THE WISCONSIN ARCHITECT

THE OFFICIAL PUBLICATION OF
THE STATE ASSOCIATION OF WISCONSIN ARCHITECTS
WISCONSIN CHAPTER OF THE AMERICAN INSTITUTE OF ARCHITECTS

Minutes of Monthly Meeting

Condensation in Walls and Attics
(Continued from May issue)

Vol. 6 June, 1938 No. 6

Condensation in Walls and Attics

By L. V. TEESDALE, Senior Engineer,
Forest Products Laboratory,* Forest Service,
U. S. Department of Agriculture

(Continued from May issue)

The still lower temperature and vapor pressure on the inner face of the sheathing paper will cause some of the remaining moisture vapor to move from the inside face of the sheathing to the colder face of the paper but as the resistance to such movement is greater through the sheathing than through the open stud space the rate of vapor movement will be correspondingly small. However, with a rise in outside temperature the ice may melt and some water may be absorbed by the sheathing. Some may even run down inside the wall. The better grades of sheathing paper commonly used are very vapor resistant and very little vapor will pass through, but with changing outdoor temperatures when cold weather is followed by mild temperature the ice that forms between the sheathing and the paper may melt behind the paper, run down to a horizontal joint where some may work through and wet the siding. This is one source of moisture that may contribute to paint failures.

The same general principle of vapor movement exists where fill insulation is used. The insulation itself is not resistant to vapor movement and the bulk of the condensation appears on the inside face of the sheathing. However, in the insulated wall the resistance to heat loss offered by the insulation results in a much lower temperature at the sheathing line, consequently the sheathing is below the dewpoint temperature at much higher outside temperatures than is the case in uninsulated walls. This fact in turn very greatly increases the amount of condensation that may collect, since periods of extremely cold weather, such as are required to cause condensation in uninsulated walls, are of relatively short duration but there may be a total of several weeks during the winter when the outside temperature is low enough to cause condensation in insulated walls.

There are a number of types and kinds of insulation on the market and the potential buyer often hears that certain types "draw water" and become wet. This is not true. Such insulation, because of its efficiency in reducing heat loss, lowers the temperatures within the wall and thus sets up the condition that increases the amount of moisture that may accumulate. Once understanding the conditions that cause the moisture it is also possible to provide means of prevention as discussed later.

The conditions that cause condensation in side walls also occur in attics or under roofs, modified more or less by any ventilation that may be provided or that may occur naturally. Roof condensation is reported far more frequently than side wall condensation, not necessarily because it occurs more frequently but rather because it is more likely to be seen by the occupants. For example, in a pitched roof house having, say, fill insulation in the ceiling below the attic, condensation may develop during a severe cold spell on the under side of the roof boards, forming as ice or frost. When the weather

moderates, or even under a bright sun, the ice melts and drips on the attic floor, leaks through and spots the ceiling below. Often such spots are assumed to be roof leaks and cause owners and contractors considerable unnecessary expense in attempting to waterproof a roof that is not leaking. If the attic has adequate ventilation little or no trouble will occur but adequate ventilation is sometimes difficult to attain, and tends to increase the heat loss.

The movement of water vapor is independent of air movement to the degree that no general circulation of air is necessary to carry the vapor into the wall. The vapor actually moves by diffusion from zones of higher vapor pressure to zones of lower vapor pressure. In fact plaster is very highly resistant to air infiltration even when under a pressure equivalent to a wind velocity of 15 miles per hour but no such pressure exists within a house. Vapor, however, will move very rapidly through plain plaster but is retarded somewhat by paint coatings and other surface treatments. Other types of well surfacing materials, such as plywood, fiber boards, and plaster boards are also permeable to vapor and here again the surface decorating material has more or less effect on the resistance. In the case of plywood the type of glue used is also a factor, the phenolic resin glues being much more resistant than soy bean and casein glues to the passage of vapor.

Moisture accumulation within a wall like those illustrated in figures 1 and 2 is affected by five factors:

1. Outside temperature and humidity.
2. Efficiency of insulation.
3. Inside atmosphere (temperature and humidity).
4. Resistance of outer wall to vapor movement.
5. Resistance of inside wall to vapor movement.

As the outside temperature and humidity cannot be controlled and as insulation adds to comfort, health, and fuel economy, methods of prevention are limited to the three other factors. Some authorities believe that indoor humidities low enough to preclude the possibility of moisture accumulation are undesirable both as a factor of health and comfort and in preventing the overdrying of interior woodwork and furniture. It is possible, of course, to compromise and carry somewhat lower humidities during very cold weather than are maintained during moderate winter weather and thus reduce the amount of moisture that would accumulate as condensation. It is also possible to so construct walls that the vapor could pass outward through sheathing and sheathing paper and escape through openings in the outside wall covering or be carried away by ventilating the space between the sheathing and outside finish. Standard construction does not lend itself to this method of moisture elimination. Either the inclusion of ventilating holes in the side wall material or a ventilating space would require more or less modification of the conventional construction. One possible method for wood siding would be to place 1 by 2 inch furring strips over the sheathing thus obtaining a vertical ventilating space approximately of ¾ of an inch which should be open to the outside at both the bottom and top of the wall so that air could enter at the bottom and pass out at the top. The openings could be concealed behind but not covered by mouldings or other treatment at the water table and cornice. Similar ventilation could be adapted to stucco, brick, and stone exteriors. With this method

(Continued on page 5)

THE WISCONSIN ARCHITECT

Official Publication

The State Association of Wisconsin Architects

•

The Building Congress of Wisconsin

•

Wisconsin Chapter, The American Institute of Architects

LEIGH HUNT, Editor
152 W. Wisconsin Avenue, Milwaukee

JOHN S. HOLBROOK, Publisher
724 E. Mason Street, Milwaukee

Published Monthly Subscription, $1.00 per year

Address all communications for publication to Editor at 152 W. Wisconsin Ave., Milwaukee.

CONTRIBUTING EDITORS
PETER BRUST HERMAN BUEMMING

ASSOCIATE EDITORS
No. 1 — Frank E. Johnson, Superior
2 — E. F. Klingler, Amery
3 — Raymond N. LeVee, Appleton
4 — C. Madsen, Stevens Point
5 — Sylvester Stepnoski, Fond du Lac
6 — Myron E. Pugh, Madison
7 — Gilbert Grunwald, Milwaukee
8 — George E. Wright, Racine

OFFICERS
Leigh Hunt—President
Herbert W. Tullgren—1st Vice-President
William Mickelsen—2nd Vice-President
Carl Eschweiler—Secretary
Arthur L. Seidenschwartz—Executive Secretary
Gregory Lefebvre—Treasurer

EXECUTIVE BOARD
Leigh Hunt ---------- Milwaukee
Herbert W. Tullgren ---------- Milwaukee
William Mickelsen ---------- Racine
Carl Eschweiler ---------- Milwaukee
Gregory Lefebvre ---------- Milwaukee
E. F. Klingler ---------- Amery
C. Madsen ---------- Stevens Point
Walter Memmler ---------- Milwaukee
Frank Drolshagen ---------- Milwaukee
Frank J. Hoffman ---------- Racine
Gerrit J. DeGelleke ---------- Milwaukee
Urban Peacock ---------- Madison
W. A. Oppenhamer ---------- Wausau
Ellis J. Potter ---------- Madison
Frank J. Stepnoski ---------- Fond du Lac
Noel Ross Safford ---------- Green Bay

ADVISORY COUNCIL
District No. 2
E. F. Klingler ---------- Amery
District No. 3
Gordon J. Feldhausen ---------- Green Bay
Leonard J. Reis ---------- Green Bay
District No. 4
C. Madsen ---------- Stevens Point
District No. 5
Sylvester Schmitt ---------- Two Rivers
Frank Stepnoski ---------- Fond du Lac
District No. 6
August F. Nerlinger ---------- Madison
Henry Loeprich ---------- Madison
District No. 7
Arthur L. Seidenschwartz ---------- Milwaukee
District No. 8
Frank J. Hoffman ---------- Racine
Wm. F. Mickelsen ---------- Racine

State Association of Wisconsin Architects

June 3, 1938

The regular monthly meeting of the Executive Board of the State Association of Wisconsin Architects was held at the Plankinton Hotel on June 3, 1938.

The meeting was called to order at 1:15 P.M., President Leigh Hunt presiding. Present were Messrs. William Mickelsen, Emiel Klingler, Frank Stepnoski, C. Madsen, Leigh Hunt, Carl Eschweiler, G. DeGelleke, William Oppenhamer, Walter Memmler, G. Lefebvre, and A. L. Seidenschwartz. Represented by proxy were Messrs. N. R. Safford, E. J. Potter, F. J. Hoffman. Messrs. Herbert Tullgren and Frank Drolshagen were absent.

COMMITTEE REPORTS

Practice Committee: Mr. William Mickelsen, Chairman

A complaint was received from Mr. J. Durrant, Architect at Boscobel, Wisconsin, that preliminary sketches for a school building were prepared by Heating Engineers. The Engineers have had several contracts with the school board. The complaint was re-referred for further investigation.

The Practice Committee of District No. 3 submitted a complaint relative to the stamping of plans by architects.

A general discussion followed on the practice of stamping plans and it was decided that a letter should be addressed to all the members of the Association calling their attention to this unethical procedure.

Mr. Oppenhamer reported that a Harvey C. Brown was listed in the Appleton Telephone Directory as an architect operating his office at 112 West College Avenue, Appleton. The Secretary to notify the State Board of Examiners of this fact.

Mr. Frank J. Stepnoski submitted a circularized letter on the stationery of Mr. Imbs of St. Louis, Missouri.

A general discussion was had upon the advisability of increasing the dues of the Association.

Leigh Hunt representing the State Association at the annual A. I. A. Convention held at New Orleans on April 19-22, submits the following report:

As your delegate to the 1938 A. I. A. convention held in New Orleans, La., April 19 to 22, I wish to report and comment on what took place.

I arrived in New Orleans April 17, two days before the convention opened to attend pre-convention meetings of the Committee on State Organization. The general organization meeting was held Sunday afternoon and Monday morning and the pre-convention meeting of the State societies was held Monday afternoon and evening, April 17.

Fifteen state societies were represented. John R. Fugard, Chairman of the Committee, conducted the meeting and Thomas P. Cope acted as Secretary.

The preliminary reports, which had been prepared by our committee, from data gathered from three regional meetings, one held in the Central States, one in the Eastern states and one in the Western states, were read and approved by the delegates to the convention of State societies.

This report had been previously submitted to the board of directors of the Institute, who had with only slight modification approved it and were offering it as a resolution to the convention on Thursday, April 21.

This resolution and report of the committee on state organization, is published in its entirety in the June issue of the Octagon and reprints of this report will be furnished to all members of our association.

Among other things you will notice that it contains a provision for creating a new office to be known as State Association Director, with provisions for setting up machinery for studying and perfecting a unification program which will be acceptable to the Institute and the State Societies, thereby bringing about real unification of the architects of this country.

The history of the unification movement is well expressed in the report in the Octagon and I hope that all members of this Board as well as all of the members of the State Society, will read it, study it and express themselves to me so that I may convey to the unification committee and the board of the institute your wishes and instructions for use in working out details which can be approved by the state societies as a whole.

It was the largest convention which the institute has ever had and I only wish that you all could have been there to have taken part.

A motion was made by Mr. Mickelsen and seconded by Mr. Oppenhamer that the Association donate copies of our minimum plan requirements and ethical practice to the several state societies. Motion was adopted.

There being no further business to come before the meeting, same was adjourned upon motion made by Mr. DeGelleke and seconded by Mr. Mickelsen.

Meeting adjourned at 4 P.M.

A. L. SEIDENSCHWARTZ, *Executive Secretary.*

Condensation in Walls and Attics

(Continued from page 3)

the sheathing paper should be of a type that passes water vapor readily, such as slaters felt. During periods of protracted cold weather it is quite possible that moisture would accumulate in the wall faster than it could pass through and be removed by ventilation, hence the ventilation method might not assure complete protection. So far, the possibilities in this method have not been thoroughly investigated by the Forest Products Laboratory.

Attics under pitched roofs can often be ventilated either through windows or louvered openings, ventilators in the roof, or openings in chimneys. Wood shingle roofs when laid on roof boards that are separated about 2 inches will often allow enough ventilation in the attic to eliminate the moisture problem. Flat roofs are more of a problem. Where the ceiling joists or supports and roof joists or supports are separated enough to allow a free circulation of air, and where sufficient openings and vents are installed a fair degree of ventilation can be obtained. Often the space under flat roofs is not sufficient to obtain adequate circulation.

The most positive, and least expensive, method of control so far experimented with at the Forest Products Laboratory is the use of vapor resistant barriers at or near the inner face of the wall and under ceiling joists under the attic. In houses under construction this barrier can be attached to the inner face of the studs after the walls have been insulated and before lathing or finishing the wall on the inside. In houses already plastered the barrier can be some suitable material or treatment applied to the interior surface of exterior walls. While it might appear on first thought that such a barrier should be 100 per cent resistant, actually, however, it is not practical to obtain 100 per cent efficiency. With a suitable barrier, however, the amount of moisture en-

tering the wall is so small that it will not raise the moisture content to a degree that is objectionable.

The Forest Products Laboratory has been making tests on the vapor resistance of various materials used in wall construction and also on many materials that might be used for moisture barriers. Although these tests are still under way and have not covered all possible materials, enough information is available to permit the selection of a number of materials that are highly resistant to the passage of water vapor. Among these are (1) asphalt impregnated and surface coated sheathing paper, glossy surfaced, weighing 35 to 50 pounds per roll of 500 square feet; (2) laminated sheathing paper made of two or more sheets of kraft paper cemented together with asphalt; (3) double-faced reflective insulation mounted on paper. The water-vapor resistances of these three materials, as measured at the Laboratory differ considerably one from another. Unfortunately, the work has not progressed far enough yet to enable a definite statement of the precise degree of vapor-resistance required for any specific set of conditions. Most of the discussions and recommendations in this preliminary article are based upon a climate such as that of Madison, Wis., and upon plastered wood construction. The recommendations have not yet been subjected to actual service tests, and may have to be modified as time goes on.

The barrier when located as described on the warm side of the dewpoint position resists the passage of moisture while it is in the form of vapor and therefore before it has a chance to condense into water. Hence there is no hazard of water forming behind the plaster or other interior wall finish. The barrier also prevents moisture from getting into the wall or attic space during the construction period, particularly during the plastering operation.

Such vapor barriers should be applied vertically on side walls with edges lapping on the studs after the insulation is installed and before lathing. Horizontal joints should be made only where backed up with a plate or header. The barrier should be brought up tight against electric fixture outlets, air registers, door and window frames, and other similar openings. If wood lath, metal lath, or other types requiring a plaster key are used the paper should be applied slightly loose so that the plaster can push the barrier back to form the key. Where the ceilings below the attic or roof are insulated the barrier should be applied in a similar manner.

Walls finished with such materials as plywood, fiber board, plaster board, and the like, should also have the barrier as described. Sheathing paper when used outside of the sheathing in combination with the moisture barriers described should be water-resistant but not very vapor-resistant so that the small amount of water vapor that may leak through the barrier can escape outward. Slaters felt meets this requirement. Quite possibly the sheathing paper could be omitted entirely; and it is conceivable that the omission would actually result in a drier wall. Further experiments will have to be made before this point can be definitely settled.

Some kinds of mineral wool are relatively resistant to water absorption, others are treated to make them resistant to wetting by water. This property, while desirable, does not make these materials resistant to the passage of vapor. Therefore they should not be considered a source of protection against condensation.

Some types of mineral wool have a vapor-resistant paper back attached to the batt. Tests to date indicate that none of these papers has a vapor resistance equal that of the 50-pound sheathing paper previously mentioned. They are sufficiently resistant, however, to be of definite help in keeping the insulation and the wall dry and to warrant proper care in installation. The wool batt is made to fit between standard stud, joist, and rafter spacing with tabs on the paper which extend out from the batt and are tacked to the studs or rafters. The batt may be cut or forced back to obtain the tabs at the end of the batt. Where the spaces are not standard between studs, such as occurs around windows, doors, and dormers, particular care should be taken to obtain good joints even if it is necessary to use one of the barriers previously described.

Blanket types of insulation are also available where the insulation is enclosed within a heavy paper covering treated with asphalt. This paper covering is a fairly effective vapor barrier but not so effective as the 50-pound sheathing paper. It is important that this type of insulation be carefully installed so that vapor cannot work through around the edges. The tabs should be nailed to the face of the studs with the insulation looping loosely inward away from the inner face of the wall or if installed between studs it should be fastened in place with wood strips.

Fiber board sheathing is often used as a substitute for wood sheathing and because of its lighter structure it offers more resistance to heat loss than a similar thickness of wood. It may be used either with or without other insulation. When used with other insulation the methods of protection suggested should be followed. When no other insulation is used the need of a moisture barrier is much less, just as with wood sheathing.

Many materials embodying the principle of reflective insulation are in use but opportunity for observation and tests has been limited. One type having metal foil attached to both sides of a heavy sheet of paper is very resistant to vapor and another type composed of a strong paper faced on both sides with metal oxides is also very effective in resisting vapor transmission. Data upon the comparative vapor resistance of these papers and many other materials are to appear in a forthcoming article.

The practice of installing insulation in existing houses, some of which have been built for many years, is becoming general, adding both to summer and winter comfort of the occupants. The occurrence of moisture or condensation in these older houses after insulation is quite uncommon, largely because such houses are not so tight as new houses, windows fit less snugly and probably have no weather strips. Under such conditions the normal humidity is lower. Occasionally, however, these older homes will also show evidence of moisture accumulation and generally when the occupant has made an effort to increase the humidity above normal. Some of the companies that insulate existing houses take off a portion of the outer wall covering and cut a large number of openings in the sheathing through which the insulation is blown and replace the outer covering without filling the holes in the sheathing. These openings allow more or less ventilation and should be helpful in allowing vapor to escape outward. Some companies include some form of attic or roof ventilation as part of their contract.

Positive protection for existing buildings that have a

moisture problem or where it is proposed to install winter air conditioning may require some type of barrier on the interior face of exterior walls and on the ceilings below the roof. Ordinary paints of the flat wall, or lead and oil types do not seem to offer the resistance desired but two coats of aluminum paint appear to offer excellent resistance and permit almost any subsequent method of decoration desired.

The question sometimes arises as to the possibility of summer cooling causing condensation in walls. This is very unlikely because the inside temperatures are seldom more than 15 degrees below outside temperatures so that the possibility of condensation would only occur during periods of extremely high humidity outside. Such a condition would be of rather short duration and would be unimportant.

General Recommendations

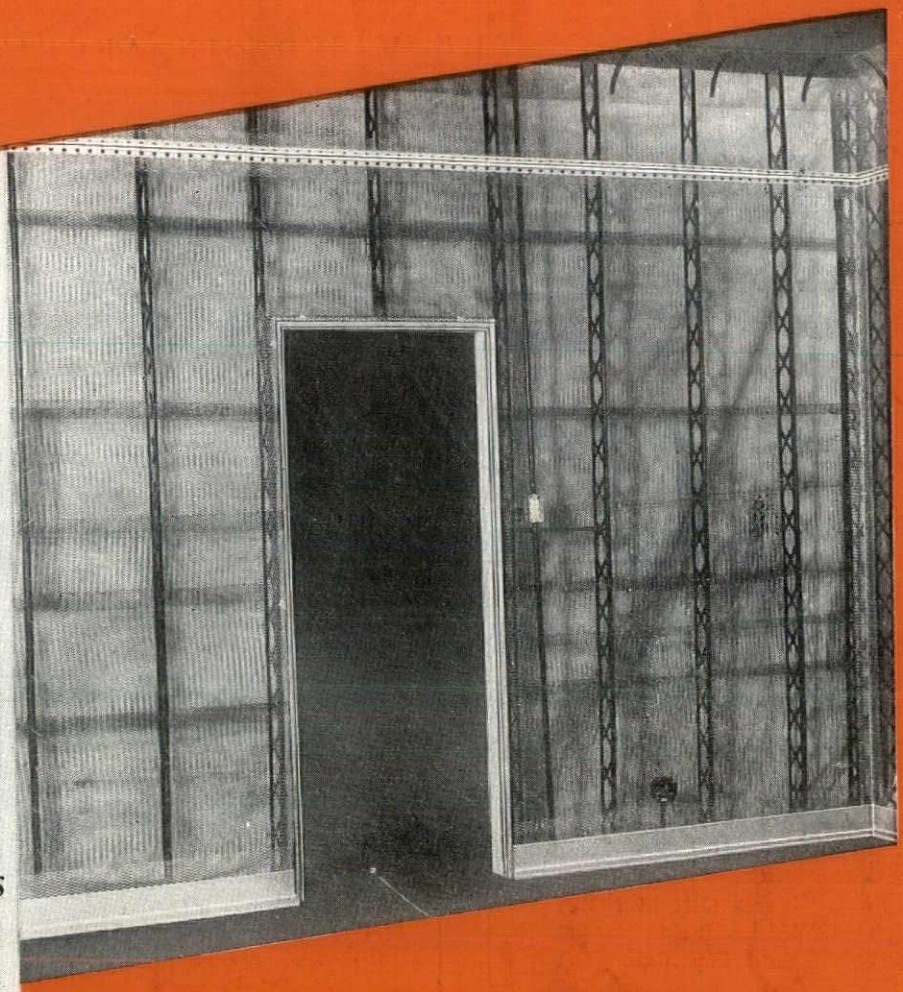
For new construction it is recommended that a suitable vapor barrier be installed on the side wall studs and below the ceiling insulation and that some attic ventilation also be provided. This will not only protect the house for normal humidities but should prove ample protection in case winter air conditioning is installed. Further, it offers protection during the construction period, particularly if plastering is done in cold weather.

For existing houses that have been or are to be insulated, and where humidities during cold weather are low, attic ventilation alone should be adequate. Should evidence of moisture appear in mild weather following a cold period, cut off all possible sources of humidity for the balance of the winter and some time later in the following summer, after the moisture has had time to disappear, coat the exterior walls and the ceiling below the roof insulation with two coats of aluminum paint after which redecorate as desired.

For existing houses that are equipped for winter air conditioning follow the foregoing suggestions and during periods when outside temperatures are below 15° F. carry relative humidities not higher than 30 per cent and in sub-zero weather reduce to 20 per cent relative humidity.

The suggestions offered here are based upon tests now under way at the Forest Products Laboratory combined with observation and experience in occupied homes. As these tests and observations are continued and additional information becomes available more specific recommendations for protection against moisture condensation will be forthcoming.

SEE
JULY ISSUE
for
Annual Stag Outing Details



Now— a firesafe hollow partition

that saves construction time and costs for your clients

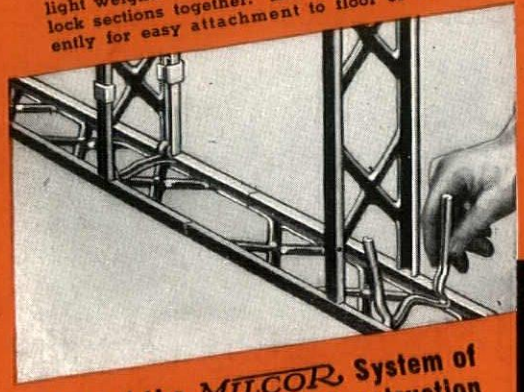
—with the new embossed, truss-design MILCOR Steel Stud

(Patent Applied for)

Your client appreciates this sound, money-saving construction — your contractor, the ease of installation . . . The new embossed, truss-design stud serves a three-fold purpose — as *studding, ceiling runner,* and *floor track.* With only one standard unit to consider, you eliminate confusion with materials and save time on the job. Patented shoes slip quickly into place, making firm attachments of the upright member to the ceiling runner and floor track.

Designed to combine light weight with functional strength, Milcor Steel Stud permits easy installation of conduits, pipes, etc. It is quickly cut to length on the job, or prefabricated if required. It is firesafe, permanent . . . There is no muss to clean up when the job is completed — and *cleaning up costs money and causes arguments* somewhere along the line . . . Milcor Steel Stud — the newest product in the Milcor *System of Fireproof Construction* — is engineered to produce, with Milcor Metal Lath, the finest, firesafe hollow partition possible today — a lasting guarantee of fine construction and a satisfied client . . . Investigate the new Milcor Steel Stud. Write for the Steel Stud folder. F-31

Truss design produces maximum strength with light weight. Patented shoe and wedge quickly lock sections together. Holes spaced conveniently for easy attachment to floor or ceiling.



Unit of the MILCOR System of Fireproof Construction

MILCOR STEEL COMPANY

MILWAUKEE, WISCONSIN — CANTON, OHIO

Chicago, Ill. Kansas City, Mo. La Crosse, Wis. Atlanta, Ga.