

A high state of surface cleanliness is of considerable importance in optical work. When lenses and prisms were mounted in their instruments (especially when the latter were sealed and made airtight) it is of primary importance that the glass surfaces should be perfectly clean. Not only does this reduce loss of light, but a surface free from contamination remains clean for a longer period.

It has already been known that some 4 to 7 per cent of the incident light is lost by reflection at an air-glass surface.

If therefore, the glass surfaces are not thoroughly clean, an additional 5 per cent, or more might be lost at each surface, with the result that double the amount given would be lost, representing a transmission of only about one-third of the incident light in the case of a prismatic binocular, for example.

This emphasizes the importance of having really clean surfaces in optical devices.

The first step in cleaning optical work is to free the surfaces from any trace of grease.

This is best done by immersing the glass in a caustic potash solution or by well swabbing the surface with benzene. It should then be washed thoroughly with soap and water (the natural oil from the fingers must not come near the surface, and it is advisable, therefore, to wear rubber gloves).

Rinsing in distilled water should then be carried out and the surface wiped with a clean (well-washed) linen cloth. A light swabbing with a 50 per cent, nitric acid solution should be given and the surface again rinsed. Finally, the surface should be wiped with alcohol and dry off with another piece of well-laundered linen.

It has been suggested that the last operation in the cleaning process should be to rub the surface firmly with a piece of freshly cut elder pith.

Test for a Clean Surface—Breath Figure.

If there is any contamination of glass surface left by the cleaning process it may be tested by breathing gently on the surface, for in the case the breath will condense in tiny droplets of water which will be seen as a film on the surface. But should the surface be really clean, the water vapor will condense in such minute and uniform drops that the film will be quite invisible, and gives the impression that the breath will not “take” to the surface.

When optical parts are mounted in instruments which are sealed up in order to ward off the effects of weather, etc., the surfaces sometimes become “cloudy” or “filmed” even though they may have been thoroughly cleaned previously. (This is best detected by looking at a source of light through the instrument in the reverse direction to which it is used.)

Some of the causes of this “filming” of surfaces are as follows:

1. Condensation caused by change of temperature and humidity.
2. Lubricant in the instrument giving off volatile constituents which condense on the surfaces.
3. Instruments with aluminum bodies giving off water vapor held in the pores of the metal.
4. Imperfect cleaning of the glass surfaces (i.e. some contamination which causes nuclei for the condensation of moisture).
5. Instability of the glass itself.

In certain cases, the “filming” has been prevented by immersing the glass in a solution containing 50 per cent alcohol, 45 per cent distilled water and 5 per cent nitric acid for about half an hour prior to cleaning.

