

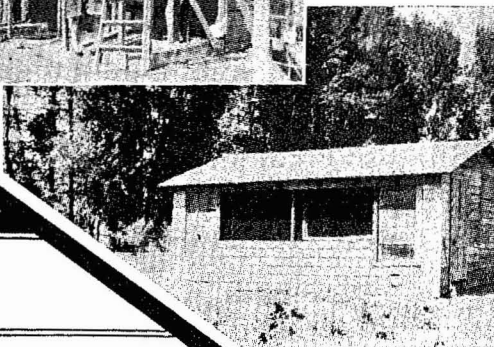
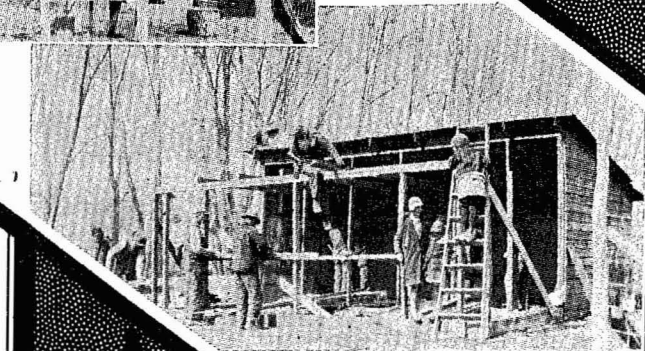
# POULTRY HOUSING

and

## Poultry House Equipment

by

Miss H. E. Cushman



Montana State College Extension Service

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# Poultry Housing

## And Poultry House Equipment

### For Montana

By

Miss H. E. Cushman,\* Extension Poultry Specialist

#### INTRODUCTION

Money and effort spent on breed improvement and balanced rations are wasted unless poultry is properly housed and provided with the proper equipment. Plans and suggestions for the poultry house and equipment recommended for Montana conditions are contained in this publication.

The proper poultry house is not expensive. Local prices and the kind of material used will determine the cost. It is important that the house be properly ventilated but not drafty, dry; well insulated, to be as little affected as possible by sudden outside temperature changes; well lighted, roomy, and convenient both for the birds and for the operator. The convenient house is apt to be a sanitary house.

Since the location can materially affect the proper functioning of a house, the situation of the building should be studied before the foundation is laid. No house, however well built, will remain dry if the soil or air drainage is faulty. A house should no more be placed in a hollow, where air pockets exist, than it should be put on wet, soggy ground. The ideal soil is a light sandy or gravelly one. Where the house must be placed on gumbo or heavy soil it is wise to put in tile to provide proper drainage.

If the house be built into the south slope of a bank, drainage ditches must be made to carry surface water away from the back and sides. The ideal spot for the house is on a knoll, but protected from wind and weather.

The house should face the south to assure maximum sunlight, a consideration which is particularly important during short winter days.

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\*Professor H. E. Murdock, Agricultural Engineer, Montana State College, assisted in the preparation of this bulletin.

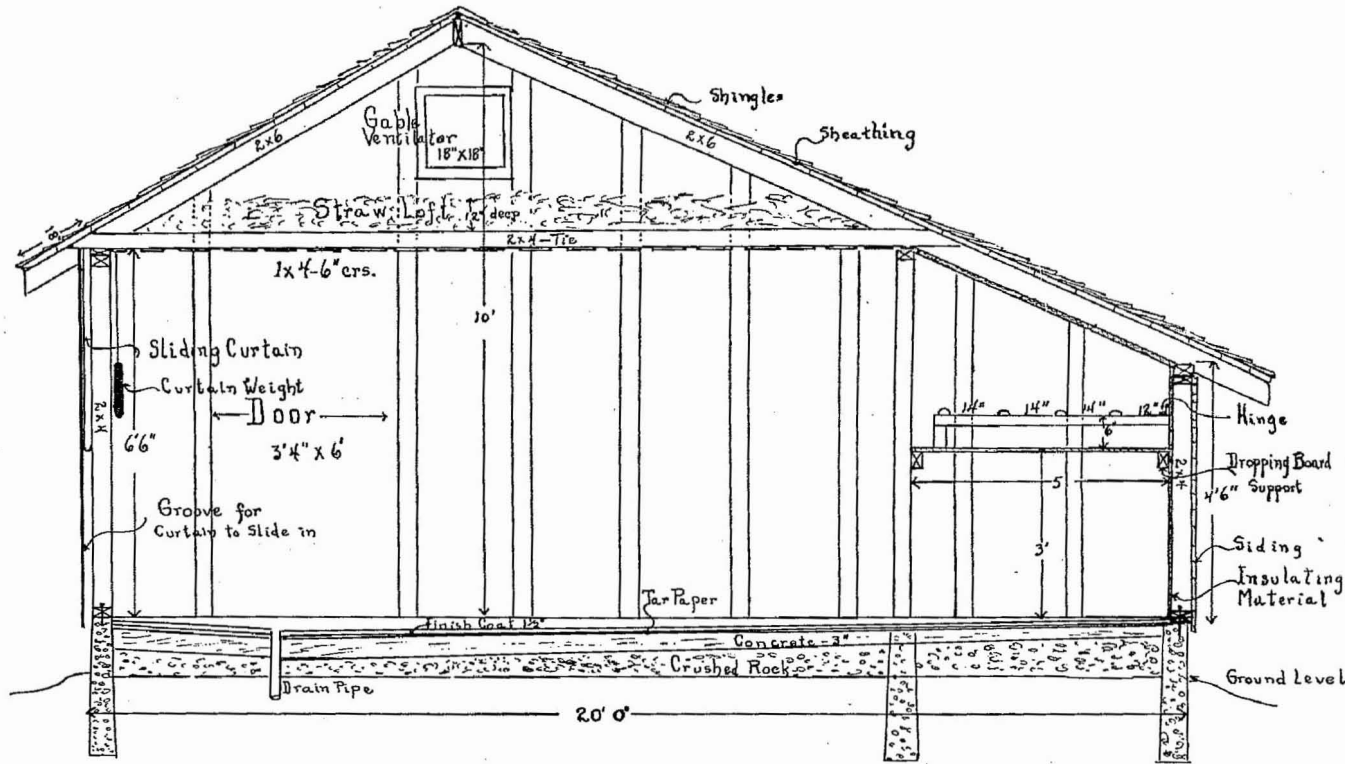
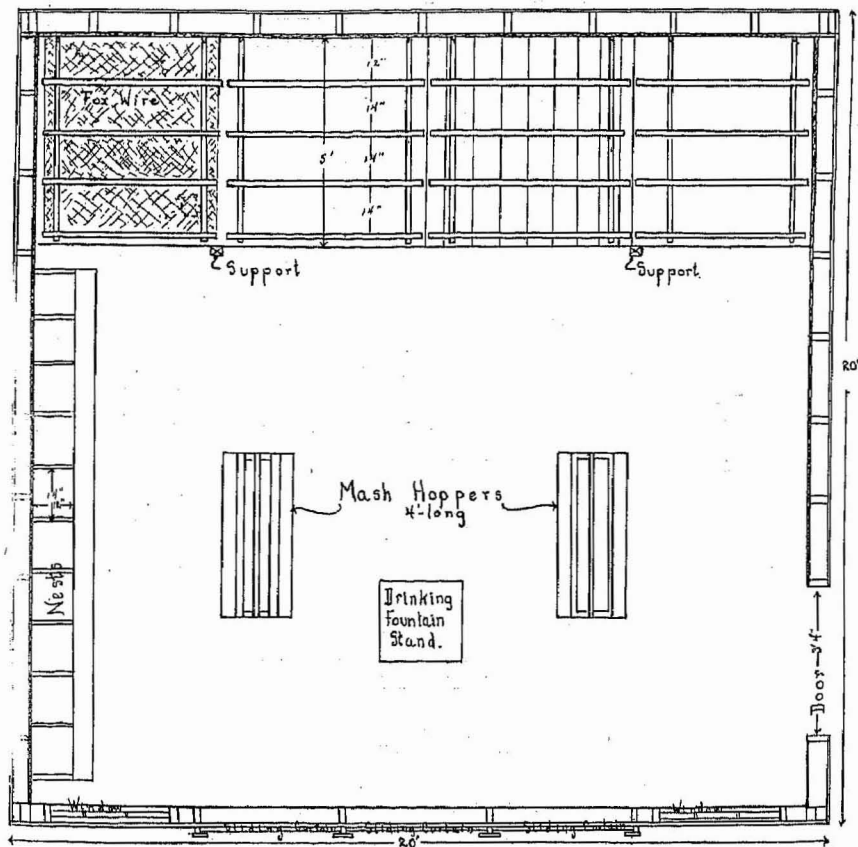


Fig. 1

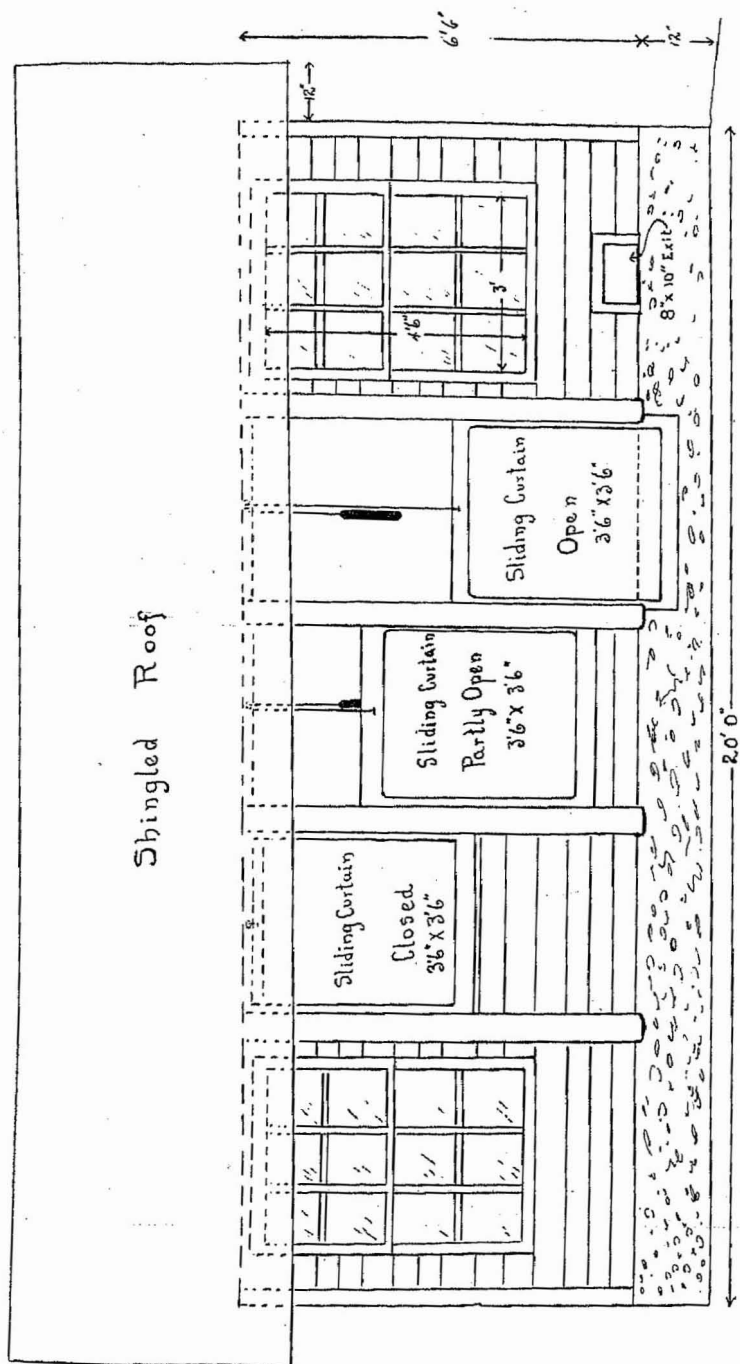
## END ELEVATION

### TYPE OF HOUSE

The type of poultry house is largely determined by the manner in which the housing principles are applied. For comfort and warmth the house should be as deep as possible, but if too deep, sunlight will not reach the back. A distance of 20 feet from front to back is best for all purposes. It should never be more than 24 feet nor less than 16 feet from front to back. Since square construction is cheaper than any other, a 20 feet x 20 feet unit is preferable for 100 birds. This allows 4 square feet per bird. If more birds are to be kept, additional units may be built on with inexpensive partitions between them to break house drafts.



FLOOR PLAN



The height is determined by the height of the operator. The warmest house is one that is only a foot or so above the birds' backs when roosting. Consequently, 6½ feet is about as high as the front of the house should be. This height gives the operator head room and gives sunlight a chance to get well back into the house during the winter when the sun slants low in Montana. The back wall should not be more than 4½ feet high.

To put a shed roof on such a house makes it exceedingly flat. Therefore the uneven or two thirds span roof is much more serviceable and lends itself admirably to the straw loft method of insulation, so frequently used in Montana.

Since light as well as air is needed, a combination front of windows and curtains on sliding frames proves most satisfactory for the state as a whole. A front that is made up entirely of sliding curtains may be used in the western part of the state where moisture is a greater problem during the winter and where temperature does not go as low as in eastern counties. In other sections frames need to be provided with glass (see paragraph on front and air intakes, page 11).

### Foundation

A concrete foundation is best for a permanent poultry house. This should be deep enough to prevent heaving from frost (12 to 18 inches) and should extend six inches to one foot above ground. A foundation that is about six inches wide will carry a 20 x 20 feet unit. Bolts which aid in anchoring the sills, should be set into the foundation while the concrete is still wet.

### Floors

While a great many people try to worry along with dirt floors, the labor of keeping them sanitary is so great that the only practical floor is one of either concrete or wood. To keep a dirt floor safe at least 6 inches of dirt must be removed annually. This fouled dirt must then be hauled to some distant part of the ranch where hens never range, then a new top dressing of dirt or gravel is added and thoroughly tamped down.

The concrete floor is the most permanent and sanitary. It should be built with a drain to facilitate cleaning. If conditions

are such as to cause a concrete floor to be damp, the difficulty can be overcome as follows: Put in a layer of crushed rock and gravel; cover with a coat of coarse concrete, place on this a layer of tar paper and finish with fine cement about one to two inches thick on top of the tar paper.

If a wood floor is preferred it is well to have a double floor with building paper between.

### Under-Floor Heat

In parts of Montana where cloudy days prevail at certain seasons and keeping dry litter becomes a real problem, many flock owners have installed under-floor heat. If the floor temperature is raised only 7 degrees the moisture laden air will start rising and active ventilation is assured. With a board floor the heat is provided by a heater under one end of the house with a ventilator chimney at the other end causing a flow of warm air under the floor. This ventilator has absolutely no connection with the ventilating system inside the house. To obtain this under-floor flow of warm air the foundation must be absolutely tight. (See figure 4).

With a cement floor both the heat and smoke from the under-floor heater may be conducted through hollow tile to a chimney at the opposite end of the house. The final cement coat for the floor is laid over the hollow tile.

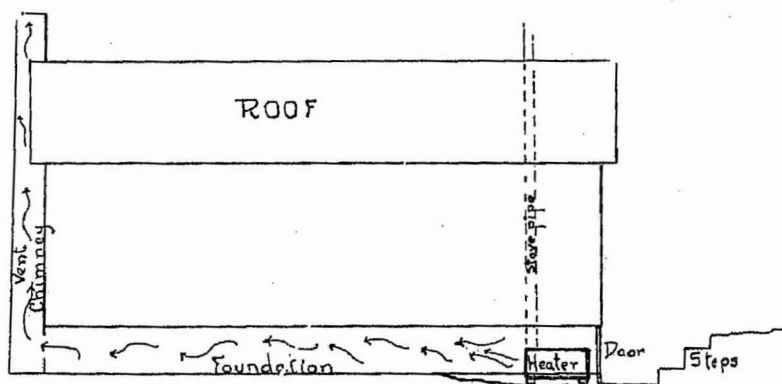


Fig. 4 .



The under-floor heater may be made from an oil or gasoline barrel or may be a fire box of cement construction.

Since any scrap material may be used for fuel in these heaters the cost of operation decidedly overbalances litter costs alone. Maintaining health of the birds and controlling winter molt are other reasons for using under-floor heat.

### Walls

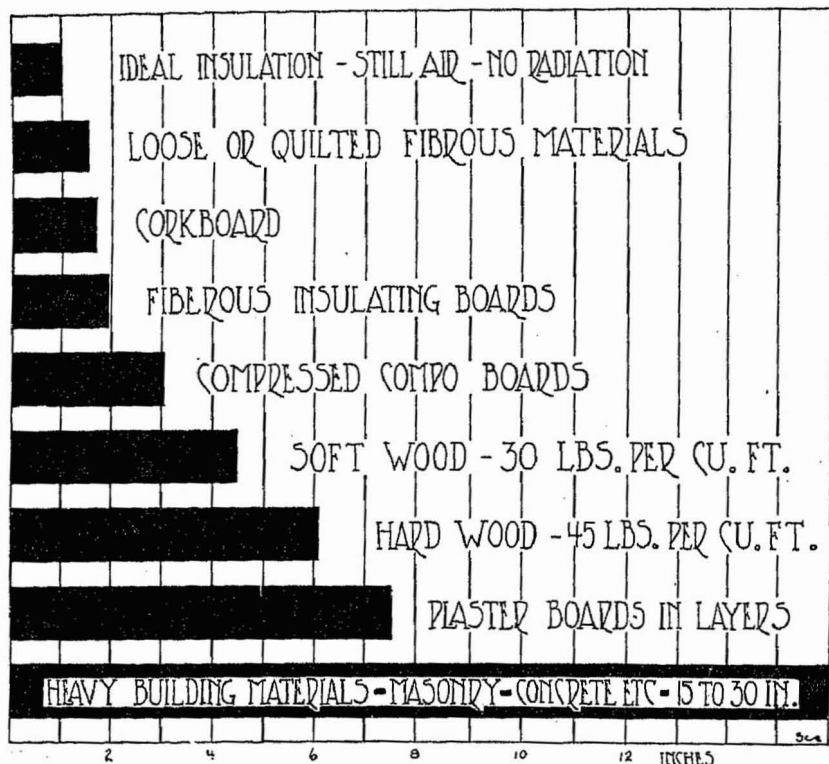
For several years housing tours have been conducted in the state on sub-zero days. It was found that houses which had adequate provisions for ventilation and removing moisture coupled with well insulated walls and roofs, were functioning properly even at the lowest temperatures.

The ideal insulation is "still air." But merely boarding on either side of studs does not provide "still air" unless the materials so used are air tight.

Ohio Extension Bulletin 94 gives a good comparison of the insulating value of different commonly used materials. (See Fig. 5).

The drawback to using many of the commercial insulating materials on the market is that the birds are apt to pick and eat them. Therefore, it is well to paint the walls, as high as the birds can reach, with gray cement paint. This may be made by mixing equal parts (by volume) of Portland cement and fine, clean and sifted sand which is free from loam; add sour milk until a thick paint is obtained. Do not use any water in the mix; mix only the amount to be used at once. Two coats of the paint should be used. Approximately 12 pounds of Portland cement, 12 pounds of sand, 1 gallon of sour milk will cover with two coats a surface of 80 square feet.

Some poultrymen report that birds even pick through the grey cement; in which case the wall may be covered with fly screening to a height where the birds cannot reach. This will keep composition board intact.



#### THICKNESS REQUIRED TO EQUAL ONE INCH IDEAL INSULATION

Fig. 5—This chart shows the thickness of various materials having equivalent heat insulating values. The horizontal scale gives approximately the thickness in inches required to furnish insulation equivalent to 1 inch of the best possible practical insulation, called ideal in the figure.

This chart also indicates that it takes 6 inches of hard wood to equal 2 inches of fibrous insulating board in insulating value; in other words, that insulating board has the same insulating value as three times its thickness of hard wood. (Courtesy of Ohio Experiment Station).

### Front and Air Intakes

As already indicated the combination front, of windows and sliding curtains, is accepted in most parts of the state.

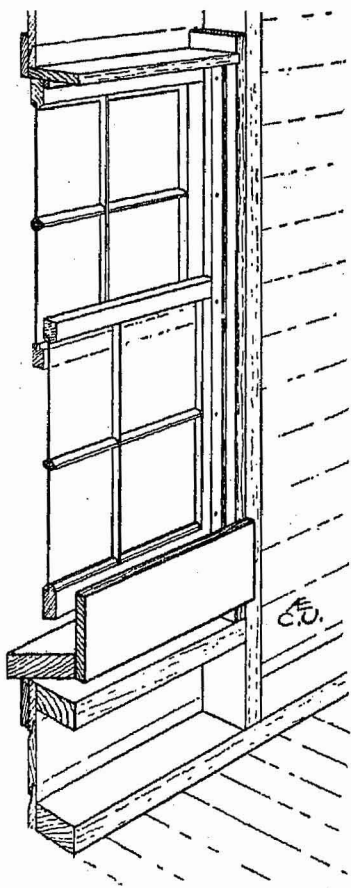


Fig. 6—Cross-section of window inlet. Note that the window sill extends clear to the baffle board so that wind cannot blow down to, nor across, the floor. (Courtesy N. Y. State College)

Either heavy muslin or glass substitutes may be used in the curtain frames.

However, in parts of the state high winds necessitate closed windows a greater part of the winter. Under these conditions other provisions must be made for fresh air intakes. A number of poultrymen construct their cold air intakes at the sill between two studs on the outside of the house. The air then enters the house through an opening near the plate.

Cornell, Massachusetts, and Maine universities have probably accomplished more than other universities in research on ventilation. Cornell suggests an intake "by setting the curtain out 1 inch from the front of the house.

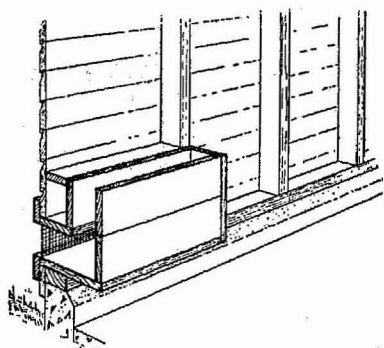


Fig. 7—A built-in intake. Built in intakes should extend entirely inside the frame.

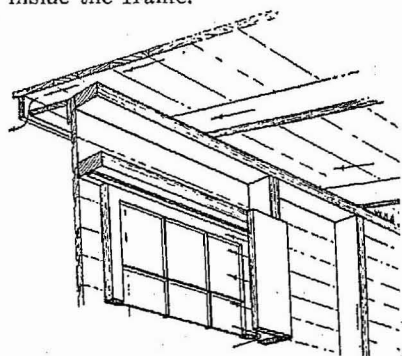


Fig 8—Window inlet in a window that slides horizontally. Note the wind baffle. The arrows indicate the course of the incoming air.

This may be done by putting 1 by 3 inch verticle strips under the side guides and renailing the guides through these strips. The fresh incoming air moves up vertically through the slot thus provided at the bottom of the curtain." Cornell also suggests built-in intakes. They state that the frame of the built-in intakes should be entirely inside the building so that the incoming air will be directed straight upward without interference from any part of the frame. (See Figures 6 and 7). Cornell Bulletin 315 also suggests an air intake plan for buildings with side-sliding windows. (See Figure 8).

### Ceiling and Air Outlets

When using a straw loft, the ceiling over the roosts should be sealed and insulated regardless of the fact that the rest of the room is provided with a straw loft. (About six inches to a foot of straw is sufficient).

When framing the house, every other rafter should be tied with a 2x4. Although the principal use of these ties is to strengthen the building, they do provide an excellent means for attaching the strips or wire which support the straw loft.

The wire or strip should be nailed to the underside of the 2x4 in order to lower the ceiling. This provides a warmer house and facilitates changing the straw. When using strips to support the straw, at least two-inch spaces should be allowed between each strip to aid ventilation.

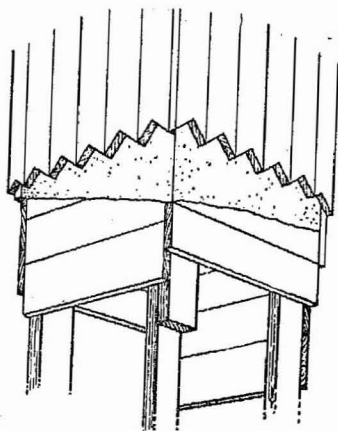


Figure 9—Construction details of a single outlet flue. Notice the double boarding with paper between.

With the straw loft method of ventilation provisions must be made for removing moisture from the house gable. Otherwise it will condense, then later rain down onto the floor. The simplest method of accomplishing this is by making gable-end doors. The cross draft above the straw forces the moisture laden air out of the gable before condensation takes place. The common error is to make these doors too small. They should be 18 to 20 inches square. Adding baffles will keep out snow and rain. Covering the openings with wire eliminates sparrows.

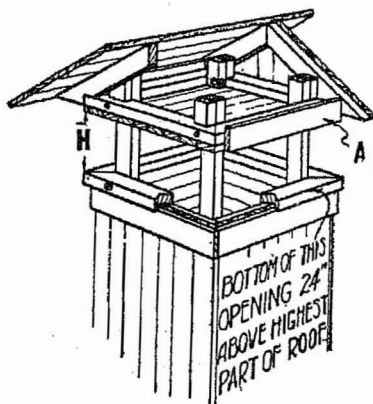


Fig. 10 — The outtake-flue head for a single-flue chimney. The flat insulated ceiling in this head is essential. For height of opening H, see columns B and C in table 1 on page 15. The board A prevents wind blowing through the top of the head.

While the straw loft is the simplest means of providing air outlets, there are those who prefer sealing the entire house. Then tower ventilators must be provided. This form of air outlets is especially necessary where the house has more than two 20 feet x 20 feet units.

Warm moisture laden air is light, rises and passes out the flue at the ceiling. However, the Cornell experiments show that, if the flues are not properly constructed, the air cools against the sides of the outlets, contracts and therefore does not permit upflow of foul air. Consequently the outlet flues must not only be adequate in size but must be properly insulated. A flue should be double boarded with paper between (see Fig. 9) and have a cap (see Fig. 10).

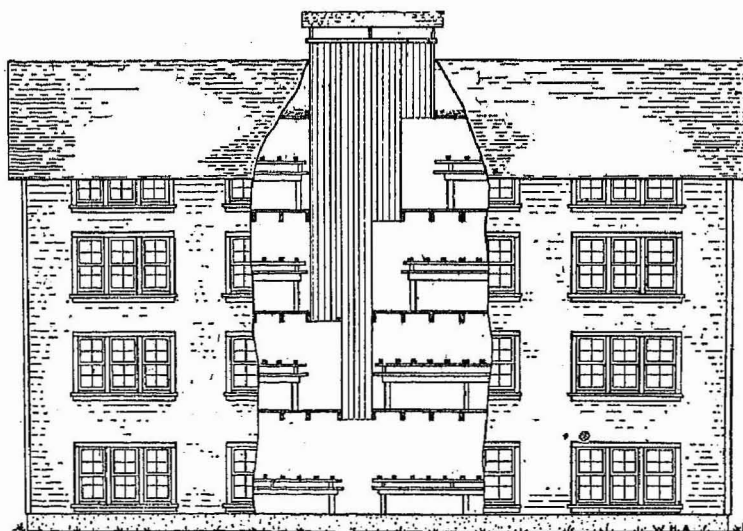


Fig. 11—The flue system of ventilation for multi-story poultry houses. The ceiling of the top-floor pen is insulated. Note that there is a separate flue for each floor.

Multi-story houses should have the ventilation of each story entirely separate from the story beneath, (see Fig. 11) otherwise the ventilation is faulty.

TABLE 1

DIMENSIONS OF OUTLET FLUES FOR PENS OF VARIOUS SIZES; HEIGHT OF VENTILATOR-HEAD OPENING FOR CHIMNEYS WITH ONE, TWO, THREE, OR FOUR FLUES AND NUMBER OF INLETS FOR EACH PEN

| Floor area of pen | Size of outlet flue | Height of opening H in ventilator head; single flue (see figure 9, page 13) | Height of opening M in ventilator head; two-flue chimney (see figure 10 page 13) | Height of opening M in ventilator head; three-flue chimney (see figure 10 page 13) | Height of opening M in ventilator head; four-flue chimney (see figure 10 page 13) | Inlet flues (each about 60 square inches in area) |
|-------------------|---------------------|---|--|--|---|---|
| A                 | B                   | C   | D  | E  | F   | G   |
| Square feet       | Inches              | Inches  | Inches   | Inches   | Inches  | Number  |
| 540 or less       | 16 x 16             | 8   | 10½  | 12   | 13  | 4   |
| 540-615           | 16 x 18             | 8   | 11   | 12½  | 13¾   | 5   |
| 615-685           | 18 x 18             | 9   | 12   | 13   | 14½   | 5   |
| 685-760           | 18 x 20             | 9   | 12½  | 14   | 15  | 6   |
| 760-840           | 20 x 20             | 10  | 13   | 15   | 16  | 7   |
| 840-925           | 20 x 22             | 10  | 13½  | 15½  | 17  | 7   |
| 925-1,010         | 22 x 22             | 11  | 14   | 16   | 17½   | 8   |
| 1,010-1,105       | 22 x 24             | 11  | 14½  | 17   | 18  | 8   |
| 1,105-1,200       | 24 x 24             | 12  | 16   | 18   | 19¼   | 9   |
| 1,200-1,300       | 24 x 26             | 12  | 16½  | 19   | 20  | 10  |
| 1,300-1,405       | 26 x 26             | 13  | 17   | 19½  | 21  | 10  |
| 1,405-1,510       | 26 x 28             | 13  | 17½  | 20   | 22  | 11  |
| 1,510-1,620       | 28 x 28             | 14  | 18½  | 21   | 22½   | 12  |
| 1,620-1,740       | 28 x 30             | 14  | 19   | 22   | 23½   | 13  |
| 1,740-1,860       | 30 x 30             | 15  | 20   | 22½  | 24  | 14  |
| 1,860-1,980       | 30 x 32             | 15  | 20½  | 23   | 25  | 15  |
| 1,980-2,120       | 32 x 32             | 16  | 21   | 24   | 25½   | 16  |
| 2,120-2,240       | 32 x 34             | 16  | 21½  | 25   | 26½   | 17  |
| 2,240-2,390       | 34 x 34             | 17  | 22½  | 25½  | 27¼   | 18  |
| 2,390-2,515       | 34 x 36             | 17  | 23   | 26   | 28  | 19  |
| 2,515-2,665       | 36 x 36             | 18  | 24   | 27   | 28  | 20  |
| 2,665-2,815       | 36 x 38             | 18  | 24½  | 28   | 29  | 22  |
| 2,815-2,965       | 38 x 38             | 19  | 25   | 28½  | 29½   | 23  |
| 2,965-3,110       | 38 x 40             | 19  | 25½  | 29½  | 30½   | 24  |
| 3,110-3,290       | 40 x 40             | 20  | 26½  | 30   | 31  | 25  |
| 3,290-3,430       | 40 x 42             | 20  | 27   | 30   | 32  | 27  |
|                   |                     |   |  |  | 32½   | 28  |

## Roof

Although in many sections of the country roofing paper may be used for roofs, in most sections of Montana shingles should be used because of high winds.

The rear slope of the roof is long and fairly flat, therefore, it should be supported by at least two, 2x4 posts. When these are placed four feet from the rear of the building, they in no way interfere with the floor space and provide a place to fasten the dropping board supports.

The house is provided with 18-inch eaves to protect the south side as well as to carry the run-off from the roof away from the foundation. With this length of eaves the sliding curtains, when used, can be lowered a little, even during storms.

A house that is 6½ feet high at the front should be about 10 feet high at the comb of the roof in order to give sufficient pitch to the rear slope and for ventilation purposes when the straw loft is used.

## FURNISHINGS AND EQUIPMENT

All interior additions to the house should be made so that they can be kept sanitary, and should be constructed as simply and as inexpensively as possible and yet serve the purposes for which they are built.

### Roosts

Each bird should be allowed 8 to 10 linear inches of roosting space. At this rate, a house 20 feet wide which contains 100 birds must be provided with 4 roosts running the full width of the house. In order to put the birds in the warmest part of the house these roosts should be placed along the north side and should be spaced 14 inches apart in order to make room for heads and tails.

Rounded poles with no cracks where mites can hide make good roosts, (2x4's or 2x2's beveled fulfill the requirements).

If heavy inch mesh wire, known as "fox wire," is fastened to the under side of the roosts and carried down to the dropping



boards the birds can be kept off the droppings. This helps in the production of clean eggs. (See Fig. 2).

### Dropping Boards

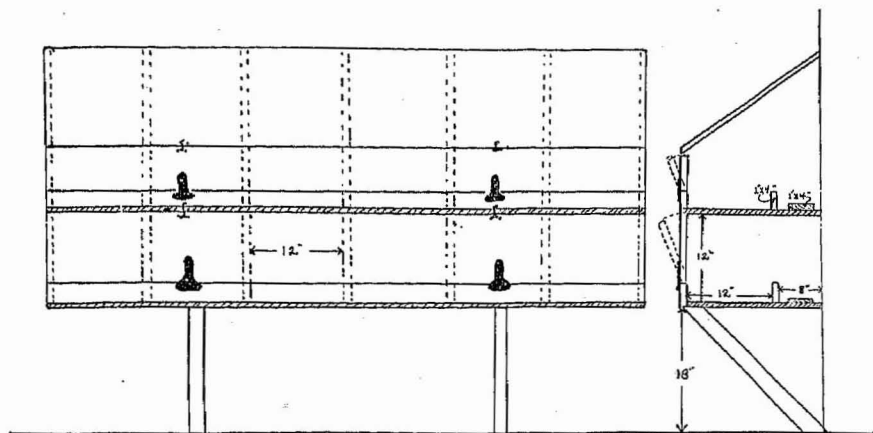
The dropping boards serve two purposes, to catch droppings, giving the birds more floor space; and, to protect the birds while roosting. Therefore, there should be not more than 6 inches between the roosts and dropping boards. The roosts should be hinged so that they can be raised when the dropping boards are cleaned.

The dropping boards may be made in panels so that they can be removed when the house is cleaned. But whether they are made portable or stationary, the lumber used in their construction should be cut in 5-foot lengths and laid to run at right angles to, rather than parallel with, the back of the house. This facilitates cleaning. For building dropping boards it is best to use tongue and groove lumber or cheap flooring which will not warp or develop cracks between boards.

### Dropping Pits

While dropping boards are in more general use, some poultrymen are trying dropping pits, which are quite generally used in sections of Washington. The pit has 18-inch boards at the front which are removable for cleaning. Wire, preferably fox wire, is stretched tightly over the pit and the roost rests directly on the wire.

Pits are all right if properly managed. Their great danger is that with them, the owner is tempted to be lax in sanitation. Sleeping over ammonia fumes is not conducive to good health. It is wise in using pits to scatter a small amount of gypsum into the pit daily. This not only does away with volatile odors but also fixes the nitrogen in the droppings and makes them a better balanced fertilizer. Also the poultryman must recognize the danger of having flies attracted to pits. Flies are always potential carriers of tapeworms.



### DARK NESTS

Fig. 12—Diagram of dark nest—birds enter from rear.

### Nests

There are two types of nests—dark nests, where the birds enter the nest from the rear (See Fig. 12), and open nests that are entered from the front (See Fig's. 13 and 14). Both are efficient. With either type provisions can be made to keep the birds out of the nesting units at night. The type depends to some extent upon the location of the nests. Some prefer to place the nests under the dropping boards while others prefer them against the end wall.

In either case, at least one nest should be provided for every five birds. The nests should be roomy but not large enough for several hens to get into at once. For Leghorns a 12x12 inch nest is adequate. For larger birds it should be about two inches wider.

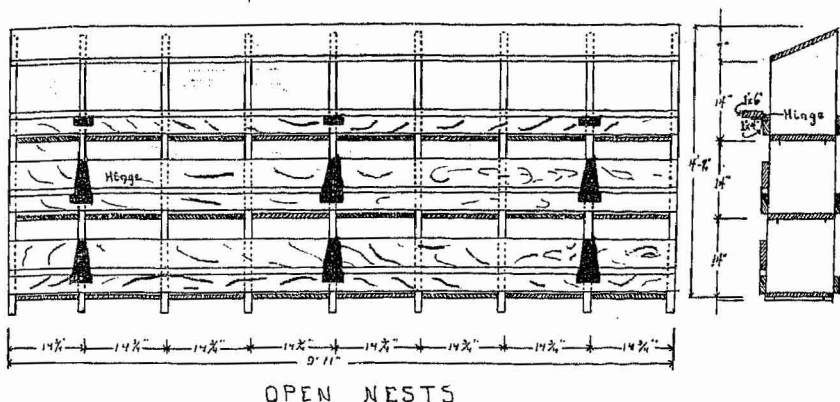


Fig. 18—Open nest with hinged perch which serves also as door that can be closed at night to keep birds out of nests.

### Mash Hoppers

The old wall type mash hopper with a carrying capacity for a week or more has given way to the small portable hopper placed in the middle of the floor with feeding space on either side. By using a hopper that is filled daily, birds will eat more mash. Increased mash consumption results in increased egg production. A popular hopper of this type is made with either a rectangular or V-shaped trough and is provided with a lip to keep birds from billing and wasting. Wires or a reel at the top will keep birds from roosting on the hopper and contaminating the feed. These

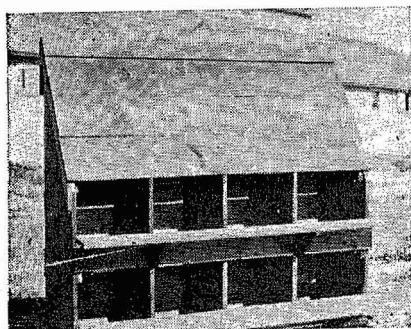


Fig. 14—Open nest.

hoppers are elevated about 18 inches from the floor so that litter cannot be scratched into them. This elevation also permits the birds to use the floor space underneath. (See Fig's. 15, 16 and 17). A 20x20 foot house should have two, 4-foot hoppers. This gives 16 linear feet of feeding space.

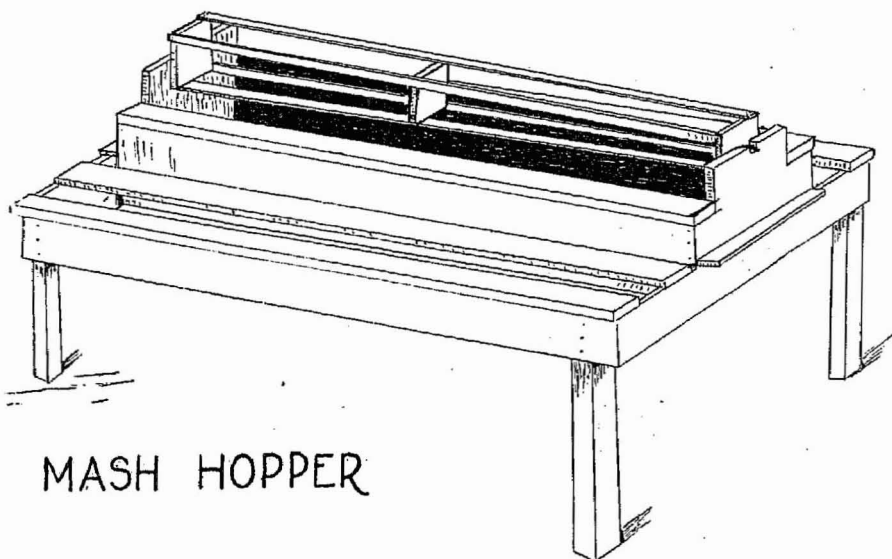
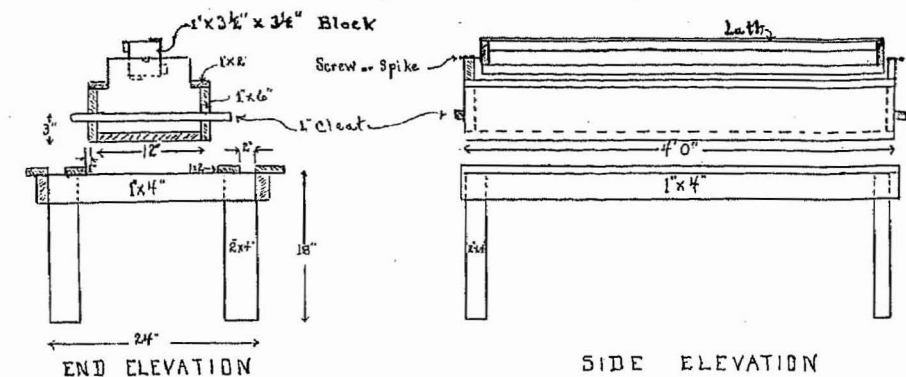


Fig. 15—Non-wasting Mash Hopper with reel.

### Bill of Materials for 20x20 House

- |                         |                          |
|-------------------------|--------------------------|
| 4 pieces 2x4—18" long   | 2 pieces 1x10—12" long.  |
| 2 pieces 1x4—24" long   | 2 pieces 1x1—18" long    |
| 2 pieces 1x4—4' 2" long | 3 pieces 2x3 1/2 x 3 1/2 |
| 4 pieces 1x2—4' 2" long | 4 plaster laths          |
| 2 pieces 1x2—4' long    | 2—2 1/2 No. 10 screws    |
| 2 pieces 1x6—4' long    | 1/2 lb. 6d nails         |
| 1 piece 1x12—4' long    |                          |

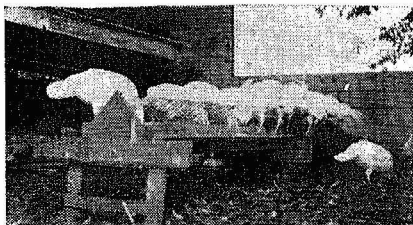


Fig. 16—Non-wasting mash hopper provided with wires to prevent wasting.

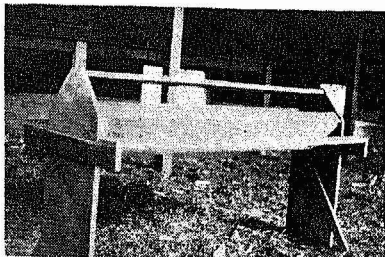
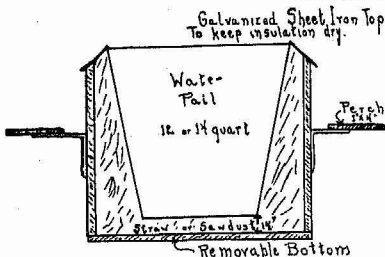


Fig. 17—Non-wasting mash hopper with V-shaped trough.

### Drinking Fountains

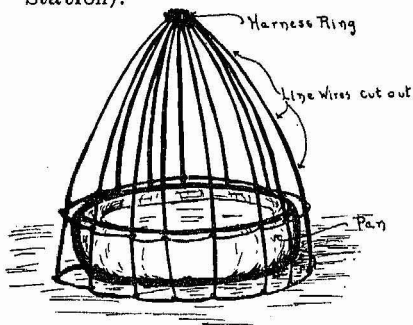
Probably more poultry diseases are spread through the drinking fountain than through any other channel. There are not only those diseases directly carried but there are a host of others that are traceable to damp litter caused by fountains which permit water to spill. Yet the drinking fountain is the piece of equipment that is most often neglected. A bucket of water on the floor is not satisfactory.

The drinking fountain, like the mash hopper, should be elevated 18 inches and should be protected from contamination and spilling. In addition, for northern states at least, provision should be made to prevent drinking water from freezing, either by insulating the fountain or providing it with artificial heat. (See Fig's 18, 19 and 20).



INSULATED WATER PAIL AND CONTAINER.

Fig. 18—Insulated water pail and container (Ohio Experiment Station).



DRINKING FOUNTAIN PROTECTOR MADE FROM ELECTRIC WELD FENCING.

Fig. 19—Drinking fountain protector made from electric lawn weld fencing with the line wires cut to permit hens putting their heads through to drink. (Maryland Experiment Station).

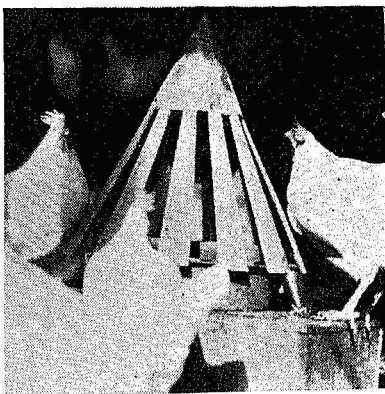


Fig. 20—Drinking fountain with lamp under it to prevent freezing and protector over it to avoid contamination.

### Miscellaneous Equipment

The well-equipped house should be provided with a dropping board scraper, a catching hook (See Fig. 21), a catching crate (See Fig. 22) and a broody coop (See Fig. 23). Where electricity is available, increased egg production can be obtained by installing electric lights controlled by a time switch. Reflectors should be used and the light so arranged that roosts as well as all parts of the floor are reached. The lights should be placed half way between the front of the dropping boards and the front of the house and 5 feet from the floor. A 20x20 house should have two lights.

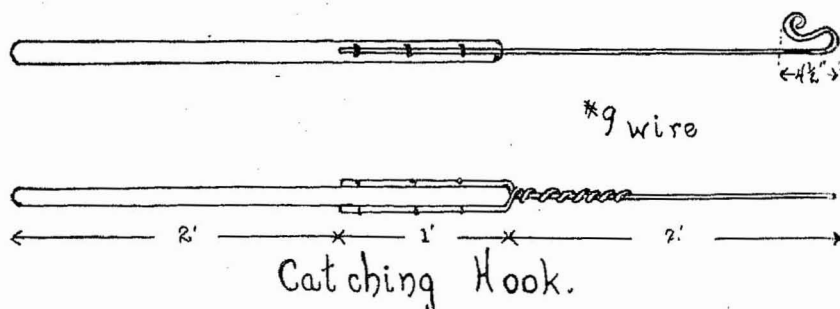


Fig. 21—Catching hook (California Experiment Station).

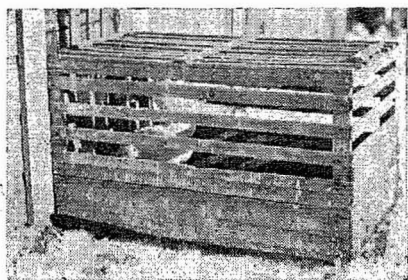


Fig. 22—Catching Crate.

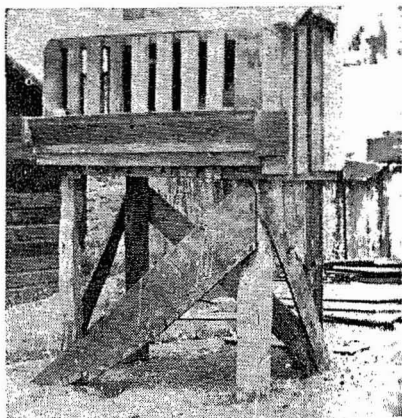


Fig. 23—Broody Coop.

## REMODELING

While many poultrymen will build new houses and take advantage of all the latest housing information, more will remodel houses already on the ranch.

Most old houses can be properly remodeled at little expense.

**High Houses** Houses over 6½ feet high, including the half monitor type, can be lowered inside by putting in a false ceiling or straw loft.

**Narrow Houses** If the narrow house is high at the rear, the back rafters can be spliced and the house extended to the rear. If the front is low it can be removed and set forward the proper distance. The upper end of the back rafters then are spliced to bring the comb about 10 feet above the ground. Front rafters are provided to connect the comb with the front of the house in its new position. This gives the approved uneven span type of house. The illustration on the cover shows the remodeling process.

**Fronts** If the house was built with curtain frames hinged to the plate, improvement can be made by changing to the sliding curtain type of front.

The house herein described will meet the varying weather and wind conditions of Montana but it is not fool proof. The operator must watch his birds. The litter must remain dry and clean. Dampness or frost in any part of the house indicates that more ventilation is needed; in which case the curtains must be set to let in more air. When birds huddle under the dropping boards this means there is too much cold air, and then, temporarily at least, the air intake should be cut down.

While floor space per bird can be somewhat reduced where larger than a 100-bird unit is being operated (a 10 per cent increase is safe) crowding should be avoided. Everything that has been done for the birds' comfort and for efficient production is lost when too many birds are housed on a given floor space.

Lastly, all that has been discussed concerning proper housing will amount to nothing if the house is not kept sanitary.

## Bill of Materials for 20x20 House

| Pieces   | Kind            | Length<br>In Feet |   |
|--|-----------------|-------------------|---|
| 4  | 2x6             | 20                | Sills   |
| 13   | 2x4             | 12                | Front and rear studs  |
| 6  | 2x4             | 16                | } End Studs   |
| 2  | 2x4             | 18                |   |
| 1  | 2x4             | 16                | Post for supports   |
| 5  | 2x4             | 20                | Plates (double)   |
| 13   | 2x6             | 16                | Rafters (rear)  |
| 6  | 2x6             | 18                | Rafters (front)   |
| 6  | 2x4             | 17                | Ties  |
| 35   | 1x4             | 20                | Ceiling board (to support<br>straw in loft and for ridge<br>pole) |
| 530 square feet insulating material<br>either insulating board of some sort or<br>cheap flooring or ship lap.<br>665 feet B. M.<br>18 bundles of shingles. |                 |                   | Sheathing   |
| 1060 square feet building paper for<br>sides—under insulating material and<br>for roof over sheathing.   |                 |                   |   |
| 2  | 2x4             | 20                | Dropping board supports   |
| 125 feet B. M.   |                 |                   | Flooring for dropping boards                                      |
| 12   | 2x2             | 12                | Roost and roost supports  |
| 100 square feet "fox" wire for under<br>roosts.  |                 |                   |   |
| 2 windows 3'x4½'.  |                 |                   |   |
| 600 feet B. M.   |                 |                   | Siding  |
| 2  | 2x2             | 16                | } For grooves for<br>sliding curtains                             |
| 2  | 1x4             | 16                |   |
| 2  | 1x3             | 16                | Sliding curtain frames  |
| 9  | 1x4             | 16                | Corner finish and window and<br>end ventilator frames             |
| 1  | 3 feet x 6 feet |                   | Door  |
| 3 weights and sash cords and pulleys   |                 |                   |   |
| 8 hinges   |                 |                   | Dropping boards   |
| 1 set of hinges  |                 |                   | Door  |
| 1 latch  |                 |                   | Door  |
| 30 sq. ft. chicken wire to cover inside<br>of sliding curtains and gable ventilator<br>doors.  |                 |                   |   |
| 5 lb. 7 d nails  |                 |                   |   |
| 5 lb. 10 d nails   |                 |                   |   |
| 1 lb. 6d flooring nails  |                 |                   |   |
| 15 lb. shingle nails   |                 |                   |   |
| 12½x8" anchor bolts  |                 |                   |   |
| 400 sq. ft. tar paper  |                 |                   |   |
| 58 sacks cement  |                 |                   | Bolting sills to foundation                                       |
| 7½ yd. gravel  |                 |                   | Between concrete and finish-<br>ing coat                          |
| 11 yd. sand  |                 |                   | Floor and foundation  |
|  |                 |                   | Floor and foundation  |
|  |                 |                   | Floor and foundation  |