and the occulting diaphragms for star and spark light were removed from the slit-head and placed on an independent frame attached to the supporting tubes. The comparison apparatus was remodeled, the direction of the spark being made transverse to, instead of parallel with, the slit-jaws, and many other smaller details were carefully attended to.

After all known sources of error in the spectroscope itself had been overcome, and after it had been placed in thorough adjustment, it was found that test spectra of the standard-velocity stars occasionally gave values differing by as much as 3 km per second from those obtained by other observers. As the probable error of the mean of the measured lines did not exceed four-tenths of a kilometer, and ...s all the other known causes of systematic error had been overcome, it seemed probable that this might be due to unsymmetrical distribution of the star light over the collimator and camera lenses. Evidently such unsymmetrical distribution can cause a displacement of the lines only when the camera is not in exact focus. The camera was always carefully focused by a modification of Newall's method, which readily detec displacements of the sensitive surface from the focal plane of less than 0.05 mm in a focal length of 375 mm. But as the plates are supported only at the ends of the plate-holders, differences in the curvature of the glass may easily cause differences of o, 1 mm or more in the position of the center of the sensitive surface, where all measurements are made. n the case of a displacement of o. 1 mm from the focus, a distribution of the star light on the collimator objective so that its center of intensity is 5 mm to one side of the axis, is sufficient to cause a displacement of the spectral line $a_{2,5}^{3} \times \frac{1}{10} = \frac{1}{2} \frac{1}{50}$ mm equivalent to a velocity of 1.8 km per second.

An examination of the illumination pattern on the collimator lens, both visual and photographic showed how easily such or even greater displacements of the center of intensity could occur even with the utmost care in guiding. The illumination could never be made uniform, no matter how the relative positions of slit and correctinglens were altered. The pattern was either a diametrical bar parallel to the slit of a width about one-third or one-fourth the aperture, or else such a bar with the addition of a peripheral ring; while a very slight movement of the slit-jaws to one side or other was sufficient to cause

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