

**Plans for Washington Farm  
Buildings and Equipment**

**Department of Agricultural Engineering  
College of Agriculture**

**and**

**Agricultural Extension Service  
cooperating**

**State College of Washington  
PULLMAN, WASHINGTON**

PLANS FOR WASHINGTON  
FARM BUILDINGS AND EQUIPMENT

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Published and Distributed in Futherance of the Act of May 8, 1914  
By the State College of Washington, Extension Service  
F.E. Balmer, Director, and U.S. Department of Agriculture Cooperating

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## INTRODUCTION

Washington is a comparatively young and undeveloped state. Many of the original temporary crude farm buildings still exist; yet at the time of the 1930 census, the value of the buildings on our 71,000 farms amounted to \$165,000,000. This figure exceeds 25% of the value of our farm lands, so that building construction and upkeep are matters of great importance. During the past few years, the expenditure on farm buildings has been far below normal, but with the coming of better times, it is to be expected that new construction and modernizing will increase. Increased irrigated acreage, favorable soil and climatic conditions, and many other factors will undoubtedly increase the number of farms and buildings in the near future. It has, therefore, seemed advisable to prepare this manual to render all possible assistance to those needing advice in connection with their farm building problems.

Climatic and geographical conditions in the State of Washington vary over an extremely wide range. We farm at altitudes from sea level to 3800 feet above sea level. Winter temperatures vary from occasional frosts in some regions to weeks of below zero weather in higher altitudes. The snow load varies from negligible to the weight of five or six feet of snow. The mild, humid summers on the coast contrast with the hot, dry areas in the central part of the state. Winds vary from light breezes in sheltered locations to occasional gales with wind speeds in excess of 75 miles per hour. Thus we see that it is difficult to specify exact construction for each building and location. Those using this manual are urged to keep these factors in mind and to make minor changes in the plans when necessary.

These plans are carefully selected to be representative of the best plans of the type available at the present time. The bibliography of other material related to farm buildings and equipment is offered as a source of additional information.

Separate sheets from this book may be obtained free of charge from the County Agents. Larger and more complete plans, in blue print form, and usually a bill of materials, may be obtained from the Department of Agricultural Engineering, State College of Washington, upon receipt of request and remittance of small service charge. Copies of this plan book may be had from the Extension Service at a nominal cost.

The authors realize that this material does not cover the whole field of farm buildings. Additional plans for the various building requirements of our state will be developed as time permits. Suggestions in regard to special requirements for various areas and new ideas in regard to farm building details and conveniences will be greatly appreciated. Often an excellent practice develops in a given area which is not commonly recognized or made use of unless given publicity through some central agency.

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## THE IMPORTANCE OF PAINT AND ITS USE ON FARM BUILDINGS

The supply of lumber in the State of Washington is so great that wood will undoubtedly be the leading structural material for farm buildings for many years to come, but with the trend towards increased prices of building materials the importance of paint as a preservative has steadily advanced. In its normal surroundings, wood is one of the most stable and durable of materials, hardening and strengthening with age so that time serves only to improve it. It is not, however, possible to use wood in building construction without exposing it, more or less, to the action of air and moisture, and this combination is conducive to the growth of parasitic fungi. The decay of wood cannot proceed without the aid of fungi and the growth of fungi cannot proceed without the presence of favorable air, moisture, and temperature conditions. Thus, we find that by excluding moisture from the wood with the proper use of paint films we can preserve wood quite indefinitely. To insure complete protection of the wood it is imperative that paint be applied before fungus growth has started because the wood contains numerous air cells and the air in these cells is sufficient to maintain a certain amount of fungus growth even if the surface is well painted. Moreover, the work becomes more difficult and expensive when the painting of any article is delayed or neglected.

The practical useful life of a coat of paint varies a great deal, with its durability depending upon composition, kind of surface to which it is applied, and the conditions to which it is exposed. Considerable information on paints and methods of applying can be obtained from reliable dealers and from bulletins listed in the bibliography of this book. The best general purpose paint consists of linseed oil and white lead, which can be obtained separately, mixed, and tinted on the job, thus eliminating the possibility of cheap or inferior substitutes and fillers. The first or primary coat of paint on a building should have a large percentage of oil to protect the wood. Subsequent coats include the pigments or color and serve to hold the oil in the wood. No paint can give satisfactory service on an exterior surface if the interior is unprotected and exposed to moisture, so that waterproofed walls and special attention to metal flashings around openings is desirable. Outside painting can be done whenever the surfaces are dry and the weather is not damp or frosty, with the optimum temperature conditions being from 60° to 80° F.

Paints and varnishes serve in several ways in addition to prolonging the useful life of buildings. They are chiefly responsible for a beauty and freshness of appearance that makes a farmstead cheerful, attractive, and homelike, for, no matter how well designed and landscaped originally, neglected buildings usually assume a drab and monotonous appearance unless brightened with paint. Painted walls can be easily cleaned and kept sanitary. Dark rooms can be made lighter and brighter, quickly and economically. A little thought as to color scheme and a little brightening with paint can help greatly in lifting the dreariness of everyday existence.

Some easily applied color schemes for the farm buildings which may be suggested are a light grey tint with white trim and green stained shingles; or another might be light cream with white trimmings and either green or brown stained shingles.

\* \* \* \* \*

## A PARTIAL BIBLIOGRAPHY OF FARM BUILDING LITERATURE

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- W.S.C. Ex. Bull. 91 Convenient Farm Homes  
U.S.F.B. 1513 Convenient Kitchens  
U.S.F.B. 927 Farm Home Conveniences  
U.S.F.B. 1497 Methods and Equipment for Home Laundering  
W.S.C. Ex. Bull. 157 Refinishing Furniture  
U.S.F.B. 1219 Floors and Floor Covering  
W.S.C. Ex. Bull. 114 Farm Home Fire Protection  
W.S.C. Ex. Bull. 32 Fuel Economy, Domestic Heating  
U.S.F.B. 1230 Chimneys and Fireplaces, How to Build Them

### FARMSTEAD LAYOUTS AND LANDSCAPING

- U.S.F.B. 1132 Planning the Farmstead  
U.S.F.B. 1088 Selecting a Farm  
U.S.F.B. 1405 Windbreak as a Farm Asset  
U.S.F.B. 1481 Planting the Roadside  
U.S.F.B. 1325 Social Aspects of Rural Planning  
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U.S.F.B. 1441 Rural Planning - The Village  
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- U.S.F.B. 1214 Farm Dairy Houses  
U.S.D.A. 849 City Milk Plants, Construction and Arrangement  
U.S.F.B. 1342 Dairy Barn Construction  
U.S.F.B. 1393 Principles of Dairy Barn Ventilation  
U.S.F.B. 1412 Care and Management of Dairy Bulls

### GENERAL PURPOSE BARNS AND LIVESTOCK EQUIPMENT

- U.S.F.B. 1350 Beef Cattle Barns  
U.S.F.B. 954 Disinfection of Stables  
W.S.C. Ex. Bull. 141 Constructing a Wooden Hoop Silo  
U.S.F.B. 855 Homemade Silos  
U.S.F.B. 825 Pit Silos  
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U.S.F.B. 1009 Hay Stackers, How They May Be Used in the East and the South to Save Labor  
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### SHEEP AND HOGS

- U.S.F.B. 810 Equipment for Farm Sheep Raising  
U.S.F.B. 1487 Practical Hog House  
U.S.F.B. 1490 Hog-Lot Equipment

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W.S.C. Ex. Bull. 160 The W.S.C. Laying House  
W.S.C. Poultry Circular 11 The Washington Laying House  
W.S.C. Poultry Circular 13 Underfloor Heat for Poultry Houses  
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## FRUIT AND VEGETABLES

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U.S.F.B. 1318 Greenhouse Construction and Heating  
W.S.C. Ex. Bull. 179 - Home Storage of Fruits and Vegetables  
U.S.F.B. 984 Farm and Home Drying of Fruits and Vegetables  
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## MISCELLANEOUS BUILDINGS

### COMMUNITY BUILDINGS

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U.S.F.B. 1622 Rural Buildings for Business and Social Uses

### GRANARIES AND EQUIPMENT

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U.S.F.B. 1542 Cleaning Grain on the Farm and in County Elevators  
U.S.F.B. 1290 Bulk Handling of Grain  
Experiment Station Gen. Bull. 262 - Grain Elevating Machinery in the Palouse Country

### ICE AND REFRIGERATION

U.S.F.B. 1078 Harvesting and Storing Ice on the Farm

## MISCELLANEOUS CONSTRUCTION DETAILS

U.S.F.B. 1279 Plain Concrete for Farm Use  
U.S.F.B. 1480 Small Concrete Construction on the Farm  
U.S.F.B. 1500 Rammed Earth Walls for Buildings  
U.S.D.A. Leaflet #46 - Bracing Farm Buildings  
U.S.F.B. 1452 Painting on the Farm  
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U.S.F.B. 1227 Sewage and Sewerage of Farm Homes  
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## CORPORATIONS AND ASSOCIATIONS

West Coast Lumber Trade Extension Bureau  
364 Stuart Bldg., Seattle, Washington

National Lumber Manufacturers Association  
Transportation Bldg., Washington, D. C.

Aluminum Company of America, Paint Division  
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Portland Cement Association  
33 West Grand Avenue, Chicago, Illinois  
Exchange Bldg., Seattle, Washington

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130 North Wells St., Chicago, Illinois

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2121 Guarantee Title Bldg., Cleveland, Ohio

National Lime Association  
Washington, D. C.

Sheet Steel Trade Extension Committee  
Oliver Bldg., Cleveland, Ohio

American Zinc Institute  
60 East 42nd Street, New York City

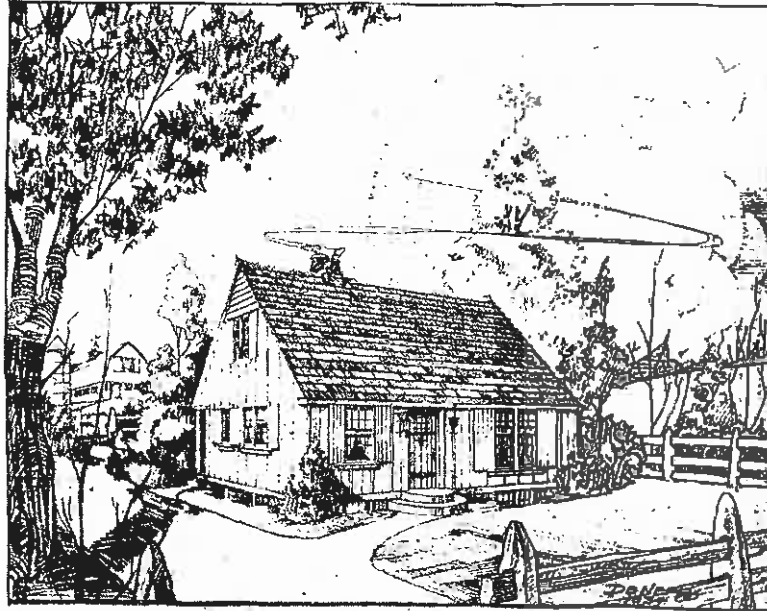
Washington Committee on the Relation of Electricity to Agriculture  
L.J. Smith, Secretary, State College of Washington, Pullman, Wash.

National Committee on the Relation of Electricity to Agriculture  
1120 Garland Bldg.  
58 East Washington St.  
Chicago, Illinois

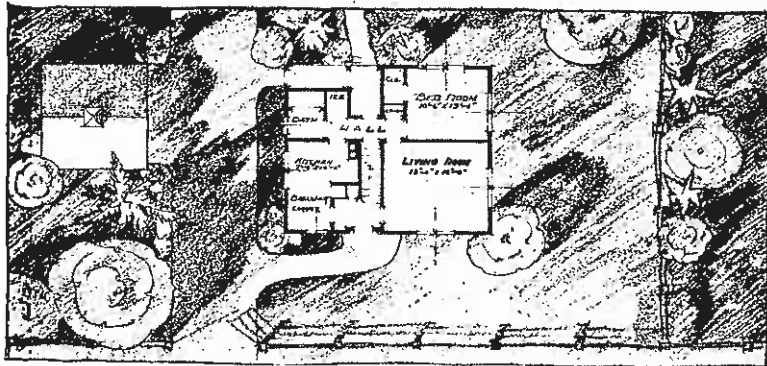
The associations above named have printed more or less educational literature concerning the use of their products. This material is usually furnished free upon request.



## CONVENIENT FARM HOUSES



A FARM RESIDENCE ~ PLAN NO 9  
DEPARTMENT OF AGRICULTURAL ENGINEERING  
WASH. STATE COLLEGE AT PULLMAN WASH.



The house plans and remodeling ideas in the following section have been carefully and completely worked out architecturally by the Agricultural Engineering Department of the State College of Washington. They may be obtained upon receipt of request accompanied by the service charge in small stamps or money order. Additional plans will be added as they become available. The complete manual listing plans of other farm buildings may be obtained from the Extension Service of the State College of Washington for a nominal charge.

## HOUSES

### Service Charge

H-1 *	A Small House	1.00
H-2 *	A Small House	1.00
H-3 *	A Farm Home	1.00
H-6 *	A Bungalow	5.00
H-7 *	A Complete Dutch Colonial Home	5.00
H-8 *	A One and One-Half Story Broken Roof Home	3.00
H-9 *	A Moderate Priced Farm Home	3.00
H-10 *	An Inexpensive Farm Home	3.00
H-11 *	An Economical Farm Home	1.00
H-11a*	Altered Plan No. 11	1.00
H-12 *	A Small Farm Home	1.00
H-13 *	A Low Cost Farm House with Addition	1.00
H-14 *	A Twice-Planned Farm Residence	1.00
H-15 *	A One and One-half Story Bungalow	5.00
H-16	A Hip Roofed Bungalow	10.00
H-30 *	Fresh Air Sleeping House	.25
H-31	Farm Utility Building	.50
H-32		

### HOUSE REMODELING IDEAS

H-41	Project: To Put A Continuous Foundation Under a House	.25
H-42	Proportional Chart for Gambrel Roofs As Used in Dutch Colonial Residence Design	.25
H-43	The Dutch Colonial Residence	1.50
H-44	The Modern English Colonial Residence	2.00
H-45	An Early American Residence	2.00
H-46	Fireplace Details and Data -- Sheet 1	(.50
H-47	" " " " -- Sheet 2	1.00 (.50
H-48	" " " " -- Sheet 3	(.50

### THE KITCHEN AND OTHER ROOMS

H-61 *	Plan of a Model Kitchen	.10
H-62 *	Kitchen Layout 12' x 10'-6"	.10

### HOUSEHOLD EQUIPMENT

H-81 *	Ice Chest	.10
H-82 *	Wardrobe	.25
H-83	Radiator Case	.10
H-84	Desk Bookcase and Pigeon Holes	.10
H-85	Blacking Stand	.10

\*Note. Asterisk (\*) denotes that plan is illustrated.

## HOUSES

A house is theoretically designed to be a home, with a convenient arrangement of personal effects, and a pleasing surrounding for the occupants' leisure hours. Mistakes in planning are costly in time, labor and money every year until corrected by remodeling, the cost of which, when added to the original cost of the house is usually greater than the first cost of a well planned home. In spite of the evident advantages of a convenient, comfortable home, many poorly planned farm houses have been constructed. This condition is unfortunate because the farmer is usually permanently located and thus must make the best of the situation. A city dweller can find a more satisfactory house and move if a house should prove to be inadequate.

It requires a great deal of thought and careful planning for an individual to design his own home. The great variety of ideas, opinions, and requirements makes it impossible to do more than mention a few principles and suggestions. First, and above all, keep an open mind at all times. Study all available farm houses carefully and encourage criticisms from other people. Make a complete list of requirements including the number of rooms and the approximate size of each. Finally, arrange ideas into a plan, drawn to scale, on cross-section paper, letting the size of the rooms determine the size of the house. The shape of the house need not be rectangular, but when it is not, it is well to make certain that offsets are used to full advantage and space is not being wasted.

After progressing to the stage of a preliminary plan, the work begins in earnest. The actual plan must be considered from the standpoint of framing to assure solid floors, walls, and freedom from ceiling cracks. Ample light and ventilation must be secured in all rooms and the heating system must not have interference from partitions, etc. A large house is quite easily planned, but as the size grows smaller, it becomes more and more difficult to include all desirable features. It usually becomes necessary to sacrifice a few things in a very small house, but if the plan is well prepared, and allowance is made for additions, it is usually possible to increase the size of the house at a later date without a great deal of needless expense. In the possibility of additions, the farm home has a distinct advantage over city houses in that it can usually be enlarged in any direction. The narrow city lots have produced a long narrow type of house which appears incongruous when other houses are not built alongside. The best appearance is obtained if the front of the house is the longest dimension, which fact makes a great many city house plans undesirable on the farm.

The plans shown in this publication have been developed with considerable care. It has often taken several months' time to secure the desired arrangement of rooms. They offer quite a range of ideas and combinations. It is hoped that they will be of service to future farm home builders.

\* \* \* \* \*

## H-1 \* A SMALL HOUSE

This house is a very small, inexpensive home, which can be built by anyone who can use a saw and drive nails. The plan was developed to make a cozy temporary dwelling for a young couple who do not have the capital to buy a farm complete with house and buildings. This house is neat appearing and may be used for several years or until such a time as the owner can afford to build a larger, more complete home. The rent ordinarily paid out for a finished house will pay for this house in a year or two, and thereafter, the owners may save or otherwise invest the rent money.

If necessary, the front 16 x 24 foot unit only, can be built the first year. This unit will provide a combination living room-kitchen, and a bedroom. The 20 foot addition can be built the next summer or at odd times, making the complete house as shown on the floor plan with a kitchen, living room, bedroom, and a small store room or bath. The kitchen equipment is grouped in the left part of the room allowing plenty of space for dining at the right near the double windows. The hallway may be omitted, making a larger storeroom if preferred. Without the hallway the rear entrance may be placed at the right of the kitchen sink.

The exterior is simple yet the lines are pleasing. A common gable roof is used over the main part of the house with a shed roof covering the addition to the rear. The plans are completely drawn and detailed so that the services of a carpenter should not be required, though the services of a carpenter for a few days would speed up the construction. The finished structure will look like a home rather than a shed as is common with so many temporary buildings. The architectural drawings of this plan are accompanied by a complete bill of materials.

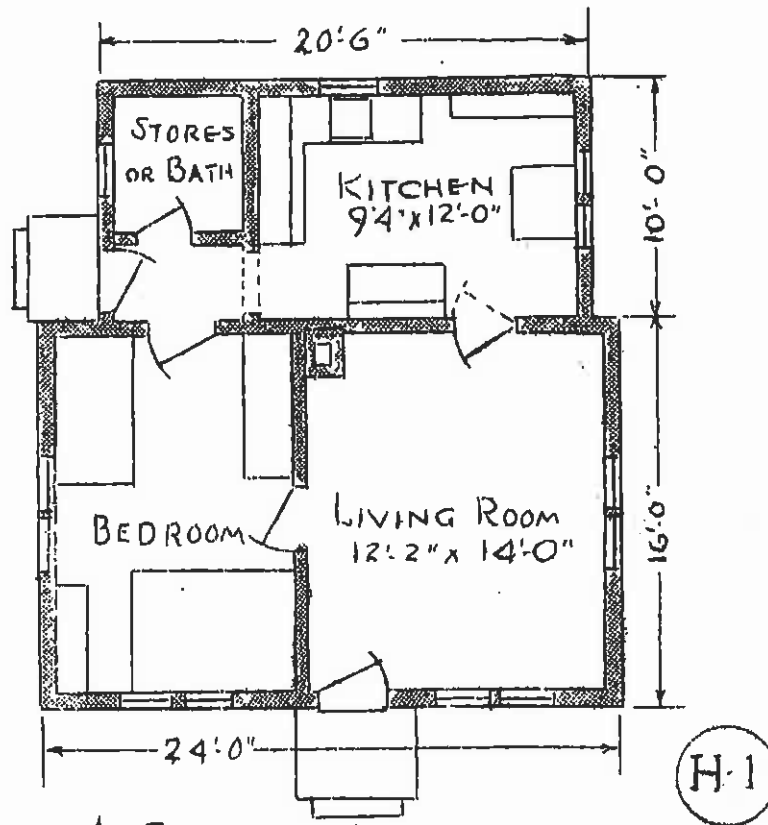
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## H-2 \* A SMALL HOUSE

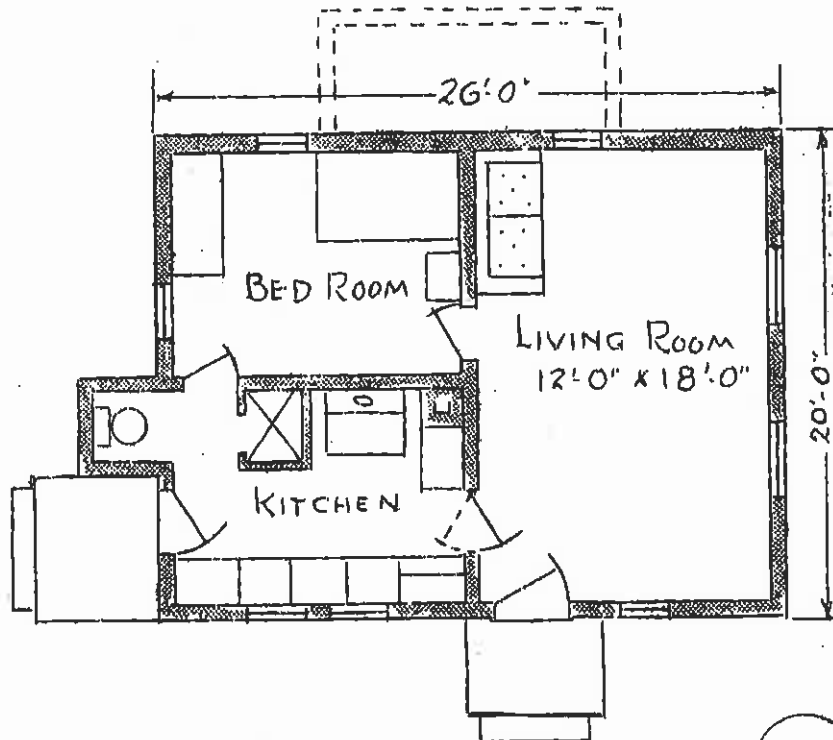
A very complete, convenient and neat temporary home can be built from this plan. The house is inexpensive and simple in construction. It can be built by the owner without hiring a carpenter, but a few days' help by a competent builder would be money well spent. The plan is 20' x 26' and provides a small, compact, modern kitchen, a bedroom large enough for parents and a small child, and a fair-sized living room. A built-in bed and seat or a davenport which can be opened as a bed may be used in the living room to provide additional sleeping facilities.

The kitchen is small, but, like the modern apartment house kitchen, it is designed to save a maximum number of steps. The dining table is pushed back against the wall of the living room when not in use. The small size of this home does not readily permit the use of a separate room as a bathroom, but all of the essential equipment is located near the corner of the kitchen and the bedroom. By opening the inside doors, this entire house can be kept very warm and comfortable throughout the winter with only a small heater and a minimum of fuel in addition to the kitchen range.

Additional bedrooms may be added to this house between the two rear windows as shown by the dotted lines on the blue print. In the case of additions, the window near the davenport is replaced by a door. Of course by the time that additions are necessary to this house, the family may be able to afford a larger new home using this building as a residence for the hired man and his wife.



A SMALL HOUSE  
 DEPT. OF AGR. ENGR. — STATE COLLEGE OF WASH.



A SMALL HOUSE  
 DEPT. OF AGR. ENGINEERING  
 STATE COLLEGE OF WASH.

(H-2 A Small House)

A shingled exterior is suggested for this little home, although any type of siding may be used. The simple gable roof is easily built. All essential dimensions are shown in the drawings, which are accompanied by a bill of materials. The upper sash of the windows should be of small glass panes for the sake of appearance even though they may be a little harder to clean.

A silver grey body paint or a white exterior, with a light green roof will give the little house a very pleasing appearance. Window boxes add greatly to the attractiveness of a house.

H-3 \* A FARM HOME; BUILT IN THREE STAGES

This low-cost farm house is planned for the minimum requirements of those starting out in life on the land. It can be built in three stages. In the first stage, the first portion, 16 x 24 feet, is constructed. The bedroom is ample in size, but the living room must also be used, temporarily, as a kitchen.

Later, the real kitchen and a bathroom (or small single bedroom) is added at the rear, with a side porch off the new kitchen. The kitchen being 14'-6" in length, there is ample space for a small dining table for a family of four or five. In the second stage of development, the door between the kitchen and living room is changed over to the right of the chimney, and a narrow hall is taken off the rear of the front bedroom. The little home has now increased to approximately 625 square feet of floor space.

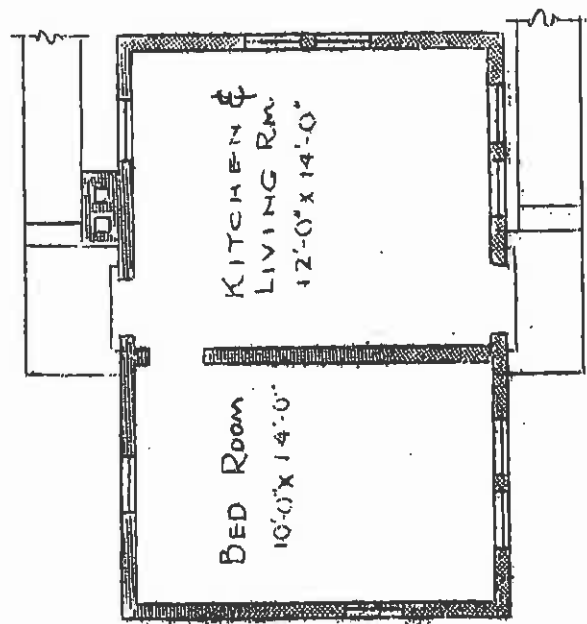
If an additional bedroom is desired, a large one can be added to the left of the bathroom. In this third stage of development, the closet in the kitchen is removed, and a door is cut through to allow easy access from the kitchen to the bath and bedrooms. The closets are rearranged to allow for these minor changes, as shown in the working drawings.

A study of the final plan may bring one to wish that the living room had been made larger. If this is desired, it may readily be extended to the right. Without doubt, many would prefer the first development to be 18 x 24 feet instead of 16 x 24 feet, as shown on the plan. In building from these small plans, do not make the mistake of having windows with plain upper sash. It is a nuisance to clean a lot of small glass, but the added appearance is worth a bit of extra work. Also, do not fail to build a good sized two-flue chimney. It adds to the appearance and is money well spent. A little spindly chimney is no ornament to any home. The builder should not make the floor level more than 18 or 20 inches above grade level.

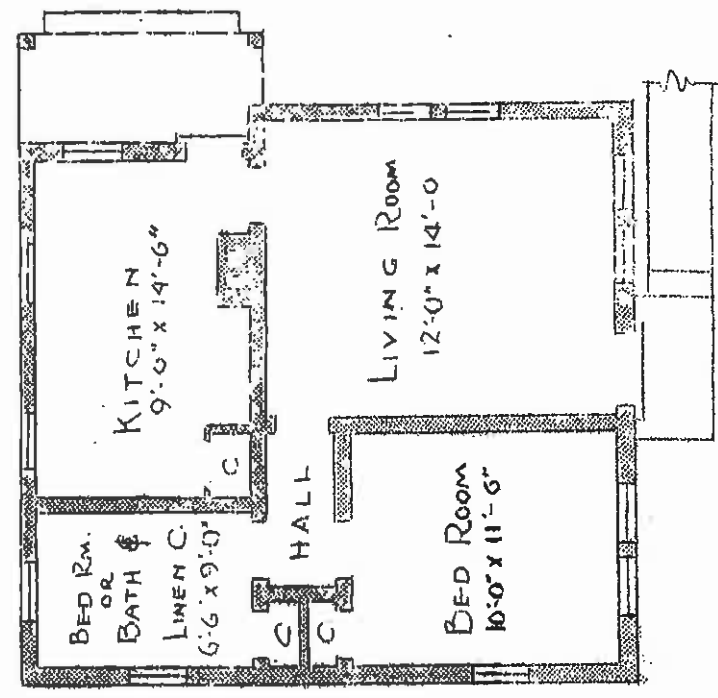
The exterior finish as shown in the architectural drawings is very simple and economical, yet if the details are properly followed, the result will be attractive. The exterior should be painted a light color which gives a building the appearance of being larger.

\* \* \* \* \*

STAGE No.1



STAGE No.2



A FARM HOME  
 DEPARTMENT OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASHINGTON

H-3

## H-6 \* A CONVENIENT BUNGALOW WITH PRIZE KITCHEN

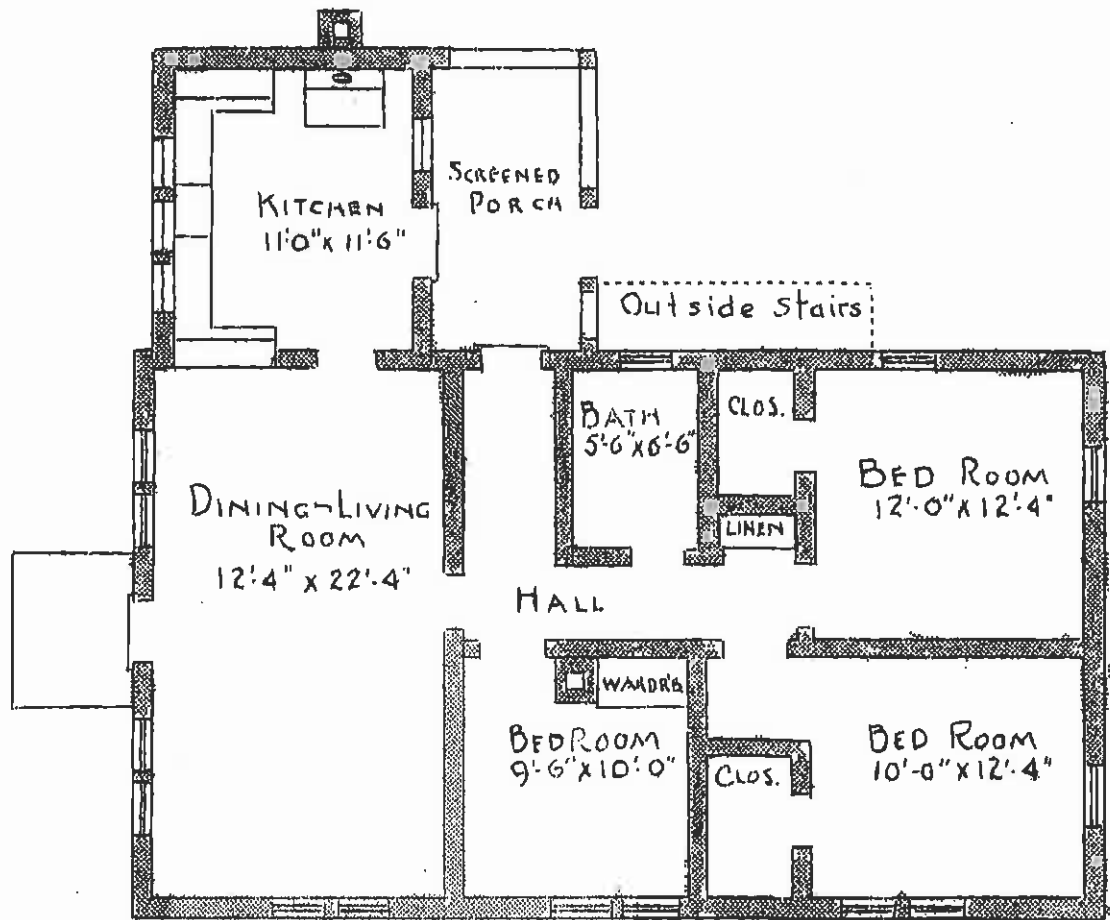
This is a nicely arranged, medium-sized farm bungalow with two complete distinctive floor plans. The main part of the house is 24' x 40' with the kitchen and a screened entrance in an addition to the rear. Both plans feature a very convenient kitchen from a prize-winning plan submitted in a recent kitchen competition conducted by a nationally circulated women's magazine. Three outside walls allow better lighting, cross ventilation, and built-in arrangements than is obtained in most kitchen plans. The location makes a cool kitchen and house possible throughout the summer and also permits a wide range of vision about the farmstead. This excellent kitchen is better illustrated by H-62. A living-dining room, three bedrooms, and a bathroom connected by a hallway complete the plan. An outside entrance may be used if the ground site permits a basement under the house. This entrance can be built convenient to the rear door and porch, when necessary. If an inside cellar stair is desired, the house may be made three feet longer and the stair located along the rear hall. This would also give more bedroom space at the front of the bungalow. The two rear bedrooms may be built as an addition after the first unit is constructed.

The kitchen and living-dining room occupy the entire side of the house. A small heater room with two grilled openings is provided in the later plan as shown in the illustration. This little nook will protect the kiddies and will take care of a circulating heater and its fuel. Of course, a basement furnace will make the heating nook unnecessary and will be safer for the children. The three bedrooms are all of ample size and have large closets. The front bedroom on the later plan has been enlarged at the expense of space in the bathroom but ample space remains for a recess tub or shower and other fixtures. An important feature of this plan is hallway connection with the rear porch. Hired help entering at the rear may reach the bathroom without entering any other room.

The exterior is simple and finished with either shingles or rustic siding. A simple gable roof with an ell over the kitchen and shed roof over the rear porch makes an attractive, easily framed roof. A side porch may be added if desired. One of the rear bedrooms may easily be converted into a screen or glassed-in sleeping porch and sun room with an outside entrance.

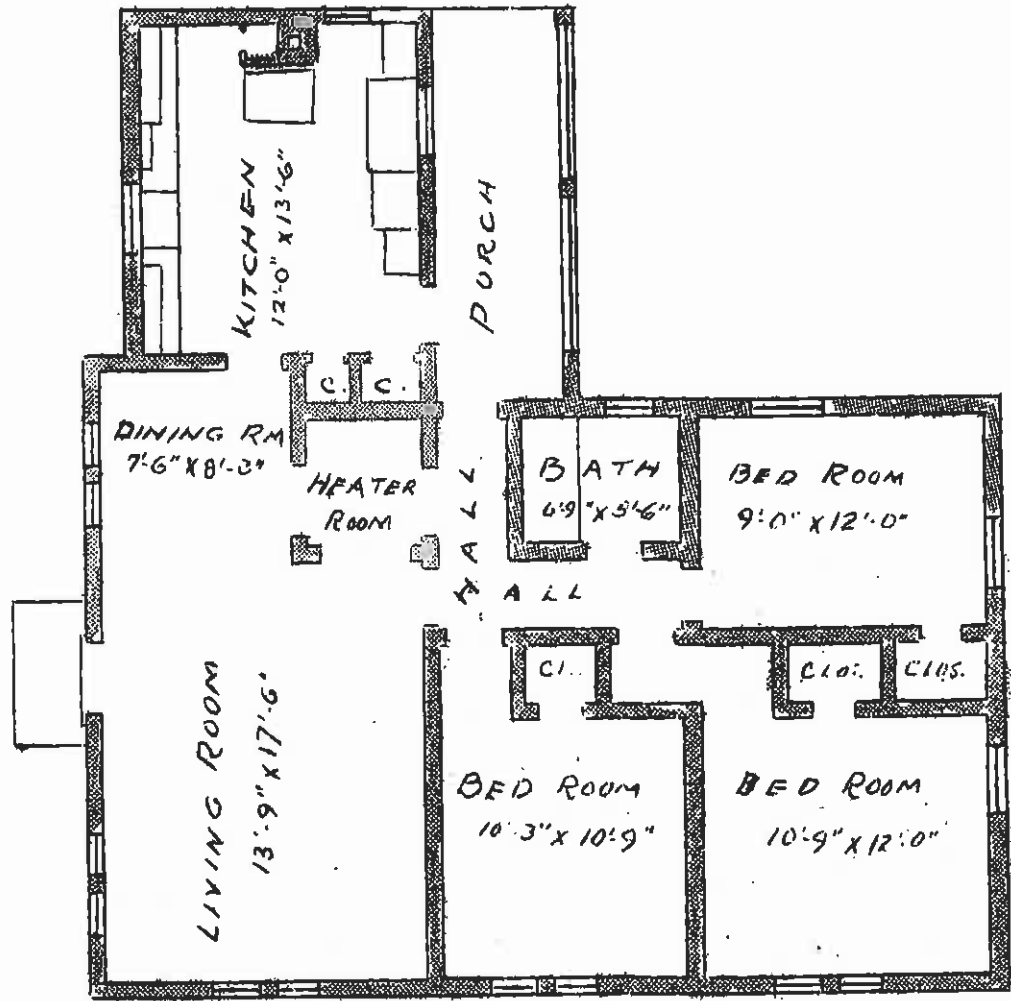
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A BUNGALOW  
 DEPARTMENT OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASHINGTON  
 (SEE PLAN H-6A FOR REVISED PLAN)

(H-6)



A BUNGALOW  
 DEPARTMENT OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASHINGTON.

(H-6  
A)

H-7 \* A COMPLETE DUTCH COLONIAL HOME

Plan No. H-7 is the complete working drawings for a prize-winning home from the W.S.C. Extension Bulletin No. 91. It is a splendid example of the Dutch Colonial style as adapted to the American home. It is a convenient, economical, well-arranged, two-story house. The outside dimensions are 29'-6" x 34'-6".

The first floor includes kitchen, dining room, living room, one bedroom, a lavatory or washroom, and hallways. An outstanding feature of the arrangement is the location of the lavatory alongside of the kitchen and opening into the rear entry. In this arrangement men entering from the fields may wash and enter the dining room without passing through any other rooms. The front entry opens into the living room and the hallway which connects directly with all other rooms except the dining room and the lavatory on the first floor.

The long wide dormers allow a nearly full-size second floor and ample closets for all rooms. The second floor is divided up into three bedrooms, a bathroom, and a hallway connecting all rooms. The bathroom is directly over the kitchen, which shortens the length of pipe through which hot water must be drawn and reduces the cost of the plumbing installation.

A basement may be used under this house if the site permits. An arrangement of the basement is illustrated in the complete working drawings. An entire sheet of detail drawings showing window framing, cornice framing, stairway, kitchen, built-ins, and fireplace construction, entirely eliminates any doubt as to the proper construction of this home.

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H-8 \* A ONE AND ONE-HALF STORY BROKEN ROOF HOME

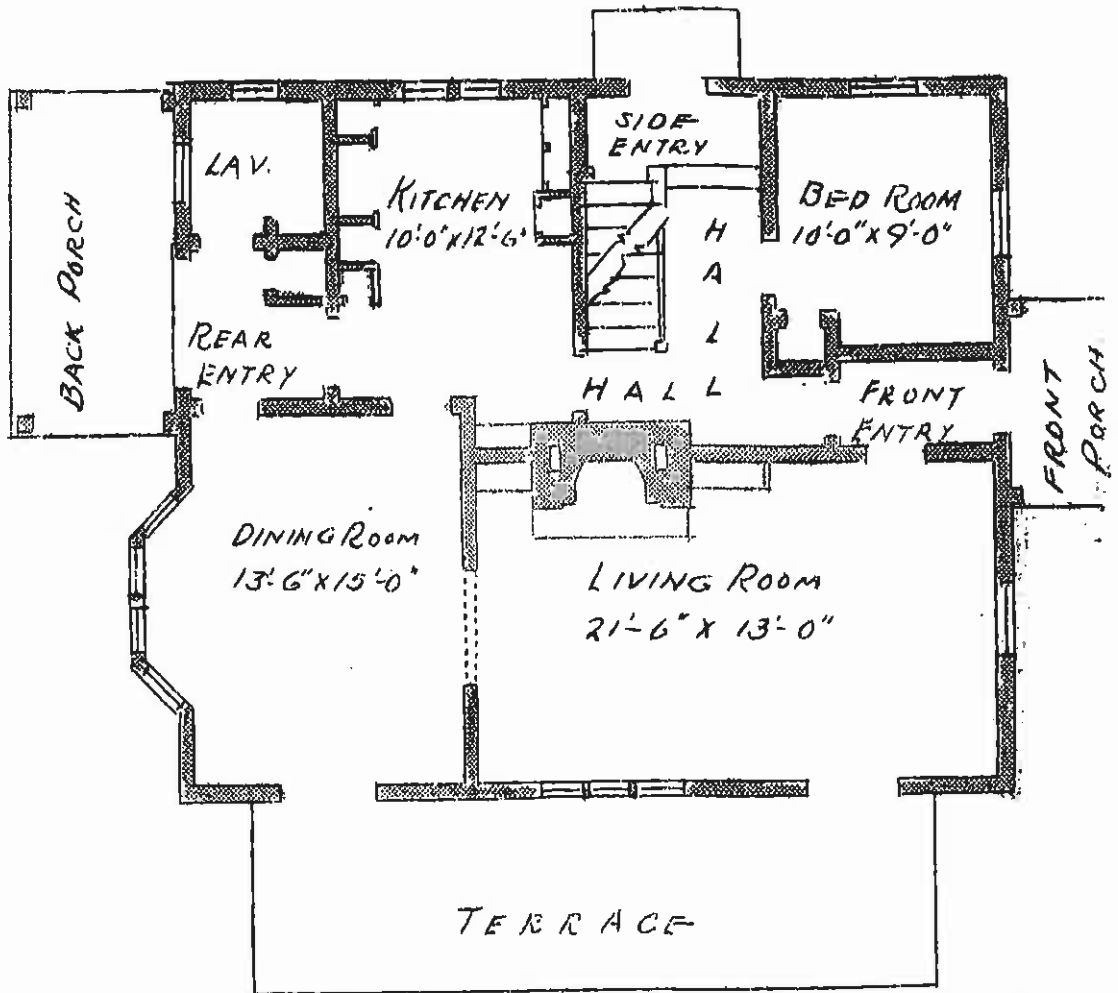
This is a charming, medium-sized, one and one-half story house. It is complete, modern, convenient, and satisfactory for the small or medium-sized family. Charm and individualism are obtained in the exterior and in the broken roof, which allows the building size without making it appear ungainly.

The hallway, which extends from the rear door, connects all rooms and stairways on the ground floor. The first floor includes a 12' x 19' living room, and a kitchen near the driveway. An inside fireplace may be located between the kitchen and living room at the opposite end from the front entry. Across the hallway a front bedroom and rear office are separated by the stairways, and the bathroom. The kitchen includes a breakfast nook, which may be used as a regular dining room. The arrangement of kitchen equipment is very convenient.

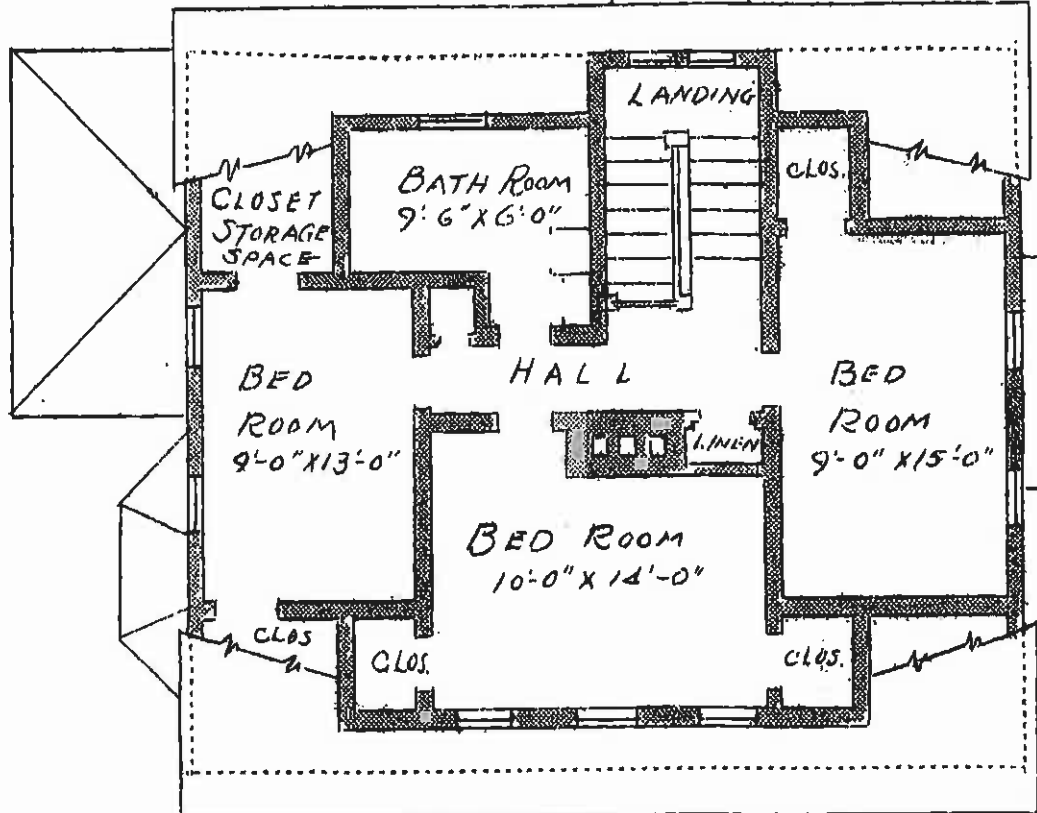
The second floor is occupied by a large bedroom, children's bedroom, lavatory, and closet. The children's room can be made into a stateroom with built-in bunks, drawers, and low cupboards for all playthings.

The house may be built either with or without a basement. The blue print shows an arrangement for a three-fourths basement with space for vegetable storage, laundry, furnace, and fuel. The first floor plan illustrated is for use without a basement. The space occupied by the basement door and stairs is used as a linen closet and a closet from the office.

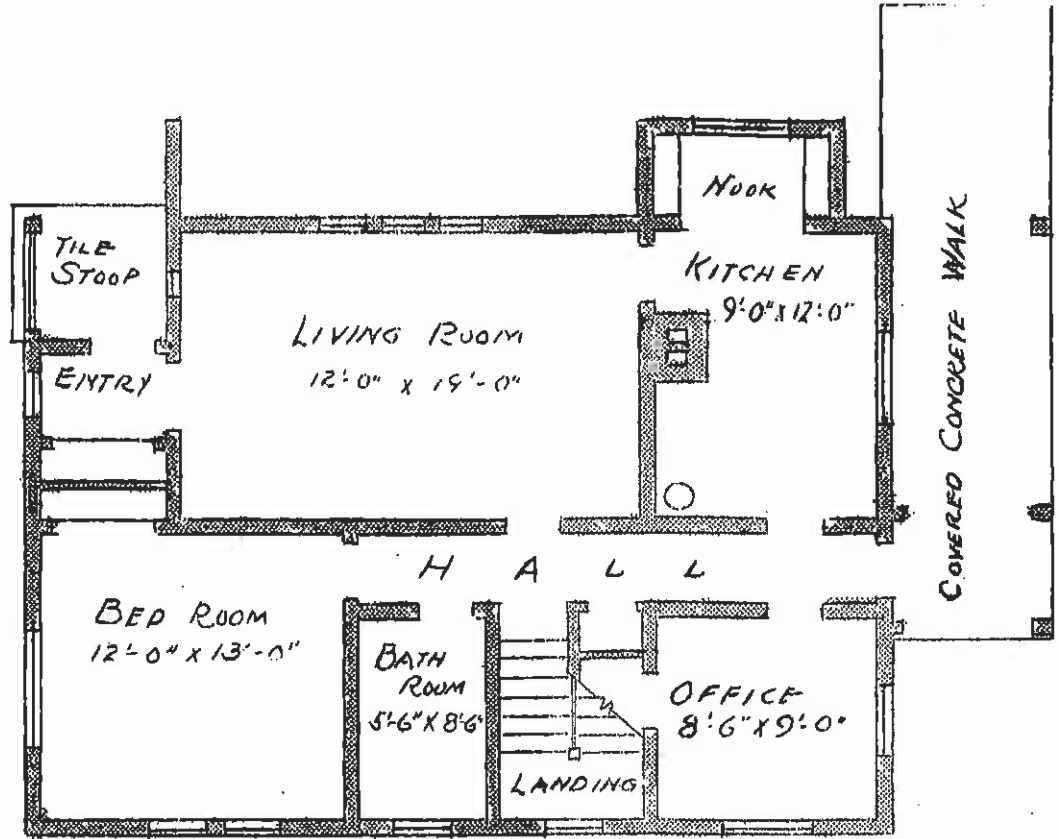
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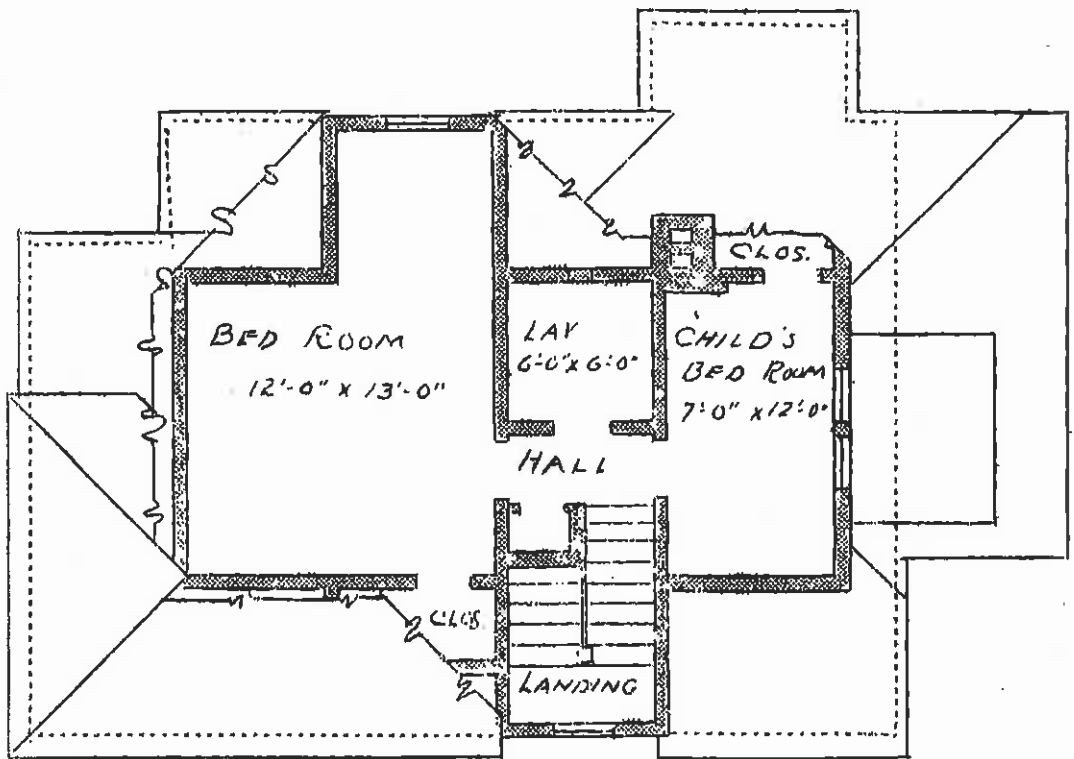
FIRST FLOOR



SECOND FLOOR



FIRST FLOOR



SECOND FLOOR

A ONE AND ONE-HALF STORY HOME (H-8)  
 DEPARTMENT OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASHINGTON

## H-9 \* A MODERATE PRICED FARM HOME

This plan represents a compact, modest farm home for the small family. Outside dimensions are 21'-6" x 31'-6". The first floor includes kitchen, breakfast corner, living room, one bedroom, and a bathroom. Ample room is provided for two bedrooms upstairs which may be finished at any time. Stairs to the basement and also to the upper floor are provided in the floor plan. Both front and rear entries are included with the rear entry opening into the back hallway.

The breakfast corner is in reality a very small dining nook making a combination kitchen and dining room at the front corner of the house. The short rear hall connects with all rooms and the basement stairs so that any room may be reached without passing through other rooms. The bathroom is alongside of the kitchen for convenience and to aid installation of the plumbing. The rear entry is semi-enclosed to allow storm doors in cold or windy location.

The construction calls for a full basement, but either full or block foundations may be used if the proposed site will not permit a basement. The exterior is finished with 12" V-edged siding placed vertical with a 3" batten on every other joint. The front door is of V-edged plank construction with black antiqued wrought iron work to give a substantial, heavily timbered appearance. The front entrance is finished with a semi-circular tile stoop. The roof is of hand-split cedar shakes stained red and offers a pleasing contrast to the rest of the house, which is painted white.

\* \* \* \* \*

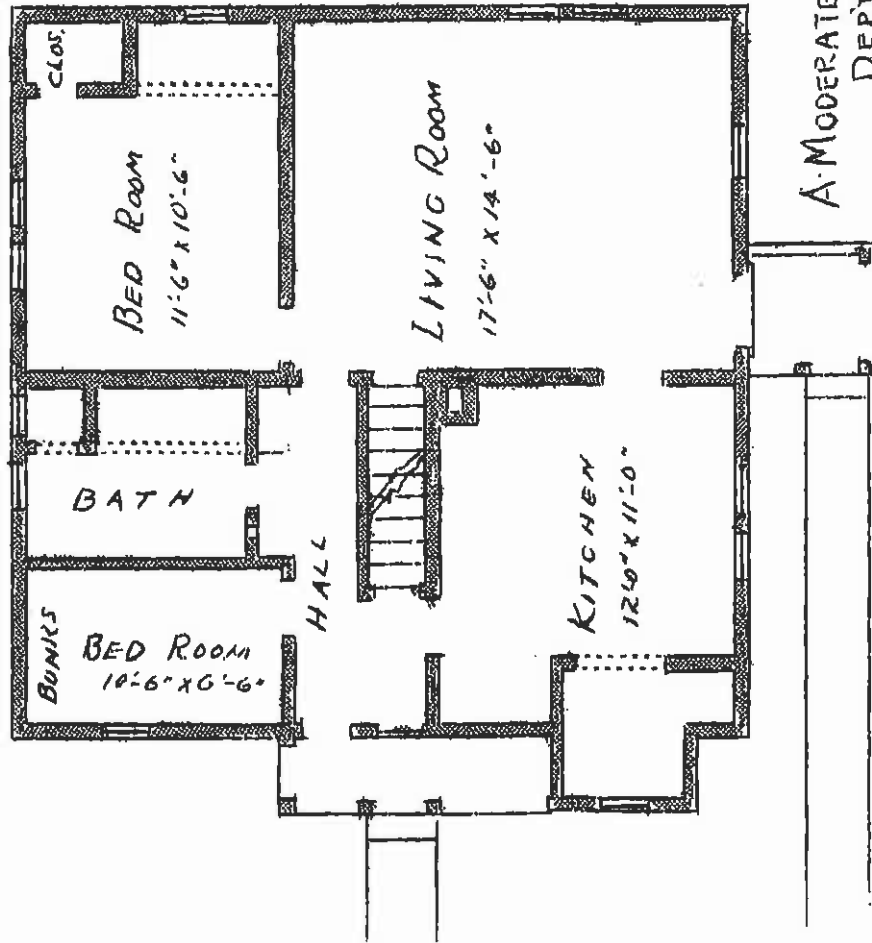
## H-10 \* AN INEXPENSIVE FARM HOME

This is a small cottage or bungalow, simple, well-proportioned, and complete in itself; yet capable of including an addition without loss of simplicity, proportion, or convenience. This plan features the kitchen on the front corner of the house and the use of a side entrance. The outside dimensions are 28'-0" x 30'-0". The first floor plan includes kitchen, combination living-dining room, bathroom, and two bedrooms. A full basement may be used and the upstairs can be finished off to make two bedrooms.

The kitchen is very well planned and includes a breakfast nook opposite the entrance to the living room. It opens into the hallway near the side entrance and the door to the basement stairway. The bedrooms are across the hallway from the rest of the house. A small bedroom in the corner nearest the kitchen has built-in bunks for the children. The bathroom is placed between the two bedrooms and may be used also as a dressing room. In keeping with the dressing room idea, the bath tub is curtained and a complete dressing table with drawers is built on the opposite side of the bathroom. Men entering at the side entrance pass directly into the bathroom, basement, and any other room without entering the kitchen.

A ten-foot addition to the living room end of the house provides another bedroom with a large closet and enlarges the living room. The hall partition is continued across the living room to provide access to the new bedroom and a fireplace is built at the junction of the old room and the new addition. It is suggested that the exterior be painted white with green shutters and roof. The low eave line and wide siding hold the house to the ground in a cozy manner.

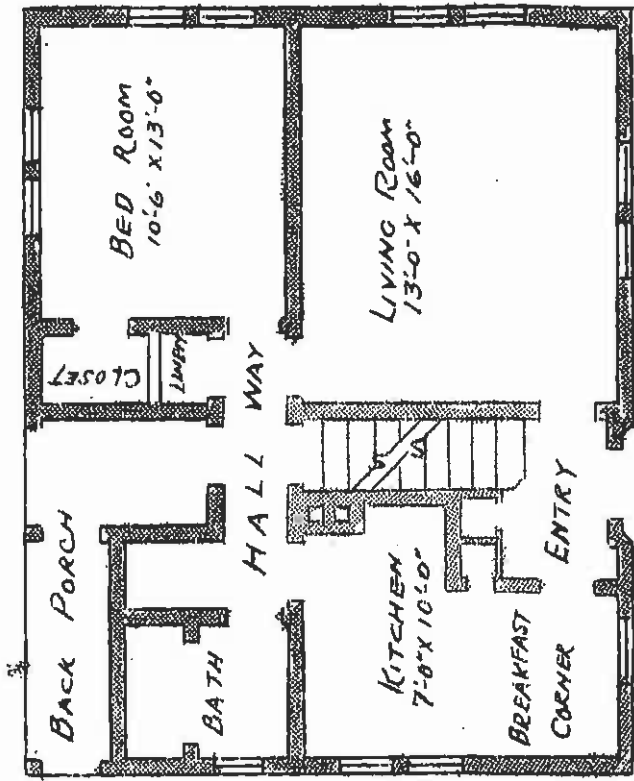
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FLOOR PLAN

(H-10)

H-10



A MODERATE PRICED FARM HOME  
 DEPT OF AGR. ENGINEERING  
 STATE COLLEGE OF WASH. FLOOR PLAN

(H-9)

H-9

H-11 \* AN ECONOMICAL FARM HOME

This is a very small and compact farm bungalow, arranged to give a surprising amount of room. The outside dimensions of this house are only 17' x 22' with a bedroom in a 9' x 12' addition. The plan includes front and side entrances, combination living-dining room, bathroom, and one bedroom.

The front entrance opens directly into the living-dining room. The partition between the kitchen and the dining room is unique in that it includes a built-in seat in the form of a folding bed. The side entrance opens into a corner of the kitchen near the bathroom entrance so that men entering by the side entrance may pass directly into the bathroom without crossing the kitchen. The bedroom is convenient to the bathroom and is reached through a passageway at the opposite end of the living-dining room from the front entrance.

All exterior wood work is painted white with the shingles stained either green or dark brown. The siding is of 1 x 12 boards lapped and applied horizontally. The gable ends are finished with 1 x 12 boards applied vertically with a 3" batten over each joint. The projecting beams from the raised dining room ceiling give the appearance of supporting the roof. This higher ceiling gives space for a very large front window, which is one of the features of the little house. A simple gable roof is used over the main portion with a shed roof over the bedroom addition. The bedroom floor level is dropped six inches below other floors if possible to avoid complication of the roof framing. This is an unusually fine plan for a small family on the farm or in town.

\* \* \* \* \*

H-11a \* ALTERED PLAN NUMBER 11.

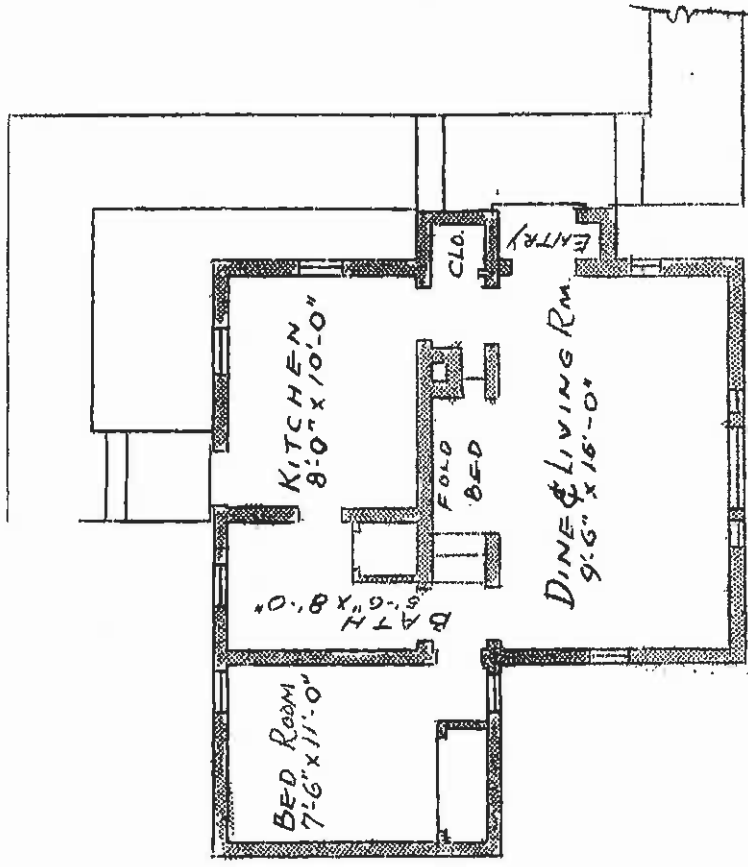
The rooms of this house have been kept fairly large by combining them or using them for more than one purpose, thus avoiding the "boxed-in" feeling common to some small homes. It is better to build this home complete as shown in the plans at the time of the first construction, but it is possible to defer the construction of the bedroom and sleeping porch if finances make it necessary to do so.

The kitchen-dining room combination gives a room of remarkable size for such a small home. The kitchen equipment is grouped in the front part of the room with the dining table located near the window. A comfortable bunk may be built on at the end of the kitchen between the outer wall and the closet if the bedroom is not finished immediately. The partition between the kitchen and the living room retains its unique usefulness. In addition to the folding bed and closets, it provides a niche for the heater stove, so that the heater takes up but very little space in the room proper. The bathroom is located off the small rear hall and is available to all rooms.

The exterior is finished in the same manner as the plan No. 11. The construction is similar throughout except as noted, but the floor of the rear extension does not need to be lowered. The rear extension is covered by a simple gable roof making an ell with the main roof which gives a more unified appearance than the shed roof.

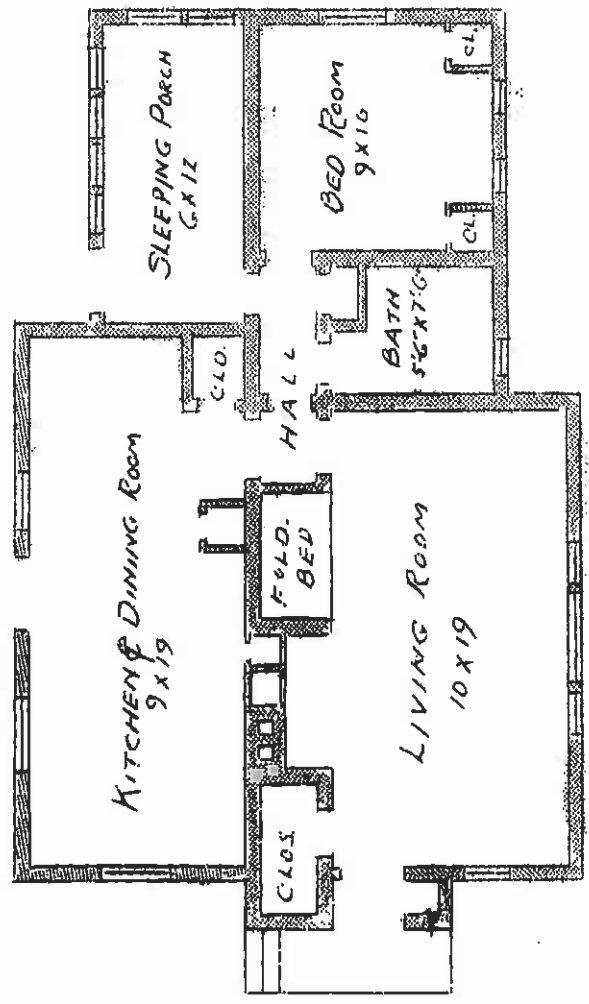
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AN ECONOMICAL FARM HOME  
 DEPT. OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASHINGTON

H11  
A.



ALTERED PLAN No. 11

H-12 \* A SMALL FARM HOME

This is a low cost house with rooms of minimum size. The plan has 475 square feet of floor area which includes kitchen, living room, one bedroom, bathroom, a front hall, and a rear hall.

The kitchen is small and compact, and similar to the small kitchenettes in apartment houses, but the arrangement of built-in cupboards, etc. allows ample room for two persons to work in the kitchen when necessary. The combination living and dining room is of ample size for the small family. A large fixed sash, studio window makes the room light and attractive. The rear hall connects all rooms of the house and forms the entry for the side door. The bathroom is near the kitchen and across the hall from the living-dining room. It is completely equipped with a shower bath and is equally convenient to all rooms.

The exterior of the house is finished with vertical 1 x 12 boards with battens. The gable corner, above the exposed ends of the beams of the raised ceiling, is of horizontal lapped 1 x 12 boards. The roof over the kitchen forms an angle or ell to the main roof, but the framing is not complicated. Green stained shingles or shakes form a pleasing color combination with the white house. The windows are equipped with white painted shutters. The position of a low, shed-roofed, addition to the right of the bathroom, suitable for a children's bedroom, is indicated on the working drawings. If not used for this purpose, the space can be trellised and covered with vines.

\* \* \* \* \*

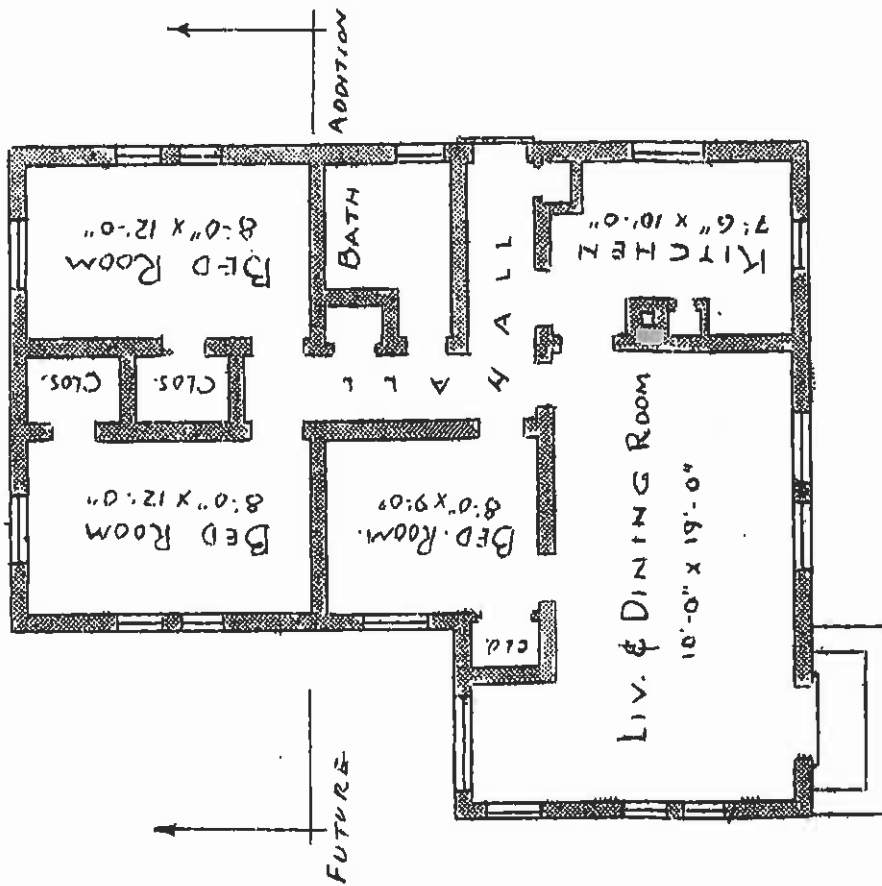
H-13 \* A LOW-COST FARM HOUSE WITH ADDITION

This is a well-balanced, simply designed house which may be built originally with only one bedroom, the two extra bedrooms being added at any time. In addition to the bedroom, the plan includes a 10' x 19' combination living and dining room, a convenient kitchen, and a bathroom. An ell-shaped hallway connects all rooms and includes the side entrance.

The kitchen and living room occupy the entire front of the house. The kitchen has no direct outside door but is convenient to the side door. Windows provide ample cross ventilation. The living room is of fairly large size for a small house and can be arranged very attractively. A position for fireplace is indicated at the end of the living room using the same chimney as the kitchen range. A little alcove across the living room from the front entrance is intended for flowers and plants.

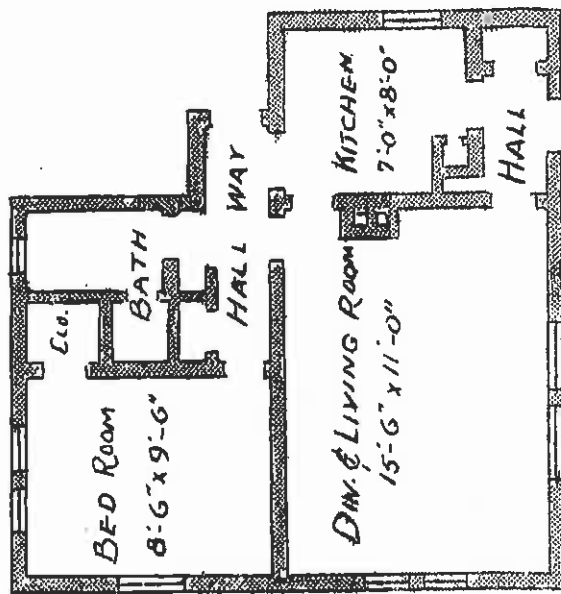
The exterior is carefully planned and can be easily ruined if the plans are not strictly followed or if alterations are made by inexperienced persons. Shingles are used for the sides of this house, alternating a 3" and an 8" course. The overhang of the eaves is small with a 6" O.G. molding at the corner. The front gable has a dove cote such as is found in many early types of farm house architecture. The antiqued appearance is further strengthened by the window shutters and a surrounding of evergreen trees. A simple, shingled, gable roof is used over the main part of the finished house with the roof over the living room forming an ell to the main roof without complicated framing.

\* \* \* \* \*



A LOW COST FARM HOUSE  
 DEPT. OF AGR. ENGINEERING  
 STATE COLLEGE OF WASH.

(H-13)



A SMALL FARM HOME  
 AGR. ENGINEERING  
 STATE COLLEGE OF WASH.

(H-12)

This house is admirably suited to the needs of a farmer who must content himself with a small house. The outside dimensions are 19' x 28', but the dimensions may be increased 2 or 3 feet each way if desired. The plan provides two bedrooms and bath as well as the kitchen and combination living-dining room. Two floor plan arrangements are available and both are shown on the working drawings. The two floor plans are illustrated in this manual and it will be necessary to make selection before the house is built.

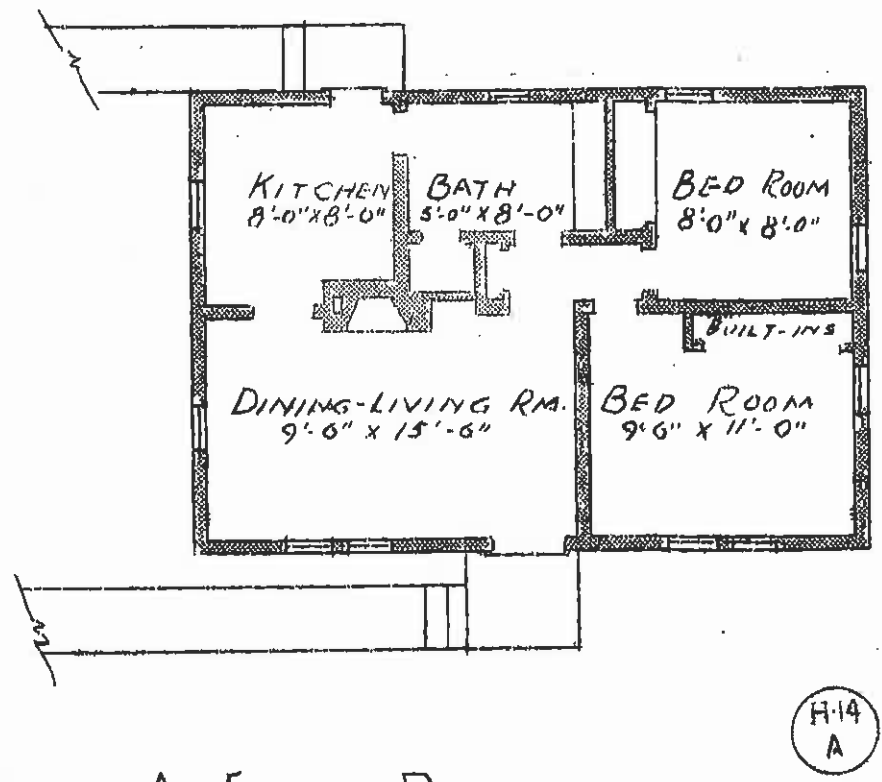
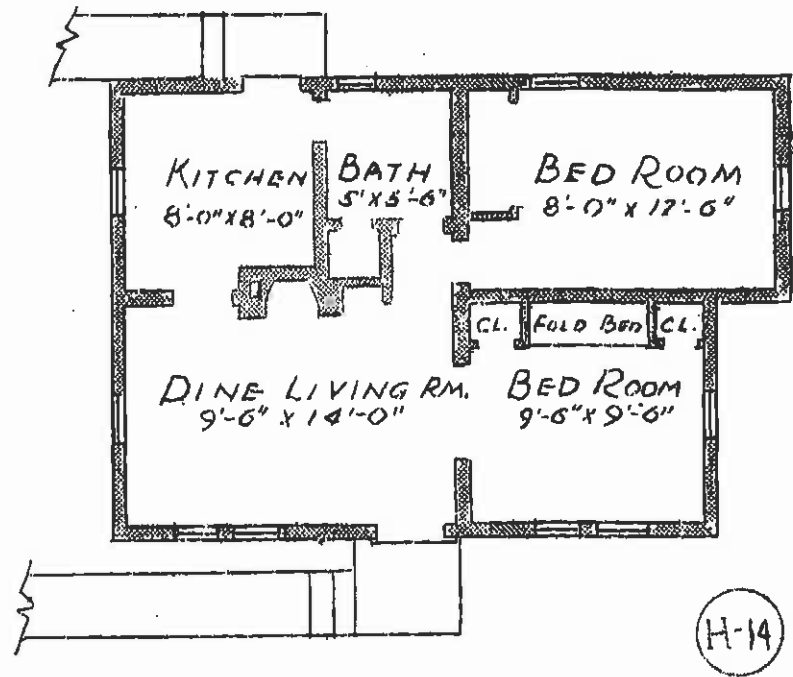
The front entry is easily accessible from the side driveway and opens directly into the living room. The living room is small but, in the upper plan, is connected to the front bedroom by French doors so that fairly large group meetings may be accommodated by using both rooms. This arrangement is made possible by the use of a built-in combination seat and folding bed in the bedroom. The fireplace and kitchen flues are combined, thereby reducing the cost of construction. The kitchen is arranged for the proper right to left movement of dishes. The rear entry opens directly into a corner of the kitchen near the bathroom door so that men entering by this entrance may wash without crossing the kitchen. The bathroom may be entered from any room except the front bedroom without passing through any other room. This kitchen-bathroom arrangement is quite common in western Washington. The rear bedroom is particularly well suited for a sick room in case of illness because it is separated from possible noises in other rooms of the house.

The alternate plan differs principally in the size and arrangement of the bedrooms. The front bedroom is enlarged and opens into the lengthened hallway so that it is used only as a bedroom. The rear bedroom is smaller but is still large enough for a single bed. The bathroom is enlarged and will permit the installation of either a wardrobe, a dressing table, or both. The living-dining room is lengthened 18". In order to again balance the front elevation of the house, the front entry and the windows are shifted somewhat.

The exterior may be finished in several ways. The plan shows the house sided with rough 1' x 12" boards applied horizontally with a lap of one inch. Wide beveled siding or shingles 10" to the weather would give a pleasing appearance and better construction though at a slightly higher cost. The gables are finished with vertical boards and battens. The roof is of simple unbroken gable type.

The iron railing around the porch stoop, the downspout, porch lamp, and paneled door give a pleasing and necessary accent to the front entrance. Simple window boxes find a natural setting below the double windows on each side of the main entrance. The shingles should be stained and all exterior wood work painted in a pleasing color combination as selected by the owner.

\* \* \* \* \*



A FARM RESIDENCE  
 DEPARTMENT OF AGRICULTURAL ENG'R.  
 STATE COLLEGE OF WASH.

## H-15 \* A ONE AND ONE-HALF STORY BUNGALOW

This medium sized farm home is adapted from a prize winning plan in a Canadian farm home competition. A simple bungalow type with full width front porch holds this house to the ground in a homey manner while the wide dormers increase the size of the second floor. The exterior is 28' x 35' with a large 10' x 35' front porch and a smaller rear porch. The first floor plan, without the porches, makes an excellent arrangement for a small one-story bungalow with basement.

The living-dining room is fairly large and arranged to permit the use of both piano and davenport. The inset fireplace opposite the front entrance is very pleasing and the same chimney may be used for the flue from the kitchen range. The English type of pass pantry and buffet between the kitchen and the dining room is incorporated in this plan. The bathroom, one bedroom, office, and a short hallway with closets complete the first floor plan. The arrangement of the rear of this house is worthy of particular attention because of its completeness and compactness. The second floor is divided into a bathroom, two small bedrooms, and two large front bedrooms. The rear bedrooms are separated by the bathroom and stairway. A plan for the basement is included.

The exterior is neat, sturdy, and free from unnecessary trimmings of passing fancies.

\* \* \* \* \*

## H-16 A HIP-ROOFED BUNGALOW

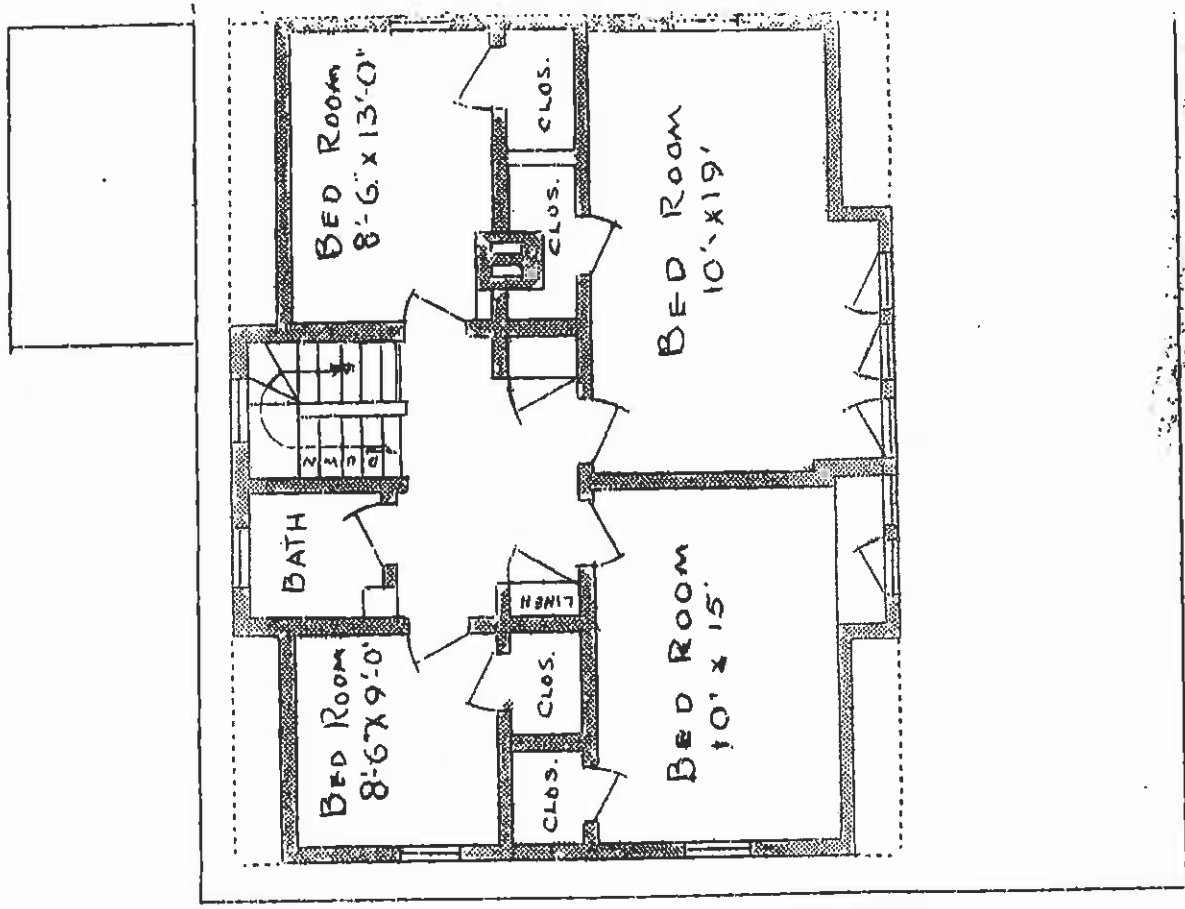
Plan H-16 is the complete working drawings of a prize house illustrated in W.S.C. Extension Bulletin No. 91, "Convenient Farm Homes". The plan includes kitchen, dining room, living room, two bedrooms, and a bath on one floor. A small hallway and basement stairway complete the plan. The outside dimensions are 32'-0" x 35'-6".

The nearly square plan permits the use of a hip roof which makes a very neat appearance. The exterior is finished in wide siding.

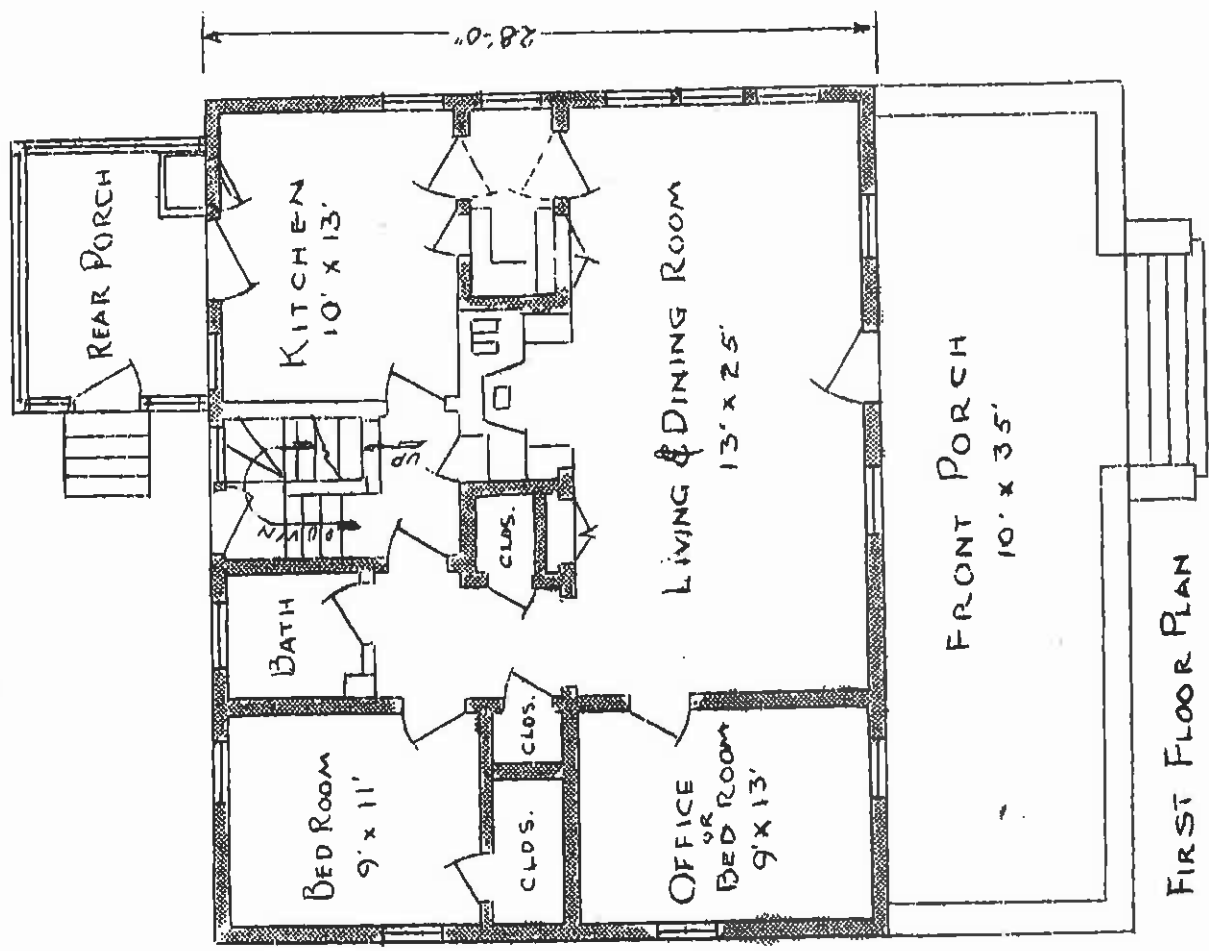
## H-30 \* FRESH AIR SLEEPING HOUSE

A fresh air sleeping house is an improvement over the common sleeping porch in that all four sides are open to the cooling evening breezes. The little cabin measures 10 feet by 16 feet and the cost of construction is very low. It will furnish greater privacy and better protection from rainy and stormy weather than the ordinary sleeping porch. In addition to furnishing sleeping quarters, this little building will allow the porches of the house to be used for social or other uses. A partition divides the building into two rooms, each of which will accommodate a full-size double bed and dressing table or wardrobe. A single bed or cot may also be used in each room if needed. A bill of material is available for this plan.

\* \* \* \* \*



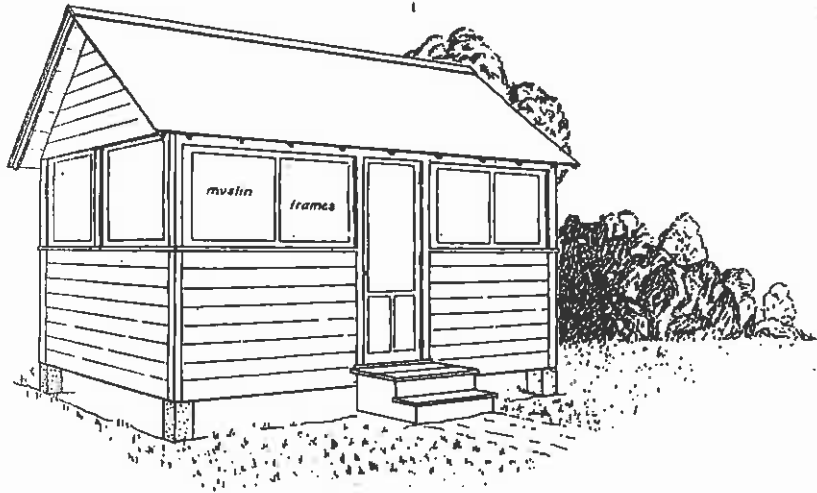
SECOND FLOOR PLAN



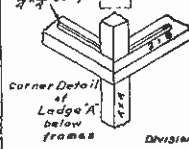
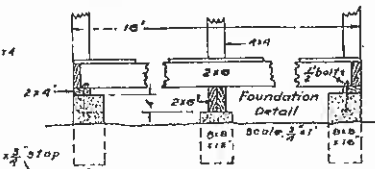
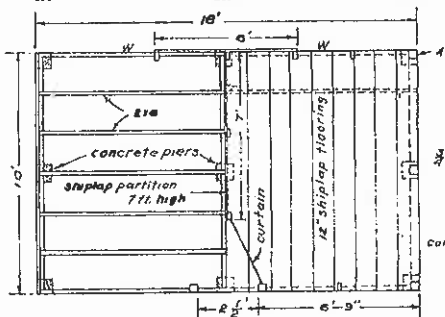
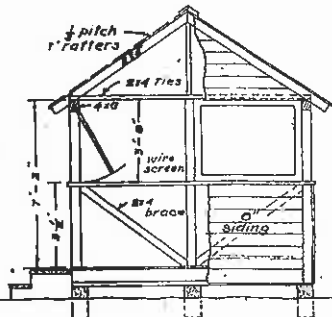
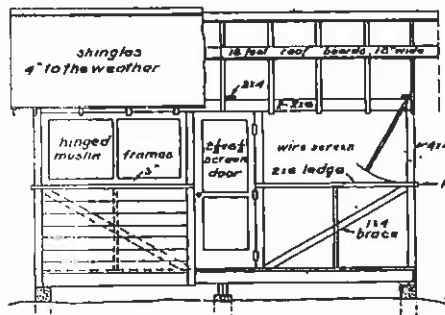
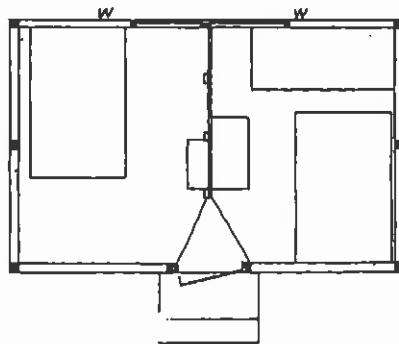
FIRST FLOOR PLAN

H15

A ONE AND ONE HALF STORY FARM BUNGALOW  
 DEPT. OF AGR. ENGINEERING - STATE COLLEGE OF WASH.



**FRESH AIR  
SLEEPING  
HOUSE**  
10 x 16  
designed by L.J. Smith  
Agrl Eng Dept.  
WASHINGTON  
STATE COLLEGE



**FRESH AIR  
SLEEPING HOUSE**  
Scale  $\frac{1}{8}'' = 1'$   
designed by L.J. Smith  
Division of Agricultural Engineering  
STATE COLLEGE - WASHINGTON



H-31 \* FARM UTILITY BUILDING

This is a general purpose or combination building which has uses similar to those of an ordinary house basement. Its use is indicated as an auxiliary building to small houses or where the location or design of the house makes a basement impossible. This building includes a small, completely equipped laundry with stove and hot water heater, a fruit and vegetable storage room with dirt floor, a wood shed with dirt floor, and a full-sized garage room with concrete floor. The wood shed may be finished into a second garage if needed. Because of the uses of this building, it should usually be located near the kitchen corner of the house. A large blue print shows complete details of construction using vertical boards with battens for siding. The outside dimensions of this building are 24' x 28'.

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HOUSE REMODELING

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H-41 Project: To Put a Continuous Foundation Under a House

This small blue print will be a great aid to an inexperienced person who is planning to replace a temporary or failing post foundation under a building with a permanent continuous concrete foundation. The steps in this important project are carefully illustrated and explained.

\* \* \* \* \*

H-42 Proportional Chart for Gambrel Roofs as Used in Dutch Colonial Residence Design

This small blue printed chart gives the roof pitches, rise of ridge above second floor, and width of front dormer which will give good proportions to a residence designed in the Dutch Colonial style with a gambrel roof. The data is given for twenty houses, dimensions ranging in size from 24' x 28' to 30' x 40'. The chart has been carefully developed, and it is hoped that its use will help small contractors and carpenters to build a Dutch Colonial house in the correct proportions. This chart should be of interest in construction of new structures as well as in remodeling.

\* \* \* \* \*

#### H-43 THE DUTCH COLONIAL RESIDENCE

This blue print has been prepared for individuals or contractors who are building or remodeling houses in the Dutch Colonial style. The plan illustrates front and side elevations with details of suitable front entrance and cornice framing. The interior arrangement is to be determined by the builder or by the conditions of the house to be remodeled.

The Dutch Colonial style is a sturdily built, rectangular, two-story house. It readily adapts itself to the needs of the average family and features the Gambrel type of roof with long dormers. The wide dormers seem to grow out of the roof, making the second floor nearly full height without making the house appear tall and ungainly. The simple rectangular plan eliminates waste of space and building materials. The exterior is finished in narrow siding on frame construction with shingled roof. The windows were originally built up entirely of small panes of glass, but the modern tendency is to allow the lower sash to be a single pane of glass. All windows are double hung and equipped with shutters. The Dutch Colonial house is commonly painted white with green roof and shutters. For proper proportions for different sizes of homes of this type of architecture, use sheet H-42. Sheet H-47 gives the details for the Dutch Colonial type of fireplace.

\* \* \* \* \*

#### H-44 THE MODERN ENGLISH COLONIAL RESIDENCE

This blue print has been prepared for individuals or contractors who are building or remodeling houses in a modern English Colonial style. The plan illustrates front and side elevations of the finished house and detail drawings of the framing of important features which characterize this type of architecture. The arrangement of the interior is to be done by the owner or builder to suit individual requirements.

The modern adaptation of the English Colonial residence has been very popular with builders and home owners during the past decade. It is especially attractive to those people who desire a charming economical two-story house with steeply pitched roof. The plan is rectangular with the exception of the kitchen which is an addition to a rear corner of the house. Although adapted to the requirements of a modern home, the massing of this house retains the bold sturdy feeling of the English Tudor style with a tendency towards Georgian rather than early American Colonial.

The strength of the house is emphasized by double courses of shingles at intervals on the roof, brick walls, and the spacing of the windows. The large dormer, shuttered windows, entrances, mould trimming, and turned spindles in the gables are strictly of enduring colonial type.

The detail sheet on fireplaces, H-47, shows the proper type of fireplace for this home.

\* \* \* \* \*

H-45 AN EARLY AMERICAN RESIDENCE

This blue print was developed for use by individuals or contractors desiring to build or remodel the exterior of an early American residence. The plan shows front and side elevations of the finished house and special detail sections of all parts with unusual framing. The interior arrangement is to be determined by the builder to suit individual requirements.

The early American residence is a two-story house which was used quite generally in the New England colonies from the time of the first permanent construction until about 1720. This type of colonial residence has been growing in popularity particularly because it is adaptable to use in small houses. The most obvious characteristic of this style is the overhanging second story with its "drops" and pendants. A simple gable roof is used over the rectangular main part of the house with either shed or gable roof over additions which are frequently used at the rear of the house. The main entrance is located in the center and is set back a foot or two from the front of the house. The door is usually plank or paneled, although the "Dutch door" was known and frequently used. The windows are of small pane glass, double hung, and symmetrically located. The second floor windows have shutters and the main floor windows are set in a projecting bay. The exterior is usually finished with clapboards or wide siding.

\* \* \* \* \*

H-46 FIREPLACE DETAILS AND DATA -- SHEET I

There is an ever-changing fascination in the appearance of a cheerful fire burning in a well constructed fireplace which lends charm and hominess to any room. The never-failing interest of a fireplace in a living room makes it a desirable accessory to any home.

There is nothing so disagreeable in a home as an improperly constructed, smoking fireplace. In order that satisfactory results may be obtained, it is essential that the mason understand the principle of construction or use dimensions provided by some one who does understand these principles.

The essential items to be considered and obtained in fireplace construction are: (1) proper flue area, (2) correct proportioning and location of the throat, (3) properly constructed smoke shelf and chamber, (4) chimney with good draft and no interference, and (5) a shape which will direct a maximum amount of radiated heat into the room. These factors have been carefully considered and a large blue printed chart prepared to give pleasing fireplace opening proportions and correct construction dimensions for any fireplace within the range of 2' to 6' wide. The dimensions are clearly marked and easily obtained from the drawing. The plate also shows details in framing of joists, rafter, firestopping, etc. around the fireplace. A complete discussion of these details may be obtained from the U. S. Farmers' Bulletin No. 1649, Construction of Chimneys and Fireplaces.

A fireplace should be in harmony with the rest of the room in proportions and details. Pleasing proportions as well as proper draft conditions are usually obtained when the width is greater than the height. These considerations and the kind of fuel to be used largely determine the size of the fireplace opening. The harmony of the fireplace details with the rest of the room, however, is not such a simple matter. Each type of architecture and each living room presents the problem of harmony combined with individuality. In order to help solve this problem, the Department of Agricultural Engineering of the State College of Washington has prepared a few blue prints showing the elevations and plans of fireplaces which are more or less standard and are generally used with a few types of architecture.

\* \* \* \* \*

H-47 FIREPLACE DETAILS AND DATA -- SHEET 2

This sheet shows a plan and an elevation of two fireplaces; namely, the Dutch Colonial fireplace and the English Colonial fireplace.

The Dutch Colonial fireplace is similar to the Georgian Colonial except that it is usually flanked by cupboards. It usually projects into the room, which projection extends unbroken to the ceiling. The hearth and fireplace opening is of simple design in brick, Dutch tile, or marbled quarry tile. Surrounding the tile opening, the fireplace is simply architruved in wood or fitted with a mantel. The walls surrounding the fireplace and above the mantel are plastered.

The English Colonial fireplace presents a bold massive feeling of plank and wooden peg construction in line with the exterior of the house and the interior of beamed ceiling with wide, stained, V-grooved board walls. The design shown fits the informal setting found in the modern English Colonial interiors. The brick hearth is arranged in a decorative design. The fireplace opening is surrounded by a single row of face brick laid flat and lengthwise on the side and vertically above the opening. The projection of the fireplace into the room terminates at the mantel.

\* \* \* \* \*

H-48 FIREPLACE DETAILS AND DATA -- SHEET 3

This sheet shows a plan and elevation of two fireplaces; namely, a fireplace of Spanish Precedence and a fireplace of Mediterranean Precedence. Both of these plans are well suited to the modern small home and bungalow.

The fireplace of Spanish Precedence combines good construction with simplicity of design. The elevation is plain and completely plastered except for the single row of face brick surrounding the opening and extending around the fireplace projection at the floor level. The projection of the fireplace into the room remains undiminished to the ceiling. A plank mantel is supported on wooden brackets. A pair of wall lights above the mantel allow a distinctive and artistic touch. A brick hearth in decorative design is used with this fireplace.

The Mediterranean Precedence fireplace uses glazed tile hearth and trim around the slightly arched fireplace opening to economically obtain a rich, distinctive appearance. The mantel is short and apparently supported by wood brackets. A small niche inset behind the mantel lends individuality and makes an excellent setting for a picture lighted indirectly. The projection of the fireplace into the room extends to the ceiling. A wide cove moulding effectively joins the walls to the ceiling.

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## THE KITCHEN

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The kitchen is ordinarily the most important room of a house. Here the housewife spends the major part of her housework hours. It is the center of activities at least three times a day throughout the year and should, therefore, receive careful consideration as to location, arrangement, and accessories.

The kitchen makes a convenient starting point in planning the home. A corner position allows ample light and good cross-ventilation when the windows are opened. In fact, ventilation and light are of such importance that a farm kitchen with a single outside wall should be avoided. The dining room should be close, preferably alongside with a swinging door connecting. The rear hall, if included in the plan, and the cellar stairs should be in such relation to the kitchen that the housewife may reach either without passing through other rooms.

The most conveniently arranged kitchen is obtained when the equipment is considered in three separate classes. These classes are: the supply unit, the cooking unit, and the sink unit. The supply unit must include mixing tables and is preferably close to the cooking unit to avoid carrying seasoning and dishes around the room. An 11' x 13'\* kitchen is the average size with wall space, built-in cupboards, etc., carefully planned and laid out before the house is built. If it is necessary for men or workers to pass through the kitchen, the outside door should be as close to the hall and dining room doors as possible.

A farm kitchen arrangement can hardly be called complete without most of the following accessory rooms: basement (or cellar), breakfast nook, screened porch, separate wash room, and separate laundry.

The two kitchen plans illustrated and described in this plan book are worthy of careful study.

\*Average size from 325 farm home plans submitted in W.S.C. Farm Home Competition, 1926.

H-61 \* PLAN OF A MODEL KITCHEN

This is a very convenient, completely equipped kitchen plan which would save the housewife many steps every day. It is located on the corner of the house with windows on two sides to give a cross-ventilation. As shown, this kitchen is equipped for electric range and refrigerator but can easily be adapted for wood or coal stove.

All kitchen supplies are grouped together in cupboards and bins around a small working table placed in front of the window so that the housewife may enjoy an open window during the summer and ample light at all times. The sink is located below a large double window, and is in the proper working position for a right handed person. A stack table or tea wagon standing at the right of the sink will hold dishes waiting to be washed. Cupboards for clean dishes, pots and pans are at the left of the sink. The range is directly across the room from the double windows over the sink so that ample light is reflected into the oven. The serving table, for hot dishes, at the right of the stove and the dish cupboards are close and handy to the swinging door into the dining room.

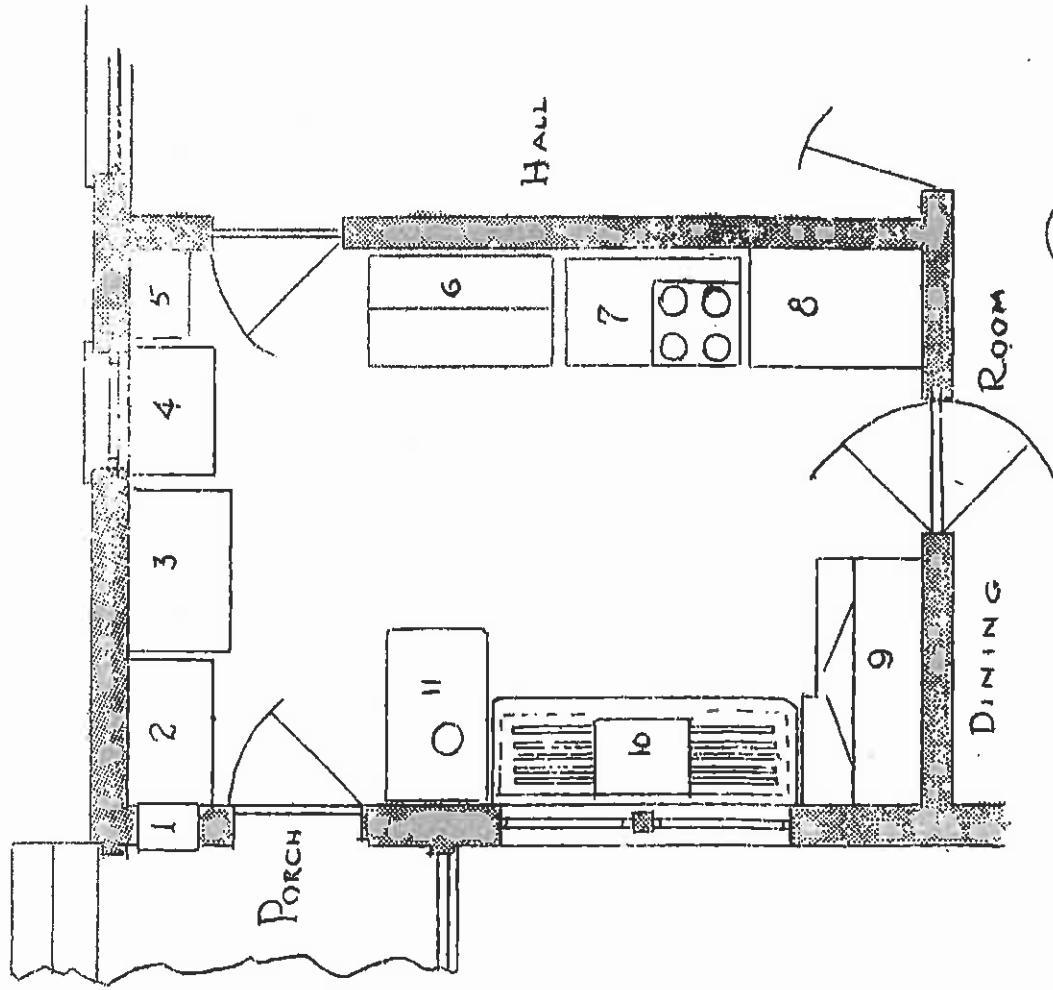
\* \* \* \* \*

H-62 \* PLAN OF A KITCHEN LAYOUT

This kitchen is built out from a side, end, or corner of the house with only one end being adjacent to the rest of the house. This location permits direct cross-ventilation of the kitchen and aids greatly in keeping the house cool in the summer without seriously affecting the warmth of the kitchen in the winter if the walls are well built. It is also possible to arrange the kitchen with windows on three sides to permit a more complete view of the farm buildings. A screened porch of any size may be used with this kitchen.

The interior arrangement features a long built-in work bench with shelves, drawers, and bins underneath. Wall space may be used to good advantage because only two doors are required. A built-in wood box filled from the outside may be installed under the window at the fireless cooker. The fireless cooker or oil burner may be placed in front of the wood box during the summer when the wood range is not being used. Note that in these plans every foot of wall space is utilized.

\* \* \* \* \*

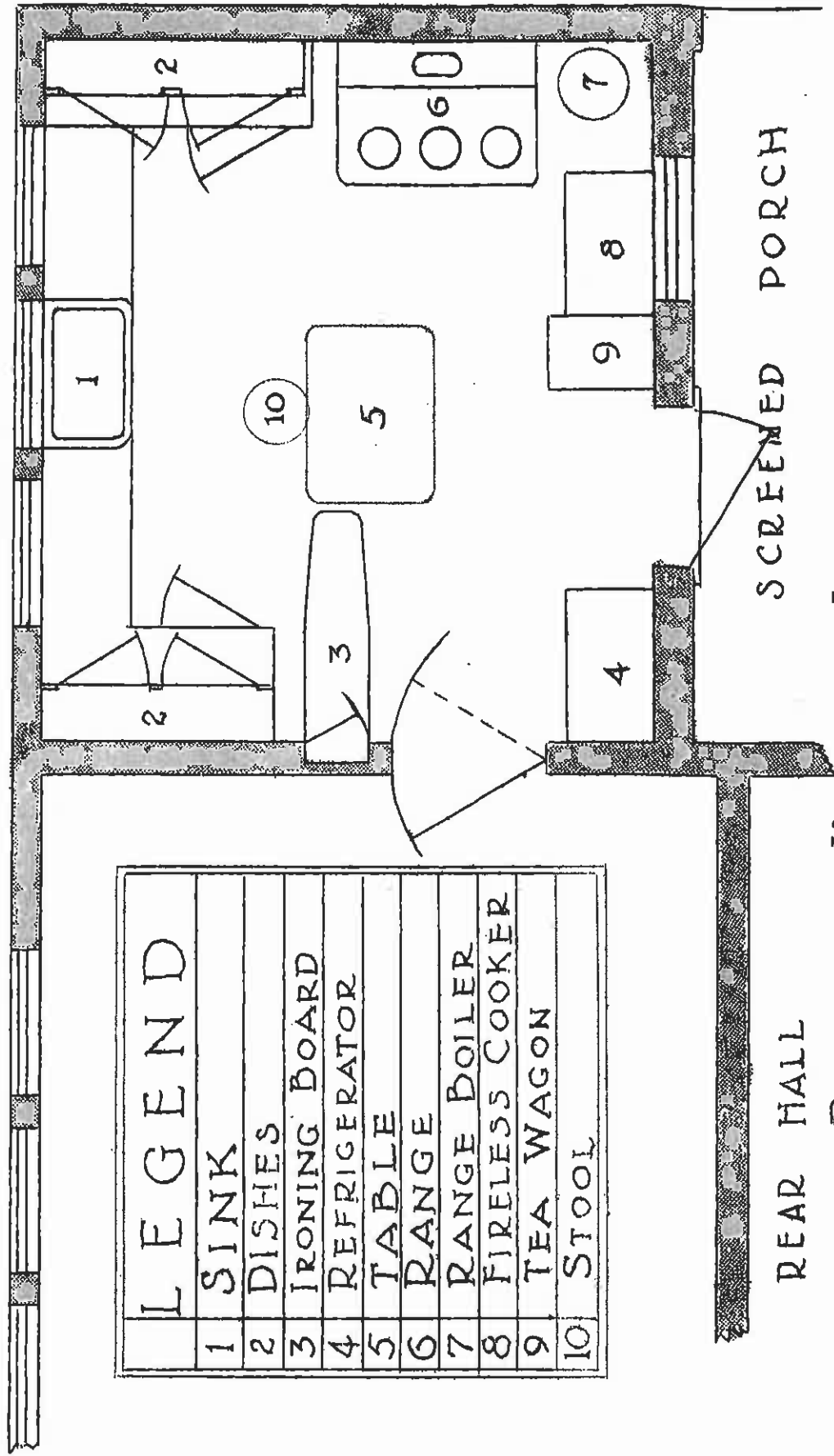


1	PACKAGE RECEIVER
2	STORAGE FOR CANNED GOODS ETC.
3	REFRIGERATOR
4	TABLE
5	BROOM CLOSET
6	KITCHEN CABINET
7	RANGE
8	SERVING TABLE
9	DISHES, PANS, ETC.
10	SINK
11	STACK TABLE

PLAN OF A MODEL KITCHEN.

(H61)





## HOUSEHOLD EQUIPMENT

### H-81 \* ICE CHEST

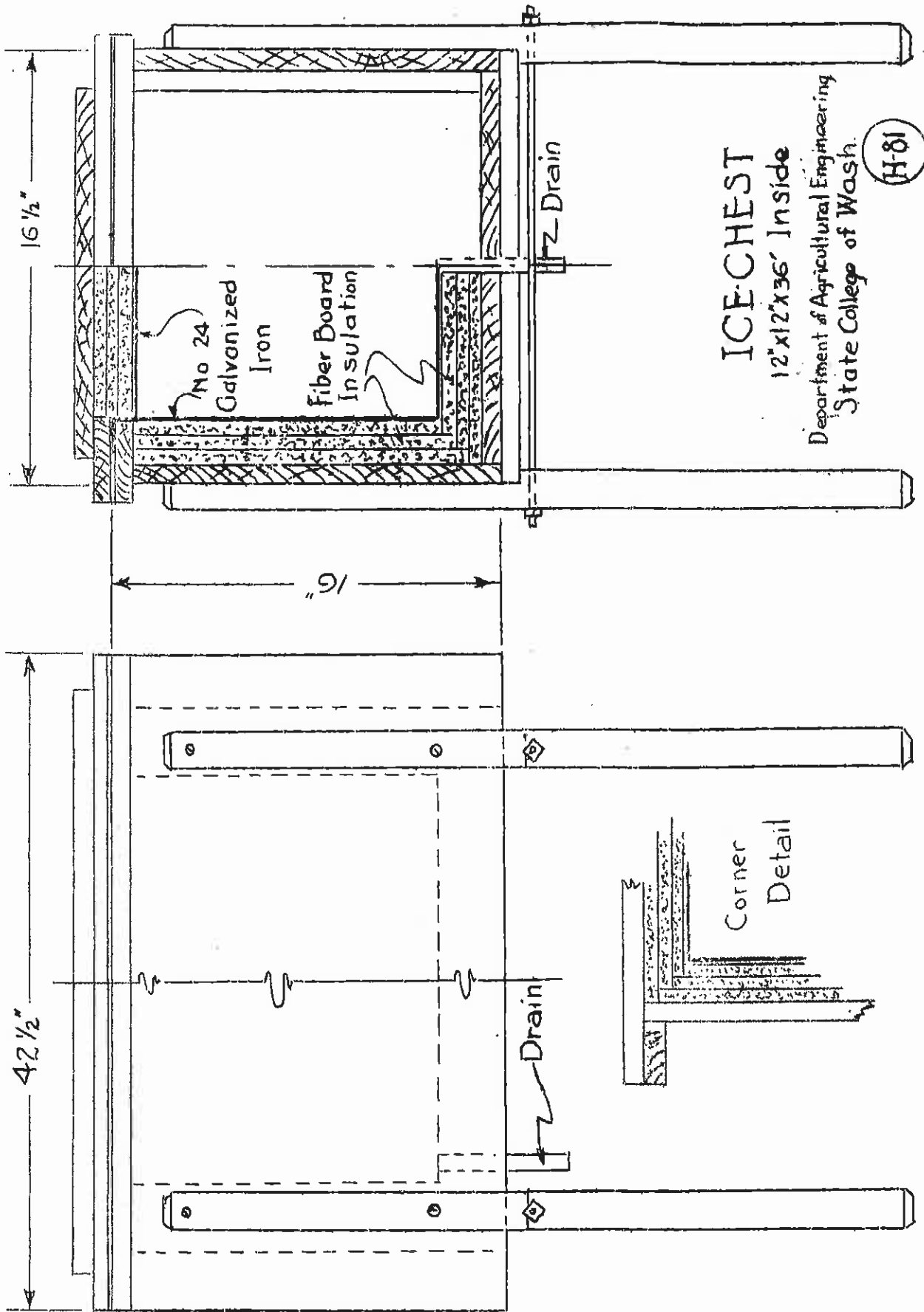
An ice chest, though little used has a great advantage of economy over ordinary ice boxes. The chest shown is simple, inexpensive, and efficient. The inside dimensions give 3 cubic feet capacity, one of which is occupied by the ice leaving two cubic feet for storage space. This space will accommodate daily supplies for most families and 40 pounds of ice. Temperature can be maintained quite constantly at about 42 degrees until less than 5 pounds of ice remains. Thirty pounds supplied twice a week or 50 pounds once a week is ample if the chest is kept in the basement or in some equally cool place.

The box is constructed from 1" x 3" or similar material. The bottom is notched into the legs and held from spreading by use of a threaded rod to prevent loosening if ice is accidentally dropped. This construction is shown in the diagram. The fiber board is cut to fit and put into place in the following order: bottom, sides, ends. The second and third layers of insulation are installed successively with all joints cut to fit snugly. Top strips are then put in place and galvanized iron lining may be made and put in position. All joints in lining must be made water-proof by soldering. The drain is soldered in the opposite end from the ice and may be in a corner. The cover is made by filling with three layers of fiber insulation and covered with galvanized iron. Hinges must lie flat to prevent air circulation. The drain pipe must be sealed to prevent loss of cold air. Proper seal may be obtained by allowing the drain pipe to terminate under water in a pint fruit jar or other vessel. A water trap may also be formed as in the kitchen sink with the use of elbows threaded onto the drain pipe. Melting ice will furnish enough water to keep the seal permanent.

Slatted boards may be set in the bottom to keep the contents out of the water draining from the ice. Shelves may be added as desired.

This ice chest was designed by C. C. Johnson of the Agricultural Engineering Department, State College of Washington.

\* \* \* \* \*



**ICE CHEST**  
 12" x 12" x 36" Inside

Department of Agricultural Engineering  
 State College of Wash.

(H-81)

H-82 \* WARDROBE

This illustration is a pictorial view of a wardrobe which makes a very good clothes closet where such is not already in the room or where it is impossible to provide room for a closet. The wardrobe is made as high as the ceiling will permit, and it is wide enough inside to allow clothes on hangers to be hung on a pole without brushing the wall or the door. A pair of drawers at the bottom provides room for small articles which are not often used and a large shelf over the clothes may be used to store pillows, blankets, etc. This wardrobe is stationary and is usually placed in a corner of the room. The working drawings show complete details of construction in blue print form.

\* \* \* \* \*

H-83 RADIATOR CASE

A radiator case is designed as a screen to hide steam or hot water radiators, particularly during the summer when the heater is not used. The case has the appearance of a low bookcase with a screen central portion. If it is desired to use the case during the winter, a hole must be cut in the screen to allow adjustment of the regulating valve, which should preferably be of the lever type.

\* \* \* \* \*

H-84 STUDENT TABLE CASE

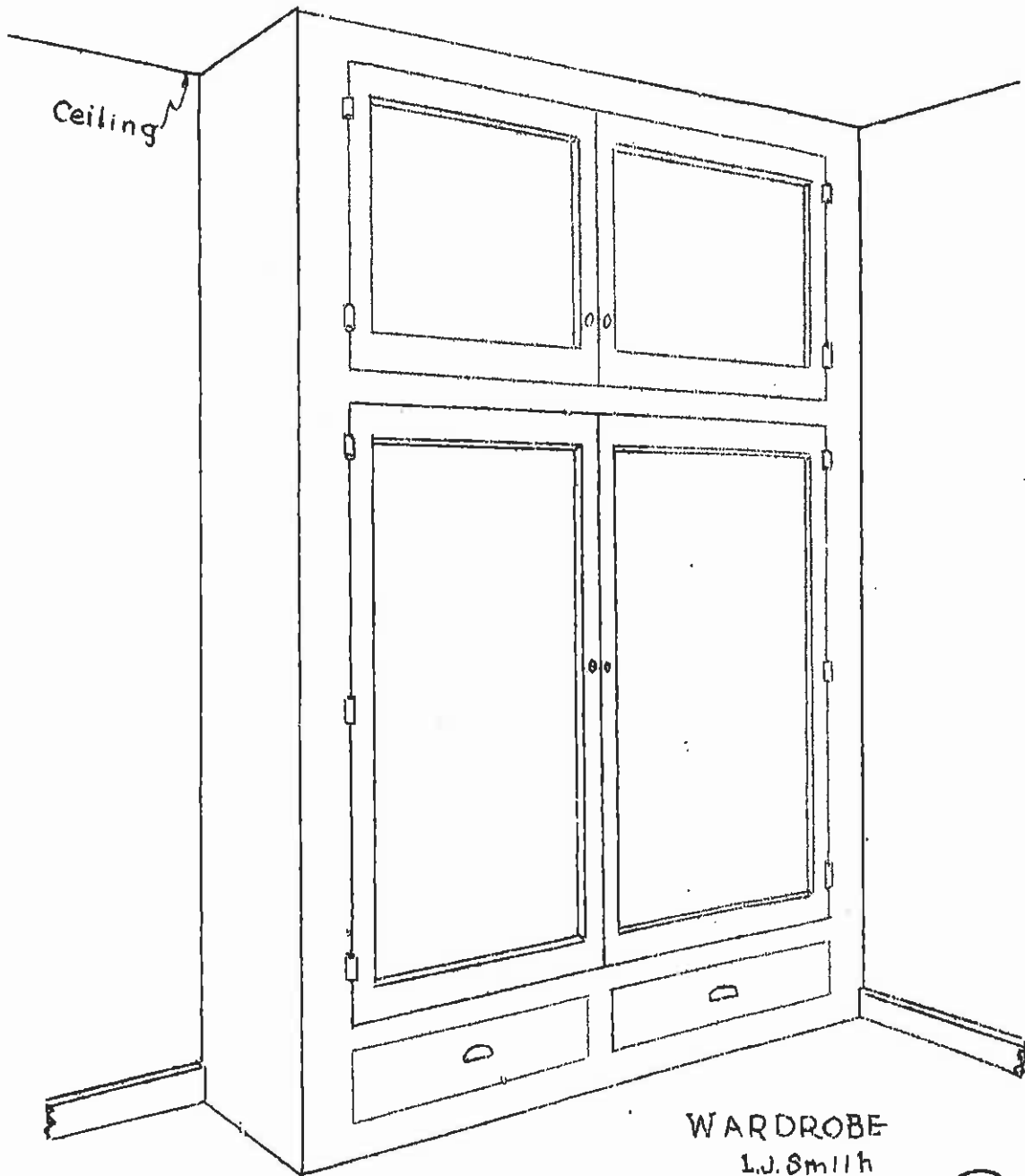
The blue print shows an arrangement of book shelves for short and tall books, shelves for paper, pigeon holes for letters, bulletins, etc., which makes a very good desk top for students and may be used in the home office or as a play cupboard for children.

\* \* \* \* \*

H-65 BLACKING STAND

The blue print gives full details for making a shoe-blackening stand. The stand is a handy household utility and a practical lesson in use of tools to the younger men in the family. The stand is light in weight, portable, includes a foot rest for use while shining the shoes, and a covered box for holding polish, brushes, cloths, etc.

\* \* \* \* \*



WARDROBE  
L.J. Smith

H-82

## FARMSTEAD LAYOUTS AND LANDSCAPING

### FARMSTEAD LAYOUTS

- L-11 \* Small Farmstead Plan, One Acre
- L-12 \* Dairy Farm Layout, Two Acres
- L-13
  
- L-19 Assorted Layouts

Service Charge  
any 3 drawings  
.25

### LANDSCAPING AND FENCES

- L-21 A Garden Gate
- L-22 A Trellis Fence
- L-23 \* House Trellises and Arbor Design
- L-24
  
- L-26 Lawn Bench

### ROADS

- L-31 Minnesota Road Planer
- L-32 Snow Plow
- L-33

\*Note: Asterisk (\*) denotes that plan is illustrated.

The plans here catalogued have been prepared by the Agricultural Engineering Department of the State College of Washington for the general use of the public. They may be obtained upon request and remittance of the small service charge directly to the department, using money order or small postage stamps. Additional plans will be added as they become available. The complete manual listing all plans may be obtained from the Extension Service of the State College of Washington for a nominal charge.

## GENERAL SUGGESTIONS FOR PLANNING THE FARMSTEAD

The position of the dwelling with respect to the highway and other buildings is the key to the entire farmstead layout, and should be given first consideration. The house should stand at least 100 feet from the highway, which distance retains an intimate contact with the highway, but allows a measure of privacy, an attractive setting, and freedom from dust. There are two general locations of the house with respect to the rest of the buildings. In one position the buildings are arranged so that they may be seen from the house and in the other the house is separated from the buildings by trees, shrubbery, etc., arranged to give an attractive background to the house. In either case it is desirable to have the farmstead present an attractive view from the highway.

A rectangular barnyard from which all buildings are accessible will require a minimum of travel while performing the chores. The occupants of the house can most readily detect unusual occurrences if most of the building entrances are visible from the rear windows. Garages and wood sheds are usually close to the house, while the barns are the greatest distance away. The barns should be located to the leeward of the house to avoid possible annoyance from odors carried by the summer winds.

The driveway should be short and looped if space permits. A short driveway presents the least problem of maintenance. A loop provides space for visiting vehicles to park or turn around and makes it possible to drive close to the house when necessary. When a loop is provided, heavy farm traffic should be routed over the side of the loop away from the house. A short, well-lighted driveway, close to the house, tends to discourage night marauders from entering the premises.

\* \* \* \* \*

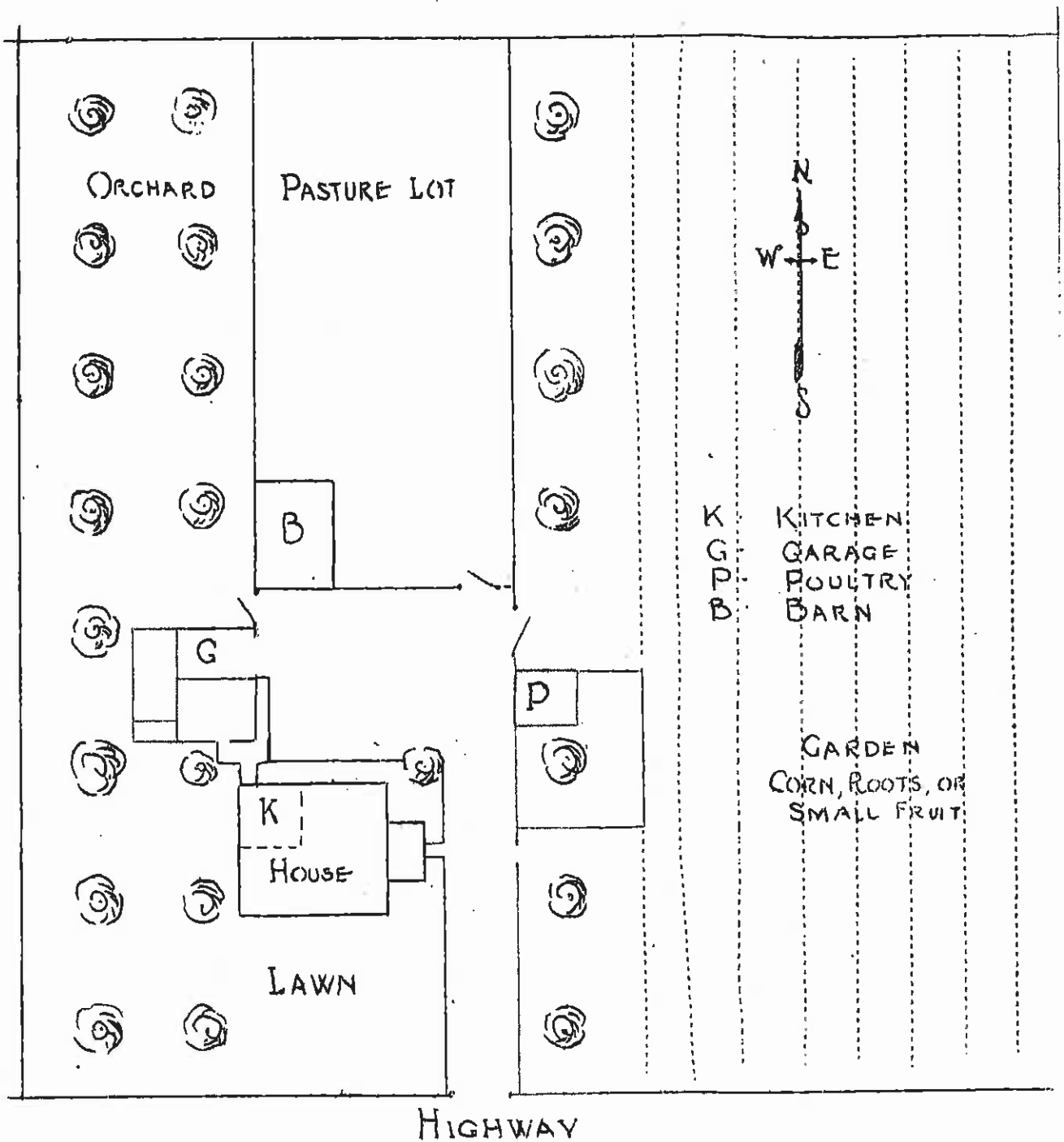
### L-11\* SMALL FARMSTEAD LAYOUT

The accompanying illustration shows a small farmstead complete on only one acre of ground. It is suggested as a home for small families that desire space enough to raise their own garden and poultry. The lot has a frontage of 200 feet and a length of 217.8 feet.

The small size of this homestead requires careful planning to avoid waste of space. The buildings are of necessity small and closely grouped. At the rear of the house near the kitchen is a combination building about 22' x 24'. This building provides garage, wood storage, small laundry, and pump house. The building may also provide a small well-insulated room, about 4' x 6', for storage of vegetables and canned goods if no basement is provided under the house. A small barn provides stabling for the family cow, horse, and garden implements. The poultry house may be as small as 10' x 12', which will care for about 30 of the heavier breeds of chickens. The garden and orchard are large enough to provide fruit and vegetables for a small family. Orchard trees may also be used as shade trees on the lawn.

For large families on non-irrigated land, it may be desirable to have more than one acre of ground. In such cases, the frontage may remain the same, but the subsistence farmstead may extend farther from the highway.

\* \* \* \* \*



SMALL FARM HOMESTEAD LAYOUT  
FOR ONE TO FIVE ACRES

DEPT. OF AGRICULTURAL ENGR.  
STATE COLLEGE OF WASH.



L-12 \* A COMPACT DAIRY FARMSTEAD

This plan illustrates an arrangement of buildings on a two-acre plot. It is suggested for a dairy farm but may be used on any type of general farm. The milk house with truck garage alongside is conveniently located between the house and the barn. Odors from the barn and hog house will not be blown toward the rest of the buildings during the summer in most localities. The implement shed with shop alongside is convenient and the location is near the lanes from the fields. The poultry house, passenger car garage, and wood shed are close to the house and away from the highway. A good lawn, garden and orchard may be used to give the layout a pleasing and homelike appearance from the highway. A good yard light at the corner of the yard near the house will light up the whole farmstead.

\* \* \* \* \*

L-19 ASSORTED FARMSTEAD LAYOUTS

Several farmstead plans have been prepared by the Department of Agricultural Engineering which may be obtained if desired, at a nominal service charge. In order to obtain the suggestive plans which will most closely fit the individual need, the following information should be given or estimated: size of farmstead, distance and direction to highway, slope of land, drainage, creeks, etc., direction of desirable and undesirable views, direction of prevailing winds, and size and number of buildings to be included. A rough sketch will be of great assistance.

\* \* \* \* \*

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LANDSCAPING AND FENCING

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L-21 A GARDEN GATE

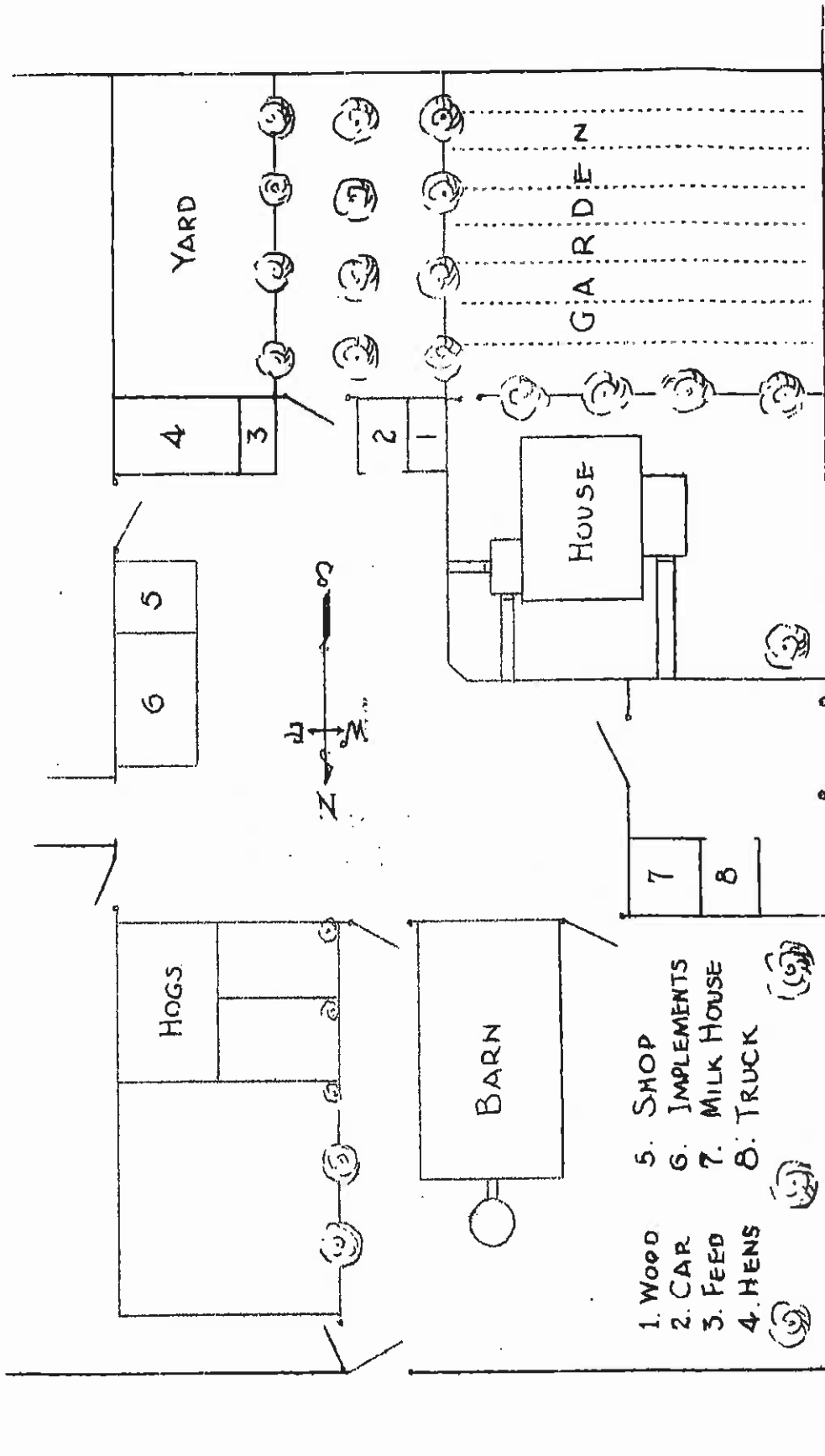
This is a beautifully designed combination garden gate and arbor which will add distinction to the entrance of any garden or yard. It is built entirely of lumber, and when painted white or covered with vines, it presents a pleasing appearance. A welcome, homelike touch is added by a seat or bench built on either side of the pathway.

\* \* \* \* \*

L-22 A TRELLIS FENCE

The design of this fence which is made of 1" x 2" material will give a great measure of privacy to any garden or yard after it is covered with climbing vines. The fence as shown is 6'2" high but may be raised or lowered if desired. The plan also includes the design of a suitable entrance to the yard enclosed.

\* \* \* \* \*



HIGHWAY  
 PLAN OF DAIRY FARMSTEAD  
 TWO ACRES - 220 X 400  
 DEPARTMENT OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASH.

L-23 \* HOUSE TRELLISES

This plan, which is illustrated, offers a pleasing arrangement of an arbor for encouraging the growth of vines up a wall, between windows or to form an arch around a window.

\* \* \* \* \*

L-26 \* LAWN BENCH

This plan is the design of a strongly built, comfortable lawn bench with a sloping backrest. The bench is easily constructed, durable, and not easily tipped over. This bench is suitable wherever a bench is needed as in gardens, parks, or by the roadside.

\* \* \* \* \*

ROADS

L-31 MINNESOTA ROAD PLANER

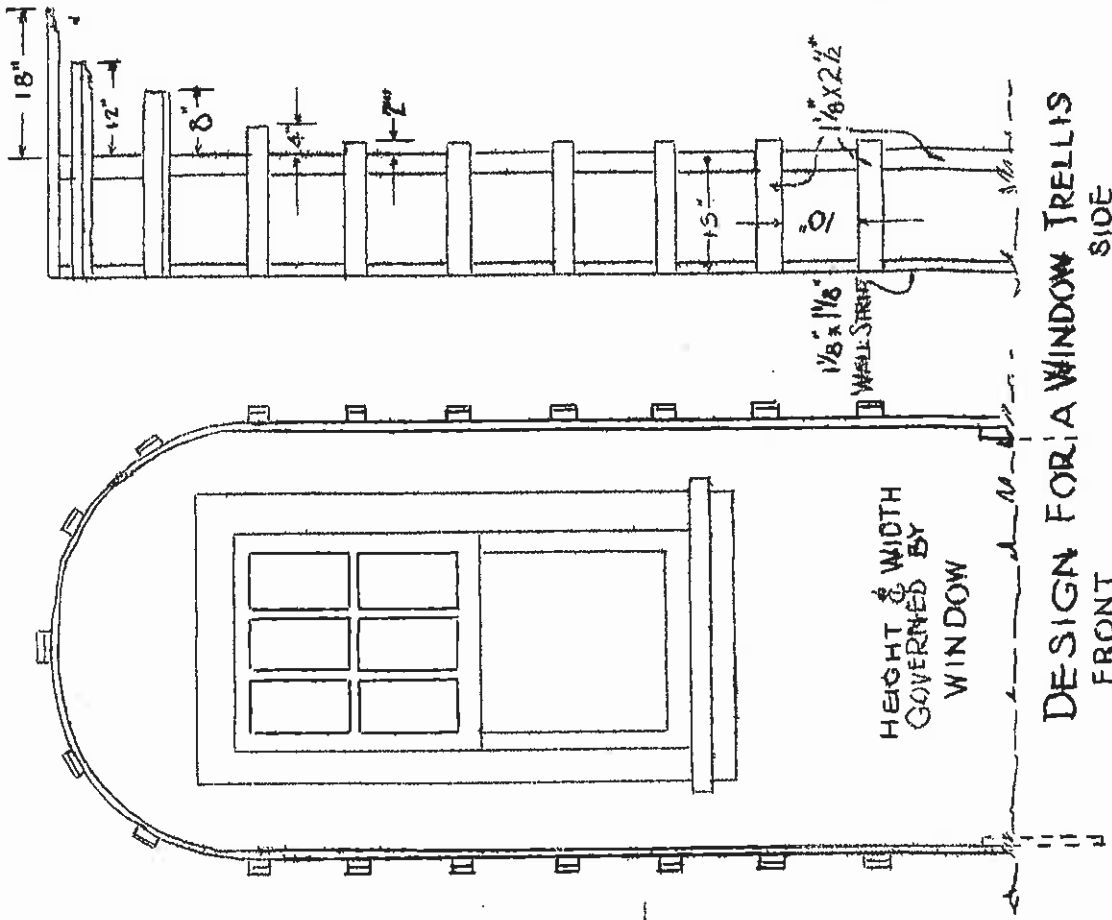
This plan shows the arrangement and sizes of materials required to make a two bladed, iron shod, skid or leveler for use in planing and smoothing country roads and lanes. This simple farm convenience will be of great assistance in farm road upkeep.

\* \* \* \* \*

L-32 SNOW PLOW

This is a plan of a strong V-shaped snow plow which is made of heavy timbers and is used for shoving snow aside. The wearing edges and point of this plow are shod with sheet metal. A handle arrangement is provided to aid in steering the plow.

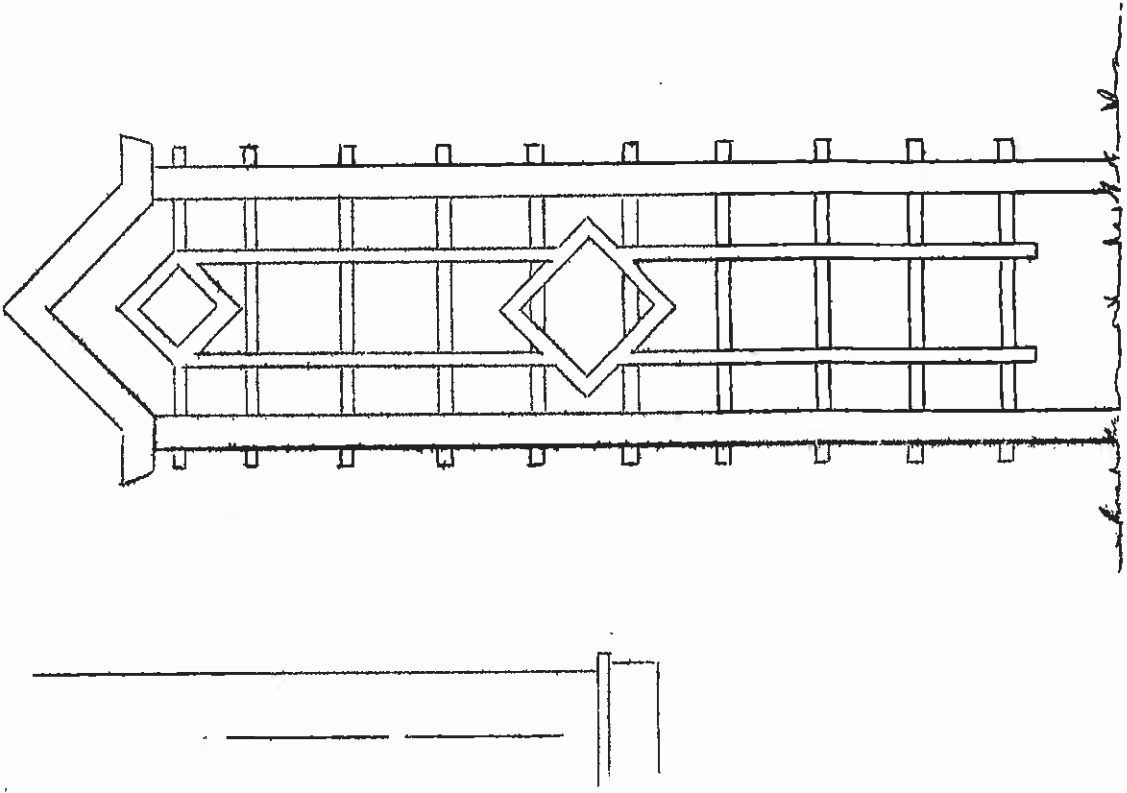
\* \* \* \* \*



TWO TRELLIS DESIGNS

L. J. SMITH — SCALE 1/2" = 1'-0"

(L-23)



DESIGN FOR A WALL TRELLIS

DAIRY STRUCTURES AND EQUIPMENT

MILK HOUSES	Service Charge
D-11 * Ten by Twenty Foot Milk House	.....
D-12 * Twelve by Eighteen Foot Milk House	.....
D-13 * Ten by Twelve Foot Seattle Milk House	.25
D-14 * Ten by Twelve Foot Milk House	.....
D-15 * Eight by Eight Foot Milk House	.....
D-16 * Eighteen by Eighteen Foot Milk House	.....
D-	
MILKING BARNS	
D-21 * Six Stall Walk Through Milking Barn	.....
D-	
D-24 * Eighteen Stall, Two Row Milking Barn	.25
FEED AND SHELTER BARNS	
D-26 * Feed and Shelter Barn for Loose Cattle	.50
D-27 * Open Feed Shed for Mild Climates	.50
D-28 * Beef Barn	.25
D-	
D-32 * A. E. Dairy Barn - Heading Out	.50
D-33 * Prosser Dairy Plan	.50
D-	
UNCLASSIFIED	
D-41 * Bull Pen Layout and Safety Details	.20
D-42 * W. S. C. Dairy Stall	.20
D-43 * Standard Dimensions of Two Row Dairy Barn	.....

Note: Asterisks (\*) denote that plan is illustrated.

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## MILK HOUSES

A good milk house, carefully planned and well constructed, is essential to the production of high-class milk. Local ordinances usually require that the milk house be entirely distinct and separate from the barn and from all living quarters. Recent changes in the U. S. Standard Milk Ordinance require that the milk house be partitioned to separate the handling of milk and the storage of cleansed utensils from the cleaning and other operations. The status of the partition has not been officially recognized in all the localities, but it may well be considered when planning this small but important farm building.

The walls and ceiling of the milk house must be tight, warm, and easily cleaned. Painted walls are less affected by the excessive moisture conditions of the milk house and they may be renewed cheaply. The floor must be of impervious material, preferably concrete, with a uniform slope towards a central floor drain. All doors, including screen doors, should be equipped with selfclosing spring devices.

The milk house should be well lighted both naturally and artificially. Lights should be high up, out of reach of the worker, and operated solely by wall switches near the door. All windows should be fitted with good, tightly fitting screens.

A ventilator of ample size should extend from the ceiling to above the peak of the roof. It should be screened at the roof level to prevent the entrance of flies. Sliding shutters may be provided for partially closing the flue entrance as the occasion demands.

The kind and amount of equipment necessary in a milk house varies with the type of dairy. All milk houses should be provided with an abundance of hot and cold water with adequate facilities for washing and sterilizing cans, bottles, equipment, etc. Small dairies shipping only cream, in cans, require the least equipment and consequently the smallest house. The larger dairies, particularly those which handle bottled milk, use more equipment and therefore need larger milk houses. The floor plan diagrams shown have been carefully selected, and illustrate several good types. For the larger dairy farms, the dimensions can be increased readily.

The cooling vat or cold box in a milk house is of great importance, particularly, if marketing is not done more than twice a week. The cold box may be cooled with either ice or a mechanical refrigerator. With either type of refrigerant it is preferable to keep the dimensions as small as possible in keeping with the maximum number of cans to be stored. There is no reason for having the cold box higher than six or seven feet as cans or bottles will not be stacked higher than the head. By keeping the cold box low it is possible to install the mechanical apparatus above. When a cold box is not used, the cans are usually kept in a vat surrounded by water cooled with pieces of ice--usually natural ice. An iced-water cooling vat should allow approximately three gallons of water to one of milk. When the water is 21" deep in the tank the following dimensions of rectangular cooling tanks will usually give satisfaction.

No. of 10-gallon cans	2	3	4	4	6	8
Width	20"	20"	20"	36"	36"	36"
Length	20"	44"	66"	50"	78"	96"

D-11 \* U.S.D.A. MILK HOUSE PLAN NO . 1336

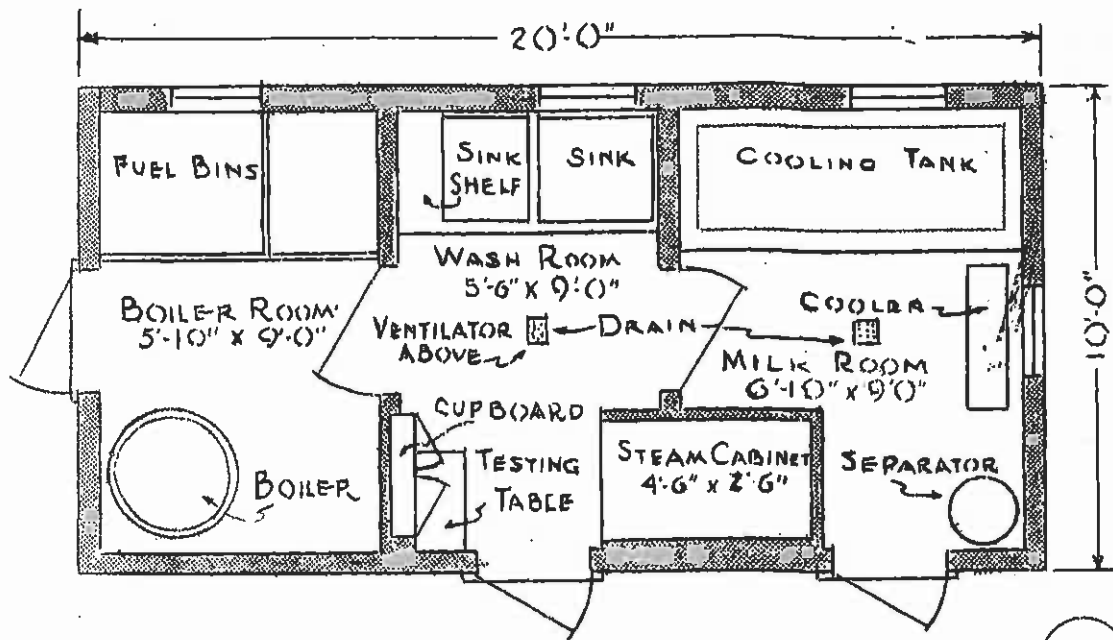
This is one of the best all-around milk houses for 20 to 30 cow dairies shipping milk or cream in cans. It is small and inexpensive - yet provides separate rooms and entrances for boiler, washing operations, and milk handling equipment. The plan is similar to many already in use but has recently been slightly revised to include a steam cabinet. The cooling tank is sunk below the floor level to minimize the lifting of cans of milk. This plan may be arranged for bottling by omitting the cooling tank and putting a bottler and cold room in its place.

\* \* \* \* \*

D-12 \* A SMALL 12' x 18' MILK HOUSE FOR BOTTLERS

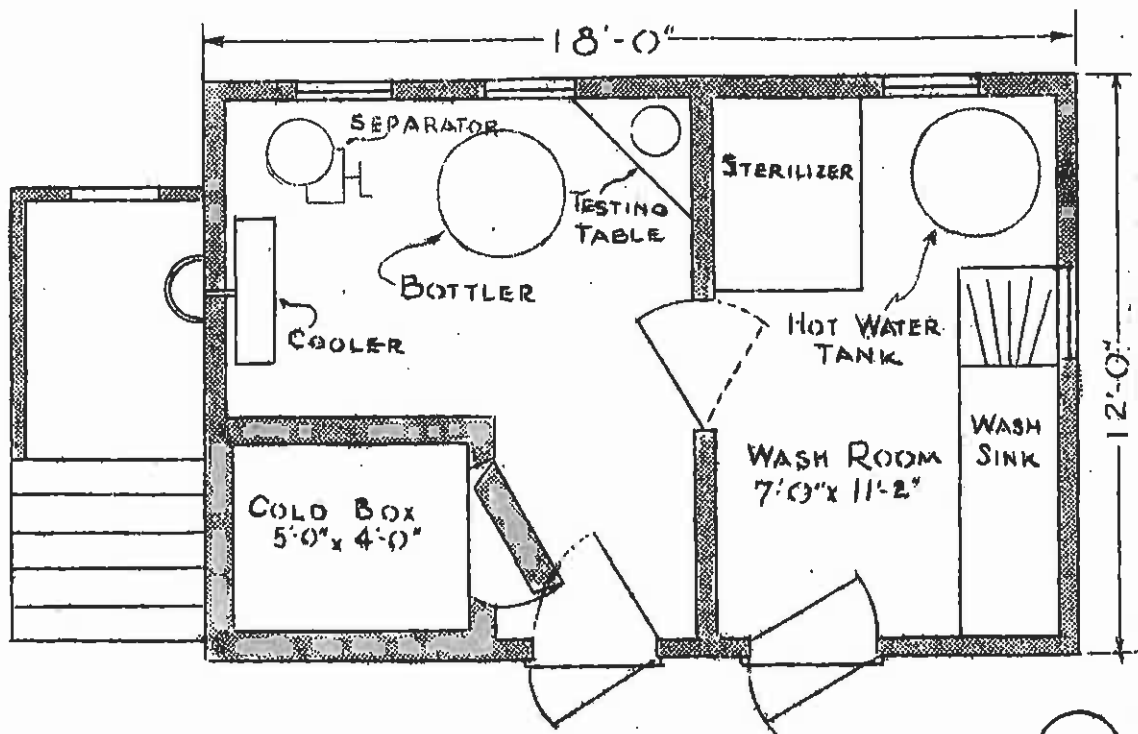
This is a very conveniently arranged milk house which allows considerable equipment in a small space and may care for up to 50 cows. An outside door is provided for the washing room so that empty bottles from the truck may be handled easily. The wash room is correctly arranged so that all movement of bottles and cans is from right to left. Space is provided for all of the usual milk handling equipment. The cooler is placed near the wall and so arranged that the milk may be strained into it from outside of the building. A raised platform and light open shed protect the cooler outside of the milk house and make it unnecessary for men coming from the barn to enter the milk house while carrying buckets of milk. The bottler can be placed alongside of the cold room so that milk running through the cooler runs directly into the bottler vat, thus saving part of the handling. The cold room is located near the door convenient for loading the truck. The capacity of the cold room depends upon the type of cooling system used but will probably not exceed fifteen 10-gallon cans or thirty-six cases of milk. The need of a cold box depends, of course, upon the frequency of marketing. If the milk is marketed immediately after milking, no cold room is needed. This plan does not provide space for a fuel burner to heat the water. If such equipment is needed, it may be housed in a small addition built alongside of the washing room.

\* \* \* \* \*



U.S.D.A. MILK HOUSE--PLAN No. 1336  
FOR SHIPPING MILK OR CREAM  
10'-0" x 20'-0"

D-11



A SMALL MILK HOUSE FOR BOTTLERS  
12'-0" x 18'-0"

D-12

SCALE 1/4" = 1'-0"



D-13 and 14 10' x 12' \* MILK HOUSES FOR SHIPPERS

These two plans are adaptations of a plan recommended by the Milk Inspection Division of the Seattle, Washington, Health Department. They are convenient, compact, and inexpensive, and are recommended for dairy-men milking 30 to 35 cows. A small door is provided in the wall so that the milk may be poured into the cooler without entering the building. The door to the cooler is protected from the weather by a small roof. A loading platform three steps above the truck ground level is provided to facilitate loading cans on the truck. The cooling tank is alongside of the loading platform and is straddled by the operator while removing the cans. If desired, the short walk between the barn and milk house may be roofed but not closed in.

\* \* \* \* \*

D-15 \* A SMALL 8' x 8' MILK HOUSE

This plan illustrates a very small and convenient milk house which may be used on small farms shipping cream only. This house is large enough to contain a wash sink, sterilizer box, can rack, separator, and cooling vat arranged in such a manner that all movements are from right to left. The cooling vat shown will hold two 10-gallon cans so that this house will care for a herd of 20 cows if the cream is marketed two or three times a week. A larger vat may be used if more than two cans will be filled between marketings. The house does not provide a partition between washing and milk handling equipment so that washing operations should not be done while milk is being handled. This plan is adapted from California Milk House Plan No. C-140.

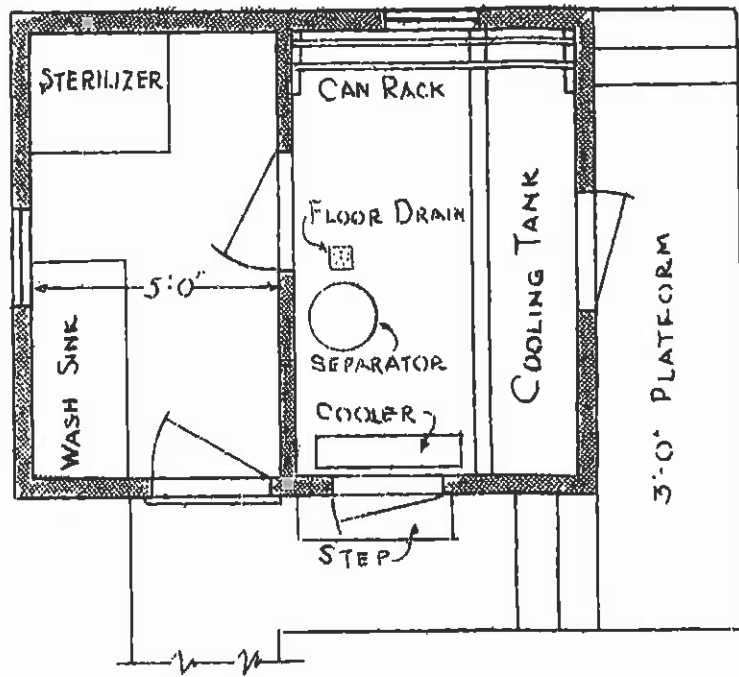
\* \* \* \* \*

D-16 \* AN 18' x 18' MILK HOUSE FOR BOTTLERS

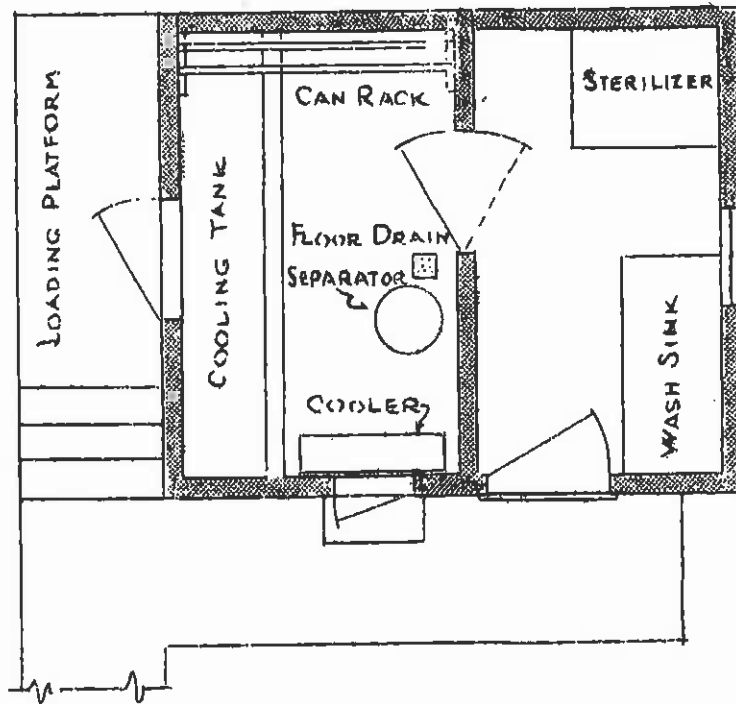
This plan is a fairly large milk house that has been found quite satisfactory for small dairies distributing bottled milk. In addition to the usual equipment, this plan allows room for the boiler and its fuel. A wash basin is also provided and located near the boiler room for the convenience of the boiler tender. The bottle washer is separated from the rest of the milk house by a partition and is situated between the boiler room and the cold room. The cold room is located near the bottler and the door for convenience in handling the bottled milk and in loading it on the truck. If a larger cold room is desired, it may be easily obtained by lengthening the one shown.

Considerable space is allowed in the center of the room for stacking cases of bottles, etc. when necessary. The original of this milk house plan is located in the Yakima Valley and is used on a dairy of about 30 cows.

\* \* \* \* \*



D-13



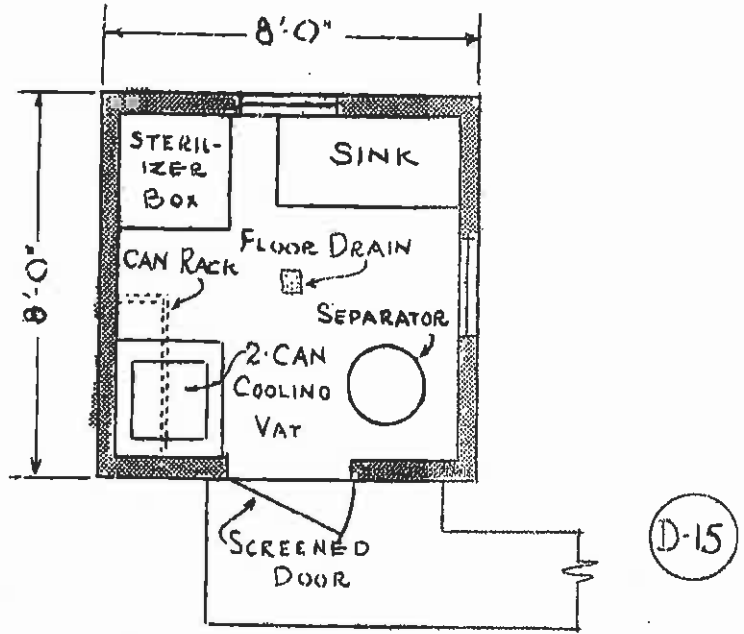
D-14

TWO ARRANGEMENTS OF A  
10' X 12' MILK HOUSE FOR SHIPPERS

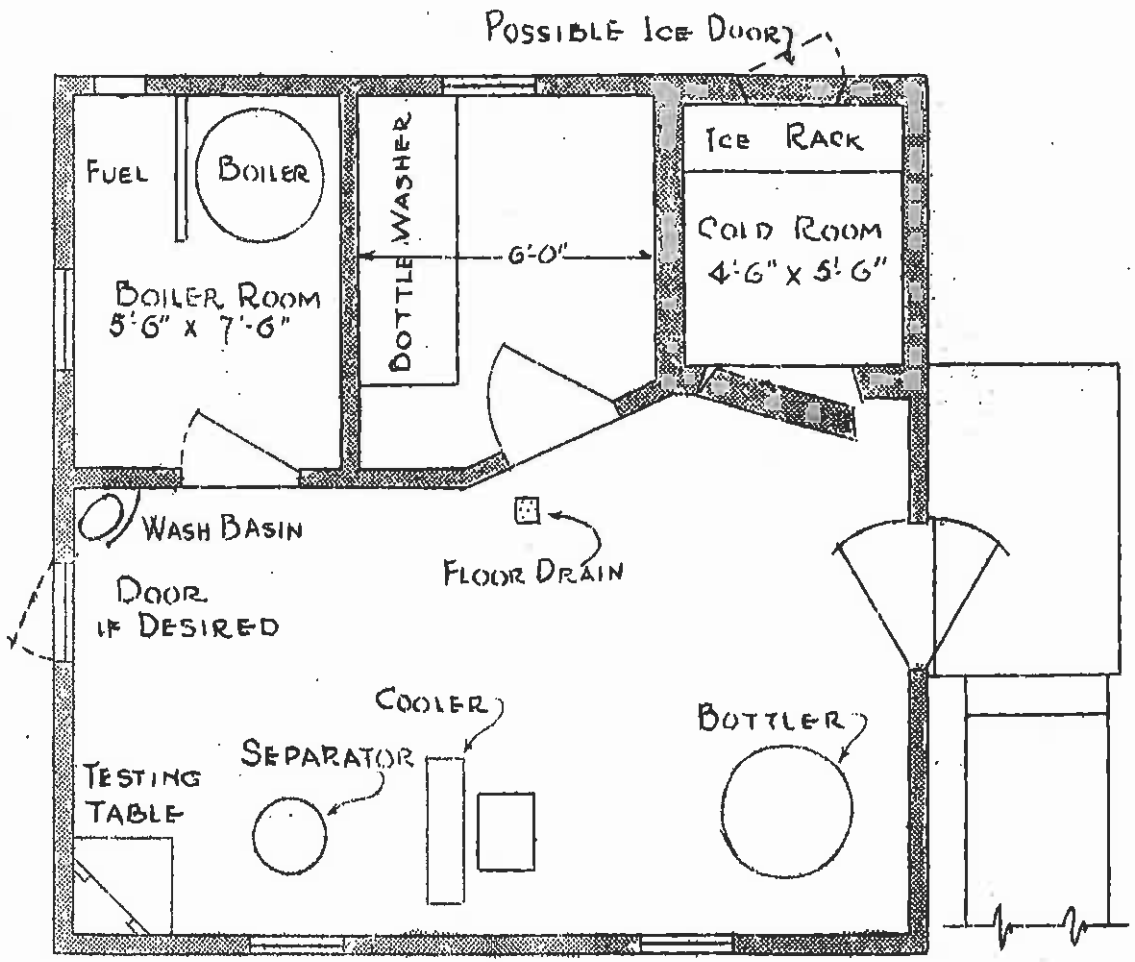
CAPACITY - 35 COWS

SCALE 1/4" = 1'-0"

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON



A SMALL MILK HOUSE PLAN  
FROM CALIFORNIA PLAN NO. C-140



MILK HOUSES FOR BOTTLERS  
CAPACITY 35 COWS  
18'-0" X 18'-0"  
SCALE 1/4" = 1'-0"

D-16

## MILKING BARN

The use of a small milking barn in connection with feed and shelter barns arranged for loose cattle is growing in popularity. A special milking barn provides stanchions for from 1/3 to 1/10 of the dairy herd so that the cows are milked in relays, several cows being milked in each stall. This feature allows the use of special time and labor saving milking equipment, and requires less expenditure for equipment than is needed for a single "unit" barn.

In addition to the saving in structural investment, the milking barn may be easily kept more clean and sanitary for milking than a large barn in which the cows are allowed to stand for considerable periods of time. The milking barn may be built alongside the feed and shelter barns if desired, but unless the lots are kept very clean, there is an advantage in having the milking barn connected to the feed lot by two lanes. At milking time the herd is corralled in a paved lane which removes them from possible nuisances, or in one side of the shelter barn. Enough cows are admitted to the milking barn to fill the stalls. The cows are milked and returned to the shelter barns by the second lane, empty stalls being filled by awaiting cows until the entire herd has been milked. A cow can be milked in about six minutes, but if she is fed in the stall she must remain twelve minutes or more so that from the standpoint of clean milk, and small milking barn, it may be desirable to avoid feeding the cows while they are being milked.

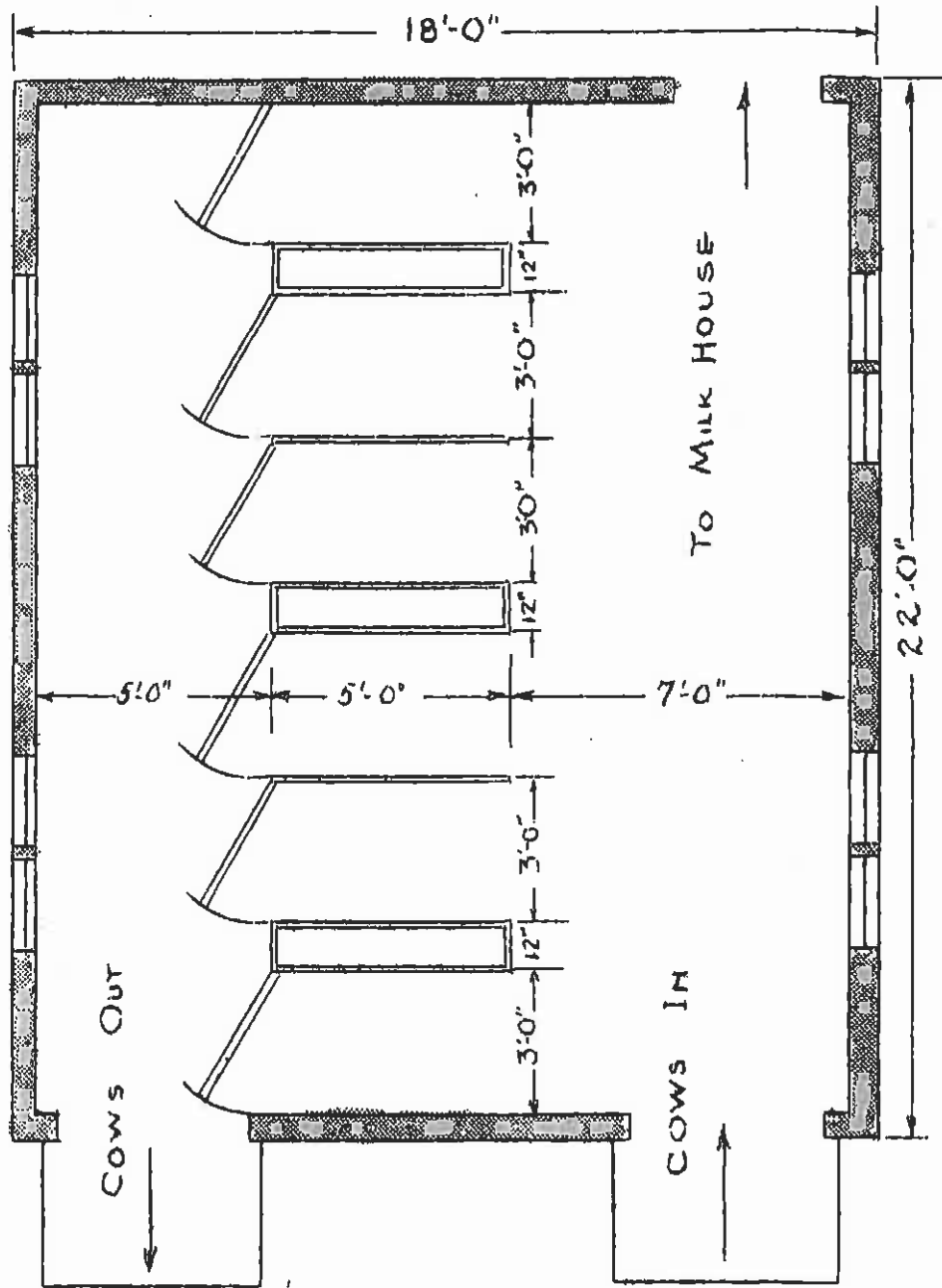
\* \* \* \* \*

### D-21 \* SIX STALL WALK-THROUGH MILKING BARN

The walk-through type of milking barn is a great labor saver in that the cows come to the milking equipment rather than the milker carrying equipment to the cows. This type of barn may be easily kept scrupulously clean and thus may be located near the milk house for convenience in handling the milk. The design of this structure readily permits the installation of either the pipe line, or the releaser type of milking machine. When this barn is built near the milk house, the milking machine pump and motor may be located in the machine and boiler room of the milk house.

The construction of this building is simple. The location of the doors may usually be arranged to coincide with the lanes from the barn. The floor should be of concrete with a raised curb around the walls to protect the walls from water while cleaning the floor. The stalls are merely used to separate the cows while milking and may be a very simple construction of pipes. The gate in the end of the stall may be hinged to swing from the stall as shown or may be a narrow sliding gate raised from the rear of the stall by means of a rope and pulleys. The floor plan dimensions are shown, for a six stall barn. If more stalls are desired, they may be added in pairs, a pair of stalls requiring a strip of floor space 7 feet wide.

\* \* \* \* \*



# SIX STALL WALK-THROUGH MILKING BARN

CAPACITY - 30 TO 60 COWS

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON

D-21

D-24 \* PLAN OF TWO ROW MILKING BARN

This plan illustrates a typical two row type milking barn. The possibility of a wide central alley for carrying milk makes it desirable that the two row milking barns should be built with the cows headed out. This plan has a capacity of 18 cows at a time, but may easily be altered to fit any size of dairy herd. A section 4' wide is equivalent to two stalls. Passage for feed truck may be obtained by lengthening the barn or by moving the stalls to leave only one cross alley at the feed room end. If cows are not fed during the milking time, the building could be made narrower by taking out part or all of the feed alleys and mangers. This barn has low side walls and a quarter pitch roof.

---

FEED AND SHELTER BARN

---

D-26 \* 30' x 42' FEED AND SHELTER BARN FOR CATTLE

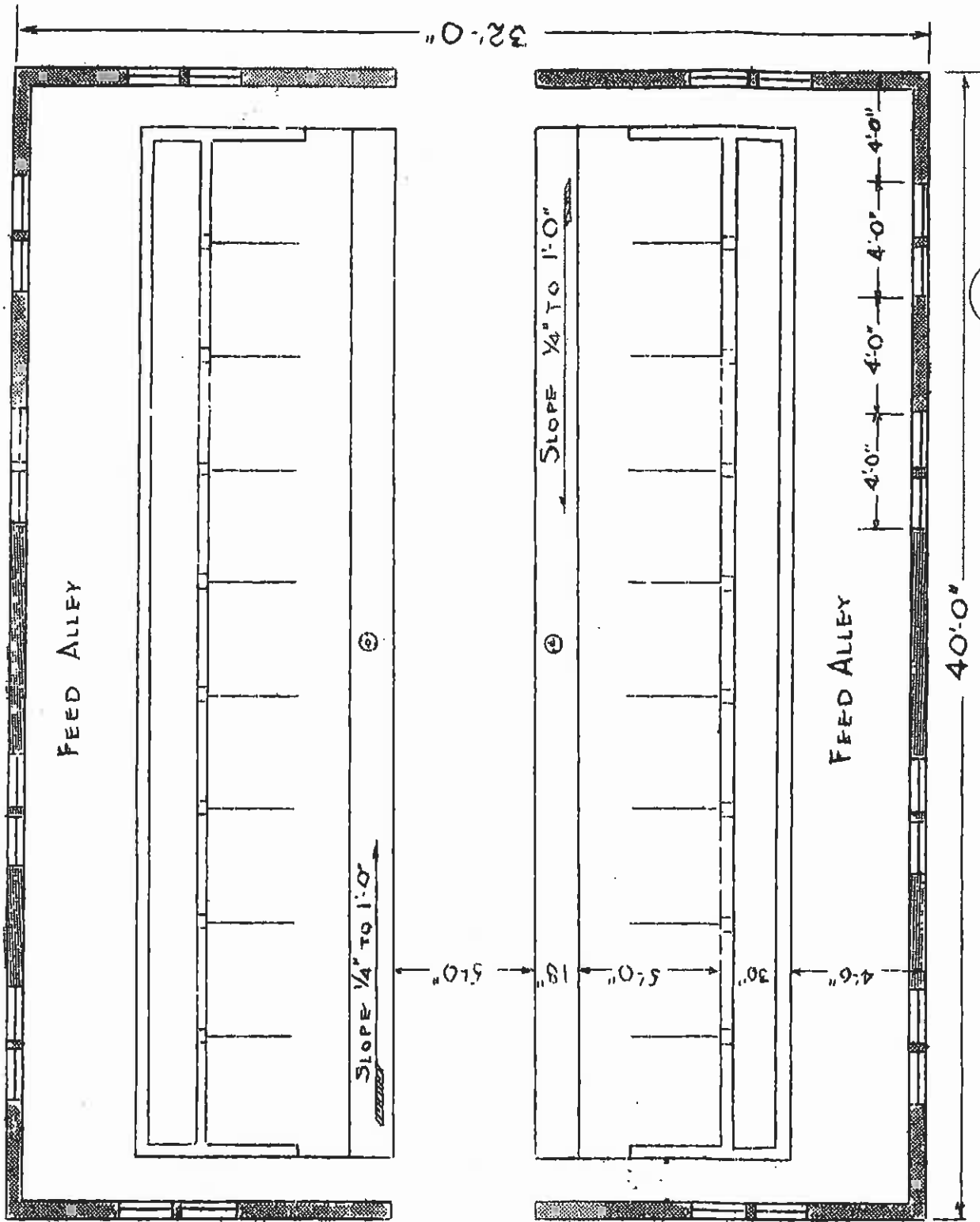
This plan is of a semi-enclosed type of feed and shelter barn for loose cattle. It provides good shelter and manger space for about 15 cows and is used in combination with a separate milking barn. The milking barn may be placed alongside or at one end of this shed, but it is better located some distance away and connected by lanes as described in connection with the milking barn plans. A prominent feature of this plan is the construction of the central feed rack which supports part of the weight of the hay loft. The loft floor over the feed rack is of loose planks so that they may be removed to form a continuous feed chute when the loft is partially empty.

\* \* \* \* \*

D-27 \* OPEN FEED SHED FOR MILD CLIMATES

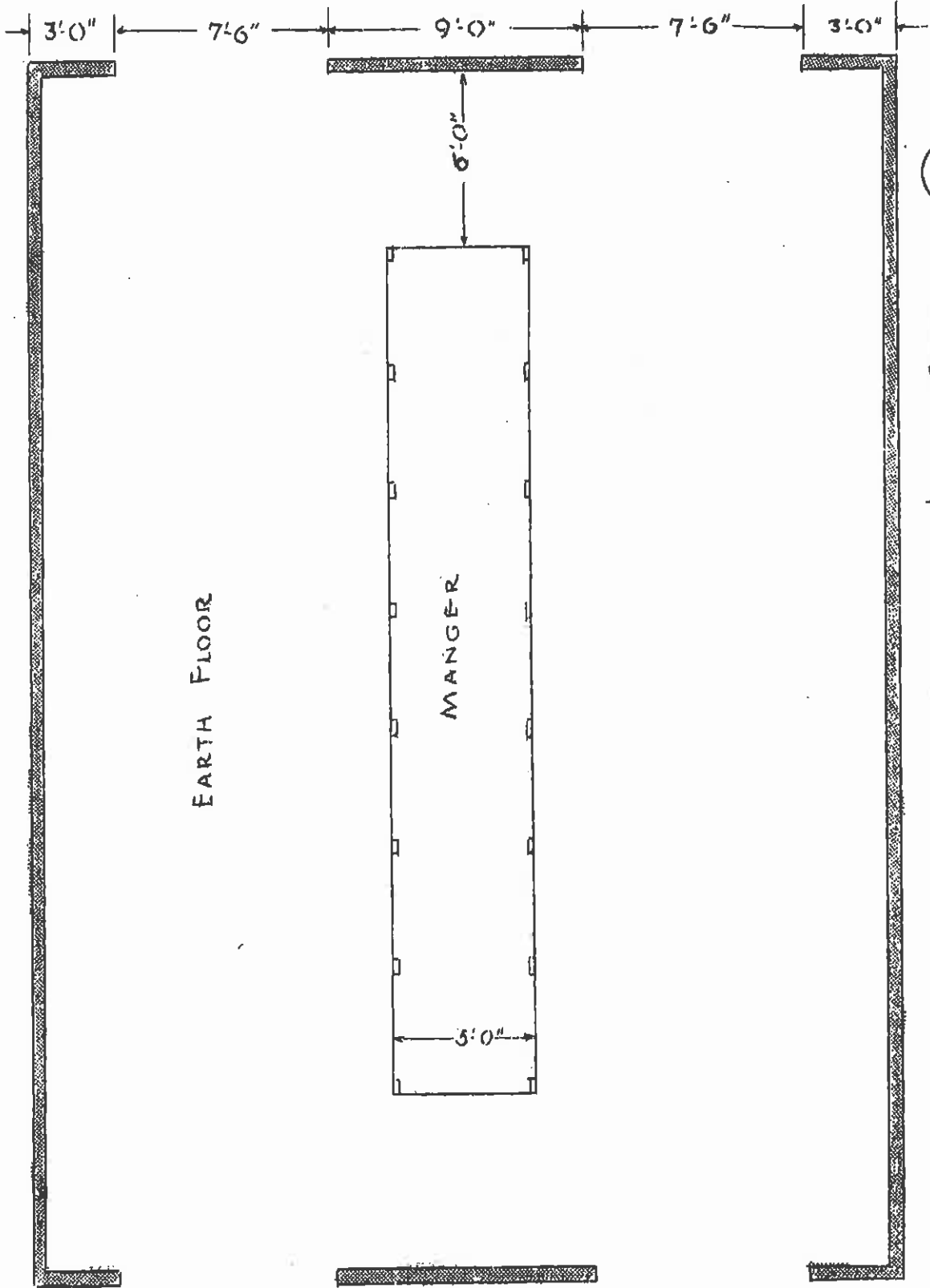
This plan is simply an open hay storage shed with sheltered feed racks along each side. The shed is designed to be built in 12-foot units of length and any number of units may be used to meet the needs of a particular individual. The central part which is the main hay storage space is 15 feet wide, 24 feet high from floor to sill, and will hold approximately 2/3 of a ton of loose hay per foot of length. The space over the mangers may be used for storage of hay or straw, but space should be allowed so that the hay may be dropped into the mangers through chutes placed 12 feet apart when the shed is full of hay. Loose boards over the manger may be removed to form a continuous hay chute when the shed is partially empty. An open front, low shed-roofed addition may be built on each side to furnish additional shelter for loose cattle if other shelter is not available.

\* \* \* \* \*



D-24

PLAN OF TWO ROW MILKING BARN  
CAPACITY 18 COWS



EARTH FLOOR

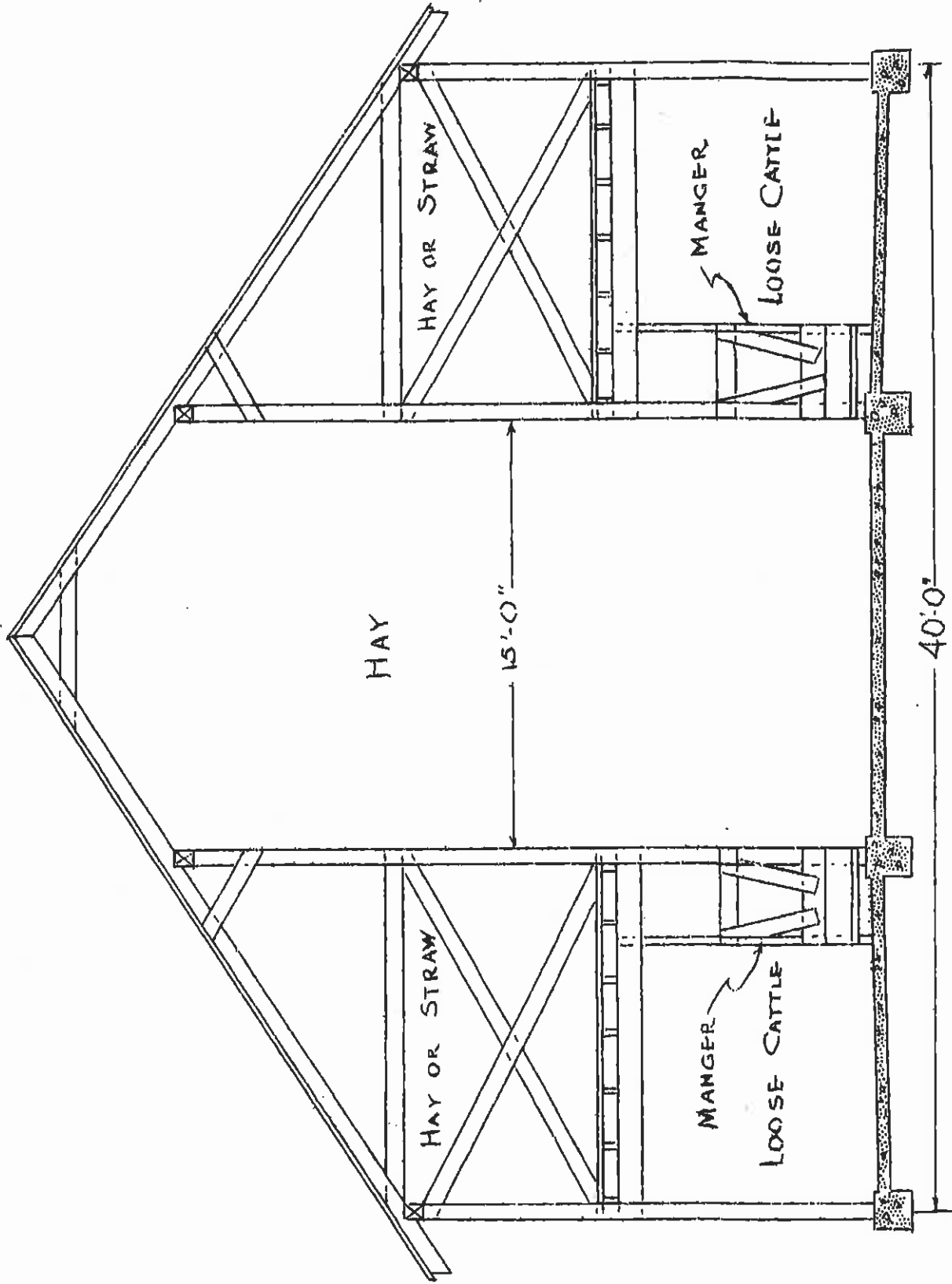
MANGER

D-26

FEED AND SHELTER BARN FOR LOOSE CATTLE

30'-0" x 42'-0"





(D27)

OPEN FEED SHED FOR MILD CLIMATES  
 LENGTH — 12' UNITS

D-28 # THIRTY-TWO BY FORTY FOOT BEEF BARN

This plan shows a very convenient arrangement for feeding silage and hay to loose cattle. The silo is located at one end of the barn and hay is stored in a loft above the floor. About fifteen head of either dairy or beef cattle can be handled with this size barn, but the length may be increased to handle much larger herds. Temporary partitions may be used as at "a" and "b" to form box stalls or entirely separate groups of cattle.

\* \* \* \* \*

D-32 # A.S.A.E. BARN - ANIMALS HEADED OUT

This plan is the result of a study of several thousand dairy barns made by the American Society of Agricultural Engineers. The plan is elastic both as to length and width and merits careful study when considering the construction of a large dairy barn.

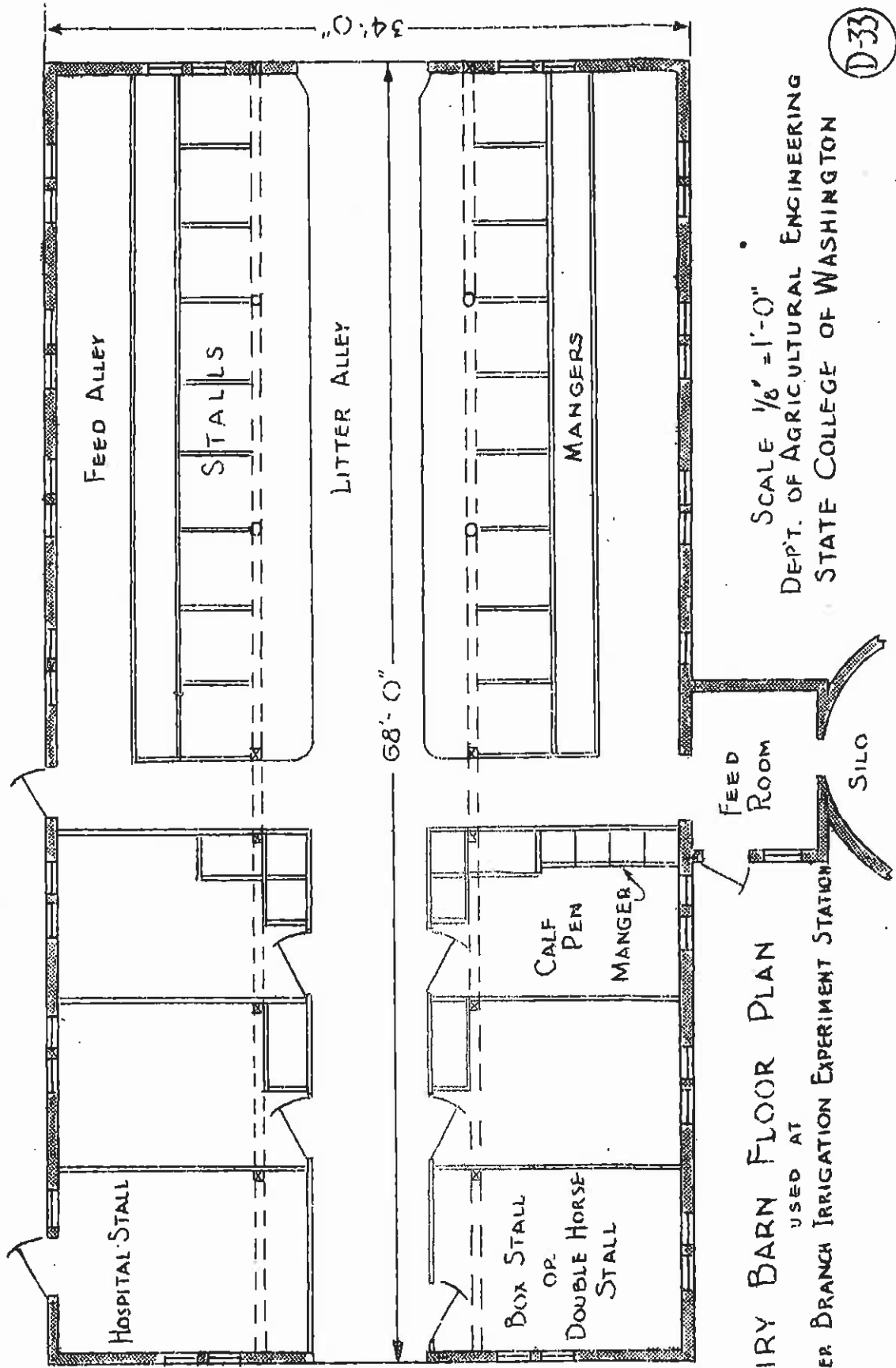
\* \* \* \* \*

D-33 \* PROSSER DAIRY BARN PLAN

This plan was developed for the Irrigation Branch Experiment Station at Prosser, Washington. It is a very flexible plan which may be adapted to different size herds. The plate shows an arrangement of stalls, feed room, alleys, etc., in a typical 34-foot dairy barn with cows heading out. The end box stalls are sometimes equipped as a double horse stall. A box stall on the cross alley is sometimes used as a calf pen. The length of the barn depends upon the number of stalls required. This barn is 68 feet long and has stalls for 18 cows. If desired, the width may be increased to 36 feet.

\* \* \* \* \*

#NOTE - These two barns are illustrated in the following section with the general purpose barns.



SCALE 1/8" = 1'-0"

DEPT. OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON

D-33

DAIRY BARN FLOOR PLAN

USED AT

PROSSER BRANCH IRRIGATION EXPERIMENT STATION

D-41 \* DOUBLE BULL PEN LAYOUT AND SAFETY APPLIANCES

This layout is intended to accommodate two bulls but with minor variations it can be arranged for only one bull. The shed is not large and is intended for shelter only. A feed room may be built or the feed must be carted from other barns. The sliding doors on the shed must be such that they may be opened from outside of the pen.

The double breeding pen is built midway between two pens and is so arranged that either bull may be used. The swinging gates are normally chained shut in the closed position as indicated in the diagram. When a cow is to be served, she is led into the stall and the buffer gate closed to keep her from passing through. Opening the gate behind the stall admits the bull and closing it crowds him back into the corral without danger to the attendant. A single breeding pen, similar to the double one, but with only one entrance gate, may be located along the fence or in a corner of the yard near other barns.

The fencing consists of 2" x 6" rails bolted or well spiked to 6" x 6" posts set firmly into the ground. Rails are spaced 6" apart so that they may be interlaced at the corner posts as shown in the diagram. All posts are set on the outside of the fence and are usually placed at six or eight foot intervals. Corner posts and posts around the breeding pen are set firmly in concrete and are usually 8" x 8" for additional strength. A long narrow pen gives the bull the most exercise. An abrasive surface of cinders or similar material in the yard will greatly aid in keeping the bull's feet in shape.

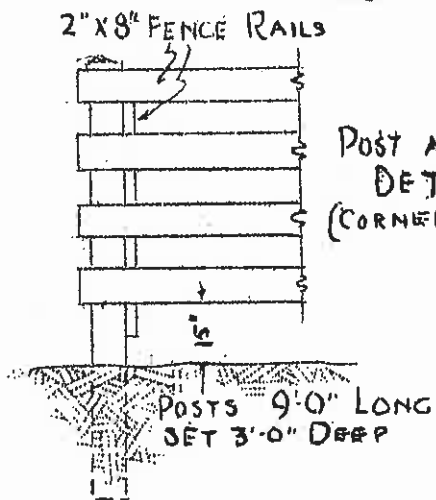
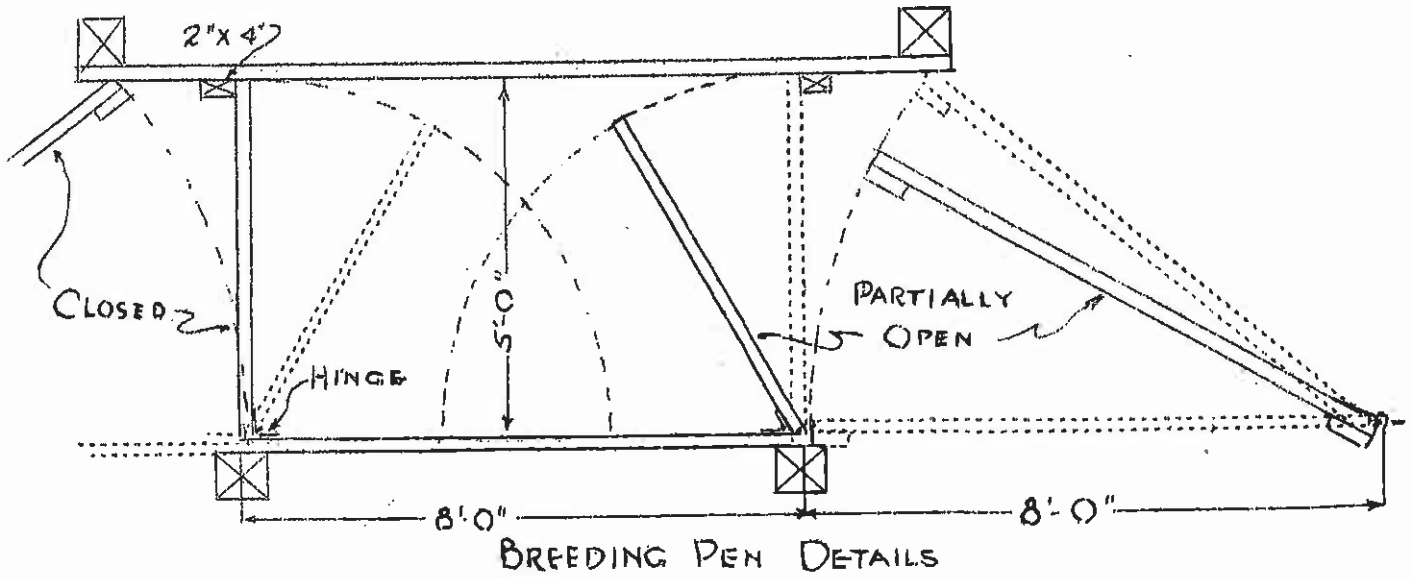
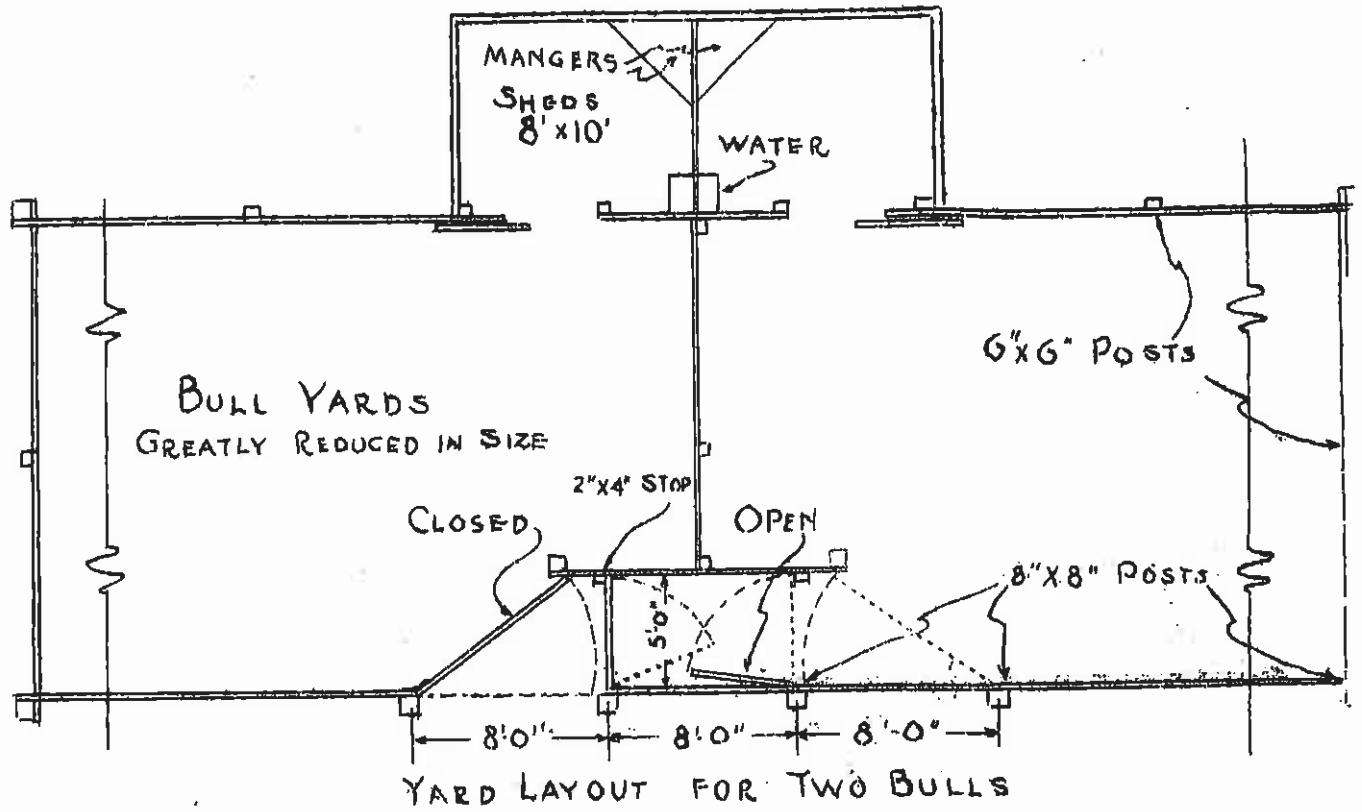
\* \* \* \* \*

D-42 \* W. S. C. DAIRY COW STALL

This type of stall will probably keep cows cleaner than any other type in general use at the present time. It is constructed, as shown in the diagram, so as to force the cow to stand with her hind feet between the crossbar and gutter, thus preventing the stall from being fouled by the droppings. In order to lie down comfortably, the cows will step forward ahead of the crossbar onto the clean platform. The crossbar is adjustable so that the stall will accommodate cows of any size.

The stall is slightly longer than most commercial types of stalls which may prevent its use in narrow barns. The dimensions given in the illustration are for Holstein cows.

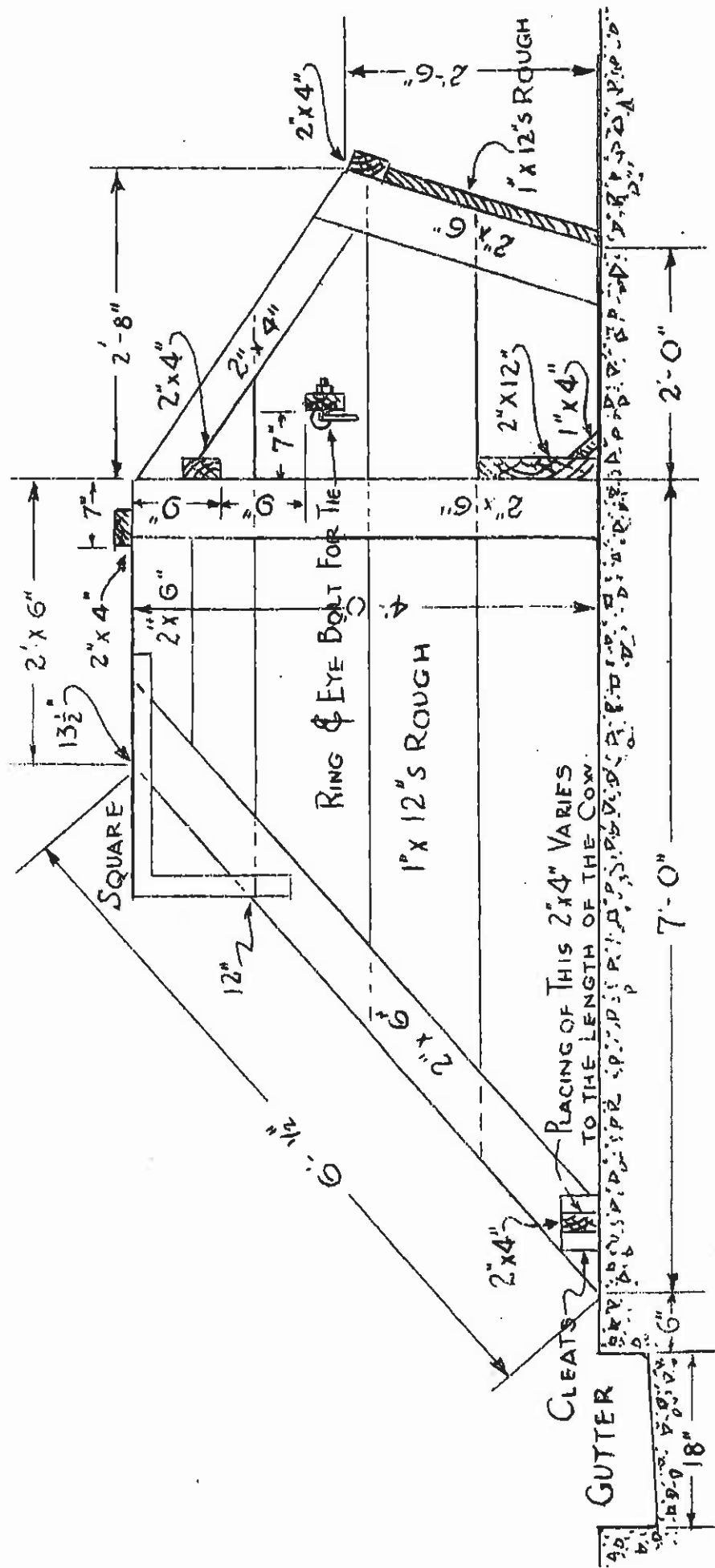
\* \* \* \* \*



(D-41)

DOUBLE BULL PEN LAYOUT  
WITH SAFETY APPLIANCE DETAILS

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON



# W. S. C. DAIRY COW STALL

WIDTH 4'-0"  
 SCALE 3/4"=1'-0"

D-42

D-43 \* STANDARD DIMENSIONS FOR 2-ROW TYPE DAIRY BARNS

This plate shows the standard cross-sectional dimensions of the common two-row arrangements of dairy barns 34 and 36 feet wide. Narrower barns have been built but usually are found to sacrifice convenience.

The dimensions are practically standard and only minor variations are usually considered, the extra space being obtained from or absorbed in the litter and feed alleys. It is difficult to carry milking equipment, keep walls clean and remove litter if the litter alleys are too narrow, so that the minimum widths are 3'6" for cows headed in and 4'6" for cows headed out. Two rows of cows are fed from one alley when the cows head in so that the feed alley should be somewhat wider than the 3'6" minimum for cows headed out. A feed alley wider than 5'0" is unnecessary so that poorer economy of floor space is obtained with the 36 foot barn when the cows head in. The floor of the feed alley is often raised to the height of the manger to avoid lifting the feed.

The minimum practical width of mangers is 22 inches because the cows often waste feed placed in narrow mangers. The manger curb should be at least 6" wide to securely anchor steel equipment and columns. Additional footing under the columns is necessary to carry the weight of the filled loft. The columns may be 2½" wrought iron pipe or larger, held in place by flanges and lag screws.

Stalls are usually designed for housing a particular breed of animal. Common stall widths are 4'0" for large cows, 3'8" for average cows, and 3'2" for small cows or yearlings. The stall platform is usually tapered from one end of the barn to the other using the maximum length for the breed for large cows at one end and the minimum length for small cows at the opposite end of the line. A depressed platform as shown in the diagram is optional, but it tends to hold bedding in place and to prevent cows from slipping while reaching for feed. Lengths of stall platform suggested for the various breeds of animals are as follows:

Breed	Length of Platform	
	Small	Large
Holstein	4'10"	5'4"
Shorthorn	4'8"	5'2"
Ayrshire	4'6"	5'0"
Guernsey	4'6"	5'0"
Jersey	4'4"	4'10"

\* \* \* \* \*

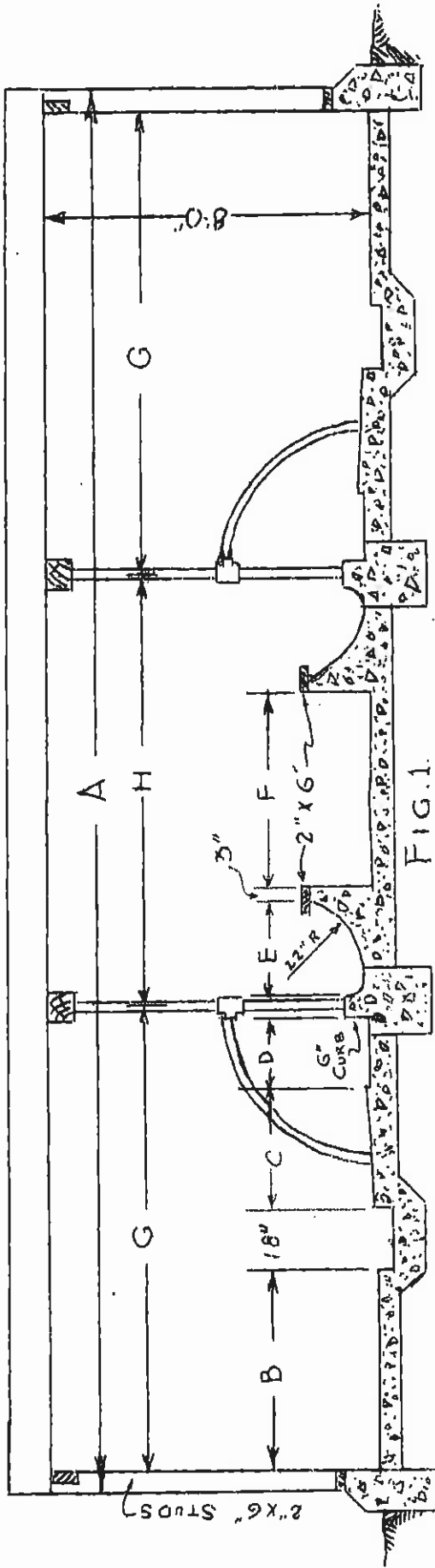
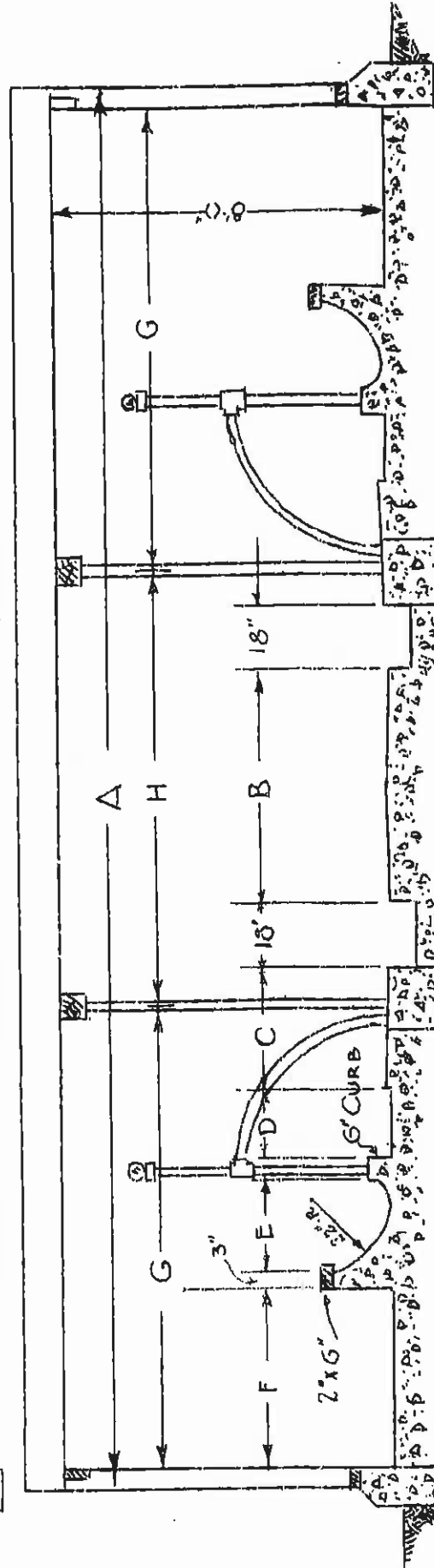


FIG. 1.



D-43

FIG. 2.

	FIG. 1		FIG. 2	
A WIDTH OF BARN	34 FT.	36 FT.	34 FT.	36 FT.
B LITTER ALLEY	4'-10"	4'-10"	5'-8"	7'-8"
C PLATFORM	3'-0"	3'-0"	3'-0"	3'-0"
D DEPRESSED PLATFORM	1'-8"	1'-8"	1'-8"	1'-8"
E MANGER	2'-4"	2'-4"	2'-4"	2'-4"
F FEED ALLEY	4'-10"	6'-10"	4'-5"	4'-5"
G SIDE BENTS	11'-3"	11'-3"	11'-9"	11'-6"

Standard Dimensions for Two Row Type Dairy Barns  
 Dept. of Agricultural Engineering  
 State College of Washington.



## GENERAL PURPOSE BARNS AND EQUIPMENT

BARNs	Service Charge
B-11 * Sixteen by Twenty Barn	.....
B-12 * Sixteen by Twenty-two Barn	.....
B-13 * Sixteen by Eighteen Barn	.....
B-14 * Sixteen by Eighteen Barn	.....
B-15 * Twenty-eight by Thirty-eight Barn	.....
B-16 * Twenty-eight by Forty-four Barn	.....
B-17 * Thirty-two by Fifty-two Barn	.....
B-18	.....
<b>FRAMING DETAILS</b>	
B-31 * Framing of 34-foot Gambrel Roof for Barn	.20
B-32 Framing of 36-foot Gambrel Roof for Barn	.20
B-33 Details of Construction of Gambrel Roof	.25
B-34	.....
B-35 * Framing Suggestions for Gothic Roof	.20
B-36 Framing Suggestions for Wide Gothic Roof	.15
B-37	.....
B-38 Barn Cupola Detail	.15
B-45 Wooden Hoop Silo	.50
B-46	.....
<b>EQUIPMENT</b>	
B-51 Home-made Litter Carrier	.10
B-52	.....
B-61 * Portable Feed Rack, California Type	.....
B-62	.....
B-71 * Cattle Guard	.10
B-72	.....

Note: Asterisk (\*) denotes that plan is illustrated.

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## BARNs

The amount and type of livestock and feed which is stored in a barn is so definitely individual for each farm that it is necessary for the owner to consider carefully his requirements before selecting a plan, and then he may need to make minor alterations before construction is started. The four main points to consider in barn planning are adequateness, convenience, economy, and sanitation.

In order for a barn to give satisfactory service it must furnish protection for all of the stock and feed which the owner desires to put into it. In addition to giving such protection, it is well to select a design which may easily be enlarged in case the owner should decide to increase the size of his enterprise. The space required for each type of animal and stall is indicated by dimensions and descriptions of the various barn plans. Only a rough guess of the hay storage capacity may be made without knowing the characteristics of the barn and hay, but the following figures for the space occupied by a ton of hay may be of value in estimating: loosely packed, 525 cubic feet; baled, 375 cubic feet, and chopped, 225 cubic feet.

Economy of time, labor, and materials is of importance in order that these elements need not be wasted unnecessarily. Yards, lanes, gates, and exterior doors of the barn should allow free access of wagons at all times for convenience in filling loft and silo, and also for removing litter. In the interior of the barn, special attention should be given to the feeding arrangements which include the location and construction of hay chutes, silo, grain bins, and feed alleys. The size and location of harness rooms and milking barns or milk houses must not be overlooked. For economy of space and material the length of loft joists and position of supporting posts to avoid interference with stalls and with pens will be of prime importance if standard width stalls are used.

Sanitation is necessary for healthy, vigorous livestock, and to enable the stock to give maximum service or returns. The sanitary requirements are ample light, good ventilation, easily cleaned floors and walls, and clean, well drained yards. Good light is obtained by the use of one square foot of glass for every twenty square feet of floor space. Windows should be high to reduce breakage and to throw light into center and corners of the barn. An abundance of fresh air without drafts is necessary, but ventilation is easily obtained by methods in common use with small barns. The ventilation of large barns should be very carefully studied in more detail than is possible to describe in this condensed plan book.

\* \* \* \* \*

B-11 \* SIXTEEN BY TWENTY FOOT BARN

This plan is a suggestion for small operators on acreage tracts. The building is very simply constructed but provides room for two cows, a box stall for calves or a horse, and a feed bin on the ground floor. Hay storage is provided in an overhead mow and is reached by a ladder on the wall beside the dotted lines which represent the loft opening. The hay may be dropped directly into the managers or to the floor between the stalls. By increasing the length two feet this plan may be used for two horses and one cow.

\* \* \* \* \*

B-12 \* SIXTEEN BY TWENTY-TWO FOOT BARN

This plan is very similar to the B-11 plan and shows one way of re-arranging the plan to accommodate another cow. The hay storage is somewhat more economical if the hay is dropped and distributed from the main floor.

\* \* \* \* \*

B-13 \* SIXTEEN BY EIGHTEEN FOOT BARN

This barn provides feed storage and comfortable housing for two cows and one horse. The hay floor may be temporarily used as a stall for an additional horse, cow, or calf.

\* \* \* \* \*

B-14 \* SIXTEEN BY EIGHTEEN FOOT BARN

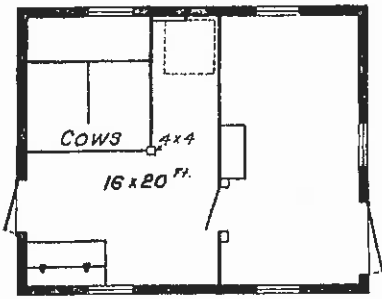
This barn is exactly the same as the B-13 barn except that it is arranged to accommodate two horses in a double stall and only one cow. The dotted line to the left is a suggestion that small barns can often be combined with other buildings to economize on materials and land.

\* \* \* \* \*

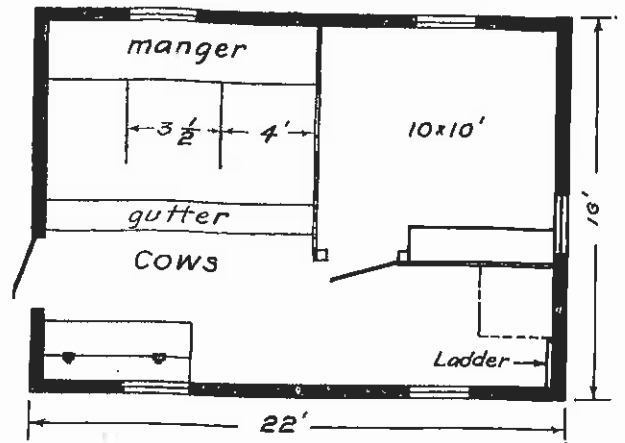
B-15 \* TWENTY-EIGHT BY THIRTY-EIGHT FOOT BARN

This is a medium sized horse barn which may be built in any length and capacity desired. The plan also provides room for a few head of cows in a single row of stalls opposite a row of box stalls. The number of cow stalls may be increased if desired, but if more than a few cows are kept, it would be better to provide either a separate barn or a partition between the horse and cow section.

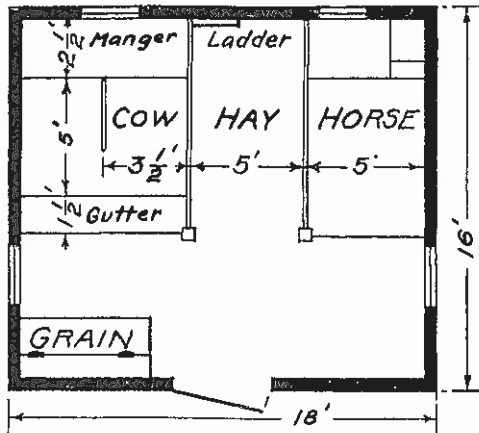
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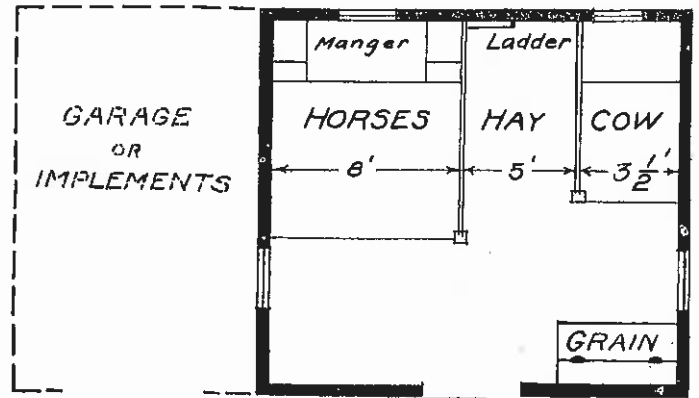
B-11



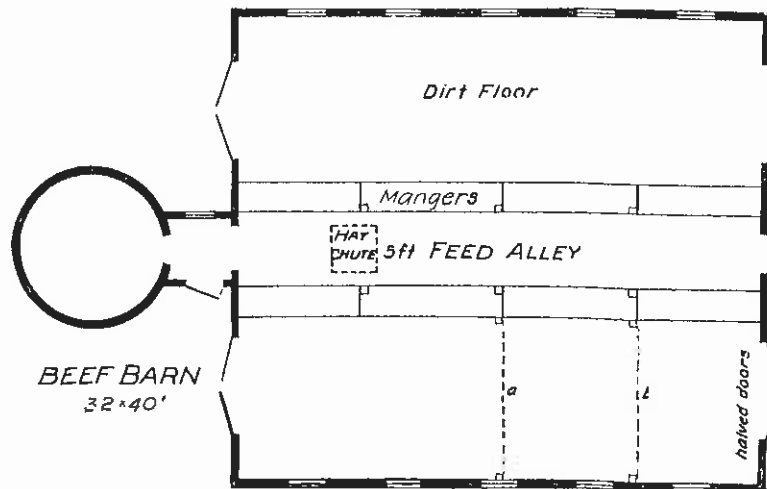
B-12



B-13



B-14



D-28

B-16 \* TWENTY-EIGHT BY FORTY-FOUR FOOT BARN

This plan is the same as the plan above (B-15) except that the cows are completely partitioned off from the horse barn and arranged across the barn. This sort of arrangement practically prevents the possibility of increasing the size of the dairy herd accommodated by this barn.

\* \* \* \* \*

B-17 \* THIRTY-TWO BY FIFTY-TWO FOOT BARN

This general purpose barn plan is designed for a definite number of horses and cattle and cannot easily be added to after construction. The cows are in predominance and are definitely partitioned off from the horse section. The thirty-two foot barn makes narrow feed and litter alleys for a two row cow barn and should be the minimum width considered for such a barn. A 34 or 36-foot width is much more desirable.

\* \* \* \* \*

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FRAMING DETAILS

---

B-31 \* FRAMING OF 34-FOOT GAMBREL ROOF FOR BARN

The gambrel type of roof provides a neat appearing, economical roof and is particularly adaptable to medium sized and large buildings. This plate shows the dimensions and method of assembling the lumber for a complete section of a 34-foot width barn. The blue prints which are available are drawn to a much larger scale.

\* \* \* \* \*

B-32 \* FRAMING OF 36-FOOT GAMBREL ROOF FOR BARN

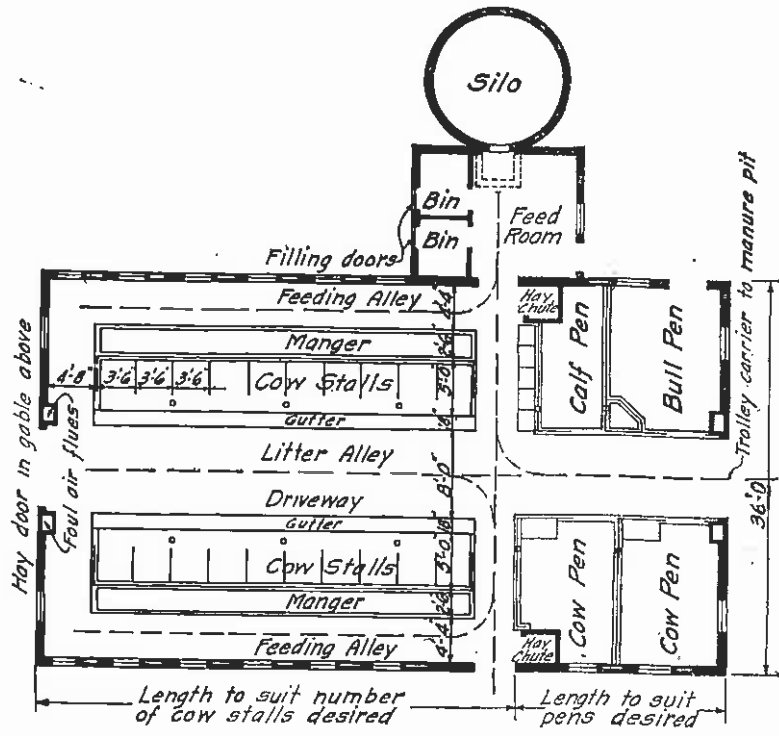
This plate is identical to the plan B-31 except that the dimensions are for the 36-foot width.

\* \* \* \* \*

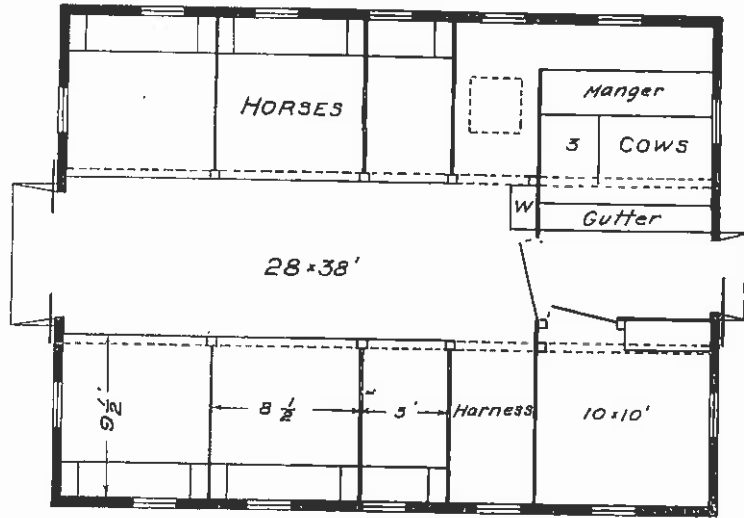
B-33 \* DETAILS OF CONSTRUCTION OF GAMBREL ROOF

This print shows a more detailed pictorial description of the framing of a gambrel roof than is shown on the plates B-35 and B-36. No dimensions of length are shown in this diagram so that it may be used for any width of barn, but its use may not be necessary to one familiar with framing the gambrel roof.

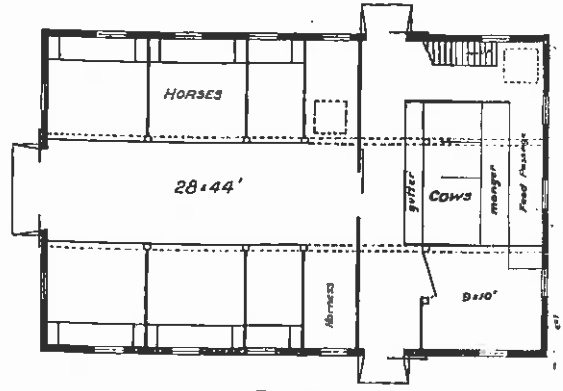
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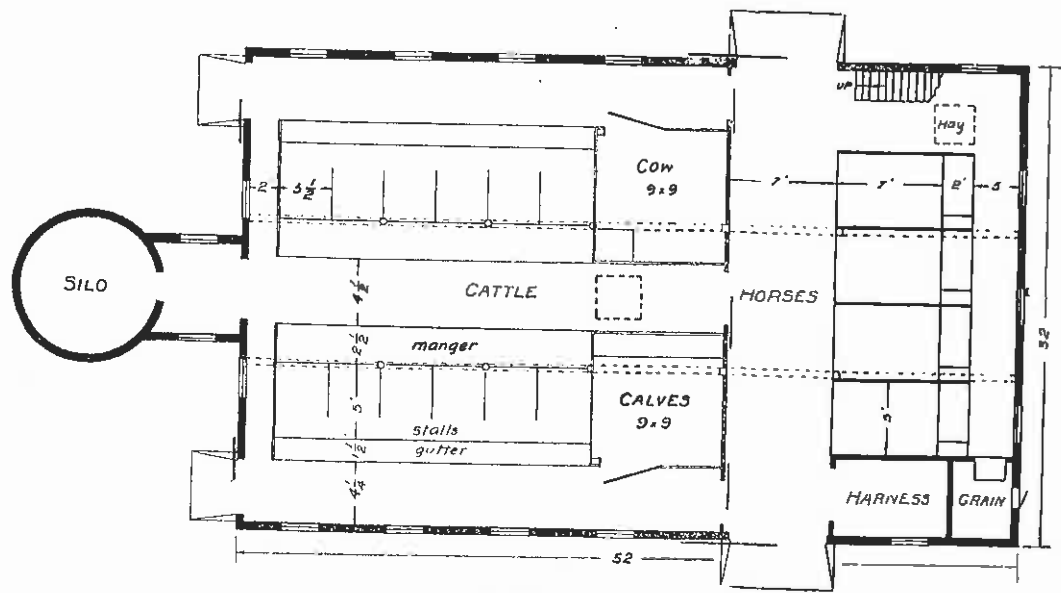
D-32



B-16



B-16



B-17

SHEEP AND HOGS

STATIONARY BARNs	Service Charges
S-11 * Central Hog House -- Gable Roof & S-11a	.35
S-11a *Central Hog House Accessories (Details of Partitions)	.....
S-	
PORTABLE COTS	
S-21 * Hog Cot, Portable Gable Roof Box Type, 8 x 8	.25
S-22 * Hog Cot, Portable Shed Roof Type, 8 x 7	.25
S-	.....
EQUIPMENT	
S-31 A Self Feeder for Hogs	.25
S-	.....
S-35 * Portable Feed Racks for Sheep	.....
S-36 * Wall Feed Racks for Sheep	.....
S-37 * Reversible Grain Trough for Sheep	.....
S-	
S-40 * Portable Panel Fence	.10
S-41 Portable Panel Zigzag Fence	.10
S-	.....
S-45 * Hog and Sheep Shipping Crate	.....
S-	.....

Note: Asterisk (\*) denotes that plan is illustrated.

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S-11 \* CENTRAL HOG HOUSE -- GABLE ROOF

This hog house is designed in such a manner that it may be built in several widths and with any number of pens. The alley and wall details remain the same but the length of the pens may be increased as demanded by personal preference. The alley width can easily be increased if necessary, but it is believed that the dimensions given are ample for most conditions.

The foundation, floor, and feed troughs are all built of concrete for permanence. The foundations extend at least 6" above the floor level to protect the sills and studs from possible moisture. The floor must be made damp-proof and is laid with a slight slope towards the gutters in the central alley. The underneath surface of the floor should be above the outside ground level. The feed troughs are poured with the rest of the floor to avoid cracks and subsequent leaking. They are 4" high at the partition and 6" high in the pan with the bottom of the trough 10" wide and at the floor level. The ends of the trough are wide enough to support and protect the alley posts. Corners in the pens and around the trough may be dirt catchers and thus should be avoided. During farrowing time it may be desirable to lay a false floor of 2 x 12's over part of the floor of each pen.

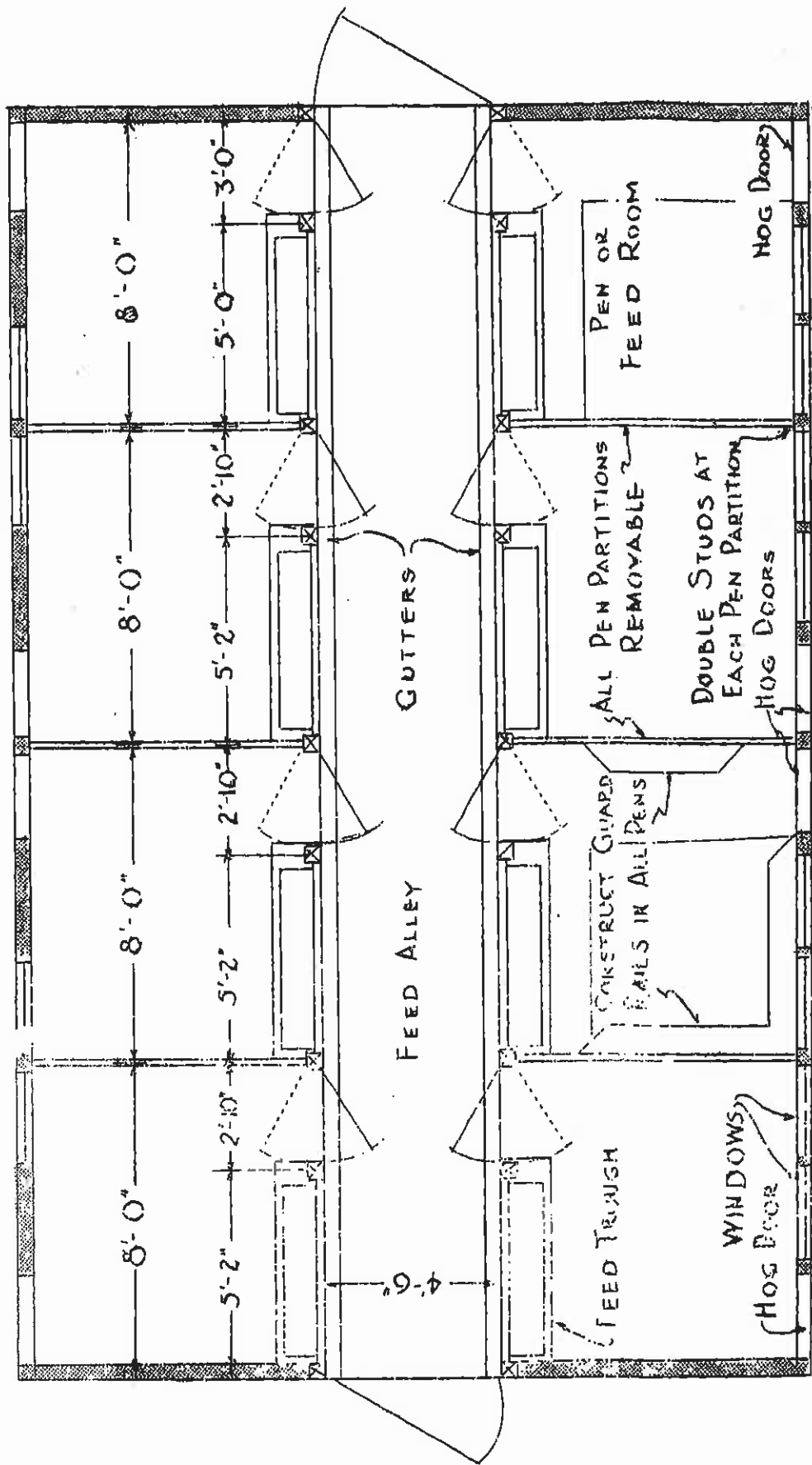
Sunlight and ventilation are very necessary in hog houses so that as many windows should be provided as practicable. If the house is to run east and west, there should be fewer windows on the north side to avoid exposure from the winter winds. The studs are spaced the width of the window sash to serve as frames and the siding runs past the studs 3/4" to catch the sash and act as window casing. Window guards may be necessary to keep sows from breaking the glass if the windows are set too low.

The hog doors may open from the outside or may be hinged at the top and swung up to the ceiling in the inside. Ropes and pulleys may be used to good advantage in opening the doors. It is a common practice to make the hog doors too low. The 42-inch height will allow a sow to pass through without taking the arch out of her back.

Sometimes the space occupied by the two end stalls and the feed alley between is utilized for the feeding young stock.

\* \* \* \* \*





FLOOR PLAN OF A CENTRAL HOG HOUSE

LENGTH = MULTIPLE OF 8'  
 WIDTH = 22', 24', 26', OR 28'

S-11a \* HOG HOUSE ACCESSORIES

This sheet shows details of the pen and alley partitions as used in the central hog house plan S-11. All partitions are of solid construction to prevent drafts. The pen partitions are easily removed so that the entire house may be used as a feeding floor or sleeping quarters. The swinging alley partitions are a great convenience in feeding as the hogs are kept entirely out of the trough when the partition is swung in and locked over the inner edge of the trough while pouring feed.

An 8" x 12" creep for small pigs is often cut into the alley partition. This creep is shown in the swinging partition but is much better located in the door of the pen because when left in this position the trough is shortened and corners are left to collect refuse.

\* \* \* \* \*

S-21 \* THE BOX TYPE OR GABLE ROOF PORTABLE HOG COT

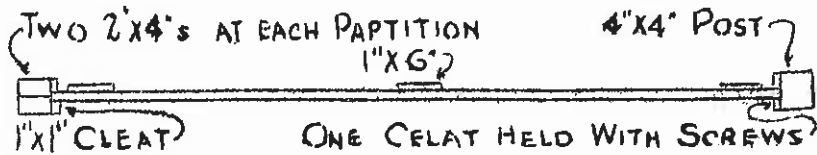
The box type of portable, individual hog house is preferred by many experienced men over all other types. Perpendicular walls enable the floor space to be utilized to good advantage and prevent the sow from raising the roof as often happens in the "A" type house. The sides of this type of hog house are often hinged near the top so that they may be raised during warm weather. The roof, if hinged, should be in two parts, so that one side may be left closed for shade and protection in case of sudden storms. The hinged roof greatly facilitates cleaning operations. The vertical sides make it possible to put the hog door on the side of the building if desired.

\* \* \* \* \*

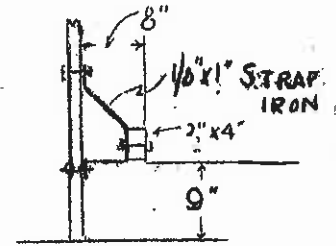
S-22 \* THE SHED ROOF TYPE PORTABLE HOG COT

The perpendicular walls of the shed roof type of hog house have the same advantages over the "A" type roof as are found in the gable roof, S-21. The shed roof allows a glass window if desired. The choice between the shed roof and the gable roof type lies largely with appearance and personal preference. The shed roof is considerable higher at one side than at the other.

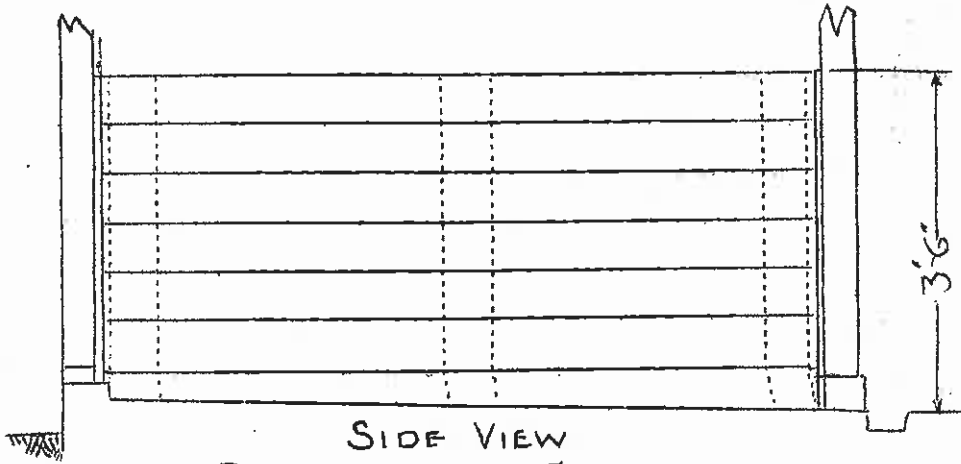
\* \* \* \* \*



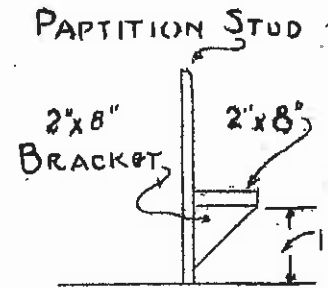
TOP VIEW



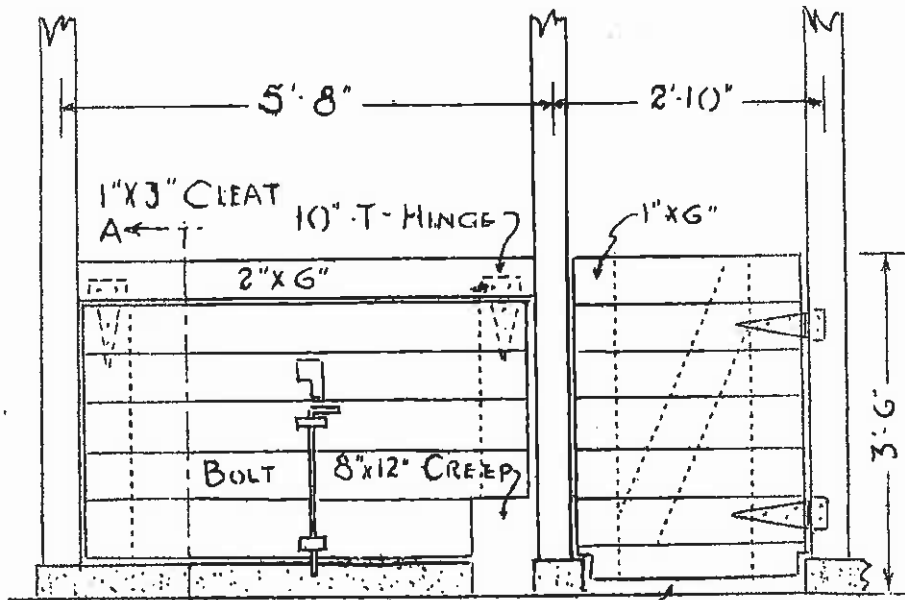
ALTERNATIVE RAIL



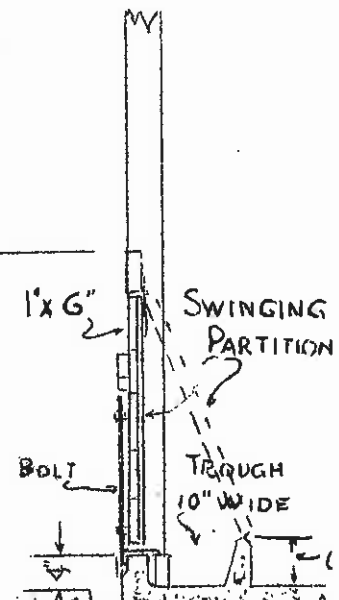
SIDE VIEW  
 PEN PARTITION DETAILS  
 (REMOVABLE)



GUARD RAIL  
 DETAILS



A ← VIEW FROM ALLEY



SECTION A-A

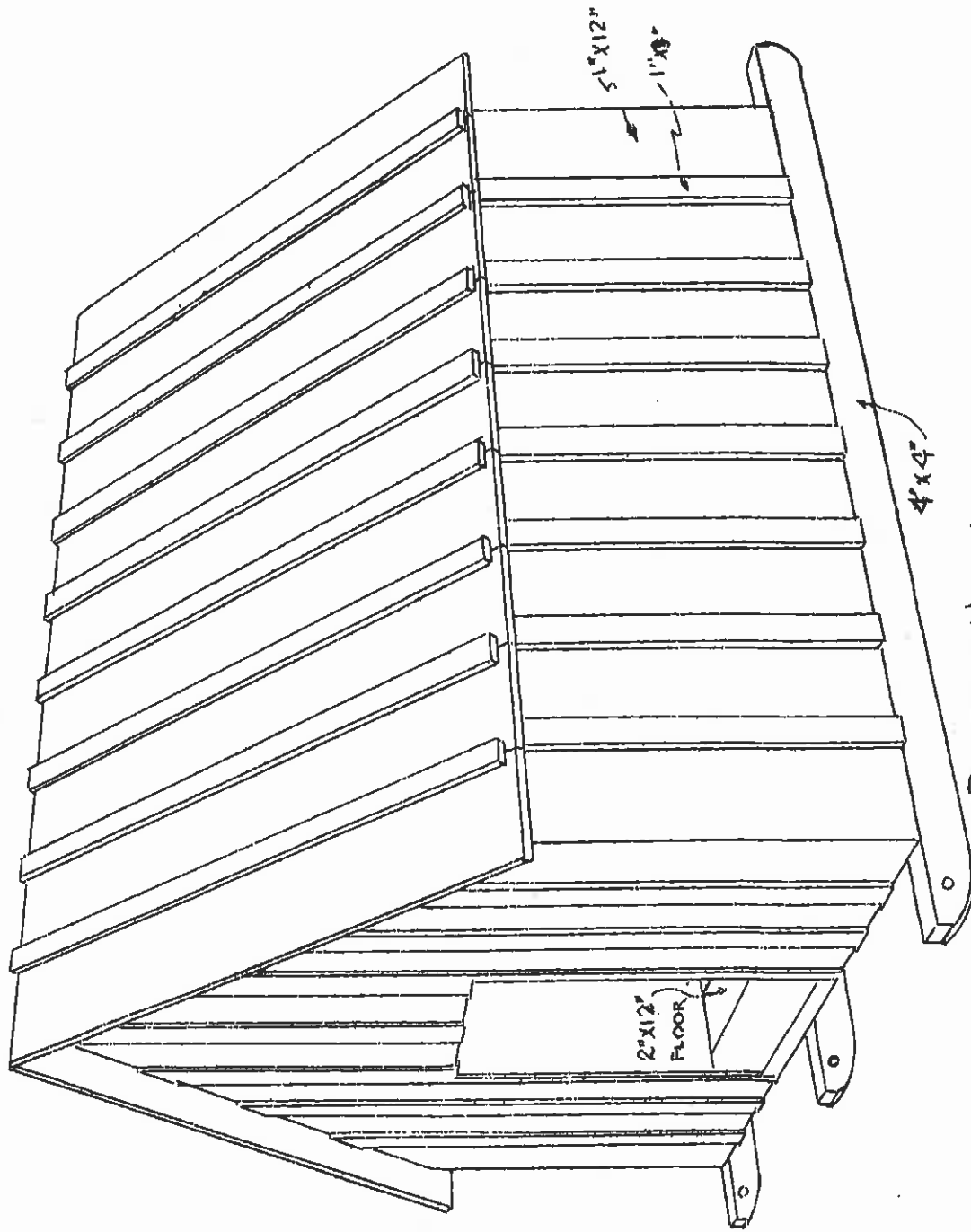
ALLEY PARTITION DETAILS

HOG HOUSE ACCESSORIES

SCALE 1/2" = 1'-0"

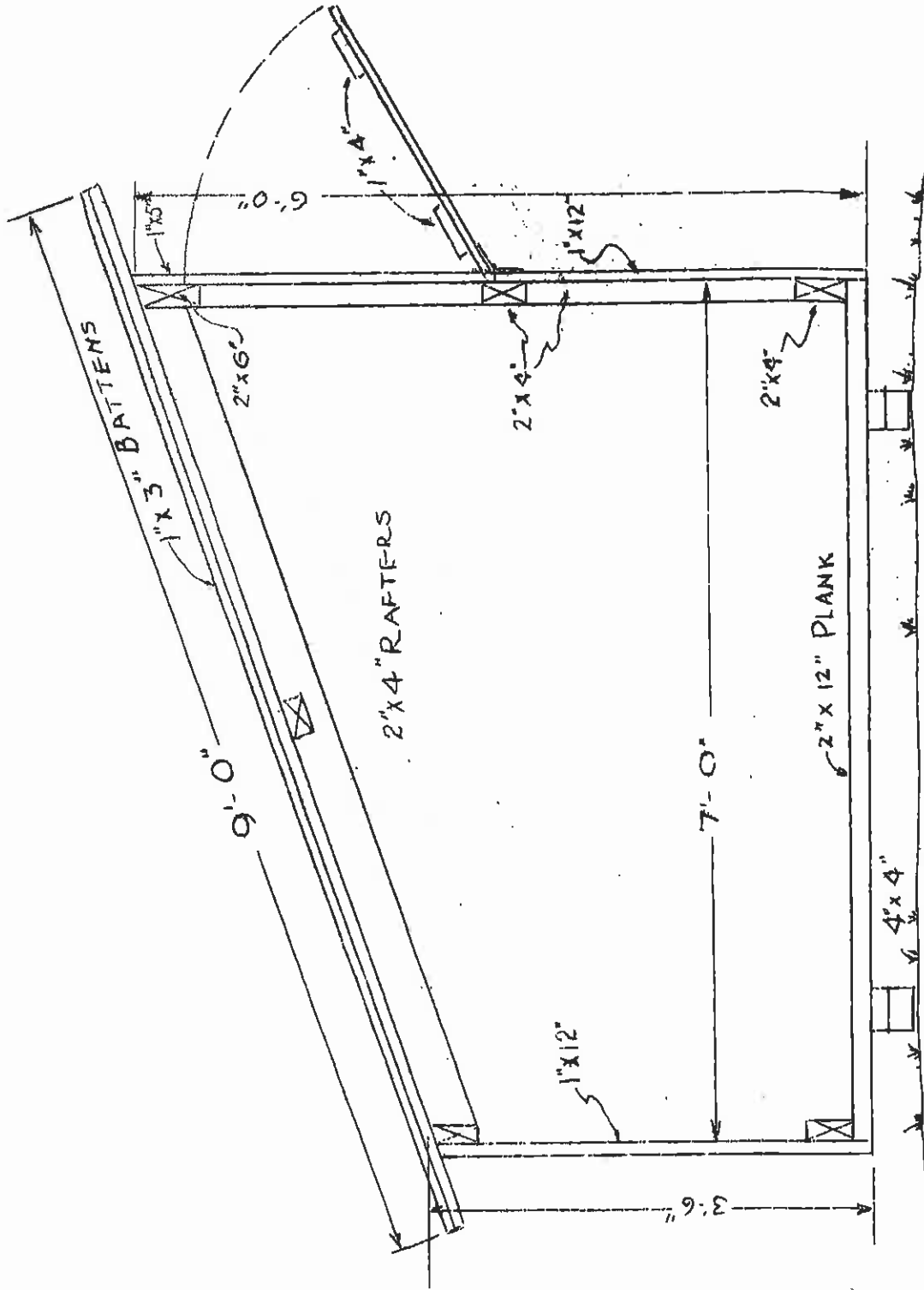
DEPARTMENT OF AGRICULTURAL ENGR.  
 STATE COLLEGE OF WASH.

S-11  
 A



PORTABLE HOG HOUSE  
BOX TYPE - OR GABLE ROOF  
8'-0" X 8'-0"

S-21



PORTABLE HOG HOUSE  
 SHED ROOF TYPE

7'-0" x 8'-0"

DEPARTMENT OF AGRICULTURE, ENGR.  
 STATE COLLEGE OF WASHINGTON.

5-22

## EQUIPMENT

### S-31 A SELF FEEDER FOR HOGS

Experiments have shown that when hogs have access to several different kinds of feeds in self-feeders that they will automatically balance their own ration and fatten in an economical and efficient manner. Many types of self-feeders have been designed to make use of this principle. This feeder was developed and used at the Branch Experiment Station at Prosser, Washington, and has been giving satisfactory results. The feeder is built on skids so that it may be moved about the yard. It stands 5'6" high and has a fairly long sloping gable roof. A hinged double door in the roof is used for filling the hopper.

The hopper is of large capacity so that daily filling is unnecessary. Troughs on each side allow the hogs to feed from both sides at once. The flow of feed is adjustable to avoid waste. The plan is complete and detailed so that the feeder may be easily constructed.

\* \* \* \* \*

## FEED RACKS FOR SHEEP

In feeding sheep, enough rack space should be provided to enable all of the sheep in a pen to be fed at the same time. Approximately 18" of rack space is required for each animal.

Combination hay and grain racks are probably the most convenient for feeding small lots of sheep. Racks may be either stationary wall type or movable double sided racks. The movable combination hay and grain racks are sometimes used to separate barns into smaller pens, thus avoiding the necessity of partitions.

The stationary racks conserve floor space but usually cannot be filled without entering the pen. The crowding of the sheep around the racks is troublesome when attendant must enter the pen in order to feed. Movable racks are sometimes made with open ends, enabling the attendant to feed from a walk-way in the center, thus avoiding disturbance to the sheep.

Care must be exercised in feeding, to avoid throwing chaff and other feeding material into the fleeces of the sheep. To aid in keeping the fleeces clean, racks with tightly closed sides are often used. In tight sided racks, the sheep must pull the hay down through openings near the bottom of the rack.

\* \* \* \* \*

### S-35 \* PORTABLE FEED RACKS FOR SHEEP

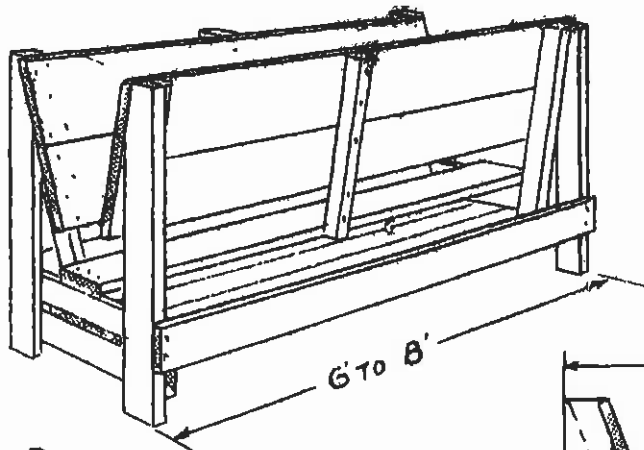
#### Combination Hay and Grain Walk-Through Type

This is a representative type of two-sided rack for feeding loose hay. It is sturdily, economically, and durably designed. The construction is well shown in the diagram so that further drawings should be unnecessary.

#### Chopped Hay and Concentrates Rack

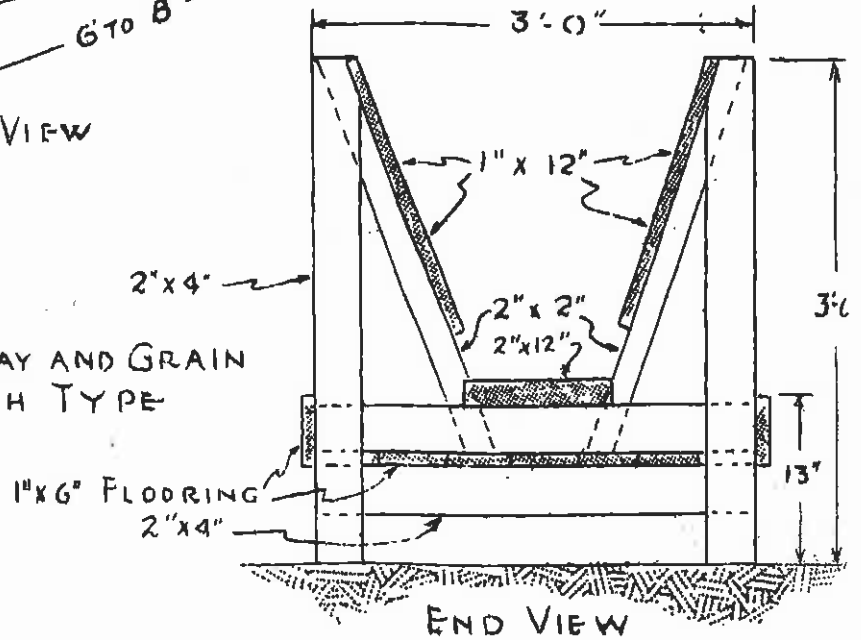
The feeding of chopped hay has a distinct advantage in keeping the fleeces clean and free from hay leaves, etc. This low rack is very light in weight, easily filled, and can be built in only a few minutes of time.

\* \* \* \* \*

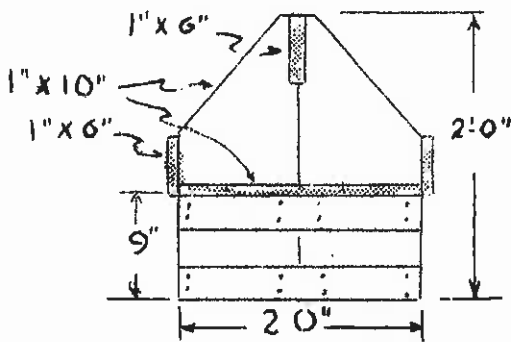


PICTORIAL VIEW

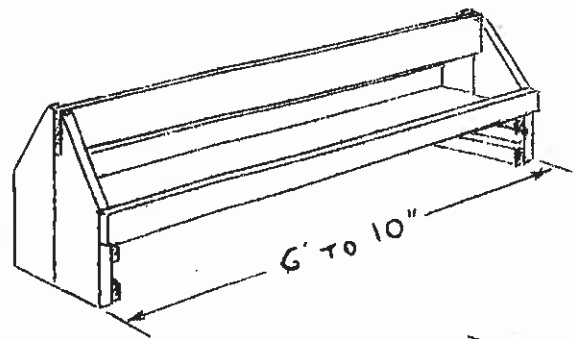
COMBINATION HAY AND GRAIN  
WALK-THROUGH TYPE



END VIEW



SECTION THROUGH CENTER



PICTORIAL VIEW

CHOPPED HAY AND CONCENTRATES RACK

## PORTABLE FEED RACKS FOR SHEEP

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON



S-36 \* WALL FEED RACKS FOR SHEEP

Two types of stationary wall racks for feeding sheep are illustrated. The racks may be built with either solid or slatted fronts. Both racks provide a grain trough in combination with the hay rack. In figure No. 1, the grain trough is built of concrete poured with the floor. The curb may be made of a 2 x 8 plank, bolted to the floor as shown, if desired. The grain trough in figure No. 2 is made of 1" boards. Figure No. 1 is easily filled from a feed alley and may be used as a partition between pens if desired. Figure No. 2 may be built along a wall with the space between the studs being used to hold the hay. If the inside of the building is sheathed, it will be necessary to allow the rack to extend further into the room.

\* \* \* \* \*

S-37 \* REVERSIBLE GRAIN TROUGH FOR SHEEP

This style of grain trough is very easily cleaned as the entire trough is reversed by pulling the stopping pegs on both ends and swinging the trough upside down. The trough is held in position by reinserting the holding pegs. The trough is simply made of one inch material with a single board providing the bottom of both sides of the trough. A much simpler arrangement can be obtained as shown in the upper left-hand corner if it is possible to use a stationary rack. The supporting post must be well set in to the ground to prevent the sheep from loosening it while crowding around the trough. With the stationary arrangement, the same trough is used as in the portable feeder except that it is set well off center and supported by stakes driven into the ground until the proper height is obtained.

\* \* \* \* \*

S-40 \* PORTABLE PANEL FENCE

Portable Panel fences are used with sheep and hogs is a system of creep feeding or for separating corrals, etc. into the pens. The fence shown is constructed of 1" x 4" material but may as easily be built of 1" x 6" material if the situation demands a stronger fence. This type of fence is usually low so that a man may step over it instead of walking around the fence. By using a horse as shown, this fence may be extended in a straight line without being easily tipped over.

\* \* \* \* \*

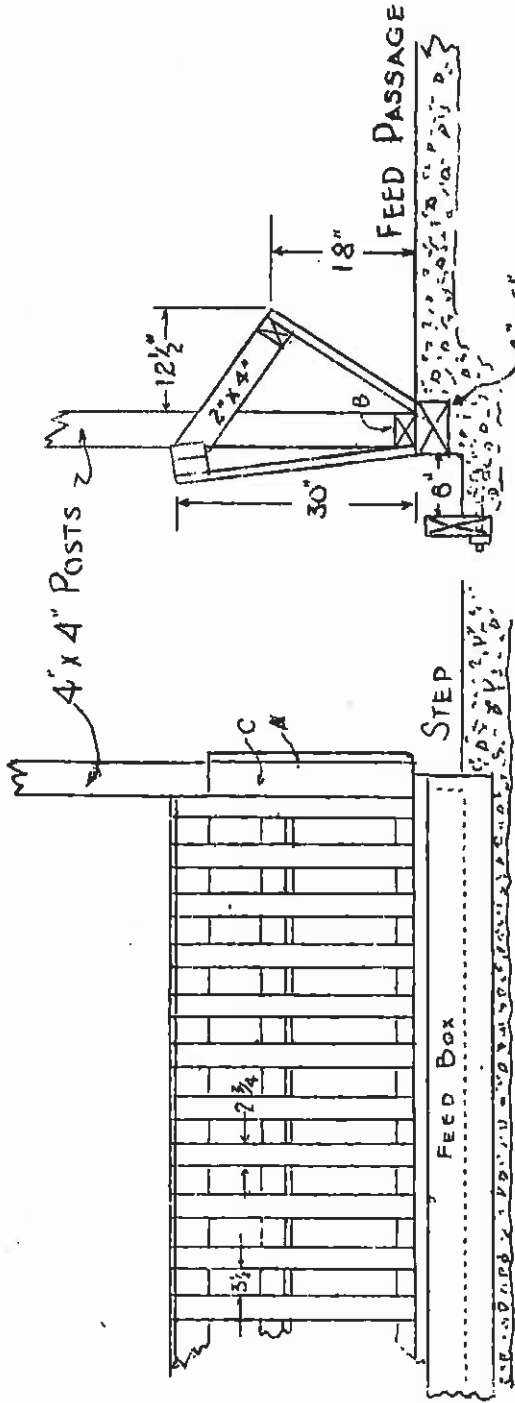


FIGURE No. 1

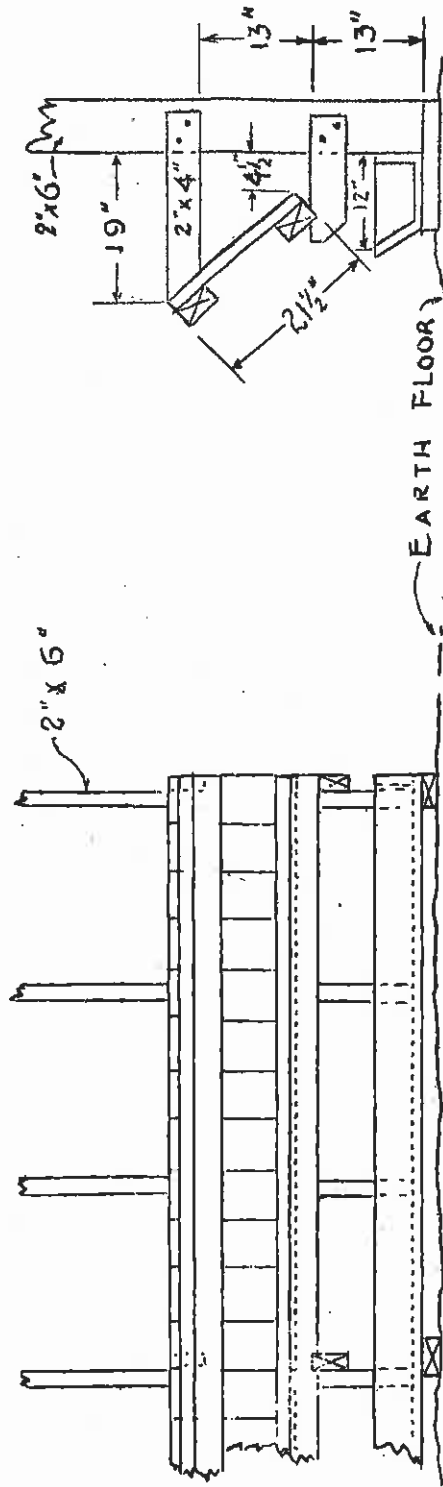
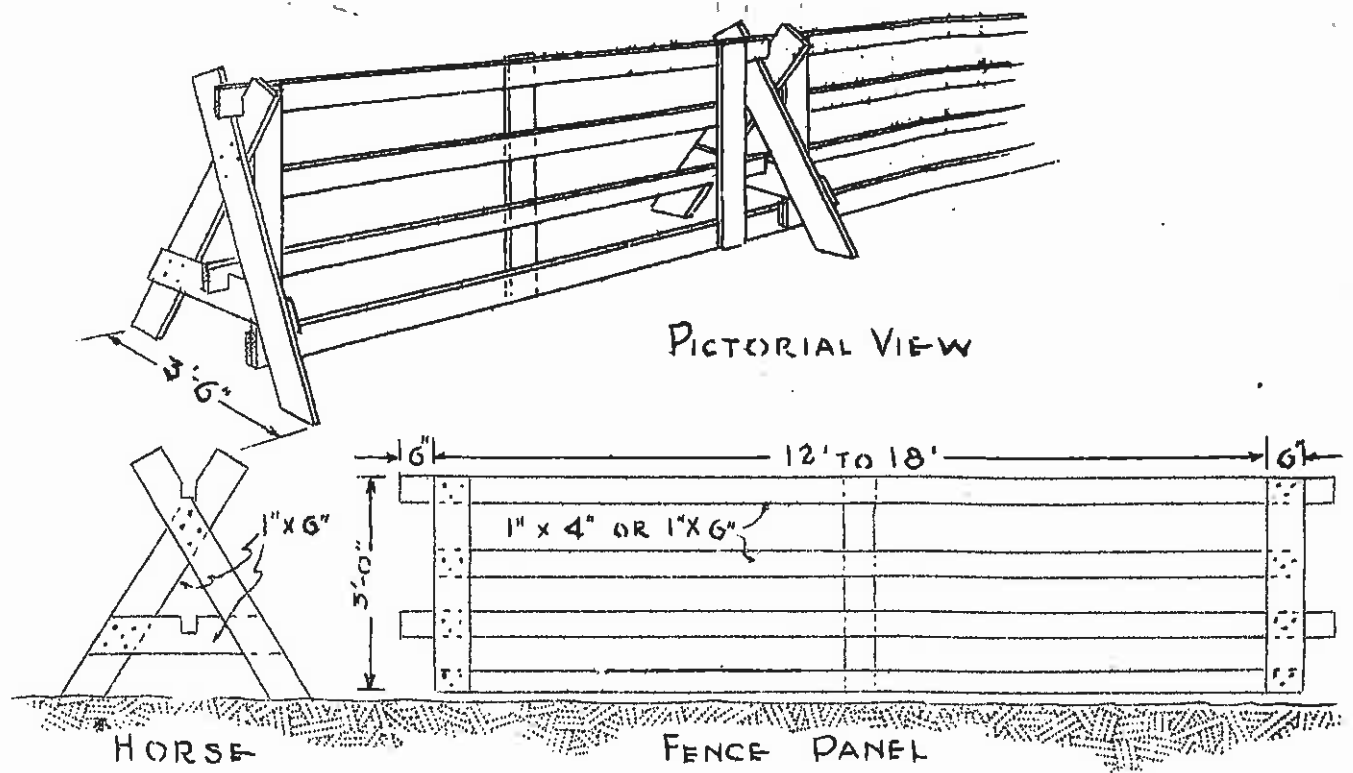


FIGURE No. 2

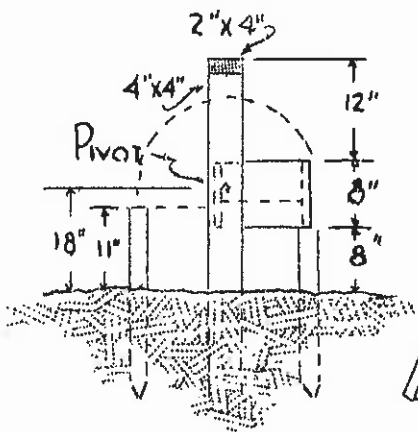
WALL TYPE FEED RACKS FOR SHEEP

DEPT. OF AGRICULTURAL ENGR.  
STATE COLLEGE OF WASH.

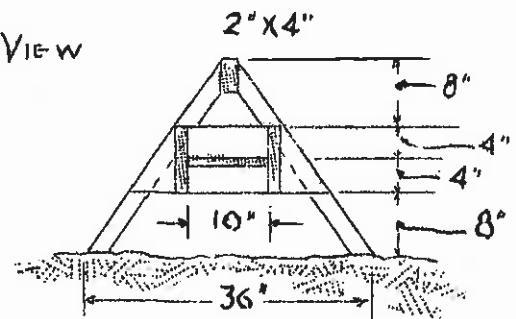
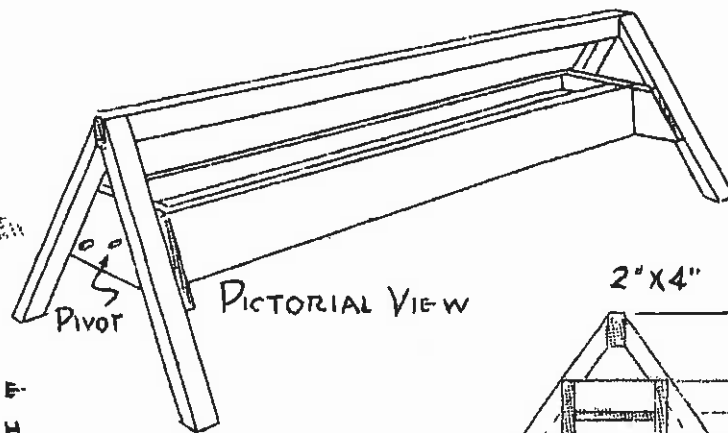


### PORTABLE PANEL FENCE FOR SHEEP OR HOGS

S-40



END VIEW OF ALTERNATE-  
STATIONARY TROUGH



END VIEW WITH  
TROUGH ON SECTION

### PORTABLE REVERSIBLE GRAIN TROUGH FOR SHEEP

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON

S-37

S-41 PORTABLE PANEL WORM FENCE

This is a self-supporting portable panel fence very similar to the S-40 portable fence except that it must be zig-zagged and does not use a horse for support,

\* \* \* \* \*

S-45 \* HOG AND SHEEP SHIPPING CRATES

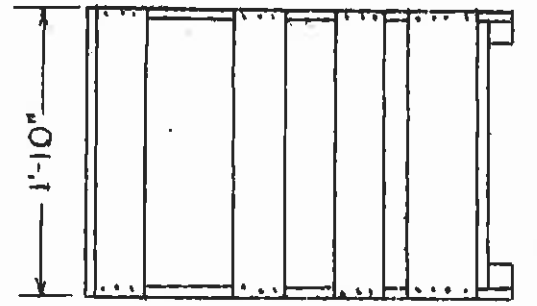
The principal problems in building shipping crates are: (1) to get the maximum amount of space for the lumber used, (2) to make the crate secure so that no accidents can happen in transit, and (3) to have the crate large enough for the comfort of the animal.

Crates should be neatly constructed of strong light material. The sides and ends may be made of 3/4 inch material, but the floor is best made of sound, rough, one-inch boards. If shipment is made long distances over water, a sliding door should be made in each end of the crate so that the animals may be taken out of the crates for exercise and returned without backing them either into or out of the crates. Crates for foreign shipments must have all corners metal bound.

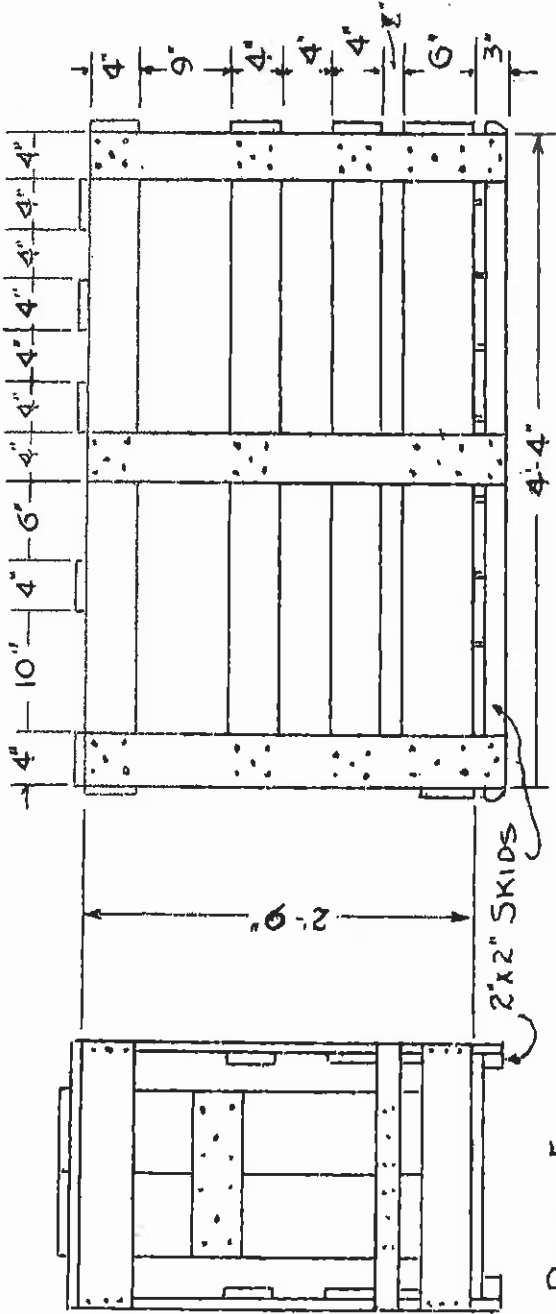
Wide cracks in or near the bottom of the crate must be avoided, else the animal's feet and legs may be injured when the crate is moved.

The size of a hog crate varies greatly with the size of the animal to be shipped. The sheep crate is of more nearly standard size as only yearlings are usually shipped. Some common sizes which may be used are suggested on the diagram.

\* \* \* \* \*



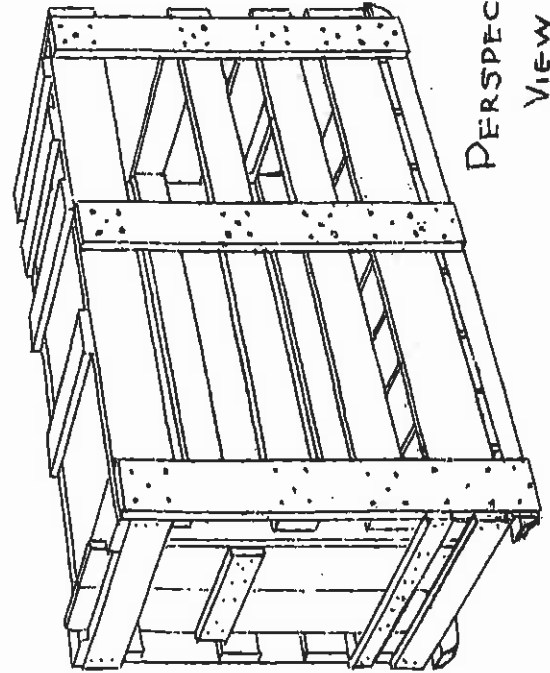
HEAD END



SIDE VIEW

INSIDE CRATE DIMENSIONS		
WIDTH	HEIGHT	LENGTH
12"	24"	46"
18"	33"	52"
24"	40"	78"
21"	34"	48"

PIGS UP TO 100#  
 HOGS 100# TO 225#  
 " 225# + 500#  
 YEARLING SHEEP



PERSPECTIVE VIEW

S-45

SHEEP OR HOG SHIPPING CRATE

SCALE  $\frac{3}{4}" = 1'-0"$

DEPT. OF AGRICULTURAL ENGINEERING  
 STATE COLLEGE OF WASHINGTON

POULTRY

STATIONARY HOUSES		Service Charge
P-11	Unit Laying House 24 x 30	1.00
P-12	Unit Laying House 24 x 24	1.00
P-13	Laying House 20 x 20	1.00
P-14	Laying House 30 x 30	1.00
P-		.....
BROODER HOUSES AND EQUIPMENT		
P-21	16 x 12 Portable Colony Brooder House	.25
P-22	10 x 12 Portable Colony Brooder house	.25
P-		.....
P-25	3 x 6 One Hundred Chick Brooder	.50
P-26	Home-made Lamp Brooder	.15
P-27	Brooding Battery	.10
P-28	Chick Feed Hopper	.10
P-		.....
POULTRY HOUSE EQUIPMENT		
P-41	Dark Nests	.20
P-42	W.S.C. Trap Nests	.20
P-43		.....
P-44	W.S.C. V-Type Feed Hoppers	.20
P-45		.....
P-46	Washington Range Hopper	.10
P-47	Fattening Battery	.20
P-48		.....
P-51	Manure Box Details	.10
P-		.....
RABBIT		
P-61	Rabbit Hutch	.10
P-		.....

The plans here catalogued have been prepared by the Agricultural Engineering Department of the State College of Washington for the general use of the public. They may be obtained upon request and remittance of the small service charge directly to the department, using money order or small postage stamps. Additional plans will be added as they become available. The complete manual listing all plans may be obtained from the Extension Service of the State College of Washington for a nominal charge.

## LAYING HOUSES

A well planned laying house should save labor and increase profits on a poultry farm. The size of the house required is determined by the number of birds in the flock; the convenience depends upon the size, type, and amount of equipment, and the true value of the house is the ability of the structure and equipment to keep the hens in laying condition.

To avoid overcrowding the laying house should provide 3 to  $3\frac{1}{2}$  square feet of floor space per bird when the house is filled to capacity. The heavier general purpose breeds require more floor space than is needed for the smaller leghorns. In order to attain the maximum floor space in the house, all interior equipment may be set on legs or posts and thus raised from the floor.

As a general rule it is well to design a poultry house in such a manner that it may be enlarged, as needed, by building a similar unit beside the original units. A unit laying house plan should include a feed room for mixing feeds and storage of bulk or sacked feeds. The feed room may be the length of the house, 10 to 12 feet wide, and should be placed on the end of the house that is exposed to the prevailing winter winds as this location will aid in insulating the house.

Experiment has shown the need for warmer, better insulated laying houses in most sections of this state. The required insulation may be obtained by filling the space between the studs of the building with sawdust or mill shavings and using a straw loft or ceiling overhead. In addition to wall and ceiling insulation, the doors and windows should be well fitted to avoid cold air drafts near the floor. In large buildings partitions at least 5 or 6 feet high and 24 to 30 feet apart are used to break up the possibility of floor drafts. A well insulated house is cool in summer as well as being warm in winter. Ample ventilation is provided in the plans which may be obtained from the Department of Agricultural Engineering, State College of Washington, Pullman, Washington.

P-11 THE 24 x 30 W. S. C. UNIT LAYING HOUSE

The 24 x 30 foot unit type of laying house is suggested as a standard for either general farm or commercial purposes because the 24' depth affords better protection from drafts than is obtained with narrower houses. Each unit will accommodate 250 leghorns or 200 hens of the general purpose breeds, and as many units may be used as needed to house the flock.

The plans of this structure include a 10 foot feed room which may serve for two or three units. The feed room has open bins for the storage of mash and scratch grains, and plenty of floor space for storing sacked feeds and mixing mash or scratch. In addition to structural details and bill of materials for the building and feed room, each plan includes blue prints of the following pieces of equipment: P-41 Dark Nest, P-42 W.S.C. Trap Nest, P-44 W.S.C. "V" Type Portable Feed Hopper, P-46 Washington Range Hopper, and P-51 Manure Box Details. Each 24 x 30 foot unit will require four-fifteen nest sections of the dark nest type, two 12 foot or three 8 foot feed hoppers, and five roosts the length of the house.

\* \* \* \* \*

P-12 THE 24 x 24 W. S. C. UNIT LAYING HOUSE

The plan of this 24 x 24 foot unit laying house is the same as that of the 24 x 30 foot unit laying house except that it is a little smaller. This house will accommodate 200 leghorns or 150 hens of general purpose breeds, and only three nest sections will be required. Otherwise the plans and descriptions of the two buildings are identical.

\* \* \* \* \*

P-13 20 x 20 POULTRY HOUSE

This poultry house is suitable as a breeding house, or farm laying house, where a small flock is kept principally for home use. The capacity is 100 to 125 birds with sufficient equipment indicated in the plans to care for this number of birds. The house is square and has a common gable roof with two ventilators projecting above the ridge. The plans include a bill of material and detail drawings of an approved window construction. The house is not of the unit type and no feed room is attached. If the size of the flock is increased additional separate buildings must be constructed.

\* \* \* \* \*

P-14 30 x 30 POULTRY HOUSE

This poultry house is similar to the 20 x 20 poultry house plan P-13, and the descriptions are identical except that this plan is larger and will care for 300 hens.

\* \* \* \* \*



## THE PORTABLE COLONY BROODER HOUSE

The colony brooder house is a building used primarily for housing incubator hatched chicks during the first few weeks of growth, but it is also excellently adapted for use as a small backyard laying house. The essential factors for successful brooding are proper temperature, plenty of room, and sanitation.

Proper temperatures are arranged through the use of a good brooder stove and tightly sealed house with good ventilation. The ventilation of the brooder house has been carefully considered and its operation is fully discussed in a description provided with the blue prints and bill of materials. Sanitation is most easily obtained by moving the building onto ground which has not been used for two or three years. The houses are so designed and braced that they may be easily moved without damage to the building.

\* \* \* \* \*

### P-21 16 x 12 COLONY BROODER HOUSE

This is a well designed, light weight, portable brooder house with a capacity of 350 to 500 chicks when used with a sun porch, or it will accommodate a flock of 50 to 60 laying hens. If more chicks are to be raised than this building can handle, more brooder houses should be built rather than crowding too many chicks into one building. Complete details of windows, doors, and ventilators are shown with the working drawings.

\* \* \* \* \*

### P-22 10 x 12 COLONY BROODER HOUSE

This plan is very similar to the larger plan P-21 and will handle 250 to 300 chicks or 30 to 40 laying hens. It is designed for a brooder stove with a hover 52" in diameter placed in the center of the floor area.

\* \* \* \* \*

### P-25 ONE HUNDRED CHICK COLONY BROODER HOUSE

This is a small 8 x 6 foot portable brooder house capable of handling about one hundred chicks. It is a low coop with shed roof and skid runners. The sides, ends, partitions, roof and floor are built in independent sections so that the house can be taken apart for thorough sunning and cleansing before the brooder season begins. An incubator lamp with the chimney flue making a loop inside of the house provides the heat which is necessary to the comfort of the chicks. A properly constructed electric heating unit might very well take the place of the lamp and would be much safer.

\* \* \* \* \*

This blue print shows the construction of an inexpensive, easily built and cleaned, home-made electric brooder which is being used very successfully. The brooder as shown is designed for use in the 10 x 12 portable colony brooder house (Plan P-22) but can be adapted to any other warm, well ventilated house. Four hundred chicks can be kept warm and comfortable.

The heating element consists of a row of ten 32-candle power, carbon element, electric lamps, spaced approximately 11 inches apart on a 1" x 4" supporting board. The lamps are wired in a simple manner to give a measure of control over the temperature. The wiring is illustrated in the drawing and consists of a system whereby all lamps are connected in parallel circuit to give the maximum heat, or by throwing the double-pole, double-throw switch to the other terminals, the lamps are connected in a series-parallel circuit which reduces the heat of the lamps to approximately one-fourth of their capacity. In a well-constructed house and with moderate weather the lamps are operated at low temperature much of the time. Four 250 watt, 110 volt electric heating strips connected in a similar manner will give satisfactory service if it is not possible to obtain the carbon element lamps.

The brooder covers a strip of floor 3 feet wide and the full length of the rear wall. The chicks are hovered on a one-half inch mesh hardware cloth platform 12 inches above the floor level. The space under the hardware cloth is boarded up to prevent the chicks from running underneath, but the boards may be removed to clean out the droppings. The row of lamps is placed along the rear wall at a height of 6 inches above the hardware cloth. Six inches above the lamps a hinged board cover or baffle is provided to keep the heat from leaving the brooder too soon. The chicks are kept from leaving the hover by a board partition at the front of the brooder. This board partition is dropped to form a ramp or inclined runway to aid the chicks in reaching the brooder after they are strong enough to be allowed free range on the floor.

This brooder was designed and built by Paul K. Jones, Smith-Hughes teacher in the West Valley High School of Spokane County.

\* \* \* \* \*

P-27 BROODING BATTERY

The battery brooder is a type which may be used to care for chicks up to the age of two weeks when large quantities are handled or when brooding space is at a premium. In order to serve this purpose a brooder must have a compact, easily and individually controlled heating system, be well ventilated and easily cleaned. The complete units or compartments of the brooder are stacked one above another in stacks two or three units high. Care of the chicks is similar to the care for single units in a small brooder house except that it may be necessary to provide additional vitamin D active materials in the feed to overcome the lack of natural light.

This blue print shows the construction of a hot water heated brooder adapted to use in battery brooding. The framework is principally of 2 x 2 inch material with all sides slatted preferably using 3/8 inch round, wooden rods. Metal feed and water trays are clamped to the outside of the compartment. The bottom consists of a frame covered with galvanized hardware cloth which can be removed at any time. A sheet metal tray under the hardware cloth tray serves to catch the droppings. This may also be removed at any time without disturbing the chicks.

\* \* \* \* \*

P-28 CHICK FEED HOPPER

This is a small feed hopper made of a strip of sheet metal and used for feeding small chicks in the brooder. The body of the hopper is nearly 4' wide so that it will hold an appreciable supply of feed. The top is reduced to a width of about one inch on each side of the adjustable lath supported over the center of the trough. The combination of the narrow top width and the lath baffle prevents the chicks from standing and scratching in the feed. The trough may be made from wood quite satisfactorily if a lip on the outer edges is provided to reduce the top width.

\* \* \* \* \*

P-41 DARK NESTS

This type of nest box, in which the hens lay in complete darkness, has been found helpful in reducing loss from the vicious pick out problem which sometimes develops in a flock of hens. In this type the birds reach their nests from a narrow aisle in the rear of the boxes. Hinged jumping boards, which can be raised to close the entrances at night, are used to aid the hens in reaching the aisle and to keep the pullets from roosting in the nests. Eggs are removed through a door made of a 1" x 6" board and hinged to the front of each row of boxes. The boxes are easily cleaned by removing an entire row of nests at one time.

A group of 15 nests consisting of three 5-box rows built one above the other makes a convenient unit, and is the standard size unit recommended for the lighter breeds. These units of nest boxes should be placed on walls or partitions in such a manner that they will not interfere with light or ventilation, and at a height such that eggs may be reached and removed easily. The location of the nests is indicated on the floor plans of all laying houses. At least one nest box should be provided for each four hens when this type is used.

\* \* \* \* \*

P-42 W.S.C. TRAP NEST

The Poultry Department of the Washington State College recommends the simple trap nest as constructed from this complete working drawing. The front of the nest is screened so that the attendant can easily see when the nest is occupied. The screen also provides ventilation for the hen and cuts down the light so that she lays in semi-darkness. Hens enter the nest from a narrow walk in the rear, tripping the catch of a swinging door as they enter. The trap door and trigger are light in weight and easily operated to avoid disturbance or frightening of the hens.

\* \* \* \* \*

P-44 THE W.S.C. "V" TYPE PORTABLE FEED HOPPER

This type of hopper has given very satisfactory service on a large number of poultry ranches. The V-shaped bottom has the advantage of saving feed and automatically keeping it mixed as the supply is constantly worked towards the center when the chickens feed. The hopper is light in weight, adjustable to various sizes of birds, and is easily constructed. It is raised 18" from the floor so that it does not cut down the usable floor space. Two 12 foot or three 8 foot lengths of this hopper should be used in each 24' x 30' unit.

\* \* \* \* \*

P-46 WASHINGTON RANGE HOPPER

This is a simple type of feed hopper, developed on the west side, with a wide overhanging roof to protect the feed from rain so that the hopper may be used outside of the poultry house. Hens feed from narrow, feed-saving troughs on both sides of the hopper. The roof is easily removed but is pivoted so that it can be tilted up and out of the way for ordinary filling.

\* \* \* \* \*

P-47 FATTENING BATTERY

This blue print shows the construction of a pen which may be used for forced-feeding and finishing of poultry. The construction is mostly of lumber and the design is suitable for stacking one unit on the top of another to form a feeding battery. The construction of swinging gate, sliding metal droppings tray, feed and water troughs is shown in the diagram. A freely sliding tray covered with galvanized wire cloth forms the floor of the pen. The framework is mostly of 2"x 2"s with round half-inch wooden rods suggested for use in all of the sides which are of an open slatted construction.

\* \* \* \* \*

P-51 MANURE BOX DETAILS

This manure box plan was designed for use with the 24 x 30 size laying house but a similar box is indicated for collecting manure from any source where the supply is not great enough at any one time to make a full wagon load. The dimensions of the box are 7' x 9'. The roof is of the gable type with one side hinged for easy filling. The front is of loose planks which may be removed when emptying the box.

\* \* \* \* \*

P-61 RABBIT HUTCH

This blue print illustrates the construction of a convenient, easily cleaned, rabbit hutch suitable for use in a battery of two or more hutches. A complete unit consists of two pens with a "V" shaped feed rack between them. The pens are of standard dimensions 2' - 6" x 4' - 0" and 19" high. The entire front is of open framework covered with 1" mesh wire except over the V opening of the feed rack which is left entirely uncovered for convenience in filling. The feed rack is 18" long; the remainder of the partition consists of a 1" x 12" board 19" long. The floor is made of boards but may be covered with sheet metal to keep the rabbits from chewing on it. A square foot hole is left in the floor of each pen in back of the feed rack, the hole being covered with 1" mesh galvanized hardware cloth. Rabbits soon learn to use this hole to deposit droppings so that a metal tray should be supported underneath to keep the pens below clean. The dropping pan should be emptied regularly. Ventilation of the hutches is greatly improved if part or all of the back is covered with wire similar to the front.

\* \* \* \* \*

SHOPS, IMPLEMENT SHEDS, AND GARAGES

STRUCTURES	Service Charge
R-11 * Large Shop and Implement Garage	.25
R-12 * Twenty by Twenty Farm Shop	.....
R-13 Twenty-two by Thirty-two Farm Shop	.50
R-14 Sixteen by Eighteen Shop	.50
R-14a Alternate Floor Plan for 16 x 18 Shop	.10
R-15	
R-21 * Combined Shop and Implement Shed	.25
R-22	.....
R-23 Large Implement Shed, 16 x 22 foot Bays	.50
R-24	.....
R-25 Single Garage, 11 x 16	.20
R-26 Double Garage, 16 x 20	.50
R-27	
EQUIPMENT	any 3 drawings .25
R-31 Work Bench	
R-32 Two Sided Work Bench (for schools)	
R-33	
R-36 Miter Box	
R-37 Tool Cabinet	
R-38 Tool Box	
R-39 Nail Box	
R-40 Saw Horse	
R-41 Step Ladder	
R-42	
R-51 Bearing Scrape	
R-52 Car Creeper	
R-53 Car Lifter	
R-54	

Note: Asterisk (\*) denotes that plan is illustrated

The plans here catalogued have been prepared by the Agricultural Engineering Department of the State College of Washington for the general use of the public. They may be obtained upon request and remittance of the small service charge directly to the department, using money order or small postage stamps. Additional plans will be added as they become available. The complete manual listing all plans may be obtained from the Extension Service of the State College of Washington for a nominal charge.

## FARM SHOPS

With the increasing amount of machinery used on the modern farm, the importance of the repair shop is gaining rapidly. A shop may be small, allowing room for tools and a bench only, but with such an arrangement it may be found very inconvenient to work on machinery. The ordinary farm should have a shop of sufficient size to accommodate all of the work of upkeep and repair, keeping in mind that a small shop may become too crowded for convenience. Having the shop in the end of an implement shed is very convenient and avoids the necessity of separate buildings. Should separate buildings be desired, the floor plan of the combined buildings is suggestive.

Light is very important in a shop. As many windows should be used as is found practical. Window lights should be small to lower the cost of replacement from breakage. In small shops a window opposite the entrance door will add to the convenience of working on long implements such as wagons with tongues, etc. It is essential that direct sunlight should not fall on the hearth of the forge as it is then hard to judge the heat color of the metal being worked.

Work benches and equipment are usually placed along the walls of the shop. This arrangement provides better light for bench work and leaves the floor space clear for working on the machine being repaired. The amount of equipment varies with type of farm and resources of the owner but may well include such power machinery as drill, grindstone, and emery wheel. If such equipment is operated from a line shaft, the motor or engine may sometimes be placed on the floor and used to operate such equipment as buzz saws just outside of the shop by running the belt out through an opening in the wall. Belting the saw directly to the motor rather than to a pulley on the line shaft saves a great deal of power in small motors.

When a forge is included in the shop equipment, the floor should be of concrete to lessen the fire hazard. The floor of implement sheds where repair work is being done should usually be of concrete or oiled dirt to avoid dust while working.

\* \* \* \* \*

R-11\* A LARGE FARM SHOP AND IMPLEMENT GARAGE

A shop plan designed for large farms where long trucks, tractors, etc. may need repairing. The arrangement of a long garage with sliding doors into the shop permits the servicing of very long trucks and equipment without exposure to the weather. The doors are placed to facilitate the use of a tractor in towing equipment into the shop as the tractor may be taken out through a door other than the one of entry. A long, straight carrier track, and low table on casters, are great labor savers in loading and unloading equipment or in moving it about the shop.

The shop tools and equipment are well arranged to avoid interference from other machines while working on any job. The metal working tools are grouped together and centered around the forge so that they may be easily reached. Two work benches are used to allow separation of wood working tools from heavy metal working tools, and to provide a clean bench free from dirt and grease for wood working.

This building is large enough to provide considerable storage space in an attic if the building is ceiled. Space for stairs to the attic is suggested alongside of the shop partition. A small supply room may be built underneath the attic stairs. Large doors provided in the gables of the building provide light and a means of getting long pieces of lumber, etc., into the attic.

\* \* \* \* \*

R-12\* 20 x 20 FARM SHOP PLAN

A shop plan which provides a very convenient, compact arrangement of equipment, a medium size working floor, and space for storing considerable small equipment. The motor or gasoline engine which supplies power to the line shaft may be mounted on a table and turned into a position for use with equipment outside of the shop. An electric motor can be attached to the ceiling, thus clearing the floor space, if it is used with the line shaft only.

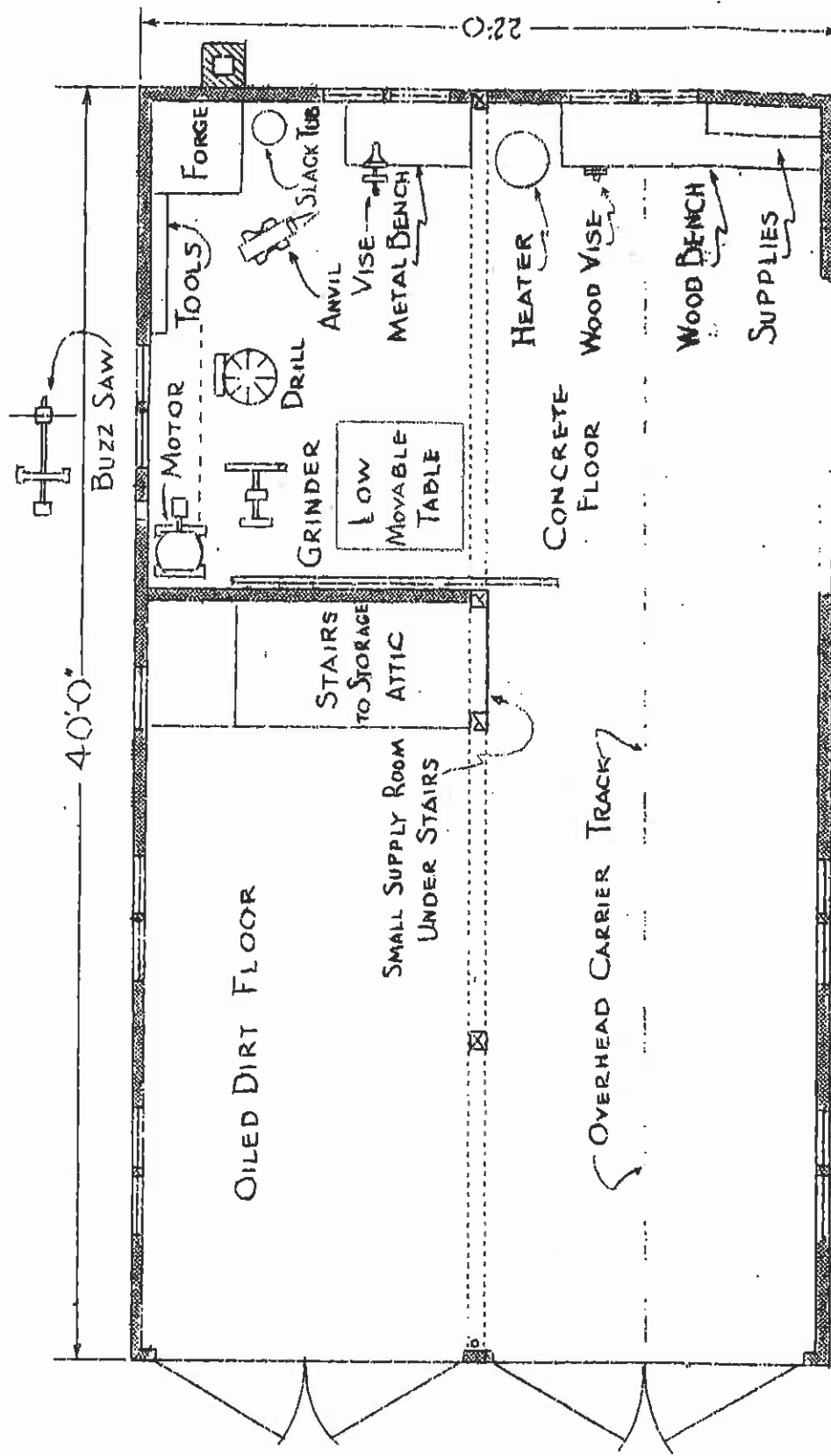
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R-13 TWENTY-TWO BY THIRTY-TWO FARM SHOP

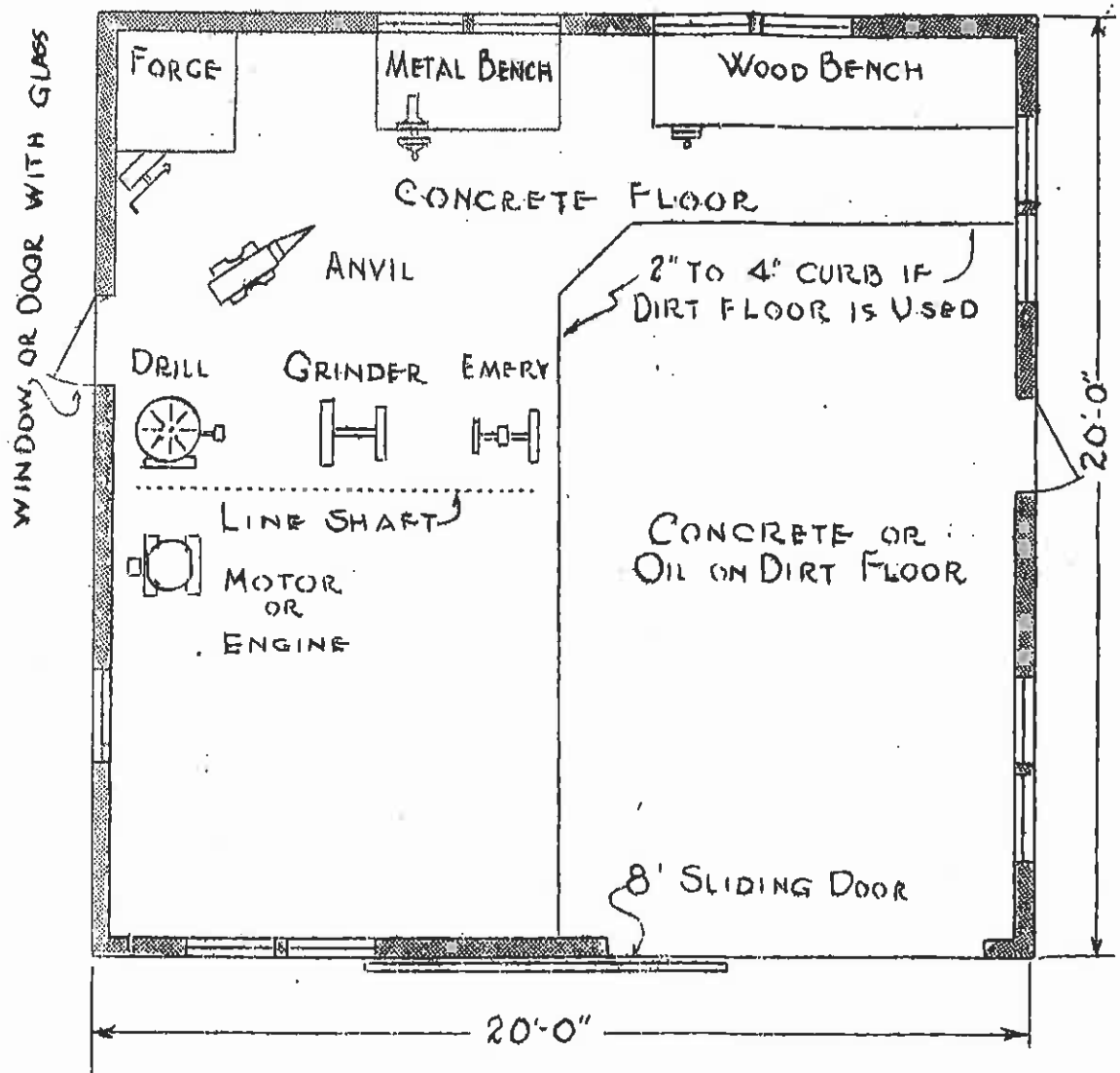
A plan that has been adapted from a large shop used by a Palouse wheat farmer for repairing combines, tractors, and trucks. The building is divided into two sections, one-half of the floor space being of oiled dirt and used for repair work only. All of the equipment which includes power drill, grinder, forge, anvil, and two work benches is compactly grouped on a concrete floored section 16 feet square. The remainder of the floor space is occupied by a supply or storage room which may be locked for safe keeping of repair parts and tools. The supply room has a board partition to a height of about 5 feet which allows rooms for shelves and pigeon holes. The remainder of the partition is of heavy screen to provide ventilation and light in the supply room.

\* \* \* \* \*





A LARGE FARM SHOP  
AND IMPLEMENT SHED  
22' x 40'



FARM SHOP PLAN  
20'-0" X 20'-0"

A CONVENIENT, COMPACT  
ARRANGEMENT OF EQUIPMENT

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON

R-14 SIXTEEN BY EIGHTEEN FOOT SHOP

This small shop is suitable for dairy, poultry, irrigated, and other farms where repairing is done on small equipment only. This structure may be used also as a garage if the car is rolled outside while working. The floor plan shows a fairly complete arrangement of equipment. The door is located to the left of the center on the 18' side. The metal working tools, including power driven grindstone, emery, and drill, are placed along the wall opposite the door. The motor or engine used to drive the line shaft is placed in the corner and may be belted to drive buzz saws, etc. outside of the shop. The metal working bench is in the corner opposite the door and is conveniently located with respect to the power equipment and the forge. The forge and anvil are placed in the center of the side. A bench alongside of the door may be used for wood working.

R-14a ALTERNATE FLOOR PLAN FOR 16 x 18 FOOT SHOP

This sheet shows the floor plan of the 16 x 18 shop R-14 and an alternate arrangement with the door on the 16-foot side. Power metal working equipment is in the corner opposite the door with the forge in the center of the right side. The iron bench is shown in the right hand corner near the door but may be placed in the opposite corner on the left side. The wood-working bench is on the left side, near the door.

\* \* \* \* \*

R-21\* COMBINED FARM SHOP AND IMPLEMENT SHED

The plan illustrates the combination of a shop with an ordinary implement shed. A sliding door is provided between the shop and the shed to make the tools easily accessible for repair of equipment in the shed. The implement shed shown has only two bays, 10' and 14' wide respectively, but the number of bays may be increased to accommodate any amount of machinery. If sliding or swinging doors are installed in the implement shed, windows will be necessary.

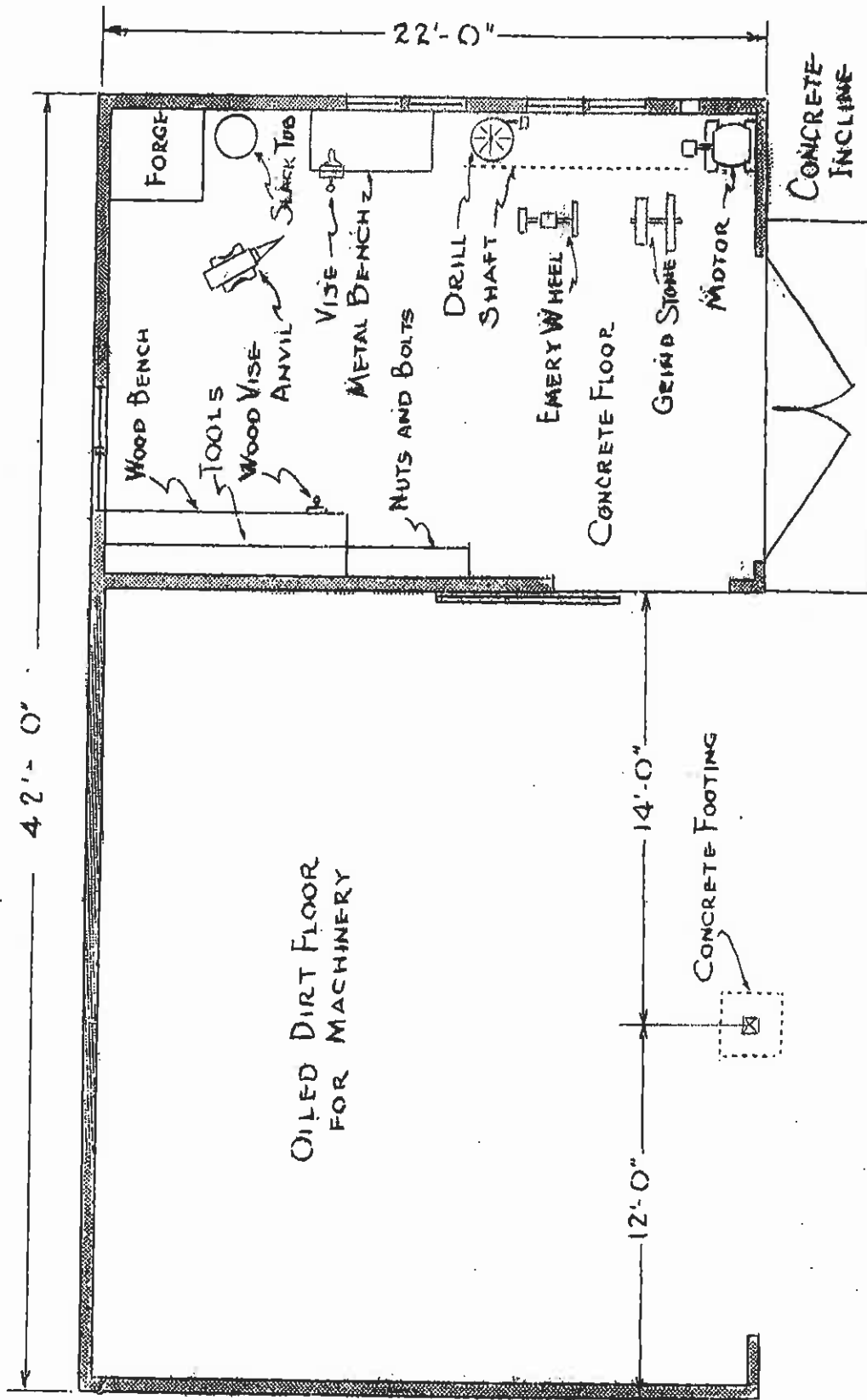
The shop is wide enough for servicing an automobile. It is only 16' wide but can easily be made wider if desired. Metal working tools are arranged in a line along one wall with wood-working equipment along the opposite wall. If the shop is used without the implement shed, windows should be provided in front of the wood bench.

\* \* \* \* \*

R-23 A LARGE IMPLEMENT SHED, 16 x 22 FOOT BAYS

An implement shed designed to accommodate large machinery and at the same time economically house smaller equipment. The 16-foot width allows ample room for large equipment and provides room for two common wagons placed side by side. The plan shows the building with five 16-foot bays but the number may be arranged by the builder to suit his own requirements. The width of the bays may also be changed to provide a few narrower units. The design shows an open concrete pier and post front with vertical board siding and battens. The framing for the ends of the building and the rafters cuts for the modified gable roof are clearly shown in the working drawings.

\* \* \* \* \*



COMBINED FARM SHOP  
AND IMPLEMENT SHED

22' x 42'

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON

R-25 SINGLE GARAGE 11' x 16'

The blue print shows the length of rafters for a common gable roof, framing of the large door and details of constructing a small, inexpensive, single garage. The size of the garage which is 11 x 16 is sufficient for small cars but should be lengthened to at least 18' if one of the larger cars is to be housed.

\* \* \* \* \*

R-26 DOUBLE GARAGE, 16' x 20'

The plan shows complete details for construction of a garage capable of housing two automobiles. The design is simple with a common gable roof so that the building is easily built. The corners of the roof peak are cut off for appearance but may be built up in the usual manner of a gable roof if preferred.

\* \* \* \* \*

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EQUIPMENT

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B-31 WORK BENCH

The blue print shows the working drawings for the construction of a sturdy, durable wood-working bench and also shows a pictorial view of the construction of a drawer suitable for use with this bench. A work bench should ordinarily be about 2 feet wide and 8 or 10 feet long. These dimensions give ample space for ordinary work and tend to discourage the habit of leaving tools lying on the bench. Tools should be kept in drawers or on hooks in such a manner that the sharp tools are not dulled or broken by contact with other tools. Much time can be wasted by trying to find a tool which is left on a bench along with all other tools and odd pieces of equipment.

R-32 TWO SIDED WORK BENCH

A work bench designed primarily for the use of students in a wood working shop where it is desirable to conserve floor space. This double bench is similar to two of the R-31 benches placed back to back but does not require as much lumber as two separate benches.

\* \* \* \* \*

R-36 MITER BOX

A simple home made miter box will be found useful on the wood-working bench of most shops. It can be made of small pieces of lumber left over from a building or any other scrap lumber in good condition.

\* \* \* \* \*

R-37 TOOL CABINET

The blue print shows the construction of a tool cabinet which will fit between the studs of a shop or other building with studs placed two feet on center. The box is arranged and illustrated with shelves, hooks, etc. to provide a definite arrangement of various tools. Both sides of the box may be used for storage of tools. Hinges are provided so that the cabinet can be closed or locked to keep tools safely out of sight.

\* \* \* \* \*

R-38 TOOL BOX

The tool box is used to carry tools to a job which cannot be brought to the shop for construction or repairing. A handle is provided so that the box may be easily carried. A nail compartment divided into four or five small boxes is provided so that nail sizes may be kept separate and carried along with the other tools.

\* \* \* \* \*

R-39 NAIL BOX

The completed nail box has a handle so that it can be easily carried and has eight compartments so that nails of different sizes can be kept separate. There is also space for a hammer and one or two small tools.

\* \* \* \* \*

R-40 SAW HORSE

The blue print shows the method of making a strong, neat-appearing three-legged sawhorse; but by making the two ends similar a four-legged sawhorse could be made from the drawing.

\* \* \* \* \*

R-41 STEP LADDER

The blue print shows the construction of a step ladder 40" tall which is very substantial and will not easily tip over. Such a ladder will be found handy about any ranch or building.

\* \* \* \* \*

R-51 BEARING SCRAPERS

The blue print shows the shape of four tools which are easily made in the forge from old files and are found very useful in scraping bearings. The print also illustrates the appearance of bearings before scraping, partly seated, and the finished job of scraping and burnishing.

\* \* \* \* \*

R-52 CAR CREEPER

The blue print shows the construction of a creeper for use while working underneath an automobile. Ball castors allow free movement and a headrest gives comfort to the user.

\* \* \* \* \*

MISCELLANEOUS

FRUIT AND VEGETABLES

Service Charge

M-11	Sixteen by Twenty-four Foot Root Cellar	.25
M-12	Eighteen by Twenty-eight Foot Root Cellar	.25
M		.....
M-15	Sketch of Side Hill Root Cellar	.10
M-16 *	Entrance to Root Cellar	.....
M		

MISCELLANEOUS AND UNCLASSIFIED BUILDINGS

M-21 *	Insulated Wooden Ice House	.25
M		.....
M-25 *	Combination Barn, Implement Shed and Garage	.....
M-26	Feed Elevating, Grinding and Mixing Plant	.50
M		

CONSTRUCTION DETAILS

M-30-49	Assorted Building Details--Plate and Sill Construction, Foundation, Rafter Cutting, etc.	.10
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ELECTRIFICATION

M-51 *	Exposed Wiring Details	.....
M-52 *	Electric Hotbed Details	.....
M		

WATER SUPPLY AND SANITATION

M-71 *	Sand Water Filter	.....
M-72	Single Compartment Sewage Tank	.10

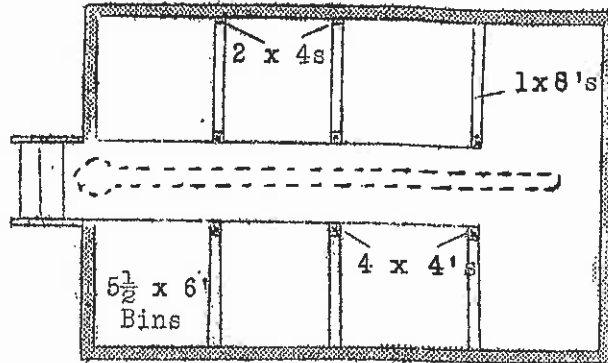
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## ROOT CELLARS

The accompanying drawing of a root cellar shows a commonly accepted and satisfactory floor plan. The arrangement consists of two rows of vegetable bins with a central alley. The bin at the opposite end from the door may cross the alley, making a much larger bin, if doors are not provided in both ends of the cellar.

Vegetables stored in large bins are likely to overheat. To avoid overheating, the bins should be limited to about 8 feet square by 4 or 5 feet deep. A bin 7 feet square and 5 feet deep will hold approximately 200 bushels of vegetables. The sides of the bins should be slatted for ventilation, 1 x 8 rough boards spaced 1 to 2 inches apart are satisfactory. The side boards may be nailed to the sides of the dividing posts or they may be held against the posts without nailing by the pressure of the vegetables in the bins. By placing the side boards of adjoining bins on the side of the division posts, a 4-inch space is left open between bins for air circulation. A circulation under the bins may be obtained with the use of a similarly slatted false floor on the bottom of each bin.



M-11 16 x 24 Ft. Root Cellar

Earth floors maintain the proper humidity in cellars better than concrete floors, so that earth floors are desirable. Excessive moisture in a root cellar increases humidity and promotes decay. For this reason, the floor should be well drained either naturally or artificially.

The accessibility of a cellar must be carefully considered. Low, dark, narrow, and winding entrances are to be avoided. Stairs are sometimes unavoidable, but an entrance which will allow the use of wheel barrows and carts is of very great convenience. If the roof is low, vegetables may be put into the bins through trap doors in the roof above by use of a chute.

The insulation of a root cellar is a very important point to consider in the maintenance of proper temperatures. A warm cellar in the winter will, of course, be a cool one in the summer, which is to be desired. The cheapest and best insulation may be obtained by the use of underground cellars. Many good side hill cellars are completely underground with only the entrances being exposed to the weather. When it is impossible to locate a cellar underground, it is usually desirable to use a high concrete foundation and bank earth around the cellar above ground. When studs and siding are used, it is usually necessary to sheath the studs with shiplap and waterproof building paper underneath the outside siding. The space between studs should also be filled with some insulating material such as dry sawdust or mill shavings. It is essential that vegetables do not come in contact with frosted walls. If the cellar is too cold, a little artificial heat (such as lighted lanterns) may be necessary.

The plans available are: M-11 16 x 24 Root Cellar  
M-12 18 x 28 " "

\* \* \* \* \*



M-15 SKETCH OF SIDE HILL ROOT CELLAR

This blue print illustrates a sketch of a vertical section of a small side hill root cellar completely covered over with earth for insulation. The cellar has an earth floor, double door with entry, and a chute arrangement at the rear of the cellar for convenience in filling. The size of the cellar is to be determined by the individual to accommodate the quantity of roots to be stored.

\* \* \* \* \*

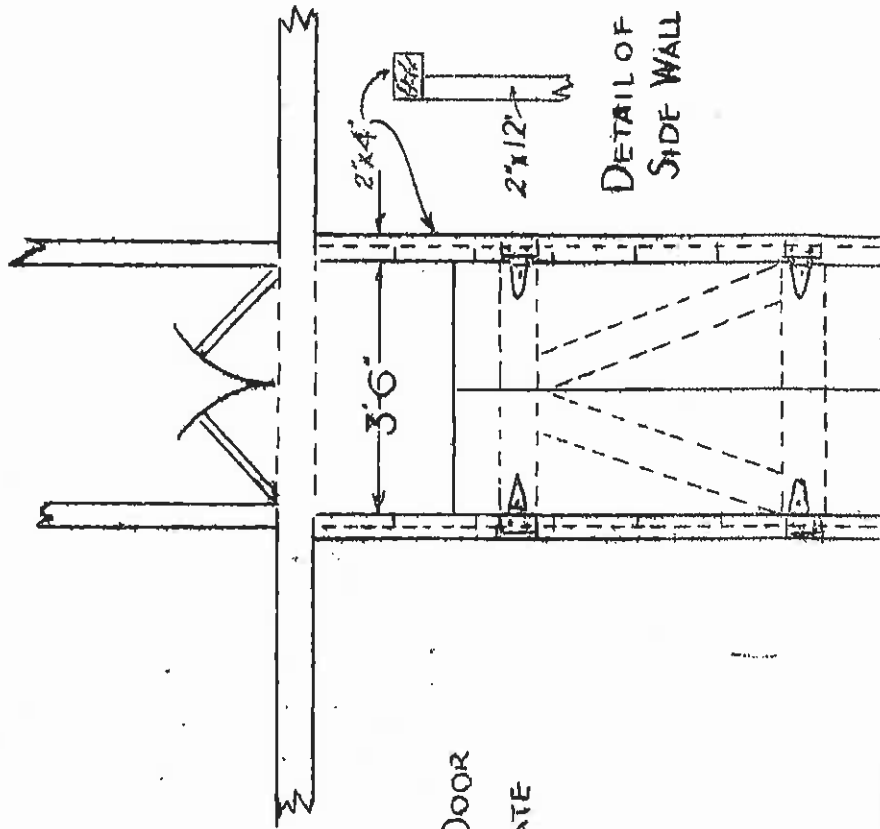
M-16 \* ENTRANCES TO ROOT CELLARS

In order to insure proper insulation and maintenance of correct temperatures in root cellars, it is necessary to consider the protection of entrances to the cellar. A single, well-built, well-insulated door may serve the purpose of guarding the entrance successfully, but in many cases it will be found more economical to use a system of two doors for each entrance. A double door with the space between guarding against winter winds is usually capable of performing satisfactory service.

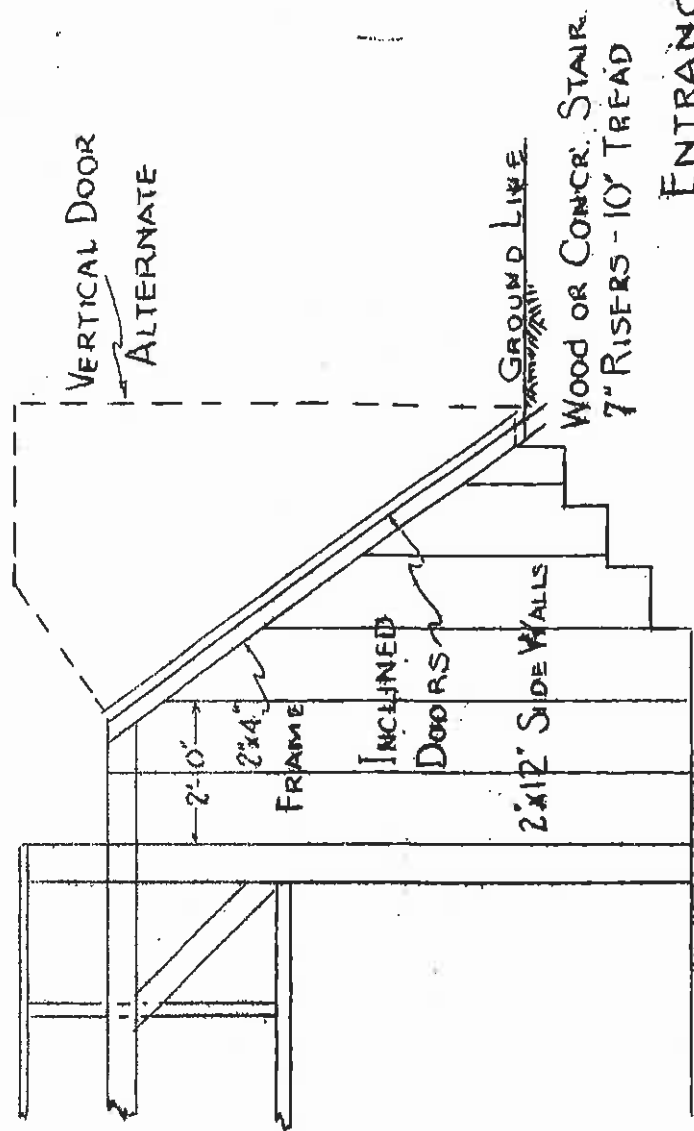
If the floor level of the cellar is about the same as the outside ground level, both doors may be swung from the same frame in opposite directions. In many cases the floor level of the cellar is below the outside ground level, in which event, a vestibule entrance is commonly used. The vestibule entrance should be enclosed to avoid trouble with drifting snow. The door to the vestibule may be either vertical or inclined. A sloping door requires somewhat less material and may provide better lighting conditions in the cellar, but the vertical door is usually more convenient to open.

Whether wagons, wheel barrows, or only men are to enter a door, it is essential that the door be wide enough to avoid inconvenience while passing through with a load. If more than one man is to be employed in a large cellar, it is often desirable to have a door in each end of the building to avoid confusion between men entering and departing.

\* \* \* \* \*



PLAN



SECTION

ENTRANCE TO ROOT CELLAR

DEPARTMENT OF AGRICULTURAL ENGR.  
STATE COLLEGE OF WASHINGTON

## ICE HOUSE

The capacity of an ice house is governed largely by the method of insulation. Unless the ice house has permanently insulated walls it will be necessary to leave at least 12" above, below, and on all sides of the ice for insulation with sawdust or mill shavings. Loss by melting is nearly proportional to the surface area exposed to the packing material or the air; hence it is advisable to store the ice as nearly as possible in the form of a cube. A cubic foot of ice weighs about 57 pounds but the quantity of ice that a given ice house will hold depends upon the method of packing the ice. The following table may be used to estimate the weight of ice per cubic foot of the ice house.

Ice thrown in at random	30 to 40 lbs.
Ice piled loosely	40 to 45 lbs.
Ice closely piled, very small crevices	45 to 50 lbs.

The estimated quantity of ice to be used during a season may be used to determine the size of ice house required. To meet the needs of an average family about 5 tons must be stored. One-half ton of ice together with suitable cooling tanks will usually be sufficient to cool the cream from one cow if marketed once or twice a week. If whole milk is cooled,  $\frac{1}{2}$  tons of ice per cow may be necessary.

\* \* \* \* \*

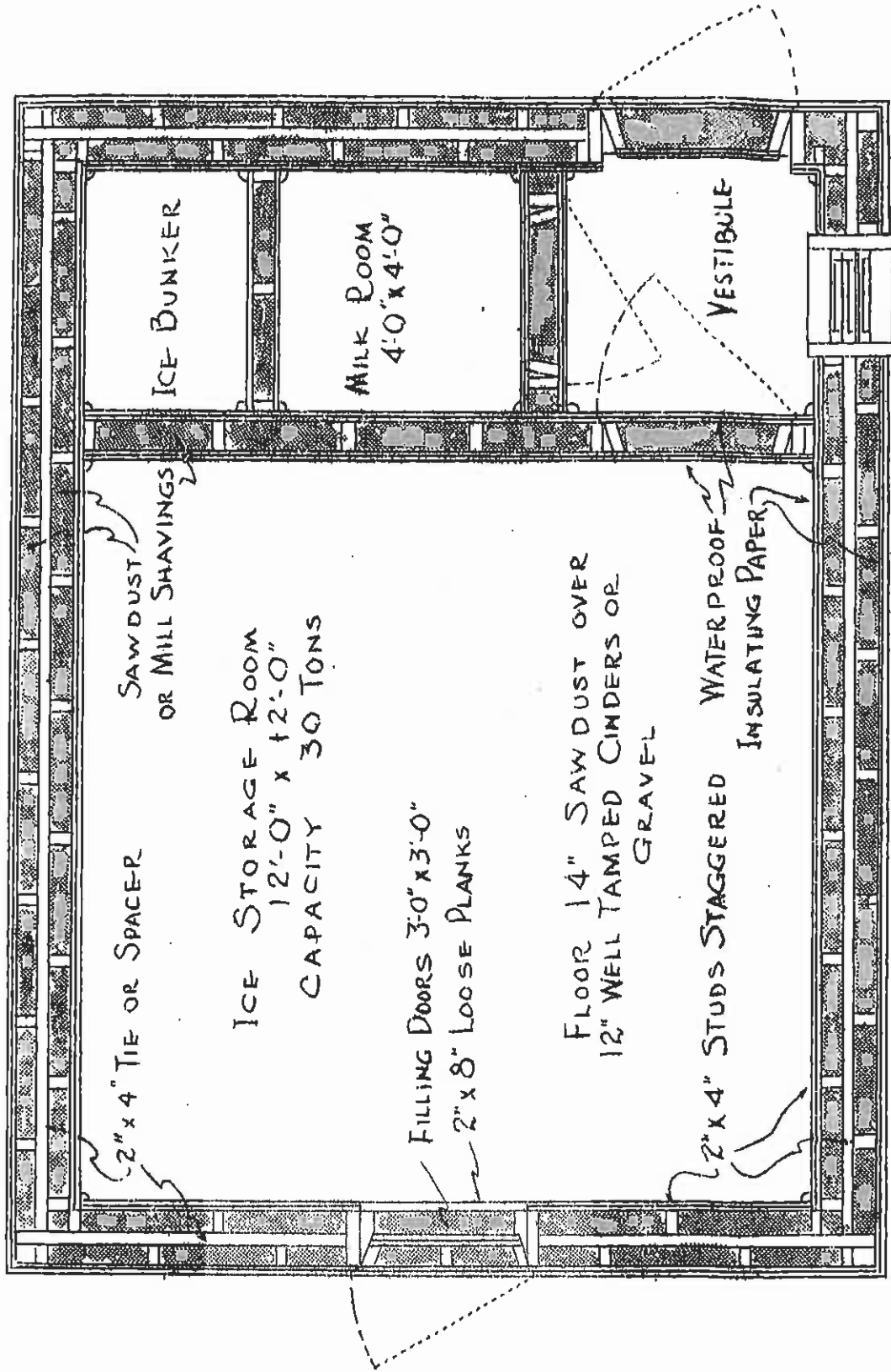
### M-21 \* INSULATED WOODEN ICE HOUSE

This is a very conveniently arranged combination insulated ice house and cold room. Access to the ice is obtained through a trap door in the ceiling of the vestibule by means of a ladder. Ice is dropped into the ice bunker through a trap door directly over the bunker. The space above the vestibule and milk room is left open to allow access to the ice. A door is provided from the vestibule directly into the ice room for use when the ice is nearly gone and to aid in cleaning the ice room. A window made up of four window lights is placed opposite to the door of the milk room so that the milk room is lighted when the door is open.

The construction of the walls is as follows: Double row of 2 x 4 studs staggered with one 2 x 4 tie or spacer as shown in vertical section. The studs are covered on the outside with one layer of  $\frac{7}{8}$ " tongue and grooved boards. On the outside of this two layers of heavy waterproof insulating paper are placed, lapping each layer 6" and this covered with a good quality shiplap siding. For the inside of the room one layer of tongue and grooved boards is laid directly on the studs; then two layers of waterproof insulating paper and finally a course of  $\frac{7}{8}$ " tongue and grooved boards.

The detail sections of the doors should be studied carefully before construction as a great deal of insulating value may be lost with poorly constructed doors.

\* \* \* \* \*



2" x 4" TIE OR SPACER

SAWDUST  
OR MILL SHAVINGS

ICE STORAGE ROOM  
12'-0" x 12'-0"  
CAPACITY 30 TONS

FILLING DOORS 3'-0" x 3'-0"  
2" x 8" LOOSE PLANKS

FLOOR 14" SAWDUST OVER  
12" WELL TAMPED CINDERS OR  
GRAVEL

2" x 4" STUDS STAGGERED  
WATERPROOF  
INSULATING PAPER

ICE DUNKER

MILK ROOM  
4'-0" x 4'-0"

VESTIBULE

INSULATED WOODEN ICE HOUSE  
WITH SMALL COLD ROOM  
12'-0" x 19'-0"  
SCALE - 3/8" = 1'-0"

M-25 \* COMBINED BARN, IMPLEMENT SHED, AND GARAGE

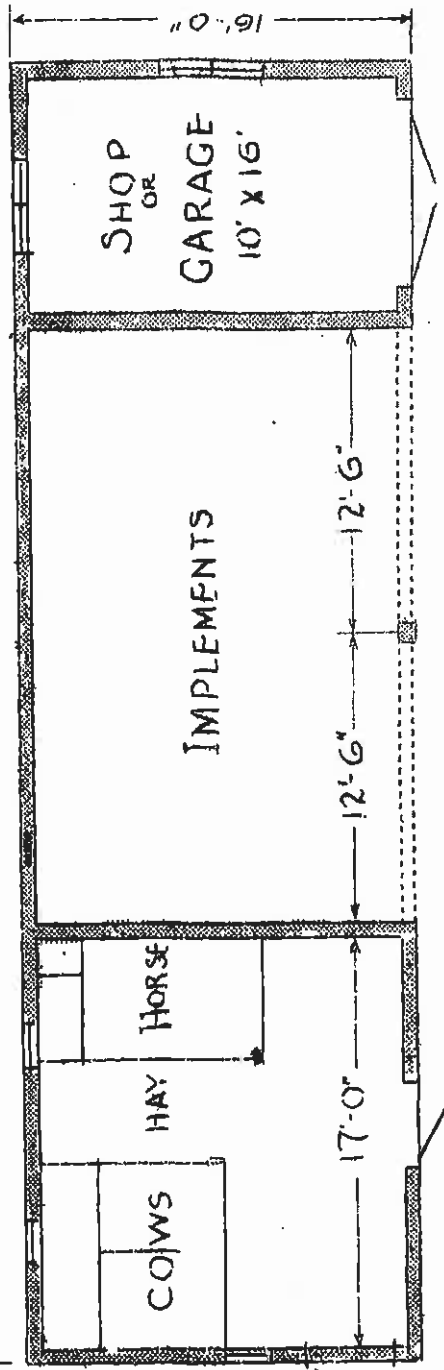
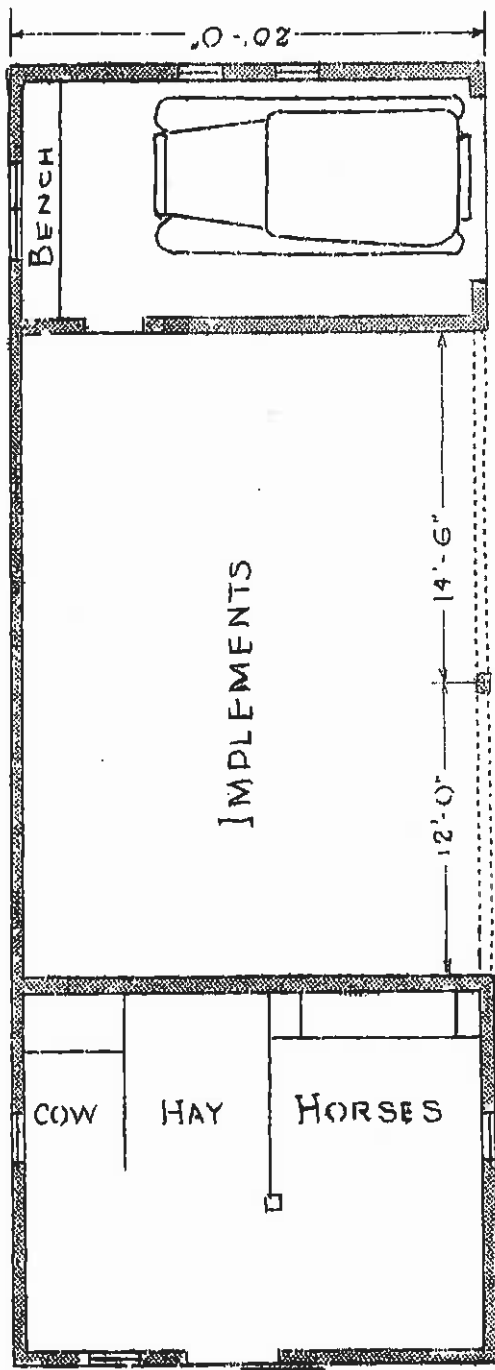
The mimeographed sheet shows a combination of buildings which leads to economy of materials in construction, and makes possible a very close arrangement of buildings on the farmstead. A bench at the end of the garage will serve for a shop until such time as the owner may need separate buildings for shop and garage or until he is able to afford the expenditure for a separate garage. This particular layout is adapted to a small ranch where one wagon and a few garden tools will be kept in the implement shed.

\* \* \* \* \*

M-26 FEED ELEVATING, GRINDING AND MIXING PLANT

A feed mill which was developed by a poultry farmer to enable a cut in overhead expenses by reducing the cost of feed grinding and mixing to a minimum. The plant is completely equipped with mills for grinding fine or coarse grain feeds, chopping straw for litter, cutting vegetables and other succulent feeds, and facilities for mixing and storing the prepared feeds. Although the plan may appear complicated and expensive, it has been operated and used very successfully by a single man on a 2000 hen ranch. Only a few hours are required for grinding a week's supply of feeds with the length of time depending upon the size and capacity of the equipment. All equipment used is of standard and commercial construction with the exception of a novel feed mixing tub which is mounted on a circular platform and is shown and described with the plan.

\* \* \* \* \*



M-51 \* EXPOSED WIRING DETAILS

This plate gives some suggestions which may aid the farmer in making repairs or minor alterations in his exposed wiring systems. The wiring systems shown were drawn expressly for use in poultry houses, but they illustrate several points in knob and tube insulation which may be used in any farm building. Wires 1 and 2 are used for the bright lights, and wires 3 and 2 are for dim lights, wire 2 being common to both circuits. Low wattage (high resistance) lamps are used in the dim light circuit.

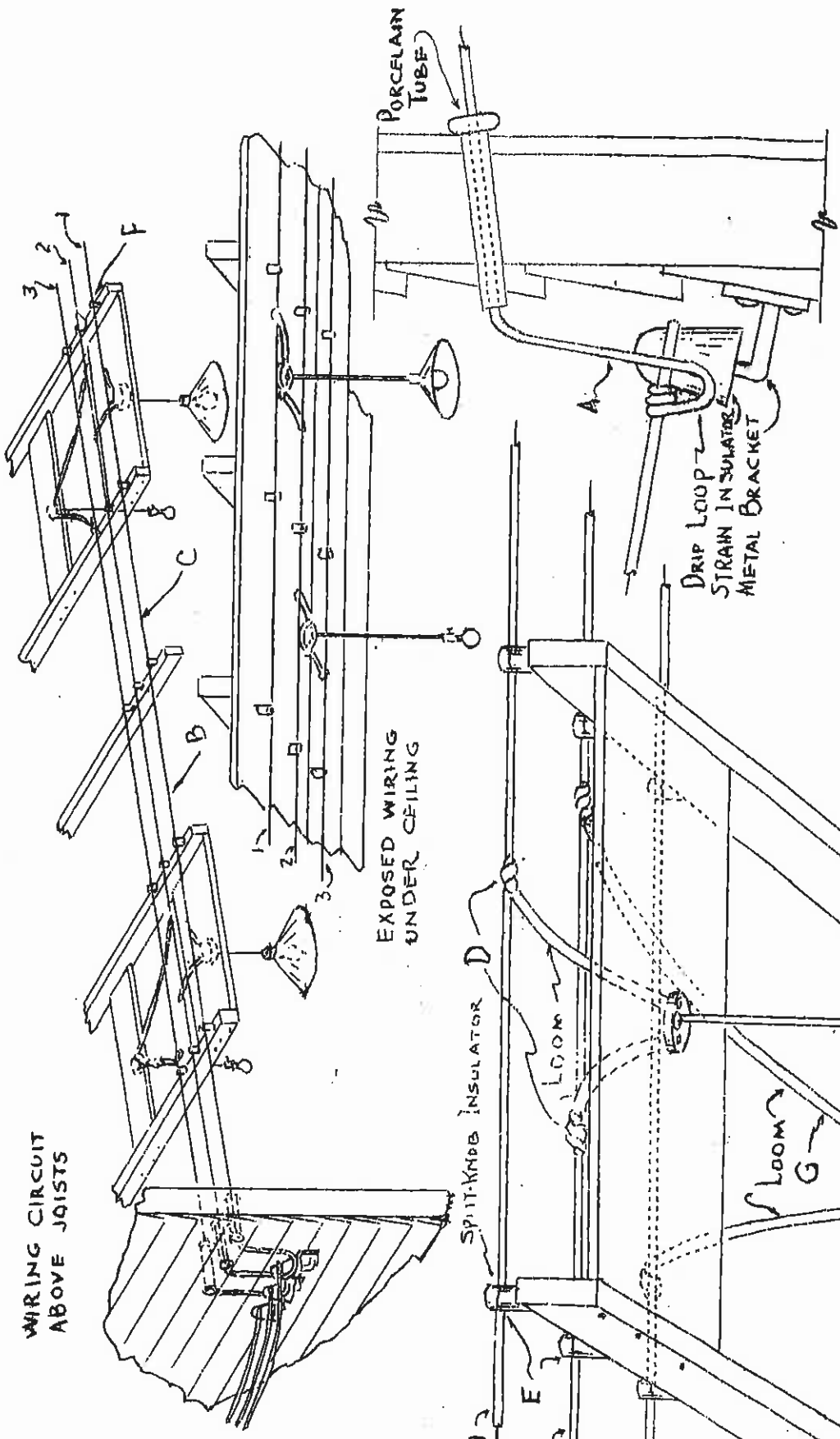
It is impossible to give complete information about wiring, and particularly about concealed wiring, so that in most cases a competent, responsible electrician should be consulted. For more complete information on wiring for heat, light, and power the National Electric Code of the National Board of Fire Underwriters may be consulted.

The points to be particularly noted are as follows:

- A. Wires entering or leaving a building shall have drip loops formed on them and shall pass upward and inward from outside of buildings through non-combustible, non-absorptive tubes.
- B. Up to 300 Volts wire must be spaced  $2\frac{1}{2}$ " apart and  $\frac{1}{2}$ " from surface wired over when in the open, but when concealed, they must be spaced 5" apart and maintained at least 1" from the surface wired over.
- C. In dry places one of the following types of wire may be used: approved rubber-covered type R, slow-burning weatherproof (SBW), vanished cambric insulated (VC), or asbestos-covered type (A).
- D. If the current is under 30 amperes the joints may be soldered and taped without using lugs.
- E. Porcelain knobs used for supporting wires must not be more than  $4\frac{1}{2}$  feet apart.
- F. No dead ends may be allowed at rosette unless the last support is within 12" of the dead end.
- G. Loom is a form of heavy insulating flexible tubing to be used where wiring passes through a ceiling.

\* \* \* \* \*

WIRING CIRCUIT ABOVE JOISTS



SPLIT-KNOB INSULATOR

LOOM

LOOM G

DETAIL OF WIRING CIRCUIT

EXPOSED WIRING DETAILS  
 WASHINGTON CREA.  
 AND  
 DEPARTMENT OF AGRICULTURAL ENGR.



M-52 \* ELECTRICALLY HEATED HOTBEDS

The electrically heated hotbed is a modification of the common manure heated hotbed, designed to use specially constructed electric heating cable, thus assuring a positive source of heat and maintenance of proper temperature for young, growing plants. The standard hotbed sash is 3' x 6' and a convenient unit for ordinary hotbeds is 6' x 6' so that this unit is also used for electric hotbeds. A 6' x 6' hotbed requires from 60 to 70 feet of cable having a resistance of 0.5 ohms per foot. At 110 volts a unit will require about 400 watts to maintain the temperature. The method of placing the heating cable in the hotbed is shown in the accompanying diagram. The temperature of the hotbed is usually controlled by a thermostat. A common type of thermostat consists of a mercury or gasfilled tube that may be placed in the soil while the operating mechanism is placed in some convenient location near the switch. By using a relay one thermostat may be used to control several hotbeds provided they are close together and otherwise similar.

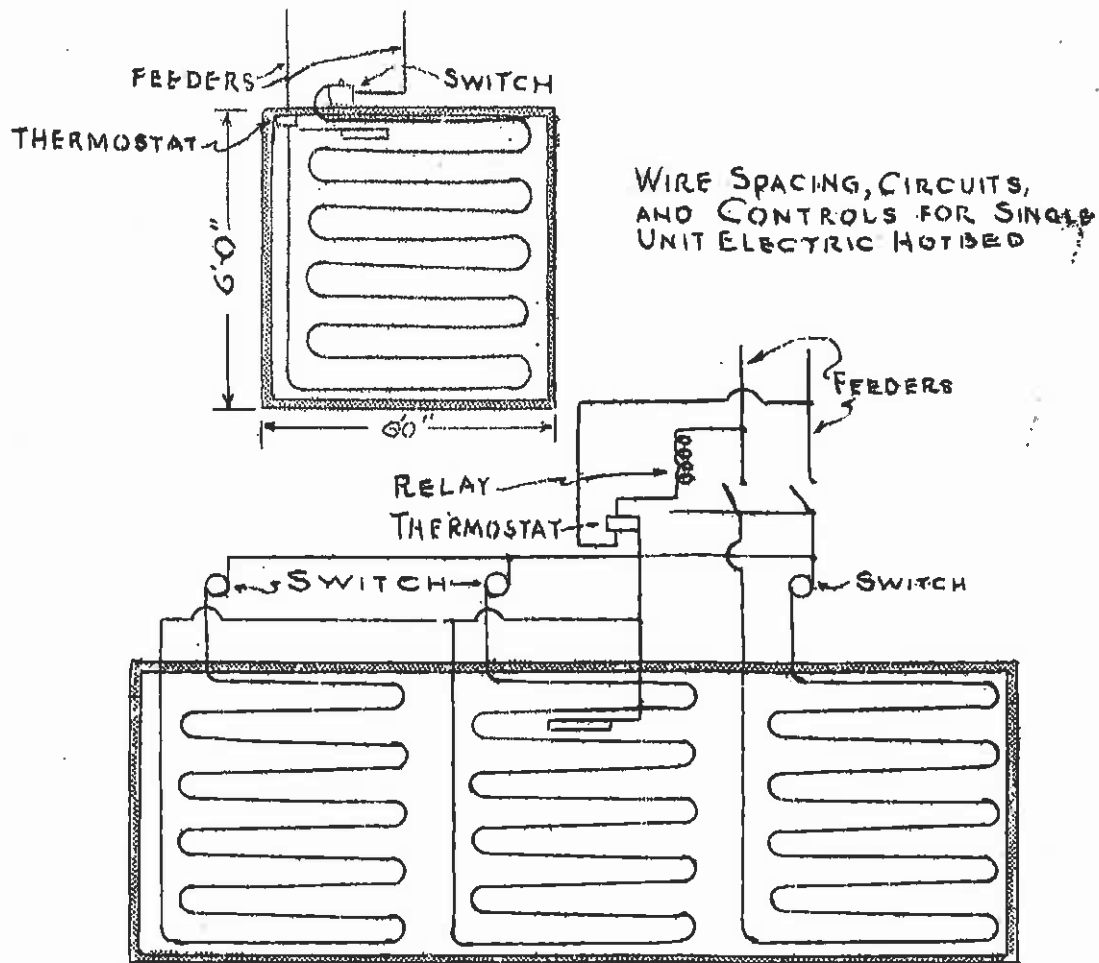
Briefly the construction of an electric hotbed is as follows:

Remove the soil to a depth of 18" from an area one foot larger in dimension than the frame of the hotbed. Level the bottom and put in a layer of cinders 6" thick. The frame, which is 15" high at the front and 21" high at the back, is next put in place. The frame may be made of one or two thicknesses of 4" flooring material with waterproof building paper between the boards if two thicknesses are used. A 1" layer of sand is next added and the heating cable put in place. The cable is spaced in parallel rows about 7" apart and to within 3" or 4" from the edges of the frame. The cable is then covered with another 1" layer of sand and protected from injury by hardware cloth. The plants grow in a layer of rich soil 7 to 8 inches thick placed above the hardware cloth.

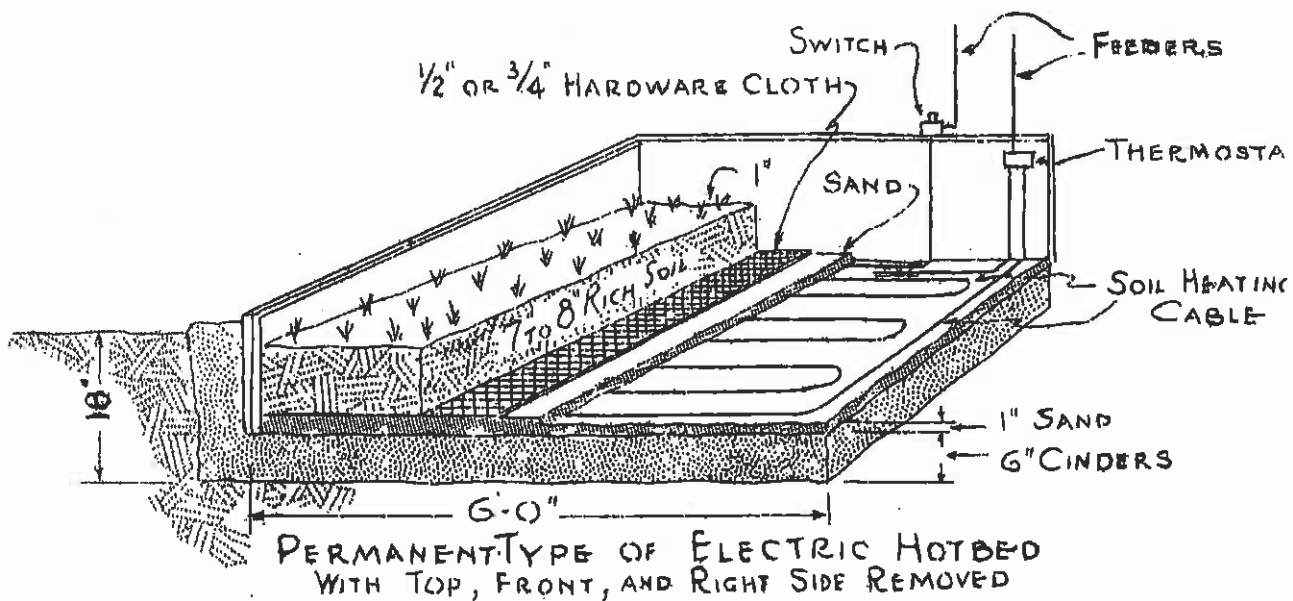
The care and operation of an electrically heated hotbed is similar to that of manure heated hotbeds except that the electric bed may require watering more frequently.

More complete information may be obtained from the Department of Agricultural Engineering, State College of Washington, Pullman, Washington.

\* \* \* \* \*



METHOD OF CONTROLLING THREE OR MORE 110-VOLT HEATING ELEMENTS WITH THERMOSTAT AND RELAY



## ELECTRICALLY HEATED HOTBED DETAILS

WASHINGTON C.R.E.A.  
AND

DEPARTMENT OF AGRICULTURAL ENGINEERING  
STATE COLLEGE OF WASHINGTON

M-71 \* SAND WATER FILTERS

A filter is a device for removing dirt and sediment from water. It promotes purity and safety but cannot remove dissolved minerals or substances, nor will it remove much bacterial life. Sand is a good filter, inexpensive and readily obtainable, so it is commonly used where large quantities of water must be filtered.

Sand filters should operate slowly--like rainfall percolating into the ground. The rate of filtration should not exceed fifty gallons in twenty-four hours for each square foot of effective area in the filter bed. The rate of operation is controlled by carefully adjusting a valve placed between the filter and the reservoir cistern. The water level should be maintained above the filtering material at all times to protect the film of silt and mud on the surface of the filter. A great deal of the filtering is done in the silt layer on the surface so that precautions may be necessary to avoid its disturbance. Should water currents disturb the silt layer, a sloping board may be installed under the inlet to act as a baffle and to allow the water to spread and enter more gently.

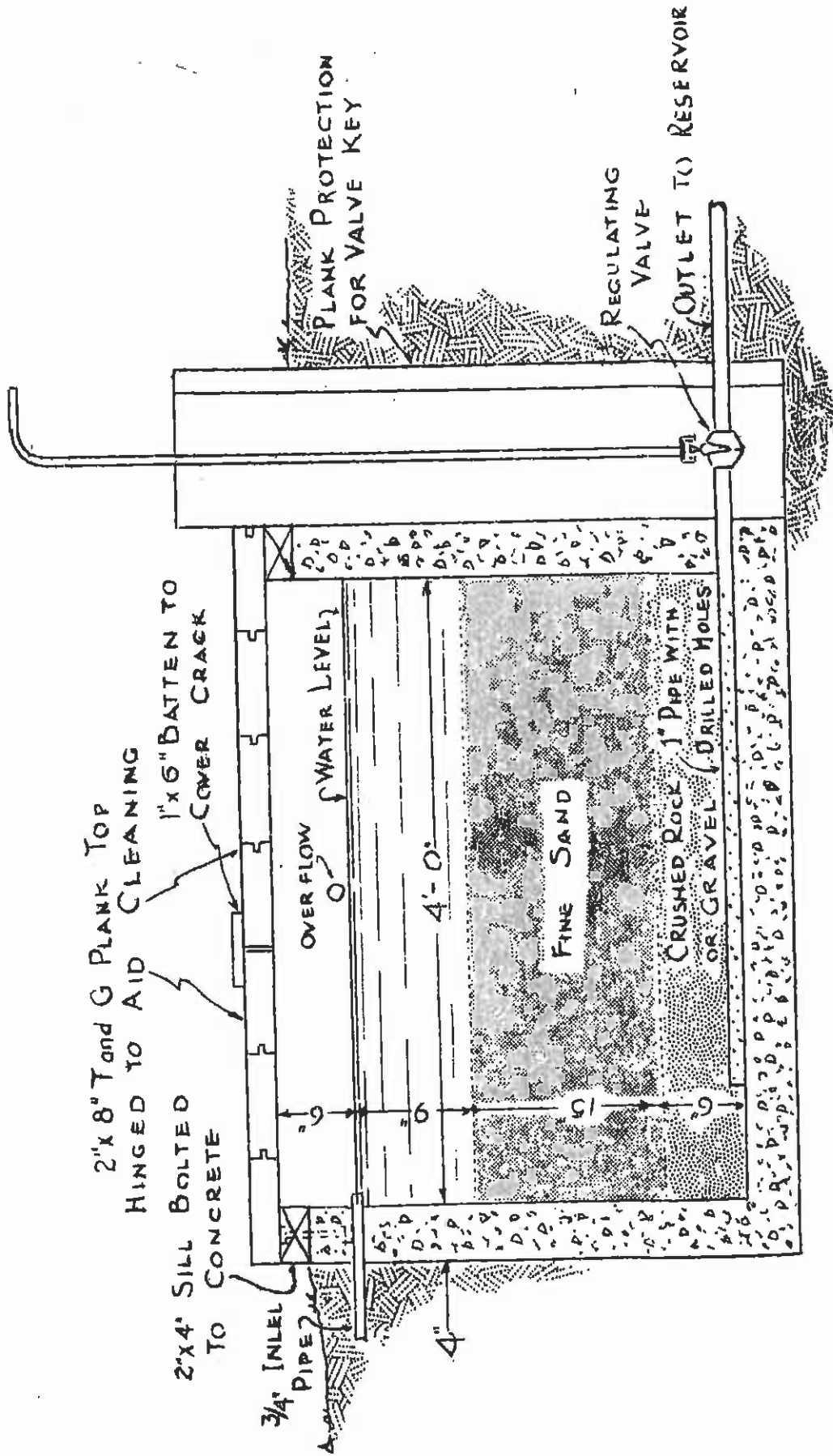
Sand up to the size of "good plastering sand" may be used. For shallow filters very fine sand is preferred. The depth of sand should be from one to two feet. Depths greater than two feet slow the action without greatly increasing the efficiency. Sand should be screened and thoroughly washed to remove organic matter, lumps of clay, etc. before using in the filter.

Charcoal is used with some sand filters, although its use is not usually essential. When properly cared for, charcoal is effective in removing color, odor, and taste. If neglected, charcoal becomes a detriment, due to storage and overloading the pores with organic matter. When used, a layer about 6" deep is placed between the gravel and the sand. Clean, well-burned charcoal about the size of wheat grains is used. Dirty charcoal must be replaced with new.

The filter should be cleaned as often as is found necessary. When the thin surface layer becomes clogged with use, a half-inch may be removed with a trowel or square pointed shovel. The sand removed should be washed and returned, or replaced with new.

The size of the filter depends upon the amount of water which must be filtered during a twenty-four hour period. The amount of water per twenty-four hours depends upon the source, size of supply tank, and reservoir tank, the amount used during a day, the waste, and the amount stored for future usage. After making an estimate of the amount of water to be filtered in a day, allow one square foot of filtering space for each fifty gallons of water and after installation keep the regulating valve adjusted so that the amount of water filtered does not exceed this amount. It is better to make a filter a square foot too large than a like amount too small.

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VERTICAL SECTION OF A SHALLOW SAND FILTER