Producing your own filmstrips

PULL-OUT SECTION: BY ROBERT TYABJI

This article describes how black-and-white filmstrips can be made by non-professionals working in remote areas under primitive conditions, and discusses the equipment and materials needed for this activity.

The filmstrip is a simple and relatively inexpensive way of transmitting visual information to many people simultaneously. It has great potential as an aid for developmental and motivational communication because it combines the advantages of modern projected media with an element of vital personal contact between the communicator and his audience. If produced locally so as to feature familiar faces, sights, problems and areas of interest, filmstrips have a tremendous advantage over external, centrally-produced materials.

A technique to simplify localised production of filmstrips has been developed by the author during the course of his work in communications at UNICEF in New Delhi, India. Called the UNICEF Filmstrip Production Kit, it reduces filmstrip-making to a series of simple, do-it-yourself operations.

The technique is appropriate to the needs of training institutions, developmental agencies and extension workers operating in backward, rural and remote areas. With it, they can photograph, develop, edit, print and project their own black and white filmstrips, without having to depend on outside professional services, or having access to a darkroom, complex photographic equipment, or even to mains electric power.

The idea for such a kit started growing in 1972 in the mind of Ken Nelson, then UNICEF's communications officer in India.

During a field trip, he was impressed by a village doctor who was using his hobby of photography in an imaginative way to involve the local community in producing a series of family planning skits, presented as a serialised slide show. Nelson reasoned that, given the means, other extension workers might well follow the doctor's example. From this evolved the idea of a simple photographic kit for field workers. To develop this into a practical production system it was necessary to experiment with different types of film, processing techniques and equipment configurations.

Requirements and parameters

Preliminary field trials with teachers and extension workers have made it clear that a viable photographic system would have to satisfy conflicting requirements and difficult design parameters:

a. the design has to take into account intangible factors such as user inhibitions, social restrictions, etc.;

b. mechanical simplicity is essential, but resort to the "you press the button" approach might be self-defeating because it would be likely to alienate the user from the technology;

c. given a reasonable amount of interest, initiative, patience and care from the user the system should

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Photo 1:
Filmstrips in the classroom. Balsevikas (pre-primary teachers) screening their filmstrip during an in-service training course at Gandhigram, Tamil Nadu

be capable of turning out filmstrips of acceptable photographic quality, with a high probability of success;

d. the system has to be self-contained in terms of equipment, and should include a projector capable of efficient operation even in unelectrified areas;

e. consumables for filmstrips need to be inexpensive and readily available at stationery and photographic stores in town markets; and

f. the system would have to ensure that organisational, logistical, operational and administrative costs of filmstrip production would be reasonable in terms of regional, district and block programme budgets.

The filmstrip making technique described below was evolved through a series of experiments, prototypes and field trials. Early experiments used the inherent advantages of vessicular reprographic film, which does not need chemicals for development and can be printed in the sun. The reprographic method was tested with science teachers and research staff of the Sri Avinashilingam Home Science College at Coimbatore, who produced filmstrips to augment their lectures, but was later abandoned because of difficulties in obtaining the special film. Thereafter, a different approach was tried with normal photographic film stock, using a rear-projection technique for printing. This was used, with very encouraging results, by government village level workers and block health personnel in Tamil Nadu and voluntary social, sanitary, agriculture, nutrition and education extension workers in Rajasthan.

Having found that normal negative film emulsions can be handled and processed quite easily in the field further refinements were made, mostly from the viewpoint of user convenience and image quality. Thereafter, front projection printing was adopted, after redesigning the projector copy stand. An improved version of the Kit was used at an international communication workshop at Lusaka, where it aroused some enthusiasm. Subsequently, twenty-two prototypes have been fabricated for field testing by grass-roots institutions and in various UNICEF-assisted programmes in India, and in several African countries also.

Photo 2: Learning to use the camera. Voluntary extension personnel at the Social Work and Research Centre, Tilonia, Rajasthan

Prototype production kit

The prototype Filmstrip Production Kit contains an automatic 35mm camera and flash (Fig. 1) a copy stand

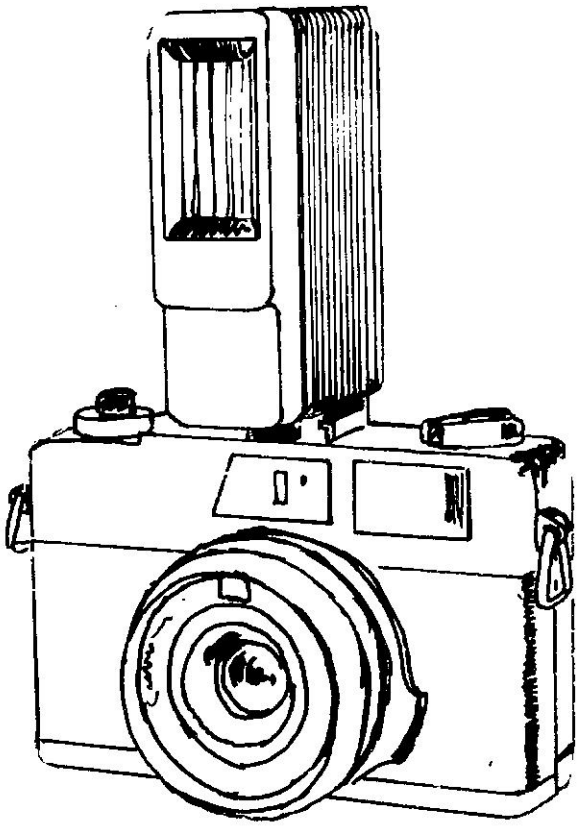

Figure 1: Camera and flash

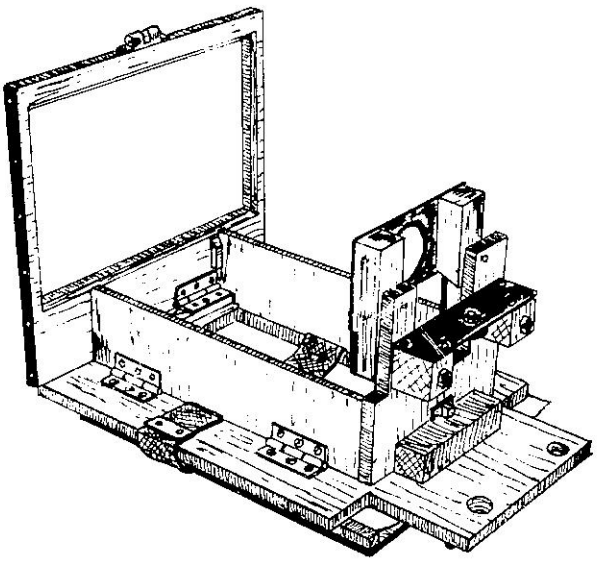

Figure 2: Copy stand

for close-up photography, copying and titling (Fig. 2), a day-light developing tank and special singlebath chemicals for film processing (Fig. 3), and a mains and battery-operated projector (Fig. 4). A package of films, chemicals and other expendable items is included in each kit initially. The projector is a separate unit with its own carrying case, which facilitates transportation from village to village.

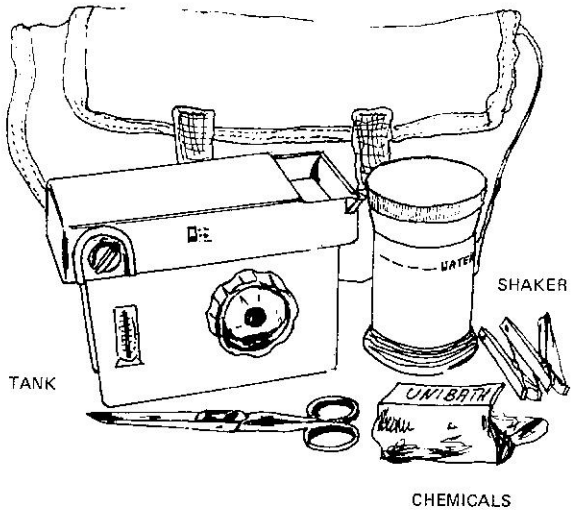

Figure 3: Developing kit

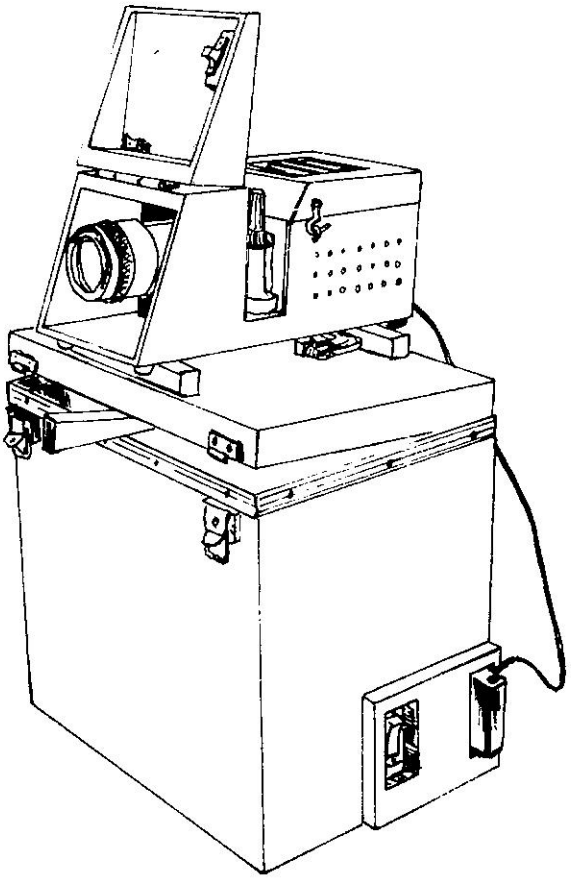

Figure 4: Projector and case. Projecting a filmstrip

Photo 3: A farmer in Rajasthan, India, taking photographs

Photo 4: Washing a negative

Photo 5: Hanging up a developed film for drying

Briefly, making a filmstrip involves the following steps:

1. Prepare rough storyboard and shot list for proposed filmstrip.

2. Photograph desired subjects (Photo 3).

3. Process exposed film. (The developing tank of the kit can be loaded in broad daylight). For extreme simplicity, use the specially-developed "one-shot" monobath developing powder. Normal processing is possible with conventional packaged chemicals (Photos 4 and 5).

4. Cut developed negative film into individual frames and mount them in standard 35mm slide mounts (Photos 6 and 7).

5. Edit negative slides by projecting them, choosing the best, and arranging them in desired order. Store selected negatives in transparent plastic slide folders (Photo 8).

6. Print the filmstrip by projecting the negatives in the desired sequence, using the projector which forms part of the kit, on a paper screen attached

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Photo 6: Balsevikas in Gandhigram, Tamil Nadu editing a filmstrip.

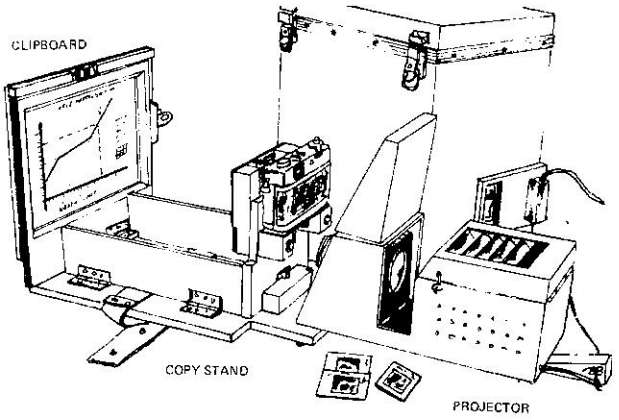


Figure 5: Printing a filmstrip. Camera, copy stand, clipboard with paper screen and projector combine into an optical printer

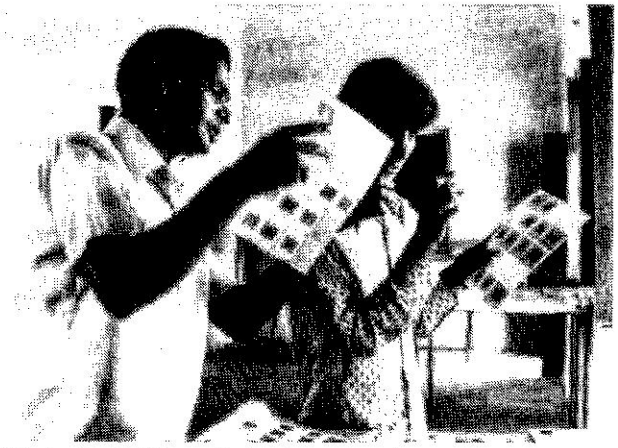


Photo 7: Editing. Selecting negatives for a proposed filmstrip

Photo 9: Developing a filmstrip at the well in Rajasthan, India

Photo 8: Negatives are edited, then stored in plastic folders. From these masters, many filmstrips can be printed

Photo 10: Projecting a teacher-made filmstrip in Gandhigram

to the copy stand, and photographing the projected images one after the other. Superimpose subtitles and other graphic notations on any desired frame by writing them on the paper screen (Fig. 5).

7. Process this roll of film. The result is a positive filmstrip (Photo 9).

8. Take the projector, with carrying case and built-in AC power pack and DC cable, to the village or classroom and project filmstrip before audience (Photos 10 and 11).

Photo 11: Village level worker projecting his filmstrip before rural audience

Cost and availability

The cost is estimated on the basis of custom assembly of prototype kits from off-the-shelf components and sub-assemblies sold by manufacturers as spare parts for other equipment. A kit containing a camera, flash, developing tank, copy stand and projector, costs about US$300. Making an original filmstrip costs the equivalent of three 36-exposure rolls of black and white negative film, plus paper, chemicals, slide mounts and other expendables amount to about US$5.00. Each filmstrip copy amounts to about one dollar.

A number of Filmstrip Production Kits have been assembled for UNICEF on an experimental basis by Dynam Engineering Corporation, 6 Haudin Road, Bangalore, 560 042, India. It is anticipated that more kits will be manufactured in the near future. This will provide an opportunity for individuals and organisations to experiment with the medium and find new and better uses for it.

TECHNICAL ASPECTS

Close-up photography with the copy stand, flash and reflector

It is possible to take sharp, evenly lit pictures of small objects, and to photograph maps, charts, diagrams, title cards and pages from books and magazines, by using the camera in conjunction with the copy stand, flash unit and reflector. A lens has been permanently attached to the copy stand so that one does not have to remember to attach and detach a close-up lens every time. The copy stand is constructed of wood to facilitate repair by local craftsmen, but a sleeker, lightweight version can be fabricated from sheet metal, or moulded in plastic. The copy-

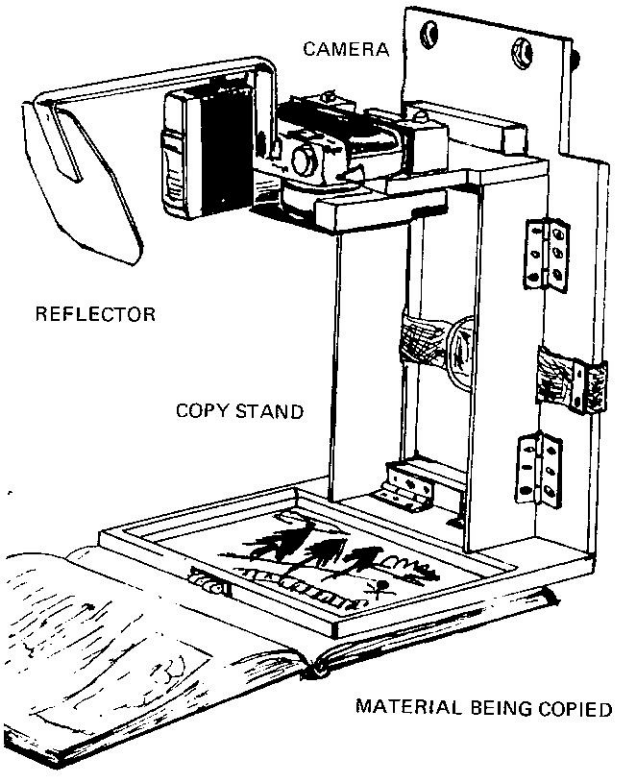


Figure 6: Photographing a page from a book (close-up photography)

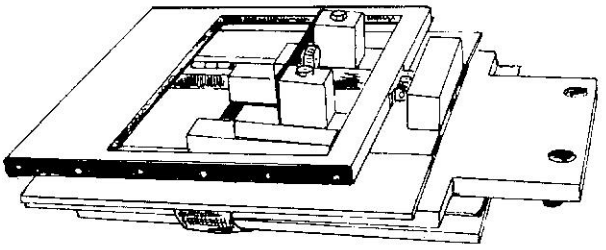


Figure 7: Copystand, folded

stand can be used vertically and horizontally, and is hinged to fold flat for storage (Figs. 6 and 7).

A special reflector is used to bounce and diffuse light from the electronic flash so that the subject is illuminated evenly. The flash attaches to a hot shoe on the reflector bracket, which has integral electrical connections (Fig. 8). The reflector itself attaches to the hot

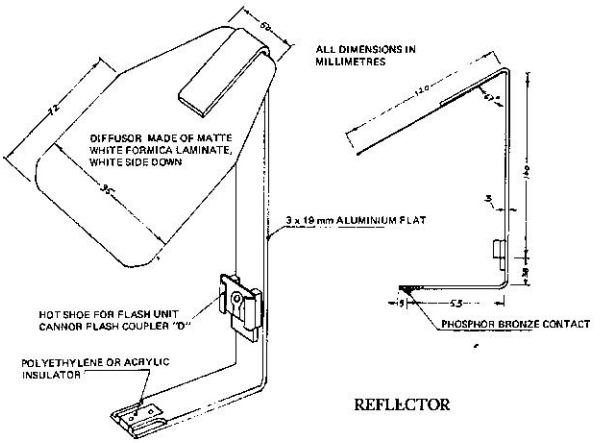


Figure 8: Dimensions of reflector

shoe of the camera. Do-it-yourself readers may find figures 8 and 9 helpful when experimenting with copy stands and subject lighting.

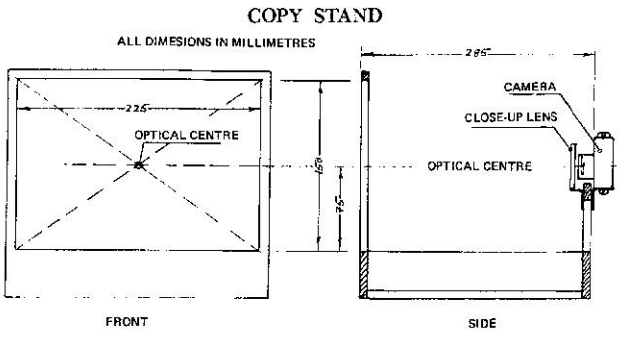


Figure 9: Important dimensions of copy stand

Film processing

This can be done wherever there is fresh water, and a safe means of disposing of small quantities of spent photographic chemicals. The Kit contains a daylight developing tank, a plastic shaker bottle, scissors, clips and string for hanging wet film, and packets of "one-shot" monobath developing powder (Fig. 3).

Briefly, film processing entails the following steps:

i. load film in developing tank;

ii. pour developing powder from a packet into shaker bottle, and add water to the mark (250 cc). For proper development, the temperature of water should be between 24-27°C. (check with the tank's built-in thermometer). In India, ground water maintains a fairly stable temperature despite climatological variations, so well water can be generally relied upon to yield acceptable results;

iii. shake bottle to dissolve powder, then pour solution into tank and agitate. In 10 minutes, the film is developed, fixed and cleared; and

iv. discard used solution and wash film in fresh water. Remove film from tank and hang up to dry.

Conventional chemicals packaged by Kodak, Agfa and others can also be used, but it will be necessary to follow established procedures for control of solution temperature and developing time, and a separate fix bath will be needed.

Monobath developer develops the film to completion and simultaneously fixes it. Density and contrast of the developed image are determined by developer-fixer ratio, developer activity and concentration, bath Ph, and bath temperature. It is possible to formulate monobath developers of known concentration to obtain specific image density and contrast values. The bath temperature, therefore, is the variable that must be controlled every time a film is developed.

Monobath can be packaged in powder form but must be packed in two separate parts. Part A is the activator and Part B the developer-fixer, and both must be used every time a roll of film is developed. The following two formulations have been tested successfully:

Formula 1 (per 250 cc water)

PART A	
Sodium hydroxide (pellets)	0.6 gms.
PART B	
Hypo crystals	100-165 gms.
Phenidone	5.0 gms.
Hydroquinone	18.0 gms.
Sodium sulphite	75.0 gms.

Formula 2 (per 250 cc water)

PART A	
Sodium sulphite	9.0 gms.
Paraformaldehyde*	0.6 gms.
PART B	
Sodium thiosulphate anhydrous	5.0 gms.
Phenidone	0.5 gms.
Hydroquinone	2.0 gms.
Benzotriazole	0.05 gms.

*Use if paraformaldehyde pack was properly sealed. If yours is a humid climate, formulate in an air conditioned room.

Note: Handle chemicals with care and wash hands thoroughly afterwards. Keep them away from children.

Seal the packet carefully against moisture, and store away from strong light. The formulations provide a gain in film speed of approximately x 2.5, which must be taken into account when the film is exposed. Excellent negative density and total gradation is possible, the average gamma being 0.86 at 25°C.

Printing the filmstrip positive

For this operation the camera, copystand and projector are combined, building-block fashion, into an optical printer (Photo 12). The projector is placed behind the copy stand. It projects an image through a window located below the camera bracket. The projected image is focussed on a sheet of white paper attached to the copy stand frame, when photographed and developed, a positive image results. A succession of positive images is recorded on the camera film by progressively photographing the image of each negative slide. Exposure is regulated automatically by the camera's exposure control system.

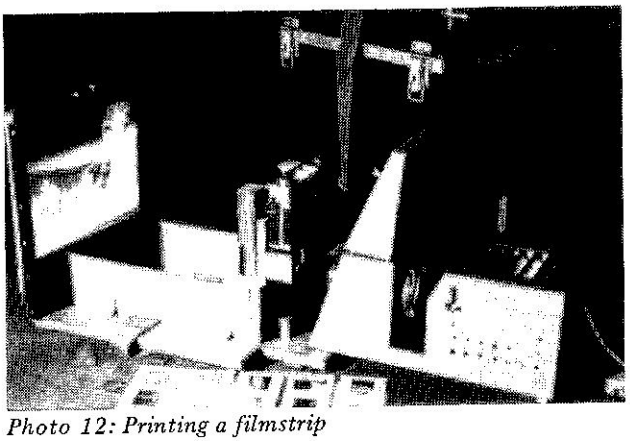


Photo 12: Printing a filmstrip

Sub-titles

Because filmstrips are printed by optical means, it is easy to super-impose additional optical information such as sub-titles and other kinds of graphic notation on any (or all) filmstrip frames. A sub-title, for example, is added to a particular frame in the following manner ... (a) project negative on screen of copy stand; (b) with a black felt-tipped pen, write sub-title on paper screen at an appropriate place within frame area; and (c) photograph projected image along with sub-title. The sub-title will appear clear (white) when the filmstrip is projected.

Slide and filmstrip projector

The projector has two functions, (1) to project negative slides on the copy stand for printing filmstrip positives, and (2) to project filmstrips on a large screen to an audience.

Function No. 1 – Projection for printing

Figure 10 illustrates the relationship between the projector, copy stand and camera when printing a filmstrip. The following should be noted:

a. projector to screen distance (throw) is 350 mm for an image width of 225 mm. Therefore, a projection lens of 50 mm focal length is required;

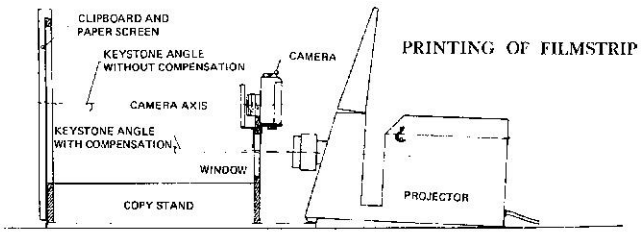
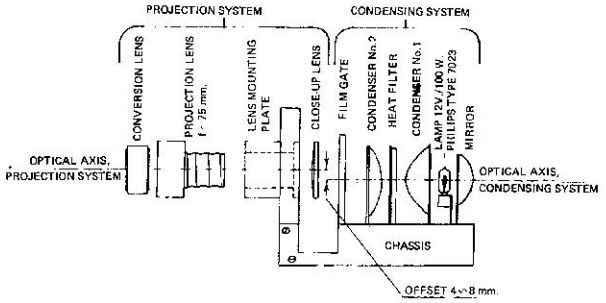


Figure 10: Relationship between components for printing

b. because of parallax between the optical axes of the camera and projector, it is necessary to tilt the projector upwards towards the screen. This causes keystone distortion and uneven focus due to unequal projection distances at the top and bottom of the screen;

Most of the distortion can be attenuated to an acceptable level by offsetting the projection lens with respect to the optical axis of object slide and condenser lens system (Fig. 11). Raising the projection lens by 4-8 mm reduces the tilt angle of the projector, but calls for use of a projection lens capable of covering 2 x 2 super slides;



PROJECTOR OPTICS

Figure 11: Projector optical system, showing offset between projection lens and condenser lens optical axes

c. short throw and keystoning combine to throw portions of the image out of focus. Consequently, the depth of focus should be increased by stopping the lens down to about f 4;

d. because of the above, a high-intensity light source is needed to produce a screen brightness of 10 ft. candles (with a neutral grey slide in the gate), which is the minimum required for the camera's exposure system to respond, at a film speed setting of 320 ASA;

e. the projector must operate in unelectrified areas also, so a low voltage lamp that can be connected to a battery is needed. Further, the lamp would have to be convection cooled. Therefore, it should be as small and as efficient as possible. A 12-volt, 100-watt quartz halogen lamp is satisfactory for this purpose (Photo 13); and

f. because of the foregoing, it is preferable to use high-speed film, in the 400 ASA range. In India, however, it is easier to buy film rated at 125-160 ASA, which may be too slow if a particularly dense negative is to be printed. The monobath developer has been formulated to compensate for this by providing an effective film speed gain of x 2.5.

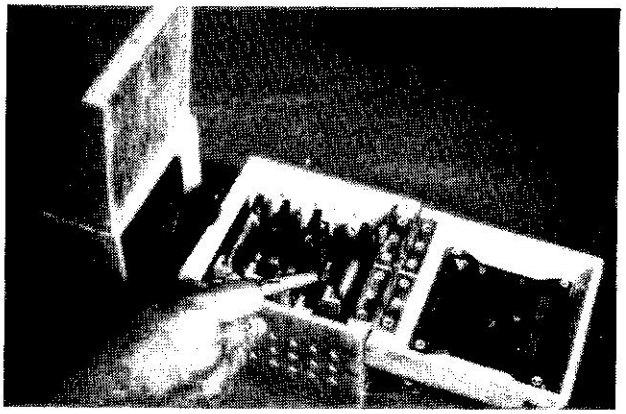


Photo 13: Inside the projector. Battery operation is possible because of 12 volt, 100 watt lamp, and convection cooling

Function No. 2 – Filmstrip projection

For the projection of filmstrips before an audience the longer throw calls for a projection lens of about 100 mm focal length.

Practical considerations

Because different focal lengths are required for printing and for filmstrip projection, two separate projection lenses are needed. Excellent results have been obtained with 50mm and 135mm Nikkor camera lenses, and these are recommended for those who can afford them.

An inexpensive but workable alternative is to use a Minolta Rokkor 75 mm projection lens with a Minolta close-up lens permanently installed behind it, and a Minnolta reversible conversion lens in the front. This projection system is illustrated in Figure 11. Effective focal lengths of 55mm (with the conversion lens screwed in one way), and 80mm with the conversion lens reversed for projection, are obtained.

The lampholder, mirror and condensing system for the prototypes are Carousel projector spares obtainable from Kodak AG, Stuttgart, West Germany.

Photo 14: Explaining a filmstrip to a village audience in Tilonia, Rajasthan

Off-the-shelf Components and Materials for Filmstrip Production Kit

Item	Model No. and important specifications	Quantity	Approximate Value In US$
1. 35 mm Electronic exposure camera	Canonet-28, or equivalent with 40 mm lens	1	80.00
2. Electronic flash	Automatic, Canonlite-D or equivalent	1	
3. Close-up lens for copystand and projector lens system	MINOLTA close-up lens for Autopak-8, 52N 0.5-0.4m, Code # 6316-570	2	10.00
4. Projection lens	Minolta Rokkor 1:2.5 f=75mm lens for slide 300 projector	1	15.00
5. Conversion lens	Minolta conversion lens for slide 300 projector x 0.8 and x 1.25, Code # 3604	1	18.00
6. Filmstrip carrier	Minolta, Code # 8523-200	1	10.00
7. Projection lamp	Quartz-halogen, 100W/12 volt type 7023	1	4.00
8. Mirror with plate and adjuster	Kodak part No. 6003304	1	
9. Condenser lens No. 1	6033554	1	
10. Condenser lens No. 2	6003504	1	
11. Heat filter	6003524	1	
12. Lampholder assembly consisting of:			
12.1 Lampholder	6023381	1	
12.2 Adjusting lever	6023450	1	
12.3 Lamp plate	6003350	1	30.00
12.4 Spring plate	4496400	1	
12.5 Axle	6003480	1	
12.6 Circlip	4499740	2	
12.7 Washer	4469900	1	
12.8 Spring	6003460	1	
12.9 Screw	6003470	1	
12.10 Toothed washer	4499540	2	
12.11 Screw	4260110	2	
13. Hot shoe for reflector	Canon Flash Coupler-D	1	3.00
14. Developing tank	Agfa Rondinax 35-U	1	16.00
15. Transformer for projector, installed in carrying case	110/220 volt primary, 12-volt 8 amps. secondary	1	10.00
16. Wooden copystand (without close-up lens) clipboard, reflector and 2-ring binder for negative slides		1 set	15.00
17. Scissors, developer measuring jar, aluminium clips and canvas carrying bag		1 set	5.00
18. Projector chassis, lens plate and wooden shell (without lenses)		1 set	15.00
19. Carrying case for projector, with fittings		1	20.00
20. Heavy duty battery cable for DC operation with battery clips, connector and switch		1	10.00
21. Wooden kit box		1	8.00
	Unit Cost of Components	US$	269.00
		or say US$	300.00

Material Required For 10 Original Filmstrips

1. 35mm film	Black & white, negative, Plus-X or equivalent 125-160 ASA	30 rolls	20.00
2. Slide mounts	For 35mm slides, can be of cardboard, plastic or metal	600 each	10.00
3. Chemicals	Monobath developer packets	30 pkts.	5.00
4. Slide folders	Plastic, transparent	20	10.00
5. Paper, felt-tipped pens, batteries for flash unit, etc.			5.00
	Direct Material Cost for 10 Filmstrips	US$	50.00