

Thesis for M. D.

SANITATION IN DAIRY FARMS IN RELATION TO

DISEASES ATTRIBUTABLE TO COW'S MILK.

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by

*Alexander Bryce M. B., C. M. 1886.
(D. P. H. (Camb.). 1890.*

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The greater part of this paper is entirely original
Some portions of it I have already published in
the "Sanitary Journal" that is the raison d'être
of the diagrams on pages 27 - 33 - 37^a.

The introduction to the paper is the result of wide
reading of books, chiefly on Public Health,
specially

Parke's Manual of Practical Hygiene.

G. Wilson's. Handbook of Hygiene

Louis Parker's Hygiene & Public Health.

Haukly's Milk Analysis

C. Fox's Sanitary Examination of Air, Water & Food.

The British Medical Journal, Lancet, & Practitioner, &c.

There are no actual quotations.

The paper was paraphrased and spaced by myself -
the type writing being done under my supervision.

The subject is one not specially treated in my books
which have come under my observation and
with the hope that it may be productive of some
practical benefit, I present it as the thesis
for my M. D.

privileges of acting under the Sanitary Director of the

SANITATION IN DAIRY FARMS IN RELATION TO

Dairy Diseases ATTRIBUTABLE TO COW'S MILK.

-----ooOoo-----

Much progress has, of late years, been made both in the laws affecting Dairy Farms, and in the buildings, water supply and drainage connected with Dairy Farms. It is my intention in this thesis to pass in review many important points of practical sanitary interest both with regard to the legal administration and the building construction of the Dairy Farm with a view to a more healthy milk-production and milk-distribution. I hope to point out defects in both and methods by which they may easily be remedied. For several years back I have devoted a considerable amount of attention to this subject both from a practical and theoretical point of view and for several months I had the

privilege of acting under the Sanitary Director of the Dairy Supply Association (Limited) London, my whole time being occupied in the Sanitary examination of Dairy Farms. Since that time I have acted as Medical Officer of Health for a very large country district and have had many opportunities of consolidating my views upon the subject.

In order duly to appreciate the practical points mentioned in the consideration of the subject, let us first glance briefly at the diseases supposed to be spread by the use of cow's milk, at the same time inquiring into their origin and the methods whereby they are communicated to man. Within the last few years the subject has received a great deal of attention and the literature on the subject is very copious. Whilst I cannot pretend that any of my remarks on this particular point are original, still I have

consulted so many works on **the subject** that I hope to give in a tabular form a fairly complete resume of the whole subject.

The following are the chief reasons given for the great capacity of milk for engendering and spreading diseases.-

- 1.- Being derived from a living animal, milk must always to a great extent be a reflection of the cow's state of health, ^{e.g.} ~~and~~ the milk of over-driven cows - or cows suffering from dropsy, produces diarrhoea.
- 2.- For a certain time milk is derived from an animal in the puerperal ~~puerperal~~ condition, consequent on parturition, a condition in which we know the animal is very liable to inflammatory diseases, and certain forms of contagious disease. e.g. In milk fever the milk may produce ^{severe} ~~severe~~ diarrhoea, although, fortunately, it is often suppressed.

3.- Milk is liable to certain fermentative changes after exposure to air, which may cause dangerous symptoms in the consumer.

e.g. The lactic acid bacillus and the ~~clostridium butyricum~~ *clostridium butyricum* ~~pidum dutysium~~ are both prone to affect milk, causing lactic acid and ~~butyric~~ ^{butyric} acid fermentation respectively and ~~forming~~ ^{producing} sickness and diarrhoea.

4.- Milk has a remarkable power of absorbing vapours and gases, organic and inorganic.

e.g. ~~Seaw~~ ^{Seaw} and other gases have been known to be absorbed with disastrous ~~with~~ ^{results}.

5.- Milk being a perfect food forms a most suitable medium for low forms of life, fungoid and

1. ENTERIC FEVER.

e.g. Like all other food it is apt to be tainted with the ~~excretions~~ ^{excre}, and ~~secretions~~ ^{secre} of man and other animals ~~is~~ ⁱⁿ a state of disease. The ~~excretions~~ ^{re} from the intestinal canal ~~is~~ ⁱⁿ enteric fever, the dispersed dust of the skin after scarlet fever, the ~~excretion~~ ^{re} of the throat

(a) The washing of the milk cans with water polluted

in diphtheria, discharges from cattle suffering,

- (b) from foot and mouth disease or garget, and from the nasal cavities of horses affected with glanders, are one and all liable to obtain access to milk and once there are not the least likely to be rendered inert, but all the more powerful in ^{air} this infecting capacity.

It would be easy to speak at length in connection with

each of the above headings, but it is quite sufficient for my purpose to mention them and hasten to give an equally brief description of the diseases known to be caused by the consumption of cow's milk.

1. ENTERIC FEVER.

Close upon 100 epidemics of enteric fever have been traced to an infective quality in the milk supply. The means whereby the milk is thus rendered infective may be shortly classified as follows:-

- (a) The washing of the milk cans with water polluted

by typhoid dejecta.

(b) The intentional dilution of the milk with water
polluted by typhoid dejecta.

(c) Storage of milk in rooms, the air of which was
polluted with drains or sewer emanations, con-
taining the typhoid bacillus.

2. (d) The cow itself being attacked with typhoid -
the specific germ is secreted with the milk.

2. (e) Through careless milking the milk being polluted
by the ⁿalv~~iv~~ic discharges of a cow with enteric
fever.

These last two causes are quite possible, but although
the evidence in their favour is daily increasing have not yet
been absolutely demonstrated.

11. SCARLET FEVER.

In this disease, the milk has usually been found to

have derived its infectivity from a previous case of the

disease in the farm. Either:-

(a) The cows were milked by a person attending on

a scarlet fever patient, or who had the disease in

his own family, or who was himself suffering from

a mild attack of the disease.

(b) The milk has been kept in a room where clothes

or refuse matters from a scarlet fever patient were

lying.

(c) It has been held by some that cows are liable to

a disease similar to or identical with human

scarlet fever. This has now received a name viz:-

IV. TUBERCULOSIS "The Hendon Cow disease", but the evidence for its

identity with scarlet fever is ^{non}unconvincing.

III. DIPHTHERIA.-

Whilst it is beyond the region of doubt that epidemics of this disease have occurred from the use of milk, it ~~is~~ ^{has} now been possible to trace the source from which the milk derived its infective quality. Attempts have been made to prove that it is a cow disease transmissible to human beings but without success. All that is certain is that it is possible to have Diphtheria transmitted in milk from farms and dairies unquestionably in good sanitary condition and where there has been no case of the disease in man and the presumption therefore is that it is a cow disease. Perhaps when our knowledge of the etiology of the disease increases our information may become definite.

IV. TUBERCULOSIS.-

It has been shown that the milk of Tub^{er}culous cows containing tubercle bacilli, when given as food, produces

tuberculosis in rabbits, guinea pigs and dogs, but the evid-

2
ence as to the transmissibility of the disease to man is as
throat and lips, and swelling up of the throat glands of the
yet insufficient. When however, we know that 25 per cent of

neck.
all stall fed cows are affected with tubercle, that when, as

is very frequently the case, there is a deposition of tubercles

in the glands of the udders and in such cases the milk is full

of tubercle bacilli, and that the mortality of children under

5 years of age from primary tubercular ulceration of the intes-

tines and tuberculous ^{er} ^{si} of the peritoneum and mesenteric ^{uc} glands is

very high we cannot ^{but} believe that in children at least, the

milk of tuberculous cows is quite capable of transmitting the

disease.

V. FOOT & MOUTH DISEASE.

When this disease causes the appearance of vesicles

upon the teats, then the milk is infected and a peculiar illness

is caused by the use of this milk as human food.

The symptoms are high fever, vesicular eruptions on the throat and lips, and swelling ~~of~~ of the lymphatic glands of the neck.

Although other diseases have been recognized as owing their origin to the use of cow's milk as food, still for my present purpose the mention of the above five is quite sufficient.

It may easily be seen that whilst it might be impossible entirely to prevent the spread of such diseases, the institution of a more vigorous sanitary control over cow-sheds and dairies would go a long way to annihilate them at their very inception.

Unfortunately very little assistance in this direction is to be expected from sanitary measures sanctioned by law, but luckily there are other means at work, not only very materially helping to stamp out such disease but educating the

Date of inspection:-

farmer and the milk consumer to recognize the only means

Owner:-

of obtaining a pure milk supply.

Address:-

Before entering into a contract with any farmer for a

Factor of Bailiffs:-

supply of milk, the Dairy Supply Assoc: before referred to

Distance from Station:-

insisted upon a thorough examination of all the farm build-

Size of Farm in acres:-

ings by a Sanitary expert employed by themselves, and once

Average Meadow land:-

a year at least this gentleman was expected to re-examine

No. of Cows: (a) Wet.

every farm on the list of supply, in order to note any

Of sanitary defect, suggest improvements, correct and prevent

An carelessness in the despatch of milk. No better guarantee

By could be given of the purity and cleanliness of their milk

By than the publication of the fact of this yearly examination.

Breed of I adopted the following method of procedure in every

Is examination with the best of results.-

Is Dairy Farm registered:-

Date of Inspection:-

e.g. Cheese, butter or cream.?

Owner:-

Any milk stored or all
despatched at once.?

Address:-

Where ^{of} men employed to
Factor ~~of~~ Bailiff:-.?

Distance from Station:-

Size of Farm in acres:-

Average Meadow land:- age
disposal, the water supply,
etc., etc., of these houses

No. of Cows: (a) Wet:-
(b) Dry.

Has there ever been an
Other Cattle:- instance at
the farm.?

Any other Farms or Estate:-
Any Cattle disease.?

Ever inspected before:-
What attention to the
cows' udders.?

By Whom:-

Are cows washed.?
Breed of Cows:-

How often are the hands
Is milk distributed locally:-

Is Dairy farm registered:-

1

Any Dairy produce PLAN OF THE FARM:-
e.g. Cheese, butter or cream.?-

with particulars of construction.

Any milk stored or all
despatched at once.?-

(2) PLAN OF COWSHEDS:-

Where do men employed to
milk cows, reside.?-

How many.?- construction?

(a) Walls.?

What kind of houses.?-

(b) Roof.

Enquire into the sewage
disposal, the water supply,
etc., etc., of these houses
and if any children:-

(d) Flues.

Has there ever been an
infectious disease at
the farm.?- Windows.

Any Cattle disease.?-

What attention to the ben.
cows' udders.?-

(2) Light.

Are cows washed.?-

(1) Heat, any artificial?

How often are the hands
of the milkers washed.?-

(3) Any rain pipes?

Any other remarks:-

(14)

Then give (1) A PLAN OF THE FARM:-

III. Stalls.

with particulars of construction.

Size. No. Pavements. Drains. Any Traps.

(2) PLAN OF COWSHEDS:-

Troughs.

I. Number.?

Any white-washing.?-

II. Construction.?

Any Disinfection.?-

(a) Walls.?

How often cleaned.?-

(b) Roof.?

Windows.?-

(c) Floor paving.

Relation to Manure heap.?-

(d) Eaves.

How are cows littered.?-

(e) Windows.

(3) PLAN OF DAIRY.-

(f) Doors.

Construction:-

(g) Ventilation.

Size:-

(h) Light.

Floors:-

(i) Heat, any artificial?

Walls:-

(j) Any rain pipes?

Roof:-

Ventilation:-
111. Stalls.

Light:-

Size. No. Pavements. Drains. Any Traps.

Surroundings:-

Troughs.

Drains:-

Any white-washing.?-

Water Supply:-

Any Disinfection.?-

Is ground outside paved

or any cement?
How often cleaned.?-

Rain pipe.?-
Windows.?-

(4) Relation to Manure heap.?-

How are cows littered.?-

(3) PLAN OF DAIRY.-

Construction:-

Water supply for Cows:-
Size:-

Floor:-

(5) MANURE HEAP. (PLAN & E)
Walls:-

Roof:-

is it paved and puddled to, etc.

(6). Ventilation:- DOWN

(7) Light:- of disease amongst cattle, what measures

Surroundings:-

(8). Drains:- in the Sheds.?-

Water Supply:- Open.

Sleeping accommodation for the men.

Is ground outside paved

or any ~~shaft~~ ^{soakage} .?-

Is Cowshed new or an old one extended.?-

Rain pipe.?-

Is manure scattered on fields or deposited

(4) WATER SUPPLY.-

Is yard paved and drained.?-

Wells:-

Is there a refrigerator for cooling milk.?-

Springs.-

Where is the house privy.?- &c.,&c.

Water Supply for Cows:-

Is it ^{tested} ~~productive~~ from soiling.?- such an extended inquiry

(5) MANURE HEAP. (PLAN OF) regarding the

with relation to surrounding structures, drainage, bottom

sides, is it paved and puddled &c.,&c. was of the (16).

(6). FOOD ~~FOR~~ ^{OF THE} COWS.

(7) In Event of disease amongst cattle, what measures

for isolation.?-

(8). How long in the Sheds.?-

" " " " Open.

Sleeping accommodation for the men.

Is Cowshed new or an old one extended.?-

Is manure scattered on fields or deposited

near drinking trough.?-

Is yard paved and drained.?-

Is there a refrigerator for cooling milk.?-

Where is the house privy.?- &c.,&c.

It will be easily seen that in such an extended inquiry the legal requirements of dairies, and cowsheds during the past few years.

healthiness and otherwise of the milk production, and what

was of quite as much importance, the method was of the

utmost value as ^{an} ~~to~~ education, ^{al} ~~at~~ medium to the farmer. Not

only ^{did} ~~was~~ he see at once that cleanliness was absolutely

necessary, but he was instructed in the means whereby

such could be obtained.

As a matter of course during the investigation ren-

dered necessary by such sanitary examinations many *irregu-*

- *larities* both in points of law and points of sanitation came

under my notice, and it was a consideration of those de-

fects that impelled me to write this thesis with the view

of suggesting remedies. A more comprehensive notion of

these may be obtained by adopting some system of classif-

ication and this may best be done by briefly glancing at

the legal requirements of dairies, and cowsheds during the

past few years.

Probably because it is only in recent years that we

have come to recognize milk as a medium for the spread of

disease, the legislation having special reference to dairy farms is not voluminous. In 1878 the "Contagious Diseases (Animals) Act" enacted that the Privy Council might from time to time make such general or special orders as they thought fit, for the following purposes, namely:- subject to

1. For the registration with the local authority of all

persons carrying on the trade of cowkeepers, dairy-men or purveyors of milk.

shops order of 1885 which on the amendment of the Contagious

2. For the inspection of cattle in dairies, and for pre-Diseases Animal Act in 1886, was amended in 1887. The only other

scribing and regulating the lighting, ventilation, acts having reference to Dairies is the Cattle-sheds in Burgh's

cleansing, drainage, and water supply of dairies and (Scotland) Act 1868: The Public Health (Scotland) Act 1867:

cowsheds in the occupation of persons following the The Infectious Diseases (Prevention) Act 1890: The Burgh Police

occupation of cow-keepers or dairymen. (Scotland) Act 1892, the last having only one clause dealing

3. For securing the cleanliness of milk stores, milk with the cleansing of byres.

shops, and of milk vessels used for containing milk

It is not my intention to sketch the provisions of these

for sale by such persons.

4. For prescribing precautions to be taken for protecting Local Authorities by the Acts and by the Orders may be included milk against infection or contamination.

under the following heads:-

5. For authorizing a Local Authority to make regulations

(1) Registration of persons carrying on the trade of cow-keeper, dairyman, or purveyor of milk, for the purposes aforesaid, or any of them, subject to

such conditions, if any, as the Privy Council prescribe.

(2) Regulations of Local Authorities.

The result of this was the Dairies, Cowsheds, and Milk-

(3) Inspector.

shops order of 1885 which on the amendment of the Contagious

(4) Prosecutions and Penalties.

Diseases Animal Act in 1886, was amended in 1887. The only other

Looking at the first point - viz, Registration - we acts having reference to Dairies is the Cattlesheds in Burghs

find that the Order of 1885 enacts that all purveyors of milk, (Scotland) Act 1866: The Public Health (Scotland) Act 1867:

except those who deal in milk for the manufacture of butter. The Infectious Diseases (Prevention) Act 1890: The Burgh Police

and cheese, or who only sell it in small quantities to their (Scotland) Act 1892, the last having only one clause dealing

neighbours, must be registered, and that local authorities must with the cleansing of byres.

keep a register for the purpose. It is to be noticed that

It is not my intention to sketch the provisions of those

Acts, but merely to draw attention to them, as they may bear on the subject of my paper. The specific duties imposed upon Local Authorities by the Acts and by the Orders may be included under the following heads:- parts or otherwise. The importance

- (1) Registration of persons carrying on the trade of cow-keeper, dairyman, or purveyor of milk.
- (2) Regulations of Local Authorities.
- (3) Inspection.
- (4) Prosecutions and Penalties.

Looking at the first point - viz, Registration - we find that the Order of 1885 enacts that all purveyors of milk, except those who deal in milk for the ^{manu}~~manu~~facture of butter and cheese, or who only sell it in small quantities to their neighbours, must be registered, and that local authorities must keep a register for the purpose. It is to be noticed that

registration applies to persons, not premises, and that however unfit the premises for the purpose, registration cannot be refused; and, further, that registration is necessary in the case of persons selling milk from carts or otherwise. The importance of registration cannot be exaggerated, as it paves the way for periodic inspection of the premises, and yet in 90 per cent of the cases examined by me there was no attempt at registration. The law was either unknown, or, where known, was not understood; and I observed that it was only in districts lying close to a pretty large town, and, therefore, coming under the jurisdiction of a regular sanitary inspector, that any attention was paid to the subject. Now, this is not as it should be, for if such an important provision of the Order is allowed to be neglected, how can one expect that the other details of the Order will be attended to.? In a private milk supply Company, of course, arrange-

*Not true of
hills*

ments are made for infectious disease in a farm being duly reported; but, as I have found, the rule is invariably neglected.

Not that registration is any guarantee that notification of infectious disease will take place, but the supervision that is exercised over persons whose names are on the register will assist greatly in the discovery of infectious disease when it does occur. This action of the milk-supply companies in large towns is very important, because it has been held that it is ULTRA VIRES for a Local Authority to demand that infectious disease on the premises should be notified, unless indeed the Infectious Diseases Notification Act has been adopted. It is only one of a series of necessary safeguards which have been taken to prevent avoidable risk to the milk purchaser. The ruin inflicted just as a local Authority has a right to interfere when a stream running through its territory is polluted many miles further up, milk drinkers moved them to insist upon country farms supplying

them with milk having upon them nothing that could contribute to so serious a calamity. It is only, however, under pressure of this kind that real progress is being made in the sanitation of dairy-farms, and farms are daily being freed from objections that previously existed. Much, however, remains to be done, and the question is, how measures can be devised which will raise all dairy farms up to the standard held necessary by such companies. It may be said that it will be time enough for further legislative interference when the laws already in force are fully carried out, but it must be borne in mind that this is not a question of mere local concern, but one that involves the health and lives of people living many miles away. Milk is sent to London from dozens of farms in Warwick, Stafford, Derby, &c., and just as a local Authority has a right to interfere when a stream running through its territory is polluted many miles further up,

so it ought to have some right to interfere when a farm outside of its area of administration is sending polluted milk to its territory.

Turning now to the second point, viz., the Regulations of Local Authorities, we find that the regulations made or allowed to be made by Local Authorities are very limited, e.g., they have no power to make regulations as to registration, and they cannot refuse to register any person who applies - they are only permitted to make regulations for the inspection of cattle in dairies, and they cannot make regulations enforcing the notification of infectious disease.

It will be observed that the powers of Local Authorities cited above, fail to meet the wants of the case; for, to mention only one point of importance, no cognisance whatever is taken of the circumstances of the ^{cow} cow in the meadows. For seven or eight months

of the year - nay, sometimes the whole year round, the cow lives in the open air, getting most of its food and nearly all its drinking water there, and yet there is no power given to control or amend the conditions of its outdoor life. It is a well known fact that in ninety-nine cases out of every hundred, no attention whatever is paid to its drinking-water which is mostly derived from ponds filled with water drained from land on which manure has been spread, or if not, the drinking place is entirely unprotected and liable to be polluted with the cow's excrement - a fact of which the animal generally takes full advantage.

Now, why this should be the case when we are so fully alive to

Sentence incomplete
the fact that water polluted with human disease, I am at a loss to understand. If enteric fever is in reality a bovine disease,

No
as is generally held now-a-days, why should not the drinking-

head to be introduced for the purpose of drinking, effectually prevented water of a cow be as carefully guarded as that of a man?.

In only one of the farms examined by me was any attention paid to any chance of excremental pollution. The whole arrangement

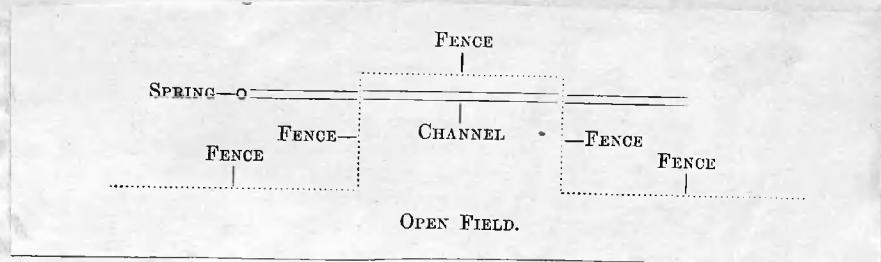
this subject of protection of cow's drinking-water in the meadows. could be put up at a very small cost, and was worth copying.

The water was derived from a spring which was protected, and poured I append a rough ground plan of the structure.

its pure limpid stream into a smooth paved channel half-a-foot above Another very reprehensible practice which was carried out

the level of the ground around. About one and a half feet above the in every case without exception, was that of scattering the

contents of the manure heap over the meadow and that the cows at the time were grazing, and the manure was scattered



may arise. Cows cannot cover a field with their own excrement, and plenty of room is left for grazing on free portions, but where the scattering of manure takes place, they are bound to channel was a covering which, whilst leaving ample room for the cow's swallow some portion. Besides it paved the way for other evils, head to be introduced for the purpose of drinking, effectually prevented and I have come across one case in which town's manure was

scattered on the pasture land. We know that this has free-
any chance of excremental pollution. The whole arrangement

quently caused contamination of drinking-water and consequent
could be put up at a very small cost, and was worth copying.

typhoid fever in man, and why not in cows? The general op-
I append a rough ground plan of the structure.

inion would appear to be that any kind of water is good enough
Another every reprehensible practice which was carried out

for a cow; because when we follow it to the farm-yard, where
in every case without exception, was that of scattering the

Local Authorities can exercise their supervision, we find that
contents of the manure heap over the pasture land where the

the water troughs are not unusually placed in a corner of the
cows at the time were grazing. Some may consider that there

manure heap and liable to contamination therefrom. We also
is no harm in this arrangement, and may cite the fact that there

find that the water is derived from a well sunk near the the
are very few parts of a field in which a cow does not void

manure heap or the privy cesspool, and in nearly every case
faecal matter, but the cases are not at all parallel and evils

polluted. The adoption of the pail system in the latter case,
may arise. Cows cannot cover a field with their own excrement,

and the sinking of the well in a place remote from the manure
and plenty of room is left for grazing on free portions, but

heap, in the former case, would simplify matters greatly.
where the scattering of manure takes place, they are bound to

Regarding the actual arrangement of the farm buildings,
swallow some portion. Besides it paves the way for other evils,

the construction of the cow-shed, the position of it with re-
and I have come across one case in which town's manure was

scattered on the pasture land. We know that this has frequently caused contamination of drinking-water and consequent typhoid fever in man, and why not in cows? The general opinion would appear to be that any kind of water is good enough for a cow; because when we follow it to the farm-yard, where Local Authorities can exercise their supervision, we find that the water troughs are not unusually placed in a corner of the manure heap and liable to contamination therefrom. We also find that the water is derived from a well sunk near the the manure heap or the privy cesspool, and in nearly every case polluted. The adoption of the pail system in the latter case, and the sinking of the well in a place remote from the manure heap, in the former case, would simplify matters greatly.

Regarding the actual arrangement of the farm buildings, the construction of the cow-shed, the position of it with re-

lation to the buildings and to the manure heap - the construction, &c., of the dairy, a Local Authority has much fuller powers, and the Order of 1885 is in this respect almost perfect.

Before the Order of 1885 a Sanitary Authority was never consulted, because the Local Authorities empowered to carry out the act were the justices of peace, and the inspectors, the police constables. But this Order enacted that the Local Authority be the Sanitary Authority of the place, and, secondly, a very great distinction was made between new and old cow-sheds. The new cow-sheds must come up to certain reasonable requirements as to lighting, cleansing, ventilating, drainage, &c., but the old cow-sheds only required to be sufficient for the health of the cattle, the cleanliness of the milk-vessels, and the protection of the milk from contamination. This last point is most important; for under it much evasion of the Order has

Authority to see that the public space...
taken place wittingly, or otherwise. Where extra accommod-
ation is required for milking cows, new cow-sheds are rarely
constructed, but any hovel, outhouse, barn, or cart-shed is
used to lodge the cows, and it is not too much to say that the
idea has been more to provide housing for the cow, than to pro-
vide an establishment from which would emanate milk quite out
of the risk of contamination.

In rural districts any kind of shelter is considered suffi-
cient for a "cow-house", and hence the reason that we find all
sorts of erections designated "cow-sheds," old hen-houses, barns,
wooden cart-sheds, mud-walled, thatch-roofed hovels, places
indeed wherein it is oftendifficult to stand upright.

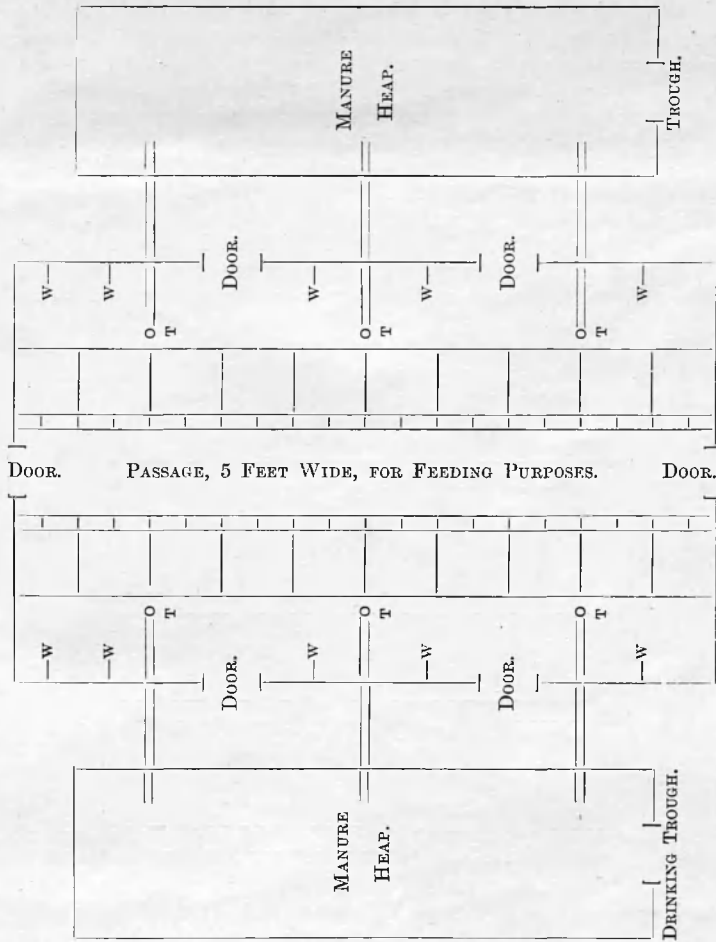
The Order of 1885, whilst adhering to the same points, has
very materially altered the phraseology, by adding the words

"including air space," and thus it becomes the duty of a Local

Authority to see that the cubic space considered fit for each cow should be supplied. Buildings, however, which are converted into cow-sheds are often very unsuitable for the purpose, even although the cubic space and the other points mentioned are supplied, and I have been very much struck with the various characteristic features of cow-sheds, both new and old. I recognise two well marked types of cow-shed, which I shall designate the English and the Scotch. I call them so because although each type is found in both countries still the one is much the more common in England and the other in Scotland. So far as I have seen them in actual practice each type has its drawbacks, the former in its difficulty of cleansing, the latter in point of light and ventilation, but a well constructed shed of either type, with a few alterations could be made literally perfect.

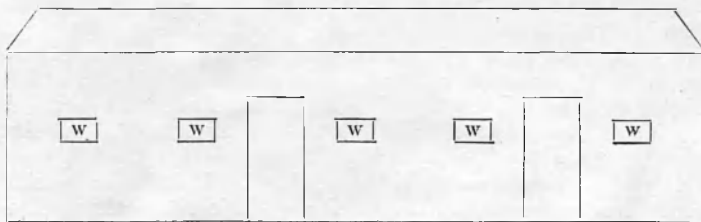
(33.)

On the opposite page, I give a ground plan, with side elevation, of what I call the "English type."



w = Window.

t = Trapped gully, with grating and drain leading to manure heap.



This shed was 28 yards wide, 10 feet high to the eaves, constructed of brick, paved with brick, roofed with slate, and provided with rain pipes. ventilation was concerned, but

Running right down the centre of the shed is a passage 5 feet wide, bounded by 3 feet-high walls on either side. The 10 double stalls were ranged on either side of this passage - the troughs being at the wall end, and therefore the two rows of cow's heads were facing each other across the passage. Not only was this very convenient for feeding purposes, preventing unnecessary trouble and dirt, but it was admirably suited for that "nose-ventilation", so essential to cattle in confinement. At each end of this passage was a door, and thus ventilation could be had throughout the length of the building, and in each side of the shed were two doors opposite each other and 5 windows with sliding shutters of wood without glass. This provided

ample provision for cross-ventilation. The roof was well provided with skylights. Than this no arrangement could be better, so far as light and ventilation were concerned, but warming seemed never to have entered into the calculation, or at least it was only to be obtained at the expense of good ventilation, i.e., by closing up doors and windows. Some provision for artificial heat would certainly have been very advantageous, as the supply of milk is diminished when the temperature falls below 55° F., and bearing this in mind many cow-sheds in the neighbourhood of London are supplied with steam or hot-water pipes.

The stalls were double, thoroughly paved, and measured 8 ½ feet by 8 ½ feet, and there was practically no channel, the brick paving of the stalls sloping gently, and at its lower end being only half-an-inch above the level of the general

floor of the byre. Now, there are two disadvantages here of great importance.

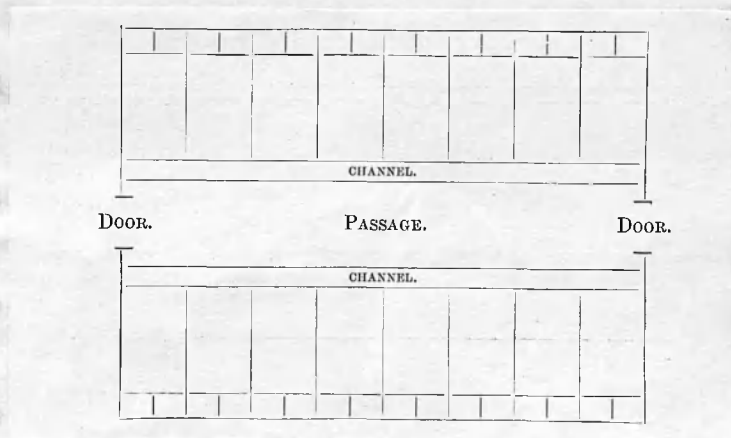
First, the stalls being so long, the cow's excrement is dropped on the paving, not into the channel, and the cows lie down therein - the excrement coats their quarters - a fresh coat being put on each day; as there is never any attempt at cleaning, even with a wisp of straw, decomposition takes place, and this goes on day after day for six months, or as long as the cow is in the shed. Even were the stall shorter, the channel being so shallow fails to answer the purpose, and the cows can, as before, lie down in their own excrement, and ^{the} above state of affairs exists as before. There are two remedies for this, and these are (1) Make the stall from the trough to the channel the exact length of the cow's body: (2) Make the channel from 6 to 8 inches deep, so that the excrement shall be quite out

of reach of the cow's quarters when it lies down. If, in addition, the floor in the stall is covered with clean straw, and the portion nearest the channel, for say the space of two feet, is renewed night and morning, there is no possible chance of the above-mentioned soiling of the cow's quarters.

The second disadvantage is that when the stalls are too large there is the chance that the cow may turn round therein and soil the contents of the trough. For this reason 7 feet wide for a double and $3\frac{1}{2}$ feet for a single stall is quite sufficient. The troughs were double, 4 feet long, 16 inches wide, and 12 inches deep, and made of brick. The best material for troughs is earthenware, and from experience I would recommend those made by Messrs J. & M. Craig, of Kilmarnock, which I saw in use in different parts of England, and which are quite non-absorbent and easily cleaned out.

This^e brick paving in cowhouses is a very great objection for as each brick can hold about 16 ounces of water and as the water under a cows body is by no means of the purest kind, not only is dampness thereby very much encouraged but putrefaction^e of the retained decomposing material takes place and may lead to serious consequences. This would be entirely obviated^{ly} by using asphalt~~e~~ as a flooring.

Proceeding now to the consideration of the so-called Scotch type of cow-shed, I append the ground plan as before. This shed



was 21 yards long, 10 yards wide, 10 feet high up to the eaves,

built of brick, paved with brick, roofed with slate, and provided with rain pipes. Right down the centre of the shed ran, as before, a passage about 3 feet wide, but bounded this time on either side by the channel for the deposit of the cows' excrement. The eight double stalls were ranged on either side of this passage, running from the channel to the outside wall of the building, the feeding troughs being against this wall, the hind quarters of the two rows of cows being therefore towards one another on either side of the passage, and their heads towards the outside wall of the shed.

The greatest objection to this form of shed is the position of the cows' heads, as in most cases there is absolutely no attempt⁷ at "nose ventilation" of any kind. If, however, special ventilators be inserted in the outside walls just opposite to the cows' heads- the channels be from 6 to 8 inches deep- and the stalls about the length of the cows' body, with frequent change of bedding, and

plenty of light from roof and gable windows, this form of shed
is quite as good as that previously mentioned. In one respect
it is better: the doors being in the gables of the building and
not in the sides, there is less temptation to have the manure heap
so close to the shed. The usual arrangement of the manure heap
in the English type is shown in the ground plan -viz., a manure
heap on either side of the cow-shed- a most objectionable plan.
The only reason for this state of affairs is that it is more con-
venient to pitch the dung right out into the heap.

The manure heap is so often unpaved or badly paved, and at
such a level, that the surface drainage of the yard flows therein,
assisting materially in the putrefaction and decomposition of the
contents, as also in the soakage into the earth beneath and around.
Now, the manure heap should in every instance be at such a
distance from the shed and buildings that there be no danger from

admitted into the cow-shed until it has been subjected to one month's quarantine in a shed by itself, all this time being properly trapped drains to it, and from it into a proper place by a person who does not come into contact with the rest of the herd of deposit. The sheds should be cleaned three times a day, or oftener if necessary, the dung being placed in properly covered isolation ^b should at once be made. non-absorbable receptacles, preferably galvanized iron vehicles,

Again there should be some such method adopted for the clearing and removed to the manure heap at once. The whole farmyard should be thoroughly paved so as to prevent soakage, and cleaned at in a previous part of this paper. In nine cases out of ten, cows periodical seasons.

which are wintered in a cow-shed have their quarters absolutely The question of cubic space is one that I will not enter into, coated with dry excrement, which is in great danger of contamination except to state that 700 cubic feet per head is the amount usually allowed, and that in estimating this, any height over 12 feet

Then the cow's udder should be carefully cleaned before the must be left out of the calculation. Without entering into the operation of milking, and what is most important of all, the milk question of "milk contamination," a few points having real practical bearing may be mentioned.

as in Denmark, after every second cow. In this way should udder In the first place, no newly purchased animal should be

admitted into the cow-shed until it has been subjected to one month's quarantine in a shed by itself, all this time being milked by a person who does not come into contact with the rest of the herd, and if udder disease break out in the herd, arrangements for isolation should at once be made.

Again there should be some such method adopted for the cleaning or the keeping clean of the cows' quarters, as is mentioned in a previous part of this paper. In nine cases out of ten, cows which are wintered in a cow-shed have their quarters absolutely coated with dry excrement, which is in great danger of contaminating the milk during the process of milking.

Then the cow's udder should be carefully cleansed before the operation of milking, and what is most important of all, the milker should wash his hands after the milking of each cow, or at least, as in Denmark, after every second cow. In this way should udder

disease attack one cow, there is less danger of the disease
becom^{ing} epidemic and attacking a whole herd.. All these points
are of the utmost importance, and it is strange that so very few
pay any attention to them, and the only reason that can be advanced
is the ignorance of the farmer, preventing the proper interpretation
of the proverb that, "Cleanliness is next to Godliness."