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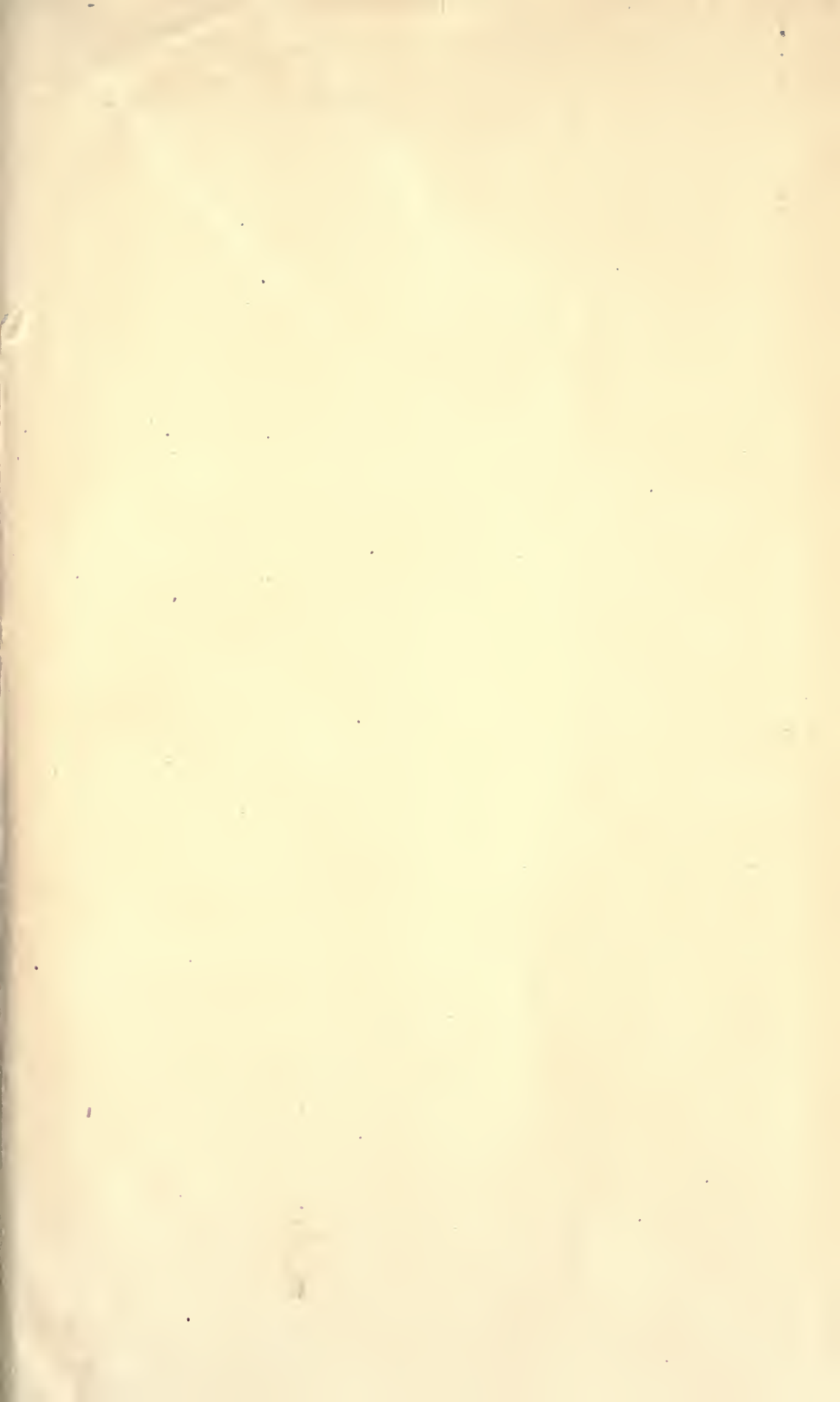
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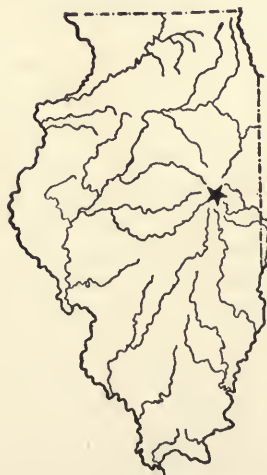
UNIVERSITY OF ILLINOIS

Agricultural Experiment Station

BULLETIN No. 110

STORAGE BARN, SHEDS, FEED LOTS AND
OTHER EQUIPMENT FOR FEEDING
EXPERIMENTAL CATTLE IN
CAR LOAD LOTS

By HERBERT W. MUMFORD
AND
EDWIN S. GOOD



URBANA, JULY, 1906

SUMMARY OF BULLETIN NO. 110

1. General plan of beef cattle experimental plant. Page 303.
2. A description in detail of construction of storage barn and methods of preparing and handling concentrates and roughages in same. Page 304.
3. A description in detail of the construction and operation of the feed lots, sheds and feed carrier system of that part of the plant situated south of the alley. Page 305.
4. Description of lots and sheds north of the alley. Page 308.
5. Description of construction of engine house, also of corn crib. Page 309.
6. General summary of cost of beef cattle experimental plant. Page 309.

STORAGE BARN, SHEDS, FEED LOTS AND OTHER EQUIPMENT FOR FEEDING EXPERIMENTAL CATTLE IN CAR LOAD LOTS

BY HERBERT W. MUMFORD, CHIEF IN ANIMAL HUSBANDRY
AND EDWIN S. GOOD, ASSISTANT IN ANIMAL HUSBANDRY

INTRODUCTION

The Illinois Experiment Station considers it extremely important for the reader to know, in studying the results of feeding tests, the exact conditions under which the feeding has been done. This bulletin shows the conditions surrounding the feeding of the experimental car load lots of cattle at this Station as reported in Bulletins 83, 90, 103, and 111.

It is not maintained that this plant cannot be improved or that it will meet the needs of, or be the most economical for, cattle feeders in general.

GENERAL PLAN

The general plan of the experimental feeding plant at this Station, for the feeding of two hundred head of beef cattle in car load lots, and individually, consists of a storage barn facing east and west and two rows of feed lots connected by a paved alley, lying east and west from the west side of the storage barn. South of the feed lots is a corn crib 144 feet in length, and north of the storage barn is a 20- by 28-foot engine house. On the west side of the barn and north of the alley are stock scales.

There are twelve feeding lots in the two rows mentioned, seven of which are situated on the south side of the alley and five on the north side. All face to the south and all are paved with brick with the exception of three lots on the north side of the alley, one of which is used for experimenting with cattle fed in an ordinary earth lot. The sheds on the south side of the alley are open on the south side, while those on the north side are inclosed, and provided with large sliding doors. None are paved.

Feed carriers convey the concentrates and chaffed roughage from the second floor of the storage barn to the lots on the south side of the alley. For general plan, see Plates 1 and 2.

STORAGE BARN

The storage barn, containing a silo, feed grinder, cutter and shredder, feed bins, stalls, and storage room for roughages, is of plank-frame construction, all the framing material being of two inch lumber sized to $1\frac{7}{8}$ inches. It is 44 by 72 feet and is divided into five bents. Beginning at the north, the bents are spaced as follows: 15 feet; 14 feet 6 inches; the drive-way, 12 feet; 14 feet 3 inches; and 15 feet 8 inches. The foundation is a brick wall 13 inches thick extending below the frost line and rising one foot above the grade line. The ground was excavated six inches for the floor and the resulting space filled $3\frac{1}{2}$ inches with gravel well tamped, then $\frac{1}{2}$ inch with fine sand over which were laid No. 1 paving brick flushed with cement. The brick were laid flat in all places with the exception of the drive-way where they were placed on edge.

The two north sections contain a 30-ton silo, feed bins, cutter, and storage for baled hay.

The walls are 18 feet high; curb, 31 feet; peak, 40 feet; studing 2x6, 24 inches on center; plates, 2x6, 2 ply; drop siding 1x8 inches; rafters, 2x6 inches, 24 inches on center; roof sheathing, 1x2 $\frac{1}{2}$ inches, 3 inches apart; cedar shingles, 5x2, laid 4 $\frac{1}{2}$ inches to the weather.

Middle Bents.—The foot of each middle bent rests upon the foundation and an inward projection of 1 foot 3 inches by 13 inches. A 2x12-inch piece is laid flat on the foundation for a sill. This sill is bolted to the brick by top screws and further strengthened by iron braces extending from the foot of the bent to the foundation. Plates 3 and 4.

End Bents.—The end posts are of the same size and material as are the interior ones, but only 3-ply. The posts rest on the foundation and are spiked to a 2x12-inch piece laid on edge. A brace extends from the upper end of this post to the purlin plates. For dimensions and bracing, see Plates 3 and 4.

The two south bents have a loft which has bins for the storage of cut hay and various kinds of prepared feed. This loft is partly supported by four interior posts, each made of five 2x8-inch pieces. Joists as drafted are 2x10 inches, 1 foot on center. Matched flooring, 1x3 $\frac{1}{4}$ is used. Plate 6.

The roof is a gambrel or curb style. The purlin plates are supported mainly by purlin posts from the foundation. A truss extends from the plates to the peak, running between them and bolted to the purlin post. This truss is drafted at an angle of 45°, but in practice was dropped 2 feet 6 inches at the peak. With this style of roof, we have a $\frac{2}{3}$ pitch. For sizes of material and manner of bracing, see Plates 3, 4, and 5.

A feed cutter and grinder are located near a 4x14 foot bin on the first floor. This bin has a capacity of 300 bushels. Just above this bin and in connection with it, is a smaller one with a capacity of 100 bushels. Grain is scooped into the south end of the lower bin and elevated into the one above from which it runs into the grinder and when ground, is elevated to the bins on the second floor. When ear corn is fed in the form of corn and cob meal it is scooped from a wagon into the grinder and elevated as in the case of shelled corn or other grain. If fed finely broken (similar to crushed corn) it is run through an ensilage machine and blown into bins on the second floor as is also done with hay when fed in a chaffed state; but if fed broken by hand it is scooped from a wagon to the second floor, through the same opening by which the feed carriers leave the barn. Other feeds such as oil meal, cottonseed meal, gluten meal, bran, etc., which are always purchased in sacks, are conveyed to the second floor by hand from a wagon in driveway of barn. As these feeds are needed they are weighed during the day, placed in feed carriers, and conveyed at feeding time to the lots south of alley. Plates 7 and 8.

There are four double, two single and four box stalls in this barn used for feeding cattle where individual records of gains and feed consumed are desired. These are situated under the loft, that part of the barn having a second floor. The partitions between the stalls are four feet in height. The uprights of these stalls are 4x4-inch oak posts, which also serve the purpose as supports for second floor. The siding of the stalls are 2x6 and 2x8 plank placed in a vertical position, capped above and set in a groove in 4x4 oak pieces which rest on 4x4's sunk in the brick pavement. At the corners of the stall, these 4x4's are joined by $\frac{5}{8}$ x9-inch joint bolts. For ground plan and dimensions, Plate 6 is explicit.

The feed mangers are placed low in all the stalls and extend their entire width; those in the box stalls are bolted to the sides so they can be taken out when necessary. These mangers are 6 inches from the pavement, 1 foot deep, 1 foot 2 inches wide at the bottom and 1 foot 10 inches at the top. The material is of 2-inch lumber and strengthened at the sides of the stalls by short 4x4-inch pieces from the pavement to the side of the boxes. The different pieces are securely spiked together. Plate 6.

FEED LOTS AND SHEDS SOUTH OF ALLEY

The lots on the south side of the alley are each 48 feet long by 36 feet wide, exclusive of shed, with a 12x36 shed open to the

south. Each lot is enclosed by a board fence 4 feet 8 inches high. All lots are paved with brick. The sheds are not paved. These lots have gates leading into each other, to the alley, and out of the south end of the lots. There is also a gate in each lot so placed that it, together with the gate between the lots, can close the space between the fence and feed bunk, thereby making it possible to confine the cattle under the shed while the lots are cleaned and in the lots when the sheds are cleaned. Each lot is furnished with a feed bunk for concentrated feed and two mangers for hay. One watering tank is provided for two lots. Plates 9, 10, and 11.

PAVING

The grade used in paving these lots was one slightly above the surrounding level and given enough slope ($6\frac{1}{2}$ inches from north to south and $3\frac{1}{4}$ inches from east to west of each lot) to allow the water to run to the south-west corner of each lot where tile were laid to carry it away.

After the proper grade had been secured the ground was covered with six inches of gravel which was rolled and tamped down solid, covered with one inch of fine sand upon which No. 1 paving brick were laid flat, (herring-bone pattern, Plate 12) except in the alley and around the scales where they were placed on edge. After being put in place, the brick were rolled down even and upon inspection, if any were found to be soft, they were replaced with good ones.

The space between the brick was filled with a grout "filler" consisting of one part clean, sharp, sand and one part of Portland cement. The cement and sand were thoroughly mixed dry in tight boxes, then made into a mortar of the consistency of cream and thoroughly broomed into the joints. The slushing was repeated to insure the filling of all cracks or joints between the bricks. This was done to keep water from getting underneath the pavement; which, if allowed to enter, would soften the subgrade or cause the heaving of the brick by alternate freezing and thawing.

The cement filler was allowed to set a week before heavy loads were allowed on it and as the work was done in summer, the sun's rays were kept off by means of a canvass for the first day. A retaining curb of 2x8 plank, braced by a 4x4, placed $2\frac{1}{2}$ feet in the ground, was put in at the gates to keep the animals from breaking the edge of the brick. Next to the shed, 3x8 oak plank were used for curbing. Where there are mangers and fences, the bottom board was placed low enough to act as a curb. Plate 12.

SHED

The shed south of the alley is 250 feet long and 12 feet wide and is divided into seven equal compartments by the extension of the same fences which separate the corresponding feed lots.

The sides and roof of this shed are supported on the north side by split oak posts set in the ground 6 feet apart and on the south side by 4x4's set 12 feet apart. The plates are 2x6's; rafters, 2x6's, 3 feet on center. The shed is sided with 8 inch ship-lap. The north side of the shed, which faces the paved alley, is 6 feet high while the south side is 8 feet high thus giving the roof a slope of 2 feet. The boards of the roof project over the frame work 1 foot 5 inches on the side toward the lots and 7 inches on the side toward the alley. The sheds are covered with 1 inch lumber over which is fastened prepared roofing. Plates I, 2, and II.

FEED BUNKS, TRACK, HAY MANGERS, AND WATER SUPPLY

The feed bunks are 5 feet 9 inches by 18 feet and are located 5 feet 6 inches from the shed. The posts are 4x4's, 9 feet apart one way and 6 feet apart the other way. All extend from the pavement above the bunk to form the framework of the feed carrier's track. On top of the 4x4 uprights are nailed 4x4 cross pieces. Short 2x4's are placed as stays between the 4x4's on the side of the bunk. The floor is made of 2x6's, resting on 2x6 pieces, spiked to the posts 1 foot above the pavement. The sides and ends are 2x6's. 1x6-inch fence boards are nailed lengthwise of the bunk for strengthening purposes. Plates I, 9, 10, and II.

Two hay mangers in each lot are built of material of the same size and in the same manner. The posts are 4x4's resting upon the brick pavement and are placed 4 feet 6 inches apart. The flooring is made of 1x6's (matched) and rests upon 2x4 ties nailed to the posts. The sides and ends of the manger consist of a 2x12-inch and a 2x6-inch piece. 1x6-inch cross pieces, placed 3 feet above the floor of the manger, help to strengthen the structure. Plates 9 and II.

The entire length of the track is 270 feet and the total fall, 11.25 feet, which means a fall of 1 foot in 24 feet. However, the fall from the door of the barn to the west side of lot 4, a little over half the distance, is 1 foot in 19.8 feet, while the remaining fall is only 1 foot in 36.5 feet. Thus it is seen the greatest fall is allowed just after the carriers leave the door. This is done for two reasons. First, the track could not be any lower in lot 7 (the last of the series) without having the feed carrier so low at that place as to

allow the cattle to interfere with it, also the car over the first bunk ought to be low enough so that it can be reached easily for dumping; second, the track for the last few lots should be of such a level as to overcome the momentum given the carriers at the start. As it is, the first three carriers out of the barn stop of their own accord over their respective feed bunks. The strength of framework, rope and windlass would have to be very strong to stop the momentum of all the carriers at once. The carriers start from the barn in a series, connected with a rope attached to a windlass in the storage barn. The rope is of such a length between the carriers as to allow each one to stop over a certain feed bunk. Plates 1, 10, 11, and 13.

Galvanized iron tanks 2x2x8 feet are so placed that the steers in two lots have access to one tank. These tanks are supplied with water from the University water system. There is a pipe extending from a tap at the bottom to nearly the top of the tank to let the water flow into the drain in case it is left turned on too long. When the tanks are cleaned these pipes are unscrewed from the tap and thus all the water allowed to drain from them. The tank is set in a wooden box the size of which leaves a space of 5 inches between it and the tank, in which may be placed a filler to keep the water from freezing. The box and tank rest upon a platform raised six inches from the pavement. Material for boxing is 1x6 lumber (matched), nailed to 2x4's. The ends of the 2x4's are bolted and braced by a 1x½-inch iron strap. This was found necessary in order to keep the cattle from crushing in the ends of the box. A lid on hinges at each end of the tank can be closed down in cold weather to prevent the water from freezing or to prevent the cattle from drinking at weighing time. Plates 9, 10, and 12.

The alley is 12 feet wide and, as has been mentioned, paved by placing the brick on edge. The paving extends to the barn and up to the scales. A dip of 4½ inches from edge to center of pavement and a fall of 3¾ feet from storage barn to end of alley, where a drain is located, keeps the alley dry and also serves the purpose of draining the water flowing from the roof of the sheds situated south of the alley. Plates 1, 2, and 12.

LOTS WITH CLOSED SHEDS

These lots lie to the north of the alley just mentioned. Four of them are 36x36 feet, and one is 48x108 feet. Two of the lots, Nos. 8 and 10, 36x36 feet, are paved; the remainder are unpaved. These lots are not provided with a feed carrier system as are those on the south side of the alley. In other essentials, however, the arrangement is practically the same.

This shed was built in 1901, two years before the main part of the plant was constructed. It was originally built to house breeding stock in winter. The south side is 6 feet to the eaves and the north side 5 feet 6 inches, and the ridge 8 feet. Split oak posts are placed in the ground every 6 feet to receive the siding. Four 4x10 foot posts supporting 2x12's nailed edgewise for plates are placed 12 feet apart throughout the center of the shed. Plates 1 and 14.

ENGINE HOUSE

The engine house is 20x28 feet, 12 feet to eaves; 2x4-inch studing, 2 feet on center; same for rafters; corner posts, two 2x4 inch; roof, one-half pitch; joists on plates 2x6 inch, 2 feet on center; and siding same as barn. This inclosure has a door 12 feet wide situated on the north end of the building and another door large enough to allow for the play of a belt between engine and machinery in storage barn; also 5 windows 2x5 feet in dimensions. The floor in this building is of double thickness and made of 2x10-inch boards, 24 feet in length.

CORN CRIB

The foundation of the crib consists of brick pillars 1x1 foot set below the frost line and extending 1 foot 6 inches above the grade line. The pillars are twelve feet apart, and upon them rest four 2x12-inch pieces spiked together for joist supports. The crib is 8 feet wide at the bottom and 10 feet 9 inches wide at the top. The height at the north side is 10 feet and on the south side 11 feet. The capacity is 5682 bushels of ear corn. For location, joist, studing, rafters, and details of each, see Plates 1, 2, and 15.

The total cost of the beef cattle experimental plant is as follows:

Storage barn, including bins	\$1,321.25
Total cost of seven open sheds and lots (this includes all material and labor except drainage)	2,036.57
Total cost of closed sheds and lots (includes all material and labor except drainage)	793.80
Special fencing for lot west of north sheds.	43.08
Cost of all draining and tiling	46.50
Cost of paving in alley and around scales	412.64
Engine house	144.22
Corn crib	350.91
Scales and scale rack, silo, feed grinder and ensilage cutter	524.53
One outside water tank	15.99
Total	<u>\$5,689.49</u>

A detailed statement of the bill of materials and cost of same will be sent upon application.

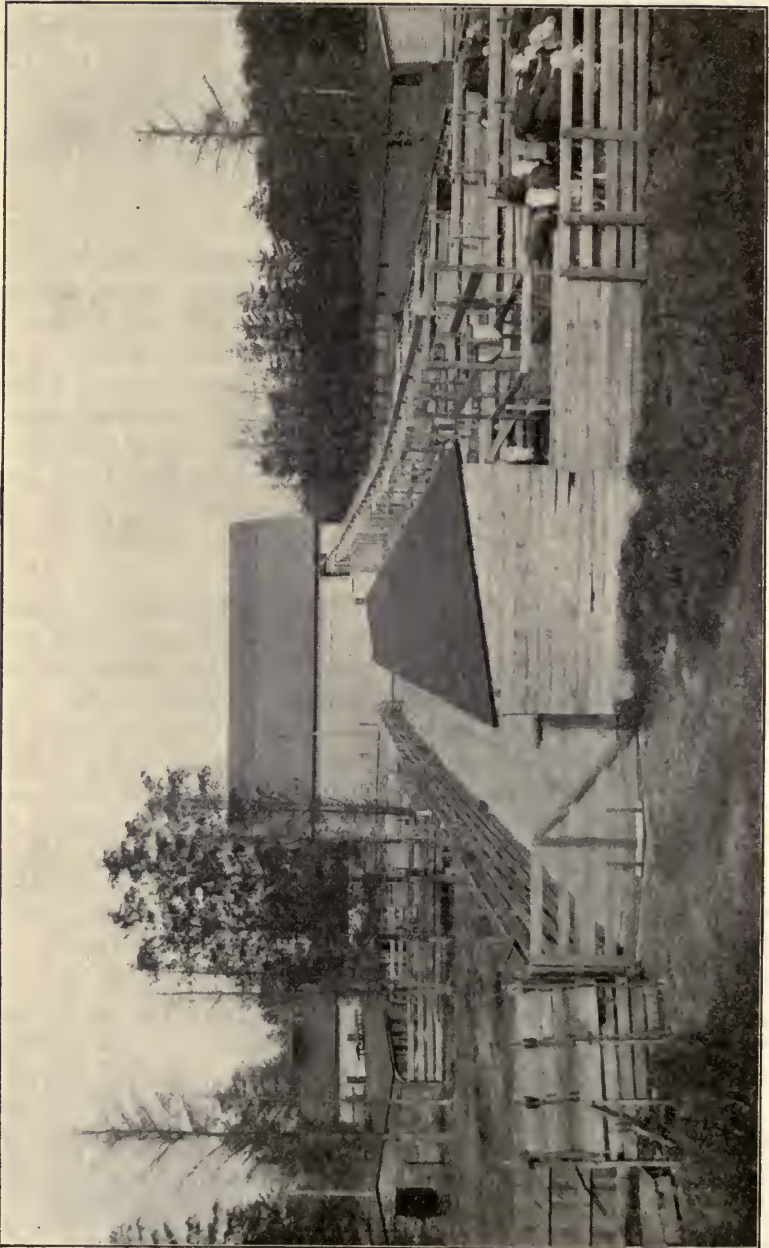


PLATE I. GENERAL VIEW OF BEEF CATTLE EXPERIMENTAL PLANT, UNIVERSITY OF ILLINOIS.

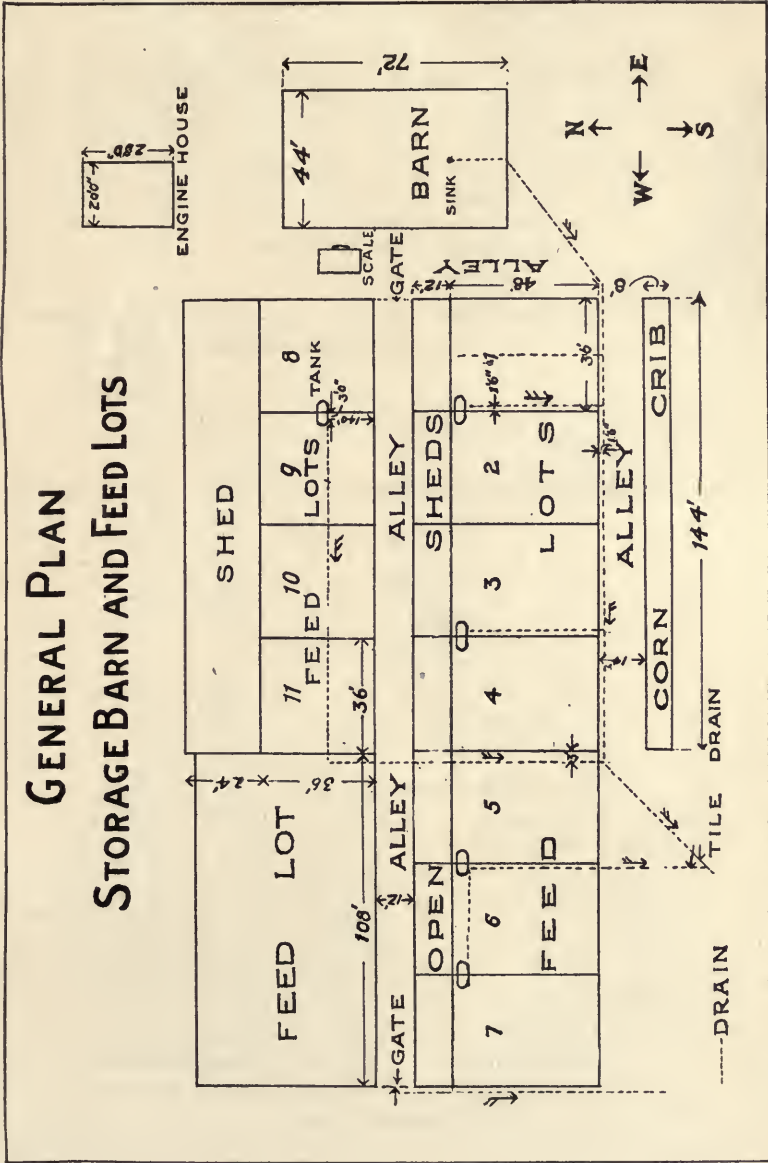
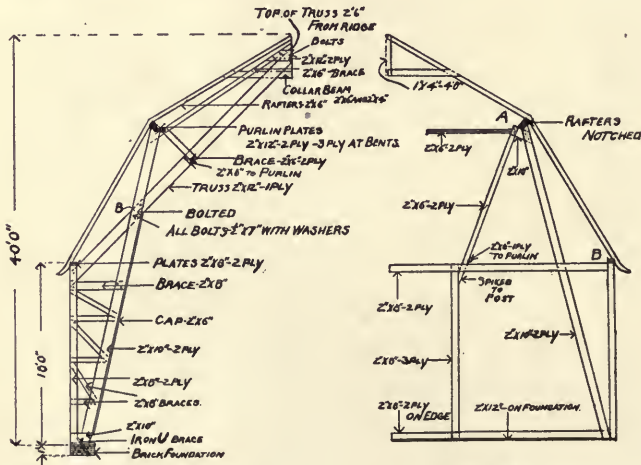


PLATE II. GENERAL PLAN OF BEEF CATTLE EXPERIMENTAL PLANT, UNIVERSITY OF ILLINOIS.



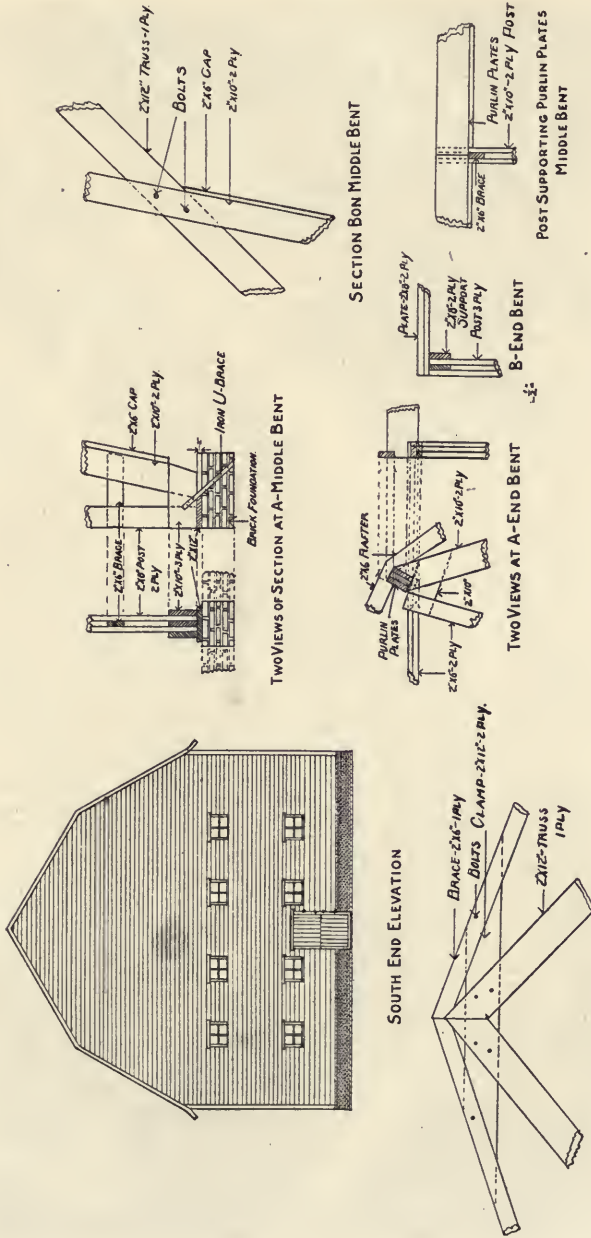
WEST SIDE ELEVATION



MIDDLE BENT ONE HALF SECTION

END BENT ONE HALF SECTION

PLATE III. SIDE ELEVATION AND CONSTRUCTION DETAIL OF STORAGE BARN.



CLAMPING OF TRUSS AND BRACE AT PEAK
PLATE IV. END ELEVATION AND CONSTRUCTION DETAIL OF STORAGE BARN.

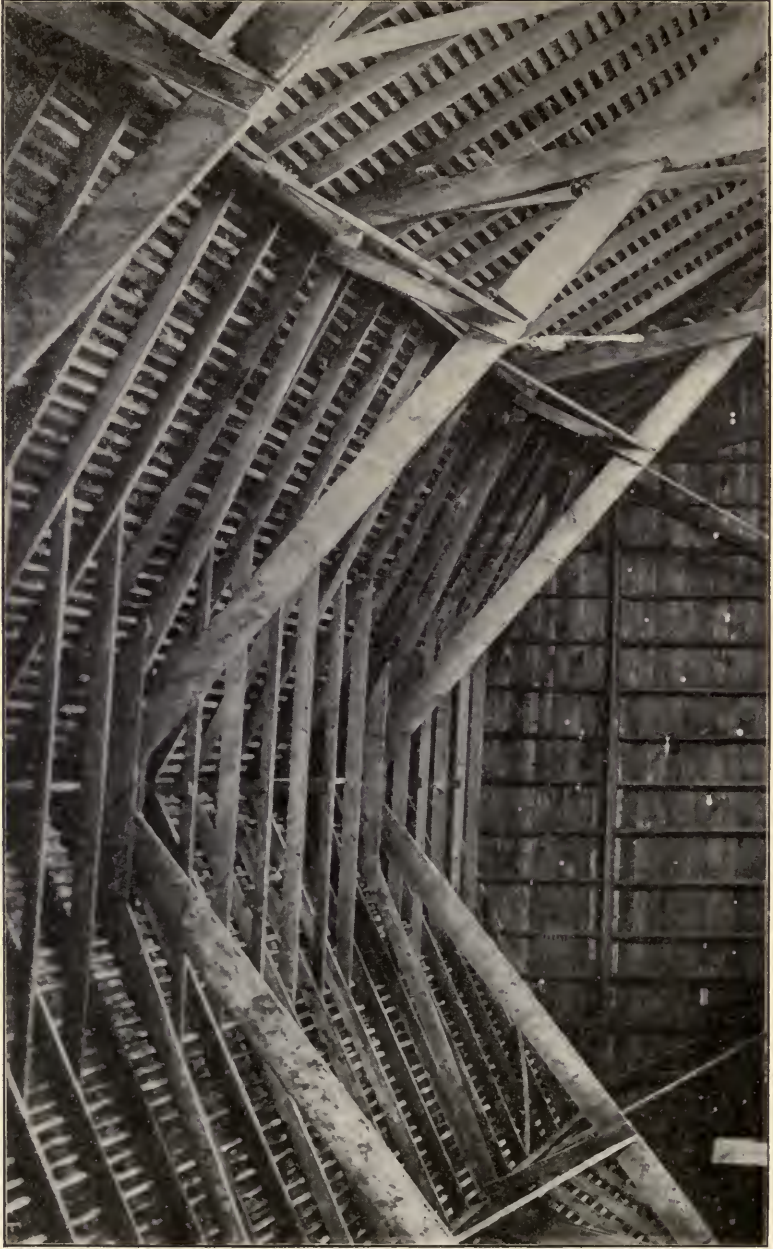
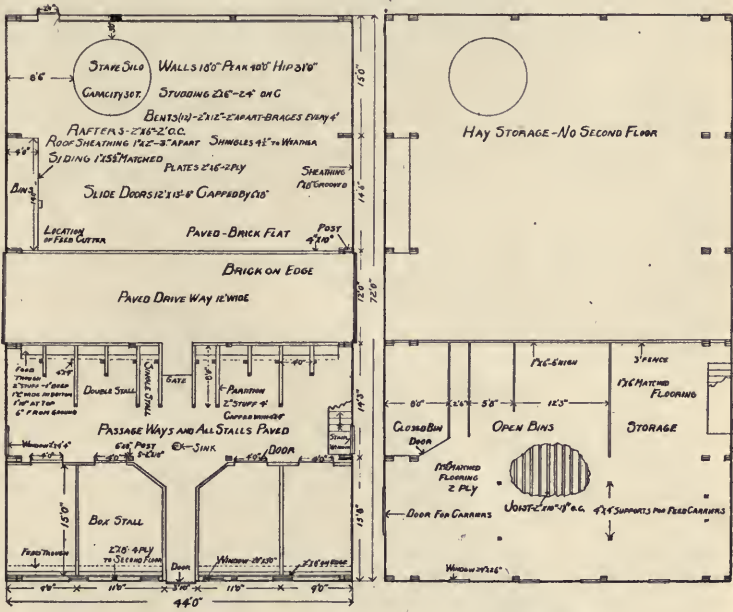


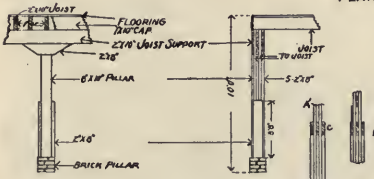
PLATE V. BRACING AT PEAK OF ROOF, STORAGE BARN.



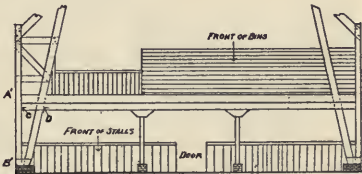
PLAN

SECOND FLOOR

PLANK FRAME CATTLE BARN



TWO VIEWS OF INTERIOR PILLAR DETAIL



CROSS SECTION - SHOWING FRONT OF STALLS & BINS

ALL POSTS SOLIO UNDER SECOND FLOOR

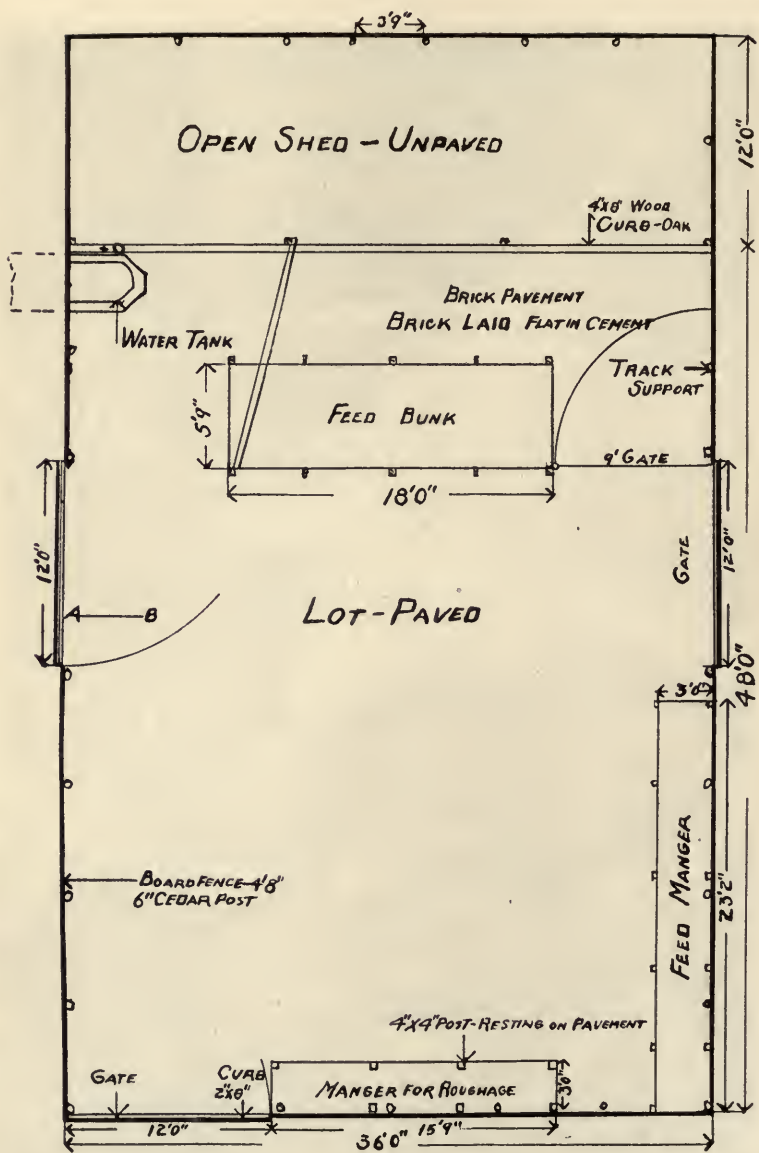
PLATE VI. DETAIL OF GROUND PLAN AND SECOND FLOOR PLAN OF STORAGE BARN.



PLATE VII. BINS, FEED GRINDER, AND ELEVATORS.



PLATE VIII. ELEVATORS AND BINS ON SECOND FLOOR.



LOT 5. GROUND PLAN

PLATE IX. GROUND PLAN OF A FEED LOT.

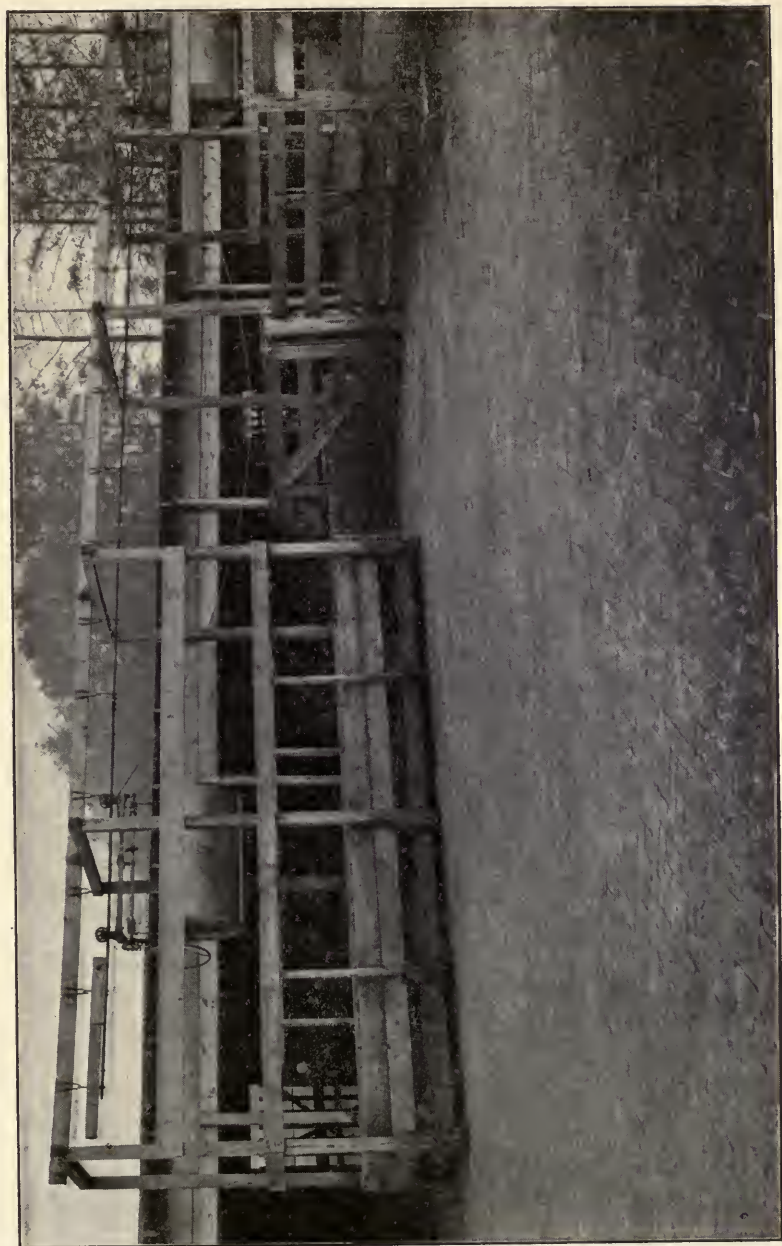
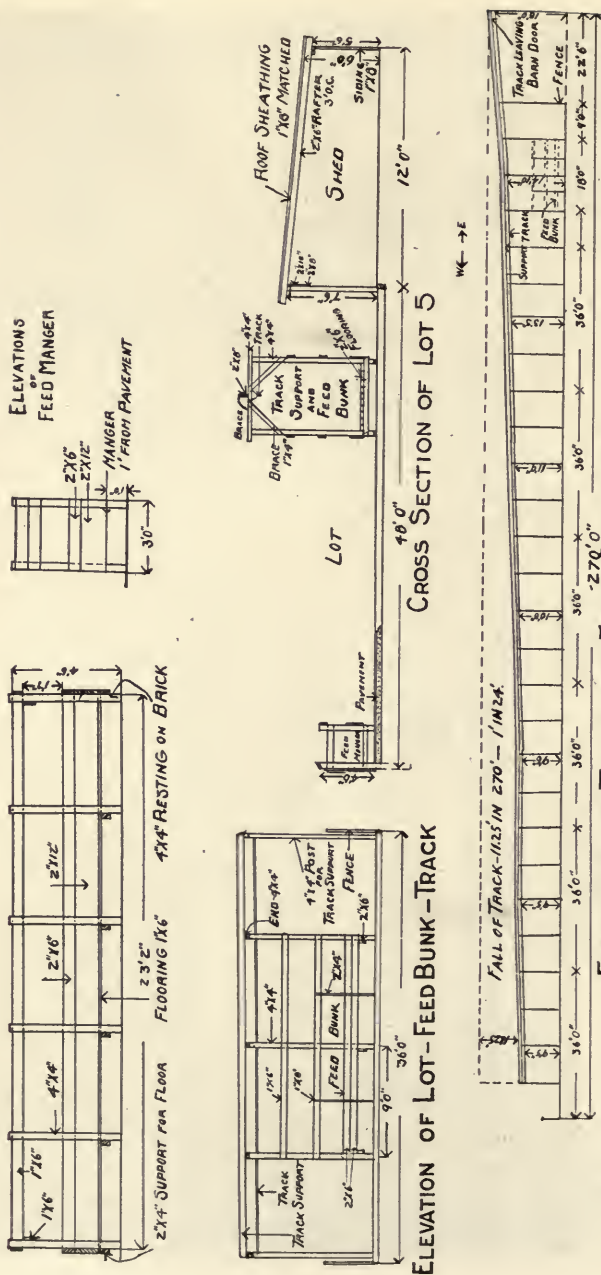
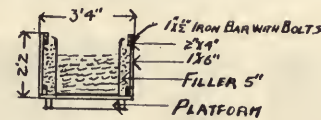
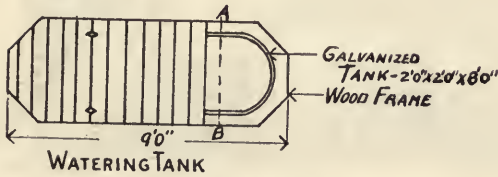


PLATE X. A FEED LOT. (LOT 7).

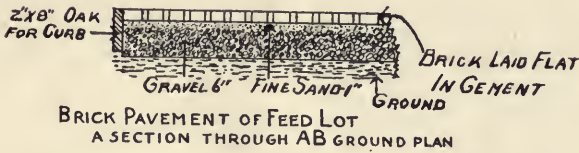


ELEVATION OF TRACK FOR FEED CARRIERS
 PLATE XI. CONSTRUCTION DETAIL.

DETAIL OF FEED LOT



SECTION THROUGH AB



BRICK PAVEMENT OF FEED LOT
A SECTION THROUGH AB GROUND PLAN

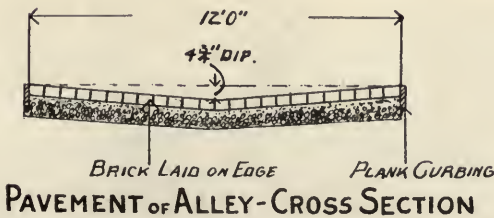
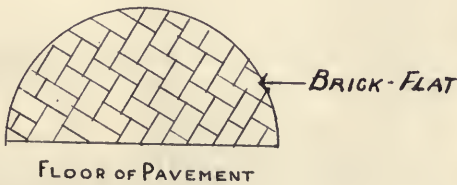
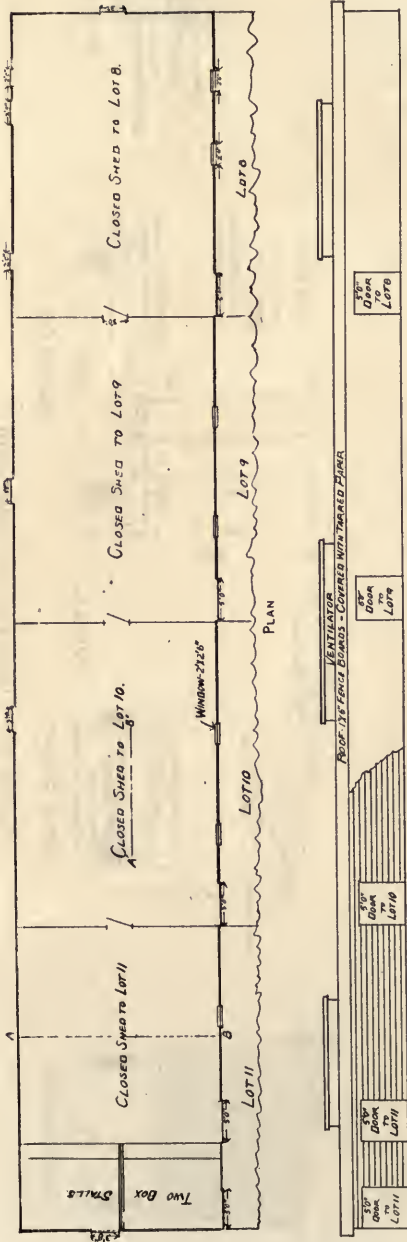


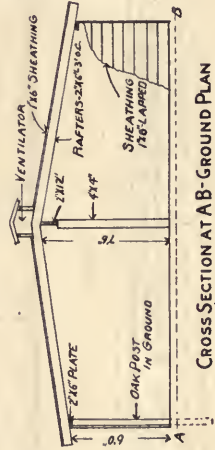
PLATE XII. CONSTRUCTION DETAIL.



PLATE XIII. STORAGE BINS AND FEED CARRIERS.



SOUTHELEVATION



CROSS SECTION AT AB-GROUND PLAN



LONGITUDINAL SECTION AT AB-GROUND PLAN

PLATE XIV. DETAILS OF CLOSED SHEDS.

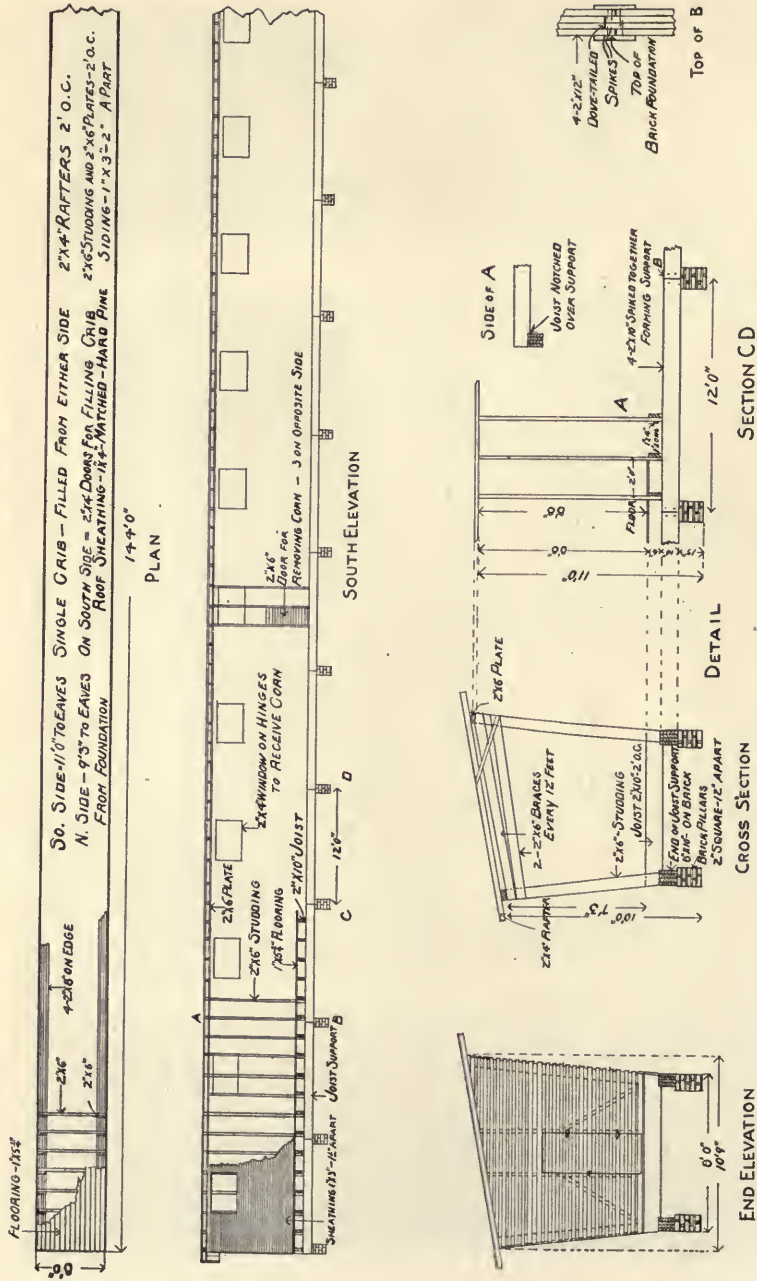
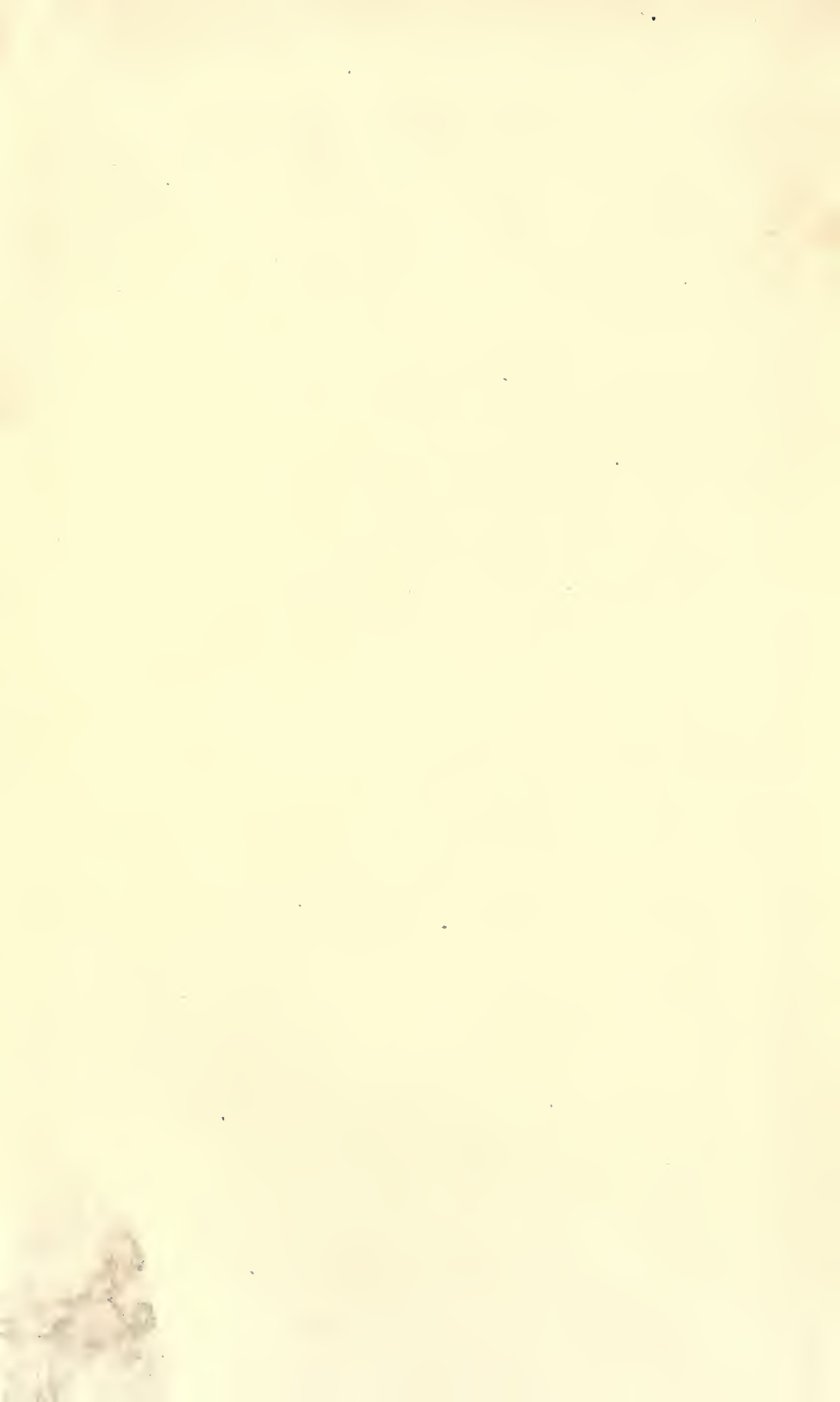


PLATE XV. DETAILS OF CORN CRIB.













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