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APRIL 1958

72/SYSTEM 24/132

AVRO COMMENTS ON CREWMAN'S LEG
CLEARANCE EJECTION TESTS, ARRANGED BY
MARTIN-BAKER IN ENGLAND - FEBRUARY 1958

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AVRO AIRCRAFT LIMITED

MALTON • ONTARIO

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TECHNICAL DEPARTMENT (Aircraft)

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AIRCRAFT: ARROW

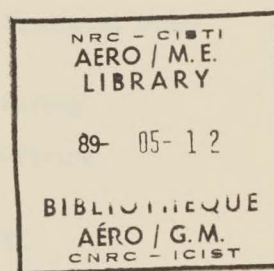
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AVRO COMMENTS ON CREWMAN'S LEG CLEARANCE EJECTION TESTS,ARRANGED BY MARTIN BAKER IN ENGLAND IN FEBRUARY 1958

PREPARED BY F. Rixen

DATE April 1958

CHECKED BY K. Kosak

DATE April 28.58

SUPERVISED BY

DATE

APPROVED BY J. P. H. H.

DATE

May 13/58

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LIST OF ILLUSTRATIONS

Except for Figure 1, all illustrations are cine shots.

Figure 1 Comparative Paths of Knees and Feet relative to Existing Cockpit (fore or aft) Obstructions, also showing approximate line of fairing in aft cockpit as described on Drawing No. 7-0152-306.

Cine Film Shots Taken at Farnborough

Figure 2 By Farnborough Photographer- Underweight Seat and Dummy Firing.
Figure 3 By Martin-Baker Photographer - Underweight Seat and Dummy Firing.
Figure 4 By Farnborough Photographer - Lynch Simulated Dummy Firing.
Figure 5 By Martin Baker Photographer - Lynch Simulated Dummy Firing.
Figure 6 By Farnborough Photographer - Lynch Firing
Figure 7 By Martin-Baker Photographer - Lynch Firing

Cine Film Shots by Martin-Baker at their Test Tower

Figure 8)
Figure 9)
Figure 10) Showing feet in various positions. Figure 12 is particularly noteworthy as showing the firing with leg in an outstretched attitude, as with pilot.
Figure 11)
Figure 12)



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AVRO COMMENTS ON CREWMAN'S LEG CLEARANCE EJECTIONS TESTS.

ARRANGED BY MARTIN BAKER IN ENGLAND IN FEBRUARY 1958

A series of three ejection seat tower tests was made on 7th February 1958 in Britain, and witnessed by W. Farrance of Avro Aircraft. Generally, the tests were made as a result of evidence noted from a series of tests made at Malton, during February, and described in A.T.R. 2803/1 Memo by C.J. Austin of Department 3110, and dated 13th February 1958. Briefly the evidence of these Malton tests is restated here.

The tests were carried out with a 95 percentile anthropomorphic dummy installed in the seat. The first two ejections simulated the front cockpit and the third ejection the rear cockpit. Significant in all three tests was the submarining action, sliding of the dummy in the seat causing the knees to project forward, and being the possible cause of damage, in all three tests, to the dummy passengers feet; the position of the legs relative to the line of seat ejection was also noted.

The aim of the tests made at Farnborough, and witnessed by W. Farrance, was to establish the amount of submarining that the seat passenger was likely to undergo. The initial leg attitude of seat passenger in these tests was not representative of the Arrow aircraft installation. Noteworthy is the type of seat and equipment used:- the seat was a Mark A5 and the angle was identical to the Mark C5 seat. A rigid mock-up of the survival pack and a semi-flexible fibre-glass cover were used in all three tests.

Test Firing No. 1 - an underweight dummy and seat arrangement, the dummy having little mobility.

Test Firing No. 2 - a simulated weight for weight replica of Firing No. 3, but with very poor dummy installed.

Test Firing No. 3 - A very much alive fellow named Lynch was fired and remained undamaged.

By inspecting the filmed results of these firings the following observations may be seen readily.

- (a) both legs of the dummy swing forward
- (b) one of Lynch's legs swung forward
- (c) Lynch did not submarine at all.



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Note, it was impossible for the dummy to submarine since it was not made that way.

Additional tower ejection tests which were made by Martin-Baker at their tower, but not witnessed by W. Farrance, are included in the illustrations. The seat used was not a C5 or modified A5, nor was the angle of the pan identical. Various leg attitudes were tested and one set of shots shows quite clearly that even with legs outstretched, as in the pilots cockpit, with feet resting on rudder bar when the seat is fired, the legs are pulled into a safe position without the aid of pull-positioning straps.

Combining results of these tests (See Figure 1) and showing the paths tracked by feet and knees relative to existing cockpit obstructions in the vicinity of seat travel, it can be seen that for the aft cockpit a fairing may be required to ensure that no harm may come to the navigators feet. Preliminary details of such a fairing are in hand (See Drg. No. 7-0152-306) and the approximate position is shown also in Figure 1.

The results of these tests are by no means conclusive evidence that ejection seat firing problems have been solved: they do lead to a belief that radical changes to either cockpit layout will be unnecessary. Furthermore, the configuration of the present seat does not need changing at all.

Further testing, however, would be useful and could be more accurately representative of conditions prevailing, thus being more conclusive. Items worth considering in another test series are:-

- (a) Alive human models tested for winter and summer conditions, i.e. using the different equipment as applicable.
- (b) Using a Mk. C5 ejection seat with the newly specified R.C.A.F type of seat pack, with contents and container for summer or winter conditions.
- (c) Ensuring full range of loading conditions and adequate facilities to check firing velocity.
- (d) Testing with legs in at least four different attitudes as outlined:
 - (i) Outstretched as with pilot
 - (ii) Brought back to halfway position *



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- (iii) With legs resting parallel to ejection line ★
- (iv) With legs pulled back and knees up ★
- (e) Testing with foot fairings, to discover effects of such fairings on feet.
- ★ Any effect the position of the knees may have on the rest of the body to be noted.



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SHEET No. FIGURE 1

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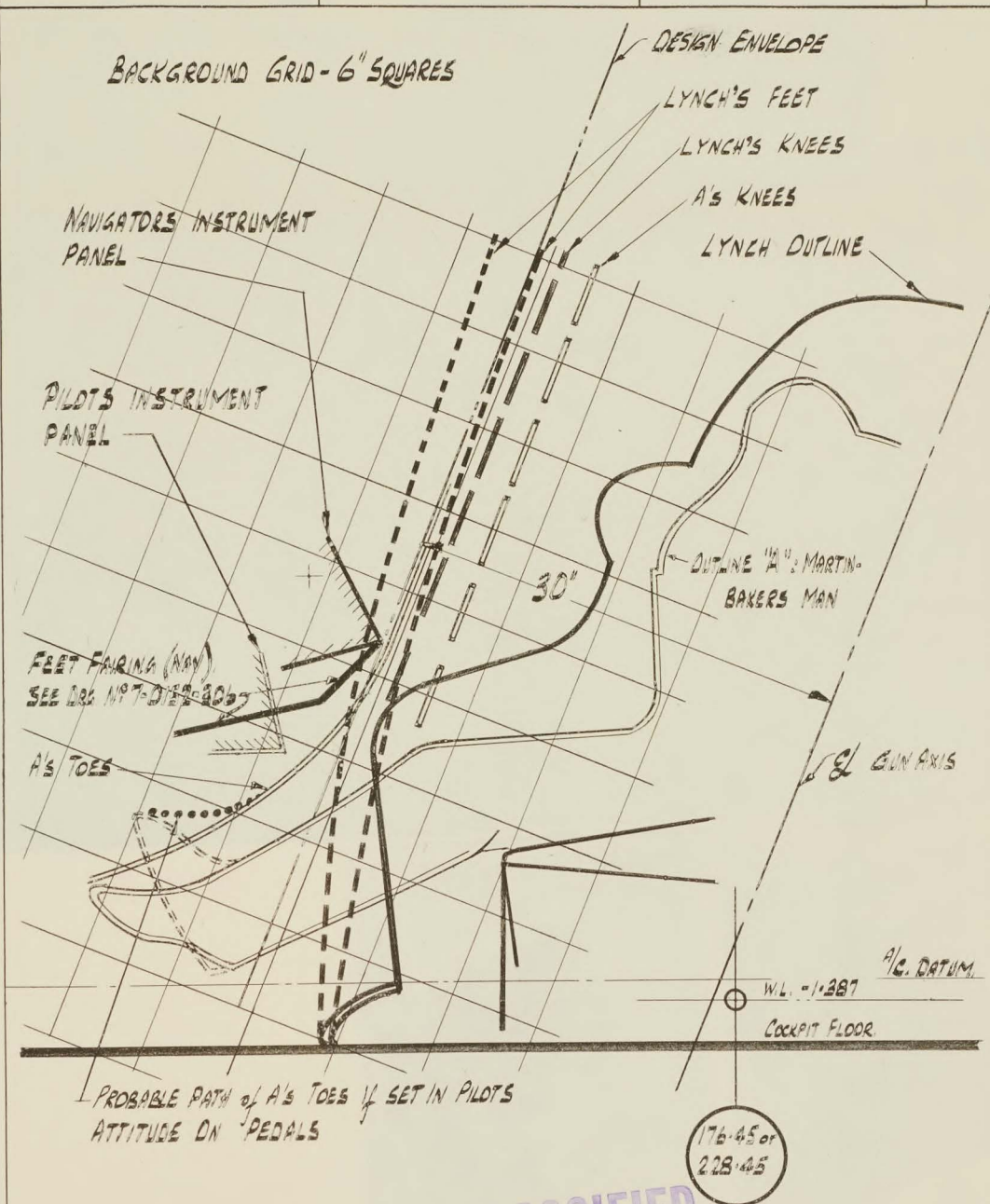
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FIGURE 1

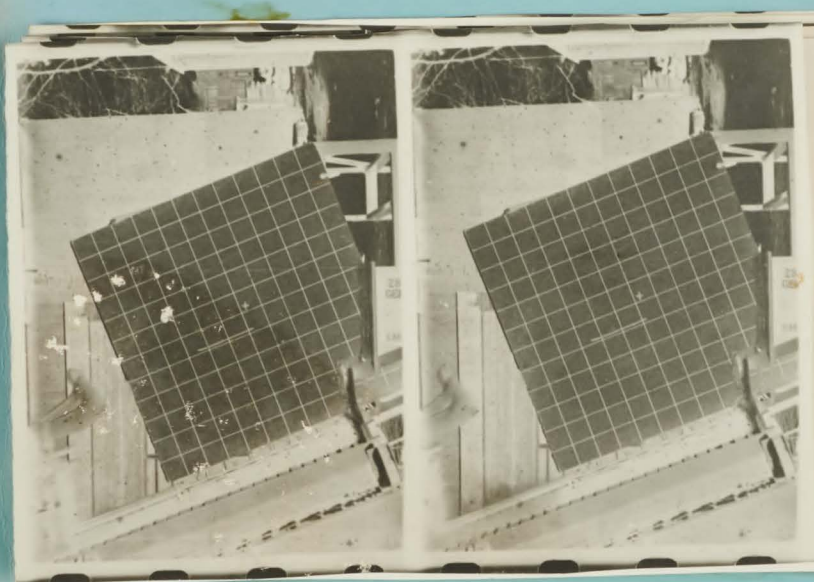
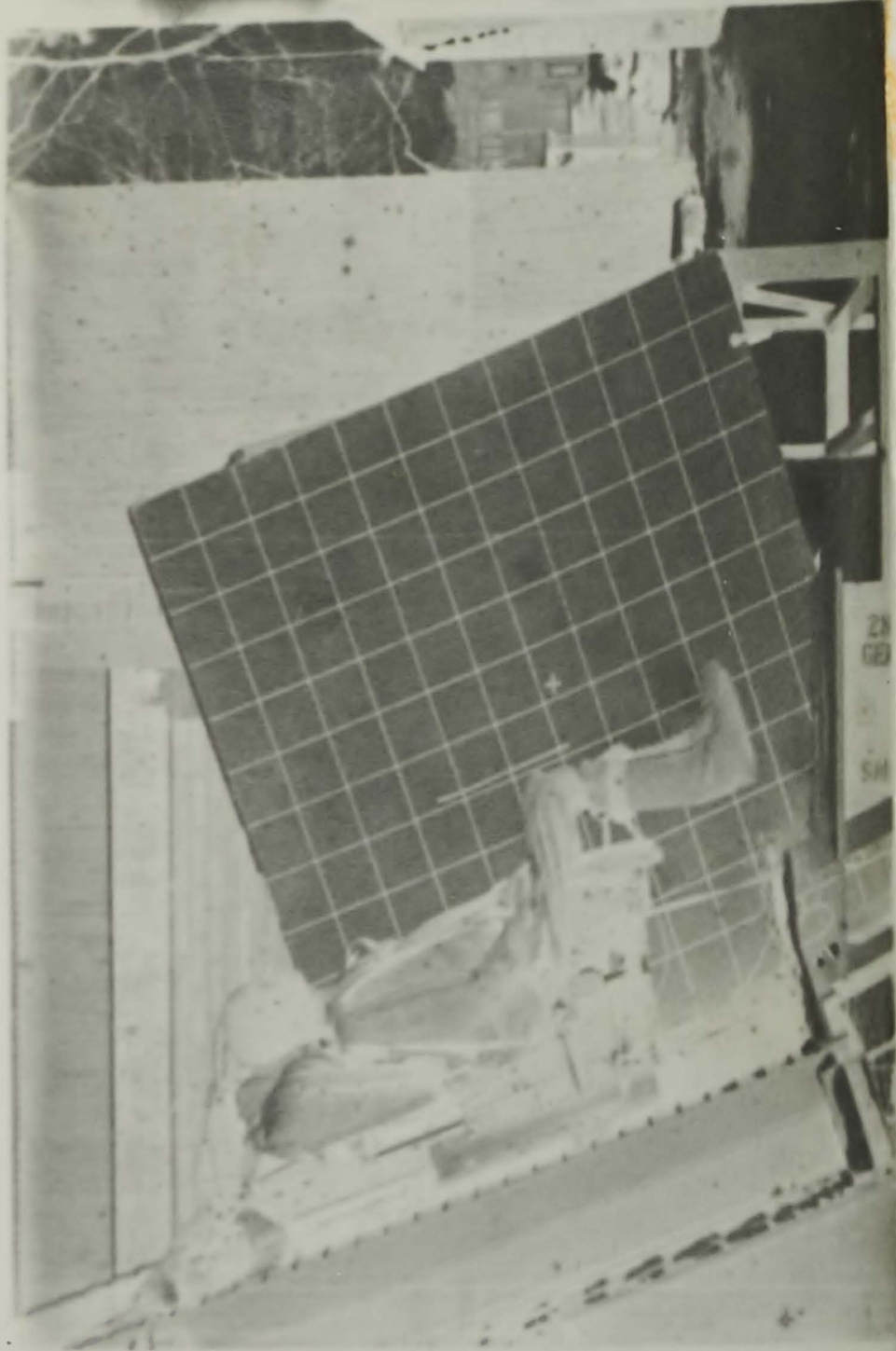
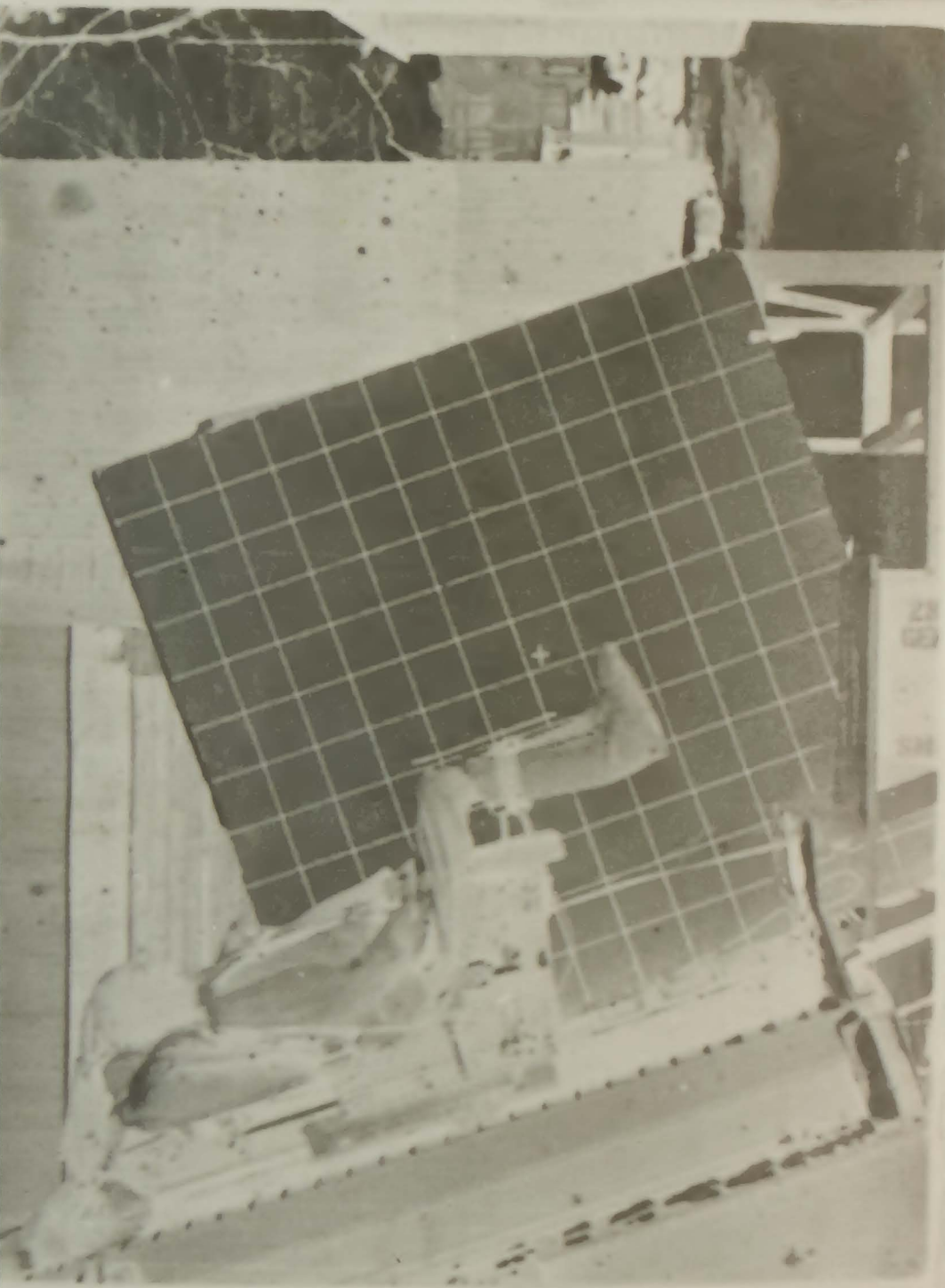
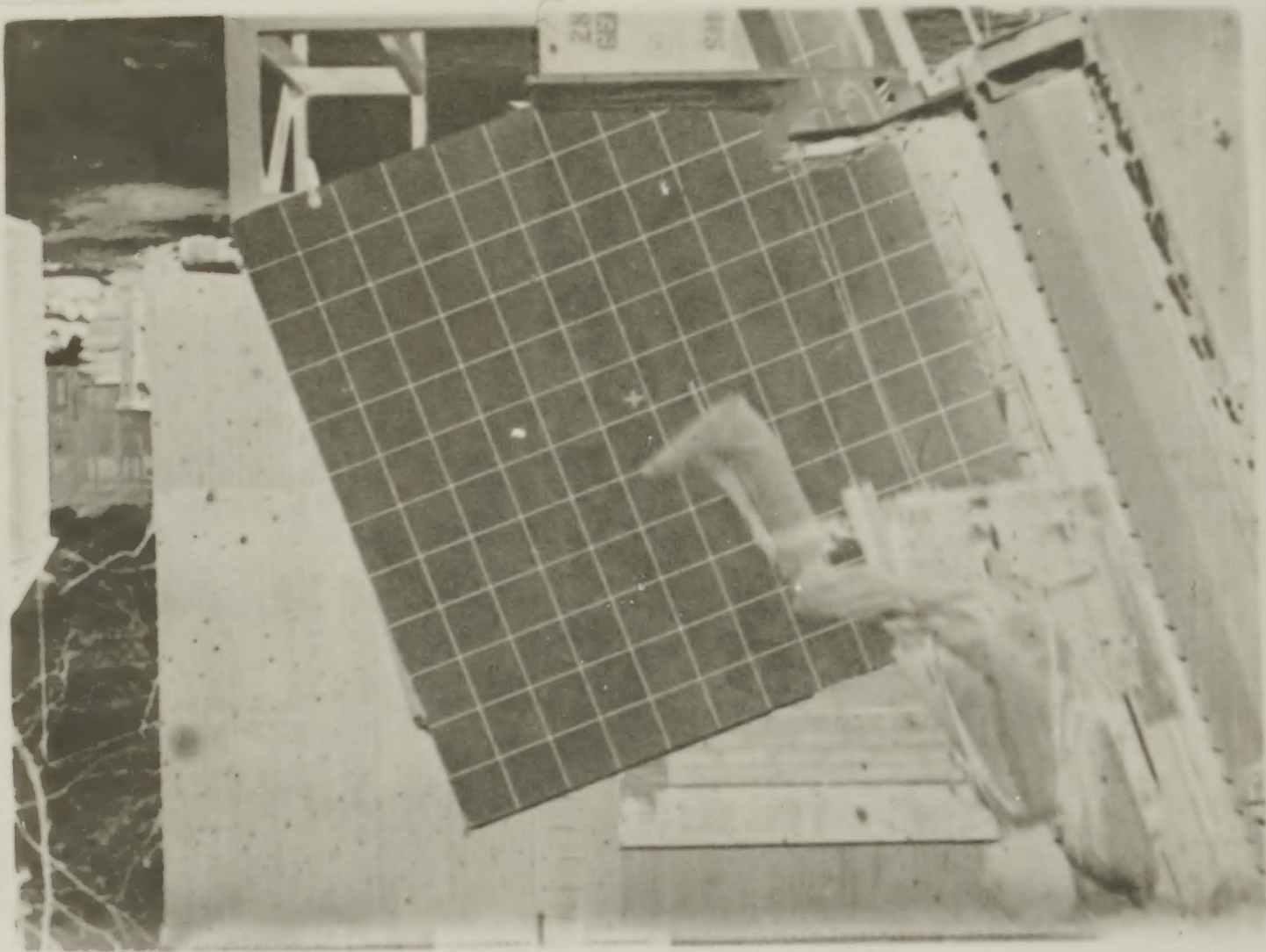


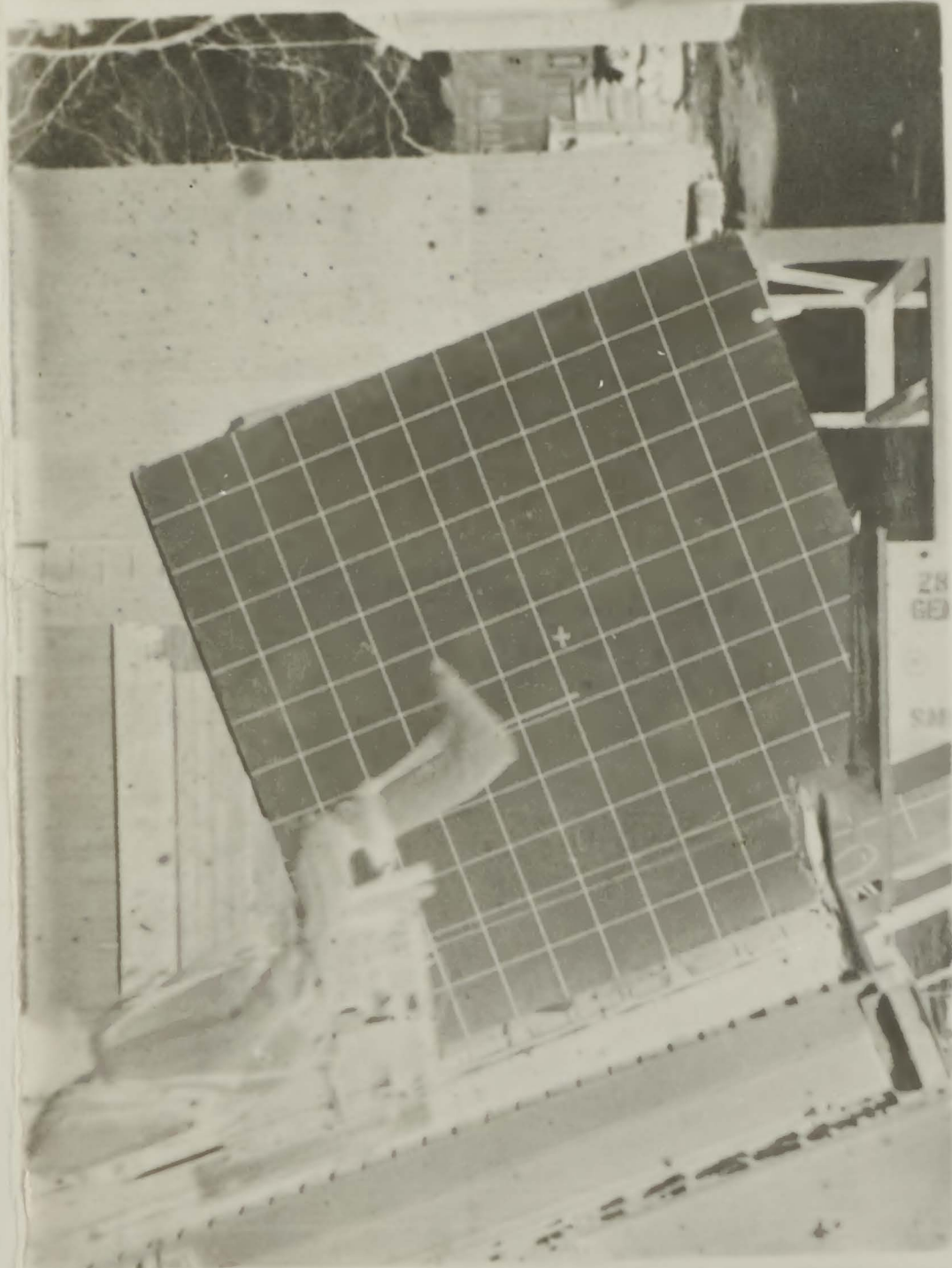
FIG. 2

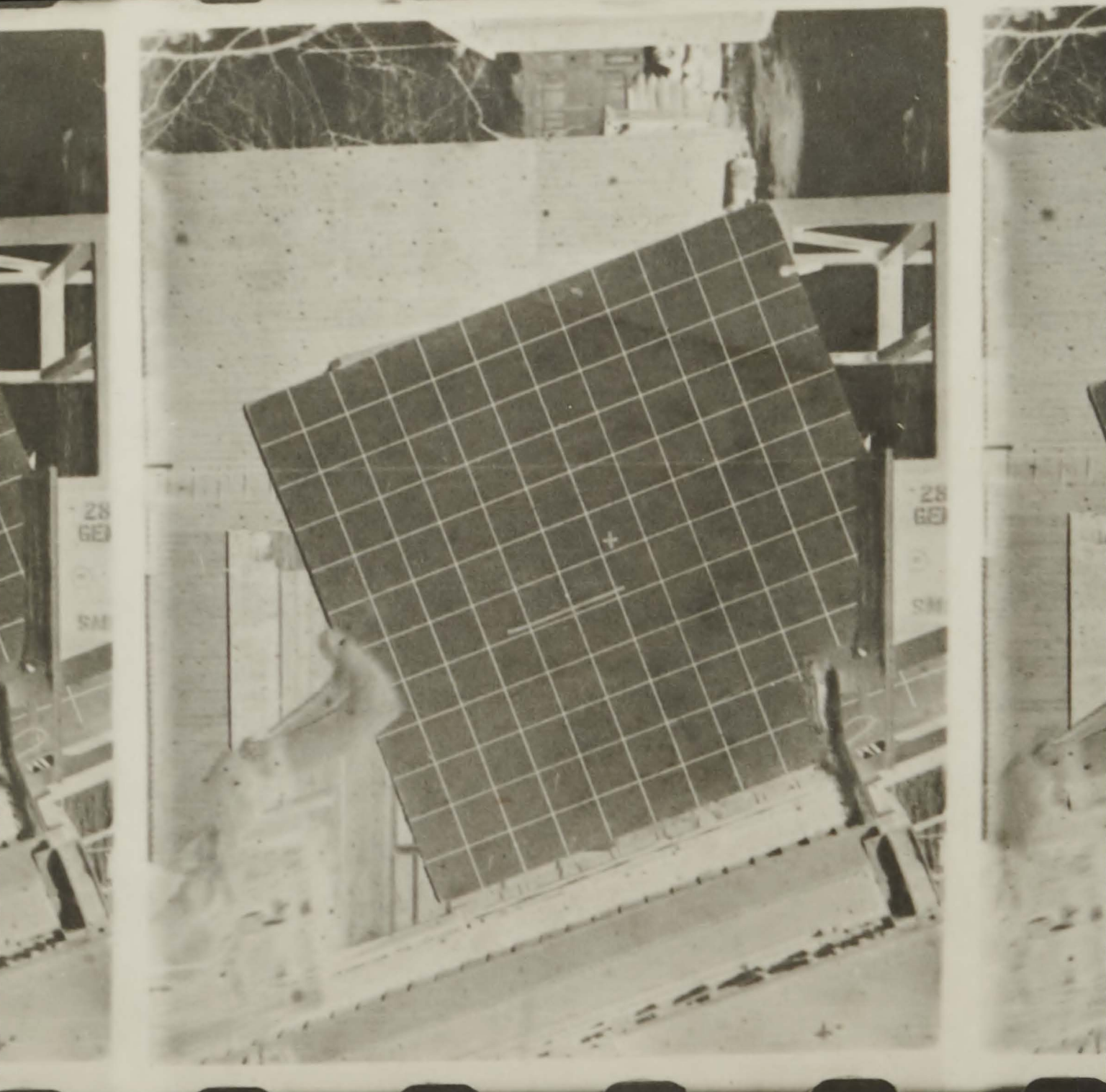
FIG 2









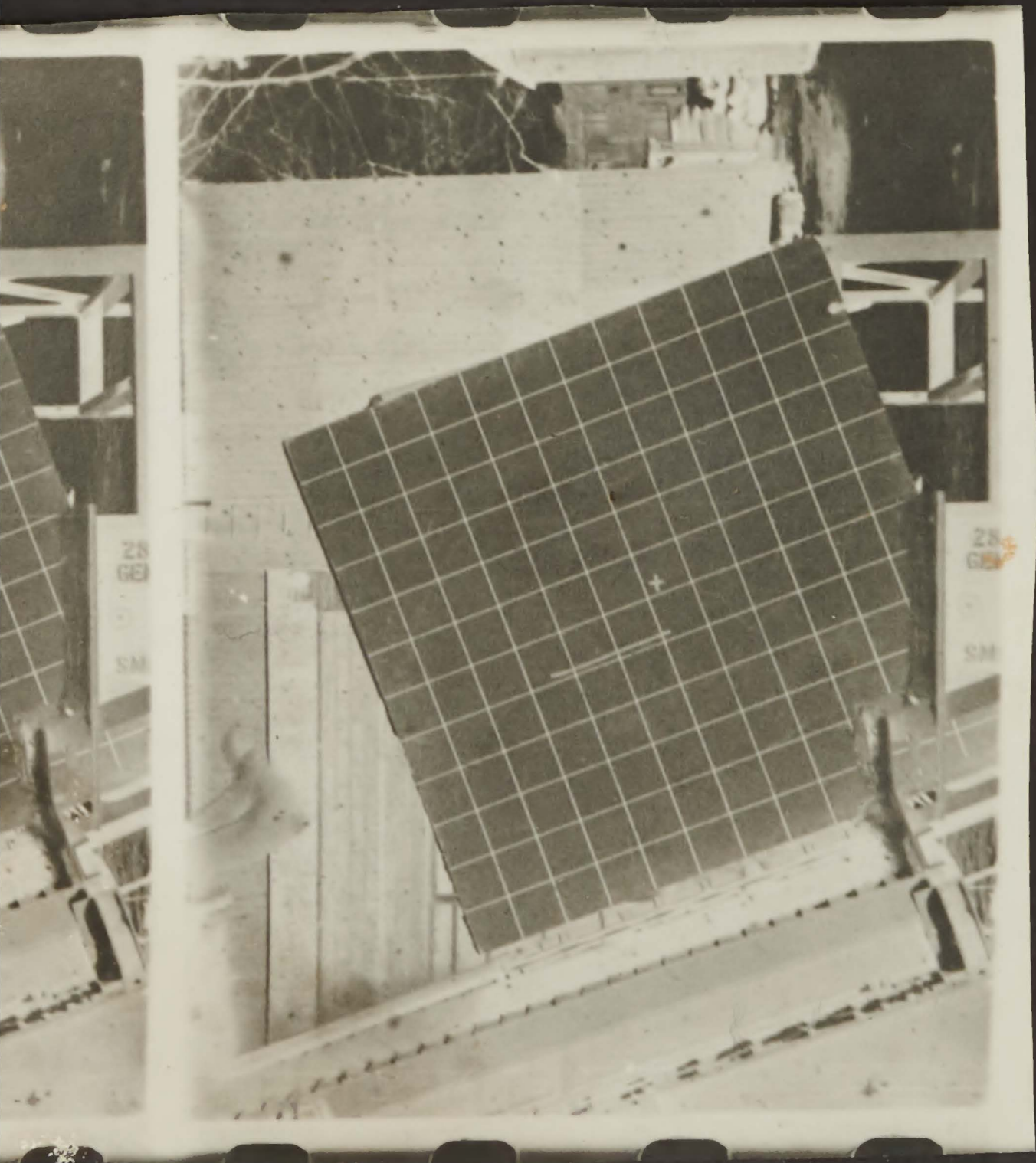


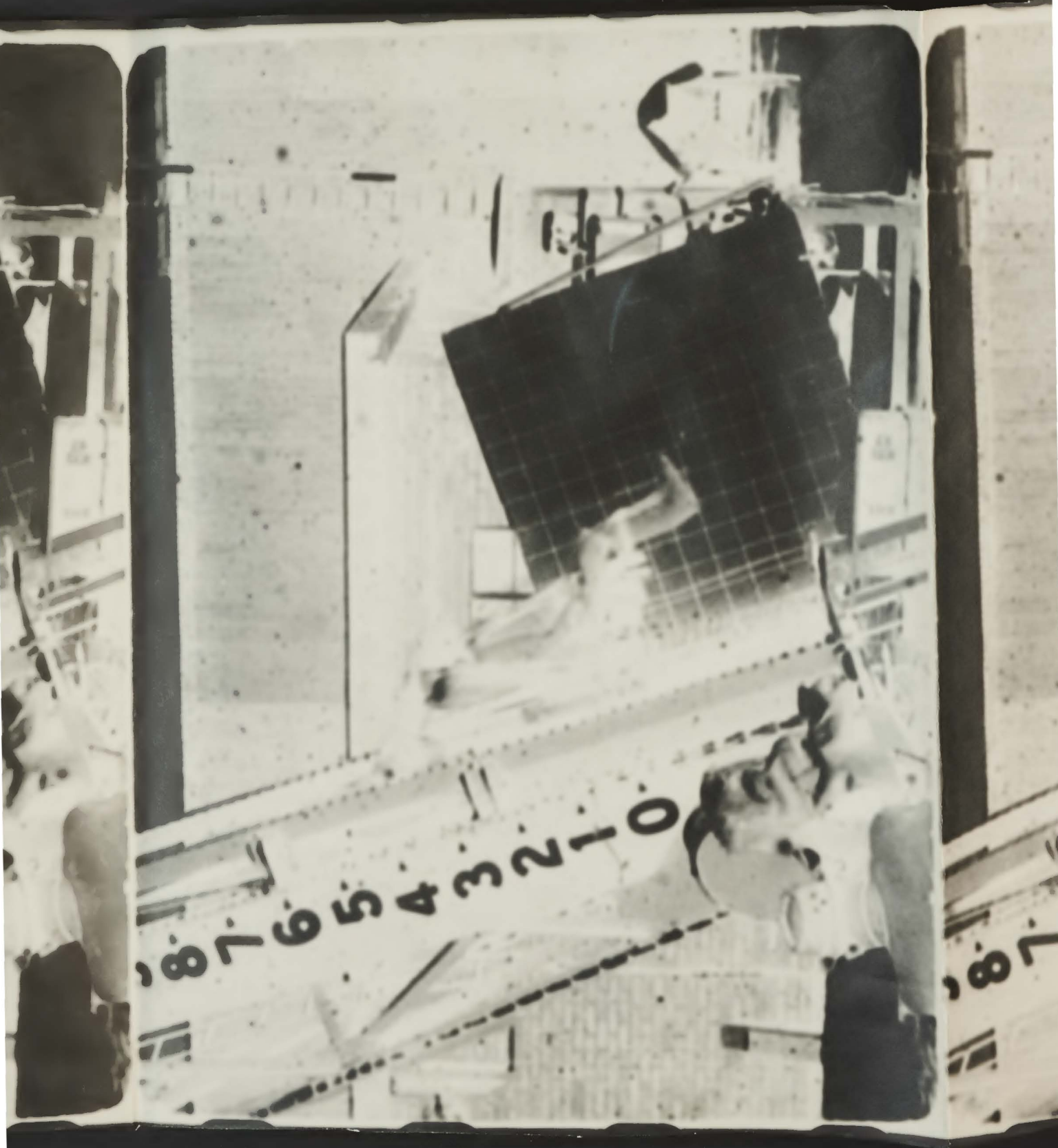
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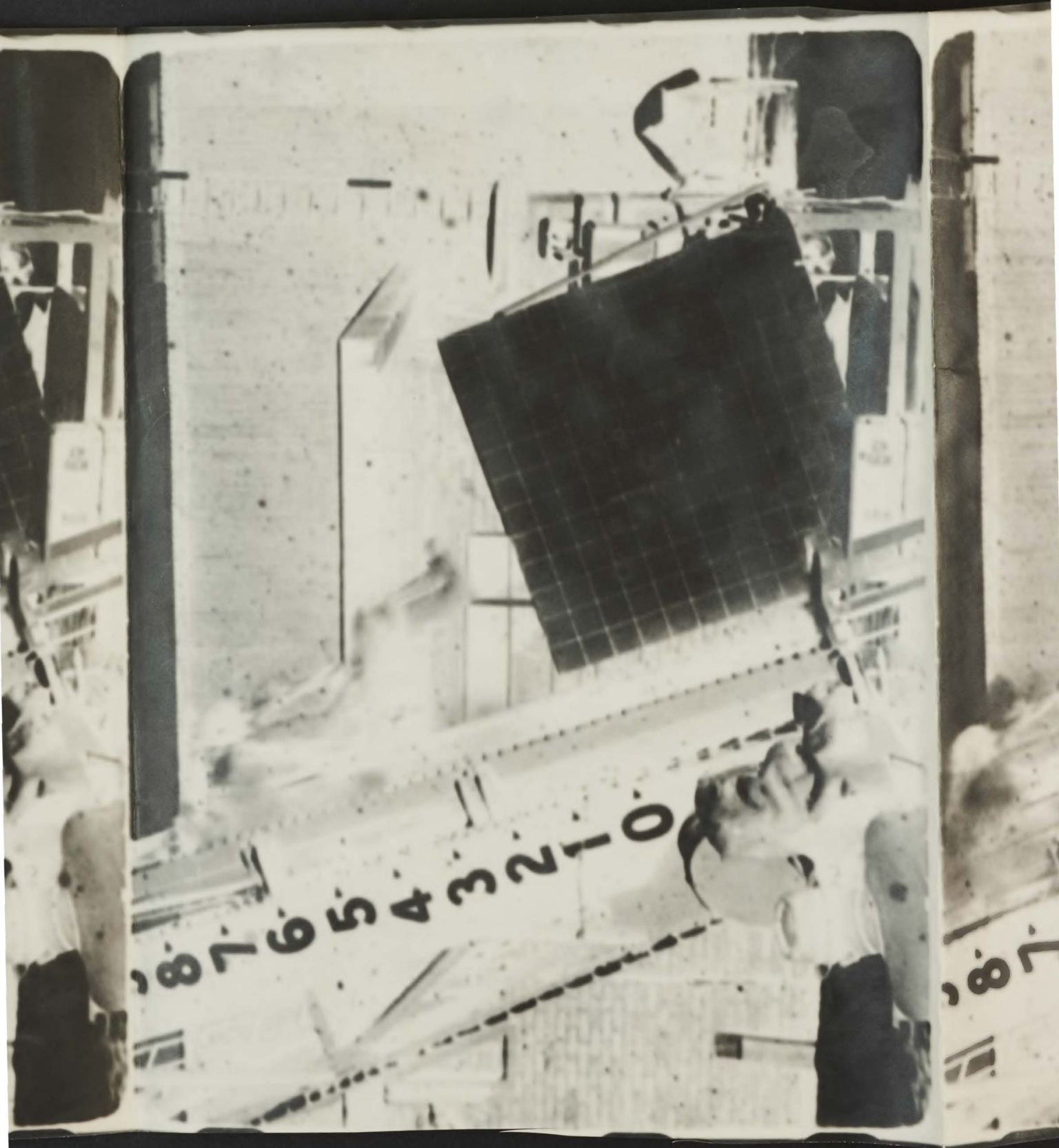
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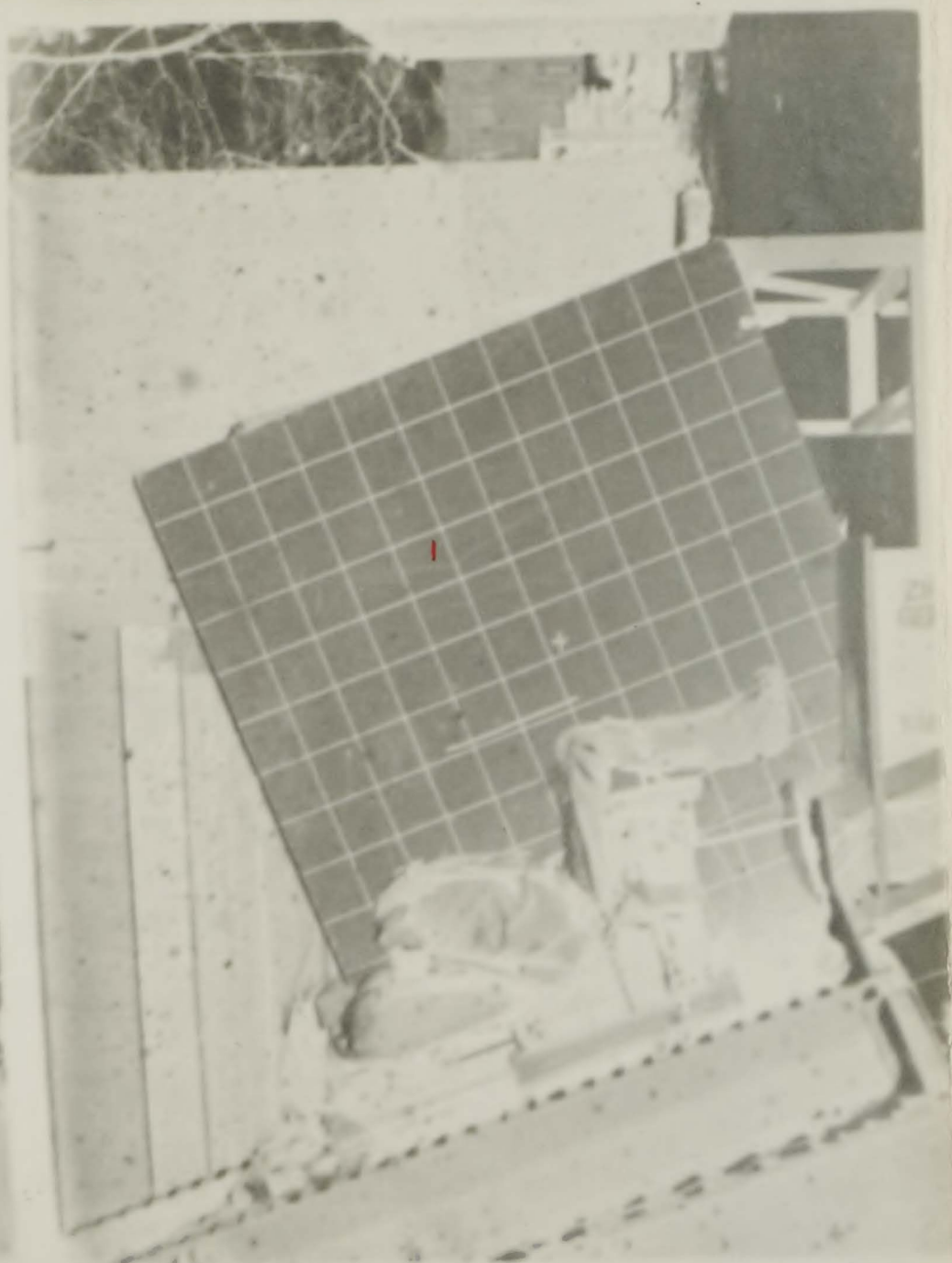
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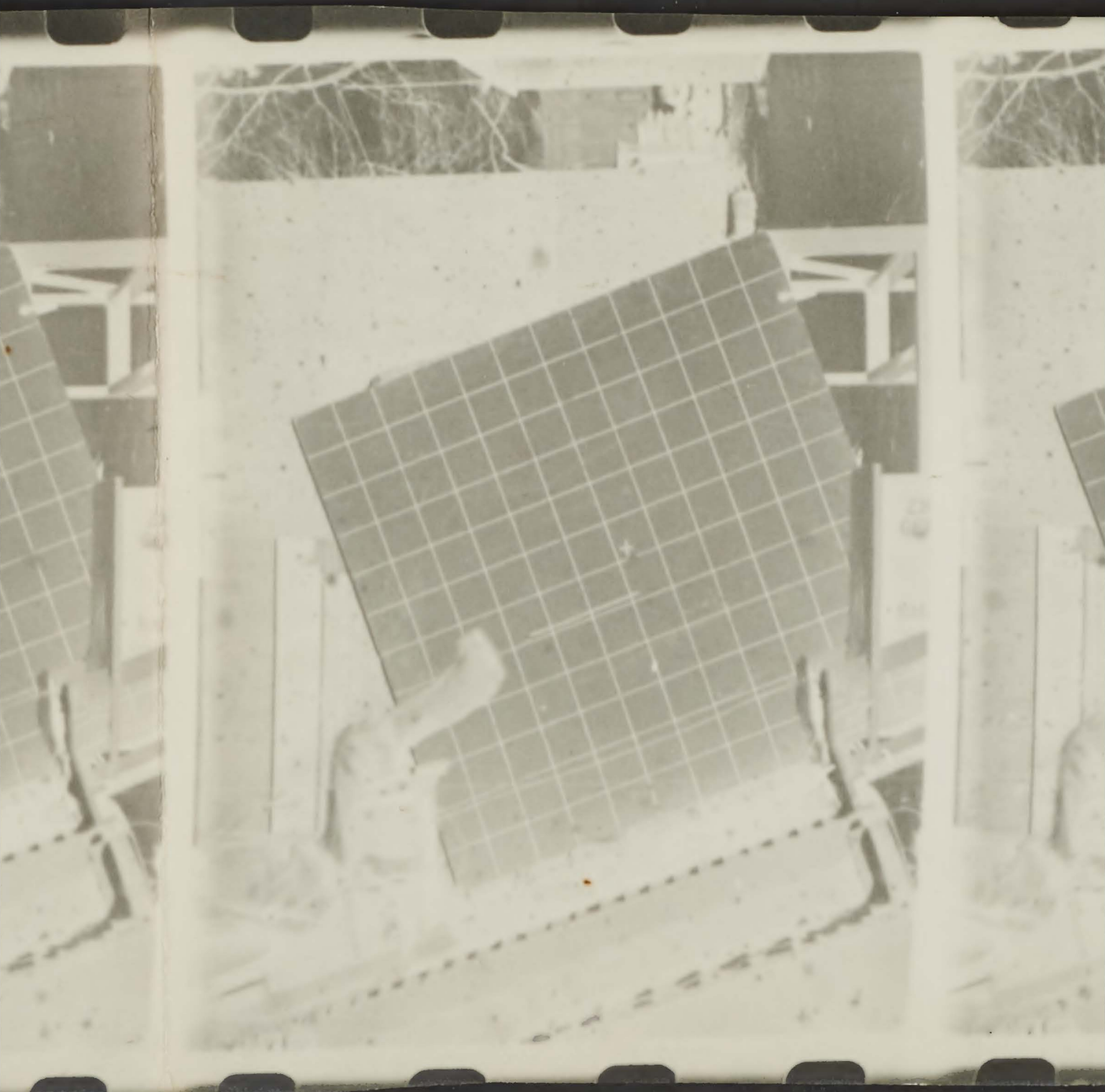
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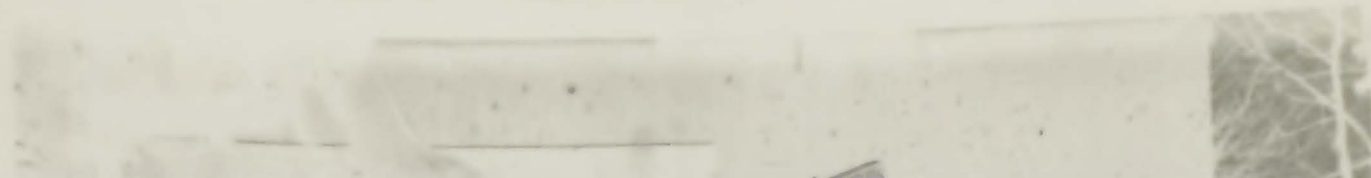
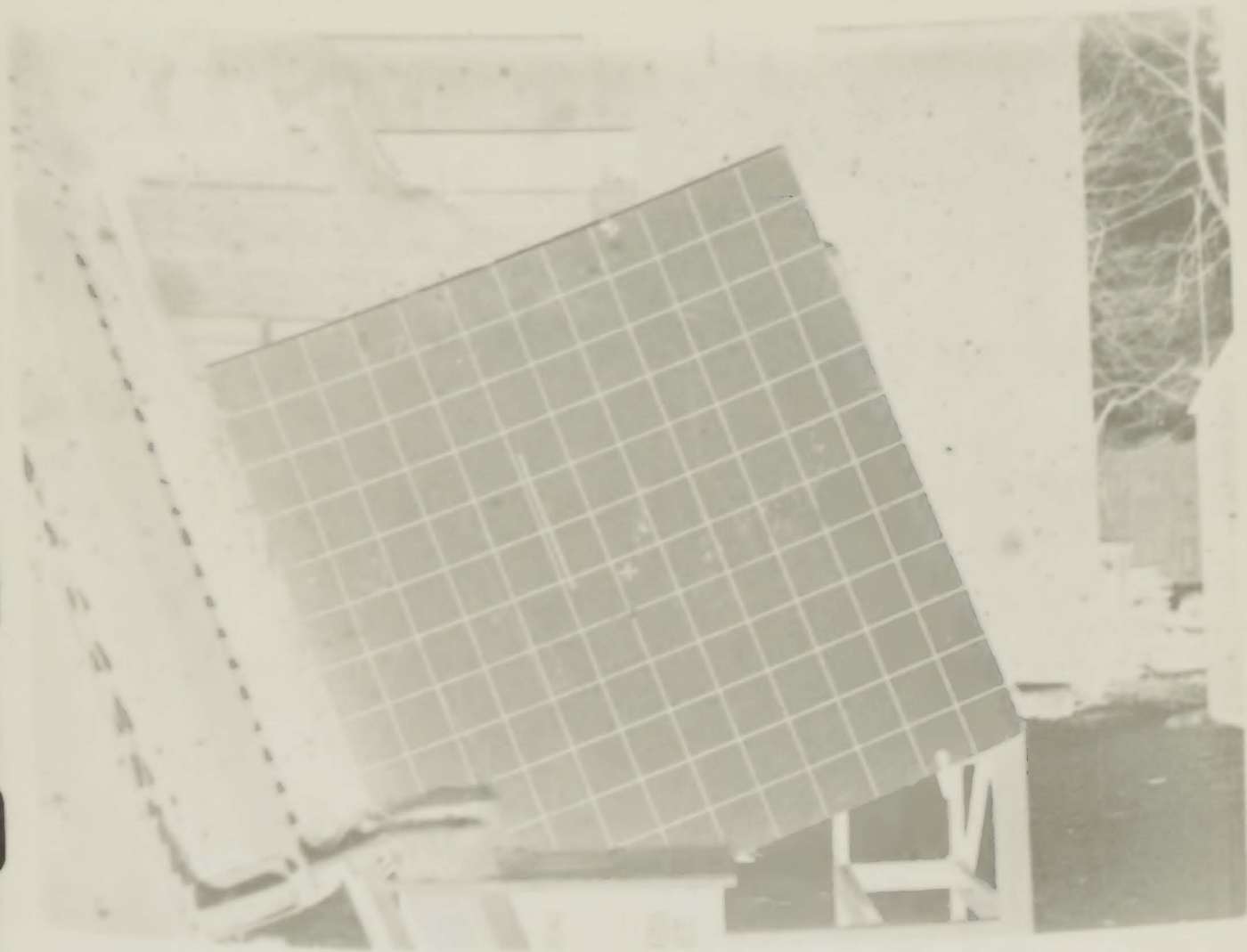


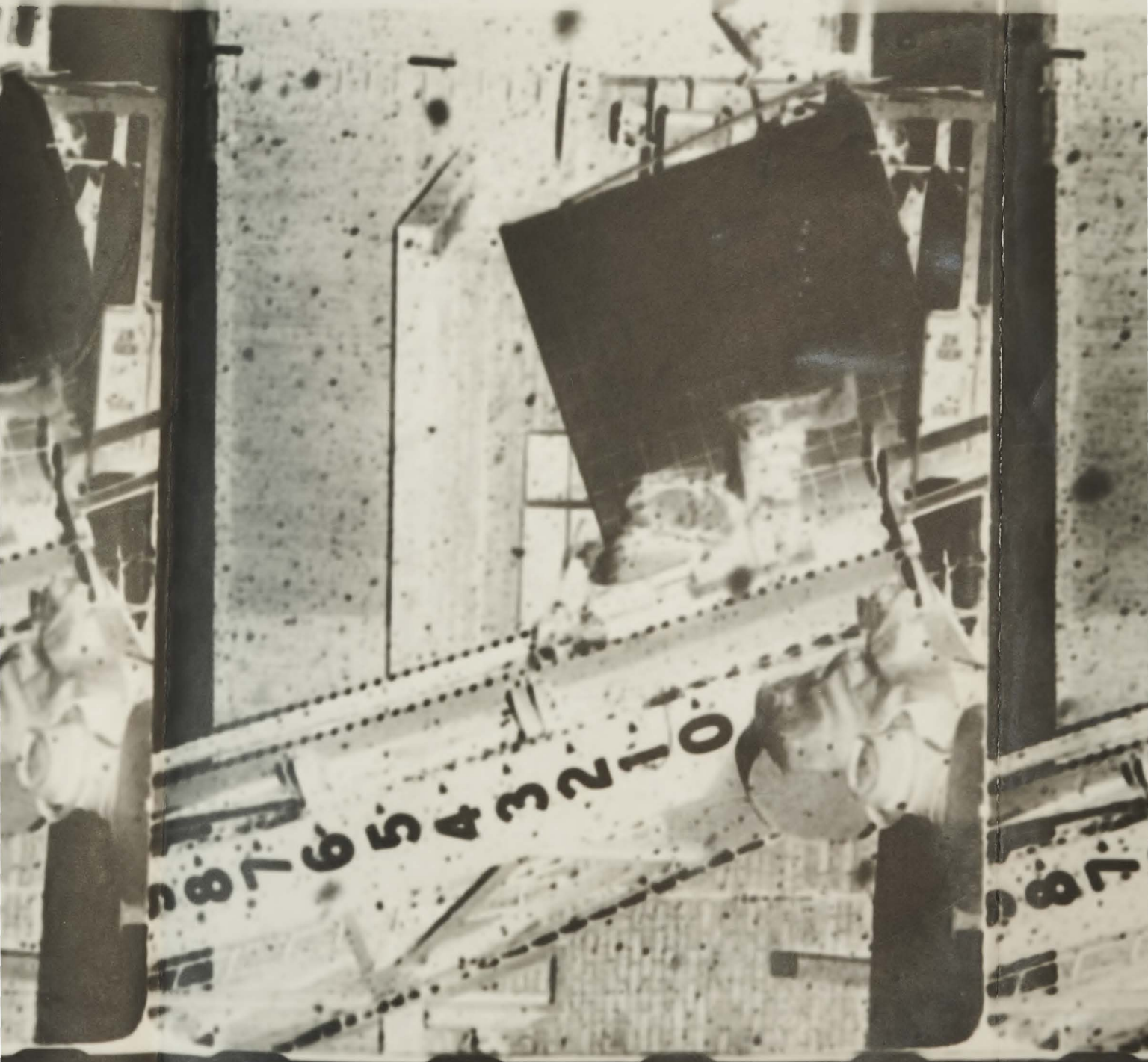












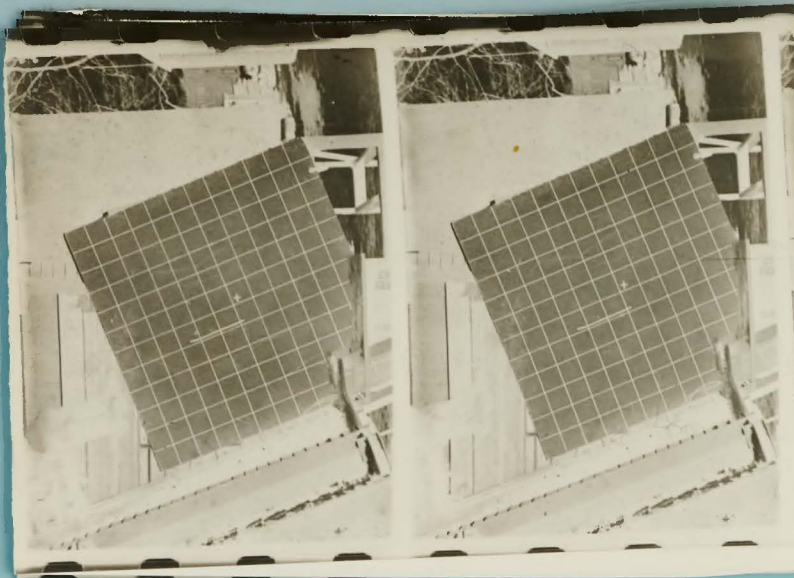


FIG. 6

FIG. 6

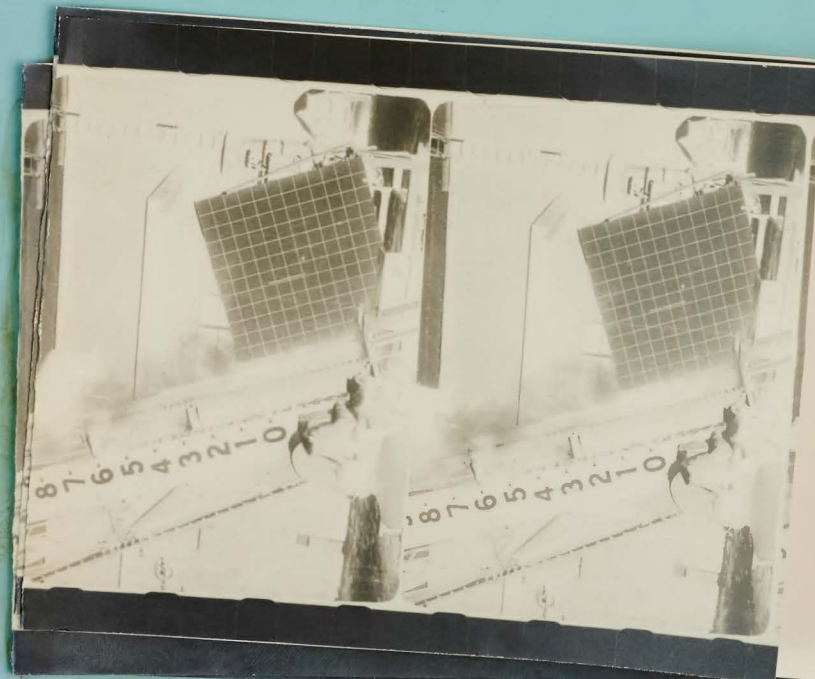
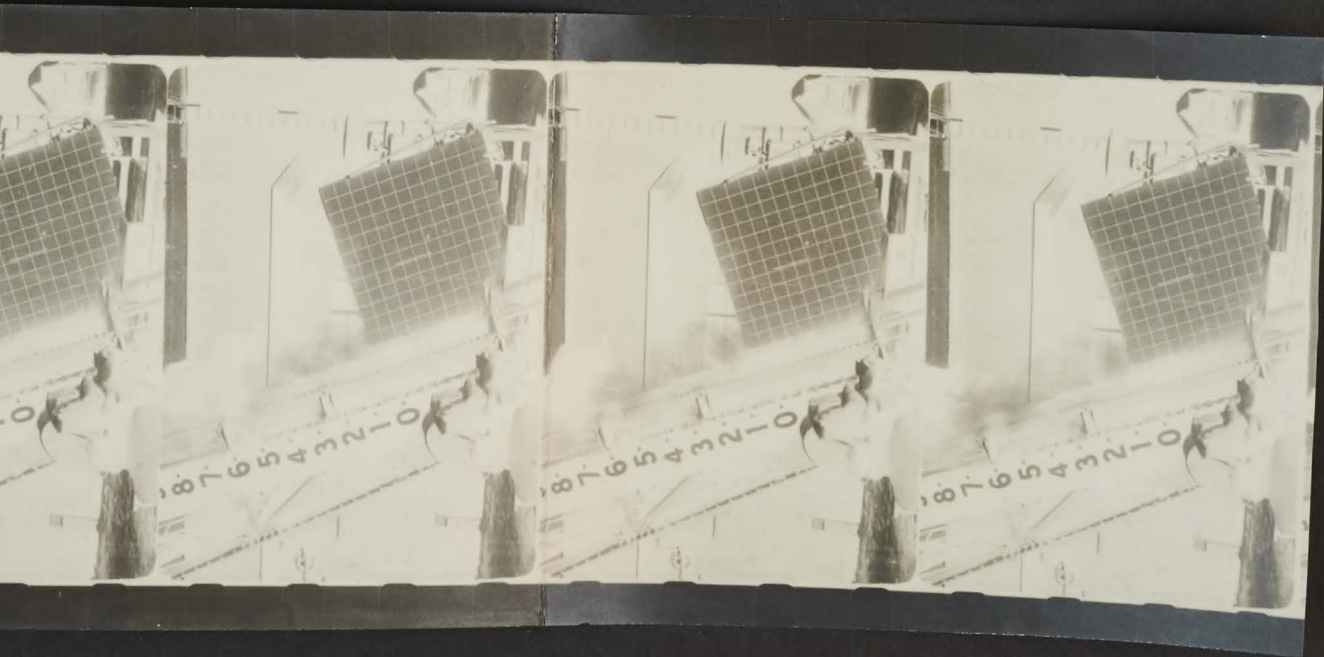


FIG. 7

FIG. 7



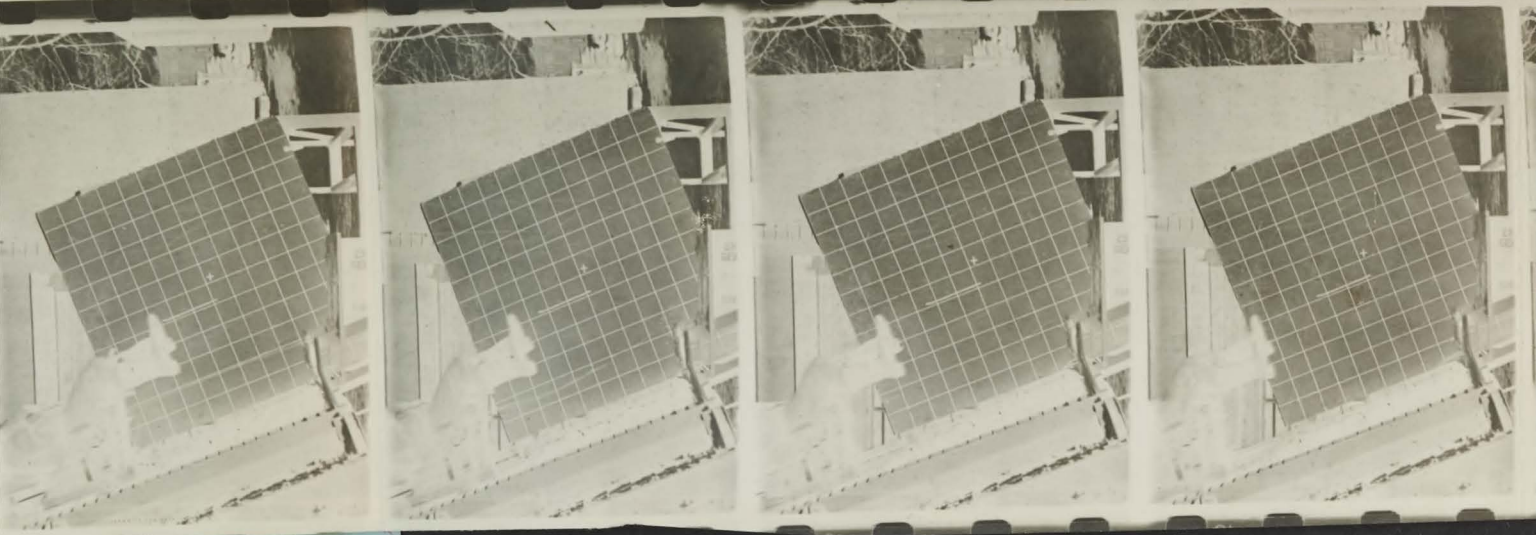


FIG. 7

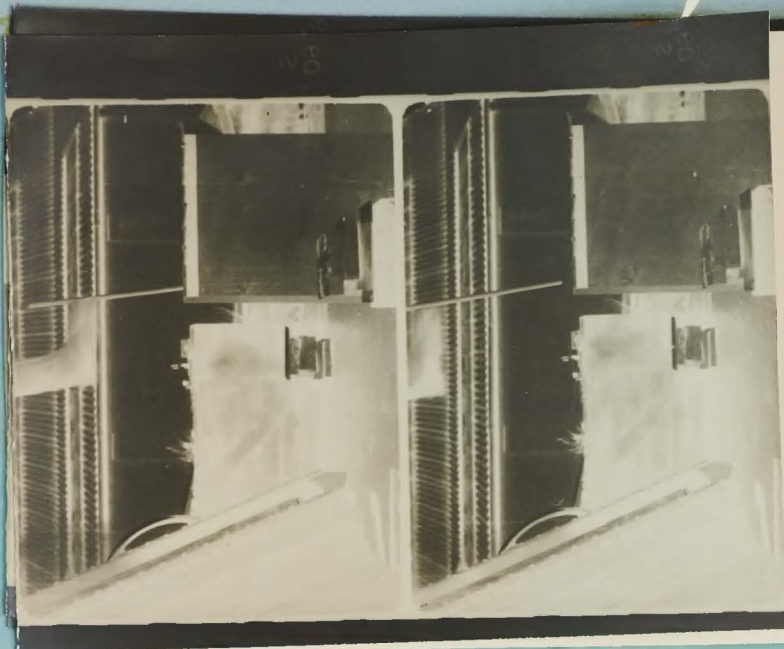


FIG. 10

FIG. 10

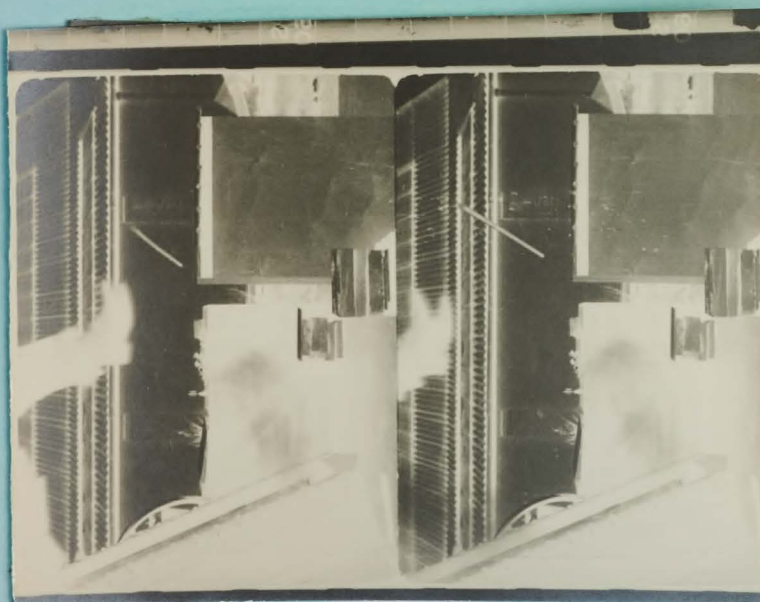


FIG. 11

FIG. 11

