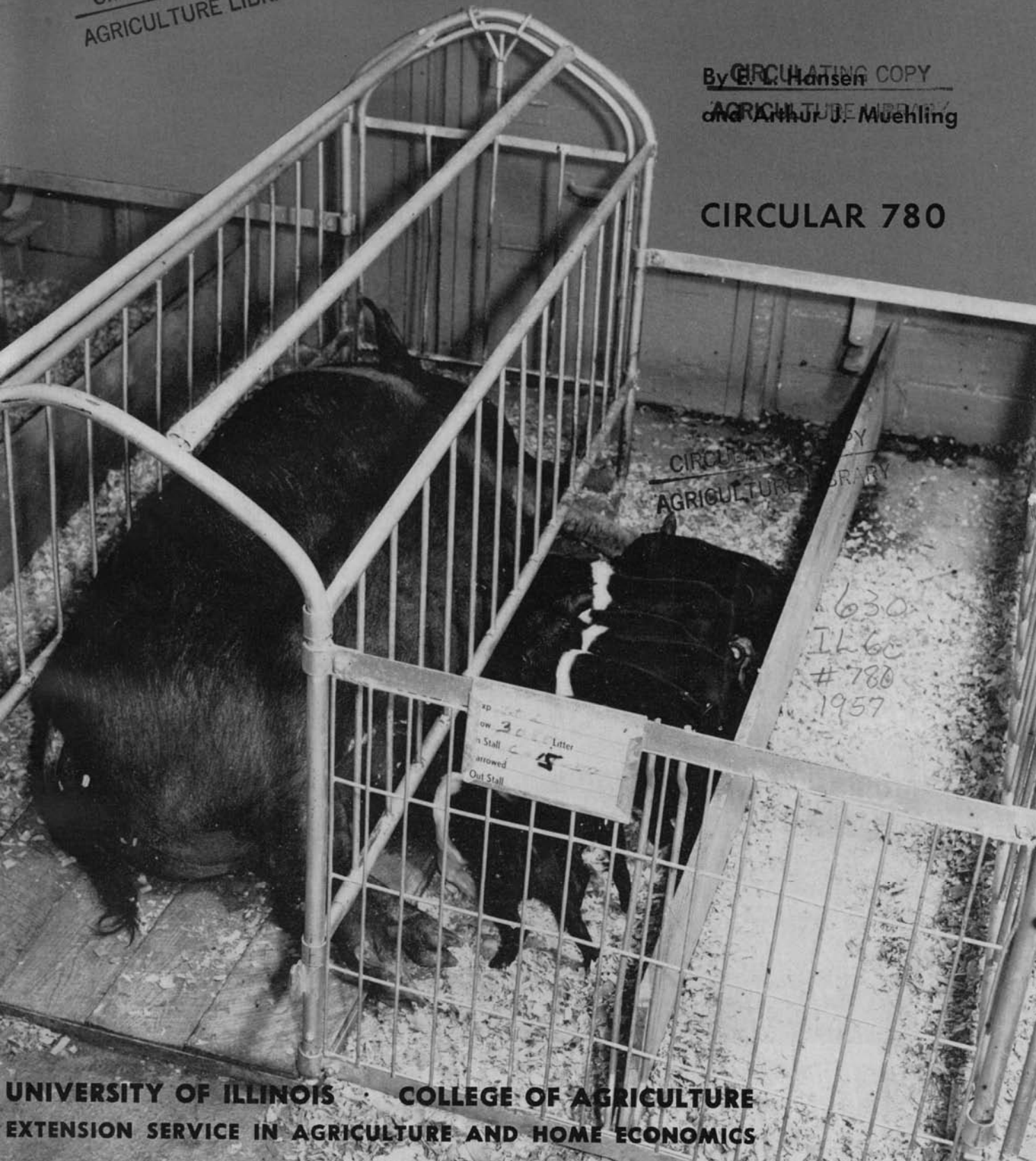
HOG FARROWING HOUSES AND EQUIPMENT

By E. L. Hansen
and Arthur J. Muehling

CIRCULAR 780



UNIVERSITY OF ILLINOIS · COLLEGE OF AGRICULTURE
EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS

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Open shelters, well bedded, are ideal for housing sows before farrowing. (Fig. 1)

Movable shelters can be pulled together in the field to form a multiple farrowing house. (Fig. 2)

(Figs. 1, 2 and 4 are used through the courtesy of the Doane Agricultural Service.)

SOME PRACTICES OF SUCCESSFUL HOG RAISERS

HOUSING AND EQUIPMENT used for farrowing hogs in Illinois are indeed varied. Successful hog raisers, however, have adopted many of the same practices and principles in their search for ways to increase production and to reduce costs and labor.

One thing they have found is that the highest degree of sanitation practical is always a must. For healthy sows and pigs are necessary if pork production is to be profitable.

Sows are usually kept in the field away from old lots. Open shelters like that shown in Fig. 1 are satisfactory if they face south or southeast, are well-bedded in cold weather, and are supplied with plenty of fresh water that is protected from freezing.

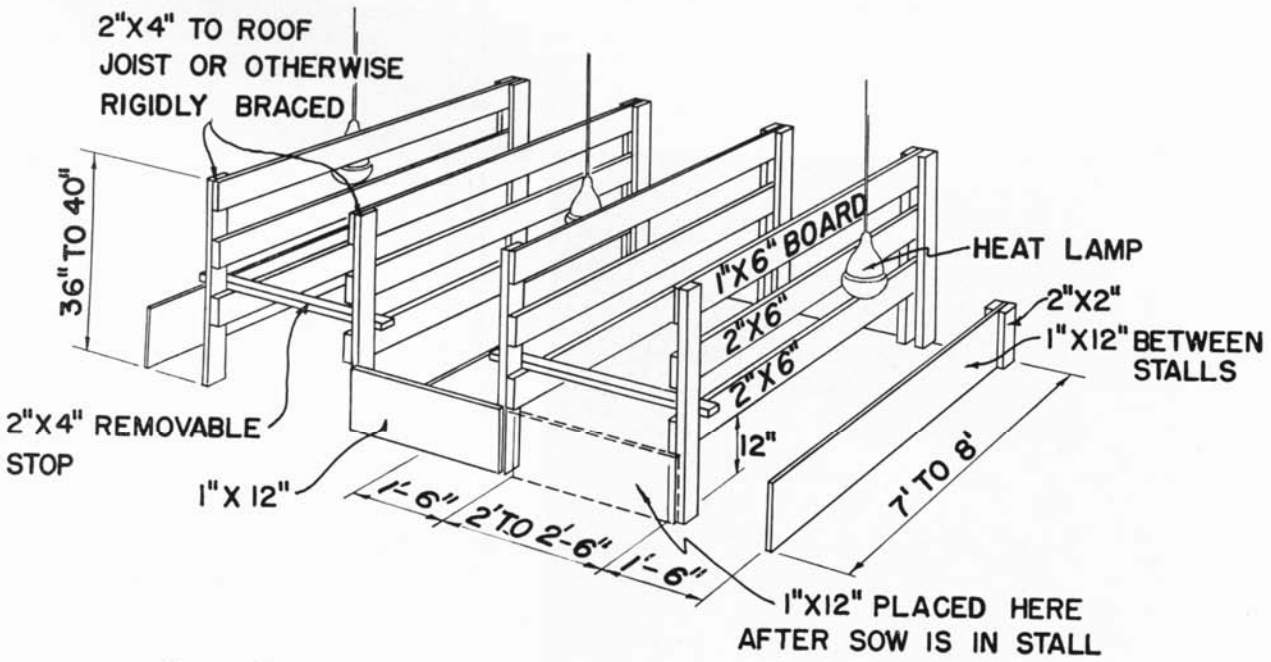
Farrowing is done either in the field or at the farmstead. The advantages claimed for the farmstead location are: It's easier to supply feed and water; working conditions are better in bad weather; electricity is available; and sanitation measures can be carried out more easily in a small area than where tractors and other equipment go from barn lot to field.

Many hog raisers use movable buildings, including both individual and multiple-sow houses. These buildings can be used on pasture in good weather and then moved up to the farmstead and lined up on a concrete slab for farrowing. Some of them are designed so that during farrowing they can be pulled together to give some of the advantages of a central farrowing house. (Fig. 2.)

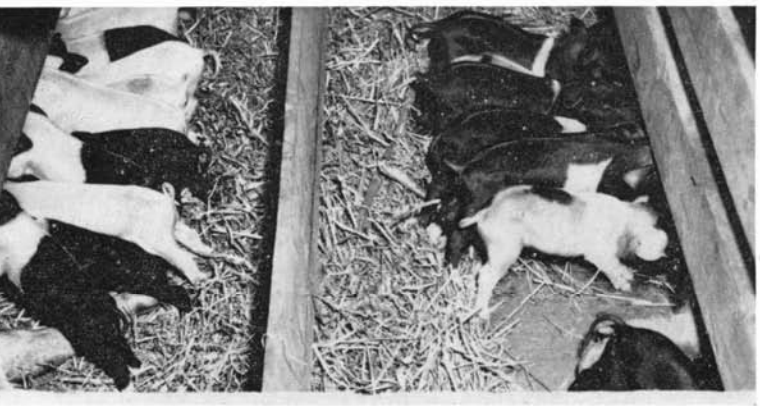
Farrowing stalls are becoming common. These have the advantages of saving space and, more important, protecting the pigs from the sow. With their use, there is a trend toward either multiple-unit houses like those mentioned above, or permanent central farrowing houses.

CENTRAL FARROWING IS BECOMING MORE ECONOMICAL

Multiple farrowings throughout the year, together with the use of farrowing stalls, are making the central farrowing house much more economical than in the past. Since stalls reduce the floor area needed per sow, houses can be smaller than they used to be. Many houses are being built with



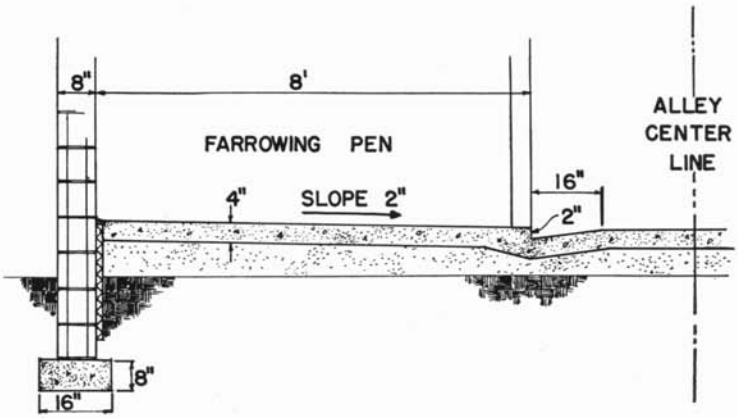
Construction of typical farrowing stall. Sow is taken out for feed and water. (Fig. 3)



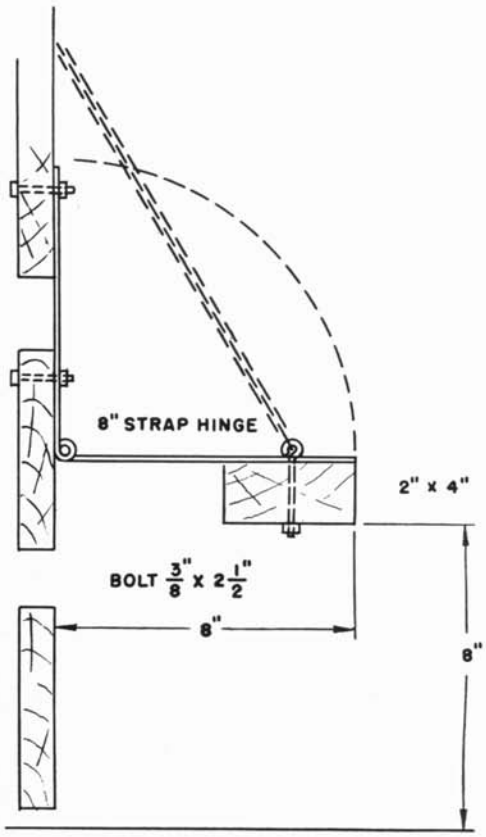
The farrowing stall protects the pigs from the sow. Keeping brooder areas warm, with floor heat or heat lamps, encourages the pigs to stay out of the sow's way. (Fig. 4)

radiant heat and labor-saving equipment, so that work takes less time and it's easier to maintain proper conditions for pigs in any weather.

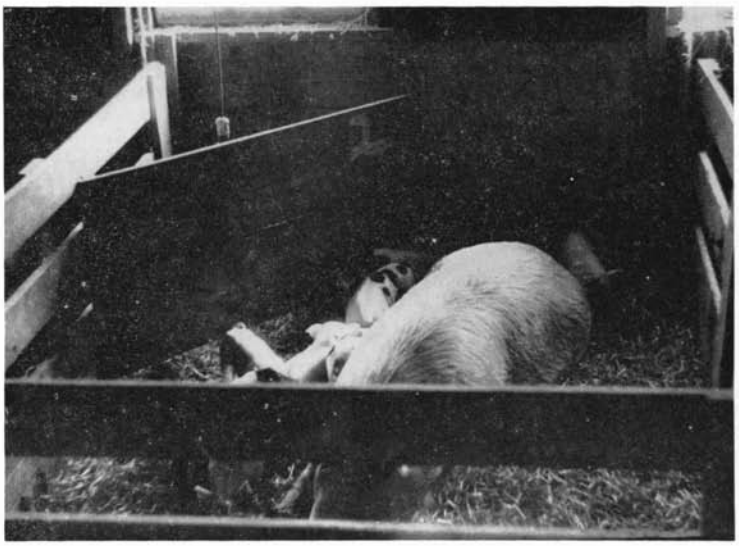
A typical farrowing stall is shown in Fig. 3. The brooder areas, which are full length of the stall on either side, effectively keep the pigs away from the sow (Fig. 4). Besides the stalls, the common farrowing pen (Figs. 5, 6, 7) with guard rails and corner brooder is in wide use, as is the pen shown in Fig. 8. This latter pen is about 6 x 10 feet with a two-slope floor and the pig brooder in the alley (Figs. 9 and 10). Since a sow lies with her back uphill when given a choice, she will lie down away from the pigs in the brooder (Fig. 11).



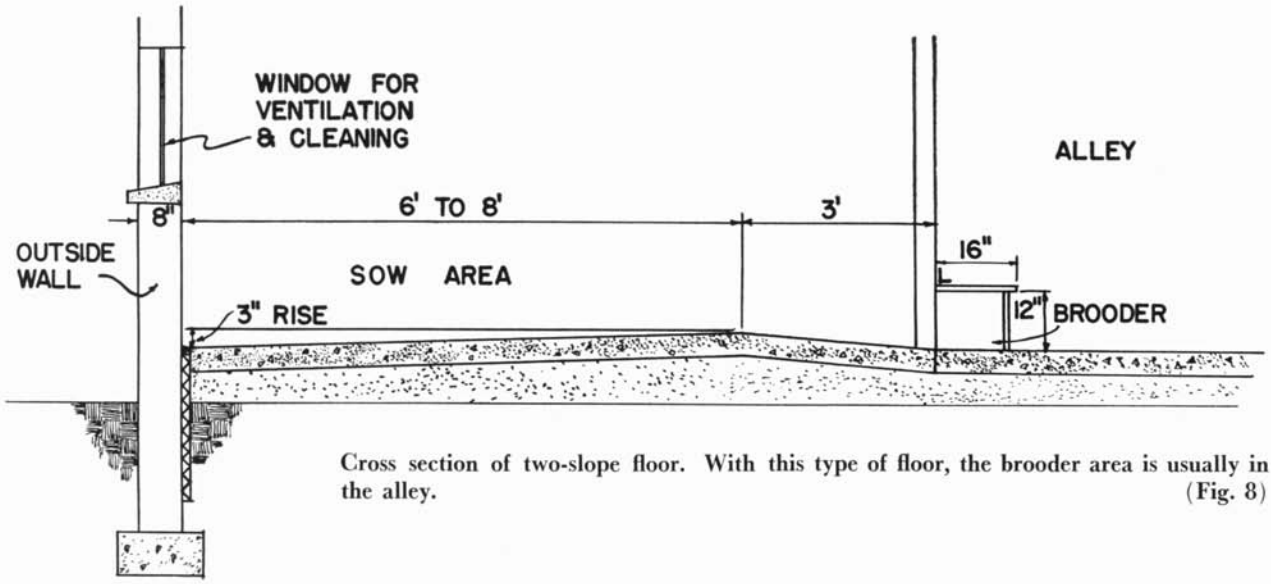
Cross section of general-purpose hog house floor. Either single or double row of pens may be used. Feed alley is usually 6 to 8 feet wide. See Fig. 12 for details of floor construction. (Fig. 5)



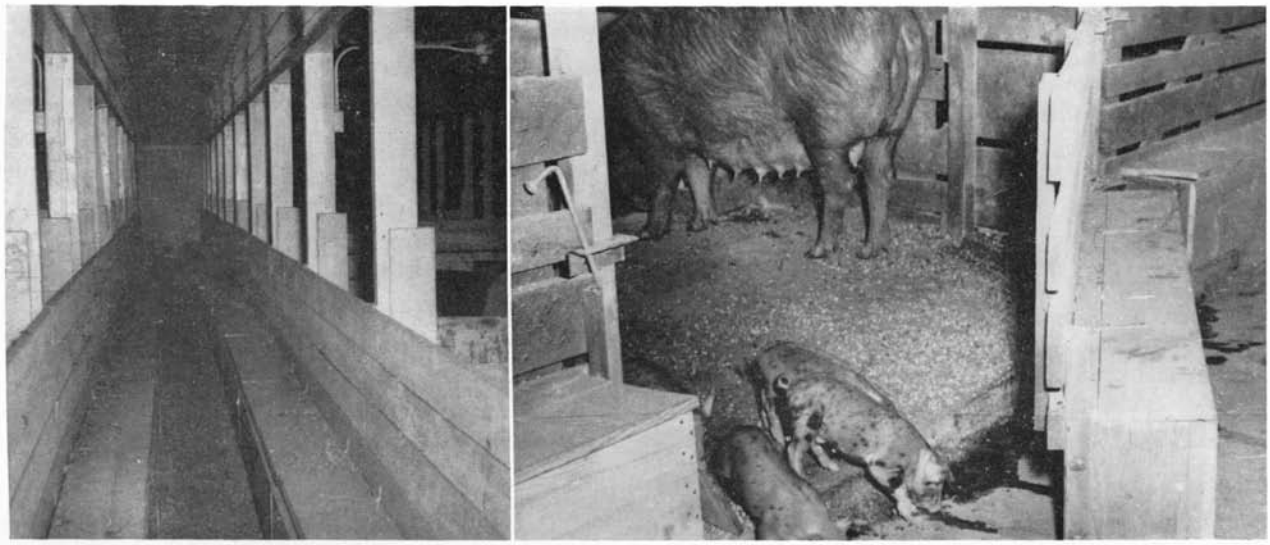
Typical guard rail used in ordinary farrowing pens is shown above. (Fig. 6)



An ordinary farrowing pen with corner brooder and heat lamp (left). Lamps should be suspended by chains attached to a sturdy support so they can be raised and lowered. They should never be closer than 18 inches to the pigs. (Fig. 7)



Cross section of two-slope floor. With this type of floor, the brooder area is usually in the alley. (Fig. 8)



Pig brooders in the alley of a house with two-slope floor (above left). Lid will open for access to pigs. (Fig. 9)

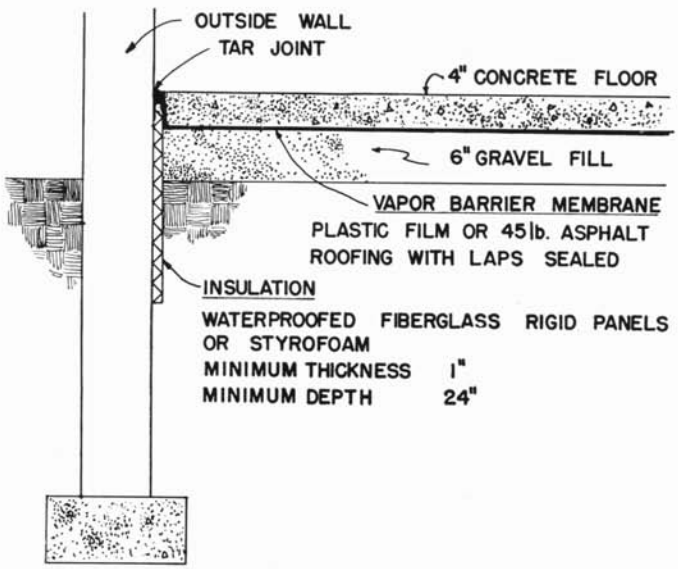
Pig brooders shown at top right are in sections and mounted on alley gate. (Fig. 10)

An advantage of the two-slope floor is that the sow lies with her back uphill away from the pigs. (Fig. 11)

RECOMMENDED CONSTRUCTION DETAILS

Floors

It is very important to construct floors so that they will be warm and dry. A waterproof border insulation should be between the edge of the floor and the foundation (Fig. 12). It should be at least 1 inch thick and extended to a minimum depth of 24 inches.



Detail of warm dry floor construction. (Fig. 12)

Make a 6-inch gravel or crushed rock fill under the floor. Do not use cinders or other corrosive fill. Place a vapor-proof membrane over the fill; then place the concrete in one pour. Insulation is not needed under the floor.

Walls and ceiling

Insulation in walls and ceiling is necessary to reduce heat loss from the building and to help maintain uniform temperatures. More is needed in the ceiling than in the walls. A 4-inch thickness is recommended for the ceiling with a vapor barrier on the underneath side (Fig. 13). A layer of plastic film below the insulation makes a good vapor barrier.

Two types of wall are commonly used, both of which are satisfactory. One is built of lightweight concrete masonry. The cores in the block are filled with the coarse lightweight aggregate used in making the block. The second type of wall is of wood frame construction. Studs are 2 x 4's with 25/32-inch insulation board sheathing and wood siding on the outside, and a vapor barrier and a wood lining on the inside.

For easier heating, it is desirable to keep both wall and floor areas at a minimum (Fig. 14). A

Aluminum foil insulation on the ceiling makes a good vapor barrier. (Fig. 13)

Low side walls with small windows under the plate, as shown below, make for an economical house. (Fig. 14)

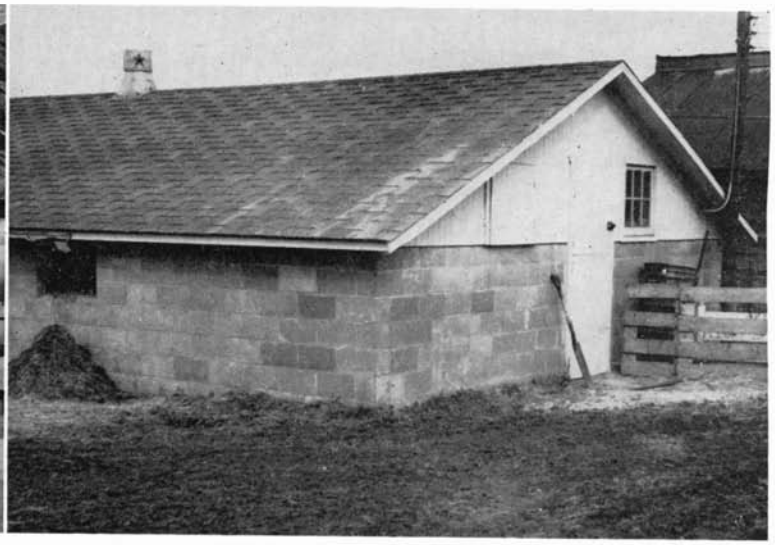


Table 1. — Farrowing Space Required in Different Kinds of Houses

Weight of sow	Central house					Movable house
	Pens with guard rails	Pens with two-slope floor	Farrowing stalls			
			Width	Length	Brooder width	
			(feet)			
Under 350 lb.	7 x 8	6 x 9	2	7 to 8	1½	7 x 8
Over 350 lb.	7 x 9, 8 x 8, or 8 x 9	6 x 11	2½	7 to 8	1½	7 x 9, 8 x 8, or 8 x 9

7-foot ceiling height is enough in alleys and areas where the operator must work. Many farrowing houses have 5-foot sidewalls and the ceiling follows the underside of the rafters up to the 7-foot height.

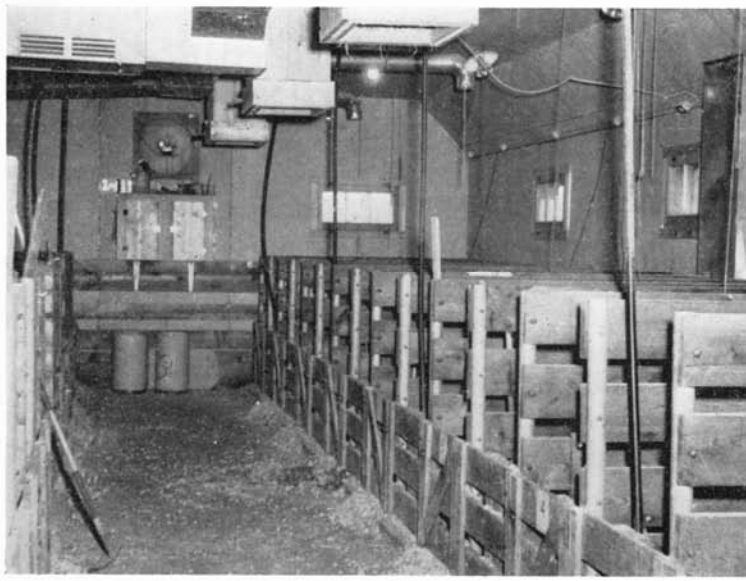
Windows

One window for every pen is desirable. Provide 1 square foot of glass for each 20 square feet of floor area. A storm sash or double-glazed sash to reduce heat loss is essential.

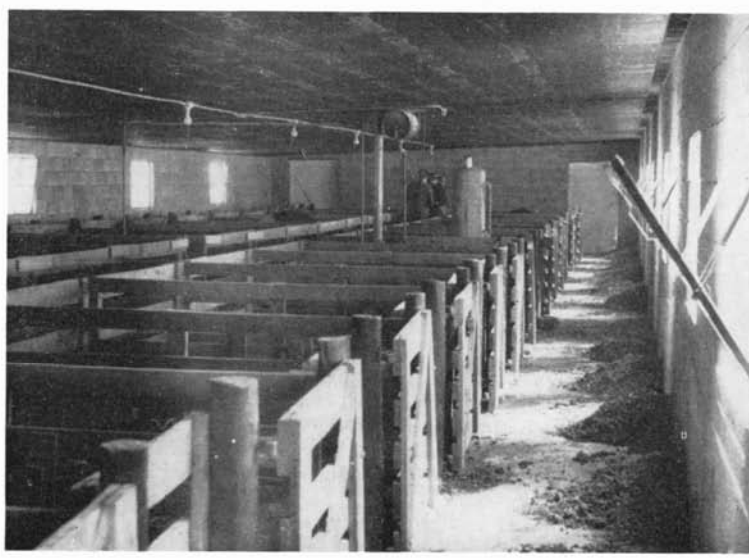
Ventilation

Even in cold weather ventilation must be maintained to remove moisture as fast as the hogs give it off and to admit the correct amount of fresh air. However, with this amount of ventilation, the house must be well insulated to keep it from getting too cold when outside temperatures are low.

On low buildings such as farrowing houses a gravity-type ventilation system is not dependable. A fan system installed according to the manufacturer's instructions is best (Fig. 15). The capacity needed is usually figured as 1,080 cubic feet per hour for each 300-pound hog. When temperatures drop below zero, the capacity of the fan should be less; therefore, it is desirable to have a two-speed fan or two fans, one with a capacity of three-fourths the desired output, and the other with about one-fourth. In extremely cold weather only the small fan is operated.



An insulated farrowing house equipped with exhaust fan and space heater. (Fig. 15)



Some large farrowing houses have three alleyways, which make cleaning and feeding more convenient. (Fig. 16)

HEAT FOR THE FARROWING HOUSE

Of 40 new central farrowing houses studied in the northern half of Illinois, 38 had some type of heating. Of these 38 half were being heated by hot water circulated in pipes in the floor (floor panel heating). Some of these also had stoves or space heaters. Others, including those both with and without floor panel heating, used heat lamps, pig brooders, and electric heat pads for pigs. Electric soil heating cable in the concrete floor was being used in some installations.

Designing a floor panel heating system[1]

Recommendations given here are based on information available to the heating industry for heating homes[2] and on observations of several farrowing houses with floor panel systems. The assumption has been made that the principles of good construction, as outlined in this circular, have been followed. This will make for more economical heating. Floors *must* meet the specifications described on page 6 and illustrated in Fig. 12.

Coil installation. Use ¾-inch wrought iron, black iron, or copper pipe. Galvanized pipe is not recommended.

No coil should be longer than 200 feet. The coils should extend to about 6 inches from the edge of the slab. Spacing between pipes should be about 12 inches.

Test the entire piping system under a pressure of 100 pounds per square inch for 4 hours before connecting it to the boiler or concealing it.

Cover coils with at least 2 inches of concrete to prevent haircracks in the concrete.

Heating equipment for proper floor temperatures. With coils installed as recommended above, it should be possible to maintain a surface floor temperature of 85° F. with 120° water and an input of 50 BTU's per hour per foot of pipe. So to find the BTU's per hour that you need, multiply the total length of pipe by 50.

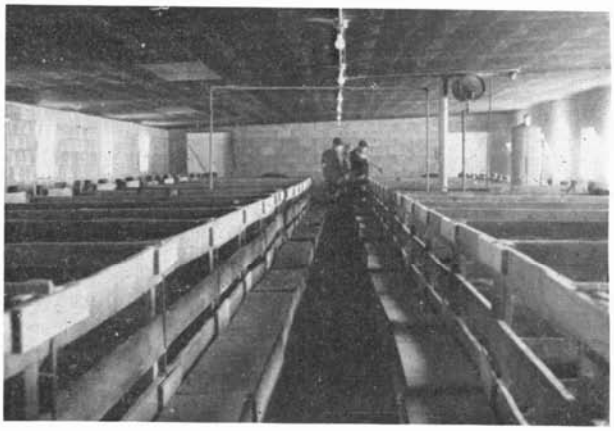
Select a boiler with a net rating in BTU's per hour that is equal to or greater than the total you need. A 30-gallon gas-fired domestic water heater is commonly used for small buildings. These have a normal output of about 24,000 BTU's per hour.

The circulating pump must pump 1 gallon a minute for each 10,000 BTU's per hour. Therefore, divide the total needed BTU's by 10,000 and specify a pump with this capacity.

Select an air cushion tank. With a closed tank, allow 1 gallon of tank capacity for each 5,000 BTU's per hour. With an open tank, allow 1 gallon for each 10,000 BTU's an hour.

Check your plan to see if additional heat is needed to maintain the desired air temperature (*see* next section). Consult your heating contractor for equipment to do the job.

Install as suggested in Fig. 18.

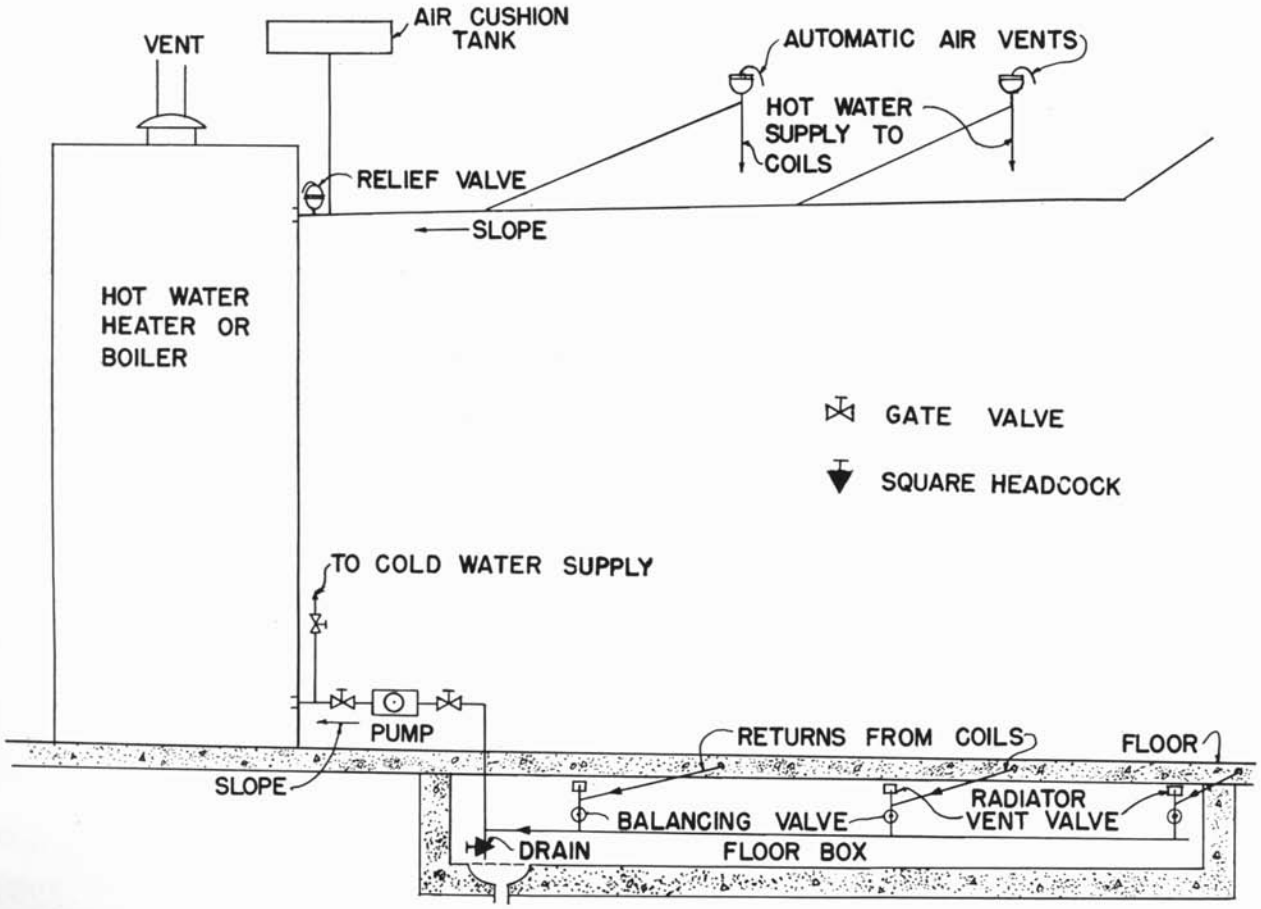


A large farrowing house with panel heating in the floor of the brooders. (Fig. 17)

Heating equipment for proper air temperatures. An air temperature of 50° to 55° is recommended. It may not always be possible to maintain this temperature with the floor panel, as low floor temperatures and the footage of pipe limit the amount of heat produced. And, of course, some of the heat will be lost even from a well-insulated house. For practical purposes the heat loss from

[1] Because of the increasing number of farrowing houses being built with floor heat, emphasis is being given this type of construction. Other practices may be just as satisfactory. Some are well-known and need very little explanation; others are too new for sufficient information to be available for publication.

[2] Panel heating for small structures. I. B. R. Installation Guide No. 6. The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, N. Y. 1951.



Typical floor panel heating system. (Fig. 18)

an insulated building as described in this circular can be figured as follows:

	Loss in BTU per hr. (70° difference between inside and outside temperatures)
1. Ft. of floor edge (insulated as in Fig. 12) × 48.5.....	
2. Sq. ft. of lightweight concrete masonry wall, cores filled (or equivalent) × 13.3	
3. Sq. ft. of ceiling with 4″ wool insulation × 5.6	
4. Sq. ft. of doors and windows × 32 (storm sash) or 80 (no storm sash).....	
5. Infiltration loss of windows and doors on two sides: Volume of house in cu. ft. × 1.9.....	
Total heat loss from building	
For 50° difference in temperature, multiply by 0.7...	

The hogs may furnish all the additional heat needed if there are enough of them and if the building is well insulated. Otherwise, a space heater can be used. Table 2 shows the amount

Table 2. — Heat Production of Swine

Size of hog	BTU/hr. produced by animal[a]	BTU/hr. available for heating[b]
1 day old.....	33	13
10 lb.....	200	80
50 lb.....	375	150
100 lb.....	520	208
150 lb.....	675	270
200 lb.....	800	320
300 lb. fat hog.....	1025	410
300 lb. gestating sow.....	870	348

[a] Mitchell, H. H. and Kelley, M. A. R. Energy requirements of swine and estimates of heat production and gaseous exchange for use in planning ventilation of hog houses. Jour. Agr. Res. 56, 811-829. 1938.

[b] Heat loss by ventilation sufficient to remove moisture respired by hog assumed to be 60 percent.

of heat produced by hogs of different weights. Even with insulation, about 60 percent of this heat is lost by ventilation to remove moisture. Without insulation the heat loss will be more.

Electric wiring requirements for pig brooders

Have all wiring installed by a competent electrician. It is best to follow the recommendations given below:

Use no more than seven 250-watt brooders on one No. 12 wire circuit (20-amp. fuse), or five 250-watt brooders on one No. 14 wire circuit (15-amp. fuse).

Run three wires (240 volts) to hog house for more than seven brooders. (See Table 3 for wire sizes.)

Have switch box large enough for all circuits needed for brooders, lights, waterers, motors, etc.

Table 3. — Wiring Needed for Different Numbers of Brooders and Different Distances From Meter to Hog House

Electrical load	Distance, meter to hog house (feet)	Number and size of wire
Up to 6 brooders and lighting	Up to 100	2 — No. 10
	100 to 200	2 — No. 8
	200 to 350	2 — No. 6
7 to 13 brooders and lighting	Up to 100	3 — No. 10
	100 to 200	3 — No. 8
	200 to 350	3 — No. 6
14 to 25 brooders, lighting, and one automatic waterer	Up to 100	3 — No. 8
	100 to 200	3 — No. 6
	200 to 350	3 — No. 4

For more details on wiring, write to the Department of Agricultural Engineering, University of Illinois, for Rural Electrification Leaflets Nos. 3, 9, and 10.

BASIC FARROWING-NURSERY PLAN

It is best to separate the farrowing unit from the nursery to help control disease. At the same time it is desirable to use the same heating system for both units. Fig. 19 illustrates a basic unit which meets these requirements. It also has the added advantages of being expandable and having a central feed room that permits mechanized feeding to either unit.

In the nursery unit, a floor area of 6 square feet should be allowed for each pig up to 25 pounds, and 8 square feet for each 25- to 50-pound pig.

Either a farrowing-stall unit as shown in Fig. 19 or a two-slope floor farrowing unit (Fig. 20) may be combined with the same nursery. It will be noted that the two-slope floor plan is longer than the farrowing-stall unit although the width is the same. Since less pipe is used in the brooder areas of the two-slope floor plan than in the farrowing-stall plan, two additional coils have been added near the outside walls to provide heat for the house. Because of manure accumulation near the outside wall the first coils are set in about 2 feet from the wall.

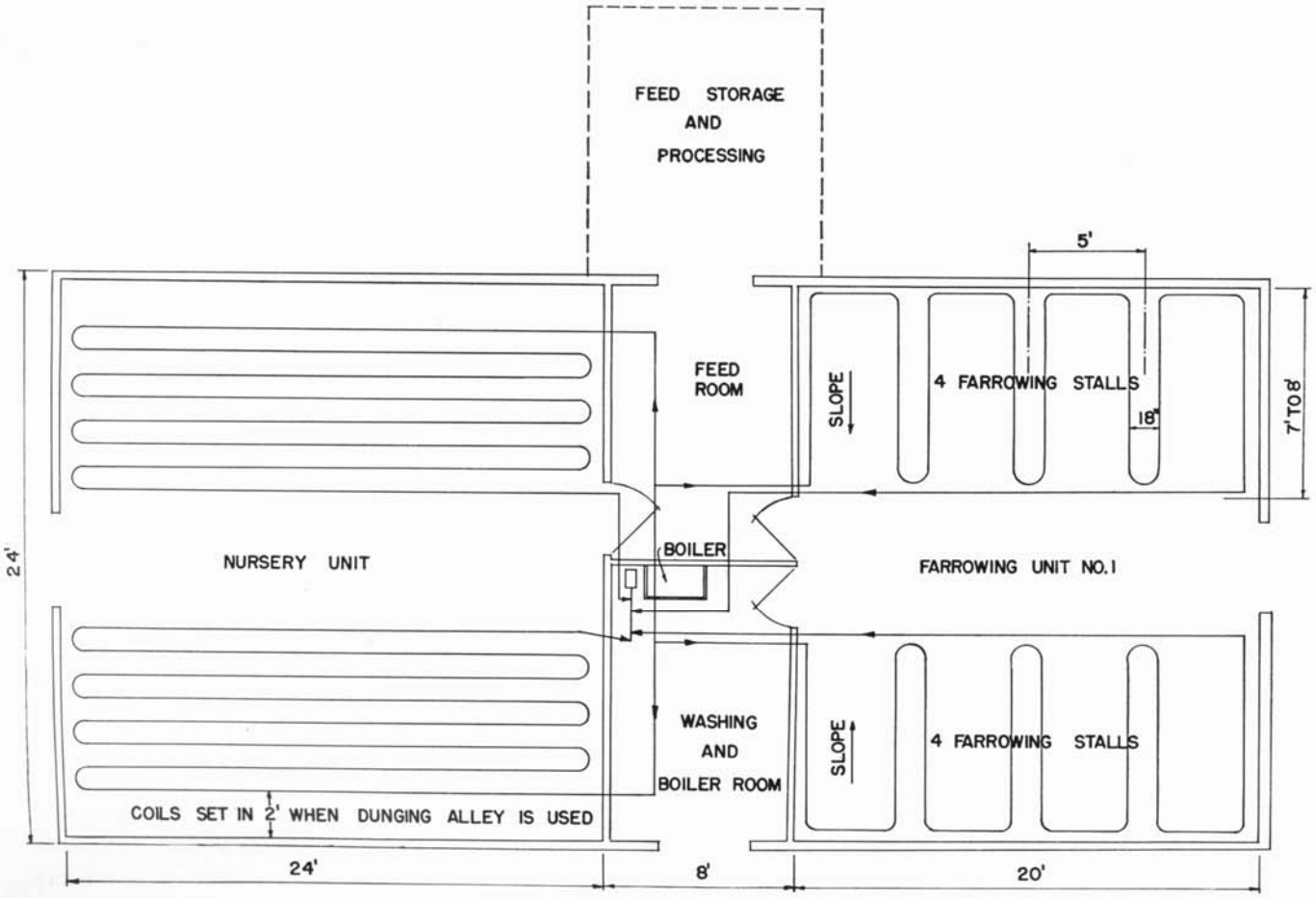
Heating system requirements

The requirements for a floor panel system for the basic house, assuming various numbers of farrowing stalls, are given in Table 4. Heat losses and heat available for maintaining air tempera-

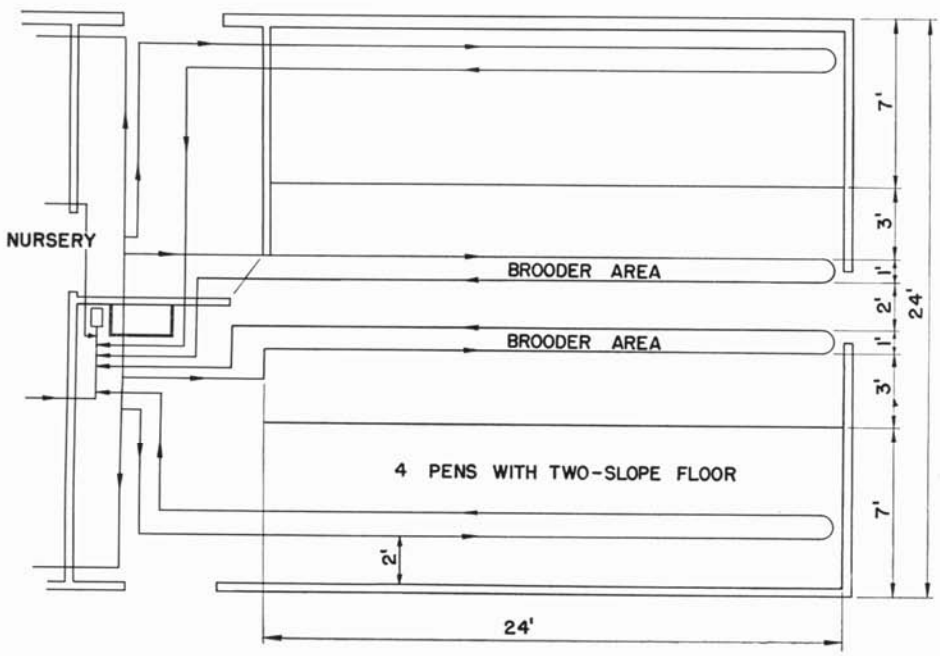
Table 4. — Floor Heating System Requirements for Basic Plan

Number of farrowing stalls[a]	Length of building (inside dimension)			Approximate length of pipe		Boiler requirement
	Farrowing unit	Wash and feed	Nursery unit[b]	Farrowing	Nursery	
	ft.	*ft.*	*ft.*	*ft.*	*ft.*	*BTU/hr.*[c]
3 pairs	15	8	18	170	288	22,900
5 pairs	25	8	30	280	480	38,000
8 pairs	40	8	48	450	768	60,900

[a] For additional pens multiply information given by 2, 3, 4, etc.
[b] Floor space based on 9 pigs per litter at 8 square feet per pig.
[c] Figured at 50 BTU's per foot of pipe.



Basic farrowing-nursery unit showing typical layout for floor coils. Table 4 gives building dimensions and pipe needed for varying numbers of farrowing stalls. No single coil should be longer than 200 feet. (Fig. 19)



A farrowing unit with two-slope floor may be combined with the nursery shown in Fig. 19. (Fig. 20)

Table 5. — Heat Losses and Heat Availabe for Basic Farrowing-Nursery House Assuming Three Pairs of Stalls and 7-Foot Ceiling

Item for figuring heat loss or production	Farrowing unit[a]	Item for figuring heat loss or production	Nursery unit[a]
Heat Losses in BTU's per Hour (see page 9)			
Floor edge (60.7 x 48.5)	2,944	Floor edge (66.7 x 48.5)	3,235
Exterior wall (425 x 13.3)	5,652	Exterior wall (467 x 13.3)	6,211
Ceiling (431 x 5.6)	2,414	Ceiling (499 x 5.6)	2,794
Door and window (43 x 32)	1,376	Doors and windows (53 x 32)	1,696
Infiltration (3017 x 1.9)	5,732	Infiltration (3493 x 1.9)	6,637
Total heat loss		**Total heat loss**	
70° difference in temperature	**18,118**	**70° difference in temperature**	**20,573**
50° difference in temperature	**12,683**	**50° difference in temperature**	**14,401**
Heat Available for Heating House in BTU's per Hour			
Floor panels (170 x 50)	8,500	Floor panels (288 x 50)	14,400
Six sows (348 x 6)	2,088	Fifty 10-pound pigs (50 x 80)	4,000
Fifty 1-day-old pigs (13 x 50)	650		
Total	**11,238**	**Total**	**18,400**

[a] One-half of feed and washing rooms included.

ture, figured according to the methods described in the preceding section, are given in Table 5.

When the difference between inside and outside temperature is 50° or less, the heat produced in the farrowing unit just about balances the heat lost, and no additional heat is needed. When outside temperature goes below 5° F. it will be necessary to add heat or reduce the ventilation rate if an inside air temperature of 55° is to be maintained. Hovers over the pigs, however, will make them comfortable even though the room air temperature drops temporarily.

To point out the importance of storm windows and doors, it should be noted that without them, the loss would be 3,200 BTU's per hour instead of 1,280.

Even with 70° difference in temperature and with coils in only two-thirds of the floor, the heat available for the nursery unit is slightly more than the calculated loss. It is unlikely that any additional heat would ever be required in a nursery built according to the recommendations in this circular.

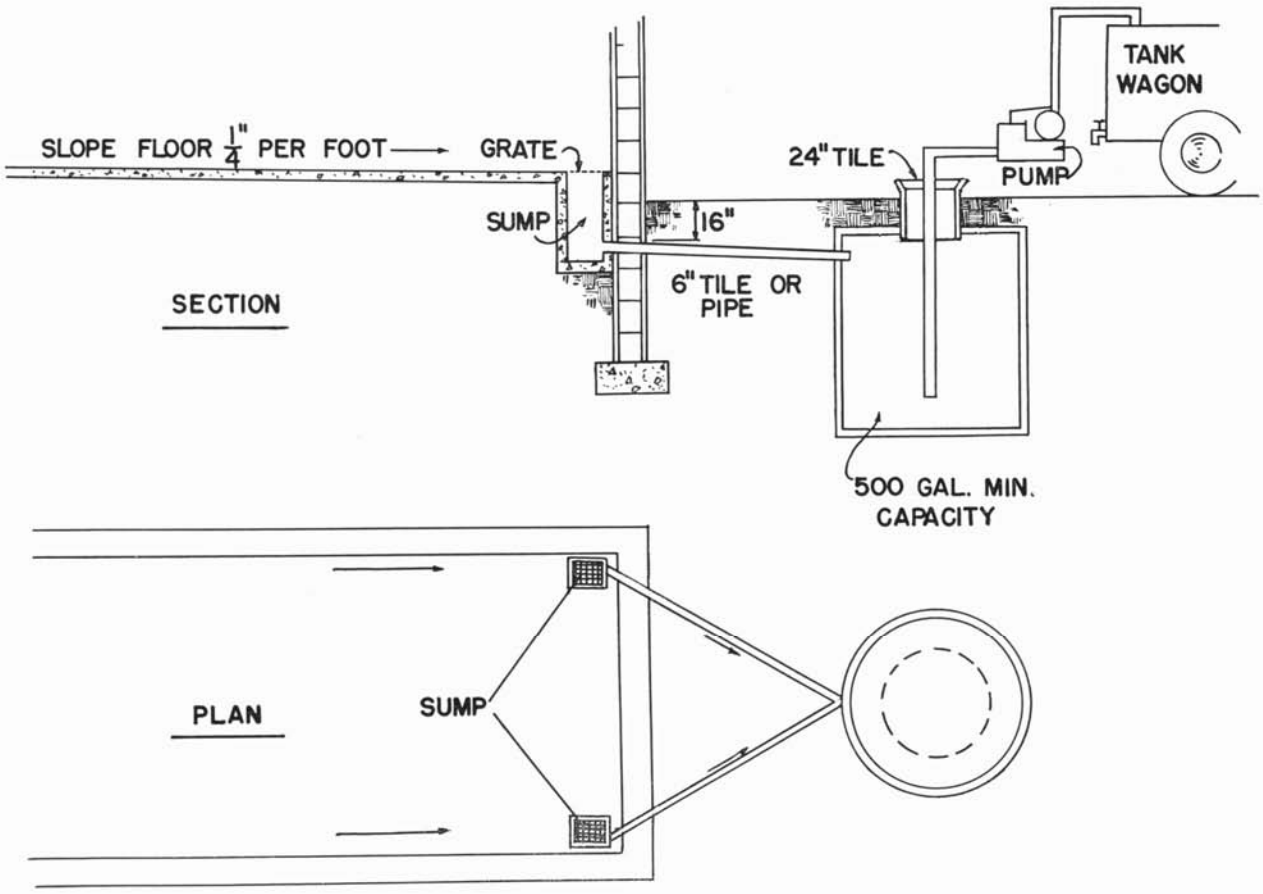
LABOR-SAVING EQUIPMENT

Cleaning concrete floors with water under pressure is very satisfactory if a pressure of at least 75 pounds per square inch and 500 gallons of water an hour are available. Most farm water supply systems do not provide this. However, with a small reservoir and an auxiliary booster pump the requirements can be met economically.

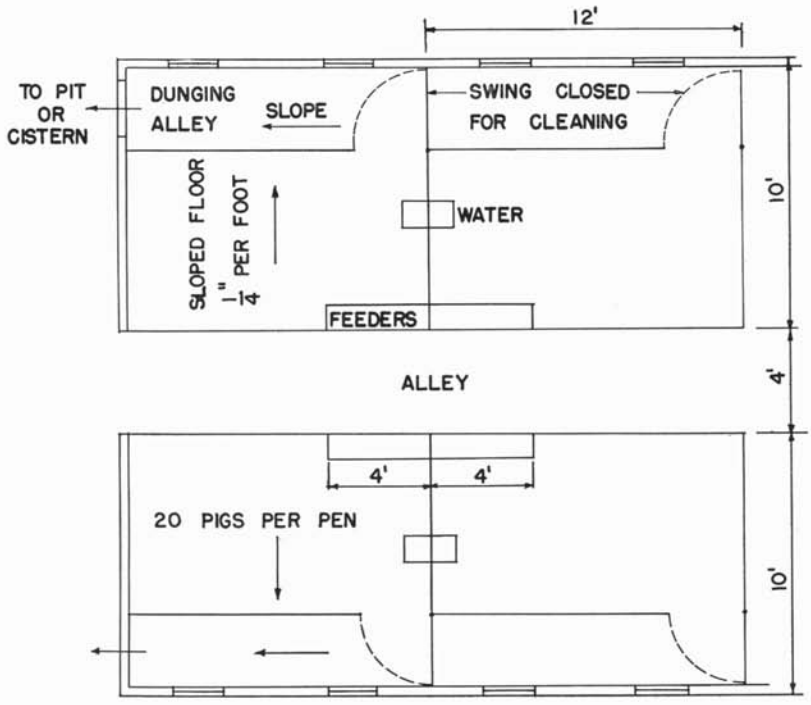
Runoff from the floors should be collected in a cistern and hauled out as a liquid manure. Small diaphragm pumps are available for pumping the liquid into tank wagons (Fig. 21).

The dunging alley (Fig. 22) in nurseries simplifies cleaning. Pigs learn to use it and most of the cleaning is confined to this alley. Gates can be closed while cleaning so that the full length of the house is unobstructed.

Several other labor-saving devices are illustrated on pages 14 and 15.

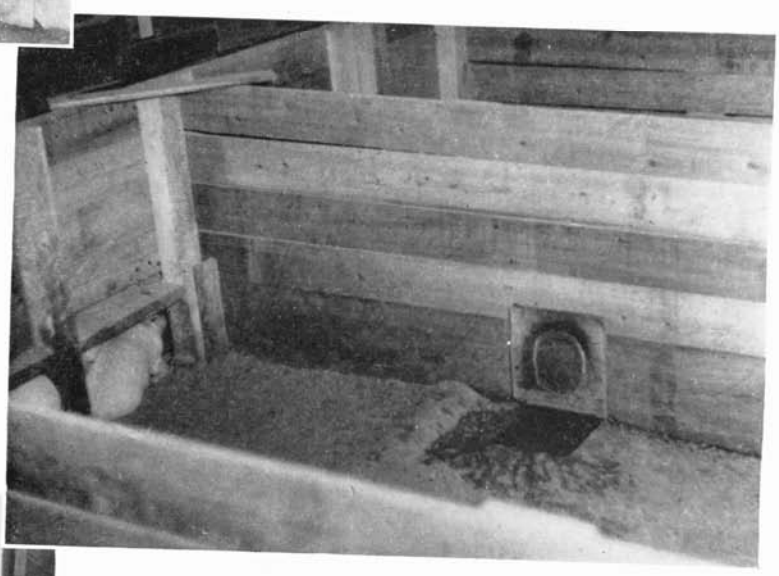


Scheme for collecting liquid manure and pumping it into tank wagon. (Fig. 21)



Suggested plan for nursery 24 feet wide. Dunging alley makes house easier to clean. (Fig. 22)

To reduce chore labor, install automatic drinking cups in the partitions between farrowing pens; also install in each pen a self-feeder that can be filled from the alleyway. (Fig. 23)

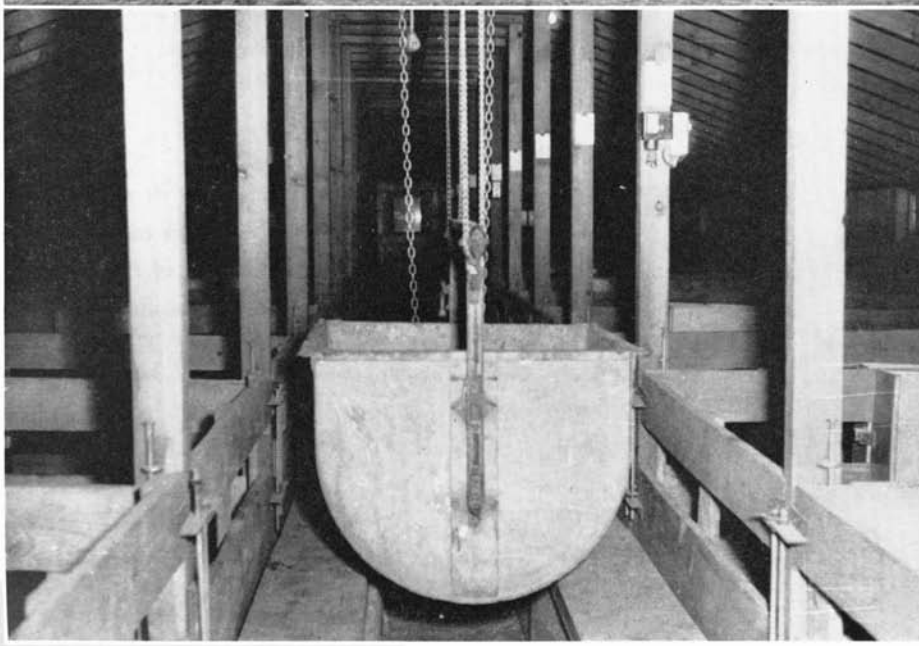


A float valve in one end of the building controls the water level in several waterers such as the one at right. (Fig. 24)

A feed cart saves considerable carrying and reduces the amount of travel necessary. (Fig. 25)

With automatic grinding and blending equipment, rations can be prepared to suit the hogs. (Fig. 26)

Cleaning is simplified with this overhead litter carrier. Note that manure can be dumped either into spreader or into manure pit. (Fig. 27)



A switch track in the feed room permits use of a feed carrier on the same track as the litter carrier. (Fig. 28)

A simple, attractive farrowing house. (Fig. 29)

A feed room with overhead bins has been added to this farrowing house. With proper equipment, feeding can be done automatically to each pen. (Fig. 30)

PARTIAL LIST OF AVAILABLE PLANS

(These plans may be obtained from the Department of Agricultural Engineering, University of Illinois. For a complete list of plans, ask for Catalog of Swine Buildings and Equipment Plans.)

Individual movable houses

Plan No.

72649 Two 6-pen sections, each section 8 x 20 ft., may be used separately or together for farrowing.

72648 Modified A-type house, one unit

72640 Illinois Sunshine House, one unit (7 x 8 ft.)

371 Illinois Sunshine House, two units

72636 A-type house, one unit

Central houses

72621 Two rows of pens and alley (22 ft. wide)

72660 Glued frame, post-free, two rows of pens and alley (22 ft. wide)

72662 General purpose for farrowing or fattening (24 ft. wide)

72663 Production layout — movable houses on concrete slab with permanent feed storage

72664 Seven-pen masonry house (22 x 32 ft.)

72666 Single row of pens (12 ft. wide)

72667 Double row of pens, adaptable as farrowing stalls (22 ft. x 48 ft. 8 in.)

Equipment

87310 Self-feeder, 25 to 30 bushels of small grain

118 Small self-feeder, 6 to 8 bushels

125 Ear corn feeder, covered hopper

426 Ear corn feeder, open hopper

411 Hog trough

87321 Automatic hog waterer

87370 Pig brooder

164 Guard rails

167 Creeps and hurdles

87350 Vaccinating and castrating rack

77621 Breeding and ringing crate

87340 Loading chute

72690 Portable shade (10 x 12 ft.)

72692 Farrowing stall

87342 Hog crate

87380 Movable hog wallow (6 x 10 ft.)

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