Construction and ventilation of dairy barns.

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The importance of efficient ventilation of dairy barns has been emphasized by the recent investigation of the causes conducive to the development and contagion of tuberculosis in cattle. BULLETIN No. 7, of United States Bureau of Animal Industry, on Investigations Concerning Bovine Tuberculosis, says: “Fully nine-tenths of all diseased animals have been infected by inhaling the tubercle bacilli dried and suspended in the air.” Without proper ventilation the tubercle bacilli and other disease germs must be much more readily inhaled, and it is a matter of record that the worst diseased herds are found in poorly lighted and poorly ventilated buildings; while range cattle and other stock, seldom sheltered or confined in close buildings, shows.
practical immunity from the disease. Most barns have no system of ventilation except the introduction of outside air through doors and windows, and farm buildings generally have an inadequate supply of these. In view of the importance of this subject, the plan of ventilation, and incidentally some other features, of an experimental barn recently constructed at the Iowa Agricultural College is herein presented.

The barn is 40 x 70 feet, standing north and south on a moderate elevation sloping gently to the east. The structure is entirely above ground, twenty-six feet to the upper plates, with a half pitch roof, and has two and a half stories. The building was erected at a total cost of $3,999.37. The side walls are of 2 x 4's upright, 24 inches on center, sided outside with 7/8 drop siding to the second story, and lap-siding above with tarred building paper under all. On the inside the first two stories are boarded with 6-inch shiplap nailed on to studding, thus forming a double wall all around with a course of tar paper, and four inch air space between. A sufficient number of these air spaces between the studding around the building are utilized for ventilation. The sectional view of the interior on opposite page shows the plan of ventilation:

Numbers 1, 2, 3, 4, 5 and 6 represent registers opening into the bottom of ventilating ducts on one side of building, and 7, 8, 9, 10, 11 and 12 represent the continuation of these ducts made by boarding on the under side of two adjoining rafters at proper intervals, and also the same on the studding from the top of the second story to the plates. This carries the ventilator ducts to the purline plates halfway up the roof. Here a long triangular box three feet on each side joins all of the ducts, from which they are continued up to two cupolas by wider ducts, A and B. The cupolas have slatted sides, that may be opened and closed by means of a heavy cord attached, and conducted to the lower floor. The hay chutes are also boarded tight to the plates and carried up to the triangular ventilator box, and thence to the cupolas. The hay chutes have hinge door openings at side and bottom, so that they may serve the purpose of ventilation ducts when desired. The root storage room communicates with one of them, and is thus provided with constant ventilation.
INTERIOR VIEW, SHOWING PLAN OF VENTILATION.
This system of ventilation works with entire satisfaction. Each box stall and about every twelve feet of side wall space is thus provided with an exit for the impure air and a source of fresh air, besides the hay chutes directly overhead. These ducts are found carrying both upward and downward currents of air, sometimes one and sometimes the other, depending upon the direction of the wind and atmospheric conditions without and within. If at any time, as in case of very severe weather, or only a few animals being kept in the barn, too much cold air is found coming in, or if more is wanted in one part of the barn than another, the supply is easily and conveniently regulated by closing the hay chute openings and the registers around the wall.

In addition to this system of ventilation, the lighting of the barn is so arranged that sunlight enters every stall and reaches every animal in the building. The west and north side windows are provided with storm sash in winter, and all lower story windows have fly screens and shades in summer, so that the conditions as to temperature, light and ventilation are pretty fully within the feeders' control. A 200 barrel tank in the upper story supplies water on both floors below, and also to yards adjoining, at a temperature only a few degrees lower than when pumped from the spring outside. A heavy stove with reservoir attachment in herdsman's room, in the southeast corner of the building, furnishes hot water when wanted. At the present time hot water is being used for steaming mixed feed. The grain and fodder ration for our dairy cows is prepared twelve hours before feeding and all mixed together in a large closely covered vat, and hot water enough to fully saturate poured over it and the lid closed, confining the steam and heat, and the mess comes out warm for feeding. This process softens the fodder and gives it succulence without sourness, and doubtless increases its digestibility.

The lower story has a cement floor, only the horse stalls being covered with a layer of plank on top of the cement. Each stall drains into a cemented sewer pipe, furnished with a grated cover and bell trap at each opening preventing the escape of foul odors into the barn. The sewer pipe drainage leads to a cistern fifty feet away from the barn, into which all liquid manure is conducted, to be pumped out and used in
fertilizing experimentation. All coarse manure is either taken direct to the field or carted out to a compost heap until prepared for application.

The cement floor is giving good satisfaction and does not seem to require plank covering for any stock except horses, although it is inclined to be slippery, and the stalls require liberal bedding. The floor was made by three inches of concrete, composed of five parts of clean sharp gravel to one of Portland cement, mixed dry, water added and cement remixed and laid on the level surface, having a bed of sand and gravel about an inch deep. The floor was then finished with a three-quarter inch covering of Portland cement and sand, in proportions of four of cement to seven of sand, trowel finished and having fall to drains. This floor was put in at a cost of ten cents per square foot. Barns with poorly constructed, open floors, permitting the seepage of liquid manure until the soil beneath becomes saturated, are a constant source of bad atmosphere and foul odors, endangering the health of stock and impairing the quality of dairy products. A dirt floor is subject to the same objections to some extent, although dirt floors with liberal bedding are much preferable to poorly constructed wooden floors. Where we have laid plank over the cement we have used matched lumber and made joints water tight by use of asphalt and white lead. A cement floor practically excludes rats. The grain bins and seed room are made of oak, and the corn crib is covered with one-fourth inch mesh wire netting, making it absolutely rat and mouse proof.

The drawing of interior view was prepared especially to show the plan of ventilation and shows only one-half of the barn. The other side of the ground floor is arranged with stalls for cows or steers and five large box stalls for hogs, sheep or calves. These stalls have movable partitions and may all be thrown together, in which form they are now being used for experimentation with a car load of calves. The opposite side of the second floor contains an oak lined mouse-proof seed room for airing and storing seeds, a wire covered corn crib having a capacity of 700 bushels and storage room for implements and experimental crops. In the cattle section of the barn the following stalls are in use: The Newton cow tie; Warriner swinging stanchion; sliding chain and rod tie; Harner adjustable manger, and the Bidwell adjustable cow stall.