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Ventilation of Animal Shelters

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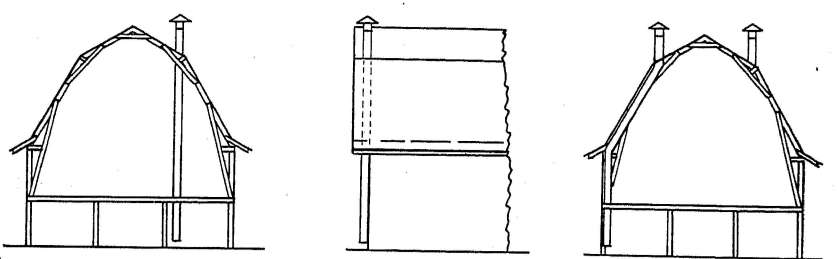

Fig. 1.—Three alternative plans for ventilation flues.

There is a general tendency in Missouri toward more open-type buildings for livestock. Poultry houses with open front ventilation and cattle sheds with the south side left open to the sun and air are being used extensively. When the amount of open front is regulated or in case there is no need to control temperatures, this type of building is satisfactory. Three sides are built with tight walls preventing drafts through the building. By making the depth 20 feet or more the animals or fowl can find a place where the drafts in and out of the south front are not too great.

In many buildings, however, it is desirable to maintain an environment that is more uniform than that furnished by the open shed. Buildings meeting these requirements are built fairly tight on all sides in order to utilize the heat given off by the animals to maintain a higher temperature. In cold weather such a barn is sure to be damp unless some provision is made for ventilating it. Many attempts at ventilation have been made in the past. Some have been successful but others have failed to give the results desired. Also many of these systems have been rather expensive to install.

Within the decade some great improvements in design of ventilation systems have been made. The efficiency has been greatly increased, the cost of installation reduced and the whole process simpli-

fied. For barns housing up to fifty cows only one outtake flue is used instead of the many called for in previous designs. This one stack or flue must be well insulated. It should be built as nearly vertical as possible. It can be located at any point in the barn and may even be set outside the barn if desired. An opening through the siding allows air to enter the flue from the barn.

In Fig. 1A, the flue is built into the barn so as not to interfere with the operation of the hay carrier. Fig. 1B shows a flue built outside the barn, having an opening into the barn near the ground level. Fig. 1C shows a flue built to offer less obstruction in the mow. The size of this flue should be increased slightly due to the decrease in efficiency of the sloping section.

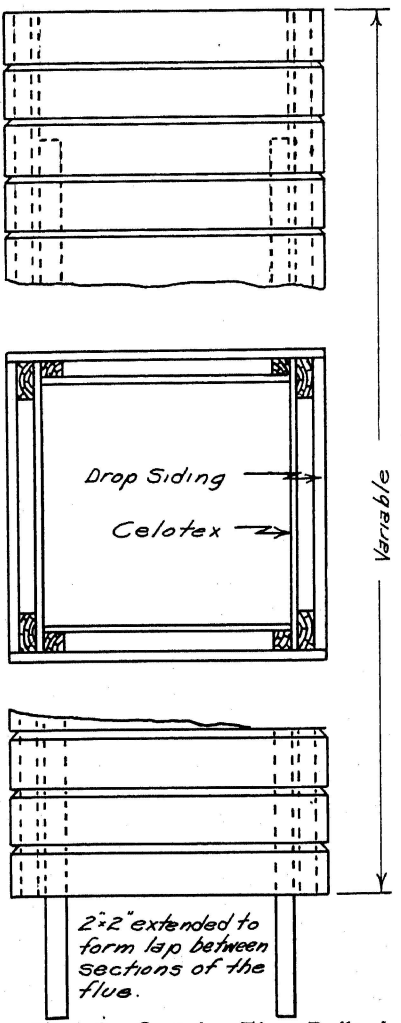

Fig. 2.—Outtake Flue Built in Sections.

This is a so-called natural system of ventilation. It depends upon the difference in the weight of warm air within the barn and the cold air outside. The insulated outtake flue keeps the air warm to the top of the flue providing a column of expanded light air which will be forced upward by an equal column of heavy (cold) air outside. Uninsulated flues also cause condensation of moisture on flue walls resulting in failure of the system in most cases. The flue should be built with a square cross-section rather than with unequal sides. A round section would be more effective still but is difficult to build.

The celotex is cut into strips the proper widths and nailed to the 2"x2" strips. The 2"x4" pieces are then fastened in place and the outside covering nailed in place. It can be built in sections and set up in place. The insulation board should be waterproofed before it is fastened in place.

Ventilator Heads

The upper end of the ventilation stack should be covered to prevent rain from entering. Suction head ventilations have been developed to produce a draft in ventilation flues when the wind is blowing. Usually, however, under such conditions less rather than more ventilation is needed in buildings except in summer when the suction head ventilator may be worth while. Commercial ventilation heads improve the appearance of the building; they are weather and bird proof and are often advisable for these reasons.

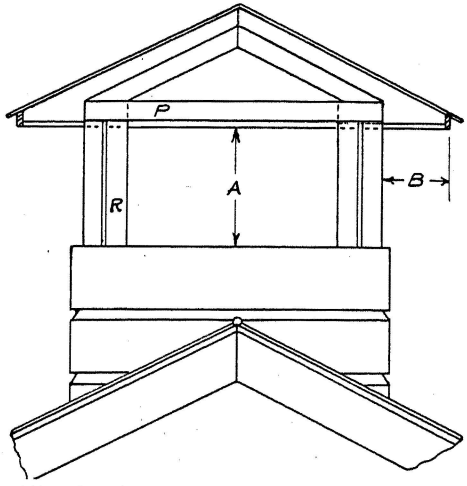

Fig. 3.—A home-made cover for the outtake flue. Plate (marked P) is mitered at the corners and spiked to risers (R). Plancher cut is made even with bottom of plate and ceiled as shown. Distance A equals ½ diameter of flue. B equals ½ A. Sheet metal roof is nailed direct to rafters.

Insulation

"Ventilation requires insulation," is a statement that is often made and is usually true. If a barn is poorly constructed the heat from the animals will not create the necessary temperature difference between inside and out to cause the ventilation system to function. The question may then arise, "Why not leave openings in the wall and avoid the need of a ventilation system?" With some kinds of livestock this may be done, although there will be times when this will not be satisfactory. In cold, windy weather the temperature will be low inside and the drafty condition may cause pneumonia and a loss greater than the cost of better construction. In North Missouri the walls in most stables should be lined inside the studding with car

siding or similar material if a ventilation system is being installed. In South Missouri matched siding or boxing with bats will usually be sufficient. The ceiling should be equal to or preferably better than the walls so far as insulation is concerned. Hay storage over-head furnishes sufficient insulation, provided all the hay is not removed in cold weather.

Size of Outtake Flue

The size of flue required will depend upon the effective height of the flue, upon the temperature difference that can be maintained, and upon the amount of moisture and carbon dioxide that is to be removed.

The figures given in Table 1 give satisfactory results in practice.

TABLE 1.—AREA OF OUTTAKE FLUE PER ANIMAL

Effective Height of Flue	Area per 1000 lb. cow	Per Horse	Per 200 lb. Hog	Per 100 Hens
Feet	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
10	.590	.690	.098	.472
12	.540	.632	.090	.440
14	.500	.585	.083	.395
16	.464	.542	.077	.376
18	.438	.514	.073	.360
20	.416	.486	.068	.336
22	.394	.460	.065	.320
24	.380	.445	.063	.310
26	.363	.425	.060	.296
28	.350	.410	.058	.285
30	.340	.396	.057	
32	.330	.386	.055	
34	.320	.375	.053	
36	.310	.362	.052	
38	.300	.350	.050	
40	.294	.345	.049	

TABLE 2.—AREA OF DIFFERENT STANDARD SIZES OF OUTTAKE FLUES.

Cross Section of Flue	Square ft.
8″x 8″	.444
10″x10″	.694
12″x12″	1.000
14″x14″	1.360
16″x16″	1.775
18″x18″	2.250
20″x20″	2.780
22″x22″	3.360
24″x24″	4.000
28″x28″	5.440
30″x30″	6.250
34″x34″	8.040
36″x36″	9.000

To determine the proper size of flue for any building:

(1) Determine the effective height of the flue. (This is considered to be the vertical distance from the floor of the barn to the top of the flue where foul air is removed at the ceiling, and from the ceiling of the stable to the top of the flue where the foul air is removed from a point near the floor.)

(2) Determine the flue area per animal for this effective height of flue.

(3) Multiply this area by the number of animals to secure the total area required.

(4) Refer to Table 2 and select the size of flue needed.

Fresh Air Inlets

A special type of window may be secured that is arranged to tilt back from the top to admit fresh air. The cold air moves in over the window and settles, forming a blanket of cold air inside the window. This procedure results in a reduction in loss of heat from the barn as compared to other methods of introducing outside air. On windy days it will be necessary to regulate windows to prevent wind from blowing through the stable. There are automatic air inlets available* that can be set to admit a certain amount of air, and the amount and direction of the wind will make very little change in the amount of air admitted. These automatic inlets should be placed over windows if possible to reduce heat loss. The need of distribution of fresh air will govern the location and number of inlets. A large number of small inlets is usually preferable to a few large ones. The total area of inlets should be from ten to twenty-five per cent greater than the area of the outlet flue to secure best results.

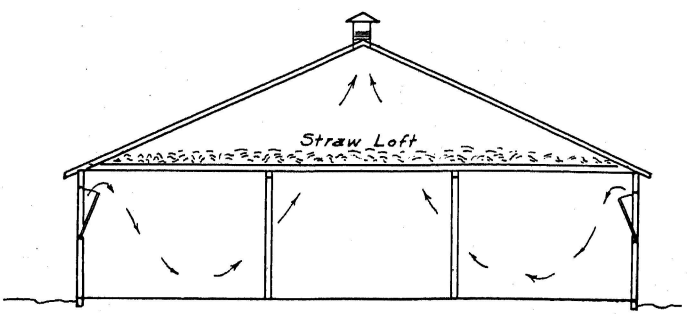

Fig. 4.—A straw Loft with Ventilated Attic.

*Barn equipment companies furnish these automatic inlets in standard sizes, 5½x22 inches and 11x22 inches.

Straw Loft with Ventilated Attic

In some one-story buildings it may be desirable to use a straw loft to serve as an insulating medium and to aid in controlling humidity. Calf barns, loafing barns for cows, hog houses and poultry houses may be designed for such a system of ventilation. The effective height of the outlet ventilators is considered to be from the floor to the top of the ventilator head. Inlets for fresh air are made similar to other systems.

Mechanical Draft Ventilation Systems

Rural electrification has made possible the use of electric driven ventilation fans on many farms. These installations vary from small exhaust fans installed in window openings to the regular cabinet type which is arranged to remove the air from near the floor or from the ceiling as desired. The amount of air removed by the fan will depend upon its size and speed. Table 3 may be used as a guide in determining size needed, although the advice of the manufacturer should be secured before purchasing.

TABLE 3.—SIZE AND SPEED OF VENTILATING FAN FOR ANY INSTALLATION

Size of Fan	R.P.M.	Number of Animals Served			
		Cows	Horse	Hog	Hens
12″	1070	8	7	48	1000
12″	1725	12	10	72	
16″	1125	24	20	144	
18″	1150	36	30		
24″	860	60	50		