A DEMONSTRATION FABRY-PEROT INTERFEROMETER

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AN opinion is held that "it is possible to demonstrate the action of high resolution equipment only to a narrow circle of observers."[1]

It is shown in practice that if one utilizes glass plates PI (used for checking gauge blocks) or PM (used for checking micrometers)* then it is possible without any great difficulty to prepare in a brief interval of time a Fabry-Perot etalon. If for the light source one utilizes a ShRD (SVDSh) quartz mercury lamp of 500—1000 watts, then the interference pattern is capable of being observed by a large auditorium. Two such etalons have been prepared in the physics demonstration room of Tomsk University in 1962.

The plates for this piece of equipment are silvered on their working side by evaporation in vacuo. The layer should be translucent and should appear bluish by transmitted light when held facing a window, and it must not be very dense. If it is possible it would be well to apply a multilayer dielectric coating with a reflection coefficient of ~ 91% designed, for example, for $\lambda = 5461$ Å. But the first method is more easily accessible, and is sufficiently good for a demonstration piece of equipment.

The frame for this piece of equipment is machined from a piece of thick-wall tube or a rod in accordance with Fig. 1. On the lower ring projection three points of support (for example, bolts) are arranged at equal distances and the lower glass plate is placed upon

*PI and PM plates can be obtained from the Ministry of Higher and Secondary Education, U.S.S.R., for optico-mechanical apparatus. They are used in any large metal working factory.

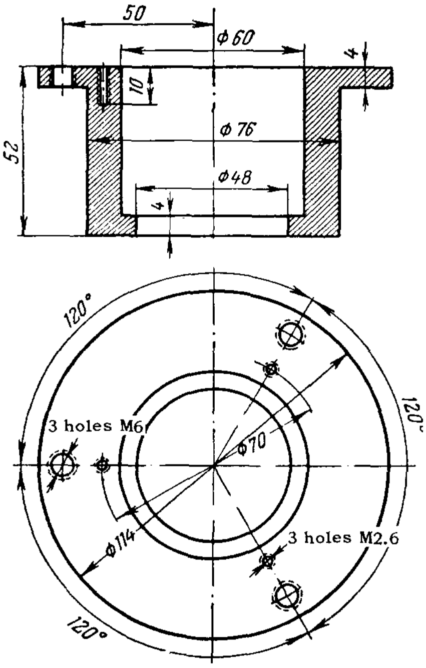

FIG. 1

them. An intermediate ring is placed on its silvered surface. It is made of a thin metallic ring to which there are soldered three identical ball bearing spheres. It is useful to prepare three rings for gaps of ~ 1, 2, 3 mm. The silvered surface of the second glass plate is placed on the intermediate ring. From the top it is pressed down by three steel plates, with ball bearings soldered to their ends, by means of screws as shown in Figs. 1 and 2. In the process of assembly the steel plates are annealed at those points at which they are to be drilled.

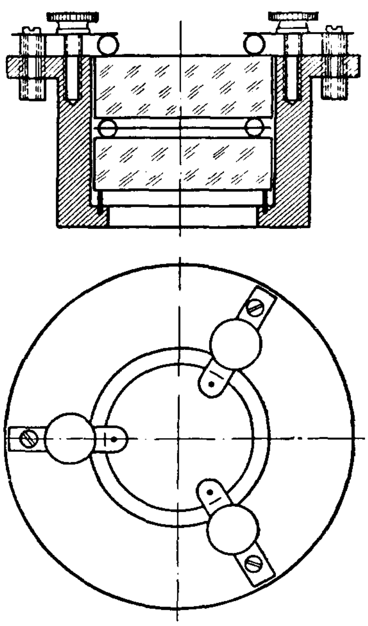

FIG. 2

In order to adjust the apparatus a mercury lamp PRK is utilized. In order to obtain narrow spectral lines it is energized by an induction coil. A ring is clamped to a stand above the lamp, and the etalon is placed on the ring. By looking at the plates with an eye accommodated to infinity one can see a system of rings. The adjustment consists of requiring that the diameter of the rings should not vary as the eye is moved. If as the eye is moved new rings appear from the center then the gap between the glass plates increases in that direction. By pressing with the screw it is possible to produce a plane parallel gap. If appreciable pressure is required then one must decrease the diameter of that ball bearing in the intermediate ring which is situated under the given portion of the plate. In order to achieve this it should be rubbed several times, for example, against a smooth wooden surface.

When the apparatus has been adjusted the demonstration can be begun. In order to do this a ShRD (CVDSh) mercury lamp is placed into a case with a cooling fan. The light from the lamp is focussed by an ordinary condensing lens on the gap between the glass plates.* In order to collect the parallel beams emerging from the interferometer and forming curves of equal inclination a long focus lens or mirror is utilized. As is well known[2,3], the diameter of the rings in this case is proportional to the square of the focal distance. Figure 3 shows a photograph of the interference pattern obtained with a spherical mirror with F = 2 m.

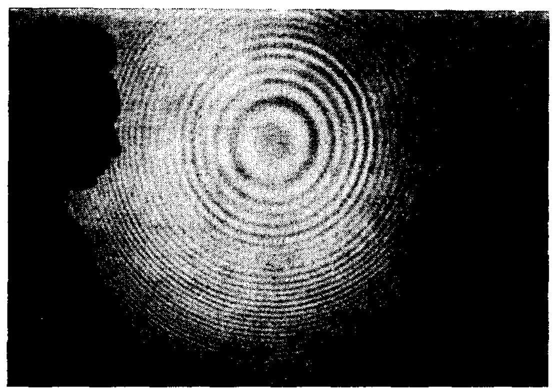

FIG. 3

In order to obtain small gaps of the order of tenths of a millimeter for which the interference pattern is particularly bright and on a large scale, it is convenient to utilize pieces of a razor blade placed in a single layer or in several layers.

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*Since the interferometer is operated in a converging beam, the working surface covers only a small portion of the plates. Therefore, even if during adjustment the family of rings showed certain defects due to the imperfections in the polishing of the surfaces, this might have no appreciable effect on the demonstration.

[1] W. Pohl, Einführung in die Optik, Springer, Berlin, 1948.

[2] F. A. Korolev, Spektroskopiya vysokoĭ razreshayushcheĭ sily (High Resolution Spectroscopy) Moscow, Gostekhizdat, 1953.

[3] S. Tolansky, High Resolution Spectroscopy (Russian Transl.), Moscow, IL, 1955.

Translated by G. Volkoff