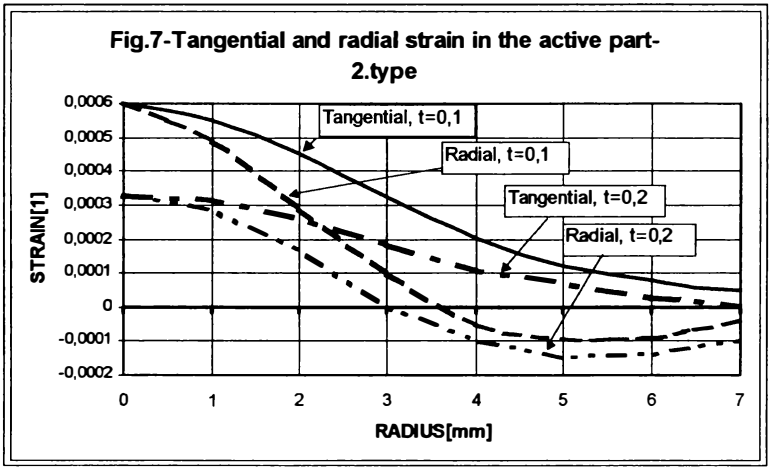


Fig.6



Resultes

When applying formed cap transducers, the used glue and the tighten cement cause a hysteresis and parasite nonlinearities in loading characteristics. And even if the basic principle of the transducer is satisfactory, very difficult will be production of a quality transducer at common workshop conditions is very difficult. These problems were eliminated at the second transducer - being made in two variants (Fig.6, Fig.8) - which keep reliably linear loading characteristics; have no

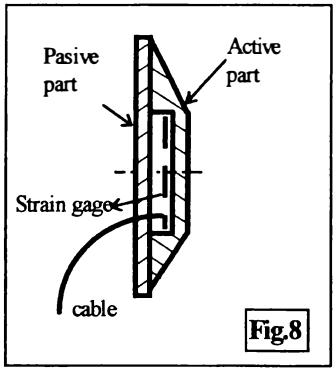


Fig.8

difficulties with the hysteresis; and in addition to it they can be relatively esasy tuned up. The cost of both transducers is low, in the order of the strain gauge price.

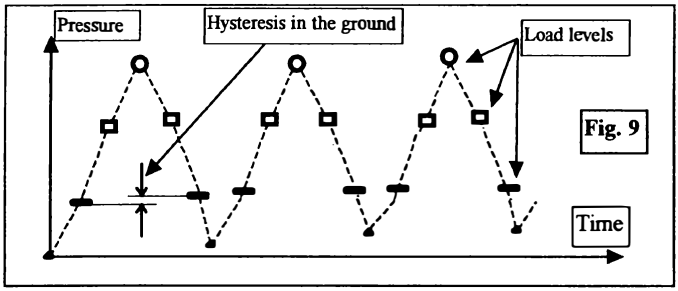


Fig. 9

The reaction of the transducers, measuring streins in a reapetedly loaded ground, is shown in Fig.9. A perceptible compacting of the soil can be seen here. At practical experiments, the second maschined type proved a reliability and steadiness of its characteristics.

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