(1) The internal diameter of the tube should be $\frac{1}{4}$–$\frac{3}{8}$ in. (6–9 mm.) and constricted at the distal end to a hole of diameter about $\frac{1}{8}$ in. (3 mm.)[1]. A smaller tube will be subject to air locks: a larger tube is unnecessary and is liable to spontaneous emptying.

(2) The connexion of the tube to the bottle must be air-tight. The slightest leak will cause the bottle to empty spontaneously.

(3) The bottle must not be too large: 500 c.c. is about the limit. An increase in the volume of air inside the bottle will lead to expulsion of water, and there are several ways (apart from leakages around the bung) in which this can happen when the animal is not drinking: (*a*) An increase in temperature of 1° C. will cause an increase in volume of approximately 0·3 per cent, that is, 0·3 c.c. for every 100 c.c. of air in the bottle. (*b*) A fall in atmospheric pressure of 0·1 in. (2·5 mm.) mercury will cause a similar increase of volume; neither of these results in serious leakage normally. (*c*) Shaking the bottle; movement of the bottle may cause the volume of water expelled to exceed the volume of air admitted: a further volume of air will then be drawn into the bottle, and the process may be repeated until the bottle is empty.

Leakage from any of these causes depends on the increase in volume of the air in the bottle being greater than the drop of water which can hang on the end of the tube: if the drop does not fall off, a subsequent decrease in volume (such as will immediately follow an increase resulting from shaking) will draw the drop back into the tube, provided the drop covers the aperture in the end of the tube.

Drop-size depends on a number of factors, the most important of which are the material comprising the tube, and the shape of its extremity. Glass has been found to carry a larger drop than other materials, metal being the least satisfactory; while a small terminal expansion can increase the drop-size considerably.

If the tube, instead of being vertical, is at an oblique angle (as frequently happens when the bottle is held outside the cage) the drop of water will not cover a centrally placed aperture. It is necessary, therefore, to make the terminal aperture at the most dependent part of the tube, so that contraction of the air inside the bottle will suck back the drop of water, rather than air (which may lead to spontaneous emptying).

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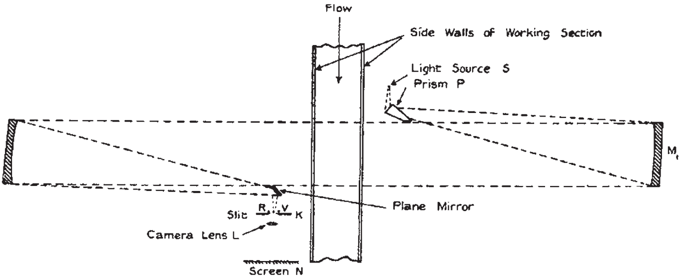
[1] Short, D. J., and Parkes, A. S., *Nature*, **163**, 292 (1949).

A *Schlieren* Apparatus giving an Image in Colour

At the last two annual exhibitions of the Royal Photographic Society, we have shown colour transparencies of the high-speed flow past aerofoils. In accounts in *Nature* of both exhibitions[1], the method used in taking these photographs is erroneously described as employing polarized light. This leads us to suppose that the technique is not widely known. It is simple, and has been found to be particularly useful for visual observations of the flow in a high-speed wind tunnel.

The arrangement is such that, when the density in the working section is uniform, the image is uniformly coloured and evenly illuminated; when there is a density gradient the corresponding part of the image changes colour. Thus, with a typical arrangement the background is yellow and the images of shock waves appear red and those of expansions green. The apparatus is shown in the accompanying diagram. A source of white light S is placed at the focus of a spherical mirror M_1 behind a constant-deviation dispersion prism P. The parallel beam of light from M_1 passes through the working section and on to a second spherical mirror M_2, which produces an image of the source in its focal plane K.



The image of the source thus formed consists of a series of coloured bands, and a slit placed in the focal plane is adjusted to cut off all the light apart from that of a particular colour. A camera lens L placed behind the slit is then used to produce an image of the working section on a screen N. When the density gradient in the working section is uniform, the image on the screen is monochromatic and uniformly illuminated. But, when the density gradient in some part of the working section differs from that in the surrounding field, the corresponding image of the source shifts relative to the slit and the corresponding part of the image on the screen changes colour. The differential refraction effect due to the differing wave-lengths being negligible compared with the overall refraction of the beam, the operation of the apparatus is analogous to that of a Toepler arrangement, except that the image on the screen is one of different colours instead of one of light and shade.

The method has the advantages over the Toepler method that the illumination is in no part of the field so low that the eye becomes insensitive, and that the eye is, in general, more sensitive to changes of hue than to changes of illumination.

It is possible that the method could be used quantitatively by moving the slit across until a particular colour disappears from a point in the image on the screen, and thus determining the displacement of the corresponding image of the source in the focal plane K of M_2.

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[1] *Nature*, **166**, 645 (1950); **168**, 689 (1951).