TECHNICAL NOTE

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FILM HANDLING PROCEDURES FOR SKYLAB S-056 EXPERIMENT

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(NASA-CR-141487) FILM HANDLING PROCEDURES FOR SKYLAB S-056 EXPERIMENT (Technicolor Graphic Services, Inc.) 14 p HC $3.25 CSCL 14E

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FILM HANDLING PROCEDURES FOR SKYLAB S-056 EXPERIMENT

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and is approved.

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INTRODUCTION

In a simulation conducted August 28, 1972, two rolls of Type SO-212 film were rewound in the sensitometer darkroom preparatory to processing. The first roll contained approximately 500 feet of film exposed to a resolution target and was unloaded from a can. The second roll of 1000 feet, with about 600 feet advanced to the take-up side, was in a flight magazine. The downloading and rewinding of this second roll of film is described in detail.

PROCEDURES

The magazine, with cover plate in place, was set on the laminar flow table with the aperture facing the unloader, R. Light. In dim light all but four screws were disconnected from the magazine cover plate. The light was then turned off, and the aperture cover plate was removed and about 12 to 18 inches of film were manually advanced by turning the drive shaft with the thumb. The four remaining screws were disconnected with the Allen wrench, and the magazine cover was set aside. The film was cut by scissors within several inches of the drive sprocket. With all fingers of his right hand, the unloader grasped the outer perimeter of the loosely wound take-up roll (on his right side) and vertically lifted the film and core from the spindle of the magazine. When sufficient free room was available the left hand was moved under the roll of film, and it was passed to the rewinder in this horizontal position. It is recommended that the take-up roll be handled while in a horizontal position, because the very low tension on the take-up side results in very loose roll formation.

With due caution the rewinder places the roll on the supply spindle of the rewind machine. The film in the camera magazine is wound counter clockwise, emulsion side out, as viewed from the open side of the magazine. The take-up roll from the magazine is placed on the left rewind so that it unwinds counterclockwise (facing the rewind table) from the bottom of the roll. After splicing to an appropriate length of leader, the film is passed under the guide and to the right rewind where it is wound clockwise from the top, emulsion side in.

During the rewind operation the operator holds his left (gloved) hand lightly on the supply rewind to make certain that it is moving. With the thumb and forefinger of his right hand, he follows the edges of the film next to the take-up rewind. Supply side tension is set at

0.06 milliamps; this does not restrain the supply roll from turning while this loosely formed roll is rewound.

With only two brief interruptions while the rewinder changed the position of his feet, the 600 feet were rewound in 12 minutes. The average rate of film transport was 50 feet per minute. No electrical discharges (static) were observed during the course of the rewinding operation. At the completion of the rewind operation two sensitometric exposures using Tungsten(2850° K)and daylight(5500° K) sources were placed on the film. For this operation the rewinder held the film roll and passed the end of the film to the sensitometer operator. A short length of leader was spliced to the film followed by a sensitometric strip similar to the one described. The rewinder then canned and taped the roll for removal to the processor.

The film contained in the magazine had been transported in a hard vacuum over a period of time. The purpose of this test was to determine how the film behaved in the magazine in a vacuum which simulated flight conditions. The film was processed to a gamma greater than 2.0 in the Hi-Speed Processor using D-19 developer at 78°F. with a transport speed of 4.5 feet per minute. Development time was 7 1/2 minutes.

Inspection of the processed film revealed a regular pattern of low density spots which were felt to be caused by static. Microtome sections were taken from an area of this film and examined under a microscope. Because of the low density of these spots, it was necessary to take a thick section which resulted in great difficulty in focusing under the microscope. Figure 1 shows a typical microtome cross section. From a number of observations, it was concluded that the areas of density were concentrated at the surface of the emulsion.

A section of the film was placed in an enlarger and printed on high contrast paper with a short exposure to accentuate the spots. This print is shown in Figure 2. To ascertain whether these spots were caused primarily by the vacuum or by the film transport in the vacuum, a portion of the film remaining on the supply side of the magazine from the vacuum test was processed. This film showed a general absence of spots. A print was made from a section of this film using the procedure described above and is presented in Figure 3. The conclusion is that the spots are produced primarily in the film transport in the magazine.

Prior to rewinding the film from the magazine another roll of film was rewound (from a can) which contained approximately 500 feet of film exposed to a resolution target. This film was processed as described except for the developer temperature being 75°F. This caused no real change in the characteristic curve except that the minimum density areas were slightly lower. A section from this film was printed in a manner similar to Figures 2 and 3 and is shown in Figure 4. This film shows that it was transported in the magazine by the broad bands between the edge of the film and the sprocket holes. But it does not show the profusion of spots as evidenced in Figure 2 from the vacuum chamber test.

Interestingly, about 10 feet of this film from the resolution test experienced a misfunction whereby the film was exposed during transport. A section of this exposed film was printed and is shown in Figure 5. The film is advanced by ten pulses from a stepping motor and each one of the steps is imaged on the film. More important, each step produces a chatter or whiplash effect which results in one or even two "ghost" images from each of the pulses.

The "ghost" images from Figure 5 have a maximum displacement of about 0.4 mm, whereas the predominant spot size from Figure 2 appears to be just over 0.2 mm. (The paper enlargements are 5.0 X) Although there is no reason to believe there should be a relationship between spot size and chatter length, I would judge the chatter to be highly suspect in this rather unusual method of film transport.

We have previously developed about 100 feet of Type SO-212 film which was used for a framing test. A sample portion of this film was printed as Figure 6 in the manner of Figures 2 through 5. The optical density in the center of the image area is 0.61 $\pm$ 0.04 in the negative. In normal printing this would be reproduced as a medium gray rather than white. This is meant to reemphasize that these film strips have been underprinted to show the surface defects, many of which would disappear in more normal printing. Also, the static spots illustrated in Figure 2 are irregular from frame to frame and would be relatively impossible to remove by digital methods from microdensitometry.

The diameter of the image area in Figure 6 is about 17.4 mm. Present laboratory equipment would be able to convert these full images onto 16mm or 35mm film.

All processing of Type SO-212 film has been done with manual removal of the rem jet backing. We expect that the rem jet removal equipment will be in operation before the end of the month. Film from the resolution test will be used to determine the quantity and quality of reproductions that can be made from the film. Further evaluation of Kodak Film Cleaner (with lubricant) as a film coating is also planned.

FIGURE 2. Enlargement of processed Type SO-212 film from take-up spool of camera magazine after vacuum chamber test. A quantity of low density spots are visible.

FIGURE 3. Enlargement of processed Type SO-212 film from supply side of camera magazine after vacuum chamber test.

FIGURE 4. Enlargement of random section of Type SO-212 film from resolution target test.

FIGURE 5. Enlargement of section of Type SO-212 film from resolution target test. Images from the ten steps used to advance to the next frame are visible. Within each of the ten steps, "ghost" images may also be seen.

FIGURE 6. Enlargement of a section of Type SO-212 film from a framing test showing circular image area and row of dots for data block.

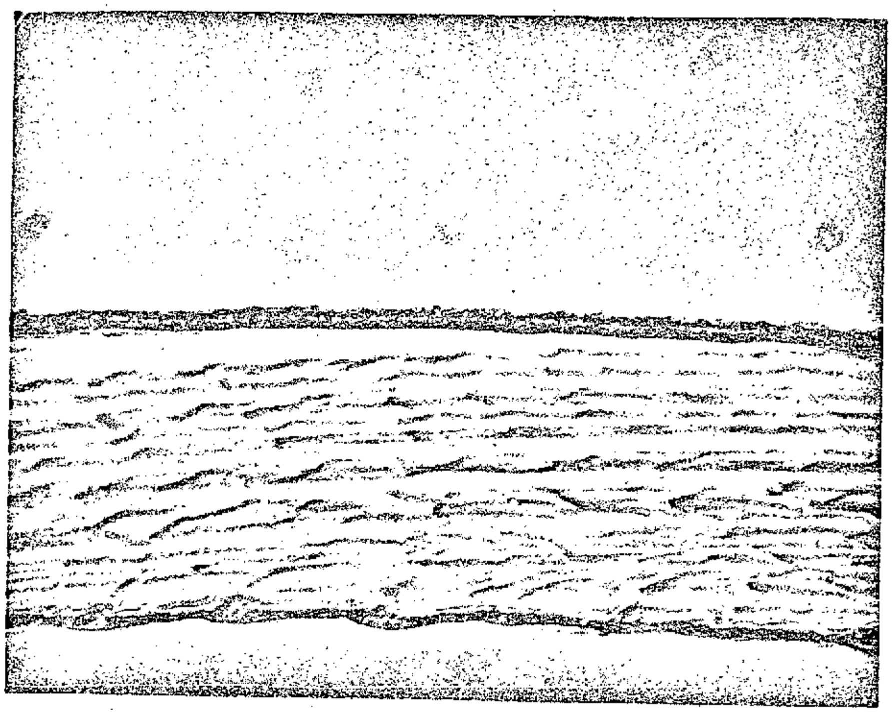

FIGURE 1. Microtome cross section of processed Type SO-212 film from vacuum chamber test. Areas of image density represent probable static marks from the transport mechanism.

FIGURE 2

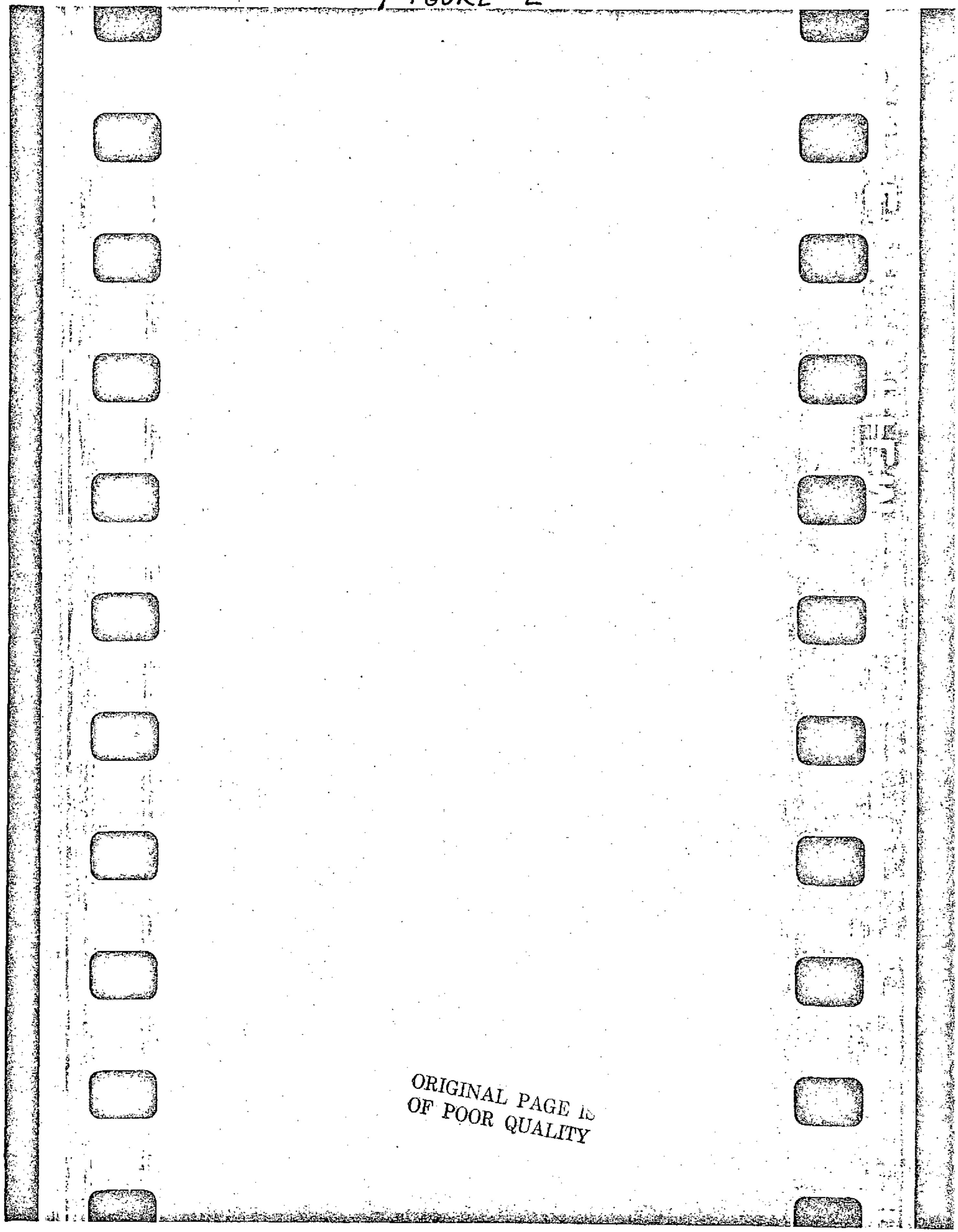

FIGURE 3

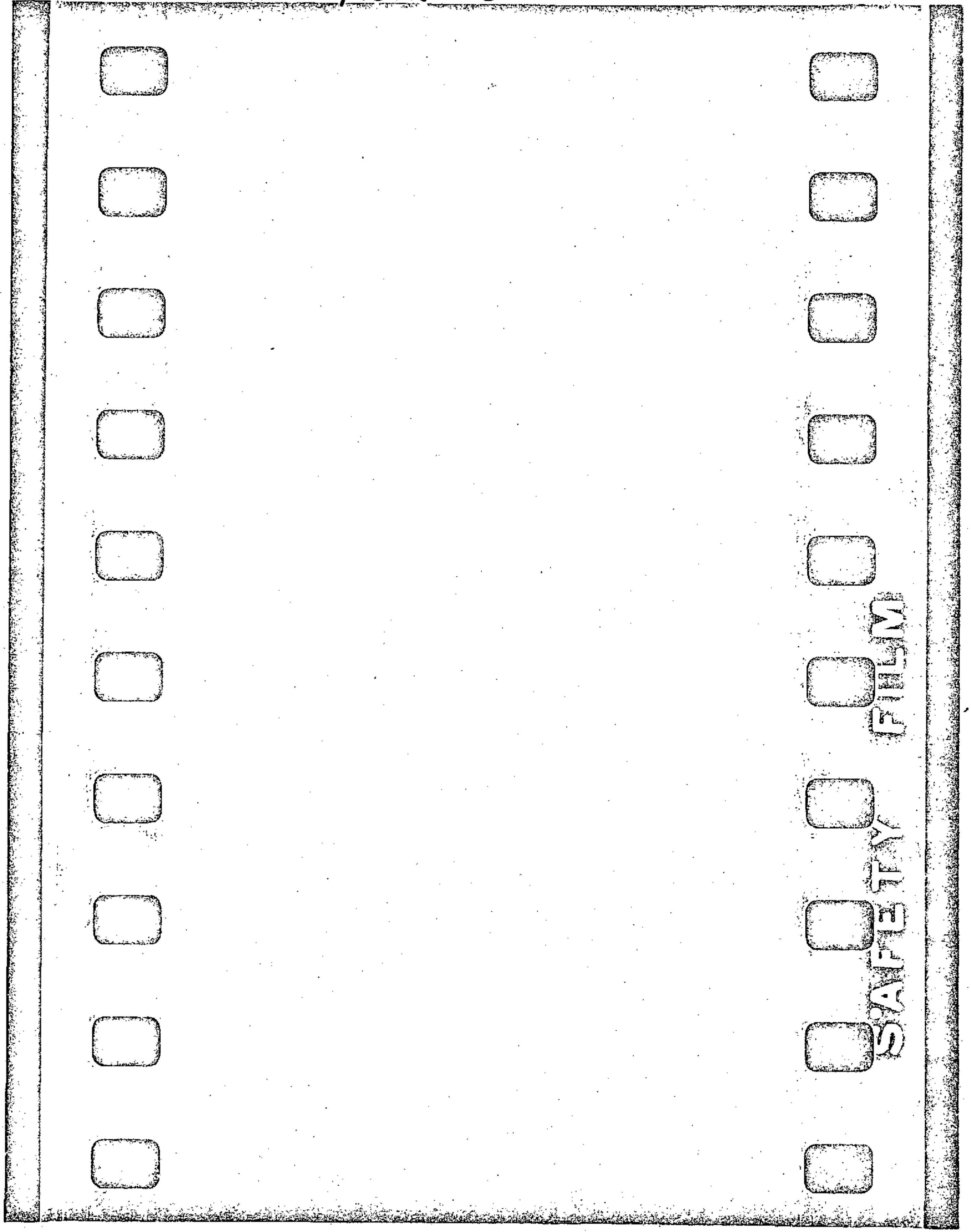

FIGURE 4

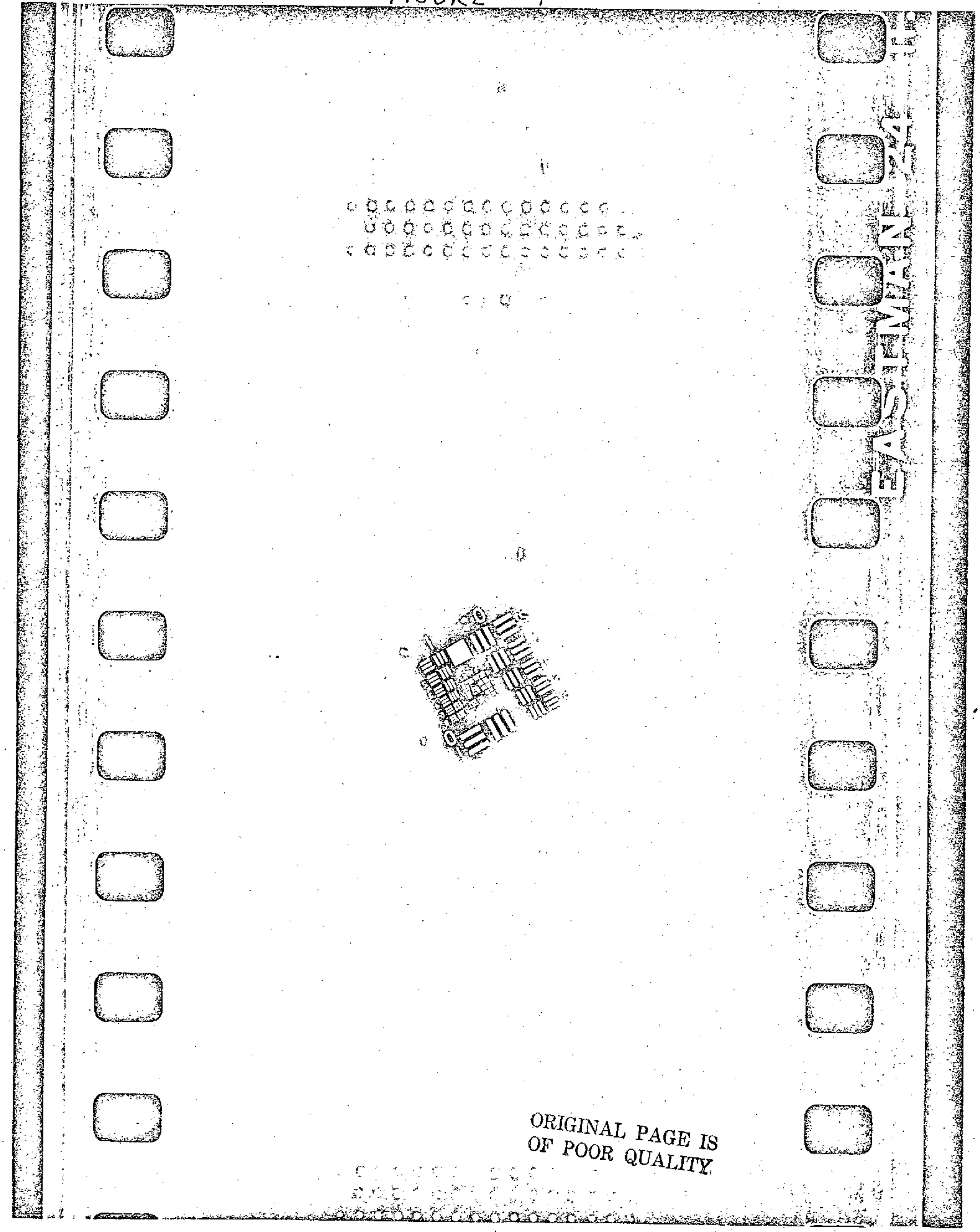

FIGURE 5

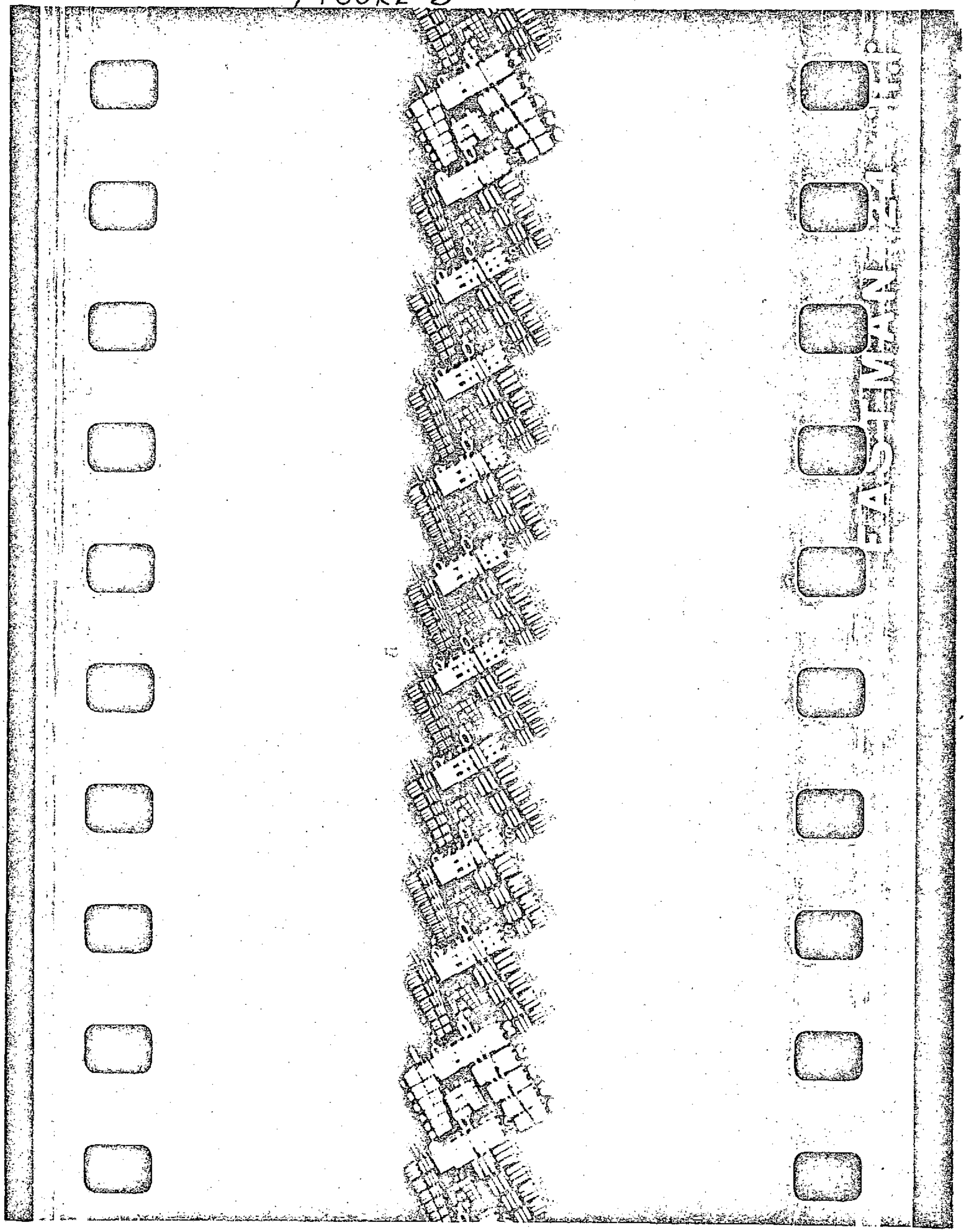

FIGURE 6