# Diamond Fluorescence.

By Arthur L. Foley.

[Abstract.]

Some three or four years since, I had occasion to cut a large number of photographic dry plates to smaller sizes. They were cut in the usual way with a diamond, and on the side of the plate opposite the film. In developing it was noticed that the film, to a breadth of a few millimeters along the edge of the plate, turned dark, as if exposed to light.

Several possible explanations suggested themselves:

1. The breaking of the glass might produce momentary fluorescence and a fogging of the film near the break.

2. The breaking or tearing of the film might result in some sort of change in its character.

3. The scratching of the diamond might set up mechanical disturbances or vibrations in the glass and these might affect the film.

4. The friction between the diamond and the glass might cause a momentary fluorescence along the line traced by the diamond, and the radiation might penetrate the glass and fog the film on the other side.
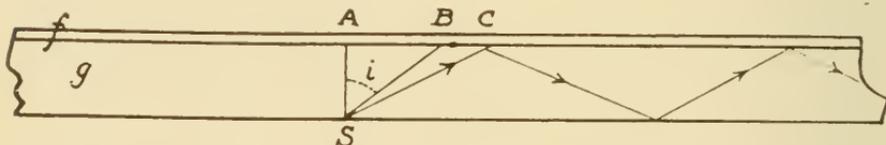
The last is the true explanation.

The first and second suggested explanations were thrown aside at once, for the dark line in the film was found to appear along the diamond-scratched line, whether the plate was broken or not. That the third explanation was not the true one was shown in several ways. The breadth and intensity of the dark lines did not appear to depend upon the depth of the cut or the rapidity with which it was made. The line was always of the same breadth on the same plate, but of different breadths on different plates. Moreover, the film always developed first on the side next the glass, which would not have been the case had the effect been due to any sort of strain or mechanical disturbance. The effect was noticeable on the most rapid plates only. Seed's "Gilt Edge" were used in most cases.

Let f represent the film on a section of the glass plate g, perpendicular to the diamond scratch s. Let us regard s as a source of radiation.

All rays (as s c) lying outside the critical angle i are totally reflected and hence do not affect the film. Those having an incident angle less than i penetrate the film and fog it if they are of sufficient intensity. The breadth of the fogged line is therefore—

$$b = 2\ \overline{AB} = 2\ t.\ \tan.\ i.$$

where t is the thickness of the glass plate and i is the critical angle for glass and the film substance.

Taking the indices of refraction of glass and gelatine for violet light, it was found that the equation is correct to within the degree of accuracy with which the various measurements could be made.

It was thought that the light produced by the friction of the diamond and glass might be sufficient to affect the eye. Nothing could be seen when the experiment was tried, although the observers had taken the precaution of staying in an absolutely dark room for an hour to render the eye as sensitive as possible. But this does not prove that no light resulted from the friction. A very feeble light would be sufficient to fog the plate when coming from a point so near the film. Besides, the fluorescence might have consisted of waves too short to affect the eye. In the formula I used the indices of refraction of violet light in order to obtain the value of the critical angle. For shorter waves the indices would be different, but their ratio probably would not be greatly different from the value used.

Later experiments have shown that fluorescence does not always occur when a diamond is drawn across a dry plate. I am not yet ready to say whether it is due to differences in different diamonds, to differences in the nature of the glass, or to changes in temperature, electrification, etc. I hope to be able to report more definitely at a future meeting.