

SOME NOTES ON UNDERGROUND PHOTOGRAPHY

by

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In this article the writer describes his equipment and technique for underground photography.

Part I is a description of the basic equipment. Part II describes techniques developed to improve the quality of underground photographs. Part III describes the design of a photo-electric slave flash.

Part I

The basic equipment consists of camera, flash gun and bulbs, and film. A piece of rag on which to clean the hands is very useful.

The equipment is best carried in an ex. government ammunition box, which has a rubber seal inside the lid and is completely waterproof. The size of box required obviously depends on the size of the camera. For a small 35 mm. camera (not reflex) a box measuring approximately 255 x 85 x 170 mm. high inside can be obtained. A slightly smaller box is often available but this is rather too small for many cameras. It is worth while lining all the inside surfaces of the box with plastic foam 10 mm. thick. The foam can be stuck in place with Evostick adhesive. The plastic foam enables the camera case to be dispensed with, with consequent reduction of handling when taking a photograph.

Virtually any 35 mm. camera is suitable for underground photography and with this format a lens of 35-40 mm. focal length is generally considered ideal. The medium-short focal length gives a wide angle view and considerable depth of field. The camera shutter should be synchronised for flash and a plug connection is more versatile than the modern 'hot shoe'.

Recently certain cameras have become available where the guide number for the flash bulb and film combination can be pre-set. After the setting has been made, adjustment of the focus automatically sets the camera iris to the correct aperture for the flash. The writer has found one example of this type of mechanism to be very satisfactory in practice.

A compact flash gun is desirable. The modern cube flash is very good, but the "hot shoe" connection very common with this type of gun should be avoided. A cable connection a few inches long to allow positioning of the gun a little distance from the camera is ideal.

With regard to flash bulbs it is useful to know that PF1B and PF5B fit into the same gun and so the intensity of illumination can be varied by selection of the bulb. The PF5B gives rather more than twice the light of the PF1B, and if a high shutter speed is used with M synchronisation (for example to reduce the effect of unavoidable camera shake) the advantage of the PF5B is greater (4x at 1/250 sec.).

For colour transparencies the medium speed films (e.g. Ektrachrome X - 64ASA: Agfacolor - 50ASA) give good results. A high speed film can be an embarrassment when photographing relatively close up since it may not be possible to close the camera iris sufficiently.

Part II

Several problems are encountered when using the simple technique of a flash gun mounted on the camera:

- a) The foreground tends to be over-exposed and the distance too dark.
- b) The lighting is shadowless owing to the close proximity of the flash gun to the camera lens, and this type of lighting gives poor delineation of the subject.
- c) Fog which is nearly always present in the air underground in the presence of cavers scatters the intense light passing in front of the camera lens back into the camera, making the photograph more foggy than would have been anticipated.

It is possible to overcome these troubles without an excessive amount of equipment. Firstly a bracket to hold the flash some distance from the camera lens is useful (12 inches is quite a help). Such brackets can be purchased from photographic dealers, but if one makes one's own it can be tailored to fit the ammunition box in which the camera is carried. It is useful to make the bracket so that the flash will swivel towards the camera for stowing in the box and away from the camera for use. The flash gun may be left plugged into the camera, which cuts down handling. Also the camera and flash may be handled by the bracket instead of directly and this helps to keep mud off the camera and flash gun. The flash bracket improves pictures considerably, particularly in foggy conditions, and facilitates handling. Secondly, a flash more remote from the camera is more effective in obviating the fog near the lens problem and producing better lighting of the subject. Such a flash can be used on its own and set off by an assistant while the camera shutter is held open on B setting. In such cases the distance of the flash to the subject (not the camera to subject) should be used for exposure calculations.

Better lighting can be obtained by using two (or more) flashes. One is placed near the camera, say on the bracket, to illuminate the foreground, and another flash more remote is used to illuminate the more distant part of the picture. When using two flashes it is necessary either to mount the camera on a tripod so that the flashes might be let off at different moments in time

without camera movement inbetween, or to synchronise the two flash guns to operate together. A flash extension lead and junction plug may be used for this purpose.

However, in many caves and mines conditions do not favour carrying a tripod, and extension leads with their small plugs are unreliable in wet and muddy conditions. To overcome these problems a photo-electric slave flash has been developed. The slave flash is actuated by light from the camera flash. A photo-electric cell triggers an electronic circuit to set off the remote flash very shortly after the camera flash. In practice an exposure time of $1/25$ sec. with X synchronisation has been found long enough to accommodate the two successive flashes.

For the slave to operate, direct light from the camera flash must fall on the photo cell.

Two flashes can be used in a variety of ways. In a large chamber the second flash can be used merely to supplement the camera flash, or to pick out an important area. In a tunnel the second flash can be used to show the shape of the tunnel and its length. A technique which works well in tunnel situations is to use a small bulb (e.g. PF1B) on the camera flash and a large one (e.g. PF5B) on the slave. The slave is held by an assistant a few yards in front of the camera. The exposure is calculated ignoring the camera flash. The result is a photograph with the sides of the tunnel near the camera dark, but showing detail; the centre part of the picture is well illuminated and the shape of the tunnel clearly shown. This technique yields very effective pictures since the camera flash, being relatively weak, causes very little fogging, and the dark surround to the picture concentrates the eye on the central region.

Part III

The slave flash to be described was designed for use underground with the minimum of operations. There is therefore no on/off switch and the circuit will not operate in daylight or strong electric light. In the dark the current drain is negligible. When the slave is not being used the battery can be conserved by a piece of black plastic insulating tape stuck over the photo cell. The slave has been tested successfully at distances up to 30 yards.

The conventional capacitor discharge system for firing the flash bulb has been incorporated in the circuit which was assembled inside a Kodak 35 mm. film cassette container. A hole was made in the plastic lid of the container, and the photo cell was secured behind the hole. The transistors, diode, and thyristor, R_2 and R_3 were assembled on a small piece of veroboard C_1 and R_1 were kept separate since these may be varied to adjust the sensitivity of the circuit. The battery was connected into the circuit by soldering directly to the end plates. All electrical joints in

the circuit were soldered for reliability.

The two leads X Y were taken through the bottom of the film container to two copper contact strips fastened to a bakelite support to make a flash bulb holder. A reflector salvaged from a damaged hand torch was adapted by enlarging the central hole to accept a rubber grommet which pushed over the bakelite bulb holder. The reflector is readily detached for stowing in the ammunition box.

Notes on the Plates

1) Main Chamber Clayton Mine, Ecton.

In this photograph the slave flash is held by the figure on the left to illuminate the more distant part of the chamber. PF5B bulbs were used on both slave and camera flash.

2) Water Level Aldort.

From a photographic point of view this tunnel presents quite a difficult situation. There was nowhere dry to put apparatus down so the camera box had to be floated in the water while the picture was taken. There was the ever present tendency to 'fog' which is typical of wet or poorly ventilated places. A PF1B bulb was used on the camera flash to give reasonable but not intense illumination of the near passage. The figure can be seen holding the slave flash in which a PF5B bulb was used to provide the main lighting for the picture.

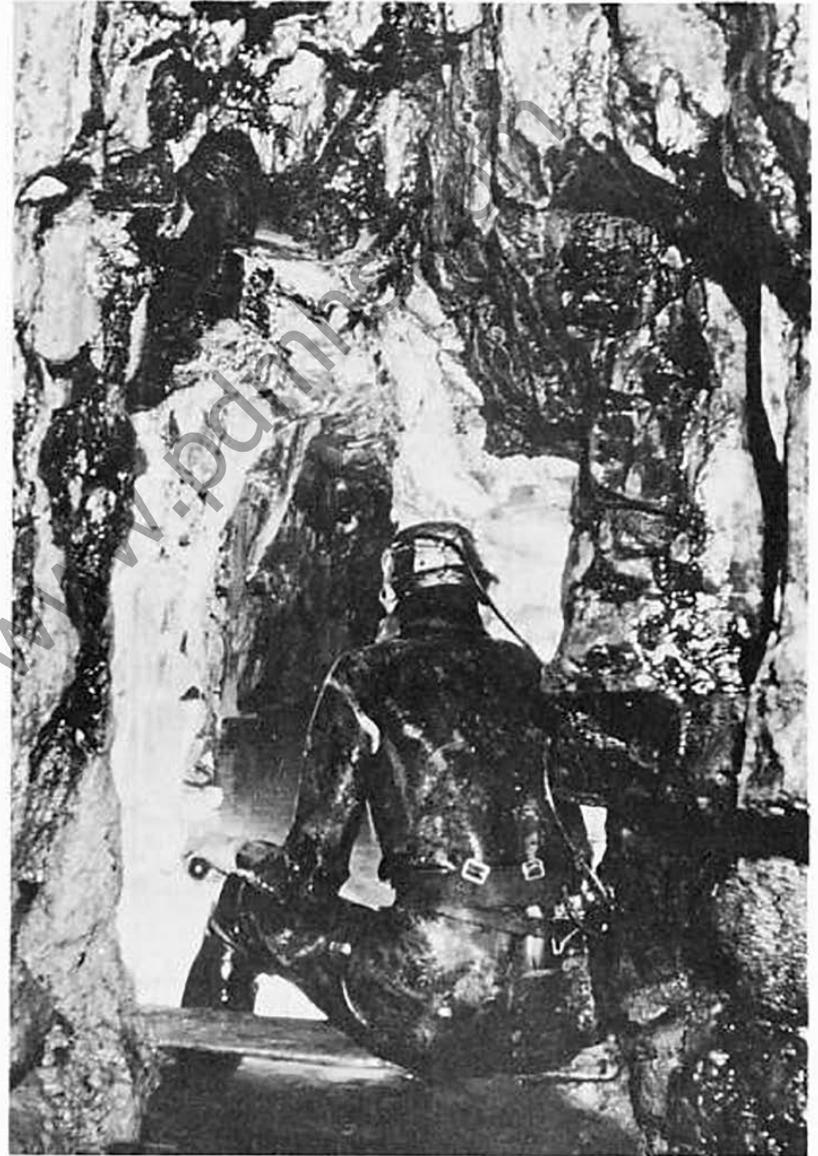
Both plates are reproduced from Ektachrome X Colour Transparencies.

Received 12th November 1971

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Main Chamber, Clayton Mine, Ecton



Water Level, Alport