MILK HYGIENE ON THE FARM

DAIRY-FARM BUILDINGS AND INSTALLATIONS IN TEMPERATE CLIMATES

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INTRODUCTION

Where cows are kept indoors it is important that suitable and adequate buildings be provided if the cows are to be fully productive. In this respect dairy cows require no less consideration than other livestock on the farm, and in some respects their need is greater. Because of their milk-producing function, the housing needed for cows demands special features enabling milk to be obtained from clean and healthy animals in a manner which will prevent, so far as is reasonably possible, the contamination of milk during milking. Each dairy farm should be provided with suitable buildings for the housing and milking of cows, and for the subsequent handling and storage of milk. In many instances, cows are housed and milked in one dual-purpose building—the cowhouse; in other cases, they are milked in a special building—the milking parlour—the cows being housed elsewhere, usually in some form of yard which may be open or covered, or kept on pasture. Milk is handled, stored and treated in a dairy or milk-room specially reserved for those purposes.

Quite apart from the need to provide good housing for dairy cows as valuable livestock, it must be remembered that milking has to be done twice a day seven days a week, and therefore demands reasonable working conditions. After food, labour is the most expensive item in the cost of milk production. Good buildings help to establish a good working routine and to reduce labour costs. Buildings that are well designed and constructed should be easy to clean and economical in management and use.

From the hygienic point of view, the production of milk free from infection—of either bovine or other origin—and contamination, involves questions of animal health (dealt with in detail in the chapter by Kaplan, page 11), of dairy-farm buildings, and of methods of milk production. It has been clearly demonstrated by many workers all over the world that irrespective of the state of the buildings used for milking it is essential that the methods followed should prevent contamination of milk. In other

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words, it is the quality of the work that counts. At the same time, however, it must be remembered that if dairy workers are given good working conditions they are more likely to work effectively than if conditions are poor. Therefore, good dairy-farm buildings are extremely important in considering any of the hygienic aspects of milk handling.

Increasing attention is also now being given to the economic aspects of milk production. In an attempt to reduce milk production costs, every effort is being made to introduce methods which will save labour. With this object in view, careful consideration has been given to the everyday details of milking and milk handling, and work study often shows that careful planning of the milking routine reduces labour costs. This can be effected not only by organizing the work of the operatives but by better planned buildings.

It will be seen, therefore, that not only are good dairy buildings needed for the hygienic production of milk but they are also a factor of considerable economic importance. When, on hygienic grounds, improvements to dairy buildings are found to be necessary, it should not be forgotten that such improvements may well be economically sound in the long run by creating conditions which will lower production costs. Equally important, perhaps, is the fact that such improved conditions may well make the work less irksome and more congenial.

Many countries have statutory requirements relating to the production of milk on farms, and when planning farm dairy buildings care must be taken to ensure that any provisions of the law are satisfactorily complied with. In England and Wales, for example, every dairy farmer must be registered as such with the Ministry of Agriculture, Fisheries and Food before commencing to produce milk for sale. Before registration can be effected, the buildings for the purpose must comply with the requirements of the Milk and Dairies (General) Regulations, 1959, which include many details relating to buildings. Although the information contained in this chapter is not intended as a guide to the statutory requirements of any country, if dairy buildings are constructed in accordance with the advice given it is unlikely that there would be any major difficulty in meeting such requirements.

There are certain basic requirements for all farm buildings and these are equally applicable to those used for dairying as for other farming operations. Briefly, the principal requirements are as follows:

(*a*) *Cost.* The capital cost of dairy buildings is always high and care must be taken to see that it does not exceed what is reasonable in the circumstances of individual farms.

(*b*) *Adaptability.* Cowhouses and milking parlours are specialized in character and thus not easily adapted for other purposes if the farming policy is changed. This makes it desirable to ensure that if at any time such a change occurs, the buildings can be readily altered to some other use.

(*c*) *Construction.* Since milk production is a day-by-day operation buildings are subject to heavy wear and tear. Such buildings should be soundly constructed of good materials. It may well be more economical, in the long run, to use more costly and better materials than to save money on the initial outlay of construction since any such saving may be offset in repair and maintenance charges.

The details of construction of dairy buildings vary in different temperate countries. In this chapter the details given relate to current practice in England and Wales. Elsewhere it is frequently the custom to use buildings of two storeys or more for dairy purposes, the cows being on the ground level with storage lofts over. It is the practice in some countries to place the cows head to head, with a central feeding manger supplied with food from lofts above. In such cases, there may be a controlling gate to the mangers to prevent the cows having access to the food until the herdsman is ready, when the gate is opened in one operation by a control lever. Where such an arrangement is used, the standings will be longer than 5 feet (1.5 m) so as to enable the cows to lie in comfort when the manger gate is closed.

In a number of countries it is the normal custom to have relatively deep and narrow gutters, especially where the cows lie in the buildings for long winter periods. In such circumstances, it is the practice to use more litter or bedding than in England and Wales, and to arrange for a man to be present during milking to remove immediately any dung dropped by the cows, so as to avoid contamination of the milk or soiling of the cows after milking is finished and the cows lie down.

These fundamental differences in practice in different temperate countries should be borne in mind when reading this chapter, as it is impossible to give full details of these variations as they occur in all temperate countries.

It is convenient to consider buildings for milking and milk handling under the following headings: (1) cowhouses; (2) yards and milking parlours, including movable bails; (3) farm dairies. These are each dealt with in detail in the sections that follow.

THE COWHOUSE SYSTEM

In the cowhouse system, the cows are housed during winter and milked in the same building. This system has been practised in temperate countries for many years, the extent of its adoption varying in different countries according to climatic conditions.

The cowhouse is a specialized building which should be carefully designed and constructed so as to provide comfortable and healthy housing for the cows and at the same time to enable them to be milked in clean conditions.

Siting

The siting of the cowhouse is extremely important. It should be sufficiently close to the dairy and food store to reduce to a minimum the handling and carrying of milk and food. To achieve this objective, it is usually desirable to have the dairy on one side the cowhouse and the food store on the other. Alternatively, in the case of a large double-range cowhouse, both the dairy and the food store may be entered separately from a central position in the cowhouse, and in some cases, the fodder store may take the form of a loft over the cowhouse with arrangements for the food to be forked into the shed below.

The cowhouse should be sited in relation to other farm buildings so that it obtains the maximum of light and air. It is important that there should be a suitable and easy approach for the cows from pasture and this approach should preferably be of concrete or some other hard material so that it can easily be kept clean. It is desirable that the cowhouse should be on high ground in relation to its surroundings, rather than be placed in a hollow where it would be liable to receive surface drainage from surrounding ground. The cowhouse should be sheltered from the north and east winds, if this is practicable. It is also necessary to site the cowhouse so that essential services —water, electricity and drainage—are readily available, although it may sometimes be wiser to select a site which is suitable in other respects and take the services to the site rather than using a less suitable site simply because the services are already there. The site should be conveniently placed to enable milk to be removed from the farm easily.

Planning and Layout

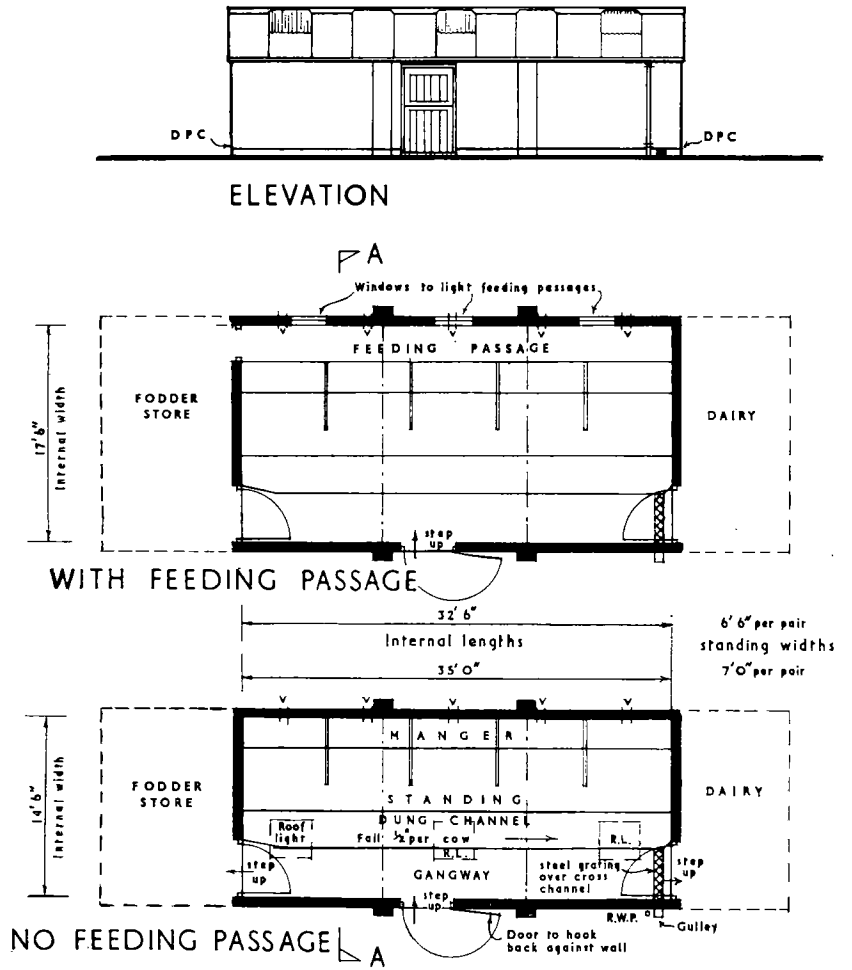
The design of cowhouses varies according to the size of the herd and, where existing buildings are to be adapted for use as cowhouses, according to the type of building available. Thus cowhouses may be planned so as to accommodate the cows in a single row on one side of the shed—single-range cowhouse—or along both sides—double-range cowhouse. Each type may be equally suitable, but where the number of cows exceeds 16-20 it will generally be found that a double-range house is more convenient and less costly to build.

Fig. 1 shows alternative plans for a single-range cowhouse of 10 cows with and without a feeding passage; Fig. 2 is a plan for a double-range cowhouse of 16 cows in two rows without feeding passages.

In single-range cowhouses the standings should be so arranged that the maximum of light falls on the hindquarters of the cows. In the case of double-range houses, the cows generally face the outer walls, with a central gangway. Such an arrangement facilitates the removal of dung; the heads of the cows are kept near to the fresh air inlets in the outer walls; the cows

FIG. 1

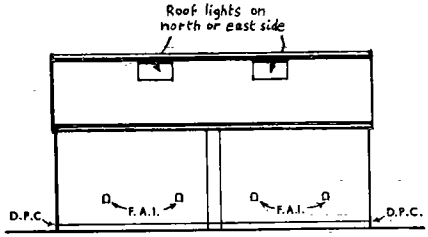
SINGLE-RANGE COWHOUSE OF TEN STANDINGS, WITH AND WITHOUT FEEDING-PASSAGE



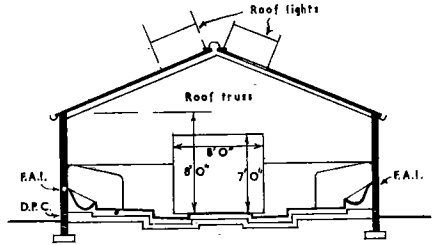
1 inch = 2.5 cm; 1 foot = 30.5 cm
D.P.C. = damp-proof course R.W.P. = rainwater pipe

FIG. 2

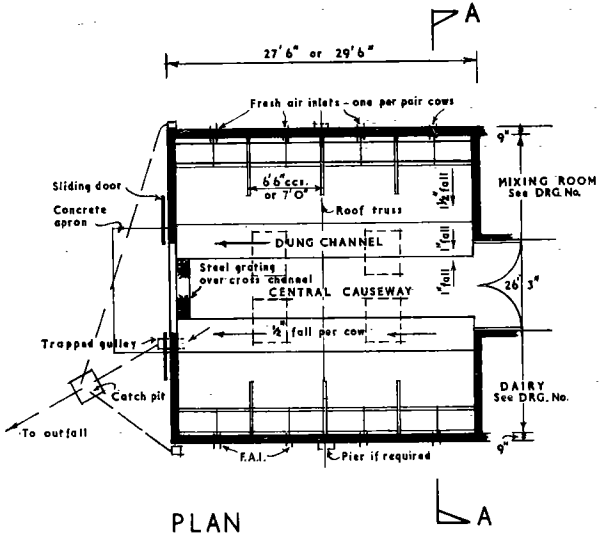
DOUBLE-RANGE COWHOUSE OF 16 STANDINGS WITHOUT FEEDING-PASSAGE



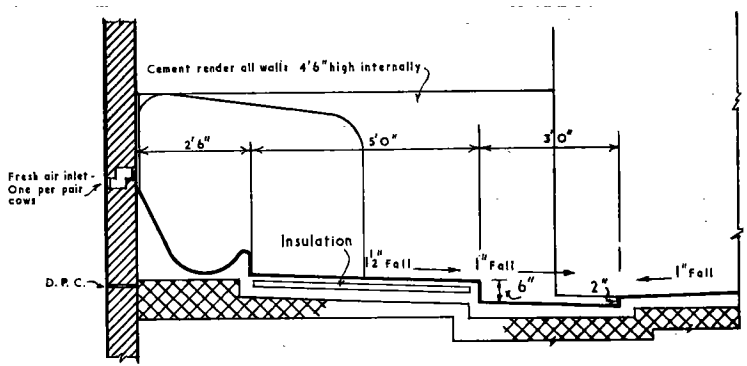
ELEVATION



SECTION A-A



PLAN



PROFILE OF COWHOUSE FLOOR

1 inch = 2.5 cm; 1 foot = 30.5 cm D.P.C. = damp-proof course F.A.I. = fresh-air inlet

can be tied up more quickly; the arrangement dispenses with the cleaning of walls behind the cows as in a head-to-head cowhouse; and milking can be carried out with greater speed.

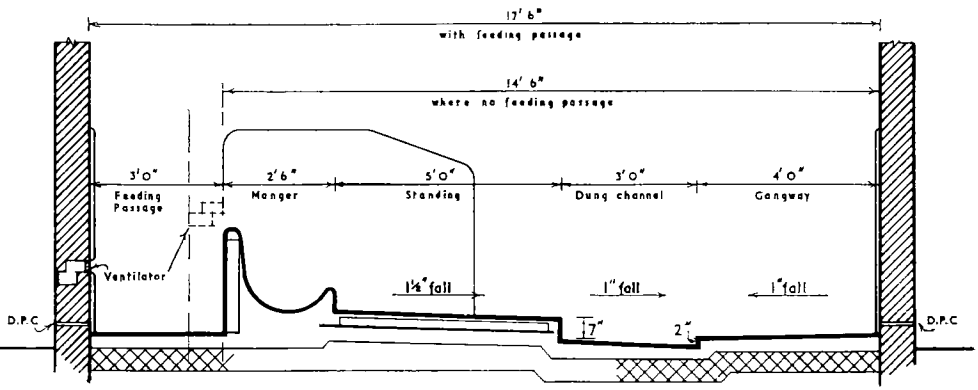
Cowhouses should be of adequate size to enable the cows to be housed in comfort and for this purpose a minimum of 50 square feet (4.6 m^2) per cow is needed, or 45 square feet (4.2 m^2) in the case of double-range cowhouses. While sufficient cubic space is necessary, adequate ventilation is of more importance (see pages 84, 89 and 91). For this reason it is not now the general rule to specify a minimum cubic capacity for each cow.

Internal dimensions

The internal dimensions of cowhouses are of the utmost importance. Over a period of many years the most suitable dimensions for the various parts of the floor of a cowhouse have been ascertained and any appreciable departure from these will result in the cows becoming unnecessarily soiled when they lie down and the floor over a wide area being fouled with dung and urine. The floor should be so constructed that the cows will lie on a clean bed or standing, that the dung will fall into a gutter or channel, and that all liquid falling on the floor will drain away freely to a suitable place of disposal outside the building.

FIG. 3

CROSS-SECTION OF SINGLE-RANGE COWHOUSE WITH FEEDING-PASSAGE



For measurements in metric scale see text.
D.P.C. = damp-proof course

Fig. 3 shows a typical cross-section of a single-range cowhouse with feeding passage. The important dimensions are as follows:

Feeding passage (optional) . . .	3′0″ to 3′3″ (0.9-1.0 m)
Manger	2′6″ to 3′0″ (0.75-0.9 m)
Standing	5′0″; range, 4′3″ to 5′3″ (1.5 m; range, 1.3-1.6 m)
Dung channel or gutter	3′0″ (0.9 m)
Backwalk or gangway	4′0″ (1.2 m)

A standing of 5 feet (1.5 m) long has been found most suitable to enable cows to lie clean, but with the smaller breeds of cow 4 feet 9 inches (1.4 m) or less may be sufficient. It is a useful practice, where a large number of cows are housed, to vary the length of the standings from one end of the shed to the other. When using standings of the lengths mentioned, it is essential that the front of the manger should not be too high; 6 inches (15 cm) is usually sufficient and it should not exceed 8 inches (20 cm). A width of 3 feet 6 inches (1.1 m) is required for each cow in all types of cowhouse, and it is usual to arrange the standings in pairs with the dividing partitions 7 feet (2 m) apart. For the smaller breeds, 6 feet 6 inches (1.9 m) for two cows may be sufficient.

Height

The most suitable height for the inside of a cowhouse is 8 feet (2.4 m) to the eaves. Adequate ventilation, especially air outlets, is much more important than height. Excessive height without proper outlet ventilation may result in foul air being retained in the cowhouse, and it increases the area of wall surfaces inside the building to be kept clean.

Feeding passages

Cowhouses may or may not be provided with feeding passages at the cows' heads. Their provision increases the over-all width of the building by at least 3 feet (90 cm) in the case of a single-range house and 6 feet (1.8 m) in the case of a double-range house, thereby increasing the capital cost of the building. Whether the increased cost is justified is a matter of opinion. Some farmers prefer feeding passages and consider them essential to enable the food to be put into the mangers easily and conveniently. Many others, on the other hand, find no disadvantages in cowhouses without feeding passages. The decision whether or not to have a feeding passage is largely one of personal preference. Feeding passages increase the area in the cowhouse to be kept clean, and there is a tendency to use them as dumps for odds and ends or for the storage of foodstuffs, which is an undesirable practice, particularly if these are of a dusty nature.

Walls

The internal surfaces of all walls liable to soiling or infection by cows should be smooth and impervious to a height of at least 4 feet 6 inches (1.3 m) so as to be readily cleaned. In the case of rough walls of brick, stone or other material this can best be achieved by rendering the whole wall surface with cement mortar brought to a smooth finish with a steel float. The remainder of the walls above that height should be well pointed and capable of being kept clean. As with all farm dairy buildings, the walls should be provided with a suitable horizontal damp-proof course to prevent damp from

rising. The thermal insulation value is considerably improved by having 11-inch (28-cm) cavity walls instead of, for example, 9-inch (23-cm) solid walls. The correct relationship between internal and external temperatures is important in preventing excessive humidity inside the cowhouse.

Floors

The most widely used material for the floors of cowhouses is concrete, but hard engineering bricks may also prove satisfactory. Where concrete is used it should be not less than 4 inches (10 cm) thick and be composed of Portland cement, clean sharp sand and good hard aggregate broken to pass through a 1½-inch (38-mm) mesh, in the proportions of 1 : 2 : 4. Care should be taken thoroughly to mix the ingredients of the concrete, which may with advantage be finished with a 1-inch (2.5-cm) layer of granolithic concrete. The surface should be roughened with a stiff broom or tamping board or be sprinkled with carborundum powder at the rate of 2-3 pounds per square yard (or about 1-1.5 kg per m^2) to prevent a slippery surface.

The *standings* should have a fall of at least 1 ½ inches (3.5 cm) from the manger to the heelstone and dung channel, and in order to form a warm bed on which the cows will lie, some form of insulation is desirable. This may take the form of field drain pipes or hollow blocks or tiles laid in the concrete. Cork, rubber or asphalt composition have been tried for cow standings for resilience and warmth but these materials are not widely used.

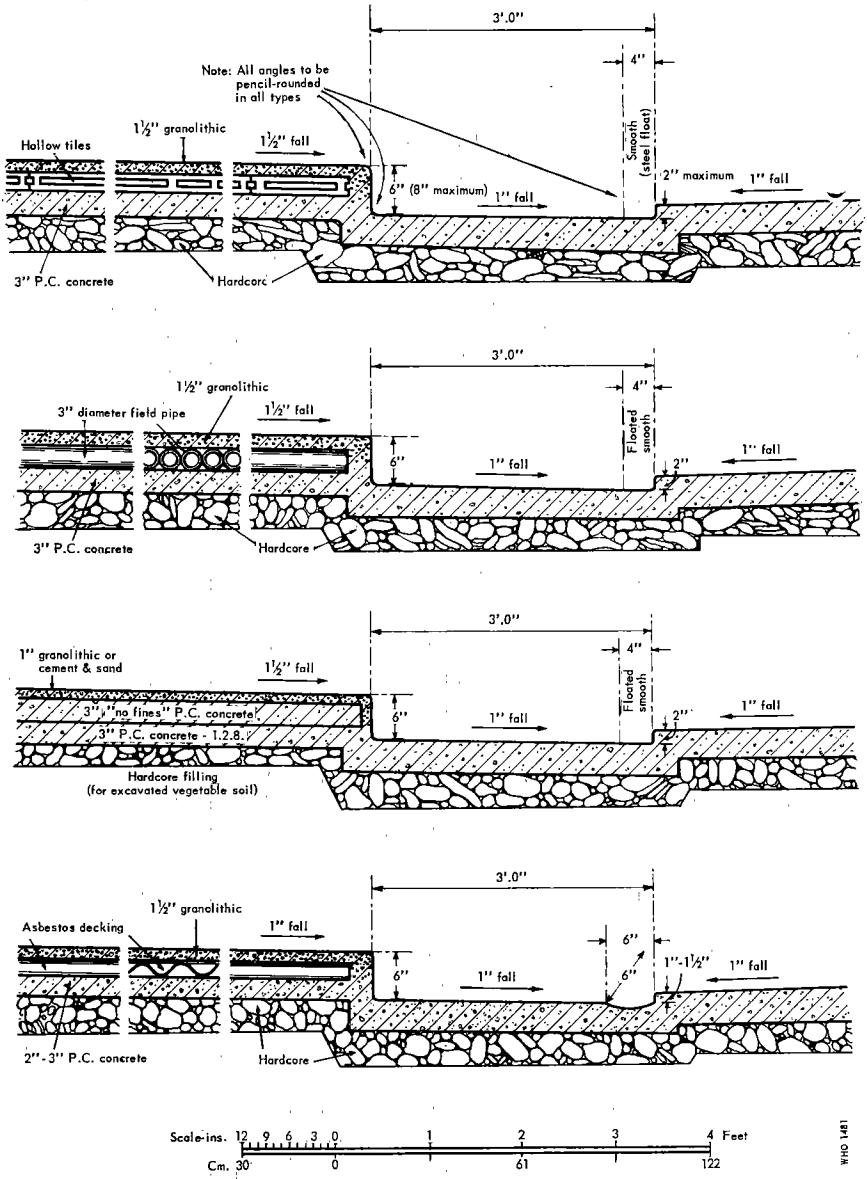
The *dung channel or gutter* should be of concrete, preferably not less than 3 feet (1 m) wide, so formed that the heelstone is not less than 6-8 inches (15-20 cm) deep and the rise to the backwalk or central gangway not more than 2 inches (5 cm). The channel should have a cross-fall from the heelstone to the backwalk of not less than 1-1½ inches (2.5-3.5 cm). The edges of the heelstone are sometimes rounded off and this is desirable so long as they are only pencil-rounded. Fig. 4 shows cross-sections of channels and floors of cowhouses.

The *backwalk or gangway* in a single-range house should preferably be not less than 4 feet (1.2 m) wide and in a double-range house not less than 9 feet (2.7 m), including the gutters, between heelstones. This will allow a trailer to pass through the double-range house for the collection of dung, and where this is done, doors of adequate width should be fixed at each end of the house. The gangway should have a cross-fall of at least 1-1½ inches (2.5-3.5 cm) towards the gutter.

The *mangers* may be formed in a number of ways but in all cases should be of hard impervious material and be so constructed that they may easily be cleaned. Mangers are of two main types—individual glazed stoneware, sometimes called the Scottish-type manger; and continuous mangers formed in cement mortar with high backs. Cross-sections of various types of manger are shown in Fig. 5. Where individual stoneware mangers are

FIG. 4

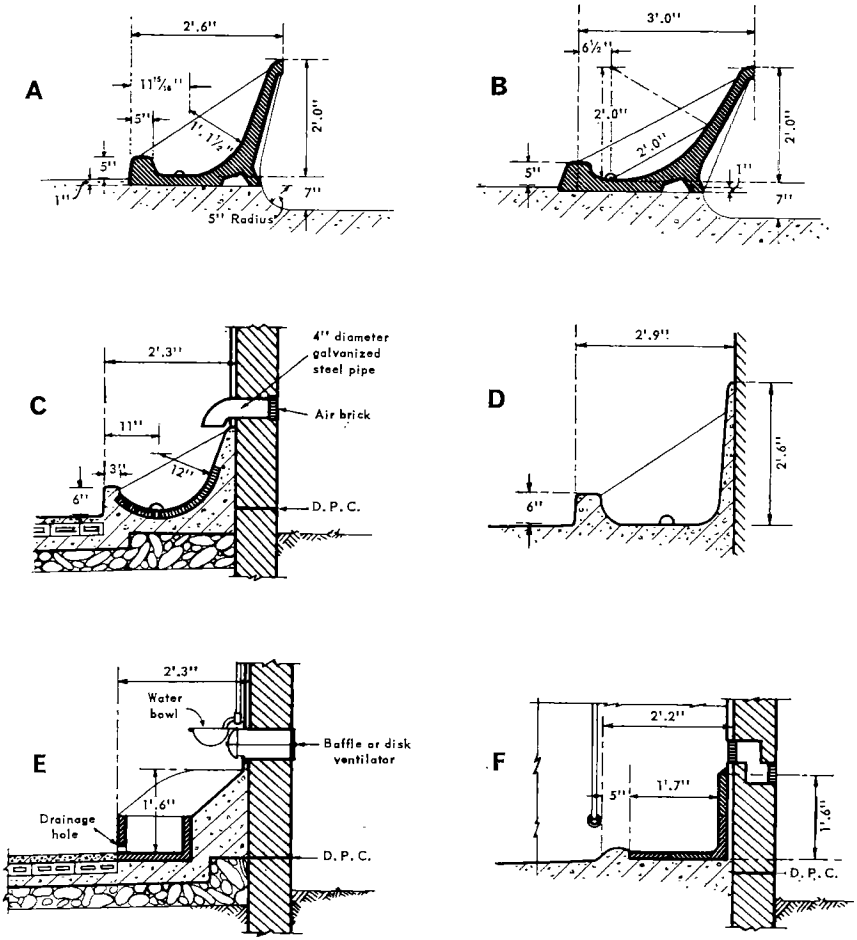
CROSS-SECTIONS OF CHANNELS AND FLOORS OF COWHOUSES



1 inch = 2.5 cm; 1 foot = 30.5 cm

P.C. concrete = Portland cement concrete

FIG. 5
ALTERNATIVE TYPES OF MANGER



1 inch = 2.5 cm; 1 foot = 30.5 cm
G.S. pipe = galvanized steel pipe
D.P.C. = damp-proof course

A = Continuous-type manger for side ties
B = Continuous-type manger for central ties
C = Concrete manger with one-third round 24-inch diameter glazed stoneware lining
D = Silage manger
E = Scottish-type manger with side ties
F = Quarry tile manger

provided, these should be 2 feet 6 inches (75 cm) long, 18 inches (45 cm) wide and 8 inches (20 cm) deep, internal dimensions; they should be set in concrete, properly benched around and the bottom of each manger fixed level with the standing so that the manger top is 8 inches (20 cm) above it. Continuous-type managers may be of stoneware, pre-cast concrete, or concrete laid *in situ*. The mangers should be not less than 2 feet 6 inches (75 cm) wide and the concrete back may be up to 2 feet 6 inches (75 cm) high. This type of manger should be laid in proper forms shaped inside with a template, and finished as smooth as possible with a steel float. Fixed or movable divisions may be provided to prevent cows from taking one another's food, and the best possible quality concrete should be used to prevent the rapid wearing of the manger surface. It is becoming a common practice to use a part section of a glazed stoneware pipe of flat tiles let into the bottom of the manger so as to provide a glazed finish, and this is a very satisfactory arrangement. An alternative method is for the normal manger to be omitted and the food to be placed on flat quarry tiles set in the floor with little or no manger kerb. This practice is adopted in certain parts of the United Kingdom and enables the width of the cowhouse to be reduced, as an over-all length of 6 feet 6 inches (1.9 m) to 7 feet (2.1 m) is required for the feeding place and standing, as against a minimum of 7 feet 6 inches (2.3 m) when the traditional type of manger is used. The omission of the old type of manger greatly facilitates the washing down of the building. Where the continuous type of manger is used, it should have a longitudinal fall of not less than ½ inch (12 mm) per cow from one end of the shed to the other and be provided with proper drainage holes at suitable points so as to discharge on to the standings.

The *longitudinal fall of the floor* of every cowhouse is most important. Every part of the floor—manger, standing, gutter and gangway—must fall longitudinally not less than ½ inch (12 mm) and preferably ¾ inch (19 mm) per cow. Where this is neglected in respect of the standings, the heelstone will vary in depth from one end of the shed to the other owing to the fall given to the gutter.

Stall Divisions

These are usually provided between each two cows, although some dairy farmers prefer single stalls. Divisions are generally either of solid pre-cast concrete suitably reinforced, or tubular galvanized steel; wood is not suitable as it is difficult to keep clean and deteriorates.

Ties are mostly of the side or of the central type. The side tie, usually consisting of a single chain, may be fixed to a vertical rail which may be in one of three positions—forward, central or back—thus allowing for the tying of cows of different sizes in the correct position so that dung will drop into the gutter and not on to the standing. The central tie (yoke or double chain) tends to restrict somewhat the forward and backward movement of the cow

but the all-metal centrally hung yoke is favoured by some milk producers. Preferably all ties should be of the quick-release type.

Water Supply

A sufficient and suitable supply of water is essential for every dairy farm and it is desirable that this should be piped to the cowhouses to provide water for cattle drinking and for washing down the sheds. The subject of water supply generally is dealt with more fully in the section of this chapter dealing with farm dairies (see below, page 116) and in full detail in the chapter by Clark (see page 143). It is an advantage to provide separate self-operating drinking bowls for each cow; these enable the cows to drink at will. There should be a tap in the cowhouse for cleaning down the buildings.

Milking cows require about 12 gallons (55 l) of water per head per day for drinking purposes. The amount of water required for other dairy purposes will vary greatly according to the size of the herd, the system of milking and type of cooling. It is usual to estimate for a total average demand of 30 gallons (135 l) per day per cow to include drinking, cooling, cleaning utensils, washing buildings, washing udders, etc., but a smaller amount will suffice with certain systems and methods.

Facilities should be provided for washing the milker's hands before and during milking operations, and in addition to clean hot and cold water there should be soap, a nailbrush, and a clean towel. If these facilities are provided in or near the cowhouse they are more likely to be used than if placed elsewhere.

Ventilation

The regular renewal of the air in a cowhouse is essential for the maintenance of the health of the cows and the prevention of contamination of milk. The general principles underlying the system of ventilation of cowhouses have been summarized as follows:

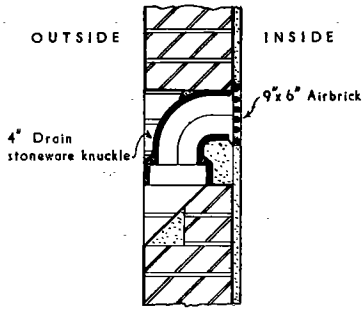
" (*a*) Air warmed and moistened by the cows' respiration tends to rise to the upper parts of the cowhouse and if suitable outlets are provided in the ridge, foul air should escape there. If, however, the roof is too high, the foul air may become cooled before reaching the ridge outlets and may then fall again. Warm air escaping from the upper parts of the building is replaced by cool air entering the cowhouse.

" (*b*) The point at which fresh air is most required is low down near the head of the cow, and the provision of inlet openings in this position will reduce the flow of air into the house at undesirable points.

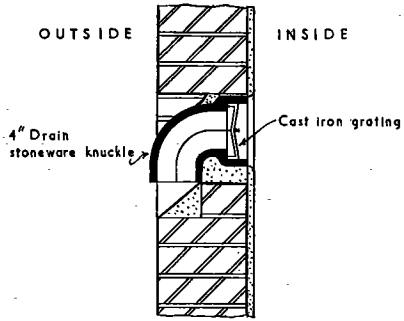
" (*c*) Inlets and outlets need to be provided and their relationship adjusted so that air circulates freely in the cowhouse without causing draughts or excessive variations in temperature and so that condensation is avoided." (Great Britain, Ministry of Works, 1945, p. 65)

Inlet ventilation may be provided by air inlets of about 12-18 square inches (75-115 cm^2) or by 4-inch (10-cm) diameter glazed sanitary bends

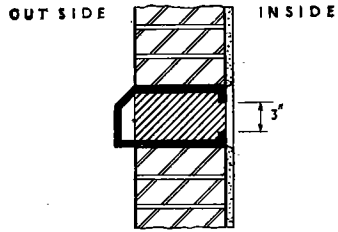
FIG. 6
BUILDING DETAILS OF VENTILATION INLETS



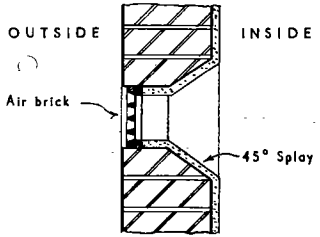
STONEWARE
BEND (A)



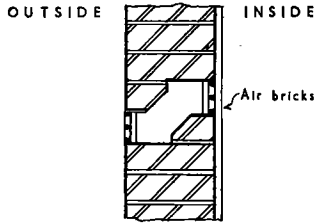
STONEWARE
BEND (B)



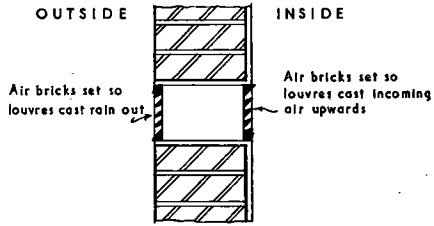
GAS BOILER FLUE
EXHAUST HEAD



AIR BRICK AND
SPLAYED OPENING



TWO AIR BRICKS
STEPPED



TWO AIR BRICKS
(LOUVRE PATTERN)

1 inch = 2.5 cm

curved downwards inside the cowhouse, one inlet for every two cows placed in the outer wall at a low level near the cows' heads. Where there is no feeding passage and the air inlets are placed near the heads of the cows the inlets should be baffled so as to avoid a draught directly on to the cows. Fig. 6 gives cross-sections of various types of inlet ventilators.

Outlet ventilation is of vital importance and should be provided at a point high in the roof to enable foul air to escape from the house. The outlets should be distributed evenly throughout the length of the building and preferably be placed in the ridge. Generally speaking, the amount of outlet ventilation should exceed that for inlet ventilation. There are many types of outlet ventilator—some of which are shown in Fig. 7—from the continuous opening at the ridge, which is probably the most efficient, to openings of various types, including cowls and louvres.

Work carried out at the Hannah Dairy Research Institute in Scotland has tended to show that the first essential in ventilation is adequate provision of outlets at the ridge of the building and that, where suitable outlet ventilators have been provided, the question of the position and extent of air inlets is of relatively small importance (Great Britain, Ministry of Works, 1946).

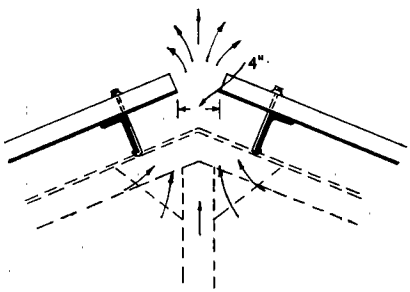
Lighting

In order to enable cows to be milked without undue risk of contamination of the milk, it is essential that all cowhouses should be adequately lighted both by natural and by artificial means. *Natural lighting* is best provided by roof lights, and experience has shown that this should be at the rate of approximately 3 square feet (0.25 m^2) per cow, evenly dispersed throughout the length of the cowhouse, although it is hardly possible to give too much natural light. Where it is impracticable to provide roof lighting, windows must be provided in the outer walls and these should be at the rate of approximately 4 square feet (0.35 m^2) per cow. A combination of roof and wall lighting is effective and the windows, if of the hopper type, also assist ventilation.

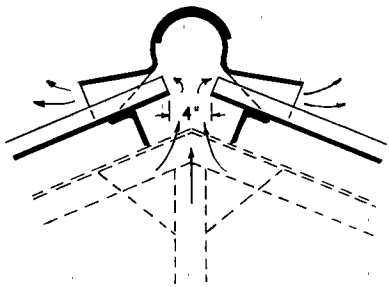
Roof lights may take the form of glass slates or tiles, corrugated sheeting, or fixed or openable roof lights. Lights should preferably face north or east and it may be an advantage to place the lights on one side of the building if the area of light is adequate. Windows of the hopper type, hinged at the bottom which open inwards, are to be preferred, as in addition to lighting the buildings, they assist ventilation when placed immediately below the eaves. Windows of larger size, made to open, and placed high up in the gable ends of cowhouses are excellent for both lighting and ventilation.

Effective artificial lighting is necessary in all cowhouses because for a number of months in the year the milking of cows may take place during the hours of darkness. Electricity or gas have obvious advantages but where these are not available, portable lamps of the pressure vapour oil type should

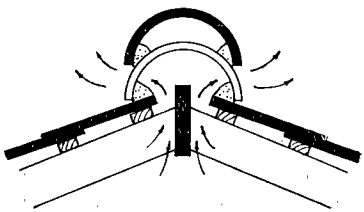
FIG. 7
BUILDING DETAILS OF OUTLET VENTILATORS



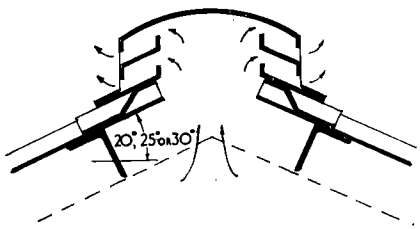
Open ridge



Ventilating ridge



Horsed or raised ridge tiles: alternate tiles raised on adjacent ones



Asbestos ridge ventilator

1 inch = 2.5 cm

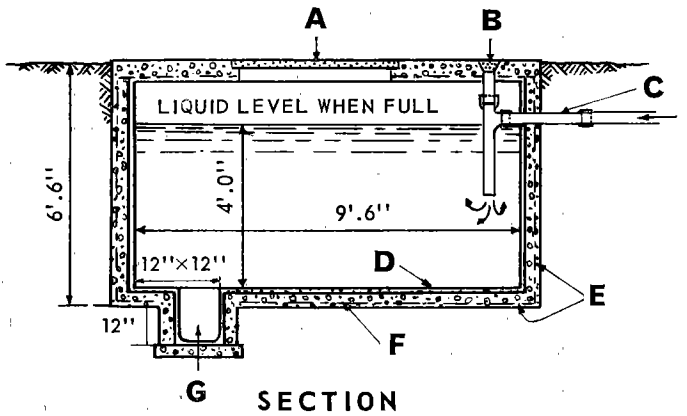
be used. Where electricity is used, a lighting intensity of 10 lumens per square foot (approximately 100 lumens per m^2) has been recommended for cowhouses and dairies (British Electrical Development Association, 1956). Fluorescent lighting is becoming increasingly popular for use in dairy buildings. In addition to high diffusion, it has the advantage of natural colour rendering and cool running. Where the natural lighting is poor, necessitating greater use of artificial lighting, fluorescent lighting may be more economical than ordinary filament lighting. Vapour-proof fittings are recommended and finishes should be corrosion-resistant. The placing of lights is important; they should be sited so that the maximum amount of artificial light falls on the hindquarters of the cows during milking. In the case of single-range cowhouses this can best be achieved by fixing the lights on the back wall at a height of about 7 feet (or 2 m) and inclined at an angle to throw the light on to the cows; in the case of double-range houses, the lights should be hung over the central gangway.

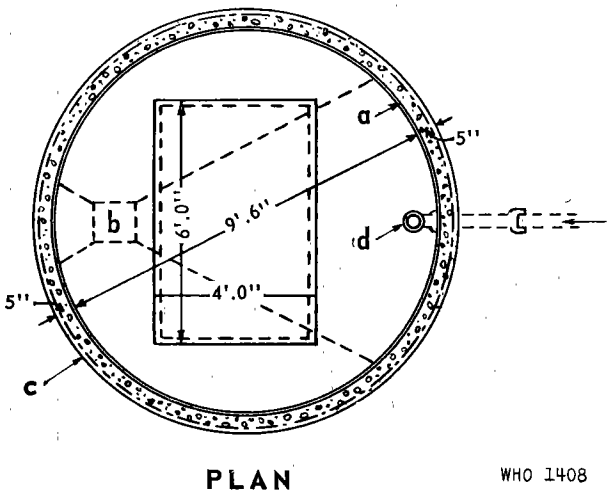
Drainage

Every cowhouse should be provided with a proper drainage system so that all liquid matter is collected and disposed of so as to avoid contamination of milk and any form of nuisance. It is not desirable to have drain inlets inside a cowhouse where cows are housed as well as milked, although there is not the same objection to this in a milking parlour where the cows are not housed (see below, page 99). The liquid waste from the gutters or dung channels should be conveyed outside the cowhouse and made to discharge over properly trapped drain inlets of the street gully type, provided with suitable metal strainers to collect solid matter and buckets for removing sediment. Alternatively, a small brick-built catchpit, about 18 × 18 × 27 inches (45 × 45 × 70 cm) internally, may be provided, covered with an iron grating, which should have a properly trapped outlet. The catchpit will retain solid matter and sediment, which may be removed as required. Where a trapped gully or a catchpit is provided, the liquid must be conveyed therefrom through properly constructed drains to a suitable place of disposal. The disposal of farm drainage is frequently a matter of considerable difficulty, depending to some extent on the proximity of dwellings and other buildings, on the possibility of polluting a source of water supply, and also on the nature of the subsoil. Where, for any of these reasons it is necessary to treat the drainage before its ultimate disposal, it may well be a difficult and costly matter. Where these considerations do not arise it is sufficient to dispose of the liquid waste in such a way that there is no risk of contamination of milk or fouling of the approaches to the farm buildings, especially the cowhouse and dairy. In such circumstances the disposal of liquid waste may be simple and inexpensive. Where, however, for the reasons stated, the liquid waste must be treated before discharge, there are several alternative methods. On the comparatively rare occasions when a public sewer is available, this may be used provided proper steps are taken by means of a suitable catchpit or otherwise to remove all solid matter from the liquid waste. In other cases it may be desirable to utilize the liquid for fertilizing the land, in which case it is necessary to exclude rain and wash water which merely dilutes the urine and renders it less valuable for use on the land. A dual system of drains is necessary using double gullies, one for washing water and the other for liquid manure, for each cowhouse. By means of a movable cover or weir arrangement the liquid may be made to discharge into either of the gullies as appropriate. The drain from the wash water and rainwater gully may be discharged at some suitable point without the liquid requiring treatment. The liquid manure, consisting largely of undiluted urine, should be taken through a properly glazed stoneware drain to a liquid manure tank, which may need a pump to enable the liquid to be removed for disposal on to the land. The capacity of the liquid manure tank will depend on the size of the herd, the frequency of emptying, and the time the cows spend

FIG. 8

LIQUID MANURE COLLECTING TANK (CAPACITY ABOUT 1800 GALLONS/8180 LITRES)
1 inch = 2.5 cm





WHO 1408

A = Cover
B = Plug bedded in tallow
C = 4-inch diameter salt glazed pipes
D = Waterproof rendering to falls
E = Reinforcing rods
F = 4-inch Portland cement concrete
G = Sump
a = ¾-inch waterproof rendering
b = Sump (12 × 12 × 15 inches)
c = Horizontal and vertical reinforcing rods
d = Plug

in the cowhouse. Where the cows are housed for the whole of the 24-hour period and the tank is emptied weekly, about 3 ½ cubic feet (100 l) of tank capacity will be required for each cow. Fig. 8 gives a plan and section of a liquid manure collecting tank to hold about 1800 gallons (approximately 8000 l); Table 1 gives capacities and dimensions of such tanks.

TABLE 1

CAPACITIES AND DIMENSIONS OF COLLECTING TANKS UP TO 2000 GAL. CAPACITY, ASSUMING THEY ARE SQUARE OR CIRCULAR ON PLAN, AND THAT THE DEPTH OF LIQUID IS 3 FT 6 IN. IN ALL CASES *

Capacity		Side of square		Diameter **	
gal.†	cu. ft.	ft.	in.	ft.	in.
400	64	4	3	4	9
500	80	4	8	5	3
600	96	5	4	6	0
700	112	5	8	6	4
800	128	6	0	6	9
900	114	6	6	7	4
1 000	160	6	9	7	7
1 200	192	7	5	8	4
1 600	256	8	6	9	6
1 800	288	9	0	10	1
2 000	320	9	6	10	8

* Above 2000 gal. it is more economical to increase the depth rather than the length and breadth.

** "Diameter" equals "side of square" increased by one-eighth, and one cu. ft. equals 6¼ gal.

† 1 gal. = 4.546 litres.

Where the dual system is not used the whole of the liquid manure, together with rain and wash water, must be collected together and given sufficient treatment to enable it to be discharged to waste at a suitable point. This will usually involve the provision of a settling chamber to hold the liquid long enough for the solids in suspension to sink to the bottom and to catch any floating particles, such as straw, etc., so that only liquid will leave the tank and pass to the next stage. The collecting tank to which the liquid from the settling chamber passes should be similar to that shown in Fig. 8. This tank will require emptying at regular intervals and the liquid discharged on to the land by means of field drains so that it is properly filtered by soil before it reaches a ditch or stream. Any scheme of this kind needs to be carefully planned, and expert advice should be obtained from someone widely experienced in the disposal of farm drainage, otherwise serious nuisance may arise or the pollution of water supplies may occur.

Dung Disposal

This frequently presents a difficult problem on dairy farms. Where a cowhouse is used it is a simple and satisfactory method to provide a dung cart into which all manure is placed as it is removed from the cowhouse each

day. For the daily removal of dung a loading ramp will be found convenient; alternatively the dung cart can be kept at a lower level so that dung may be tipped easily into the cart.

Where it is not possible to remove dung daily from the vicinity of the cowhouse it is desirable that there should be a proper dungstead in which to store the dung until its removal.

The dungstead should be properly sited so as not to cause fouling of the approaches to the cowhouse or dairy, from which it should be placed at a distance of not less than 60 feet (18 m). The dungstead should preferably be covered to protect the dung from being leached by rain; it should not be too large but of sufficient capacity for from 6 to 8 weeks' requirements, which will vary, of course, according to the size of the herd. Each cow will produce about 5 cubic yards (3.8 m^3) of dung in 6 months. The dungstead should be sloped and drained to the back and be provided with retaining walls so as to prevent access of cattle. Fig 9 shows a typical dungstead. The liquid manure is drained from the dungstead to a proper storage tank for use on the land (see above, pages 93-95).

Isolation Boxes

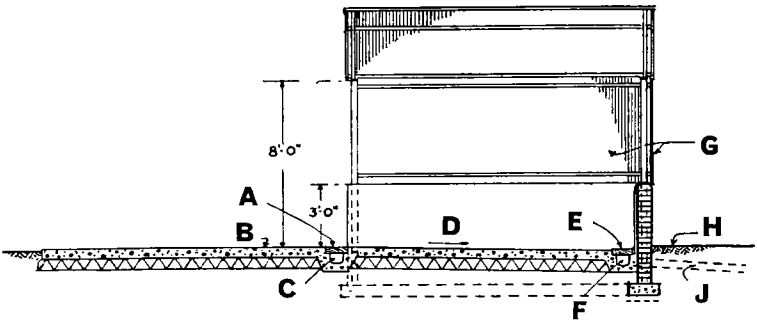
It is essential that there should be accommodation, usually in the form of suitable boxes, for sick animals and cows about to calve. These should be soundly built, well ventilated and lighted, properly drained, and so constructed that they can easily be cleaned and disinfected. They should not be provided with an unlimited supply of water by automatic drinking bowls, but be rationed according to veterinary advice.

YARD AND MILKING PARLOUR SYSTEM (INCLUDING MOVABLE BAIL)

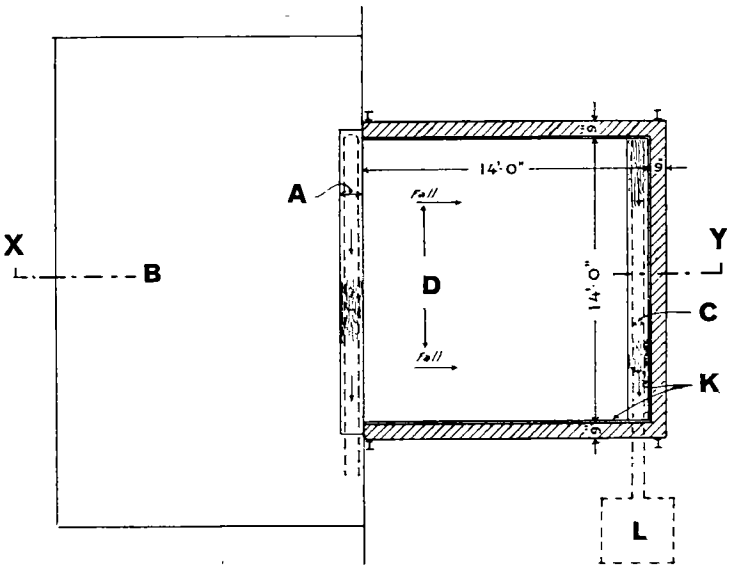
In England and Wales, an increasing number of farmers have discontinued the housing of milking cows in cowhouses, and adopted a system where the cows are milked in parlours and either allowed to lie in the fields all the year round or kept in yards (which may be covered, or partially covered) in the winter. Where there are extremes of temperature during the year, as in the north of the United Kingdom and elsewhere, there may be a combination of both systems, the cows being housed in cowhouses during the cold winter months, and lying in the fields during the warmer summer period. In contrast to the cowhouse system, where the cows are housed and milked in the same building, in the yard and parlour system the cows are housed separately in yards or elsewhere and milked in a special building reserved for that purpose and generally known as a *milking parlour*. In essence the milking parlour consists of a number of stalls, few in number

FIG. 9

COVERED DUNGSTEAD WITH VERTICAL SHEETING ON BACK AND SIDES



SECTION X Y



PLAN

A = Loose-fitting railway sleepers covering open-channel drain
B = Concrete apron (level)
C = Open-channel surface-water drain covered with loose-fitting railway sleepers (for drainage to sump if required)
D = Fall
E = Railway sleepers
F = Open channel
G = Vertical sheeting
H = Ground level
J = Drainage if desired
K = Cement rendering
L = Sump

1 foot = 30.5 cm

compared with the size of the herd, through which the cows pass in turn and in which they are milked. Although the system varies from farm to farm, the concentrated food may be fed in the parlour, leaving the bulky food to be eaten in the yards or elsewhere, whilst on other dairy farms no food is taken into the parlour, which is used only for milking the cows.

The yard and parlour system was originally closely associated with "releaser" or "releaser-recorder" milking machines, although the "bucket" type of machine was sometimes used. Recently, however, "direct-to-can" milking has been adapted for use in milking parlours, and "pipeline milking", in which the milk passes along a milk pipe to the dairy and thence direct to a can or to a bulk milk tank.

The advantages and disadvantages of the yard and parlour system have been defined as follows:

"*Advantages*

(*a*) Lower building costs compared with the cowhouse system;
(*b*) Better health of cows and freedom from troubles in knees and hocks;
(*c*) Milk of high quality can be produced with less labour and trouble;
(*d*) The daily cleansing of a large cowhouse is avoided;
(*e*) Less water is required and there is less effluent;
(*f*) Dung and urine are conserved and may be removed from the yards at convenient intervals, an ideal arrangement for mixed or arable farms, whether large or small;
(*g*) The facilities and equipment for producing and handling milk are concentrated, making supervision easier;
(*h*) In the summer months a collection yard and a milking house are the only accommodation used by the herd;
(*i*) Where the open-air system is adopted during the summer months only, the bail can be transferred to a prepared site at the farm buildings to serve as a milking house during the winter; and
(*j*) The buildings can be easily adapted for purposes other than milk production should a change in the system of farming render this necessary.

"*Disadvantages*

(*a*) Difficulty of isolation or segregation for disease control;
(*b*) Danger of bullying unless the master cows are separately housed or dehorning is practised;
(*c*) Difficulty of controlling individual rationing; heavy yielding cows require more careful handling and individual attention than is possible under this system;
(*d*) Frequent moves during milking time may adversely affect the milk yield; and
(*e*) Unless ample straw is available the yards housing the cows become fouled." (Great Britain, Ministry of Works, 1945, p. 88)

Although horned cows have been milked in parlours it is really essential that all cows should be polled or dehorned before parlour milking is started. Horned cows are dangerous to one another in the yards and the horns may become entangled in the parlour fittings. The dehorning of calves of horned breeds should be standard practice whenever cattle are yarded.

There is no reason why cows should not be milked by hand in a milking parlour but this is rarely done. The parlour may be used with one machine unit to every two stalls or one unit to each individual stall. In this connexion it must be remembered that in those parlours where concentrates are fed—and this means in the majority of cases—the time each cow will spend in the parlour will largely be determined by the time taken to eat the food rather than the time taken to complete milking. Where the cows are fed a production ration based on milk yield (see below, page 109), the time in the parlour will be longest with very heavy milkers.

Milking parlours are arranged in a variety of ways and common examples are: (*a*) single-level abreast; (*b*) two-level abreast; (*c*) two-level chute; (*d*) two-level tandem; (*e*) two-level herring-bone; and (*f*) movable bail.

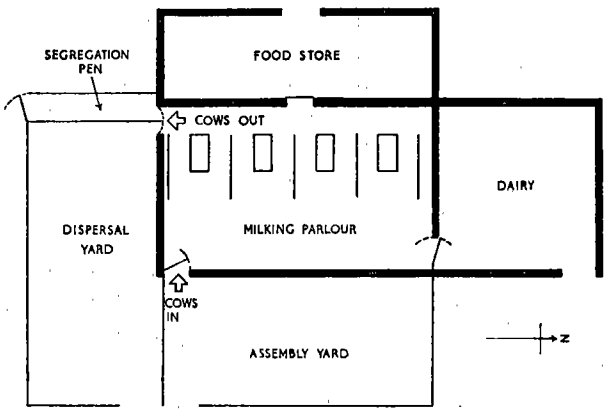
There are modifications of the standard types.

The selection of the milking parlour best suited to the individual requirements of a particular farm depends on a number of factors. Clough (1958) has considered the subject in some detail, and Clough & Dodd (1959) have considered the question of the measurement of performance in machine milking in parlours. They conclude that the factors that affect the performance of a milking installation are concerned with the cow, the number and organization of milking units and the milker's routine.

In all types of milking parlour, requirements similar to those for cowhouses are necessary as regards construction, lighting, ventilation, drainage and water supply. So far as *lighting* is concerned it is essential that particular attention be given to the placing of the lighting points, and fluorescent strip lighting has been found effective. 80-W " natural " or " warm white " fluorescent lamps with open top or translucent plastic reflectors should be used. In abreast-type parlours, one 60-W lamp per 150 square feet (16.5 m^2) of floor space will be satisfactory but one lamp per two stalls is advisable. For natural lighting, roof lights are probably the best; corrugated lighting sheets fixed over the operator's portion of the parlour will be found satisfactory. Where windows are placed in the side walls, care should be taken to fix these at such a height that the cows will not break them. In general, this means that they should be of the hopper type fitted immediately below the eaves. *Ventilation* should be provided in all milking parlours although it is of less importance than in a cowhouse where animals are housed as well as milked. A combination of hopper-type windows opening inwards together with roof ventilation, preferably at the ridge, will be satisfactory. The constant opening of doors for the entry and exit of cows automatically reduces the immediate ventilation requirements. *Drainage* in milking parlours is just as important as in cowhouses so as to avoid the ponding of liquid on the floor. This necessitates the floors having adequate falls to convey all liquid to the gullies, which should be placed outside the building, unless this is impracticable. Where outside trapped gullies cannot be fixed, one should be provided at a suitable point inside the parlour and the floor

should be laid with proper falls to it. The supply of suitable and sufficient *water* is most important. This is needed to swill down the walls and floor, for washing the cows, and for personal washing by the operators. A piped water supply is best, and there should be a tap for a hose-pipe suitably placed. It is an advantage (as shown later in Fig. 18, see page 111) for hot and cold water to be piped to each stall for udder-washing purposes. A proper wash-hand-basin, suitably placed in the parlour, will enable the operators to keep their hands clean throughout milking. All walls should be rendered smooth and impervious to a height of at least 4 feet 6 inches (1.3 m) and there are obvious advantages in rendering the whole of the walls so as to facilitate cleaning.

FIG. 10
TYPICAL LAYOUT OF MILKING PARLOUR AND ASSOCIATED BUILDINGS



It is essential to understand that in this system the " yard " is an indispensable part. To function efficiently, the milking parlour must be provided with proper collecting and dispersal yards. The essence of the system is so to arrange the yards, especially the collecting yard, in relation to the milking parlour, that the cows will themselves enter the parlour without the necessity of a worker having to go into the yard and drive the animals in. To do this needs careful planning and the provision of easily opening and self-closing doors or gates. In the case of a two-level tandem-type parlour, doors should be capable of being opened by the operators, closing by their own weight when released. This can be done by means of cords, the doors being hung at the appropriate angle. A typical layout of a milking parlour and associated buildings is shown in Fig. 10.

The collecting yard should be no larger in area than is necessary for the maximum number of cows to be acommodated at any one time for milking.

In general, and depending on the breed of cow, 15-20 square feet (1.4-1.8 m^2) per cow is adequate, and for a mixed herd 18 square feet (1.7 m^2) will be sufficient. By tightly packing the cows in the yard, they will pass into the parlour quickly and quietly without the need for anyone to drive them in. With large herds, it may be an advantage to have a movable electric wire across the yard which will assist the passage of the cows through the parlour as the wire is moved by the operator from the pit. The floor of the collecting yard should be made of an easily cleaned material, preferably concrete laid with good falls to drains. There is an increasing tendency for the collecting yard to be completely covered, and this has some advantages in that the cows keep dry in wet weather and are more comfortable when the weather is cold, avoiding changes in temperature which cause chills; the yard is also easier to keep clean. A water trough accessible to the cows should be provided.

The cows should disperse from the parlour to a suitable place which may take the form of a roadway, a concrete yard, or partially or completely covered yards. The practice of housing cows in cattle yards is increasing and this has many advantages, which have been summarized as follows:

(1) The animals tend to be healthier, more comfortable and cleaner, and it is easier to observe when cows are in season;
(2) the labour of tending the animals is much less;
(3) dung and urine are conserved more efficiently and in greater quantity in the form of well-trodden manure;
(4) no elaborate drainage system is necessary;
(5) yards are more adaptable to other uses;
(6) surplus straw is put to good use;
(7) the cost of building a yard may be cheaper than building a cowshed, especially if surrounding buildings make new walls unnecessary and only a roof and some fencing have to be provided;
(8) washing-down water is not required for the floor.

The drawbacks of this system are that the cows should be dehorned (which some farmers object to); " master " cows may be a nuisance even if dehorned; it is more difficult to give individual attention to cows where this is desired; and the yard can be used efficiently only if there is an adequate supply of straw available (England and Wales, Ministry of Agriculture, Fisheries and Food, 1954).

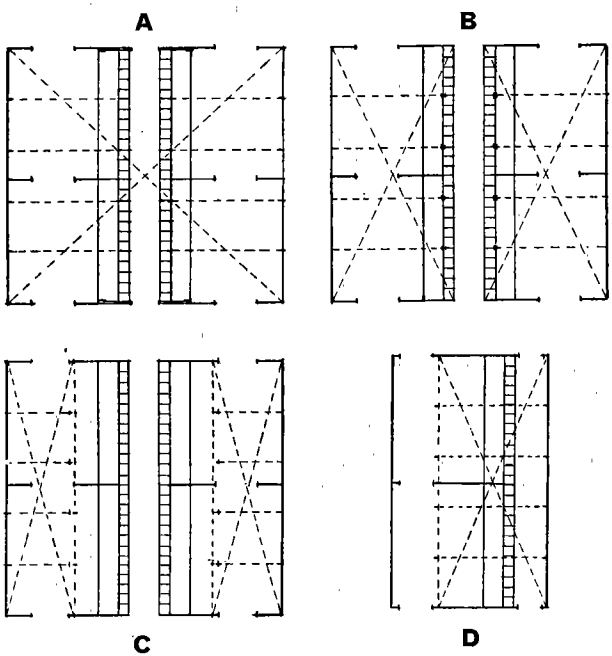
Straw is essential for the housing of cows in yards and although there is no precise information available on the amount required, it has been estimated that in winter about 12 pounds (5.5 kg) per cow per day are needed as against 7 pounds (3 kg) in a tie-up cowshed. The actual amount required varies widely in different districts, depending on climatic conditions and whether the yard is open, partially covered, or covered. More straw is needed where large quantities of silage and kale are consumed by the cows. Roughly twice as much straw is required per cow in a yard as in a cow shed.

A well-planned set of yards should satisfy the following basic requirements:

(1) sufficient space for all the animals to feed, lie down and move about comfortably;
(2) walls and/or fences and gates surrounding the yard should be high enough, in relation to the yard bottom, to contain the cattle and the manure, even when the level of the manure has risen three feet or more;
(3) adequate shelter for the animals;
(4) draught-free yards;
(5) efficient and labour-saving feeding arrangements;
(6) the fewest possible obstructions to the mechanized removal of manure;
(7) adequate lighting and ventilation;
(8) the provision of water-troughs or groups of drinking bowls;
(9) the aspect of the open parts of the yards (if any) to be as sunny as possible;
(10) no projecting uprights or corners against which animals can injure themselves;
(11) adequate drainage of concreted areas (England and Wales, Ministry of Agriculture, Fisheries and Food, 1954).

In the United Kingdom cattle yards are classified according to the extent to which they are covered (see Fig. 11).

FIG. 11
TYPES OF CATTLE YARD

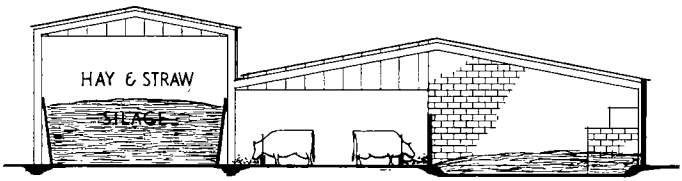


A = Fully covered
B = Mainly covered, with open feeding-passage
C = Partly covered, with open feeding-passage and mangers
D = Partly covered, with covered feeding-passage and mangers

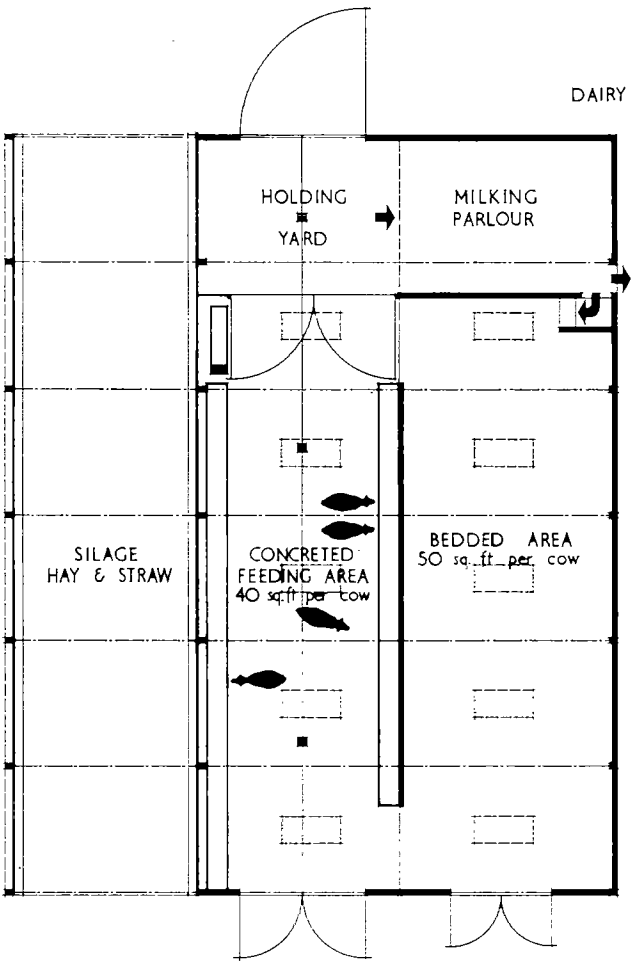
Diagonal lines denote extent of cover.

FIG. 12

TYPICAL LAYOUT FOR A YARD AND PARLOUR FOR 40 COWS WITH MANUAL FEEDING ARRANGEMENTS



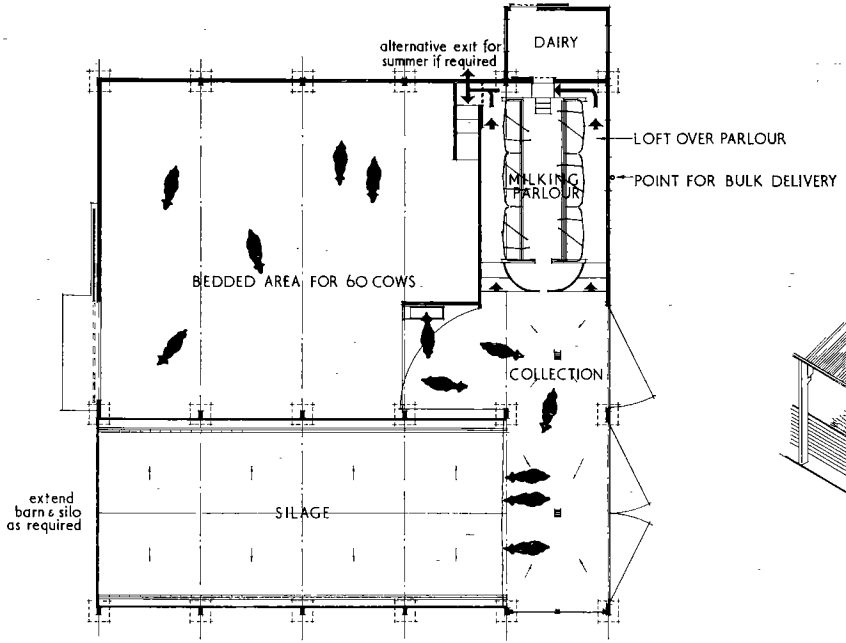
SECTION THROUGH SILAGE BARN AND COVERED YARD

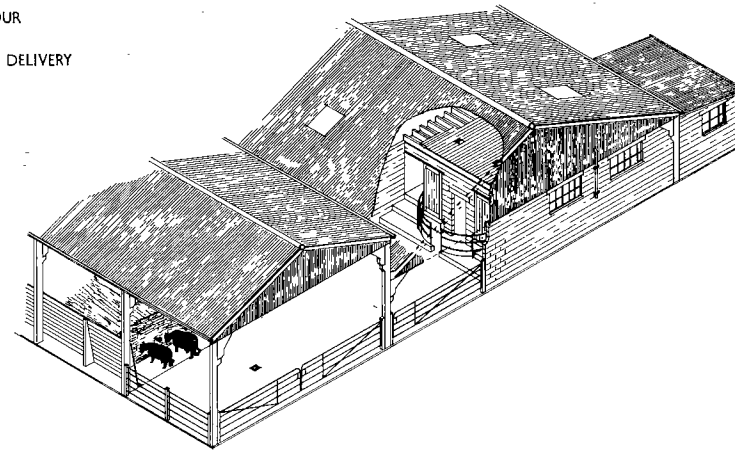


40 sq. ft. = 3.7 m²; 50 sq. ft. = 4.6 m²

FIG. 13

TYPICAL LAYOUT FOR YARD AND PARLOUR FOR 60 COWS WITH SELF- OR EASY-FEEDING ARRANGEMENTS





SKETCH SHEWING ENTRANCE TO PARLOUR

The following classification is adopted:

Types of yard

(1) fully covered;
(2) mainly covered, with open feeding passage;
(3) partly covered, with open feeding passage and open mangers;
(4) partly covered, with covered feeding passage and covered mangers; and
(5) mainly open.

The amount of space allowed per animal varies from about 15 square feet (1.4 m^2) for a calf to 80 square feet (7.4 m^2) for dehorned cows (150 square feet (14 m^2) for large horned animals).

The system of feeding cows in yards varies, but however this is done about 2 feet 6 inches (75 cm) of manger space per cow is needed. A typical layout for a yard and parlour for 40 cows with manual feeding arrangements is shown in Fig. 12. Fig. 13 shows a layout for a herd of 60 cows, including self-feeding arrangements.

Single Abreast Milking Parlour

In this type the cows stand side by side and operators and cows are on the same level.

Fig. 14 shows typical single-level abreast parlours. Alternative arrangements with direct-to-can milking are shown in Fig. 15. The essential dimensions in milking parlours of this type are as follows:

Outlet passage	3 feet 3 inches (1 m) wide
Stalls	7-8 feet (2.1-2.4 m) long
Space behind cows . . .	7 feet 6 inches to 8 feet (2.3-2.4 m)

The floor should have a good fall to the rear wall, where the drainage may be taken by a half-round channel to a suitable trapped gully outside the building. It is essential that the fall should be carefully determined so that the whole of the floor drains towards the drainage channel, otherwise much unnecessary brushing will be required.

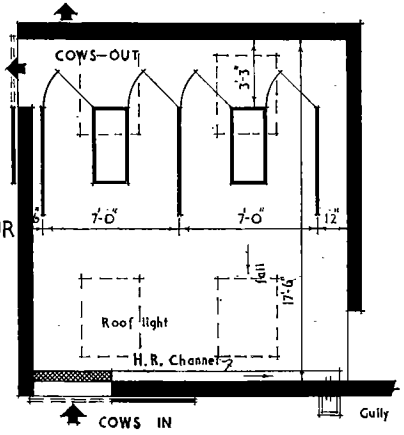
Two-Level Abreast Parlour

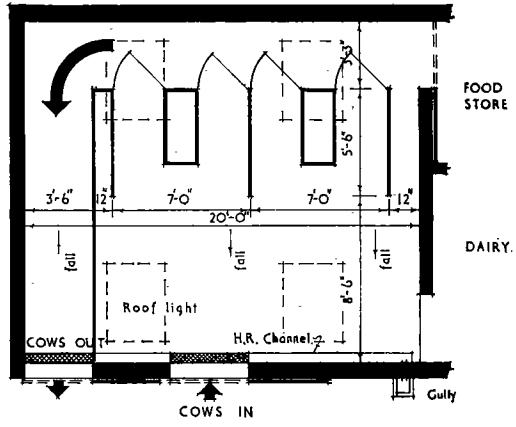
In this type, which is similar to the single-level abreast type, the standings in the stalls are raised above the level of the floor in order that the workers will not have to bend down so much as in the single-level type. The step should not exceed 16 inches (40 cm), otherwise there may be danger of damage to the teats of the cows as they mount the platform, and usually the steps are about 14 inches (35 cm) high. In some cases, attempts have been made to raise the standing even higher by the use of two steps, but this is not a desirable practice as the steps project out into the working space behind the cows and are dangerous to the cows and a nuisance to the workers. Fig. 16 gives details of this type of parlour with one step.

FIG. 14

MILKING PARLOUR: SINGLE-LEVEL ABREAST TYPE

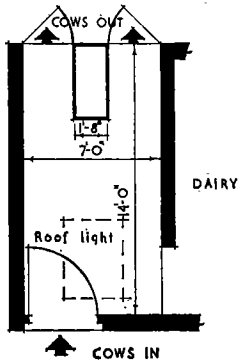
TWO POINT-FOUR STALL RELEASER OR IN-CHURN RECORDER OR FOUR POINT FOUR STALL RELEASER

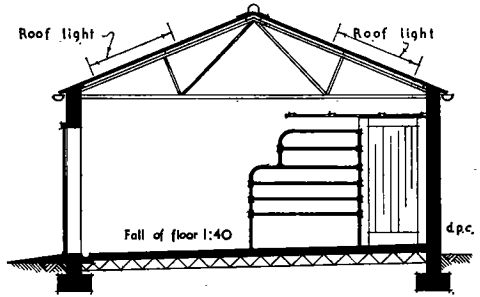




ALTERNATIVE EXIT ARRANGEMENT

ONE POINT-TWO STALL RELEASER OR IN-CHURN RECORDER OR TWO STALL TWO-POINT RELEASER





TYPICAL CROSS SECTION

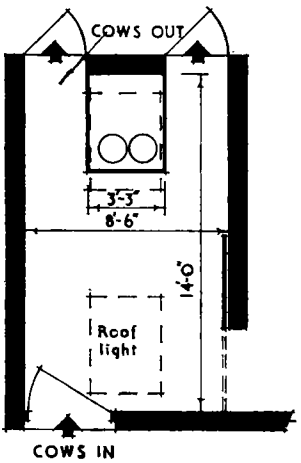
H.R. Channel = half-round

D.P.C. = damp-proof course

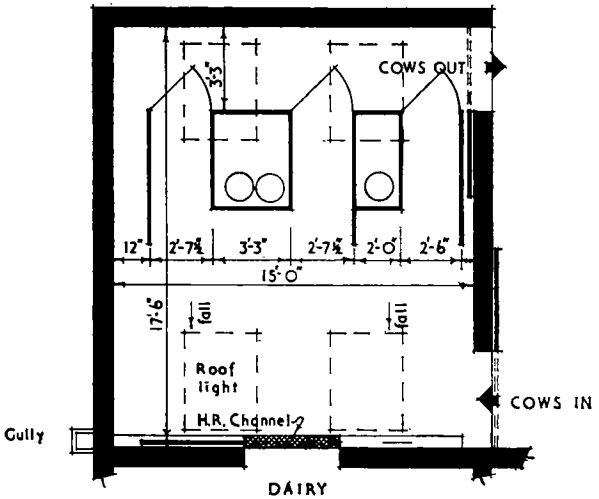
1 foot = 30.5 cm

FIG. 15

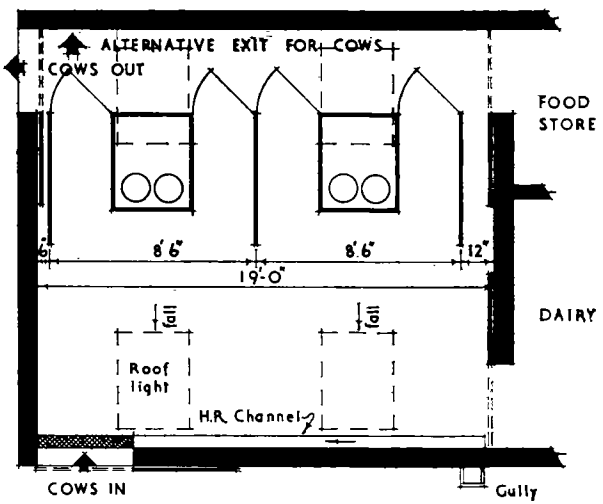
MILKING PARLOUR: SINGLE-LEVEL ABREAST TYPE, DOUBLE IN-CHURN



TWO POINT-TWO STALL



THREE POINT-THREE STALL

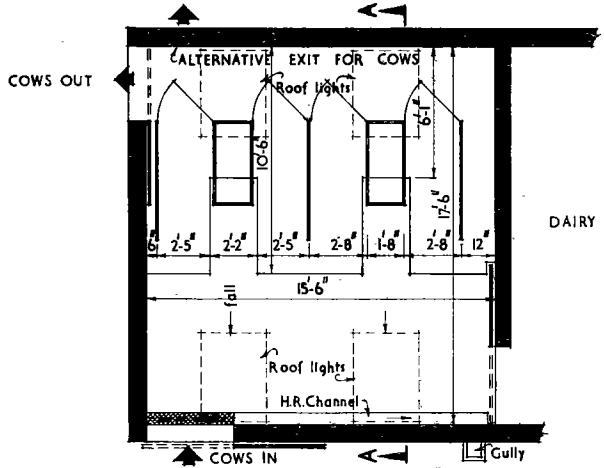


FOUR POINT-FOUR STALL

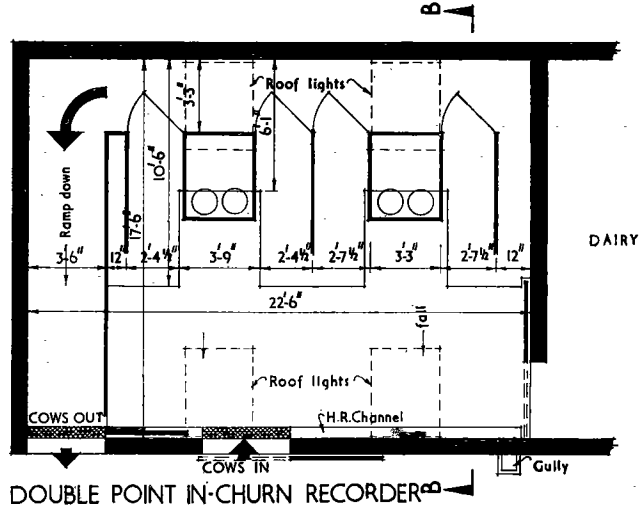
H.R. Channel = half-round 1 inch = 2.5 cm; 1 foot = 30.5 cm

FIG. 16

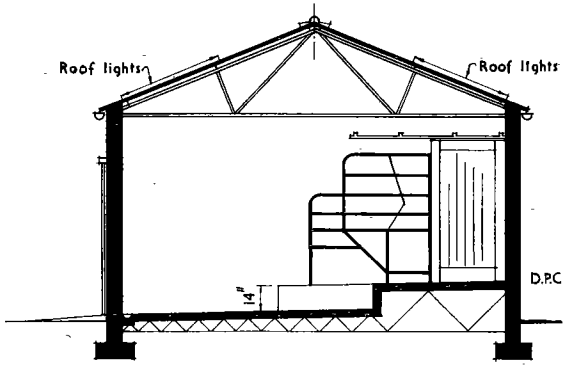
MILKING PARLOURS: TWO-LEVEL ABREAST TYPE



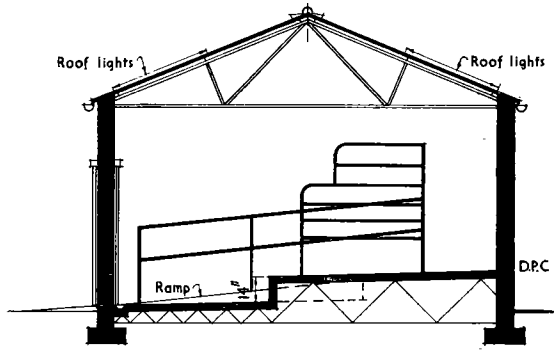
RELEASER OR IN-CHURN RECORDER



DOUBLE POINT IN-CHURN RECORDER



SECTION A-A



SECTION B-B

H.R. Channel = half-round D.P.C. = damp-proof course 1 inch = 2.5 cm; 1 foot = 30.5 cm

Two-Level Chute Parlour

In this type of parlour the cows stand in line on each side of a pit, usually at a height of 2 feet 6 inches (75 cm) above the floor of the pit; this enables the operator to work in an upright position and avoid all bending. The number of stalls varies from two to four on each side, rarely exceeding four. The cows are let in in batches, each side being operated as a single unit, all the cows being let in on one side together and similarly released in a single operation. This constitutes a disadvantage in that the speed of the slowest cow is the speed of all the cows on one side of the parlour. Fig. 17 shows a parlour of this type.

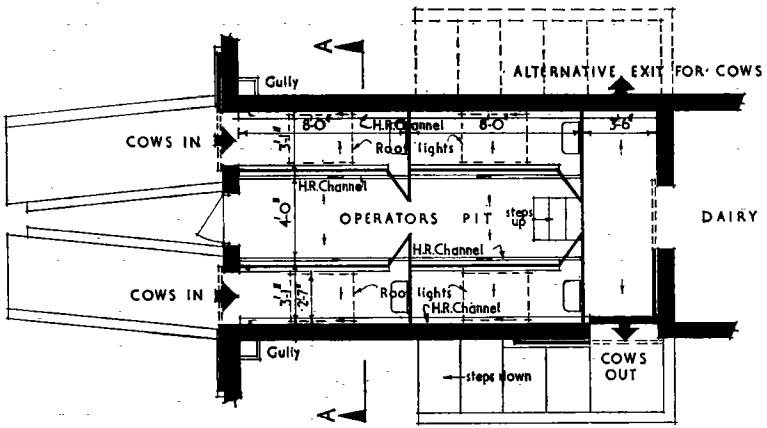
Tandem Parlour

This is similar to the chute parlour, but a passage is provided to give independent access to each stall for entrance and exit of the cows; the parlour may be constructed so as to have the cows on one or both sides of the operator's pit, or the stalls may be arranged in an L shape. This type of parlour consists essentially of three parts: (*a*) milking stalls for cows; (*b*) passage for cows to enter and leave the stalls; and (*c*) operator's working pit. The stalls and passage should not be less than 2 feet 9 inches (85 cm) wide, and with the larger breeds 3 feet (90 cm) wide. The operator's pit should be 4-5 feet (1.2-1.5 m) wide; if it greatly exceeds this distance the workers will have more walking about to do than is necessary. The milking stalls are usually in pairs, one milking machine unit being used for each pair of opposite stalls, so that while one cow is being milked the cow in the other stall is being brought in, washed and given its food, so as to be ready for the machine when the first cow is milked. In some cases, however, there may be one unit for each stall. This depends on whether or not the cows are being fed concentrates in the parlour and on the management of the herd. The whole object is to milk quickly and efficiently with the minimum of time and effort on the part of the operator. Fig. 18 shows details of a four-stall tandem parlour and shows the arrangement of gates for admitting and releasing cows from stalls. Fig. 19 shows a U-shaped tandem parlour with cows on three sides of the pit, which is usually about 7 feet 6 inches (2.3 m) wide, and a double-row tandem parlour. Fig. 20 shows a three-stall single row tandem parlour.

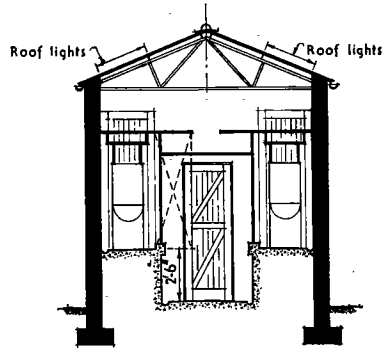
The construction of the tandem-type parlour requires special care. The stalls should have sufficient fall from the edge of the pit to the outer walls to enable all liquid to drain away to a suitable outlet. In some cases the actual cow standings are raised 3-4 inches (7-10 cm) above the floor level but this is not really necessary; it increases the cost of construction.

FIG. 17

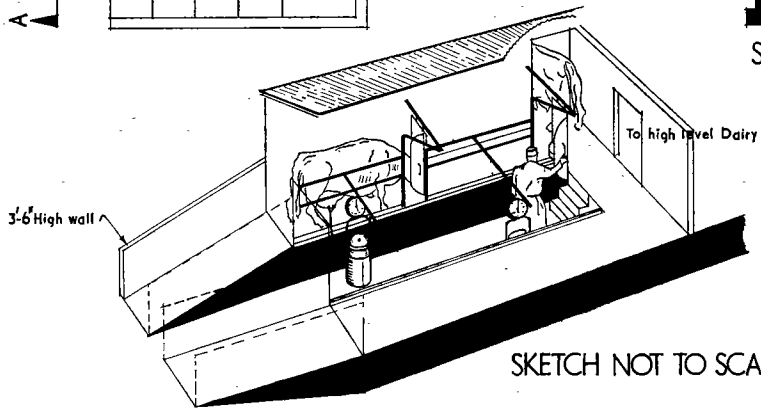
MILKING PARLOUR: FOUR-STALL TWO-LEVEL TWO-UNIT CHUTE TYPE



PLAN



SECTION A-A



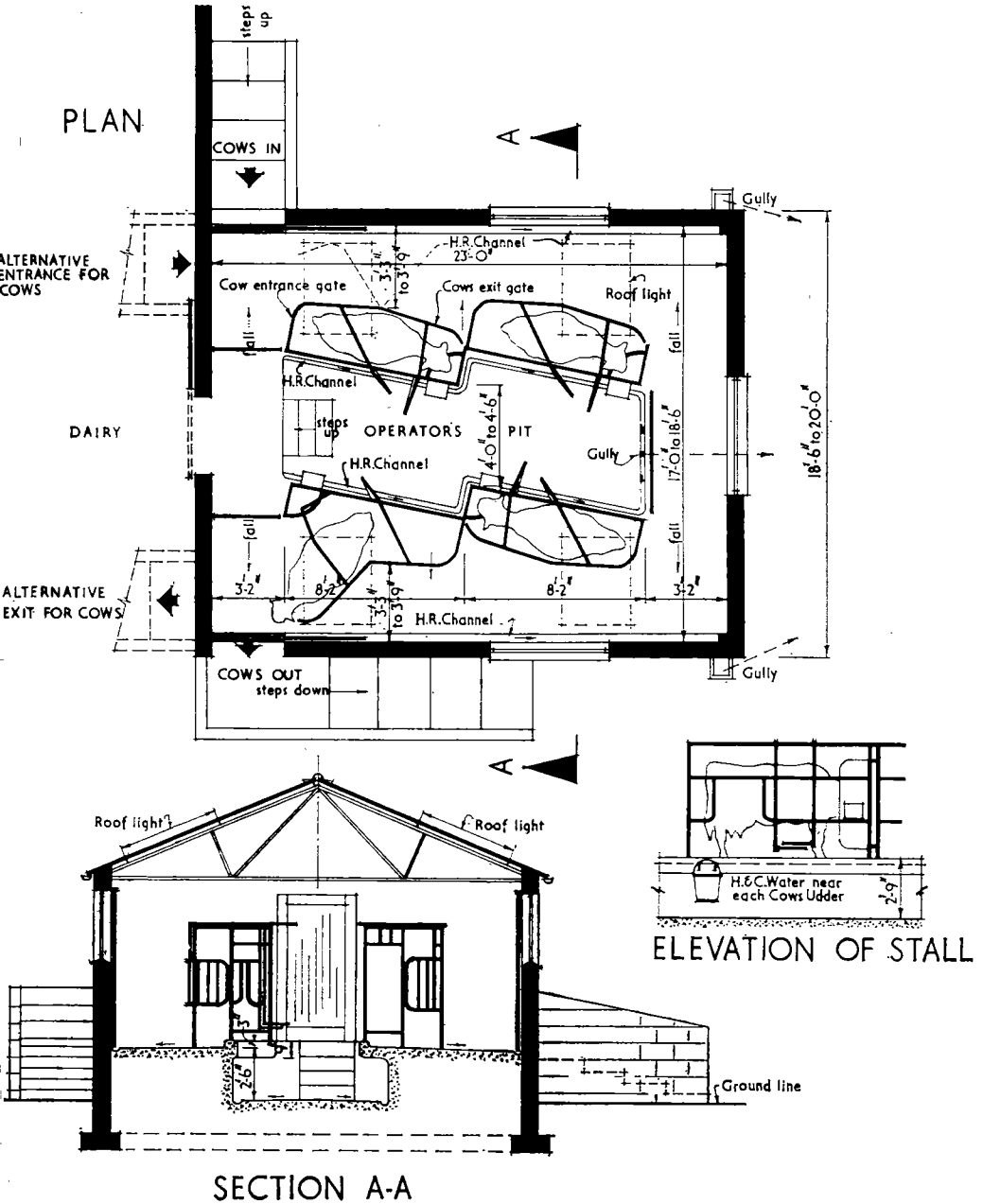
SKETCH NOT TO SCALE

H.R. Channel = half-round

1 inch = 2.5 cm; 1 foot = 30.5 cm

FIG. 18

MILKING PARLOUR: FOUR-STALL TANDEM TYPE



H.R. Channel = half-round

1 inch = 2.5 cm; 1 foot = 30.5 cm

FIG. 19

MILKING PARLOUR: TWO-LEVEL U-TYPE AND DOUBLE-ROW TANDEM

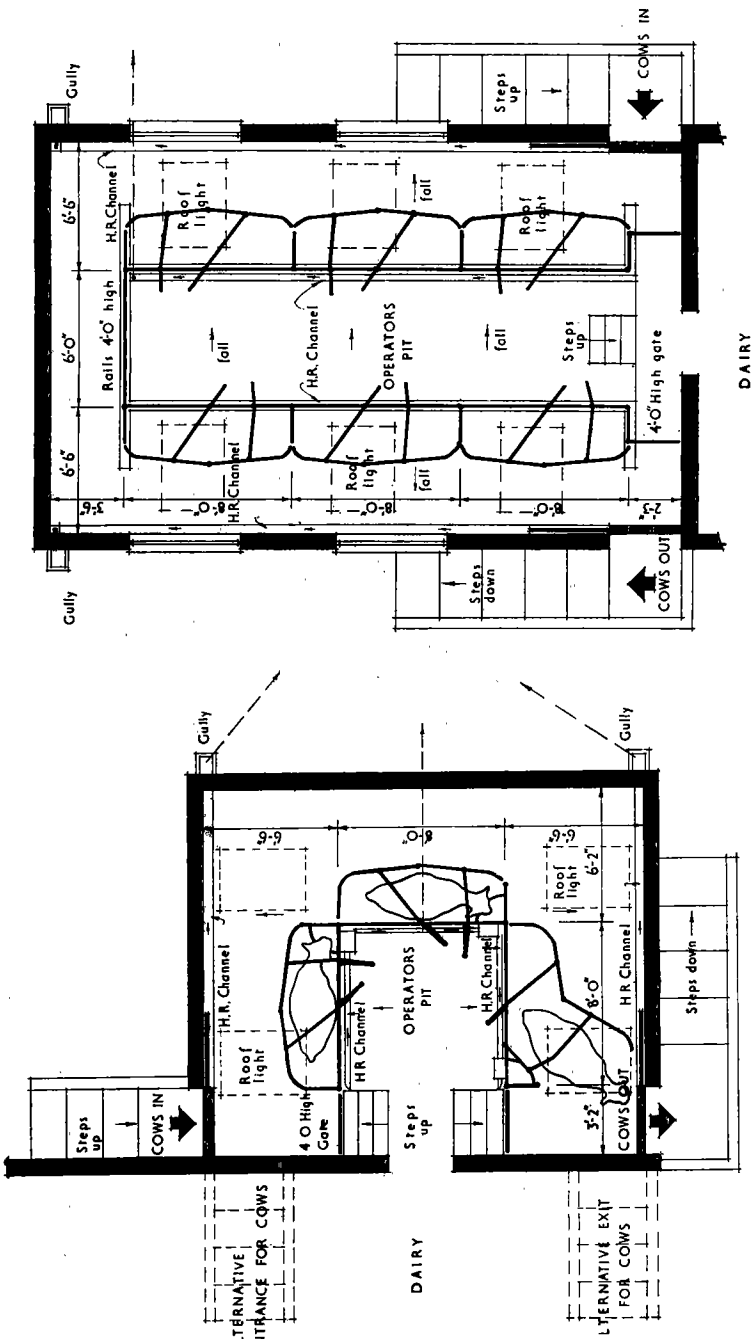
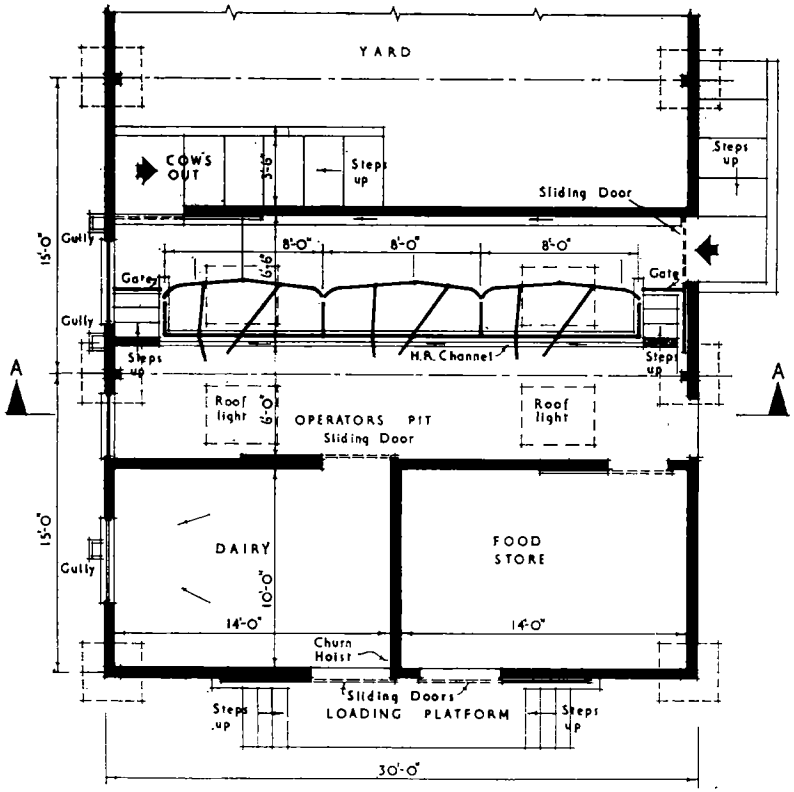
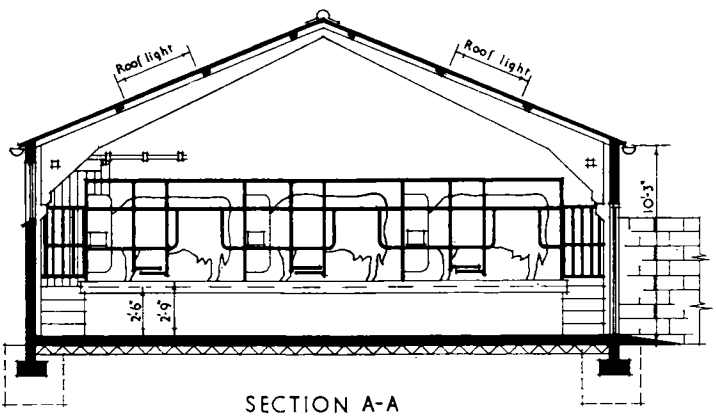


FIG. 20

MILKING PARLOUR: SINGLE-ROW TANDEM



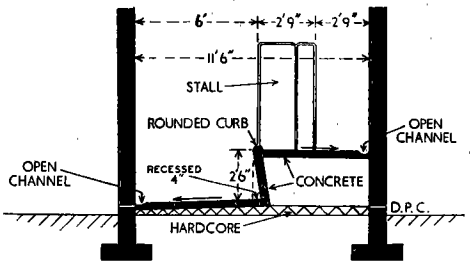
PLAN



SECTION A-A

1 foot = 30.5 cm

FIG. 21
SECTION OF TYPICAL TANDEM MILKING PARLOUR



D.P.C. = damp-proof course
1 inch = 2.5 cm; 1 foot = 30.5 cm

An open channel around the outside walls assists drainage. The walls forming the pit should be recessed inwards about 4 inches (10 cm) to enable the operators to stand comfortably, as shown in Fig. 21, which shows a section of a typical tandem milking parlour. All the concrete work should be carefully carried out and all wall surfaces brought to a smooth finish with a steel float. The pit requires to be provided with proper drainage facilities and this is best done by means of a properly trapped gully at the lowest point in the pit, connected to the drainage system. Alternatively, an open-ended 4-inch (10-cm) diameter pipe may run from the pit to a point outside the building to discharge over a trapped drain inlet.

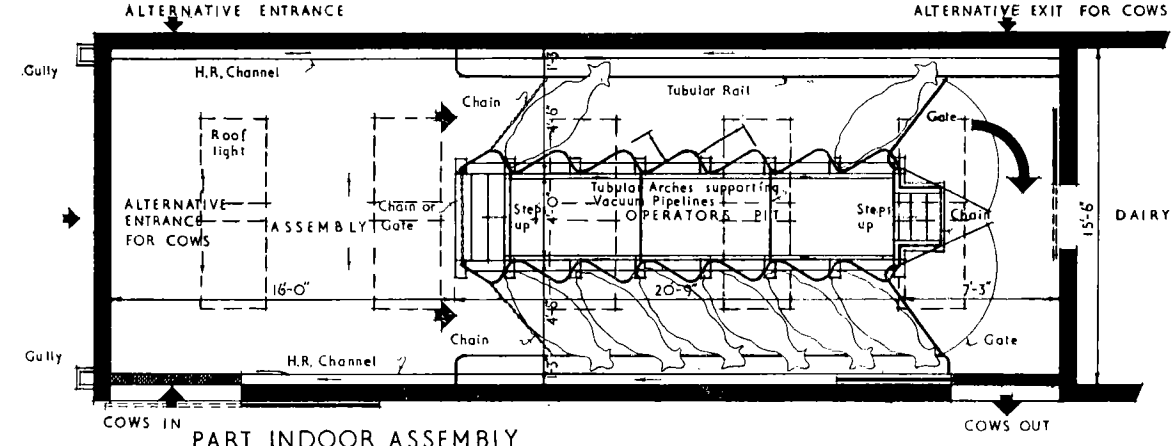
Herring-Bone Parlour

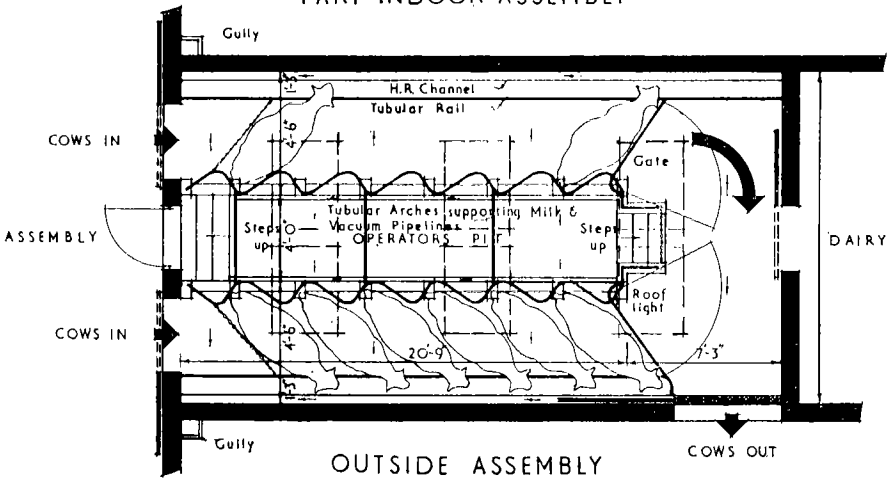
A recent development in milking parlour design is the herring-bone parlour, details of which are shown in Fig. 22. This type has evolved from the chute-type parlour (see above, page 109). It consists of a pit with rows of cows on each side, standing at an angle so that the maximum number of cows can be accommodated in the smallest space. As with the chute type, all the cows are let in to one side at a time and the speed of the slowest cow determines when all the cows are released after milking. In this system, it is usual to milk by pipeline so that the milk is conveyed to the milk-room; the system works well with a bulk milk tank which incorporates refrigerated cooling (see chapter by MacWalter, page 249). The operator, having let in cows to one side of the parlour, prepares each cow for milking, puts on the machines and after completing the row, lets in cows to the other side and prepares these cows, by which time the milking of the first row of cows will be completed or nearly so, and the machines are transferred from one side to the other. Originally, no feeding was done in a herring-bone parlour, but experiments are taking place to develop suitable food hoppers to enable concentrates to be fed as in other types of parlour. Owing to the close standing of the cows it is particularly important that the lighting of the parlour should be adequate, and this involves care in the placing of artificial lighting points.

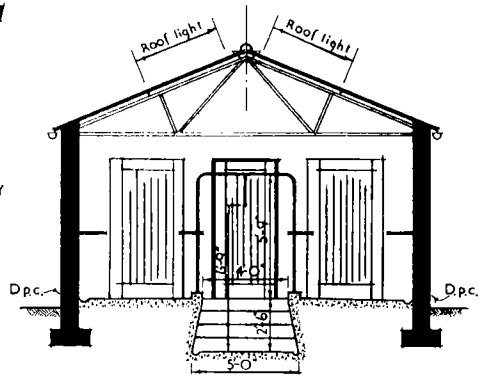
Movable Bail

The types of milking parlour referred to in the previous paragraphs, although different in type, are all fixed permanent buildings. The system

MILKING PARLOUR: HERRING-BONE SIX POINT-TWELVE STALL







H.R. Channel = half-round D. P C. = damp-proof course 1 inch = 2.5 cm; 1 foot = 30.5 cm

of outdoor milking has been practised in temperate climates for many years, and in essence consists of a portable milking parlour on wheels or skids which is moved round the fields to the cows instead of the cows being brought from the pastures to the farmstead. Where the soil and climate are suitable this arrangement may have distinct advantages. For example, if the pastures are some distance from the farm buildings, or if the farm is large and many fields are used to graze the cows, much time may be taken up in moving the cows twice daily to a fixed milking parlour or cowhouse. In addition, the labour of cleaning out cowhouses, the disposal of liquid waste from parlours and the cleaning of cattle yards are also avoided if the cows remain on their pastures all the time. On the other hand, however, it is essential that the land should be free-draining so that it does not become fouled, as the cows will stand on the ground when milked and not on an impervious and properly drained surface. It is also imperative that the bail be moved at regular intervals, daily if necessary, whenever the site becomes soiled. There is an added drawback with a portable bail in that the milk has to be moved to the farm dairy, although in some instances there is also a portable dairy attached to the bail. The problem of supplying the bail with a sufficient and suitable water supply also arises. It will be seen, therefore, that the use of a portable bail is restricted to suitable and carefully selected sites, and that considerable difficulties are likely to arise if the conditions are not suitable for this type of milking. To overcome some of the difficulties referred to, portable bails have been placed on permanent concreted sites, to which a proper water supply has been laid and drainage facilities provided. In such circumstances, there is really very little difference in principle from the abreast milking parlour previously described (see above, page 105).

FARM DAIRIES

The main functions of the farm dairy are:

1. To provide suitable accommodation for cooling and storing milk after milking and until it leaves the farm.

2. To provide accommodation for cleaning farm dairy equipment and utensils, and their storage between milkings, and for the storage of empty milk cans.

3. To accommodate, in properly constructed cupboards or other suitable containers, spare milking machines, parts, etc.

The farm dairy should not be used for any purposes other than milk handling and the cleansing and storage of equipment. It should not be used as a general store for all the odds and ends which tend to accumulate on a farm.

Siting

The siting of the dairy is important. It should be adjacent to the place where the cows are milked but should not have direct entry thereto if the cows are also housed in the milking house. If the cows are not housed in that building there is no objection to direct entry from it. Thus, in the case of a cowhouse in which cows are housed as well as milked there should be an intervening lobby between the cowhouse and the dairy to prevent direct access, but in the case of a milking parlour where cows are not housed, direct entry is permissible and indeed desirable from the management aspect. The dairy should not be sited near possible sources of contamination, such as dung heaps, stagnant ponds, untrapped drains, rubbish dumps, etc., all of which may give rise to dust or strong smells and enable fly breeding to occur. As with the cowhouse or milking parlour, there should be a suitable approach, preferably of concrete or some other easily cleaned material, laid with falls to ensure proper drainage. It is desirable that the dairy should be so sited that there will be ready access to the farm road so that the milk in cans may easily be removed from the farm. In this connexion, if the contour of the ground permits, a loading platform should be formed on to which the cans may be rolled without lifting from the dairy floor. The platform, on which milk in cans awaits collection from the farm, should be protected from the direct rays of the sun so as to avoid heating the milk while awaiting collection. If this cannot be done, the full cans should remain in the dairy until collection.

Layout

The dairy may consist of one or more compartments as follows:

(*a*) milk-room in which milk is strained, cooled, bottled and stored;

(*b*) wash-room in which dairy equipment and utensils, including bottles, are cleansed;

(*c*) where required, a room for making milk products such as butter, cream or cheese; and

(*d*) where necessary, a boilerhouse and fuel store.

On the majority of milk-selling farms the dairy consists of a single compartment where all processes are carried out. Where, however, the volume of milk handled is considerable, or where the milk is bottled for retail sale, it is desirable to divide the dairy into two compartments, so that the washing and sterilizing of equipment can be done apart from the handling, bottling and storage of the milk.

Size

The size of the dairy will depend on the amount of milk handled, the equipment accommodated, and whether milk is bottled for retail sale.

The space required for the standard items of equipment is shown in Table 2.

TABLE 2

SPACE REQUIRED FOR STANDARD ITEMS OF FARM DAIRY EQUIPMENT *

Type of unit	Floor space required	
	square feet	m^2
Surface cooler on wall brackets	6	0.6
Surface cooler on tripod	8	0.7
Steps up to milk-receiving pan	8	0.7
Storage for churns (each)	2	0.2
Bottling machine	6	0.6
Storage for bottles (per crate deep)	2	0.2
Churn-immersion-type cooler (4 churns)	15	1.4
Refrigerating unit for use with surface cooler	15	1.4
Each door opening inwards (90°)	9	0.8
Washing trough	6	0.6
Table	8	0.7
Small sterilizing chest (with door open)	20	1.9
Large sterilizing chest (with door open)	30	2.8
Steaming stool for churns	2	0.2
Bottle washer (approx.)	9	0.8
Washing machine for teat-cup clusters	15	1.4
Combined wash-trough and sterilizer	14	1.3

* Based on data from England and Wales, Ministry of Agriculture, Fisheries and Food (1953).

Convenient minimum dimensions for the various compartments of the milk-room are given in Table 3.

TABLE 3

MINIMUM DIMENSIONS FOR COMPARTMENTS OF MILK-ROOM ON FARM DAIRIES *

Size of herd	Milk-room				Washing and sterilizing room				Boilerhouse	
	Wholesale only		Producer-retailer		Wholesale only		Producer-retailer			
	square feet	m^2	square feet	m^2	square feet	m^2	square feet	m^2	square feet	m^2
Less than 20 cows	60	5.5	80	7.5	60	5.5	100	11	30	2.8
20-40 cows	80	7.5	100	9.3	80	7.5	150	14	40	3.7
Over 40 cows	100	9.3	120	11	120	11	200	18.5	50	4.6

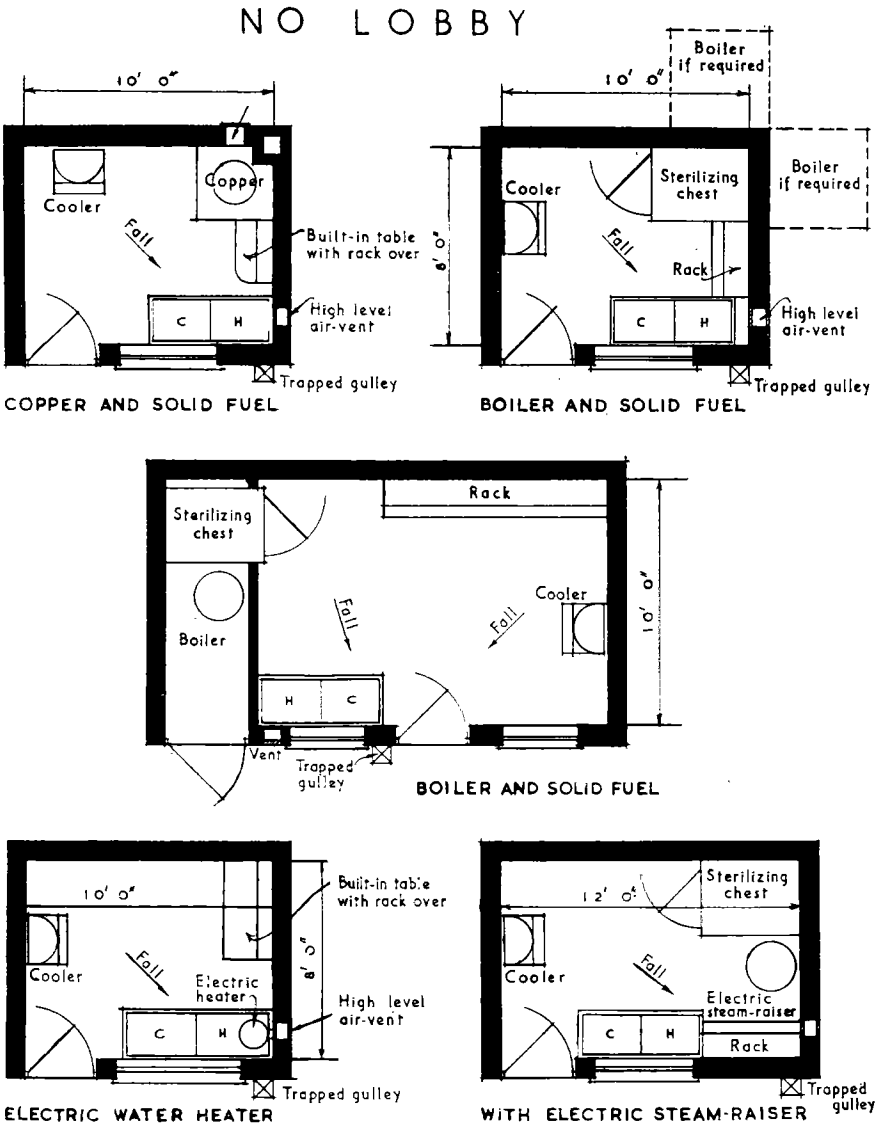
* Based on data from Great Britain, Ministry of Works (1945) (page 95).

Where solid fuel is used a boilerhouse is essential; it should be separate from the milk-room proper, and should be entered from the outside and not directly from the milk-room.

It is most important that the size of the dairy should be adequate; it is better to err on the large side rather than restrict the working space so that the operations in the dairy cannot be carried out properly and conveniently.

FIG. 23

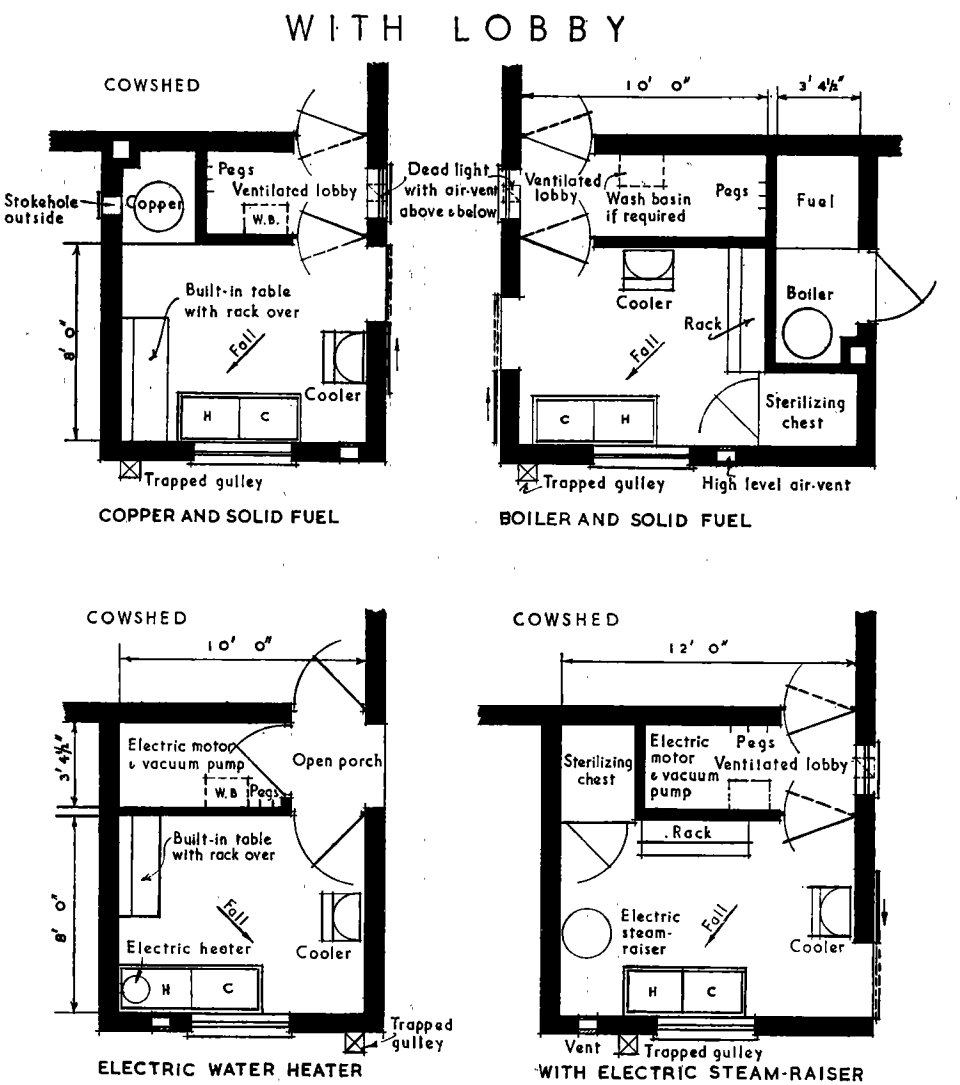
VARIOUS TYPES OF DAIRY (UP TO TEN COWS)



1 foot = 30.5 cm

FIG. 23

VARIOUS TYPES OF DAIRY (UP TO TEN COWS) (*continued*)



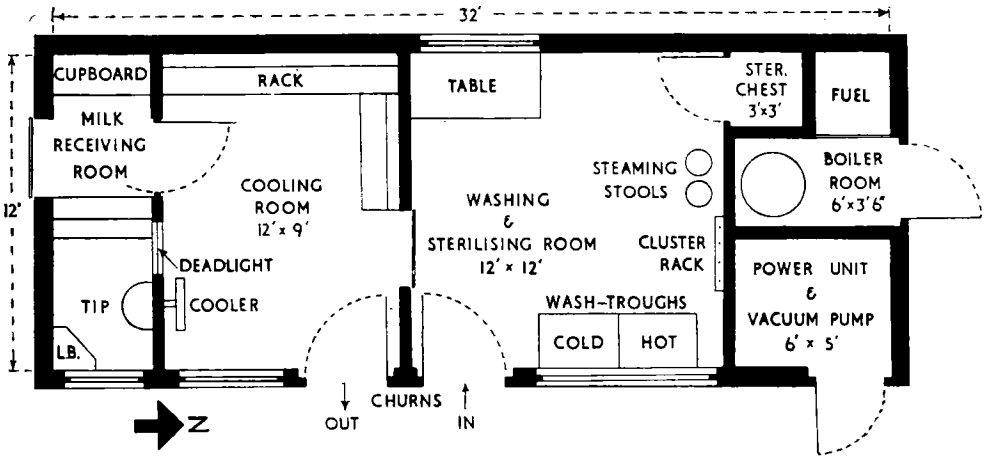
NOTE : DAIRY WINDOW TO BE ON NORTH OR EAST SIDE

1 foot = 30.5 cm

Fig. 23 shows various types of single-compartment dairy, without a lobby, with various types of water heating, and four layouts of dairies with lobby for use with cowhouses. Fig. 24 shows the layout of a dairy using a solid fuel boiler and steam for a large herd with the cowhouse system, and Fig. 25 gives the layout of a dairy for a larger herd with the parlour system, where electricity is available for water heating and sterilization.

FIG. 24

DAIRY FOR A LARGE HERD: COWHOUSE SYSTEM (ELECTRIC POWER NOT AVAILABLE)



L.B. = lavatory basin 1 foot = 30.5 cm

Water supply

In practice a piped supply of suitable water is essential in every farm dairy. It must be suitable in quality and sufficient in quantity. (As to water supply generally on dairy farms see the chapter by Clark, page 143.) It is sufficient here to say that the quality of the water used in the dairy must be such that there is no risk of the milk being contaminated or infected, and that whenever there is any doubt about the quality of the water available on a farm it should be treated with sodium hypochlorite or other suitable chemical agent. The water supply must be sufficient in quantity to enable all necessary cleaning processes to be carried out efficiently; but where there is a shortage of water, that used for cooling milk may be conserved and used again for swilling down the buildings or for drinking by cattle.

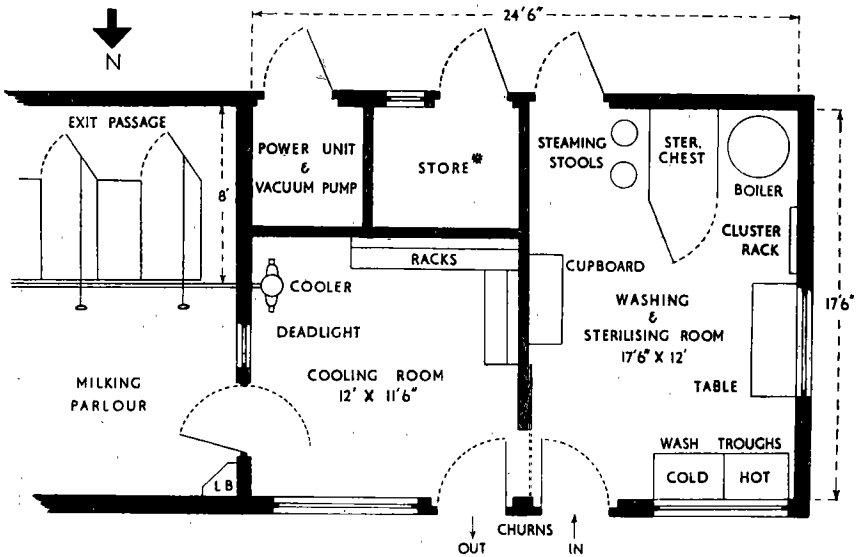
Construction

The internal surfaces of the farm dairy should be of impervious material, soundly constructed, and readily capable of being maintained in a thoroughly clean condition. The *floor* should be of impervious material, and although

FIG. 25

DAIRY FOR A LARGE HERD: MILKING PARLOUR SYSTEM

Electric power available, but * indicates possible position of boiler room if electric power not available.



L.B. = lavatory basin

concrete is frequently used this is not always the best material because it is subject to considerable wear through the rolling of full milk cans. To obviate this, perforated cast iron gratings may be set in the concrete where the traffic is heaviest. Alternatively, a floor of metal plates or of granolithic concrete will be found satisfactory. The floor should have a good fall to the drain inlet, which in the case of farm dairies is best placed outside the building. Whether inside or outside the dairy the drain should be properly trapped. The *walls* should be of impervious material, at least to a height of 4 feet 6 inches (1.3 m) and preferably to the full height, and steel-floated cement or glazed tiles or bricks will be found suitable. All angles should be coved to prevent the accumulation of dust and dirt. Where the walls above 4 feet 6 inches (1.3 m) are not cement rendered or tiled, they may be painted with a suitable durable waterproof paint; lime-wash and distemper are unsuitable because of their tendency to flake. Window ledges, etc., should be sloped to avoid the accumulation of dust. A smooth *ceiling* is best, and with a pitched roof the ceiling may be plastered or underdrawn so as to provide a good surface.

Lighting is as important in the dairy as in the milking house, and the artificial lighting should be of an intensity of 10 lumens per square foot (approximately 100 lumens per m^2). Natural lighting is best provided by a north light if this is possible. The amount of window area should not be

less than one-tenth of the floor area. Hopper-type windows, the upper portion made to open inwards, are suitable. The *ventilation* of the dairy is important so as to maintain the air in it in a fresh condition at all times. The hopper-type windows previously mentioned will assist ventilation, which should be supplemented by means of properly positioned air inlets in the form of air bricks or gratings.

ACKNOWLEDGEMENTS

The author is indebted to the Ministry of Agriculture, Fisheries and Food of England and Wales for permission to write this chapter, and to his colleagues in the Ministry—in the Milk Service and the Agricultural Land Service—for help and assistance in its preparation.

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