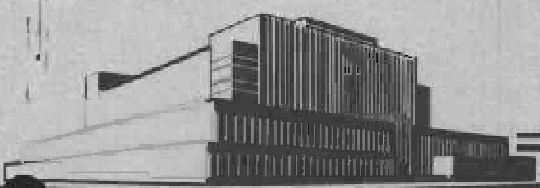
WATER-REPELLENT PRESERVATIVES REDUCE RAIN-CAUSED PAINT BLISTERING ON WOOD SIDING

Information Reviewed and Reaffirmed

September 1959

No. 1990



FOREST PRODUCTS LABORATORY
MADISON 5, WISCONSIN

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
In Cooperation with the University of Wisconsin

WATER-REPELLENT PRESERVATIVES REDUCE RAIN-CAUSED PAINT BLISTERING ON WOOD SIDING[1]

By

L. V. TEESDALE, Engineer

Forest Products Laboratory,[2] Forest Service
U. S. Department of Agriculture

Summary

Rainwater is an important, though not generally recognized, cause of paint difficulties in wood-sided houses. It gains entry back of the siding chiefly by capillary action, working through the lap joint between courses of bevel siding. High winds are a minor cause. Laboratory tests have shown that entry of rainwater through house siding can be minimized or eliminated by dressing the back of standard-pattern siding so that a tight joint, which can be more or less sealed with paint, is formed between the courses; modifying the standard pattern by dressing the back side and adding a horizontal groove; treating conventional or modified siding with water-repellent preservative before it is nailed to the house; and applying a water-repellent preservative to the siding of a completed house before the house is repainted.

Introduction

Wood siding is the most popular exterior wall covering used on homes, and has been for centuries. Such siding is still in excellent condition on many colonial homes that are more than 300 years old and still in use.

Most wood-sided houses are painted, not only for decoration but also to protect the wood from weathering and from moisture changes that might cause warping. Unfortunately, many of our modern paints are more sensitive to moisture than those used some years ago, and, if too much water gets into the siding, the paints may blister and peel.

---

[1]These investigations were made in cooperation with the Weyerhaeuser Timber Company.

[2]Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

There are two main sources of this moisture: (1) water that accumulates by cold-weather condensation; and (2) rainwater that is driven by the wind or works up in back of the siding by capillary action.

The cause of cold-weather condensation is well known and need not be discussed here, as methods of protection have been described in many publications, such as those listed at the end of this article.

Rainwater, however, is not generally recognized as a source of paint-blistering moisture, even though it may be as important a source as condensation. Some rain has always gotten behind siding, even in old houses that were protected with good overhang and narrow-pattern siding, but the paint on these old houses was much less sensitive to moisture than are our modern paints, and there was little or no trouble with paint blistering (fig. 1).

Many of our modern houses are designed with no overhang at the gables and very little at the eaves, so that the siding is given little protection from rain. This lack of protection plus the moisture sensitivity of modern paints often results in paint failure (figs. 2 and 3).

An exploratory study was started at the Laboratory to find ways and means of improving the performance of beveled wood siding under service conditions and, particularly, to reduce or eliminate moisture entrance from the outside. The first objective was to determine how water got back of siding, the second to determine the effectiveness of modified siding patterns and treatments in preventing or reducing water ingress (fig. 4).

Methods of Test

Test Panels

Panels of 8- by 7/16-inch standard-pattern (fig. 5, A, B) bevel siding were made with 2- by 4-inch studs and frames and nominal 1- by 2-inch sheathing strips. They were assembled so that the back of the siding could be observed. When the panels were examined from the back in a dark room with a bright light on the face of the siding, a thin opening could be seen at each siding lap, where the band-sawed edges, which were slightly rough, made contact only at the high points.

The panels were painted and again examined. The paint had closed the opening between the boards at the lap. The panels were then placed in a dry kiln and exposed first to a high humidity and then to a low humidity to swell and shrink the siding at the lap and break the paint film at that point. This simulated the condition that occurs in service. Again light could be seen through many of the laps, but the paint had apparently closed some openings and partly sealed others.

The panels were then exposed to a spray so that water ran over the face of the panel from top to bottom. During exposure the back of the panel was examined regularly for appearance of water. With standard-pattern material, wet spots appeared irregularly on the back of the siding at the top of the lap and slowly crept upwards. In some cases, the spots covered one-half or more of the exposed area in 4 hours. The water had worked up through the laps and out onto the exposed surface by capillarity. In some cases, water flowed down from under the sheathing strips, and examination showed that this occurred when the nail had split the thin edge of the board under the lap. The split was actually concealed by the overlapping board. Water working upwards under the lap passed through the split and ran down the back face of the board, wetting the board excessively. This form of wetting may account for large local paint failures on a side wall where other areas have smaller, scattered paint failures.

Width of Lap

To determine the importance of the width of the lap, panels were made with a 1/2-, 7/8-, or 1-1/4-inch overlap. Nails were placed a scant 1/2 inch above the butt edge. No distinguishable difference in wetting was noted between boards having 1-1/4- and 7/8-inch lap. The wetting was much more general, however, with the 1/2-inch lap because the nails split the thin edge. The wetting due to capillary movement of water was probably about the same regardless of width of lap. To prevent nail splitting at the thin edge, the lap should apparently be at least 7/8 inch.

Modified Siding Patterns

Several modified patterns (fig. 5, C, D, E) were tested to determine the effect of drip cuts, grooves, and back dressing on capillarity. A drip cut at the butt of 1/2-inch siding was ineffective. Water jumped the drip cut and followed the same wetting pattern as in the standard siding. Back dressing at the butt to provide a smooth surface in the same plane as the face of the siding was effective in reducing capillarity and in making a tighter joint at the lap so that the paint offered some mechanical resistance to moisture entrance. A horizontal groove on the back in the area covered at the lap also reduced capillary flow. The best results were obtained with a combination of back dressing and the horizontal groove.

Back painting at the lap edge, using two coats of paint, reduced wetting on the back to about the same degree as the back dressing. Presumably, such back painting would offer protection during the life of the paint. It is not believed that back painting with a single prime coat would offer much protection.

Effect of Wind

To obtain information on the effect of wind, the panels were placed in a five-sided revolving frame and exposed to a fan directing air against one face of the frame as it revolved (fig. 6). The air velocity at the face of the panel was the equivalent of a 40-mile wind. Water was sprayed on the panel in front of the fan. With all panels exposed to wind pressure, the water ingress was only slightly greater than in the tests where no wind was used. Under service conditions where the siding would not be so tightly and uniformly applied as it was in the panels, the wind effect could be expected to be more pronounced.

Treated Siding

Another series of panels was made with standard and modified patterns of siding that had been dipped for 3 minutes in a water-repellent preservative. These panels were painted, exposed in the dry kiln to cause swelling and shrinking, and then wetted in the same manner as the untreated siding (fig. 7). Regardless of pattern, the treated material was consistently free from wetting on the back. There was no evidence of capillary action nor of the wetting caused by splits on the thin edge. When the panels were exposed to wind in the revolving frame, there was evidence of some minor, relatively unimportant wetting on some of the panels.

Panels were also made up of treated and untreated standard-pattern stock and tested without being painted. Here again there was no evidence of capillary wetting on the back of the treated material, but there was general wetting on the untreated material (figs. 8 and 9). Perhaps this means that, where treated siding is used, priming need not follow immediately after the siding is applied but could be deferred to a time more convenient to the builder.

Results of Tests

The results of the tests on untreated siding show that a very material reduction in water ingress may be obtained by the use of back dressing and grooving as described. The exposure conditions in the test were severe, and under service conditions the protection provided would mean better paint performance than that found with standard-pattern, untreated siding.

The results of the tests with water-repellent preservatives were particularly impressive and indicate that, if it is used, the pattern would be unimportant. In spite of the good results on treated, standard-pattern bevel siding, it would seem desirable to back-dress to obtain a better and tighter joint at the lap to reduce openings through which wind-blown water could enter. Moreover, the paint could provide a better seal at the lap. Furthermore, back dressing gives better support for nailing and should reduce splitting in both the butt edge and the thin edge.

Good results were obtained with panels of standard-pattern, untreated material that had been previously tested and then brush-treated at the lap and again exposed to wetting. Though these were not fully equal to the panels made of siding that had been dip-treated, again the results were impressive. Very little water appeared on the back of the siding.

The results of the tests on the untreated panels indicate that the application of water-repellent preservatives to existing houses would greatly minimize paint blistering caused by rainwater that works in from the outside and thereby save considerably in paint maintenance. The water-repellent preservative should be applied generously along the butt edge of the upper course of siding where it lies against the next lower course, so that the fluid can work up into the lap between the boards. Many of the larger lumber dealers stock commercial water-repellent preservatives.

The studies described above did not include water entrance through end joints, and there were no butt joints in the panels. The end joints were set in white lead, and no leakage was observed. Since it is not common practice to use white lead in the end joints, some leakage may be expected under normal service conditions. The use of the water-repellent preservative should be helpful in preventing leakage through butt and end joints.

In the Laboratory tests capillary flow was completely eliminated in test panels made of bevel siding that had been dipped in a water-repellent preservative for 3 minutes. Subsequent tests indicated similar results could be expected with a 10-second dip. The treatment was also effective in preventing the entrance of wind-driven water.

The application of a water-repellent preservative along the under side of the butt edge at the lap was effective in reducing capillarity, though not equal in effect to dipping. Nevertheless, these tests indicate that the application of the water-repellent preservative in this manner to the siding of existing houses would materially reduce the effects of capillary water flow. It would mean better paint performance and reduced maintenance.

References

Dunlap, M. E.
1949. Condensation Control in Dwelling Construction, U. S. Housing and Home Finance Agency. 73 pp., illus.

Teesdale, L. V.
1953. Condensation Problems in Modern Buildings. U. S. Forest Products Laboratory Report No. R1196. 9 pp., illus.

____
1949. Thermal Insulation Made of Wood-base Materials. U. S. Forest Products Laboratory Report No. R1740. 40 pp., illus.

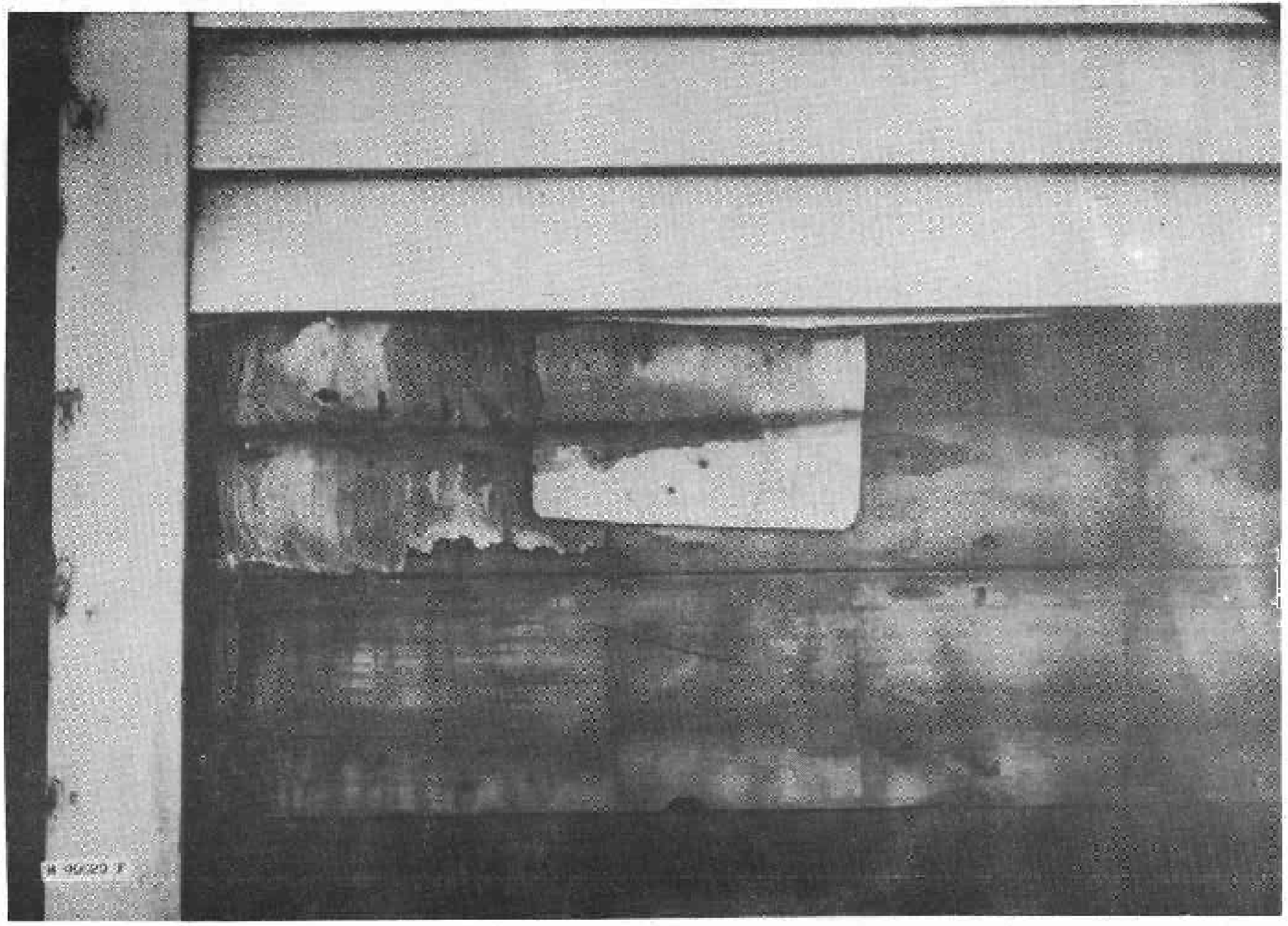


Figure 1.--Although water got in back of the siding of this 61-year old house, as shown by the paper and wood sheathing, the paint was still in good condition when the house was torn down.

ZM 96020 F

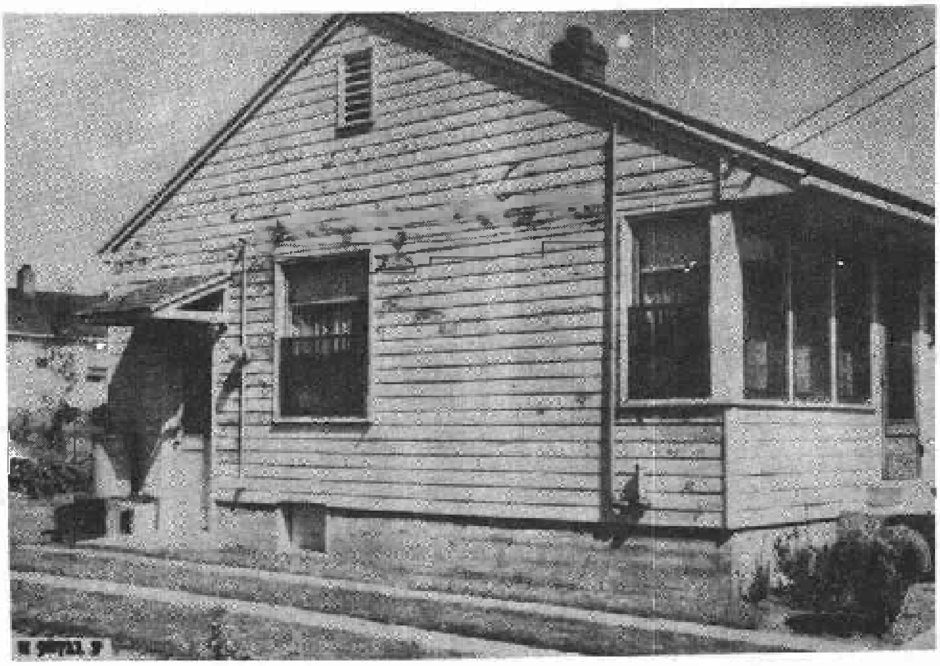


Figure 2.--The gable end of this house has little roof overhang, and the side wall is not protected from rain. The wide overhanging eave on the front gave good protection to the siding below, and the paint though spotted with dirt, is in good condition.

ZM 98711 F

Figure 3.--The limited overhang on this Florida house did not protect the siding and paint from frequent wetting by rain. Siding and paint on nearby houses with wide overhangs were in good condition.

ZM 92443 F

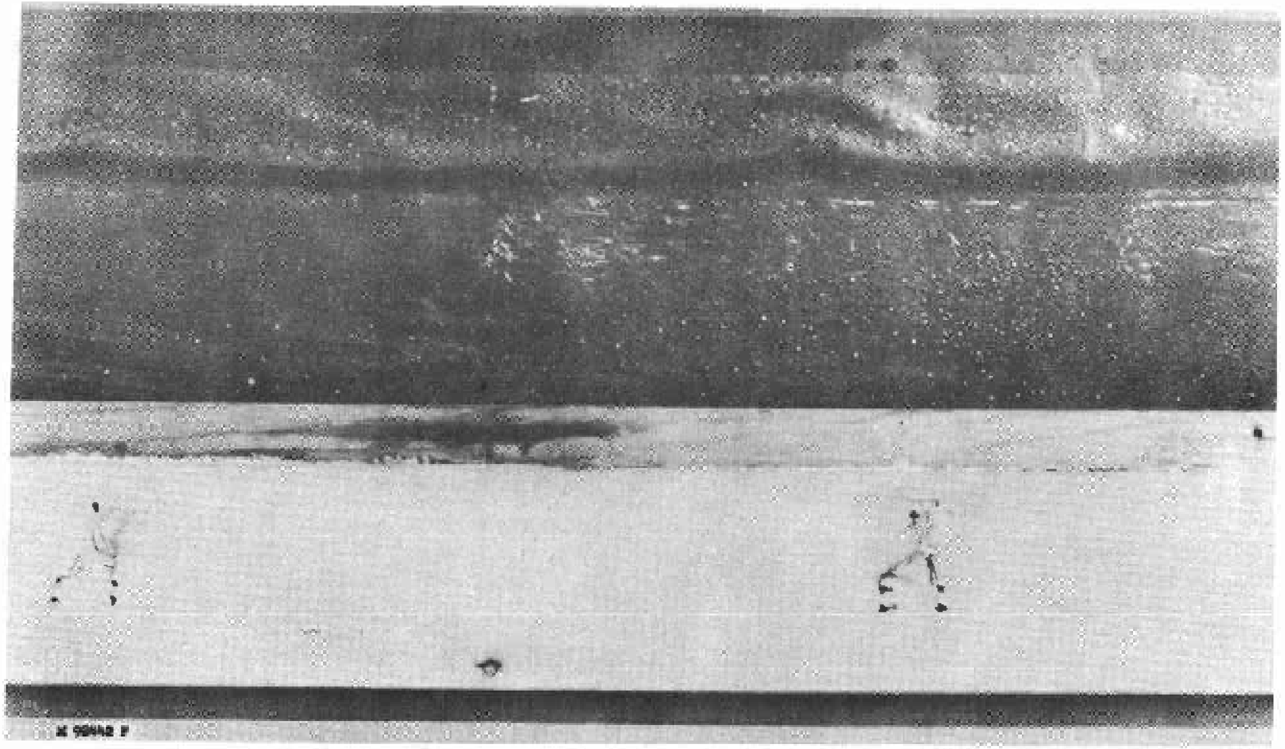


Figure 4.--Water found on sheathing paper when siding was removed in late September. The back of the siding was wet. The water had worked under the laps by capillary action.

ZM 92442 F

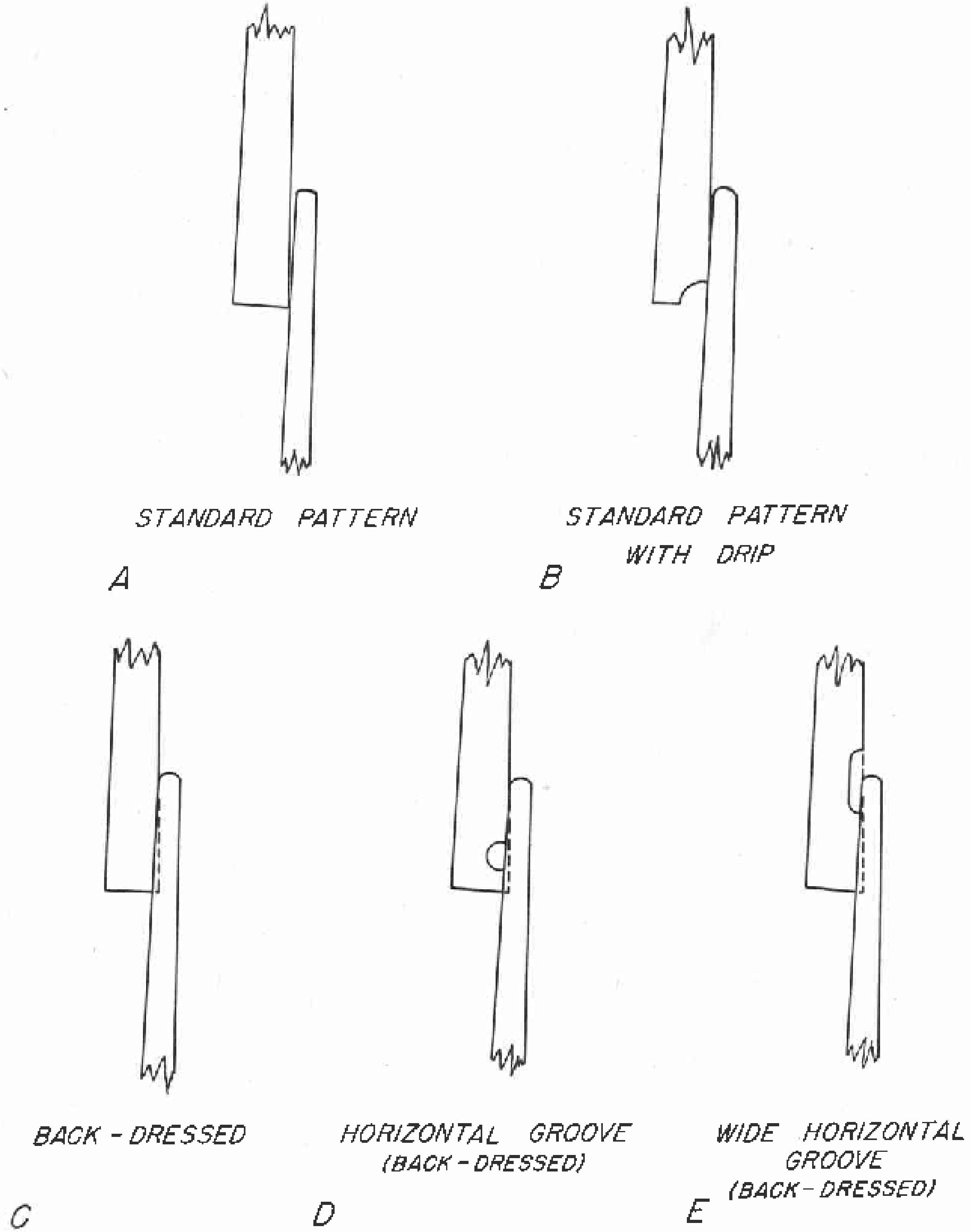


Figure 5.--Siding patterns tested in the exploratory studies.

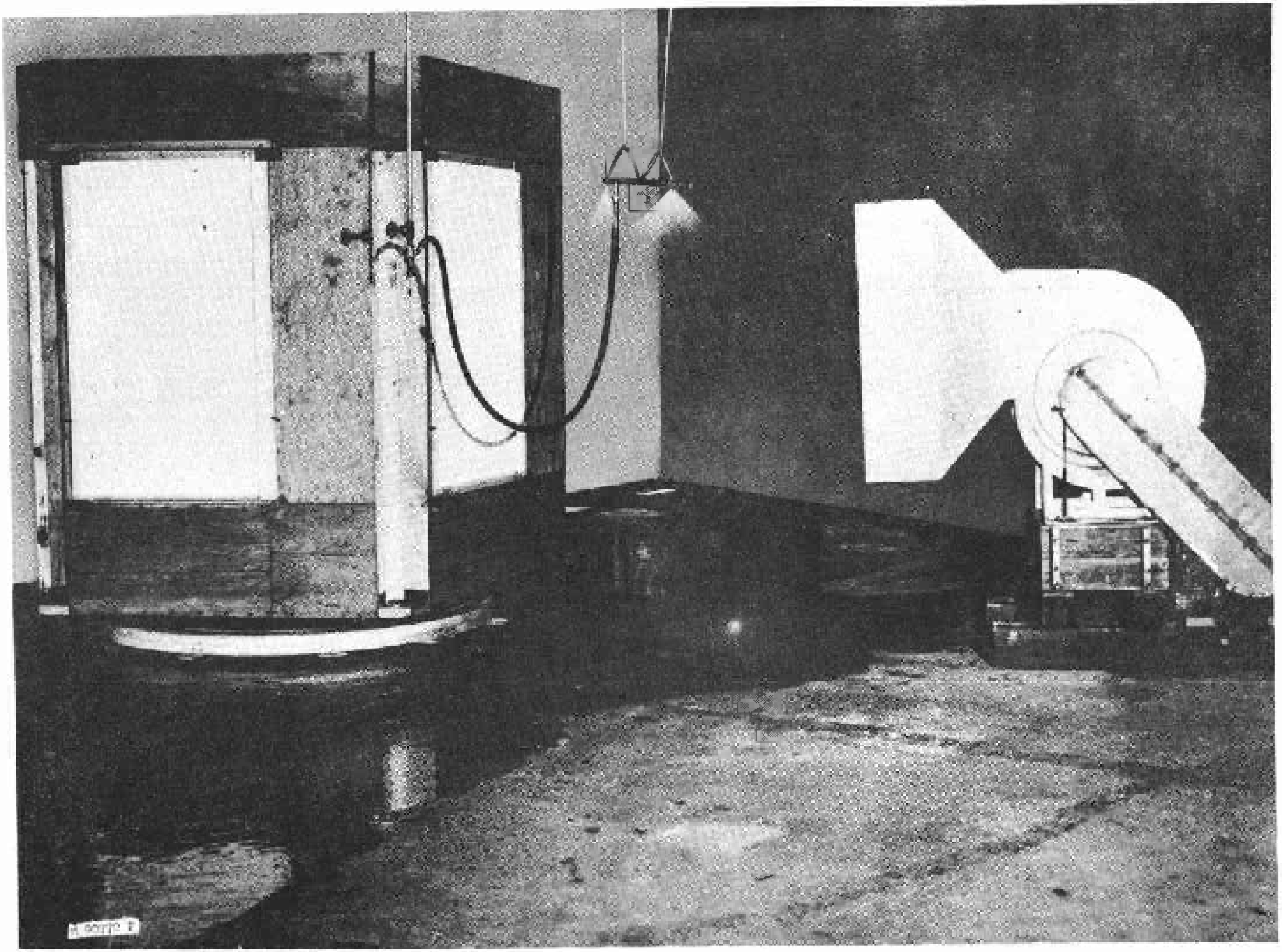


Figure 6.--Turntable and fan used in exposing panels to wind test.

ZM 90772 F

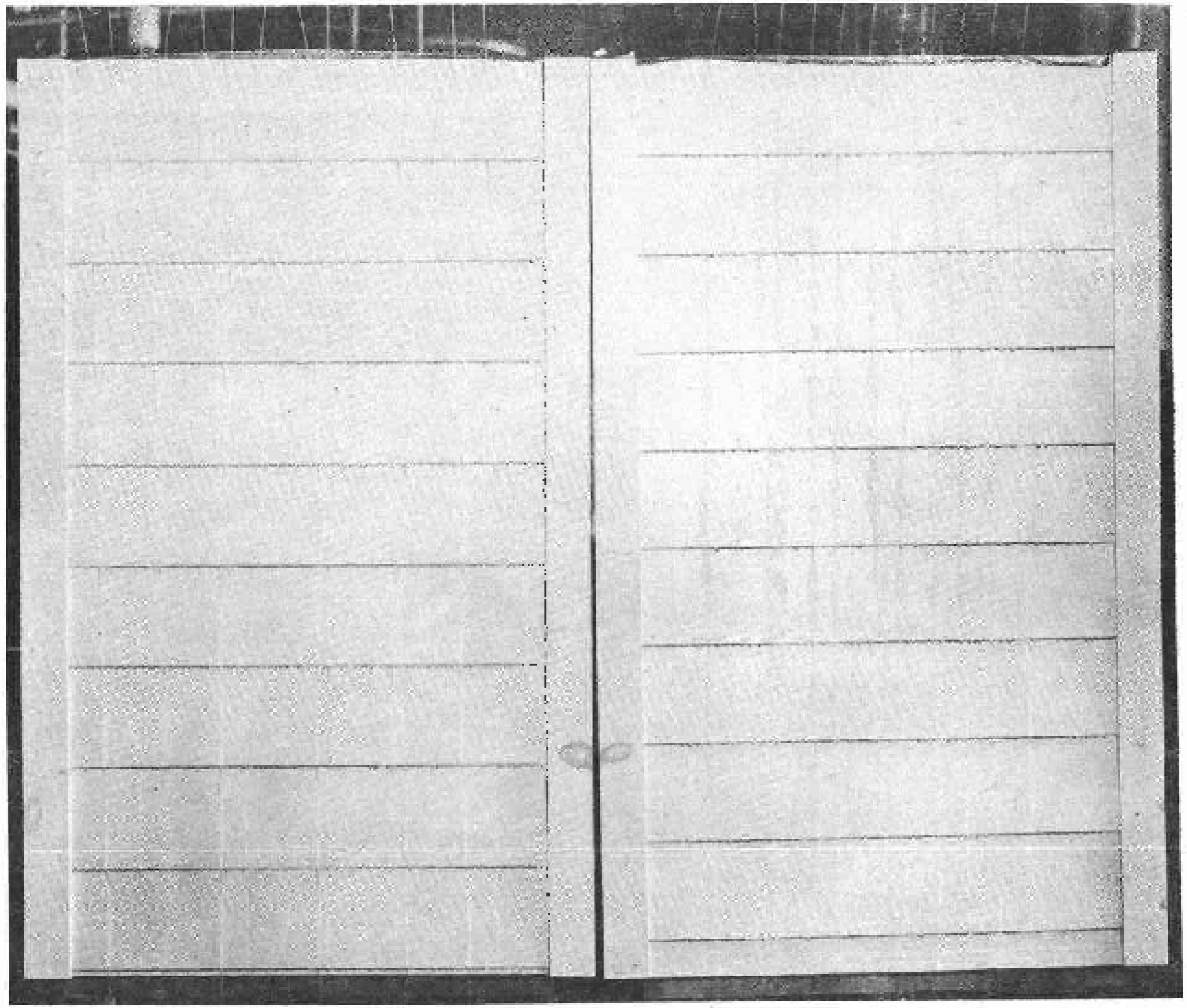


Figure 7.--The panel on the left was made up of treated material, that on the right of untreated material. Note the difference in the water pattern.

ZM 90572 F

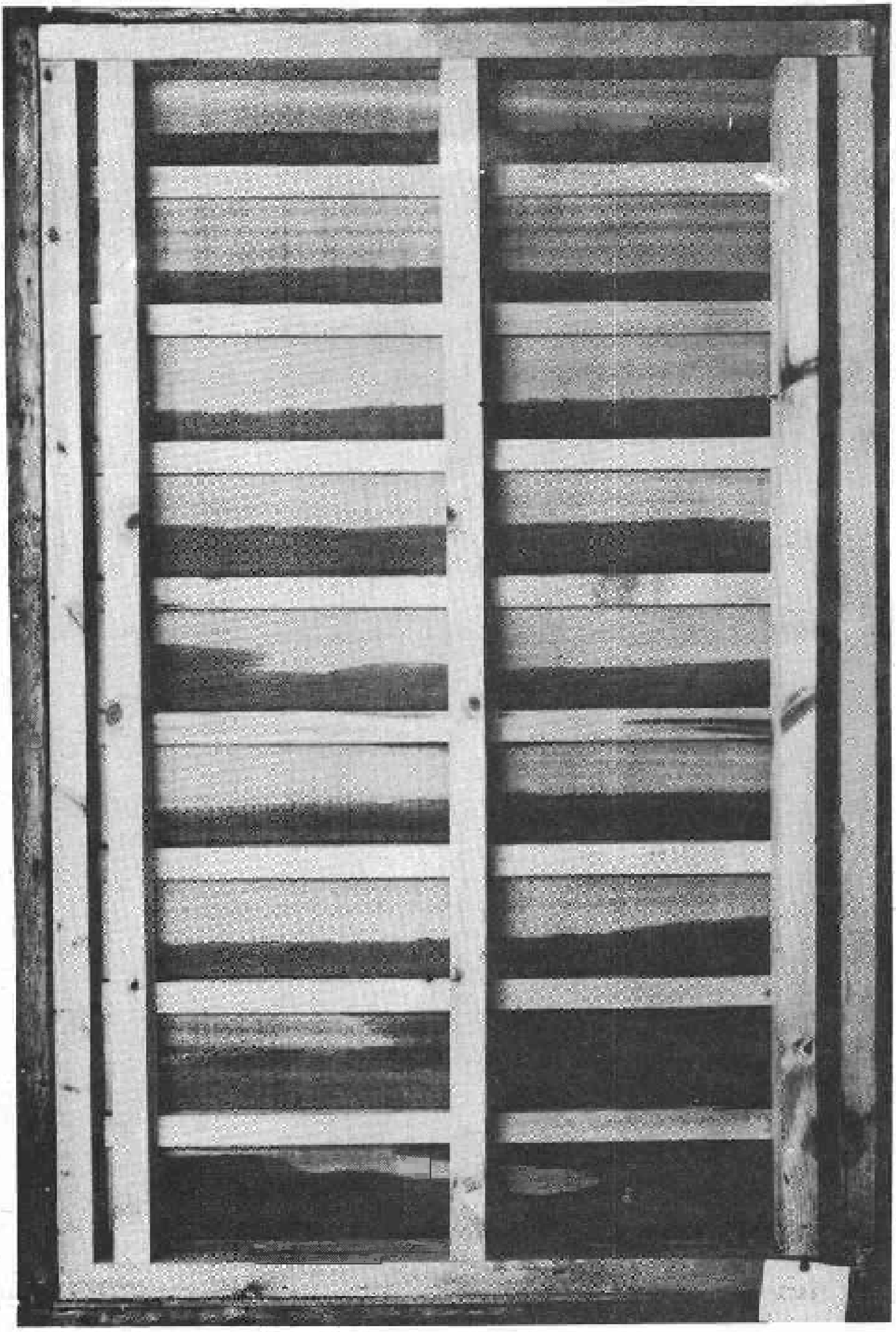


Figure 8.--Untreated, unpainted siding showed general wetting after a 4-hour water spray on the panel face. Marked wetting of the bottom boards was due to a nail split. Paint would reduce but not eliminate water ingress.

ZM 90909 F

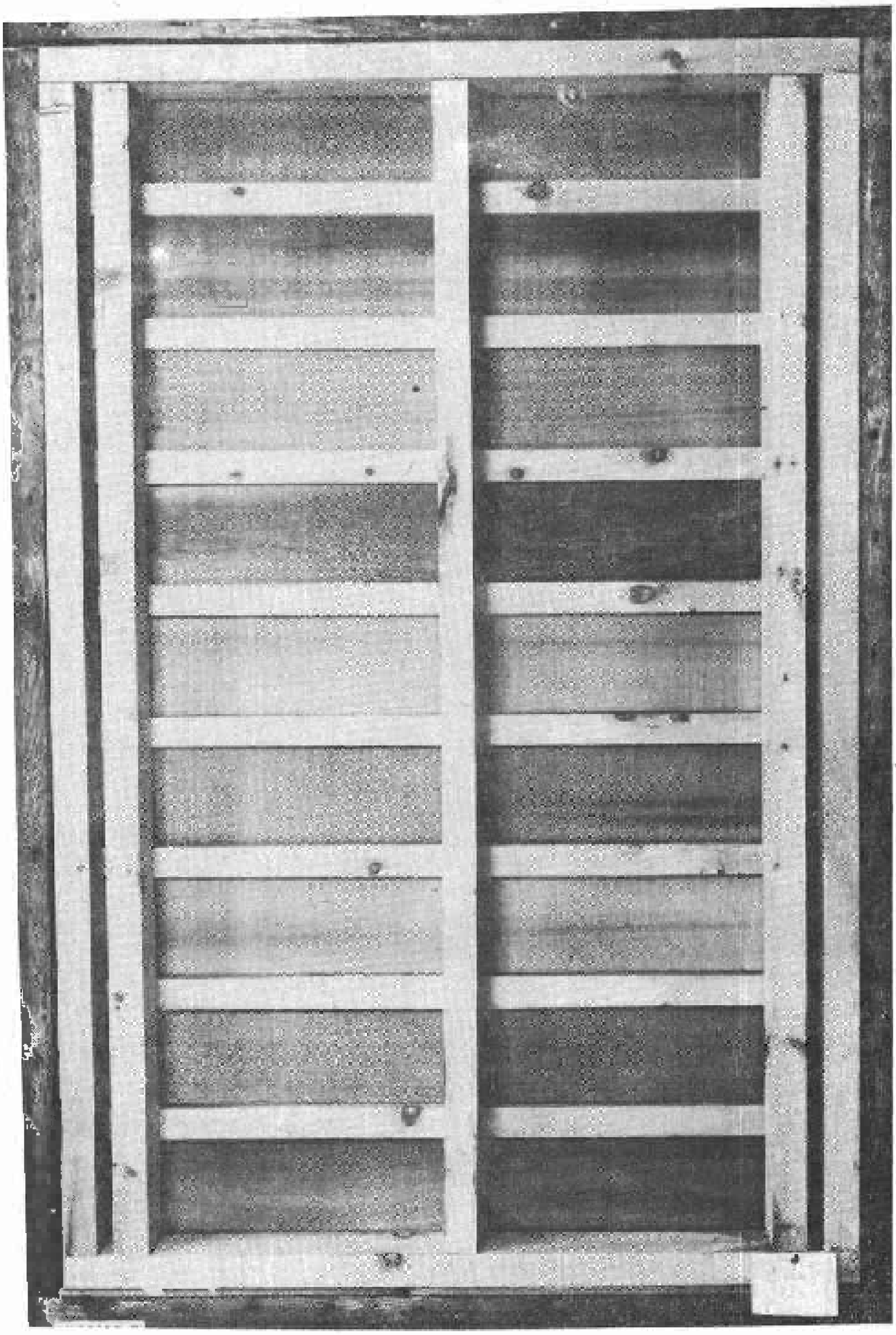


Figure 9.--The back of this panel of treated but unpainted siding showed no wetting after a 4-hour exposure to water sprayed on the face of the panel.

ZM 90910 F