NORTHWEST ARCHITECT

Volume XII **Official Publication Minnesota Society of Architects** Number 1

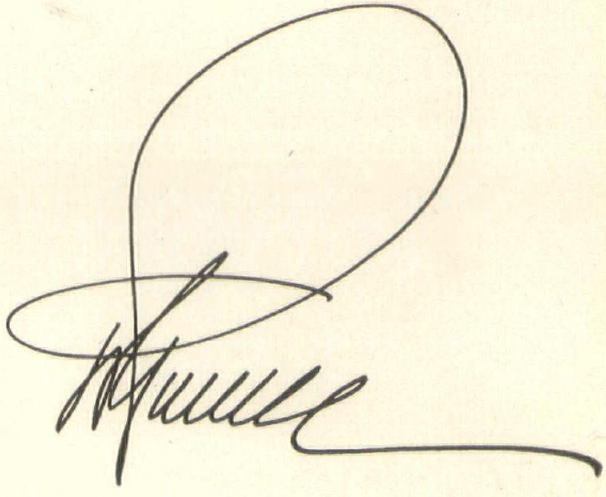
Read in this issue

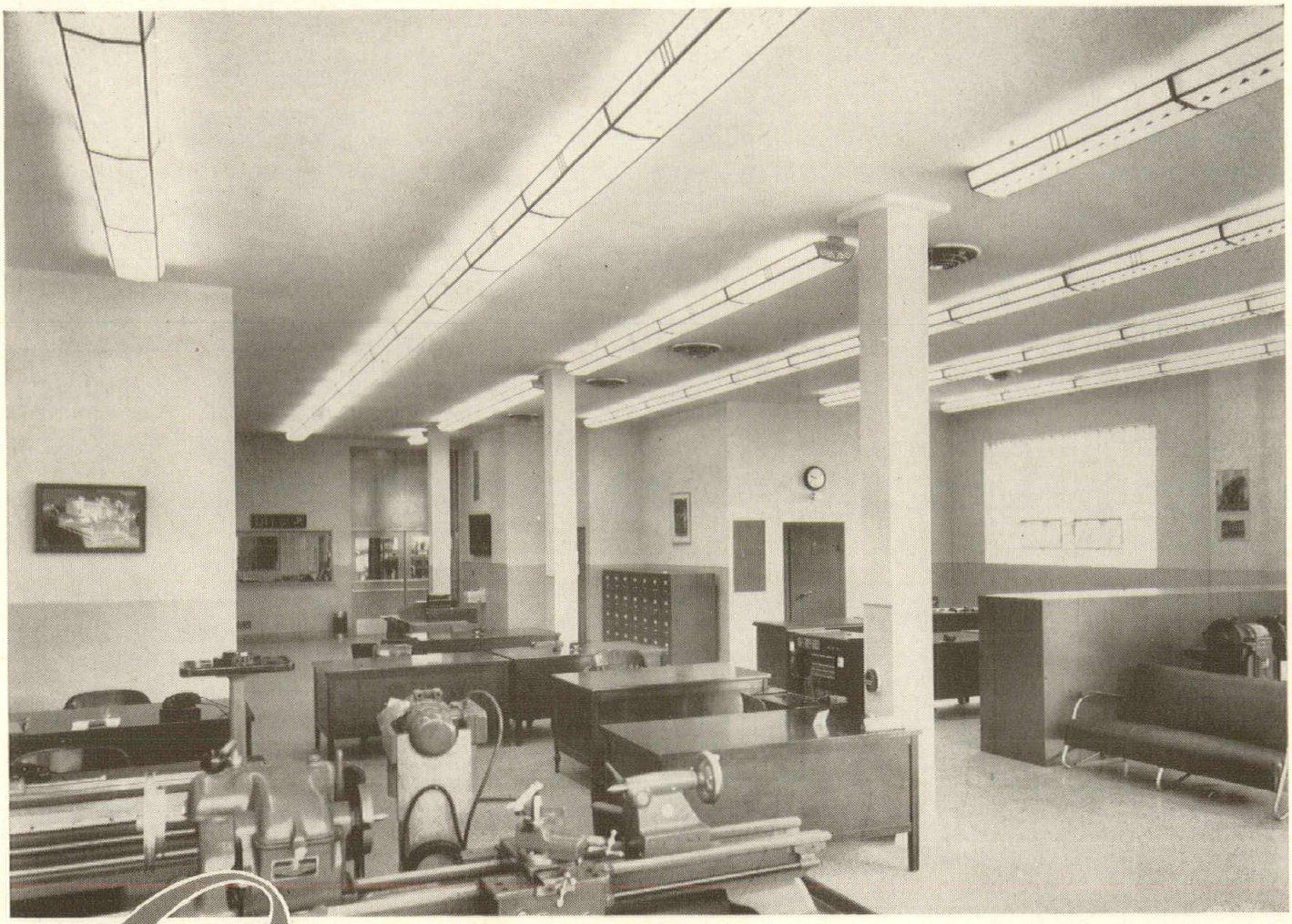
"IT MAY BE YOURSELF"

by
WILLIAM GRAY PURCELL
ARCHITECT
Who now begins his Eighth Year of writing for this Journal.

ERVEN JOURDAN
PHOTOGRAPHER
LOS ANGELES

With kind personal regards to all my old friends . . . .





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Northwest Architect

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1948

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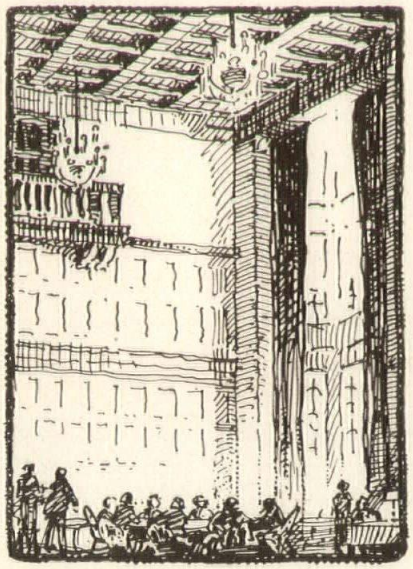

University Club, Portland, Oregon
sketch by William Gray Purcell, 1929

Myself when young
Did eagerly frequent
Doctor and Saint
And heard great argument
About it and about:
But evermore came out
By the same door
Where in I went.

"Rubaiyat of Omar Khayyam," A. D. 1079
Edward Fitzgerald translation, 1859

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"AN AUTHORITY!" . . . -THAT MAY BE YOURSELF.

. . . KEEP AWAY FROM BOOKS for many years. As soon as you start reading books you are drinking in what adults have thought instead of creating your own ideas. Eventually you will have to read some books so as to be invited out in the evening, where people talk about books they have not read and seldom understand--*Morris Ernst

By WILLIAM GRAY PURCELL

FOR SEVEN YEARS now I have been writing these pieces for you. This is true in quite a literal sense, for in looking over the mailing list I find that I know personally over six hundred of you. So I always feel as if I were writing a letter, and many of you have felt this personal quality.

A good many of these discussions really got their original start as letters to some one of you. I get fired up with an idea, seize a pen, "Dear Fred, or John, or Harry" and I'm off; a reply and rejoiner starts a file. At once the subject begins to turn up in my reading, in books, in magazines, in the newspapers. The file material grows and grows. I begin to make notes; write others on the subject; and before long there are two inches of material in the file on "Wood" or "GI's Houses" or "Dr. Gray." I become impelled to think about the matter more and more at odd times. A lot of alternative titles suggest themselves. Dozens of them are put down and crossed off. Soon this "writing" job has become an editing job. The mass of material is gradually reduced to four NORTHWEST ARCHITECT pages. The layout is drawn for each page, type and pictures selected, and my collective letter to you is finally ready to go. In this way, there has been produced only a magazine piece. It soon passes and is forgotten. But it has become a part of a still growing me.

+ Where you come in . . . .

TO WRITE A BOOK, that is a more durable objective. Many have the ambition to write a book. They know something or have lived something useful or interesting. We may say a book is a book, but it is generally assumed that a book is not a book unless there is a great many of it. Thus many persons who are capable of producing good and useful books never do so because they see no way of securing a publisher, nor for paying the cost of printing and binding a thousand copies.

But even if a thousand copies of a book have been printed, you can only use and enjoy one copy at a time. And if an "edition" of a thousand, or five thousand duplicate copies of a single book have been printed and sold, the time will come, in a hundred years or in five hundred years, when only one of them will remain intact on earth. Whatever good the book may have done will have been planted in the successive generations of men's minds and hearts. And the last book itself, like a pod of dried peas, will await a dusty end or be replanted in a new edition by some cherishing person of a future age whose character we cannot now even guess.

***From "The Best Is Yet," page 259 by Morris L. Ernst, Harpers, 1945. A distinguished and very entertaining biography by a widely known and patriotic lawyer who is deeply devoted to the continuity of basic Americanism.**

WE PROPOSE, therefore, to encourage every person to produce his own book, just one copy, to be concerned with whatever it is that interests him, or in which he believes or works. Let him make formal record of that which is his very self.

Daily creative work is important to everyone because a man grows upon his own accomplishments; grows by expressing his own particular genius. His best growth comes from a deeper and fuller understanding of his own character in action. One must not only keep his progress in line with the life objective he has made for himself, but he must continually reappraise his production. It is essential to have a personal record of what this man has thought in the past and the works he himself has produced which are based upon that thinking.

But there is much useful germinal idea which cannot be developed for lack of time or suitable occasion. If skeleton memoranda be made, the author can from time to time take up these uncompleted factors and develop them along with the general fabric of his current work. I know of no first-rate author, scientist or artist who has not been producer of many times the amount of material that ever saw formal presentation to the world during his lifetime, and the notebooks, manuscripts and sketches of great minds are often of equal value with their formal utterances.

+ For example . . . .

IN A CORRIDOR GALLERY of the Chicago Art Institute is a large collection of preliminary and progress sketches by great artists of the past. Here you see the power and quality of many men whose work no longer holds any living interest. Here artists whose "finished" work may be second rate are seen to be men of vision and technical skill. It was their misfortune to live in times when formal deportment, in art and manners, was given precedence over life and imagination. Or the necessity of earning a living forced the author to package his work in a way acceptable to the customers of the day. Very often a man of creative spirit is not a good judge of his own work and the future puts new relative values on whatever of it remains—Abraham Lincoln was discouraged over his now immortal speech at Gettysburg. All of which should prove the best of encouragements toward preserving all one's own output in the most presentable form.

+ How to build it . . . .

WITH THIS practical view of *your* potential world, I should like to consider two sorts of personal books, and show how useful and agreeable to you the writing of them can become. I would like to outline from my experience how the production of your encyclopedia can grow natu-

rally and organically from day to day, and the way in which useful and illuminating material may be obtained.

The first section of this enterprise might be described as a handbook, and the remainder will appear as a set of volumes of more extensive and formal possibilities.

+ First, the handbook . . . .

ONE CARRIES in his pocket an envelope or suitable holder containing standard 3″ x 5″ library filing cards. Form the habit of using these cards in a number of ways:

A. Use them for notes in words, or by drawings, that flash into mind at times when there is no opportunity to develop them. Follow the faintest impulse and reach for a card. *Thinking* vividly is not a "doing"—you have to make a habit of linking the idea to the pencil and paper by action.

B. For street addresses and practical memoranda of every kind. Be sure to add exact identification for persons, products, events, as it is surprising how things become merged in a haze of inexact impressions. Date every card. Note where you are.

C. Use the cards, or less expensive paper cut 3/5 or 6/5 and folded once, as actual writing paper for developing a thought or writing out impressions which later can be sorted and further developed. With this system, one can wholly eliminate from his life the irritation of ever being obliged to wait for any person or event. Such time spaces become heavenly gifts for recreation in line, color or written word. From a street corner, much of life can be seen in five minutes. Write it down. Draw it.

D. Pencil practice, analyses of form, color records, investigations of whatever your particular interest may be are thus recorded in sequence and if you expect again to contact some experience on which you have already made cards, slip these from your file into an envelope and take them with you for more complete definition.

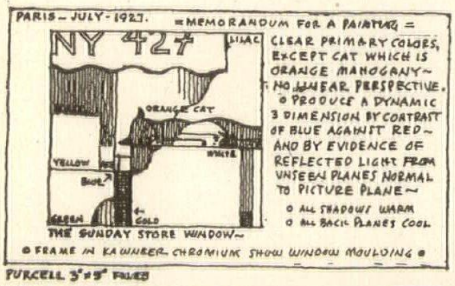
Below, on this page I have reproduced six of these cards which will give you a better idea of the wide variety of uses to which they can be put; but let me say, out of disappointment, that the most valuable decision in starting such a handbook is a resolution never to make a hasty record.

It takes only a little extra time to make a neat presentation, *there is time* at the time to do it, but never will be again. Your good intentions to complete or put the cards in order the first time you have an opportunity simply never comes, because if your mind is active, the accumulation of cards is too rapid and it would take you more than all your Sundays to complete and to put in order the cards of only one week. The system would soon *own you* to no good end. So whatever you do, make a finished, complete intelligible record and a work of art of it, *at the time,* then proper filing is all that is needed.

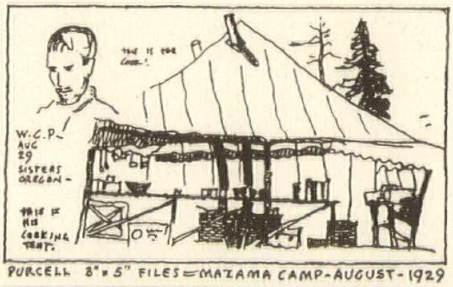
+ "Tomorrow and tomorrow and . . . ."

AS TOM DONALDSON SAYS, "The problem is always to deal with what is at hand—to make a quarter's worth of common stuff look-like-a-million-dollars" and it is just this type of inherent and sincere impulse within the simplest act of the artist that produces indigenous, vivid, significant, and moving works of art.

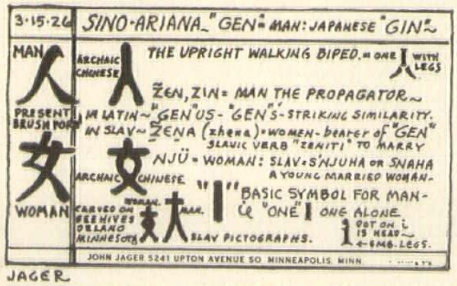
Live where you are or you will never live at all. There is no tomorrow in art—and as we now all know—no yesterday. If you have no brushes, paint with your fingers, and open new teaching vistas for children. If no stone and chisels, use a stick of firewood and your jack-knife and become the only German sculptor to survive the Nazis. If you can't study at the conservatory—play in a honky-tonk and write the "Symphony in Blue." Read biography—all great men build first, secure their material and tools as a reward.



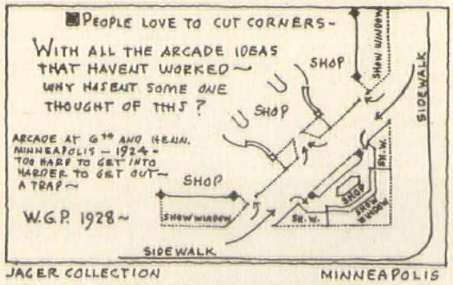
PURCELL 3″×5″ FILES



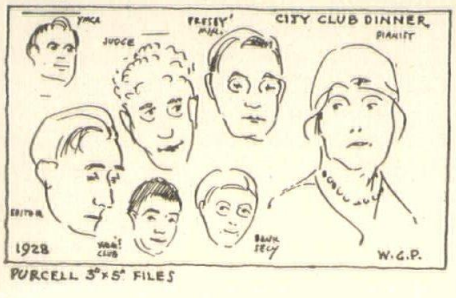
PURCELL 3″×5″ FILES = MAZAMA CAMP – AUGUST – 1929



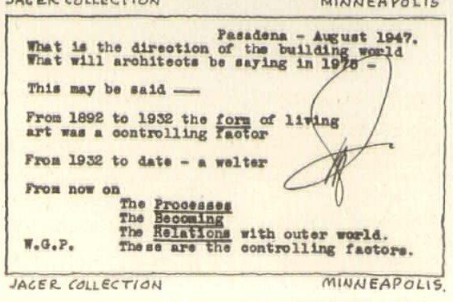
JAGER



JAGER COLLECTION MINNEAPOLIS



PURCELL 3″×5″ FILES



JAGER COLLECTION MINNEAPOLIS.

+ HERE IS WHAT I MEAN

I GOT TO THINKING about my boxes of record cards which had not been reviewed for some time; took down the oak one, 1927-1931. The number and variety of things that had wholly passed back into the hinterland of memory was a real surprise. "My handbook" was at once again very interesting. Yours will be, too. Here are a few of my classifications; dozens of cards under each head; six examples reproduced at left.

Forgotten men
Bayfield Trail
  Notes for book
Blackfoot Indians
  Sign Language
  Teepees
Book on Architecture
  Collect
Character of Russians
  1927!
Color notes
  Greek boats
  Donaldson lectures
Decorators Exposition
  Paris 1927
Etruscans
Kynourian Language
Memory Experiments
"Ornament"
  What Where When
Postage stamp design
Public Speaking
  My system
Verse trials
  Word sounds
  Sound as music
Writing subjects
  "Small Home"
  "Spectator" etc.
  "N. W. Architect"

You may say, "I am not a writer." "All these things mean nothing in my life." **That** is the point, not **my** book — **your** book. I only suggest how wide a world every man's thoughts are constantly ranging. Yours may be politics, sport, religion, boys and girls, handicraft, gardening — or what. But write it down and file it. Beats "keeping a diary" all to pieces. A diary is too self conscious.

If you are to be architects, you don't even need paper and pencil, just legs to walk to the nearest building under construction; a mind for stone and clay and wood, for steel, for textiles, and for processes and their chemistry; a heart for entering into the very souls of masons and carpenters, riggers and truckers, mixers and fixers—smoothers and sprayers.

Just a few more push buttons to operate this streamline world and there will be no necessity even for pushing the button, the meaning of life will have skidded into a philosopher's abstraction—without the philosopher.

So far my recommendation has been based on small scale records—3" x 5". This tends to emphasize its laboratory or research aspects. Its active use is more of a collecting experience. The productive factor is still just a potential.

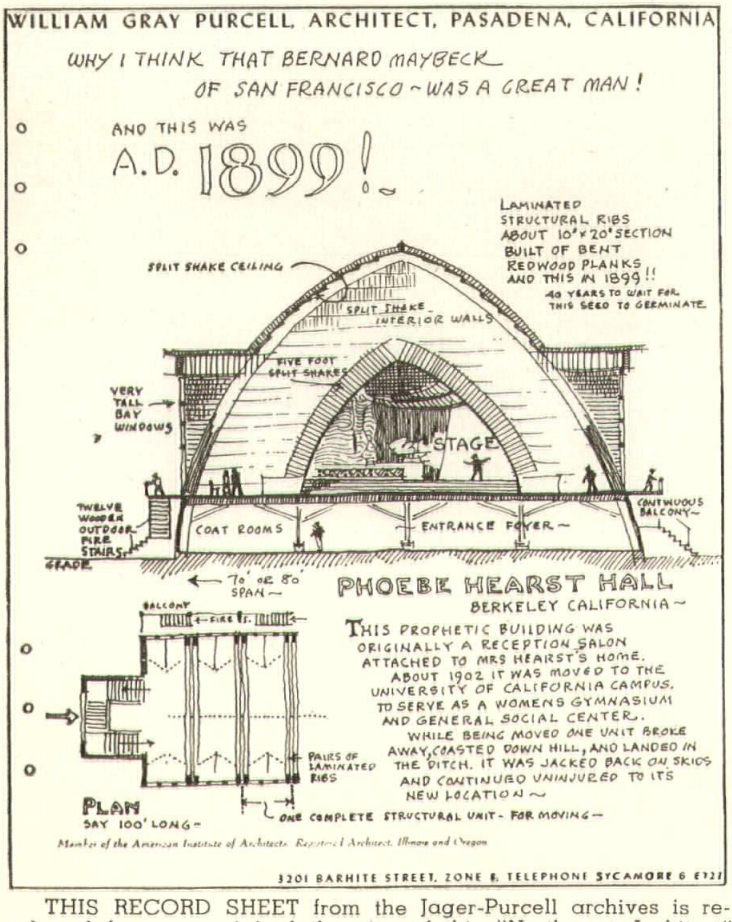
But the natural development and extension of this personal, intellectual tool under pressure of the practical world, of correspondence, of national publications, of universal file systems, of the invitation to *create* which larger areas of paper would present, all these and many other factors, soon step up this whole system for you into a more important and useful arena of action.

+ Encyclopaedia . . . .

THIS MOVES US on toward the production of a formal book of much broader scope and usefulness. It is based upon letter-sized sheets 8½" x 11". The same principles, as outlined above are applied.

One soon finds that drawings and text from periodicals can be trimmed to letter size and inserted in their proper places with accompanying note sheets in extension or criticism. The saving of architectural magazines is in general futile, as the mass accumulation is so great that one never returns to such material as he intends to do, but a selection of material that is related to one's own special interests becomes a part of one's personal mental experience. If his later critical views are divergent from his early selections, the wilted material can always be discarded. Where unusually good things are found or produced, they can be shared with others by mimeograph process. Designs and drawings significant enough for preservation and sharing can be made and duplicated in a number of colors in one operation by means of the very inexpensive and rapid Ditto gelatin sheet process. In order to always have a supply of fresh 8½" x 11" sheets available, simple manila folders in your brief case or zipper wallet keep sheets unrumpled. A piece of stiff light-weight plastic board with spring clips to hold the sheets, provides a tablet for writing and sketching, AND DO NOT FORGET COLOR! It stimulates imagination, brings joy, peace, encouragement. Keep two or three Castell colored pencil stubs in your pocket, and several selections of say twelve such pencils, freshly sharpened and instantly available, on your work desk or on the reading table beside your bed. A selection which I have found useful is Castell numbers 37, 31, 42, 48, 52, 18, 38, 25, 7, 21, 23, 38, 14, 202 or 203. (One will, of course, develop his own color preferences.)

One can have his photographs enlarged to 8½ inches wide so as to mount straight up on 8½ x 11 flexible card boards, or smaller prints may be mounted on 8½ x 11 in the usual fashion.



THIS RECORD SHEET from the Jager-Purcell archives is reduced from an original the size of this "Northwest Architect" page. Such letter size records have more area freedom than 3x5 cards. This illustration suggests how to organize your records as an ever growing extension of your practical daily thinking :: :: :: I should like to write about Architect Maybeck for you. His philosophy and works have good answers for today's needs.

+ Self Starter . . . .

IN THIS AGE of Gadget Glorification the cry is for equipment. "If I only had" that extra lense, a button gear shift, a new set of this or that, more books and more courses, a better studio or office or shop to work in, more time—THEN "Couldn't I do marvelous things—express MYself—be a CREATIVE ARTIST!"

Well—horsefeathers!

Irvin Cobb says, "The first and almost only need of the writer is to apply the seat of his pants to the seat of the chair." Soroyan tried tying himself down with strong rope in many hard knots.

Louis Sullivan said, "The way to begin is to begin."

The Bible, Shakespeare, or someone said, "Well begun is half done."

And as for tools—"The Lord will provide," but not until a very monument of genuine Necessity has been laboriously built up by the artist's persistent and enduring spirit. "Knock and it shall be opened unto you—seek and ye shall find." "Split the rock and ye shall find me, hew the wood and there am I." Hew, split, drive *first*—then you draw the pay. This movie world idea of going around looking for "a break"—it's all baloney. All those "stars" work—*how* they work!

Once at a Salamagudi Club luncheon my life-long friend Charles S. Chapman was discussing a technical point with respect to painting. Illustration was needed but no one had pencil, let alone any color. Chapman (who recently held an exhibition of his pictures, executed in over twenty different mediums) seized a piece of bread for a canvas, and made a painting with yellow butter, amber mustard, cerise raspberry jam, chinese red catsup, green lettuce leaves and chocolate for black brown. What! no blue? Yes, no blue. El Greco didn't have any blue either. Nor was Chapman's canape any dime store funny. Its philosophy was broader than the thesis.

Keep trying out any idea that comes into your mind. You never can tell when you're going to land a trout. Listen, listen, listen. Everything is talking to you—beats all the radio-mayonnaise (not even olive oil in it any more).

+ The tools . . . .

THERE is a very complete and excellent system with cards 2¾ x 3 or 3 x 5 or 4 x 6, leather pocket containers, dated, and with many other cards, and special file cabinets. This is "MEMINDEX," made by Wilson Memindex Co., 163 St. Paul Street, Rochester, N. Y.

Criticism: "Memindex" cards are tabbed and ruled to file vertically, while standard (3 x 5) file systems file horizontally. But you can use stock 3/5 library cards and write your notes horizontally—buy standard file boxes. I have used this system since 1911. But a fancy case is not going to make you perform successfully and continuously.

☆ ☆

I find that a couple of firm 3⅛ x 5⅛ cardboards held with a rubber band is very satisfactory. Or two firm envelopes—one for blanks and one for those written on—serve very well if the envelopes are snug enough to keep the cards from sliding around and smudging.

Make yourself a few cards with a pocket knife. I like to enjoy the various surfaces and colors of beautiful papers which I cut from advertising booklets, etc.—papers that one simply can not buy at the stationery shops.

☆ ☆

The "Robinson Reminder" is a pocket container for memo tablets perforated into detachable tabs.

Criticism: Tearing out obsolete memos; retaining others yet to be attended; keeping intact still others needed for permanent record, soon gives you a hopeless pocket full of shredding lettuce.

If the tabs had gummed backs, the useful ones could be quickly transferred to letters, carbon copies, file sheets, contracts, etc., and the pocket records then remain intelligible. But getting out paste and making a chore of sorting—well, one just never gets to that.

☆ ☆

Then there are the letter size ring books, 8½" x 11." The conventional type with three rings have serious disadvantages. The large holes are too far in from the margin and still they tear loose. The hole interferes with the integrity of the sheet as an area for beautifully completed material. The holes are also physically too insistent an eye baiter. You will wish eventually to bind your material into a series of books, and at once a conflict appears between the holes and the different construction of the future binding edge. The punched holes then become no longer functional, but there they are—now dead.

HERE IS HOW IT WORKED

FOR J. B. PRIESTLY

Famous British playwright

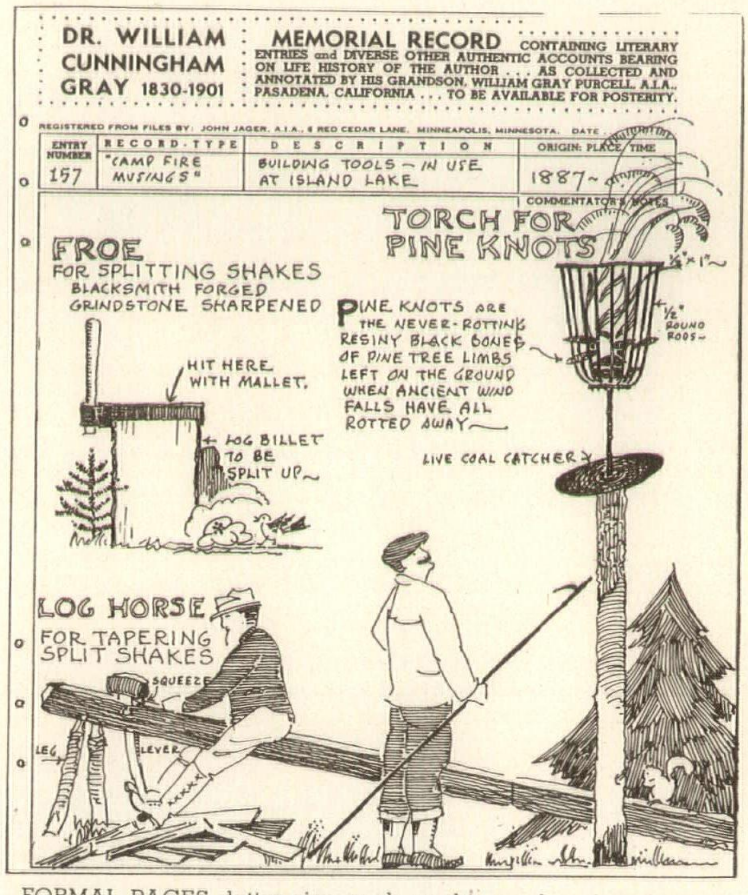
"FOR MANY YEARS now I have used a small shiny black-backed note-book, which goes with me everywhere, even if only for one night away from home, and in which I jot down an idea — or the germ of an idea — as it occurs to me. The fifteen plays I have written began their life in that note-book, and I suppose there are in it still at least forty to fifty ideas, hints, suggestions, for other plays."

Again . . .

"BUT DURING my lecture tour I had a great many long and rather tedious railway journeys to make, so that I had time to work out roughly many of the scenes and to make numerous notes."

From his book "Johnson Over Jordan,"
An autobiography — Harpers, 1939

Most of these disadvantages are overcome by the "six ring" books and sheets made by Goldsmith Brothers, 77 Nassau Street, New York City, not generally available. Write to manufacturer. The rings are smaller—holes much smaller—close to edge and paradoxically much less liable to tear out. They do not spoil the looks of the sheet. You can get a little leather punch and make your own sheets.



FORMAL PAGES, letter size, such as this much reduced sample, encourage orderly and complete records. They give significance and value to the wide variety of collected material. Frame your pictures, bind your sheaves of precious records; people are more likely to concede importance to that which appears to have been valuable to someone.

+ Fun with your book . . . .

THE SURVIVAL FACTOR for your work rests on actually producing *bound books.* For some reason or other the unthinking mind (and hand) has no respect for loose sheets, cards in files, drawings in drawers or portfolios—they can put fishhooks, or other gadgets in a drawer and so the "old trash" is junked—"cards hm, hm, what's all this—well, well—" so into the ash can it goes.

You really have to eventually get a good many of your 3/5's stuck on 8½ x 11 sheets or photo-mount pages, and for this reason, get the printer to cut you some 3 x 5 noncurling gummed paper, and tend to use these for all but passing engagement and errand notes.

You can see why everything is flowing toward the vertical steel letter file and from these into subject or continuity units that can be bound into books.

And don't put off the binding too long. When a subject is pretty well filled out, photographs and drawings in place, clippings pasted up and edited, better get it bound—not more than 1¼ thick per volume—as the thicker ones tend to pull to pieces under the use you will be giving them. New material coming along on same subject can make up Volume X Supplement B, with inevitable cross references. The Encyclopedia Britannica now does this with annual issues.

W.G.P.

In this issue can be read how

"YOU ALSO CAN BE AN AUTHORITY"

which could have been titled

"YOUR ENCYCLOPEDIA"

or

THINK MORE—AND HOW!

"YOURCYCLOPAEDIA" is a New Tool for Practical Cogitating. We have reproduced some sample Bits to fit such a Drill. With fingertip control you can readily bore into the Toughest Ideas, or make quick holes in Stupid Theories. It will rout Slick Boards, polish off Rough Assemblies, uncover Split Planks. Can also be used for reaming old Nuts. Directions for use on pages 4, 5, 6 and 7 of this issue. *"O.K. - Then . . . .*

Why not Begin Now to line up your arguments for the next Big Job?"

W. G. P.

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MINNEAPOLIS **MINNESOTA**

CONDENSATION IN BUILDINGS

In Two Parts

By Richard S. Dill, National Bureau of Standards

Excessive dampness in buildings or wetness of parts of them can result either from leakage of rain inward from the outside or from condensation of water vapor generated on the inside. Leaks in roofs or walls are not under consideration in this piece of writing. The underlying cause of condensation is simple, but the great differences in house design and construction, in climate and in the living habits of families make it impractical to formulate simple remedies applicable to all cases. Obviously, however, architects, builders and home owners should be acquainted with the general principles involved.

Condensation can occur under either summer or winter conditions but the causes and results are different for the two seasons. In winter, water vapor is liberated in houses or buildings by cooking, washing and bathing, sometimes by evaporation from basement floors or earth in crawl spaces, by the use of unvented fuel burning devices, from potted plants, from clothing dried in the house and, in some cases, by humidifiers used for the purpose. Water vapor is capable of permeating most ordinary building materials such as wall paper, plaster and wood. Hence, high humidity in a house may result in condensation of water not only on the windows but also on or within the exterior walls, the ceiling or the roof. In winter, condensation on window panes is often an indicator of excessive humidity and additional ventilation of the house is a usual remedy. The inner panes of double or storm-windows are warmer than those of single windows under the same conditions so that double windows are less liable indicators of excessive humidity.

Summer condensation may be preventable by ventilation in conjunction with heat either from sunlight or from some heating device such as a water heater. This is not always adequate so that driers, employing calcium chloride, silica gel or other agents, are often used.

Often a closed, unheated house in a temperate climate becomes damp on the inside. Weather changes contribute to this result. When the basement floor or earth under the house is warmer than the house, convection currents occur. Also, water evaporates from the basement floor and, carried upward by the convection currents, condenses on surfaces or in materials in the upper part of the house. By this means, water is transferred from a basement or a crawl space to the upper part of a house. When the basement is cooler than other parts of the house, the convection currents cease; the air in the house stratifies with the cool air at the bottom and the warm air above.

Water Vapor and Condensation

Condensation is part of the process of distillation whereby a fluid is moved from one place to another by evaporation and subsequent condensation. If some warm water and a cold surface are placed in an enclosure, the water will evaporate, move by diffusion to the cold surface and condense on it either into water again or into ice. The tendency is for the water vapor to move from a warmer to a cooler place. The movement of water vapor is accelerated by air motion which usually exists when there are differences in temperature. If a house is warmer than the outside air, ventilation will tend to dry it. This is the usual cold weather condition. If the house is colder than the outside air, ventilation may make it damp. This occurs sometimes in warm weather when objects or surfaces in the house are for a time colder than the dew-point of the outside air, due to weather changes.

All air, even that in a desert, is admixed with some water vapor and is to that extent humid. Everyone is familiar with the "sweat" on a glass containing cold water. This sweat is the same as dew. It represents water vapor or steam condensed from the atmosphere. Its existence proves that the surface of the glass is colder than or "below" the dew-point because, by definition, the "dew-point" of air is that temperature of a surface at or below which the surface will condense water from the air.

This water vapor is low-pressure steam. It is invisible; visible "steam" is really mist, consisting of fine droplets. Water vapor, admixed with air, migrates from place to place by diffusion and is conveyed from place to place by the motion of the air. Air movement, termed convection, conveys heat and water vapor from place to place.

When the dew-point temperature is the same as the air temperature, the air is saturated. Needless to say, objects exposed to such air are expected to become damp. Dry air, by definition, contains no water vapor and has no dew point since no water can be condensed from it. Such air is difficult to produce even in a laboratory. Materials like some of the salts are called "hygroscopic" because they have strong affinities for water and will extract its vapor from air when warmer than the dew point. Wood and fabrics made of cotton, animal wool or hair, used in house construction and furnishings also have this property. These organic materials sometimes become damp enough to support the growth of mildew or mold when exposed to air somewhat less than saturated. This usually occurs, if at all in summer or when the house is not heated.

Water vapor can pass through partitions or walls in several ways. If two spaces, one at high and the other at low humidity, are separated by a porous substance or membrane, water vapor will pass through the membrane by diffusion. If the spaces are separated by a hygoscopic material like wood diffusion will occur but also water vapor will be absorbed on the more humid side, pass through the material and evaporate on the drier side. The tendency will always be, of course, for the water to pass from the more to the less humid side. These facts explain the difficulty of making enclosures, especially buildings, vapor proof. Migration of water vapor would occur even if all workmanship were perfect and cracks and other accidental openings did not exist. However, in ordinary buildings, there are usually cracks due to imperfections in lumber or in workmanship and there are always air currents due to wind pressure, thermal convection or both. Air motion is often more important than diffusion in conveying water vapor within and through the structure of houses and buildings. It is this fact that prevents practical solutions of condensation problems based on a theory of diffusion as precisely as heating problems are solved by a theory of heat transfer and a knowledge of the thermal conductivity of materials.

Some terms in wide use in connection with this subject are as follows:

Absolute Humidity, defined as the amount of water vapor, by weight, mixed with a given quantity of air;

often expressed as grains of water per thousand cubic feet of air.

Relative Humidity, defined as the ratio of the water vapor pressure in a space to the water vapor pressure that would exist if the space were saturated; approximately equal to the ratio of the absolute humidity in a space to the absolute humidity that would exist if the space were saturated.

Saturation: Air is said to be saturated with water vapor when, the temperature remaining the same, more water vapor cannot be added to the space containing the air without condensation of a like amount of water.

Dry Bulb Temperature: The temperature of the air indicated by a thermometer with a dry bulb or sensitive element. For precise results the bulb or sensitive element must be shielded from radiation or other extraneous effects.

Wet Bulb Temperature: The temperature indicated by a thermometer with a wetted wick surrounding its bulb. Shielding against radiation is desirable for precision and ventilation with an air stream moving at 15 feet per second or more is essential. The difference between the readings of the dry bulb and the wet bulb thermometer indicates the relative humidity of the air. The sling psychrometer is a simple instrument which gives wet and dry bulb readings with sufficient accuracy for most purposes.

Condensation and Climate

In warm dry climates, condensation is not a problem. Doors and windows are usually open and water vapor generated in the house readily escapes. In warm, damp climates, or seasons, condensation may occur in houses due to weather changes in conjunction with the heat capacity or heat lag in the building parts. This usually happens when warm, humid weather follows several days of cool weather that leaves some objects or surfaces cooler than the dew-point. The usual results are dampness followed by mildew in rugs or hangings and on walls, especially behind furniture or pictures. In cold or temperate regions, whenever the house is kept closed for warmth, the water vapor liberated in it is trapped at the same time. Under this condition, the weather makes little or no difference. Whenever air is warmed, its capacity for carrying water vapor increases. Therefore, air brought in and heated will have a drying effect in the house even though rain is falling and the air outside is practically saturated. When saturated air is warmed, it is no longer saturated, but becomes capable of carrying more water.

Condensation on Windows

A most noticeable consequence of condensation is the formation of frost or ice or of liquid water on the inside of window panes in cold weather. If water, either as liquid or solid, is simply deposited for a time and re-evaporates, no harm is done; but, in bad cases, the water runs down and damages the wall or its finish or any furniture or wood work in its way. Rotted window frames, sash or sills are a common result. Metal sash are also a problem. Metal is a comparatively good conductor of heat so that such sash is colder, where it is exposed to room air, than wooden sash under the same conditions.

The humidity in houses or buildings is limited in cold weather by condensation especially on the windows and especially if the windows are single glazed. The occurrence of excessive condensation on the glass is an indication that ventilation or some other precaution is advisable. For illustration, assume what is impossible, a house

with no air leakage and made of non-hygroscopic materials. If water is continually evaporated in such a house the humidity must inevitably rise until condensation occurs somewhere within it. At a steady state, the condensation rate must equal the evaporation rate. This process of water transfer by distillation would cease if the temperature of all exposed surfaces in the house equalled that of the source of water vapor.

The temperature of single window glass can be fairly well estimated. It depends on the air temperature on the two sides of the glass and on the air motion or wind. For no air motion, the glass temperature will approximate the mean of the indoor and outdoor temperatures. Wind will make the glass somewhat colder. When the humidity in the house is such that the dew-point equals the glass temperature condensation on the window commences. Thus humidity in houses is limited by glass temperature and hence by outdoor temperature and wind. The colder the weather, and the stronger the wind, the lower the inside humidity must be kept if condensation is to be avoided. Humidities which will cause window condensation can be estimated if some assumptions, such as wind velocity, are made. The results of some such calculations are given in Table 1 A.

Outside Temp. °F	1 A Computed Inside Relative Humidity (%) For Window Condensation			1 B Mean of Observed Inside Relative Humidity (%) From BMS 56 Humidifier	
	Single Glazed; No Wind	Single Glazed; 15 MPH Wind	Double Glazed; 15 MPH Wind	Yes	No
40	59	44	73	45	31
30	49	32	66	30	27
20	40	24	59	25	22
10	33	18	51	21*	18*
0	27	13	46		
−10	21	10	40		
−20	19	6	36		

*Extrapolated

Table 1—Computed Relative Humidities in Buildings for Incipient Window Condensation. Inside Temperature Assumed: 70°F. Also, Mean of Inside Relative Humidities Observed During Survey of Residences, Reported in NBS BMS Report No. 56. For comparison, table 1B shows the average humidity observed in some homes during a survey described in BMS Report No. 56 (5).

The inside pane of a double or storm window is warmer than a pane of a single window, under the same conditions. Consequently, condensation on the inner pane of a double window occurs only when the humidity is much higher. Therefore, a double window is not so good an indicator of excessive humidity. For this reason it has been suggested that one or more panes be left

single, in houses equipped with double or storm windows, as indicators of undesirably high humidities.

Sometimes condensation is observed on the inner surface of the outer pane of a double window. The water vapor which condenses in this location originates within the house and enters the space between the window panes through leaks, usually around the sash. A remedy is to minimize this leakage as far as is conveniently possible and to ventilate the space with outdoor air. This ventilation is sometimes accomplished by boring holes through the outside sash at the top and bottom. Good results have been reported with two three quarter inch holes per window. If leakage from the inside is prevented, no ventilation is necessary. The difficulty is avoided if factory-made double panes are used which are hermetically sealed at the edges. In some railway passenger cars, renewable capsules containing absorbent material are installed in the space between the window panes to prevent this condensation.

Condensation in Exposed Walls

This subject is complicated because the types of walls in use are numerous and each presents a special problem. In general, vapor barriers on or near the inner surface are desirable. If materials with the properties of vapor barriers are used at or near the outer surface special precaution may be required to prevent condensation within the wall.

A vapor barrier is a sheet, membrane or diaphragm capable of arresting or of greatly retarding the passage or migration of water vapor. Metal sheet or foil is practically a perfect vapor barrier if the joints between sheets are tight. Other vapor barrier materials, like paper specially treated with bituminous material, are adequate for most practical purposes. The permeability of materials intended for use as vapor barriers is often measured by the standard methods of the Technical Association of the Pulp and Paper Industry or of the American Society for Testing Materials. Most ordinary building materials, including wood, ordinary wall paper, many paints, plaster and masonry, are not considered vapor barriers because their permeability is too high.

The impermeability of metal sheet is likely to cause condensation when that material is used as external sheathing on building walls. It constitutes a vapor barrier in the wrong place—on the outside. When the weather is cold, the metal sheet also will be cold. Water vapor from inside the house can pass through the plaster and other permeable wall components and approach the metal sheet from the inside. When the water vapor concentration is sufficient, condensation will occur, resulting in a deposit of water or of ice on the inner sur-

face of the metal sheet. The water immediately runs downward and that from the ice does so upon melting. Either action can result in wet timber or other material and can promote corrosion in metal or rot in timber. When metal exterior sheathing is used, a practically perfect vapor barrier is required at or near the inner wall surface also. However, this is seldom attained even with a metal interior wall surface. In constructions suggested so far, the cost of making absolutely tight joints, as by soldering or otherwise, is prohibitive. Therefore, various means of ventilating the stud spaces of metal-clad houses with outdoor air have been suggested and some show promise of success. Work has not yet progressed far enough to permit specifications to be given. However, the usual arrangement includes a couple of inches of insulation adjacent to the inside surfacing material. An air space an inch or so wide is left between the insulation and the external sheathing and the air space is ventilated with outdoor air by means of openings at the top and bottom of each stud space with an area on the order of one or two square inches per opening. Various architectural means have been suggested for concealing the openings and for excluding insects and rodents. The effect of the openings on the heat transfer through the wall probably is small, estimated to be less than 10 per cent based on work covered by NBS BMS Report No. 106. Experiments now in progress in various laboratories may throw further light on the subject. Tar or asphalt coated paper can promote wall condensation in the same way as metal sheathing. Such materials should be used, therefore, with proper precautions. Stud space ventilation may prove valuable with other than metal walls. However, experience with it is lacking so that its application rests at present on the judgment of individual designers.

A conventional wooden exterior wall, known as a frame wall, consists of studs, typically 2-in. by 4-in. wooden uprights with lath and plaster on the inside and sheathing boards covered with weather board on the outside. Building paper is usually installed between sheathing and weather board to exclude the wind. This should be a fairly vapor-permeable paper since otherwise it would be a vapor barrier in the wrong place—near the outside of the wall—and would invite condensation in houses carrying high humidity unless precautions are observed similar to those desired for metal sheathing.

Conventional wooden walls are traditionally regarded as troublefree, so far as condensation is concerned, and work described in BMS 106 indicates that they are so for indoor relative humidities up to 30% and outdoor temperatures down to −10°F. Table 1A indicates that condensation can be expected on single glazed windows at less severe conditions. Such windows are often indicators of hazard for such walls because condensation will ordinarily appear on the windows before it occurs in the wall.

Brick veneer walls and stone veneer walls are similar to frame walls except that a layer of brick or of stone is used on the outside of the sheathing instead of weather board. Like frame walls, they contain a space between the studs in which insulation can be installed. The condensation phenomenon is similar for all walls containing such spaces.

Both solid and block masonry walls are in use, some with plaster applied directly to the inside surface and some furred, lathed and plastered. Furring consists of vertical wooden strips, attached to the masonry of the wall. Furring serves to support the lath and plaster and by this arrangement, an air space is provided between the plaster and the masonry.

Masonry walls with plaster applied directly on the surface are not to be recommended except in arid regions. In temperate climates, such walls often condense water during warm weather when the house is not heated and when the windows are open for comfort.

Furred masonry walls are usually trouble-free because the masonry is likely to be practically as permeable as the plaster. In winter, water vapor passing through the wallpaper and plaster passes readily through

the masonry also, to escape outside. In summer, any condensation occurring on the masonry, due to its heat lag, is hidden from view by the plaster and is so small in quantity that it is readily dissipated without damage to the structure.

Condensation in Roofs and Attic Spaces

Roof coverings, with some exceptions like shingles, are practically impervious to the passage of water vapor or of air and an impervious roof covering may create a condensation problem since it constitutes a vapor barrier on the outside of the building where it becomes cold in cold weather and can act as a condenser when water vapor comes in contact with it from below. Water vapor is not prevented from coming in contact with the roof surfacing material by the roofing boards or by plaster used in ceilings since these are pervious and when excessive humidities are not prevented by ventilation or otherwise condensation may occur in roofs. This condensation not only wets the roof boards but may drip downward and wet the ceiling beneath. These effects are sometimes attributed to leaks in the roof and much effort has undoubtedly been expended uselessly in seeking non-existent leaks. Precautionary measures in the roof construction of some buildings such as offices, churches, etc., may be unnecessary because little water vapor is generated in them. However, the safest roof is one with a space under it which can be ventilated with outdoor air. Any insulation used should be beneath this air space. A roof which is self-ventilating, like a wood shingle roof, may be an exception.

Roofs may be classed as peaked and flat. The peaked roof, the most popular for dwellings, affords an attic space under it. Insulating material may be installed in the floor of the attic if the attic space is not to be used for living quarters. This arrangement is ordinarily safe against condensation provided safe limits of relative humidity are maintained in the house because the natural ventilation or infiltration in attics under peaked roofs is ordinarily sufficient to prevent condensation. However, ventilation of the attic space by means of two or more louvers or their equivalent with an aggregate free area of at least 1/576 of the attic floor area, as suggested by Professor Rowley, is required for new houses by the Federal Housing Administration.

Insulation can be installed in the roof itself when the attic is to be used for living quarters. If this is done, an air space of from one to several inches between the insulation and the roof boards is recommended by some builders. If provided, such a space is worse than useless if it communicates with the inside of the building as through a stud space or pipe shaft. In all cases such spaces should be ventilated with outside air and this ventilation can be provided by leaving spaces between the boards constituting the under side of the exterior overhang. Exact dimensions for such arrangements have not been established. In flat-roofed houses without attics, spaces or cracks between boards from ¼ to ½ inch wide, running the length of the eaves, have been used. Such openings must be protected from the weather and wire netting is usually applied to exclude insects. Wind is relied upon for motive force to cause the ventilation. Roof ventilators are sometimes provided to ventilate spaces under flat roofs. If excessive water vapor is present, condensation under impervious roofs may occur regardless of the presence or absence of insulation.

Condensation in Floors

Condensation in or on ordinary wooden floors is seldom a problem in heated houses in winter. Water vapor generated in a house is always associated with warm air which rises and carries the water vapor with it. This chimney action in the house tends to prevent concentration of water vapor at or near the floor sufficient to cause condensation. Also, due to this chimney action, air leakage into the house is likely to be down low, in the absence of wind, while escape of air occurs near the top. Any air brought into the house, whether by

wind pressure or chimney action, will have a tendency to dry the house and not to deposit moisture. Condensation may occur near the outer or exposed edges of concrete floor in winter, whether such floors are placed over crawl spaces or on the ground. Concrete is a good heat conductor and floor surfaces near the outside walls of the house may be cooled below the dew-point by the rapid conduction of heat to the outside air. A remedy is to insulate the edge of the concrete slab by means of a strip of insulating material to break the heat path.[4] Specific recommendations cannot be given because standard practices have not been established but the insulations used should be moisture and rot resistant and as an estimate, an inch or more thick.

The results of some experiments at the National Bureau of Standards showed that metal foil insulation, installed under a wooden floor over a crawl space, is not in danger of becoming wet under winter conditions even though higher than normal humidities are maintained above the floor and in the crawl space beneath. The same conclusion is considered to apply to other forms of insulation also. During the warmer seasons and in any but arid climates, condensation is common on floors and its appearance depends on the floor type.[6]

In the spring, the earth under a house is likely to remain cold after the weather is so warm that the heater is turned off and when the house is copiously ventilated by opening windows and doors for comfort. Under this condition, a concrete slab floor on the ground is likely to exhibit condensation, especially under rugs or furniture or in closets where there is some ventilation but not sufficient to promptly warm the floor to some temperature above the dew point. A rug insulates the floor and prevents the air from heating it but the rug is pervious to water vapor. Condensation is hence more likely under a rug than on the uncovered floor.

The heat capacity of concrete floors, either on or

(Continued on Page 18)

That Necessary Evil, The Architectural Engineer

BY THOMAS H. MCKAIG

It is interesting to note the causes of deterioration in wood structures, which by proper precautions could be avoided. Frequently these imperfections are put down to "the nature of the material," but knowing the nature of the material, much of our trouble could be eliminated by applying our knowledge.

I have seen cracked plaster ceilings and all that goes with them, due to the fact that a bearing partition from above rests on the joists near the middle of their span without making sufficient provision for this bending moment. Occasionally a wood structure is designed and the strength of member computed on nominal size instead of actual size. The nominal size of a 2 x 4 would be 50% stronger in bending than the actual dressed size. We have all seen much of the best portion of the joists cut away to permit the passage of a pipe or a conduit—frequently much more than is necessary, and often across the entire width of a bathroom. In the case of a fairly heavy load, crushing of the beam may occur at the bearing because the allowable bearing on the side grain of a timber is low, only about one-third of the allowable and grain bearing.

Extreme care should be taken in designing wood beams for deflection. Steel or concrete, under a given load on a given span, will take a given deflection, and will assume its original position within the elastic limit when the load is removed. This is not strictly true with wood. If a timber is loaded excessively with a constant load, it will deflect and the deflection will continue to increase under the same load, even within

(Continued on Page 17)

(Continued from Page 16)

the elastic limit of the material. When the load has been removed, it will be found that the material has taken a permanent set or deflection.

This deflection is frequently noticed in the sagging of wood trusses. Here, however, an additional cause enters the picture. The shrinkage of the timber permits the actual shortening of the compression members, notably the top chord, and this permits the sagging of the bottom chord. After this has once taken place, it is difficult to correct, so the best method of providing against it is to build a slight camber into the truss when it is laid out.

Another point in the discussion of wood construction, is the holding power of nails. These points pulled from actual test data will be of considerable interest to most architects. Nails driven in holes 1/32 to 1/16 inch smaller than the diameter of the nail will have considerably greater resistance to pull and shear than nails driven without holes. Cement coated nails are considerably superior to uncoated nails. The length of nails for best service should be somewhat more than twice the thickness of the member holding the heads. Slender nails will hold better than thick nails under repeated shocks and constant weaving action, because they bend without losing their grip at the point. The best results in holding power are given by nails with a short pyramidal point. Either blunt or sharp point reduces this holding power. If a cut nail is driven with the taper sides parallel to the fibers of the wood, the resistance to withdrawal is greater than when driven in the usual manner, but it is more liable to split.

from *Empire State Architect*

Producers' Council Construction Forecast

Public works and other government financed construction is expected to account for more than half of the anticipated increase in the volume of new construction in 1948, according to a forecast prepared by the economists of the Producers' Council, David S. Miller, Council president, stated today.

"A slight decline is anticipated in the volume of publicly financed residential building, but expenditures for non-residential projects such as schools, public hospitals, recreational facilities, and administrative buildings are expected to rise to $775 million, an increase of 52 per cent.

(Continued from Page 16)

above grade, in conjunction with weather changes can cause these same symptoms. When cool weather is followed by warm humid weather, the floor tends to remain cool and parts of it may for a time be below the dew point with condensation resulting.

Suggested remedies for these conditions include provision of an insulating layer on top of the floor with a covering which is impervious to water vapor, heat applied to the floor as by means of a floor panel heating system, use of dehydrating chemicals to dry the house, etc. Standards of practice have not been set and the solution of the problem rests at present with individual designers or builders.

Sometimes, masonry walls or piers, being good conductors of heat, remain cold with the ground in spring so that wooden joists or other timbers resting on them are cooled sufficiently at the point of contact to gather water from the air and undergo local decay.

Condensation and Crawl Spaces

Consideration of crawl spaces under basementless houses is important chiefly because the earth is a source of water vapor which may be carried by air currents to any of several parts of a house and cause dampness. This is particularly true in the fall when the earth under the house is warmer than the air and, at times, much warmer than many of the house parts. Under this condition, water tends to evaporate from the ground and to be absorbed by house timbers or other wood members. The floor above the crawl space may become damp enough to rot. Sometimes, warm, damp air ascends pipe shafts or spaces in walls and condensation occurs on the cooler under side of the roof.

Remedies for these conditions consist in ventilating the crawl space and treating the ground to decrease evaporation of water from it. The Federal Housing Administration requires ventilation by means of openings of at least one square foot area per 15 linear feet of surrounding wall. Ventilation by means of stacks or ducts extending from the crawl space through the roof has been suggested but not extensively applied. Ground treatments in crawl spaces have included concrete, bituminous coverings, gravel and roofing felt or tar paper. An effective treatment lessens the need for ventilation. Tar paper, with the edges of adjacent sheets lapping each other several inches but without any sealer or caulking compound, was applied in one large apartment project and is considered adequate. Obviously, openings extending from a crawl space to the underside of the roof, or to another cold surface, should be avoided or stopped up if possible.

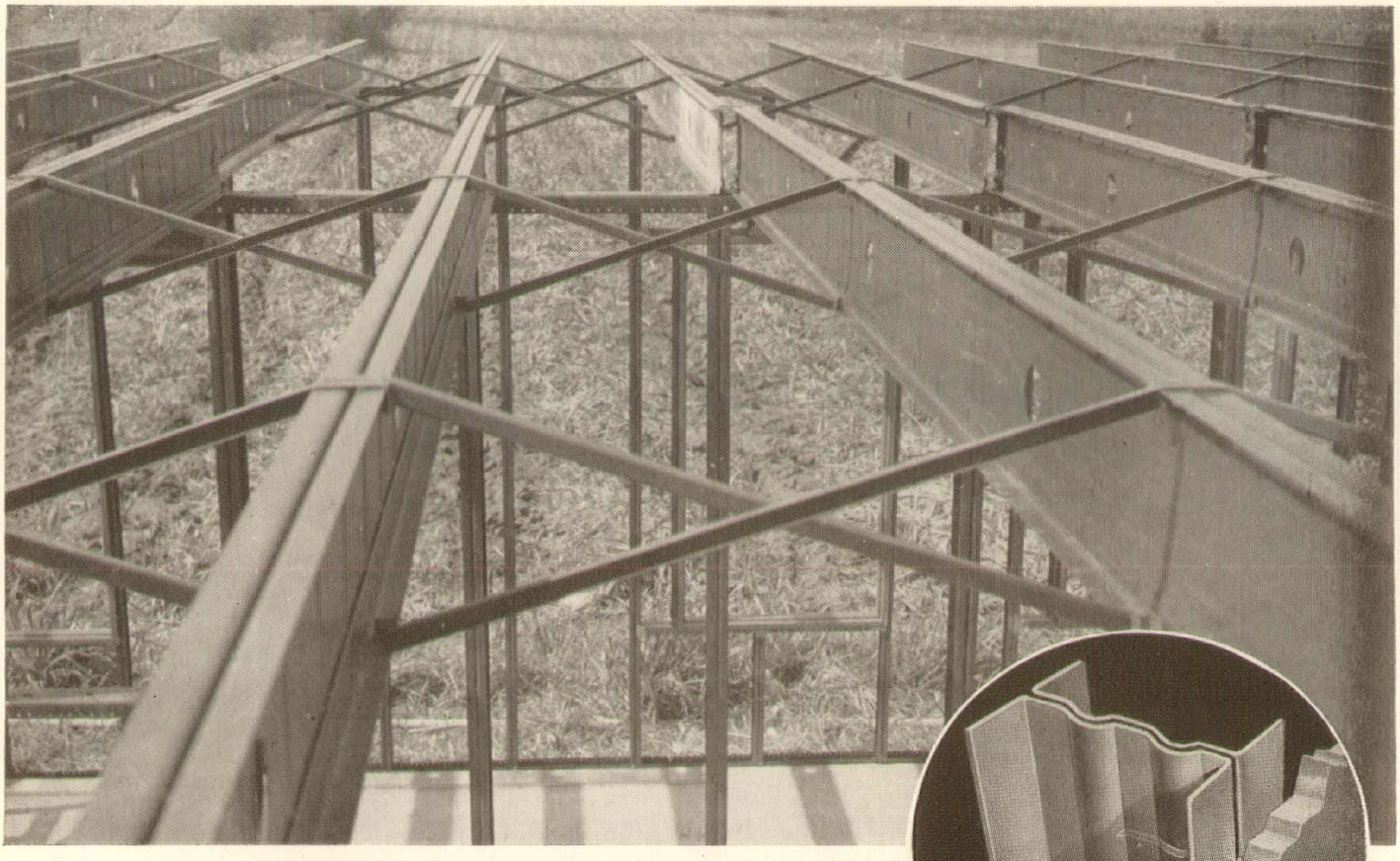
Condensation on Pipes and Fixtures

Condensation occurs on water pipes and on bathroom tanks, usually in the spring when the water, passing for a long distance through mains buried in cold earth, is at times below the dew point temperature of the air. A drip results which is sometimes a nuisance but in most houses this problem is not considered serious enough to require a remedy since the condition does not last long. If necessary, possible remedies are: heating the water or insulating the pipes or tanks. Insulation of the kind used on refrigerator piping is regarded as effective. The insulation should have a vapor resistant outer surface to prevent water vapor penetration to the pipe.

Condensation and Insulation

Water vapor generated within a house in winter spreads in all directions by diffusion assisted by air motion. It passes through ordinary wall paper and plaster and will condense within a wall or other building element wherever a surface is below the dew point. If condensation occurs in a wall, it is likely to be at or near the outside surface since that portion is coldest and an insulated wall is expected to be colder on the outside, and warmer on the inside, than an uninsulated wall. Also, unprotected insulation, although effective as a barrier to heat, is not usually a barrier to water vapor migrating through the wall. For these reasons more precautions against condensations are essential when insulation is used. These precautions take the form of ventilation, minimizing water vapor generation, use of vapor barriers, particularly in new houses, wall ventilation, etc., discussed elsewhere in this letter circular. The effect of insulation in ceilings or roofs is similar. An attic is colder in winter after insulation is installed in its floor and roof boards are colder after insulation is placed under them.

Part two on Condensation will be published in the March-April issue.



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