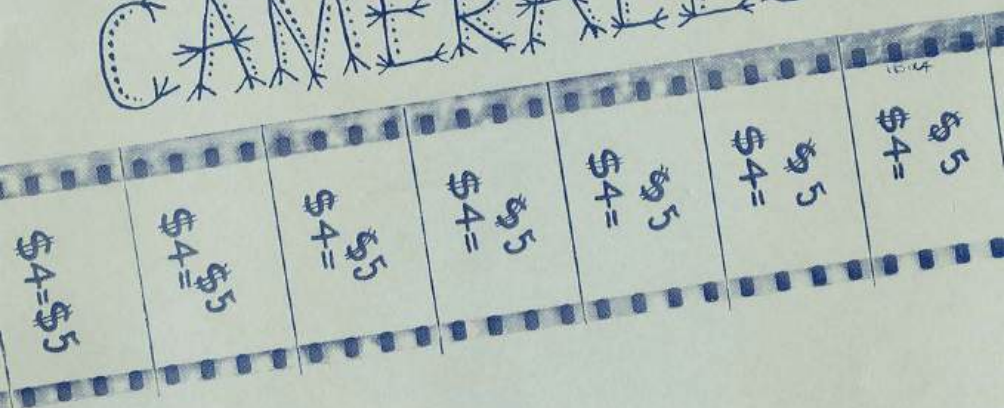
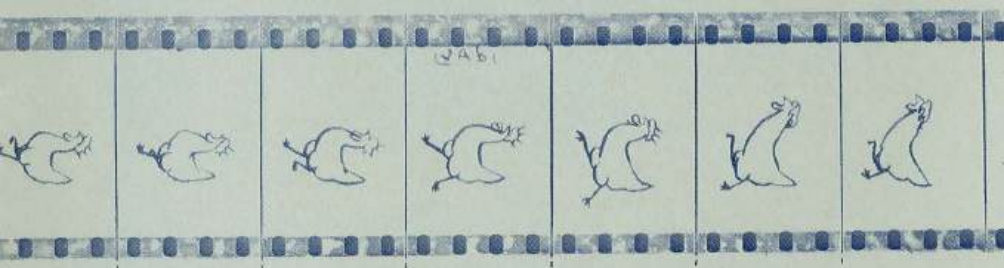


CAMERALESS



ANIMATION



A technique developed at the National
Film Board of Canada by Norman McLaren

CAMERALESS ANIMATION

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1. How to Make Animated Movies without a Camera

-- by *Norman McLaren*

(Reprinted from *Fundamental Education: A Quarterly Bulletin*, Vol. 1, No. 4, October 1949 - published by UNESCO.)

2. Design of Optical Device for Free-hand Animation

HOW TO MAKE ANIMATED MOVIES WITHOUT A CAMERA

NORMAN McLAREN

Things needed:

1. *A chair*

for the artist to sit on.



2. *A table*

for the artist to sit at.



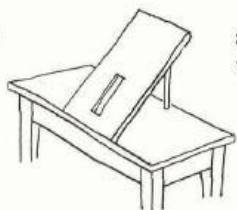
3. *A board*

fixed securely on the table at an angle to allow the artist comfort while drawing.



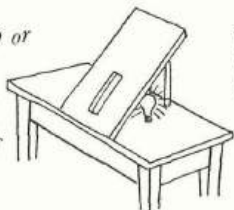
4. *A hole*

about 2" by 10" (50 mm. $\times$ 250 mm.) cut in the board to let light through from behind.



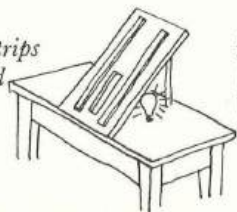
5. *A lamp or mirror or even a wide sheet of white card*

to place on the table behind the hole, to give illumination or to reflect skylight or daylight through the hole.



6. *Two strips of wood*

for fixing vertically onto the board about 3 1/2" (90 mm.) apart, thus making a channel on the board above the hole.



The film holder:

7. *A piece of wood*

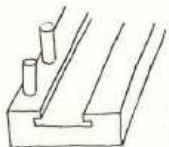
about 3 1/2" by 21" (90 mm. × 533 mm.), to slide smoothly up and down in the channel.

8. *A row of pegs along one side of the piece of wood*



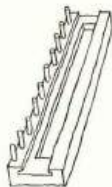
so that the artist's free hand can easily push the wood up the channel a little at a time, while he is drawing frames of film. The pegs should be on the left hand side for the right-handed artist, and on the right hand side for the left-handed artist.

9. *A groove*



along the entire length of this piece of wood to hold the 35 mm. film. The groove must be 35 mm. wide and have lips on either side to hold the film securely in place. The lips should overhang about 1/8th of an inch (3 mm.) and should not press on the edges of the film enough to prevent it being pulled through the groove.

10. *A hole*

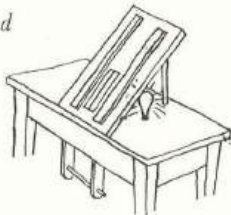


about 1" by 19" (25 mm. × 480 mm.) should be cut out of the centre of the groove to let the light through from behind.

11. *A piece of frosted or ground glass, or thick ground celluloid*

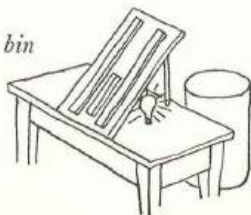
to be countersunk into this hole, so that the film held in the groove will have a solid but transparent support.

12. *A rod*



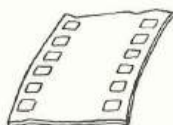
fixed *below* the table to carry 1000' (304 metres) roll of blank 35 mm. film for drawing on. The film will feed upwards between the artist's knees and into the groove in the film holder.

13. *A bin*



placed on the far side of the table from the artist to catch the film as it drops down from the top end of the channel. The drop should be sufficient to let the wet ink image drawn on the film dry before it hits the bottom of the bin.

14. *Film*



for drawing on. 35 mm. Machine leader, motion picture Safety film with negative perforations (Bell and Howell perforations). This is supplied in 1000' (304 metres) rolls by any large motion picture stock supplier. This film is quite clear and transparent, and is used for drawing directly upon with ink.

15. *Ink*



black waterproof India Ink. (Higgins' Ink of this sort is very satisfactory).

Care should be taken that the ink is opaque. The bottle of ink should be attached in a position convenient for the artist to dip into without too much movement.

16. *Pens*



any type of regular pen nib can be used. Various types can be employed for different thicknesses of line. For movie work stiff, rather than flexible, nibs are best, as it is easier to maintain a uniform thickness of line from frame to frame. For very fine lines, use Josef Gillott's crow-quill nibs, or a similar type.

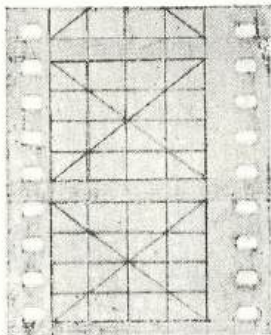
17. *Brushes*



can also be used; in the hands of a western artist they have not been as good as pens for movie work. This is because the forms made with them fluctuate too uncontrollably from frame to frame. However, in oriental hands, a brush may be even better than a pen.

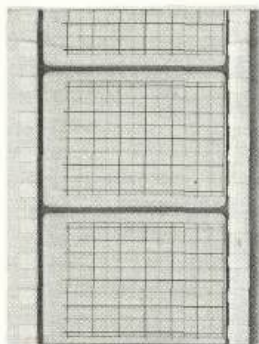
18. *Registration Strip*

(Hand made)



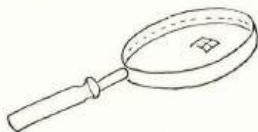
to make sure that the drawing on each frame of the movie film is in the same place. This registration strip is made by taking about 2' (608 mm.) of machine leader that the artist uses to draw on, and etching on it a grid system of lines. The grids should be clearly marked on each frame and the patterns should be identical. The sample herewith shows one such system of references lines. It indicates the sound track area on one side and the frame line area between the frames, leaving a rectangular area with diagonal lines which is the effective screen area for drawing on. For reference purposes while drawing, the frames should be numbered from 1 to 24, on the sound track area or on the film holder at the side of the registration strip.

18A. *Alternative
Registration Strip*
(Photographically made)



This can be made by filming with a movie camera 25 frames of a card with a grid drawn on it. Though this has the advantage of producing a perfectly identical pattern on each frame, it has one disadvantage. Due to the fact that movie film shrinks with age, the strip may become shrunken so that it does not fit the machine leader on which the artist is drawing, and errors of vertical placement will develop in the registration of each frame. This can be remedied by reshooting the registration card onto new film every few months, so that strips of varying degrees of shrunkenness are available. The artist then chooses one which will match the sprocket holes of the machine leader he is drawing on.

19. *A magnifying
glass*



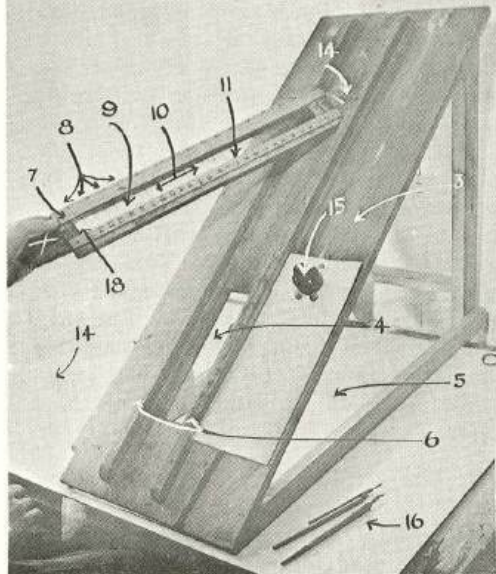
This is not absolutely essential, particularly for artists who are used to working close or on a small scale; but it is recommended, for not only does it increase the size of the image, but more important, it prevents extreme convergence of the eye-axes for long periods. The 'super-sight' magnifying glass on a jointed arm sold by the Boyer-Campbell Co. Detroit, Michigan, is excellent for this purpose. However, any large magnifying glass held on an arm will do.

20. *Before starting
to draw*

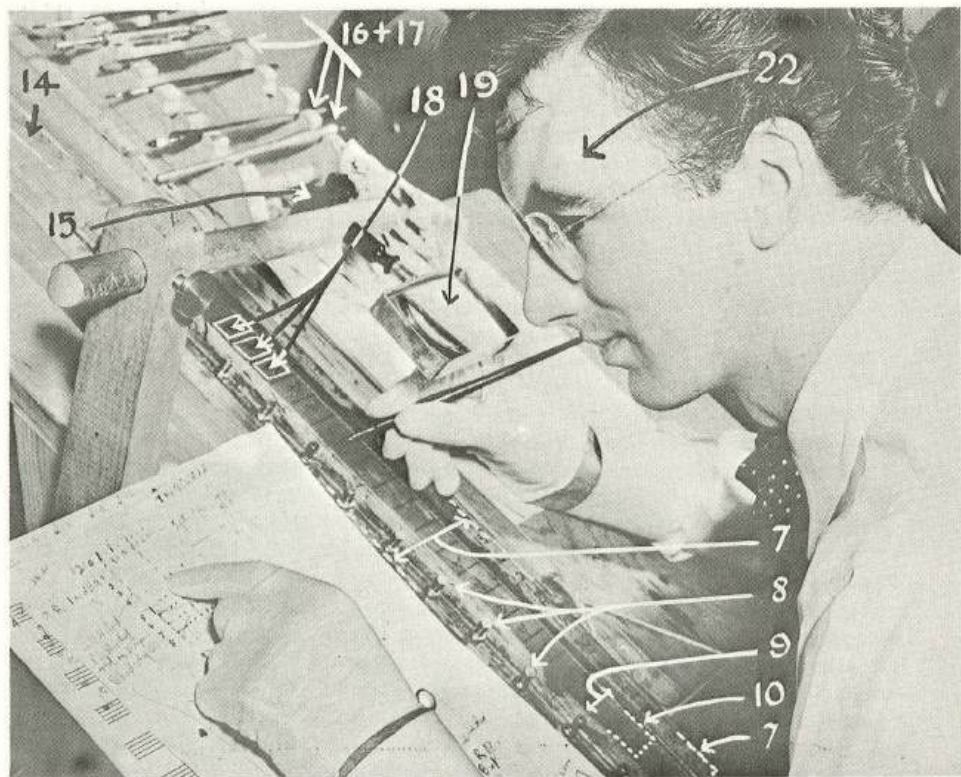
the artist should find the correct side of the film to draw on. He should make a few ink lines or blobs on both sides, wait until the ink is dry, and then try scratching or flaking the ink off. He should avoid the side which flakes off easily and draw only on the side which the ink clings to.

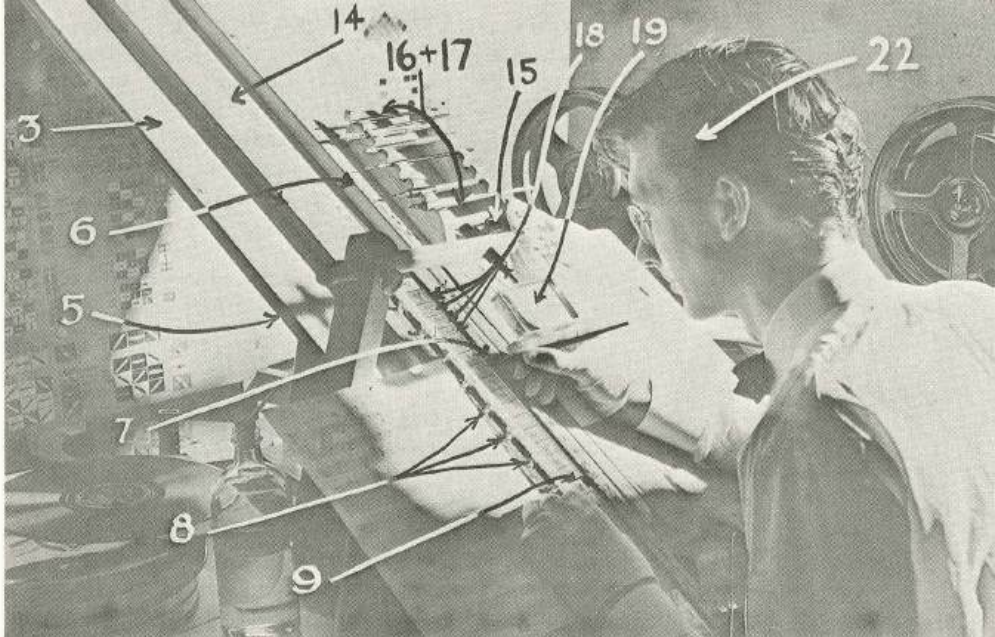
21. *The 24 frames*

of clear film above the registration strip are drawn at one time; starting from the top and working down, they represent one second of time. The artist then stops drawing and pulls the 24 frames of film up through the groove until the last frame drawn is at the top, and there is only clear film in the groove. He then starts drawing the next 24 frames. And so on. For animating purposes, it is often best not to complete each frame and then move on to the next, but rather to select the most important moving element and animate it first, over quite a long stretch of film. Then pull the film back



The camera brings together some of the separate items described so far.





and go through it again, this time drawing the second most vital element, and so on, until in the last run-through of the film, the artist only fills in the most static or unimportant details in each frame.

If mistakes are made they can be rubbed off the film with a damp cloth; the spot should be wiped dry before it is drawn on again.

Owing to the small scale of drawing, and the continuity in drawing one frame after the next, the artist can easily train himself to rely greatly on muscular memory in his hand to secure steady registration of the image from frame to frame, particularly if he does not stop between one frame and the next, but boldly draws as quickly as possible down the whole 24 frames at once. In this way he can vividly sense the movement which he is creating.

22. *The artist will find that*

the small scale on which he is working will force him to simplify all his shapes, images and symbols. This is a real advantage and it should be encouraged. It will force him to make his point primarily by means of the movement, action and gesture itself, and only to a very small extent to rely on static characteristics in his drawing. In this way he will turn out something that is cinematically interesting.

23. *Cleanliness*

is important, A pair of thin white cotton gloves will keep grease and dirt from the film. The ink will not cling to the film if there is grease on it. The room where the artist is working should be clean and dusted, especially the drawing table, and board, and the bin into which the finished film falls.

24. *The finished film that drops into the bin*

is the equivalent of an original picture negative in normal procedure. When finished it should be gently and carefully rolled up, and sent to a laboratory for a regular print. The print will have a white line image on a black ground (the opposite of the artist's original which was black line on a clear ground). Except for movement tests (which the artist may wish to make), the original should *never* be screened; only prints should be projected.

For Black and White release prints, either the white image on a black screen can be used or the black image on a white screen. In the latter case release prints are made, not from the original, but from the print from the original; in other words, the 'third generation' is used.

For Colour release prints there are many possibilities. The principle behind most of them, is that prints or dupes of the black and white original are used as separation negatives in any colour printing process that uses a separation process such as Cinecolor or Technicolor. 16 mm. Kodachrome prints can then be made by reduction from 25 mm. colour master.

For filmstrips in colour, the artist can paint with coloured transparent dyes or inks straight onto the original, and this can be reproduced onto 35 mm. Kodachrome release prints.

The above is the simplest and cheapest way to make animated movies, but there is a more accurate though more expensive gadget to replace the registration strip of the above method.

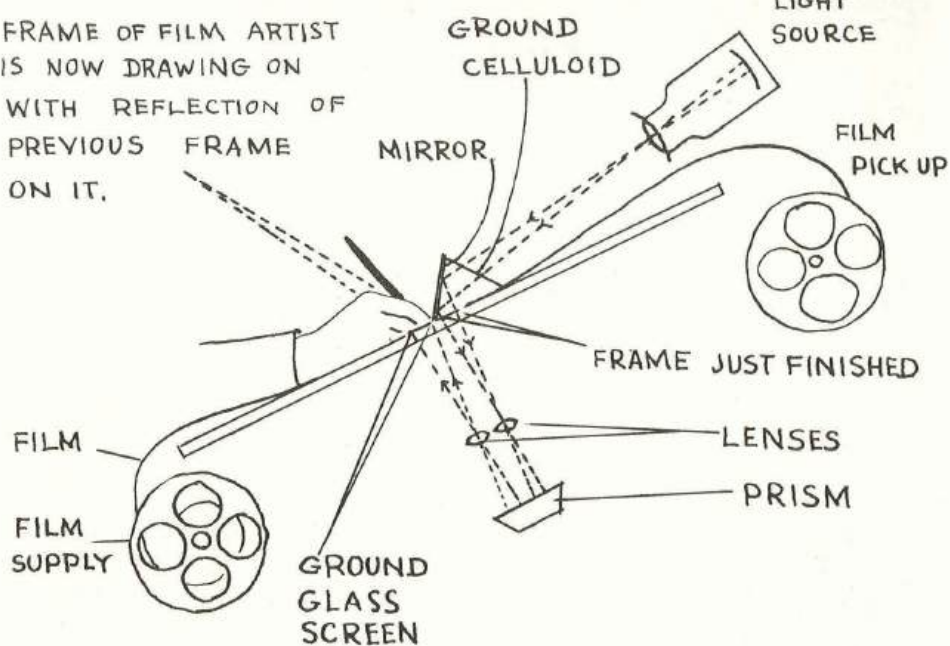
25. *Special optical device for registration*

The diagram shows an optical device which can be used for frame registration when making hand-drawn animation. This is an alternative method to the registration strip of 24 frames.

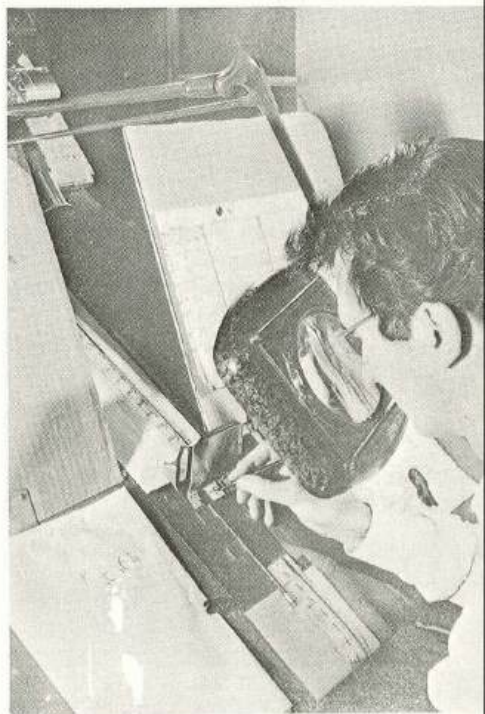
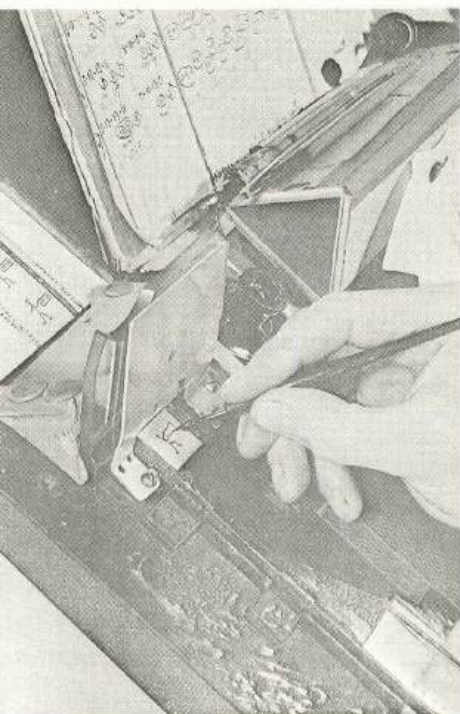
Its purpose is to throw a faint image of the frame just completed by the artist, onto the frame which he is about to draw.

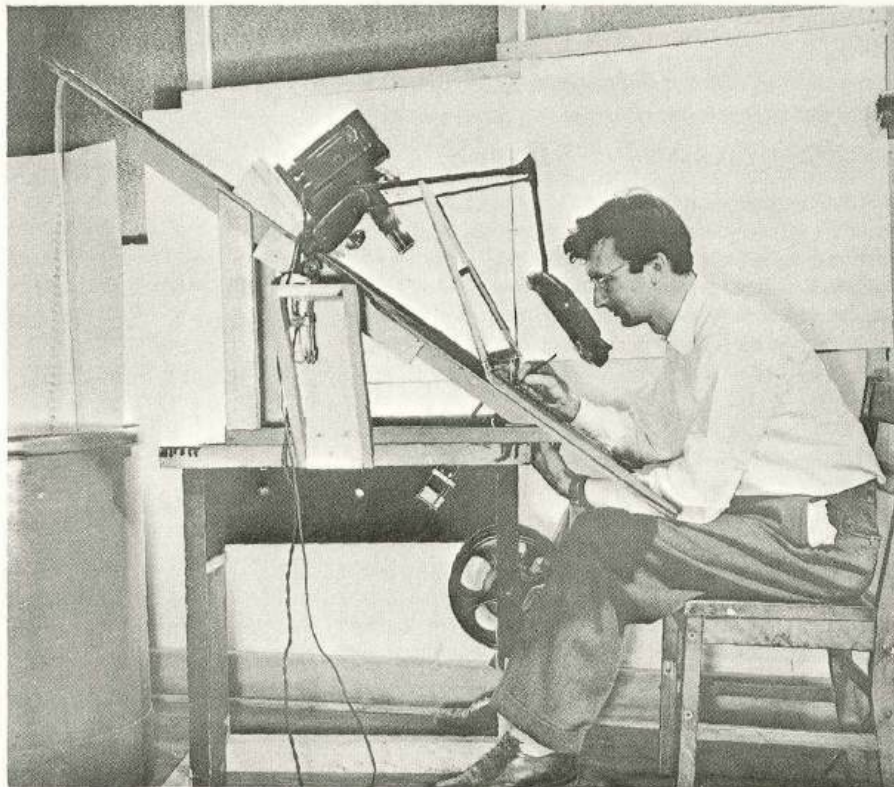
The film is held in an adapted camera-gate which, by the turning of a wheel, can move the film forward one frame at a time.

FRAME OF FILM ARTIST
IS NOW DRAWING ON
WITH REFLECTION OF
PREVIOUS FRAME
ON IT.



(See also over the page for photo, and Page 11 for details of design.)





HOW TO MAKE FILMSTRIPS WITHOUT A CAMERA

This is done by the same principle used in the making of cameraless animation. However, the process is very much simpler.

All that is needed is a device to hold the clear film in position and indicate the area of each frame while the artist is drawing. There are no problems of registration from frame to frame such as are found in animation. Each frame is treated separately.

The artist can use any types of transparent dyes (Craftint inks for painting on celluloid are recommended).

The hand-painted original can then be treated as a regular filmstrip negative and sent to a lab for printing.

DESIGN OF OPTICAL DEVICE FOR FREE-HAND ANIMATION

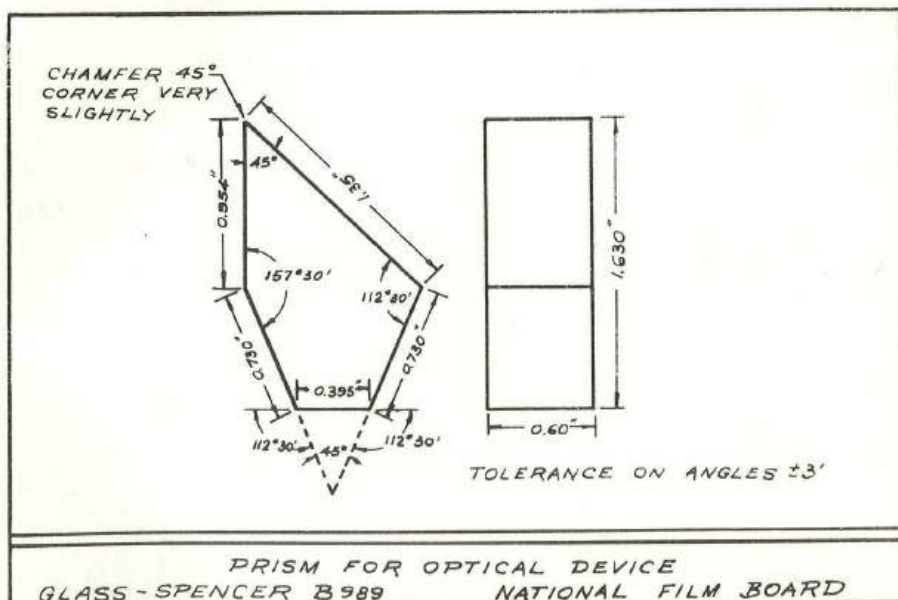
The following is a description of the design and construction of an optical device to cast an image of the picture drawn on one frame of 35mm film onto the adjacent frame without change in size or location of the picture.

The picture to be imaged is illuminated from above by a frosted 25-watt lamp enclosed in a lamp-house provided with holes for ventilation purposes and a suitable baffle to prevent the light from falling directly upon the adjacent frame where the image is formed and the succeeding picture drawn. The optical system consists of two lenses of equal focal length (2-inch), and a prism of a special design consisting of a penta and a 45° prism, but constructed as a single prism unit. The first lens forms an image of the completed picture within the prism and the second lens forms an image of this on a ground glass screen immediately underneath the frame where the drawing is taking place. The prism turns the light through 360° without inversion by means of reflections from three surfaces, while the second lens cancels the inversion caused by the first lens so that the final image is formed without change in location of the picture.

In order to obtain correct registration of the image with respect to the next frame, one lens is mounted in a tube on a small movable plate which may be adjusted sufficiently to allow the image to be centred with respect to the frame where the drawing is completed. The other lens is fixed in the horizontal plate and adjustments for correct magnification and focus are possible by moving the plate and lenses as a unit or, for smaller motions, the lenses may be moved with respect to their supporting plate. The prism is supported in a box on a lower plate with adjusting screws for correcting the tilt of the prism holding it firmly in position. These plates are fastened to the four supporting rods by means of small screws.

Whenever a drawing is completed, the film is shifted forward a single frame by means of the transport mechanism from an old type movie camera, which is operated by means of a foot treadle.

The device was constructed for the National Film Board by the National Research Council of Canada, in collaboration with Mr. McLaren.



NOTES

Information & Promotion Division, National Film Board of Canada, Montreal

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