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M. F. MILLER, *Director*

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# Farm Building Repair

J. C. WOOLEY

## Published in Furtherance of the War Effort on the Farm Front

Farmers can well afford to spend money on the repair of buildings, particularly if the lack of repair will cause rapid depreciation. Replacements are difficult to make and new construction is costly. If a building has deteriorated so that it no longer provides the conditions necessary for the care of livestock and stored crops, the expense of restoration to serviceable condition should be justified.

Certainly if buildings have become a source of danger to either workers or livestock, repairs should be made at once. Damaged siding or doors cause barns to be cold and drafty. Leaky roofs cause spoilage of feed. They also cause wet floors and bedding. These conditions affect production and may even cause loss of livestock.

Most farmers derive considerable satisfaction in having their buildings present a good appearance, and this calls for frequent repair and constant attention to maintenance.

Buildings and gates kept in good condition make the chore work around the farmstead easier and more efficient. This has a helpful influence on the labor problem. Men can be hired more readily on a well equipped farm, and women and children can do chores with greater ease and safety.

### POINTS THAT NEED REPAIR IN FARM BUILDINGS

The manufacturer of a machine soon learns of the weak places in his product from the orders for replacement parts. This is not possible to the same degree with farm buildings. However, when a large number of buildings are studied it soon becomes evident that there are very definite points of failure and perhaps equally definite causes to which such failures can be attributed.

As a result of the study of the buildings on more than 200 farms in Northwest Missouri and through many additional contacts with

**"Repair Now." "Build When the War Is Over."**

farmers on building problems, the following have been selected as being the more common repair problems. The methods suggested for making repairs are of course general and may need to be modified in some cases.

### RULES FOR FOUNDATION REPAIRS

In construction or repair of foundations the following practices will pay large dividends in the long run.

1. Use not to exceed 6 gallons of water per sack of cement in making concrete for foundations.
2. Use only clean materials.
3. Reinforce foundation walls near top of walls and around the corners.
4. Use forms on both sides of the wall for best results.
5. Place foundation wall on a broad footing. (A width of 12 to 16 inches is usually sufficient).
6. Set bolts in concrete to hold the sills in place.
7. Provide good drainage for roof water.
8. Place footing below frost line.

#### Additional Circulars on Farm Buildings

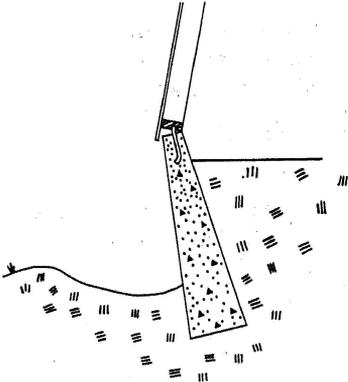
- |                                      |  |
|--------------------------------------|--|
| C219—Ventilation of Animal Shelters. | E470—Dairy Farm Building Plans.  |
| C240—Emergency Storage for Soybeans. | E471—Plans for Hog Houses.   |
| E277—Missouri Type Milk Houses.      | E472—Plans for Buildings and Equipment for Beef Cattle, Sheep, and Work Stock. |
| E369—Native Lumber Silos.            | E473—Plans for Poultry Buildings.  |
| E384—Poultry House Remodeling.       | E474—Plans for Storage Buildings.  |
| E398—Building With Stone.            | E475—Plans for Farm Homes.   |
| E404—Missouri Summer Range Shelter.  | E479—A Self Feeder for Hogs.   |
| E419—Homemade Poultry Equipment.     | E491—Stanchions for Dairy Cows.  |
| E439—Planning the Farmstead.         |  |

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Room 129 Mumford Hall  
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## FOUNDATION FAILURE AND REPAIR

**Failure No. 1. Foundation Wall Tilted Out.**—In the first drawing below is shown a common type of foundation failure. Proper care of the roof drainage would probably have prevented it. Wet soil has about one-half the strength of dry soil.

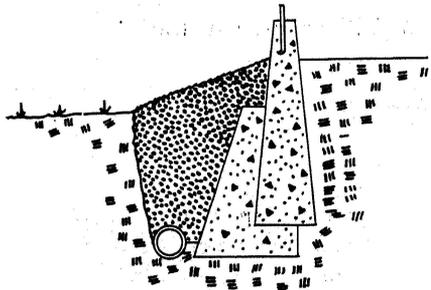
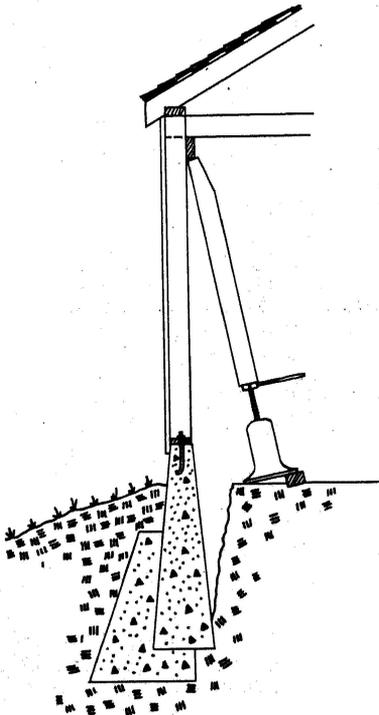


### *Causes of Failure*

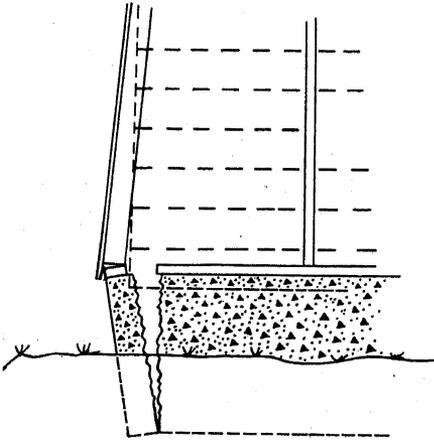
1. Soil beside and under the foundations failed.
2. Pressure was developed inside of foundation wall.
3. Livestock may have crowded against the wall.
4. Footing was too small.

### *Steps in Repairing*

1. Jack up one section of the building at a time. Raise a little higher than the normal position.
2. Straighten foundation wall and pour footing as shown.
3. Allow time for curing and then lower the section into place.
4. Provide spouting or grade up around building to secure drainage.
5. A tile drain covered with gravel may be used in lieu of spouting.



**Failure No. 2. Foundation Split at Corner.**—Concrete is ten times stronger in compression than it is in tension. By casting steel rods in the concrete when it is made, this weakness is overcome.

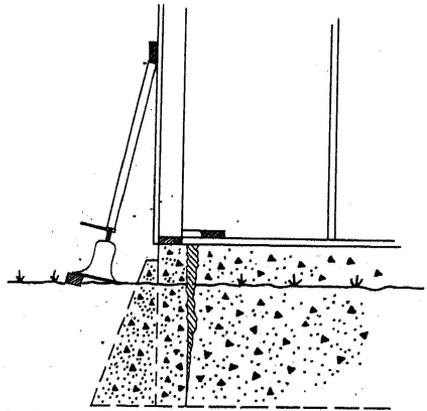


#### *Causes of Failure*

1. Pressure on inside of both walls causes extra load on foundation at corner.
2. Lack of reinforcement at corners.
3. Excess water outside the foundation at corner.

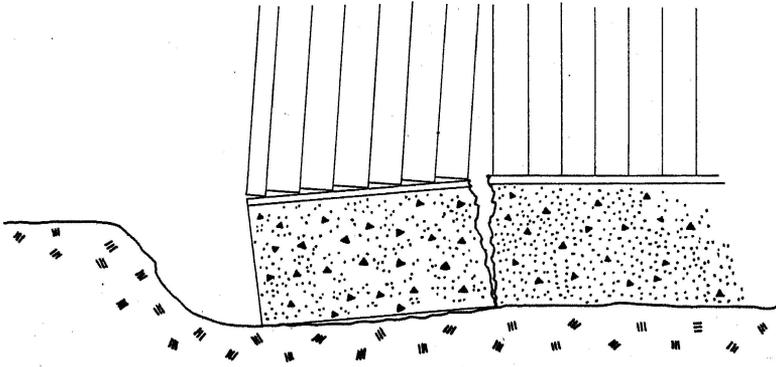
#### *Steps in Repairing*

1. Chip away about 2 inches of the wall at break to allow end foundation to come back into place.
2. Jack wall and foundation back into correct place.
3. Build pilaster to hold wall in place.
4. Nail tie across corner to hold sills in place.
5. Fill opening in wall.



A reinforcing rod placed 6 inches below the top of the foundation wall and extending around the corner would have prevented this failure.

**Failure No. 3. Foundation Undermined**—Lack of care of roof drainage is the cause of many failures in farm buildings. Spouting connected with surface gutters of concrete will remove this water safely.

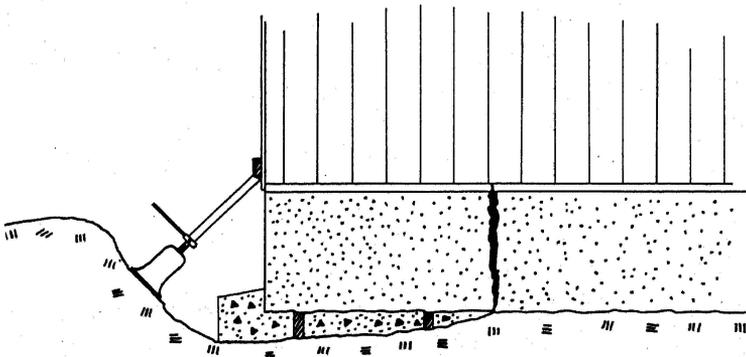


#### *Causes of Failure*

1. Erosion or a hog wallow caused by lack of drainage.
2. Lack of support under footing at corner.
3. Lack of reinforcement in the top of the wall.

#### *Steps in Repairing*

1. Dig under foundation at one point to provide room for jack.
2. Chip off about 2 inches of the wall at the break to aid in getting it back into place.
3. Lift foundation and building back into place.
4. Support on brick pillars as shown.
5. Pour a concrete footing, tamping it well under the old wall.



If a foundation is undermined between supports, the reinforcement is needed in the footing or at the bottom of the beam.

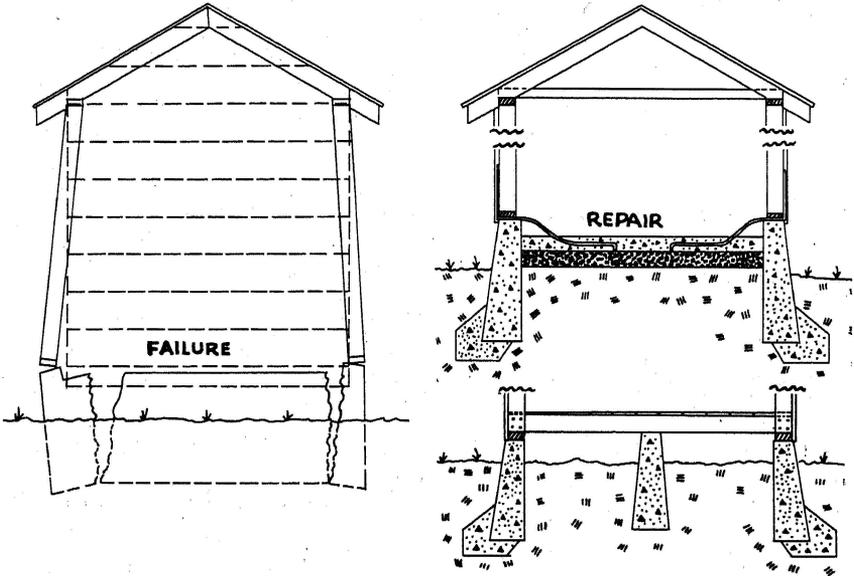
New foundations should be reinforced near the top, the bottom, and around the corners to be safe for all conditions.

## SMALL GRAIN STORAGE

Failure No. 1. Spreading of Walls—Either wood or concrete floor.

*Causes of Failure*

1. Pressure of grain.
2. Lack of adequate cross ties.
3. Lack of reinforcement in foundation and floor.
4. Burrowing rodents.
5. Moisture in grain keeps lumber damp.
6. Livestock damage lumber attempting to get to grain.

*Repairing with Concrete Floor on Gravel or Cinder\* Fill*

1. Jack up one side of building and straighten.
2. Put foundation back in correct position.
3. Grout in a footing to hold foundation in place.
4. Repeat for opposite side.
5. Break out section of floor to hold anchors (spaced 6 feet).
6. Repair floor and cast anchors in place.
7. Renail siding as needed.

*Steps in Repairing (Wood floor on concrete walls)*

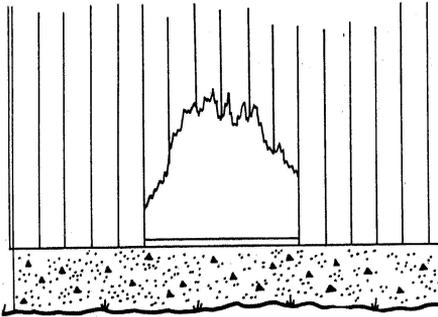
1. Jack up one side of building and straighten.
2. Put foundation back in correct position.
3. Grout in a footing to hold foundation in place.
4. Repeat for opposite side.

\*If cinders are used it may be advisable to place roofing paper under the cinders.

5. Remove end foundation walls and leave center open.
6. Place center wall.
7. Treat floor joists with cresote or carbolenium.
8. Renail siding as needed.

**SIDING AND FRAMING FAILURE**

**Failure No. 1. Mechanical Damage to Siding.**—Repair should be made as soon as convenient to prevent damage to the floor and sill, to prevent barn from being cold, and to keep up the appearance of the building.

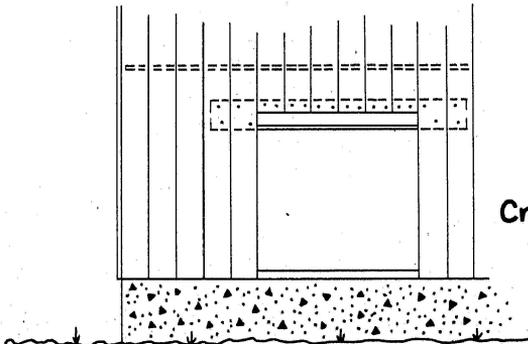


*Causes of Damage*

1. Siding boards broken by livestock.
2. Lack of protection on inside of barn.
3. Not sufficient room back of stalls.

*Steps in Repairing*

1. Square across damaged boards at a point above the damaged section. Saw across to eliminate damaged parts.
2. Secure a piece of galvanized iron, 26 or 28 gauge 2 inches wide, and long enough to go across the opening. Bend and fit in place as shown to weather-proof the joint.



Inside  
 — Tin strip to waterproof joint at top of repair.  
 2" x 4"

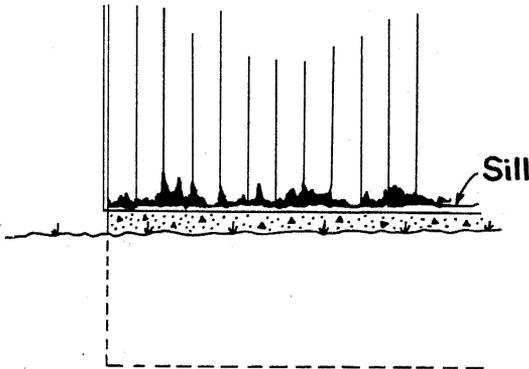
**Cross Section of Repair**

3. Nail a 2" x 4" or a 2" x 6" near top of opening as shown.
4. Saw boards to length and nail in place.
5. Nail heavy boards on inside of frame as protection to siding. (These are not shown on drawing.)

**Failure No. 2. Siding and Sill Rotted.**—This type of damage if neglected will rapidly grow worse and endanger the entire building.

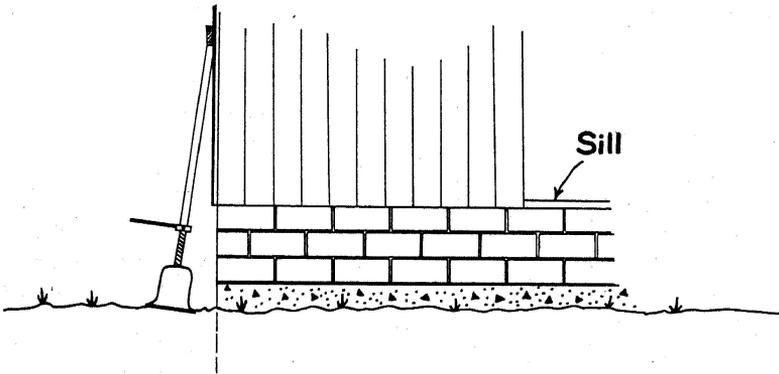
*Causes of Failure*

1. Sills and siding too close to ground to dry out readily.
2. Rainwater splashes mud on siding.



From observations of over 1000 buildings, 20 inches seems to be a satisfactory height.

If concrete foundations are extended up to form a part of the wall, they usually cause too great a loss of heat from the building.



*Steps in Repairing*

1. Lift a section of the building slightly higher than its final position.
2. Saw through siding and studding at such a height that the desired number of rows of blocks, tile, or brick will fill in.
3. Lay up new wall on the old foundation and allow mortar to set.
4. Install new sill and lower building into place.

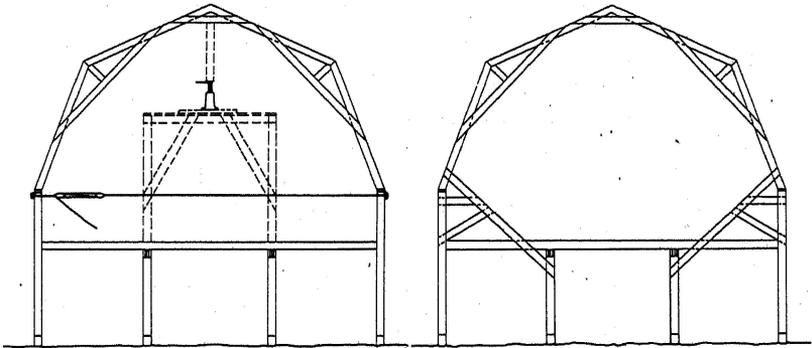
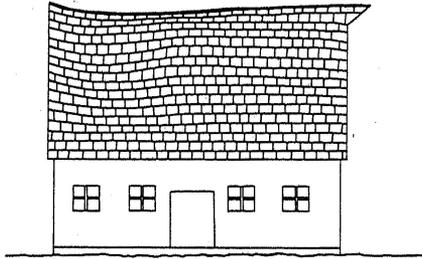
Many buildings so treated are good for another quarter of a century of service.

## ROOFING FAILURES

**Failure No. 1. Sagging Roof.**—This is another type of failure that grows rapidly worse unless promptly repaired.

### *Causes of Failure*

1. Pressure of hay on frame on sidewalls.
2. Lack of stiffness in plate.
3. Incorrect bracing.



### *Steps in Repairing*

1. Build up a platform from which to lift at center.
2. Attach a cable and block to pull side walls in at the plate level.
3. Apply both at the same time to straighten roof line.
4. Install side braces made of two 2" x 8"s at intervals of 8, 10, or 12 feet.
5. Renail all braces affected.

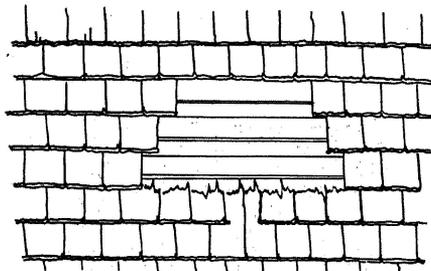
### *Additional Safeguards*

Both in the repairing of a sagging roof and in the original construction, the likelihood of failure can be greatly reduced if the frame is tied in, as shown below, to prevent spreading.

## Roof Renewal—Wood, Asphalt or Metal Shingles

### *Causes of Failure*

- |                         |                           |
|-------------------------|---------------------------|
| 1. Due to long service. | 3. Improper laying.       |
| 2. Wind storms.         | 4. Poor quality shingles. |



### *Steps in Repairing*

- I. WITH WOOD SHINGLES.
  - a. Remove all old shingles.
  - b. Renail sheathing and replace damaged places.
  - c. Pull or drive all nails into sheathing.
  - d. Reshingle.
- II. WITH ASPHALT SHINGLES.
  - a. Nail all loose shingles.
  - b. Add wood shingles to fill all holes in shingle roof.
  - c. Apply asphalt shingles using long nails.
- III. WITH METAL SHEETS.
  - a. Nail 1" x 4" or 1" x 6" fencing, 2½ feet on center, across roof.
  - b. Apply metal sheets to strips with lead head nails.
  - c. If sheets tend to separate between nailing strips, fasten them together with metal screws.

## REPAIRING METAL ROOFS

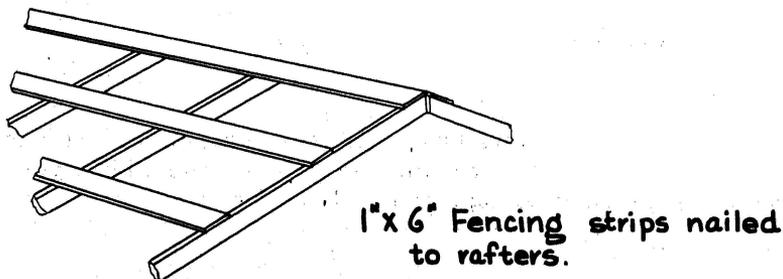
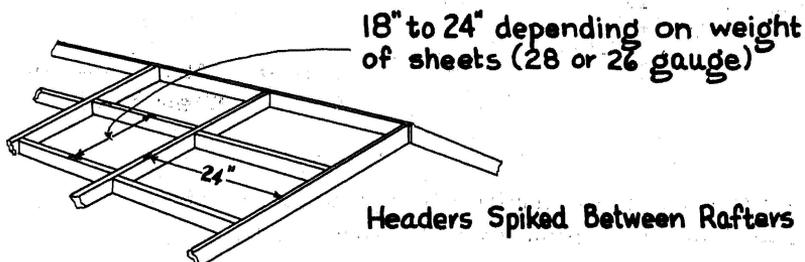
### *Cause of Failure*

1. Years of exposure.
2. Insufficient zinc covering.
3. Improper storage before application.

### *Steps in Repair*

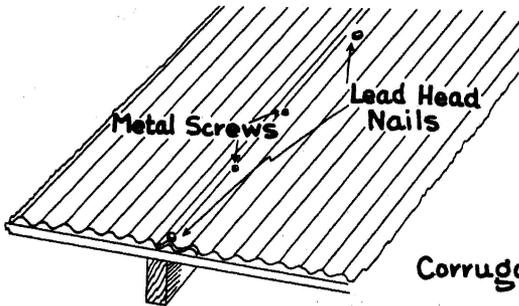
1. Pull all loose nails and replace.
2. Renail all loose sheets with lead head nails.
3. Fasten between nails with metal screws.
4. Use steel brush to remove loose rust.
5. Paint with metallic zinc paint.
6. Ground metal roof.

### METAL ROOFING CONSTRUCTION Rafters, Headers and Nailing Strips

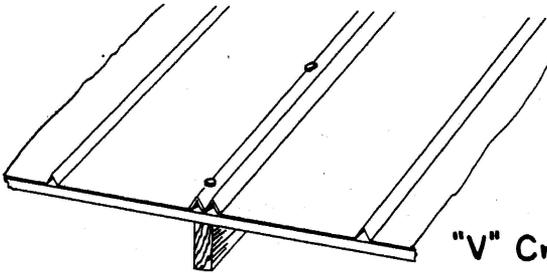


1. Nail headers or strips in place as shown.
2. Bend 1" of first strip down to start on first rafter.
3. Nail to strips with lead-washed roofing nails.
4. Fasten sheets together between strips with sheet metal screws.

## Nailing Corrugated Sheets



Corrugated sheets on strip sheathing.



"V" Crimp may be laid on strip sheathing.

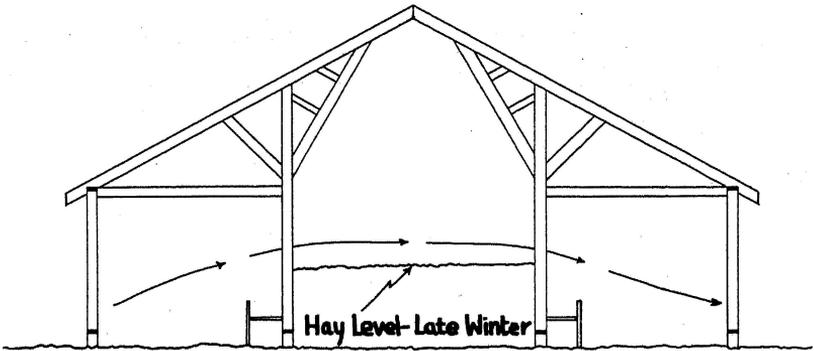
1. Arrange sheets so junction will be made over rafters.
2. Nail into top of crimp using lead-head nails.
3. Use one nail in each strip with a metal screw between.
4. Use special screw nails in soft sheathing.
5. Nail V-Crimp sheets each 12 inches as shown.

Your county agent or your lumber dealer can supply you with the names of manufacturers of metallic zinc paint—colors, blue, green, or red. One gallon covers approximately 500 sq. ft.

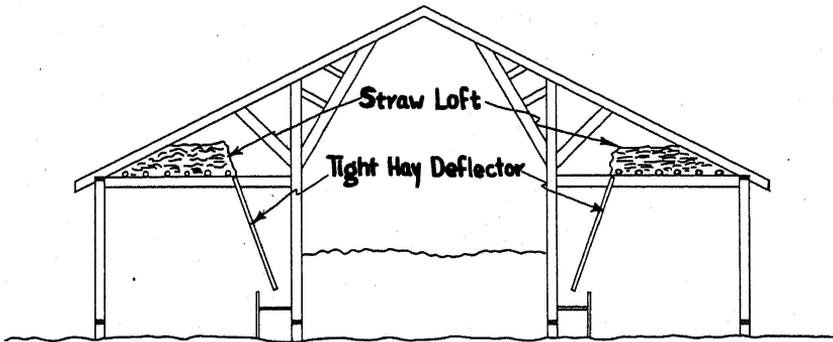
Enlarged charts of any of the illustrations used in this circular may be secured, at nominal cost, from the Agricultural Engineering Department of the University of Missouri College of Agriculture.

## FAILURE IN VENTILATION

## Cold Drafty Barn

*Causes of Failure*

1. Heat produced by stock is dissipated into hay storage space.
2. If shed doors are open, drafts through the entire building are sure to result.
3. No checks or barriers to air movement are provided.

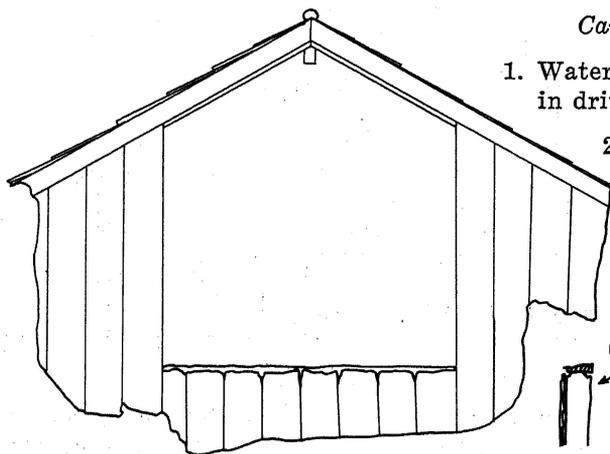
*How to Repair Ventilation Failure*

1. Build solid deflector over mangers.
2. Place poles one foot apart on ceiling ties.
3. Cover poles with chicken netting and straw.
4. Add extra hay or straw to mangers on extremely cold, windy nights to prevent drafts.

Hay can still be fed direct to mangers but cross drafts will be checked. Air movement through straw loft will give adequate ventilation.

### REPAIR OF HAY DOOR

**Sill and Siding Rotted Out at Base of Door.**—In new construction, this trouble can be prevented by installing a waterproof flange under the door.

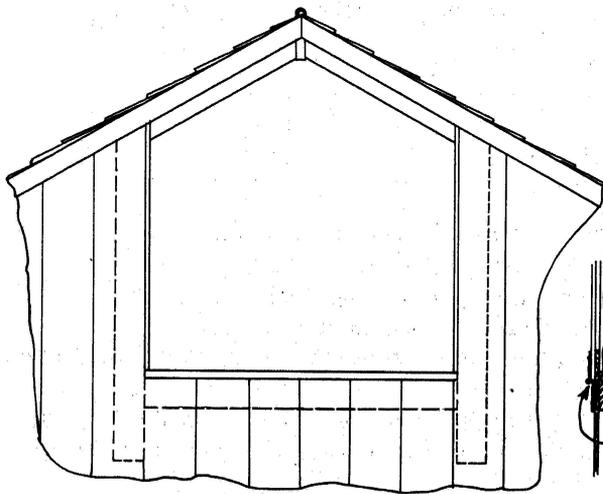


#### *Causes of Failure*

1. Water leak at top of sill in driving rain.
2. Frequent opening and closing pulled hinges.

#### *Steps in Repairing*

1. Nail a 2" x 8" on edge below the old door sill.
2. Nail all siding to this new piece.
3. Remove old sill and cut siding flush with new piece.
4. Nail new sill in place and nail 1"x 4" boards on sides to decrease width of door.



Cross Section

Inside

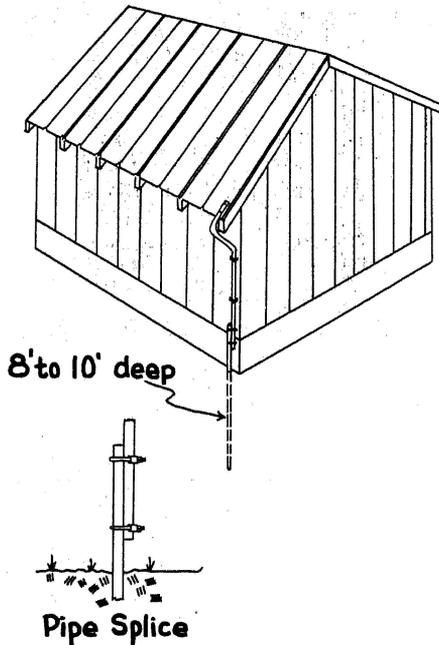
Offset Hinge

5. Secure 3 offset hinges and put door in place, lowering it 2 to 4 inches below old position.
6. Close opening above door or leave open for ventilation as desired.

## LIGHTNING PROTECTION FOR METAL ROOFS

### General Information

1. A metal roof should be grounded for safety.
2. Ground opposite corners of the roof. If building is over 200 feet in circumference, ground four corners.
3. Renew ground pipe if rusted.



### Specific Instructions

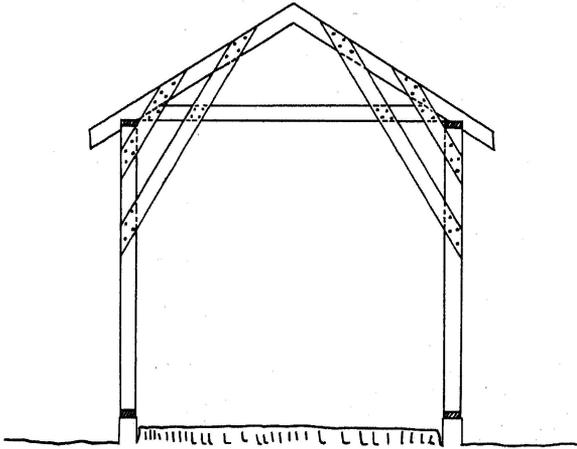
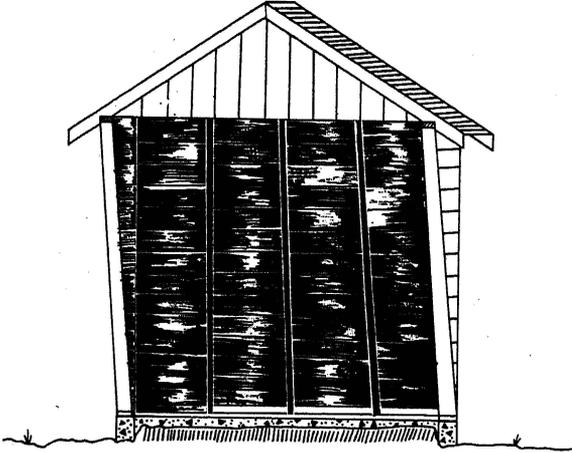
1. Flatten  $\frac{1}{2}$  inch pipe so as to secure 3 square inches of contact with metal roof.
2. Drill to take bolts for fastening to roof.
3. Bend to fit against building as shown. Avoid sharp turns.
4. Drive or set ground pipe deep enough to reach moist soil. If rock is encountered, lay in a horizontal trench.
5. Splice to upper pipe with clamps or "U" bolts.
6. Cupolas or raised parts on roof should have points. These can be grounded to the metal roof.

## FAILURE IN BRACING

### Single Garage Without Bracing

#### *Causes of Failures*

1. Doors are open a great deal and wind causes a strain .
2. There is no width of wall to give stability.
3. Weight of doors causes strain.



### Bracing Inside the Building

#### *Steps in Repairing*

1. Straighten building until sides are plumb.
2. Nail short tie to hold rafter on plate.
3. Nail brace to rafter, joist and studding. Set brace as far down as possible without interfering with use of door.
4. Nail and brace across rear end if needed.

## END BRACING ON WIDE BARNs

### *Causes of Failure*

1. A 60-mile wind produces about 15# pressure per square foot on the wall.
2. Varying winds produce vibration and tend to loosen joints on a long span.

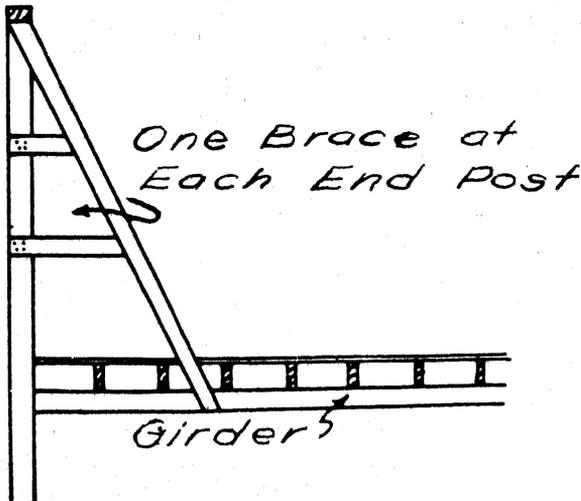
### *Methods for Repair*

1st Method: Build a horizontal truss at the plate level to stiffen the wall.



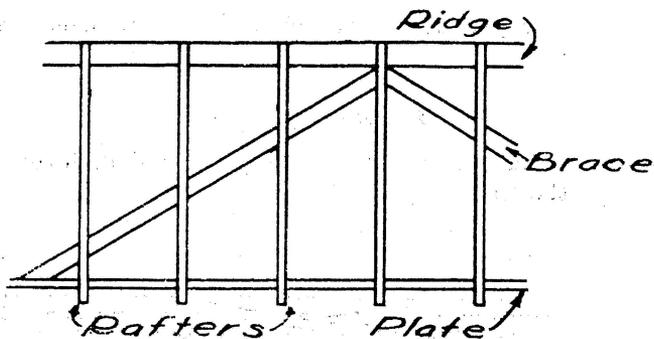
A shelf bracket is placed under truss at each post.

2d Method: Build a brace to the girder as shown below. One at each end post.

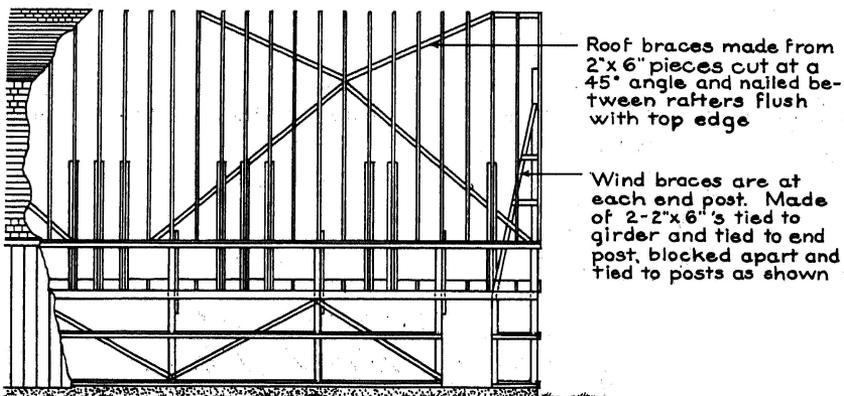


## BRACING THE ROOF ABOVE THE PLATE

Steep roofs extend to a considerable height above the plate and require some end bracing.

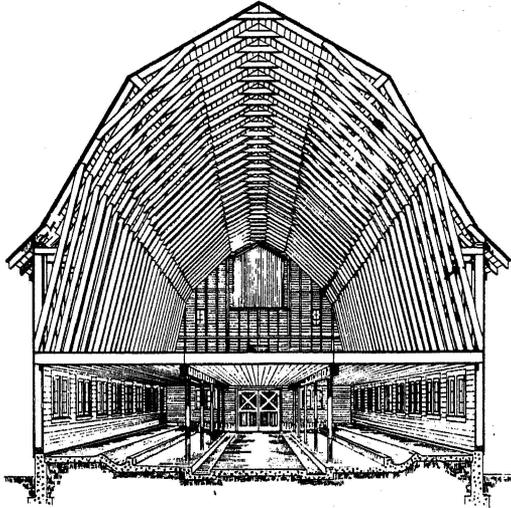


A 1" x 6" board nailed under the rafters may be used on a straight gable roof.

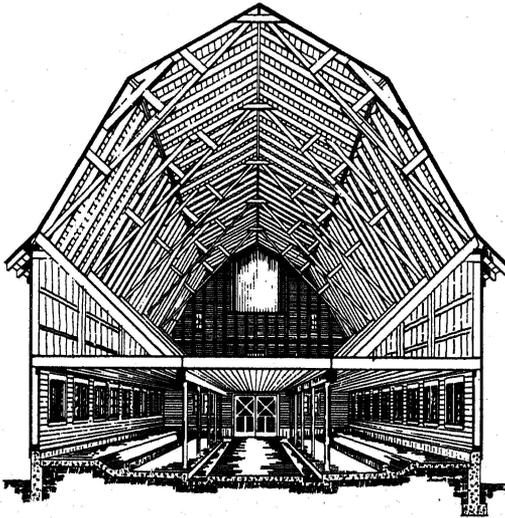


2" x 4" pieces nailed in between rafters as shown is used on roofs with obstructions on under side as in the gambrel roof.

SIDE BRACING FOR GAMBREL ROOFS



Bracing for the wing-joint type of gambrel roof.



Bracing often used on wide barns.

### PAINTING FARM BUILDINGS

Paint when properly selected and applied lengthens the serviceable life of buildings as much as 40%. An investment in paint brings an annual return of about 3¼% through saving in buildings alone.

#### A Good Paint Job Depends On:

1. *The Paint.* Good quality suited to the job.
  - Pigment—60 to 65% by weight.
  - Vehicle—40 to 35% by weight.
2. *The Surface* to be painted.
  - a. Wood should be dry and clean.
  - b. Knots should be treated with
    - (1) Shellac.
    - (2) Aluminum primer.
    - (3) Furfural.
3. *The Painter.*
  - a. Paint **must** be mixed thoroughly before using.
  - b. Paint **must** be selected and applied as per specifications of manufacturer.
  - c. Paint **must** be brushed to secure thorough spreading and intimate contact.
4. *The Weather.*
  - a. Surface should be dry.

### INSULATE THE HOME TO SAVE FUEL

Things to do based on returns for the investment involved on the average house.

- 1st. *Insulate the Ceiling.*
  - (1) Install insulation boards on top of joists. Or
  - (2) Use insulation bats between joists. Or
  - (3) Use fill-insulation between joists.
- 2nd. *Stop air leaks through walls and around windows and doors.*
  - (1) Renail loose boards.
  - (2) Calk cracks around window and door frames.
- 3rd. *Install storm windows and doors.*
  - (1) North and west windows and doors most important and may be done first.
- 4th. *Stop air leaks through foundation.*
  - (1) Point or calk cracks.
  - (2) Cover summer ventilators with tight covers.
- 5th. *Insulate walls.*
  - (1) Fill-insulation blown in.
  - (2) Stucco cover over siding.
  - (3) Check heat loss at floor joist level.
- 6th. *Weather strip windows and doors.*