light beam in order to diminish the overall dimensions of the cap without changing the position of eyepiece thrust face.

A pair of the caps SEC may cooperate with any microscope of biological or metalographical type equipped with double eyepiece. The cap SEC is to be inserted into every lens barrel together with any pair of eyepieces from the microscope set (Fig. 3). Depending on the diaphragm position the stereoscopic or pseudostereoscopic effect can be obtained, independently of the microscope magnification and the applied technique of observation (bright field, dark field, epi, dia, phase contrast etc.) without change in magnification, field of vision or hight of the microscope pupil. Moreover, the SEC turns the image from the upside-down position in ordinary microscopes to the right one.

Jolanta Wilk, Antoni Sojecki *

A New Optical System Realizes Wide Range of Continuously Variable Magnifications

A new triplet system that realizes a continuously variable magnifications with a 11.5 : 1 zoom ratio has been developed. Simultanously the total conjugate remains constant within 0.14 mm.

A symmetrical triplet system that realizes a continuosly variable magnification by shifting the exterior elements fixed together has been developed recently by CLO in Warsaw. This system has a zoom-ratio 4 : 1. T. Wagnerowski [1] proved that the system mentioned above keeps the total conjugate within a small depth, while shifting the exterior elements. It is possible for two cases of magnification +1 (Fig.1) and −1 (Fig. 2).

This idea was utilized in PZO to develop a new optical system with a wide range of continuously variable magnification. The invention was to use the same system twice for changing the power as shown in Fig. 3. Rays comming from the left through

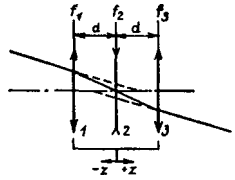

Fig. 1. Rays passing through a triplet form an image with magnification +1

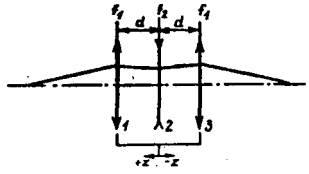

Fig. 2. Rays passing through a triplet form an image with magnification −1

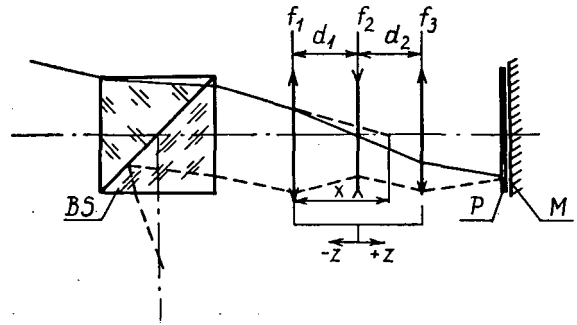

Fig. 3. Rays passing a triplet for- and backwards form an image with magnification −1

a polarizing dielectric multilayer beamsplitter BS pass the triplet as shown in Fig. 1. After reflection from the mirror M rays pass the system backwards

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as shown in Fig. 2. In that way the change of magnification occurs very quickly when shifting exterior lenses. Due to the quarter-wave plate P placed in front of the mirror and situated at 45° to the polarization plane of incident rays, all of them are reflected sidewards as shown in Fig. 3.

This idea has been proved by calculations. Assuming a symmetry of the optical system, the results received finally are shown in Fig. 4.

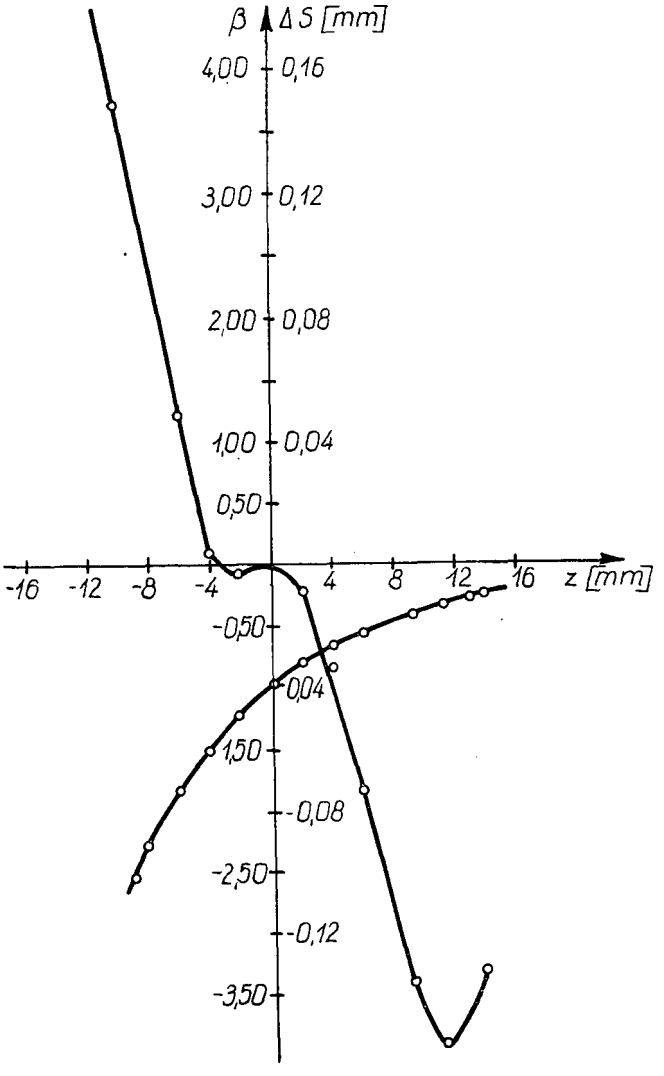

Fig. 4. Magnification β and axial displacement ΔS of the image while shifting z exterior lenses of a symmetrical triplet

Hence it follows that with 10 : 1 magnification ratio the total conjugate remains constant within 0.2 mm.

The above results were found not to satisfactory. It was assumed for further calculations that this optical system is not symmetrical. In that way a system was developed which reduced the change of total conjugate to 0.14 mm and simultanously increased the magnification ratio up to 11.5 : 1. The data and the performance of that system are shown below (Fig. 5).

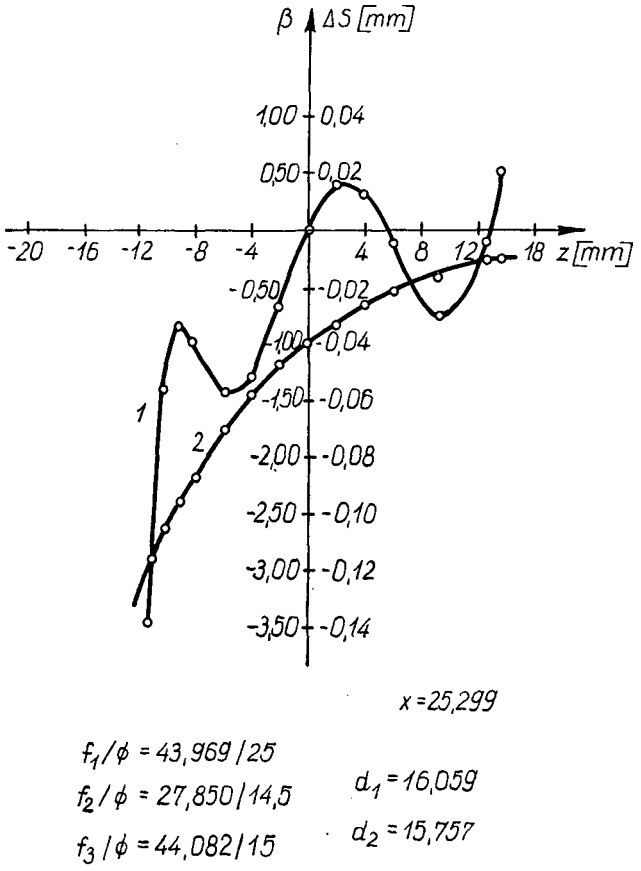

Fig. 5. Magnification β and axial displacement ΔS of the image while shifting z exterior lenses of a semisymmetrical triplet. Data are given, too

All above calculations were made using two spatial programs developed in PZO for the CDC16A and ELLIOTT 80BB computers.

References

[1] WAGNEROWSKI T., *Theorie elementaire du triplet pancratique dont les lentilles extremes sont deplacees solidairement*, Revue d'Optique, No. 6, Juin 1966, p. 245–248.