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Some observations of pig behaviour with special  
reference to pre-slaughter treatment

by T. Wichmann Jørgensen, Agricultural Engineer

The Danish Meat Research Institute, Roskilde

Since Danish pig production is based mainly on export of Wiltshire bacon it is decisively important that the rind appears in first-class condition, and at the same time a high meat quality (colour, taste, and texture) must be aimed at. Many factors must be taken into consideration to achieve these aims, one of the most important being pre-slaughter treatment. By this is meant the handling of the pigs from loading at the farm to slaughter at the bacon factory.

Correct pre-slaughter treatment is complicated by the fact that handling in practice is often contrary to the pigs' psyche and biologically based behaviour. Therefore methods have to be found that will as far as possible combine both aspects of the problem and this paper describes some of the investigations we have made in this field at the Danish Meat Research Institute.

Behavioural Characteristics

Feral swine live in herds of 5 to 8 (Hanson & Karstad, 1959) usually under the leadership of a senior boar (Phillips, 1926). The aggressive disposition of the wild boar equips him well for both territory and herd protection. Under domestication the pig has been modified from a pugnacious free ranging, foraging beast to a more docile animal, which, however, still to some degree has kept the instincts of the wild boar such as watchfulness, solidarity in groups, profound curiosity, and antagonistic disposition.

In the following some examples are given to show how these instincts are reflected.

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Alertness. Pigs react quickly and vigorously when exposed to actions, to which they are not used. Their watchfulness or, as Pavlov calls it, their "What-was-that" reflex action is similar to that of the dog. When a person approaches a herd, an alarm call or "woof" is given, and the animals will rise in apparent fright. If changes in the environment which in the pigs' opinion are too violent, dangerous and sudden, occur, they may cause panic, during which the pigs behave completely inexpedient and often contrary to what is aimed at e.g. when unloading and droving the pigs at the bacon factory.

I shall discuss later the importance of creating a smooth procedure linking the various steps involved in pre-slaughter treatment. Here attention shall only be drawn to those biochemical aspects of the pigs' vigorous alarm-reactions that are connected to the pigs' endocrine system and to the consequent influence on the chemistry and structure of the pork.

#### Group Formation

The pigs' social instincts lead them together in groups. When large numbers of pigs are brought together in stockyards, they bed down in groups according to the farms on which they originated (Self 1961).

Among other things the solidarity within the group is shown by a markedly aggressiveness towards a newcomer to the group and to other groups.

The feeling of the group as a whole is reflected in the fact that a "What-is-that" reflex action by one pig is immediately transmitted to the whole group.

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If one individual is stricken by panic and fear the group feeling may be upset to such a degree, that the pig horror stricken flies alone in one direction, when the herd flies together in another.

Later practical examples will show the place of group feeling in the pre-slaughter treatment of pigs.

Investigatory Behaviour. The profound curiosity of pigs should also be mentioned. When a person enters a sty, the pigs will show reactions of fear in the beginning, but if the intruder stands still or sits down, the pigs will return to investigate by smelling, rooting, and nibbling. They are apt to bite rubber boots or root at gates and doors that could allow them access to an unexplored area. In this connection may be mentioned the general inclination to break out and the tendency to ill-treat and destroy the fixtures and partitions of the sties.

Antagonistic Behaviour. When piglets are 2 days old they begin to use their sharp teeth to bite or slash their opponent as they fight during suckling. When suckling-order is established, the level of aggression is lowered. Play patterns include some antagonistic behaviour but seldom involve prolonged vicious attacks on littermates.

After weaning the aggressiveness depends upon management practices. Fighting for food on account of small rations or insufficient room at the feeding trough may accustom the pigs to be aggressive. Insufficient water intake also makes the pigs irritable and aggressive. However, the aggressive disposition is first and foremost connected to the group feeling. With each addition of new animals to a group some fighting ensues as newcomers are attacked, although fighting is frequently less intense if two groups are joined in an environment which is new to both. This happens e.g. when pigs from various farms are loaded on the same lorry or brought together in the pen at the bacon factory. Nevertheless, it has been a problem to us in Denmark that the skins were damaged by biting. This made it necessary to find means of preventing the pigs from biting one another. We have succeeded in this respect, as I shall later report.

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Climatic Adaptation. It is known that piglets are unable to regulate their body temperature until 2 to 3 days post partum (Mount, 1960). Within a few minutes after birth they begin to huddle together to conserve body heat. It is very interesting that this inclination towards community heating by huddling persists to adulthood. Now and then pigs as heavy as 200 lb can be seen lying on top of one another. In hot weather pigs seek shade and water. If a water pool is present they root around in it and wallow to cool themselves. That pigs are sensitive to heat-stress has inspired a few Danish bacon factories to apply sprinkling devices in the pens during summer. However, experience shows that wet pigs are more exposed to skin damage than pigs that are kept dry. It is therefore better to apply a strong air ventilation instead of water-sprinkling. We shall later consider the ventilation of lorries and pens.

Sensory Abilities. In discrimination for a food reward olfaction seems to be of first importance, kinaesthetic and other motor cues second, auditory cues third and vision fourth (Hafez 1962).

Pigs are sensitive to the same light wavelengths as humans but the wavelength of maximum sensitivity is slightly shorter.

Wesley (1955) has found that 3 of 16 pigs distinguished between a black and a white card for a food reward if they were stopped for 5 seconds about 2 feet from the stimulus cards. Animals allowed immediate access to the cards, and those halted 4 feet from the cards did not learn. This finding should be taken into account in considering the problem of why pigs may have difficulty in finding entrance to the CO<sub>2</sub>-immobilizer.

Investigation of the pigs' sensory abilities may yield important information, but it is difficult for human beings to obtain knowledge about how the pigs experience by means of their senses. We have the possibility only to watch their behaviour and reactions on various stimuli. On the basis of observations a hypothesis may be put forward, which can be confirmed or weakened by experiments with the animals.

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We have not proceeded this far at the Danish Meat Research Institute. We have just let the knowledge which we have gathered about the pigs' behaviour be part of the considerations as to the work with loading, transport, unloading and lairage of pigs.

#### Figs - Fights

Production of Wiltshire bacon requires pigs of a very uniform size. This means that the farmers must deliver the pigs when they are as close as possible to the ideal slaughter weight. Consequently, a farmer who has 100 pigs does not deliver 25 pigs at a time, when he thinks that they have reached a suitable weight, but must often deliver 1, 2 or 3 pigs, which are of the required weight at that moment. A carrier therefore has to visit a rather large number of farms before he gets his lorry filled with pigs. A typical sequence of a carrier's route is shown in fig.1.

Referring to what has earlier been mentioned about the pigs' aggressive inclinations, it is easy to understand that this mixture of pigs from various farms creates fights and resulting bite wounds on the skin. As the official Danish bacon control has prescribed that such damaged sides must not be exported, it has been necessary for the Danish Meat Research Institute to try to find means that effectively could prevent fights among the pigs. The result of our investigation in this field was the development of the halter, shown on fig.2.

The halter consists of a spring-band of steel, and on the top it is closed with a rubber strap. A rubber bit is connected with the spring-band by means of 2 cheek straps, also made of rubber. The bit protrudes a little outside the mouth and effectively prevents the pigs from biting each other. The halter is put on at the farm during loading, and it is not removed until the pig has reached the sticking pen. The halters are removed immediately before the electrical stunning. When CO<sub>2</sub>-stunning is used, the halters are not removed until the pigs come out of the immobilizer.

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Initially putting on the halters caused some difficulties. For one thing this delayed the transport of pigs and for another the pigs were handled in such a way that they became excited and strained. One result of this was that pigs without halters had a dressing wastage of 27.4% compared to 27.0% for pigs with halters. This was a serious problem as increase in dressing wastage resulted in fall in the carcass weight, but when we started to put on the halters in the platform of the hydraulic pig lift as shown on fig.3. the dressing wastage was reduced to 26.9%. This example shows how only a few minutes mis-handling of the pigs may cause extremely bad effects.

Now that all practical difficulties are overruled it is easy to get the bacon factories to apply the halters during transport as well as lairage.

The results obtained are 1) sides without bite wounds on the skin, 2) a more quiet behaviour of the pigs which results in less slipping and similar conditions which cause internal lesions, 3) a beneficial effect on meat colour as shown in fig.4.

Ventilation of lorries and lairage pens. It has earlier been mentioned - under climatic adaptation - that pigs are sensitive to heat-stress. A higher frequency of "watery pork" (defined as meat showing pale colour and excessive loss of fluid when cut) is found in pigs which have been exposed to hot and humid air. Therefore we have built a lorry which allows effective ventilation during transport of pigs, as you will see in fig. 5.

The prototype is an ordinary lorry, the sides of which are 110 cm high. The body is permanently covered with a tarpaulin. This is stretched over a support consisting of steel tubes, which rests upon the sideboards of the body. If desired it is very easy to remove this support and the tarpaulin in order that the carriers may drive with other goods. The tarpaulin has a front and a tail flap, which can adjust the air admission. The front flap can be regulated as shown on the figure by 3 positions. At A it is wide open, at C it is completely closed and at B it is fastened to a ventilation board, by which the air is drawn down towards the bottom of the body. The last method is used in very warm weather,

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when the ventilation must be effective. The ventilation board is a flat board, angled at  $45^\circ$ , and is placed about 50 cm behind the front of the body. This type of board has proved to be fully satisfactory.

During transport a low air pressure develops at the back of the body. This means that air can also stream into the carriage from behind. Therefore, the tarpaulin is adjustable here too and should be opened on very hot days.

Since stationary time for the lorry amounts to one-half of the total transport time it is important to ensure ventilation during this time. Here we have suggested that on the lower part of the sideboards about 10-15 cm over the bottom a row of holes of 5 cm diameter is drilled at intervals of 10 cm. As the tarpaulin does not fit quite tight to the body, but stops 15 cm over the sideboards a chimney draught is generated, because the air heated by the pigs due to its buoyancy escapes at the top and fresh air enters through holes at the bottom of the body. Not all carriers like these ventilation holes, because the sideboards then are less fitted for transport of goods. Therefore the mechanical ventilation system, shown in fig.6., is most preferred by the carriers.

Ventilation while the pigs wait in the pens at the bacon factory is of course quite as necessary as during transport. The sketches in fig. 7. show 2 systems. Despite the fact that the pigs like very much to cool themselves with water we cannot recommend sprinkling devices in the pens because experience has taught us that sprinkling reduces the appearance of the skin.

Of course effective ventilation is only achieved when each animal is given adequate space for the air to circulate unhindered among the animals. The Danish transport regulations runs as follows: for good ventilation the minimum area at each animal's disposal must be  $0.35 \text{ m}^2$  for pigs between 80 and 100 kilos live weight; for bigger animals the area must at least be  $0.65 - 0.8 \text{ m}^2$  according to the size of the animals.

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### Unloading and droving of pigs

As emphasized above it is important to aim at a smooth operation linking the different processes involved in the pre-slaughter treatment. Unloading results in a violent disturbance to the pigs, requiring them to move from the lorry, which they have become accustomed to during transport, into a new and unknown environment. When the backboard is removed and a man enters the lorry the pigs' reactions, based on their instincts of alertness and alarm, are brought into play. Therefore unless special precautions are taken several animals can be stricken with panic, causing desultory movement leading to some pigs rushing off in a direction opposite to that taken by the group. Such happenings can be avoided provided the pigs' natural curiosity is made use of and that care is taken to ensure that the group is kept together. This can be realised in practice by use of the following method of unloading.

1. The backboard should be removed along the complete width of the lorry.
2. The driver should step aside until the most curious of the pigs have entered the loading platform.
3. When approximately one-third of the pigs have voluntarily left the lorry, the driver should calmly enter the load by the side, taking his droving-board which should be approximately the same width as the lorry.
4. To keep the group together the more cautious and nervous animals should be gently guided forwards so that they remain in close contact with those that have left the load calmly and more voluntarily.

Use of the droving-board is demonstrated in fig.8. The same system can be used for droving pigs into the pens or into the bacon factory.

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Fig.9. shows a sketch of the lairage house where the gates at the entrance of the pens are used to accomodate the pigs between unloading and slaughter. The gates of the unloading passage have an additional use as droving-boards. When the pigs have been droven out from the receiving pens into the passage leading to the pen for stunning and sticking, the hoist-gate should be raised and the pigs pushed gently out into the passage by means of the droving-board. As an experiment, mechanically-controlled droving by use of a conveyor-belt will shortly be introduced at the bacon factory at Roskilde, Denmark.

The tratment of the pigs in the stunning and sticking pen

In Denmark all but the large slaughterhouses use electrical stunning. The pigs are driven into the stunning-pen where they are stunned and hooked up by means of a shackle attached to the hind leg and then stuck. Before proper attention was paid to this subject the man operating the stunning device often used to stand among the pigs so that the electrodes could not be applied to a pig before it had been shackled and raised to a level above that of the other pigs. This meant that the pig had to hang in pain and be jerked along by the hind leg which was bearing the full weight of the body. This procedure was naturally unsatisfactory.

By making use of the behaviour pattern of the pigs a more satisfactory procedure has been devised. This involves droving into the pen at one time only that number that can be accomodated in the corner, as shown in fig.10. There is then ample room in which to carry out stunning correctly.

The reasons for placing the pigs as shown are to keep them as quiet as possible.

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When the pigs are driven into the stunning-pen, which is closed, they feel trapped and desire to return to the lairage-house, which they have adopted during some hours of penning. Instinctively they are able to sense that they can escape by the same route as that by which they entered. They move back towards the entry-gate and turn their heads towards the hoist-gate or they try to group themselves around the openings in the wall. These openings even when covered with a lattice of pipes will calm the pigs by the draught of fresh air, and the pigs will stand quietly.

Fig.10. shows that the pigs turn their hind-parts towards the sticking-lift making it a simple matter for the shackling-chain to be applied correctly so that it pulls in the proper direction relative to the position of the animal. Dislocation of the hindleg, causing bleeding in and around the hip **-joint** can thus be avoided.

The large slaughterhouses in Denmark use CO<sub>2</sub>-stunning which is satisfactory provided that droving to the CO<sub>2</sub>-immobilizer is carried out properly. Fig.11. shows the principles involved in the layout of a CO<sub>2</sub>-immobilizer in relation to the pens and gives the names of the relative parts.

During operation introduction of pigs should be carefully regulated, otherwise they may be pushed too hard, causing them to be upset and perhaps to have difficulty in finding the entrance to the tunnel. It is important to have a continuous filling of the tunnel and therefore discontinuous droving to the stunning pen should be avoided. This has been verified and described in a recent experiment (Jensen, M.M., 1963; unpublished results). With continuous droving pigs were constantly in the tunnel and those pigs that were guided to the entrance of the tunnel stepped willingly into the waiting queue. On the other hand, by discontinuous droving the tube was emptied while a new group of pigs was brought from the pens. The first pigs that had to go into the empty tunnel were obstinate and the agitation raised among these pigs spread to the others and to the drover. With a large number of pigs to be driven the drover used vigorous force and this resulted in even greater excitement among the pigs.

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Any treatment that is contrary to the pigs' instincts and nature will result in the pigs becoming highly excited. The effects of such errors do not fail to appear. They show up in a marked reduction in meat quality, shown and explained in fig. 12.

It should be emphasized that our approach to the problems of correct pre-slaughter treatment of pigs and the technical developments which we have made in the field of handling, transporting and slaughtering is only one of several possible approaches. However, previous studies have too often neglected the fundamental behaviour of the pig, and we hope that our results may make some contribution towards a better understanding of what principles are involved and how these may be used to modify existing practices.

#### Acknowledgement

I thank Mrs. A. Thomsen for assistance in this work, and I am indebted to the Danish Meat Research Institute for the permission to publish the work, reported here.

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Figure 1. Characteristic schedule for a lorry fetching pigs at the farms

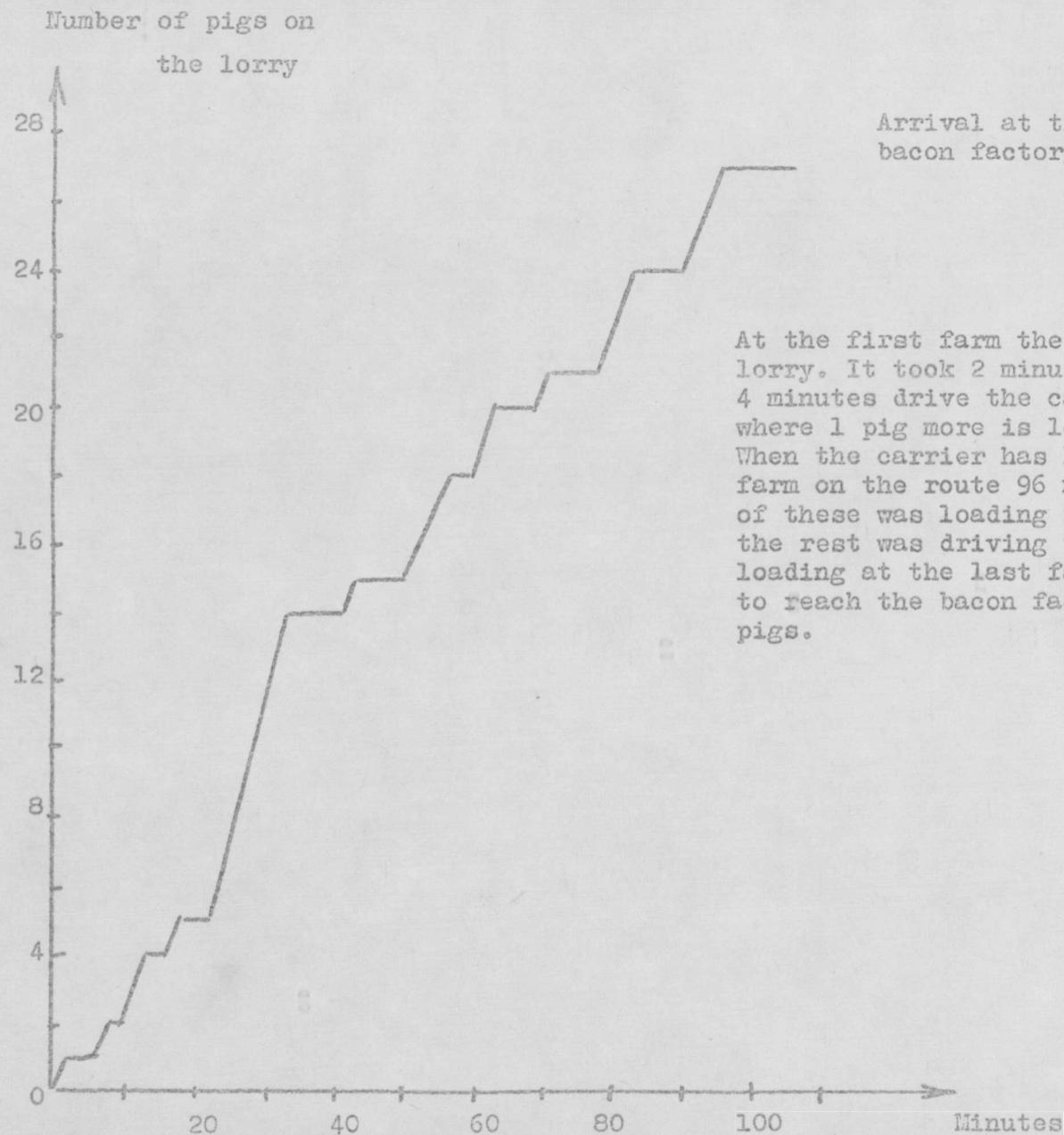
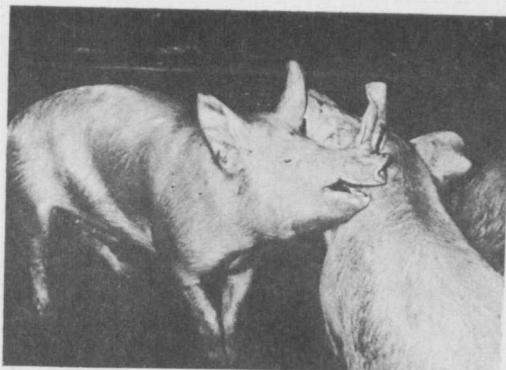
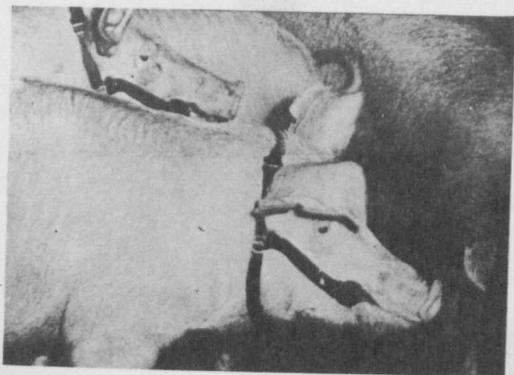


Figure 2. Prevention of fighting among pigs



The pig's aggressive nature should not be brought to development on the way to the bacon factory or during lairage at the bacon factory.



The halters prevent the pigs from biting one another.

The halter consists of a spring-band of steel (1), a neck strap (2), 2 cheek straps (3 and 4), and a bit (5). The rubber parts of the halter can be renewed.

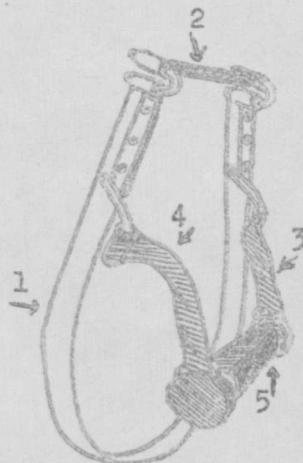
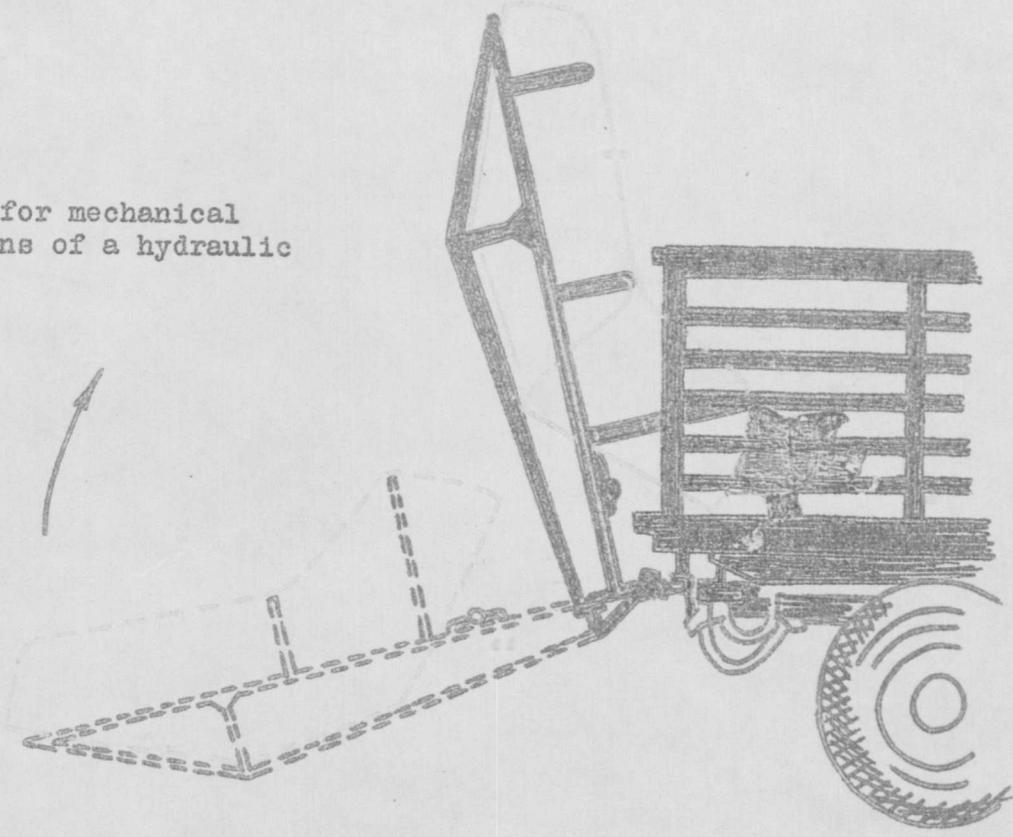


Figure 3. Putting on the halters is carried out in conjunction with mechanical loading.

The principle for mechanical loading by means of a hydraulic pig lift.



The loading platform into which the pig is pushed, is equipped with a spring-loaded gate. When the gate is closed, the pig is locked up in the platform while the halter is put on. This takes 5-15 seconds. The lock can be released by a pressure with the foot.

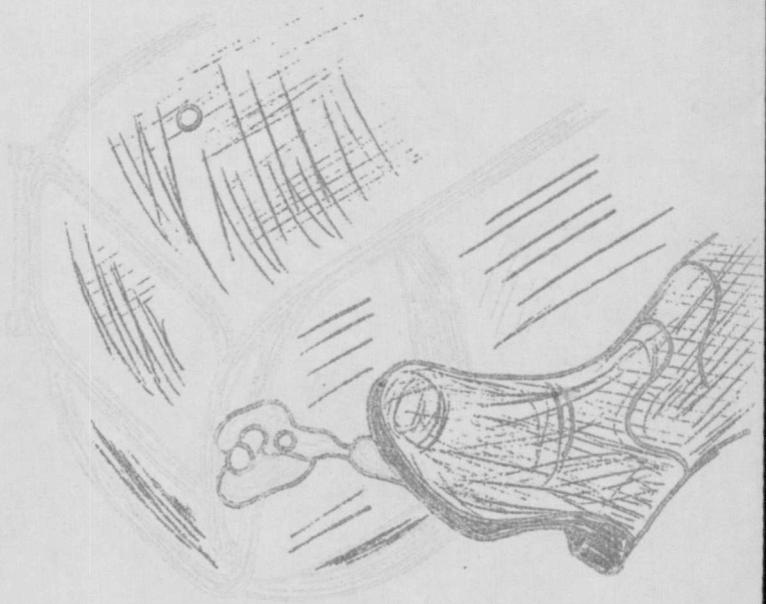
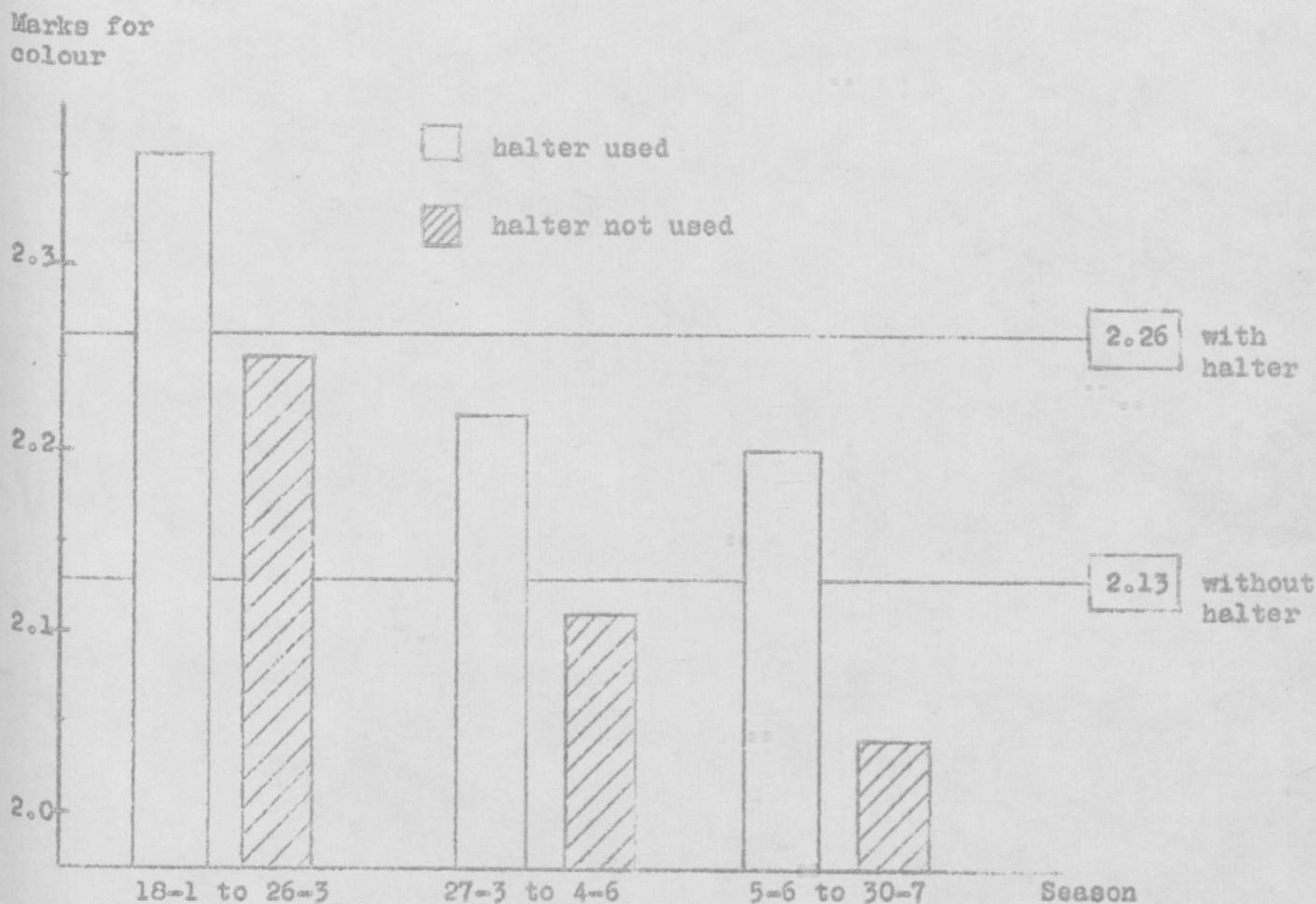


Figure 4. The use of halters has shown an improved effect on the meat colour.



The investigation has been carried out on pigs from progeny testing stations. The pigs are tested for health, rate of growth, feed conversion and carcass quality.

The colour of the meat has been judged on the cut side. In this assessment the structure of the meat is also taken into account. If both colour and structure are without defects, 2.5 points are awarded. Falling points below that means increasing degree of pale and watery pork.

It is seen that when the halter is used the improving effect on the meat colour is achieved all year round. However, it is relatively greater in the warm season when the pigs are most exhausted and the meat colour generally poorer.

Figure 5. The recommended lorry for transport of live animals, particularly pigs. The small drawing shows the three positions of the front flap of the tarpaulin.

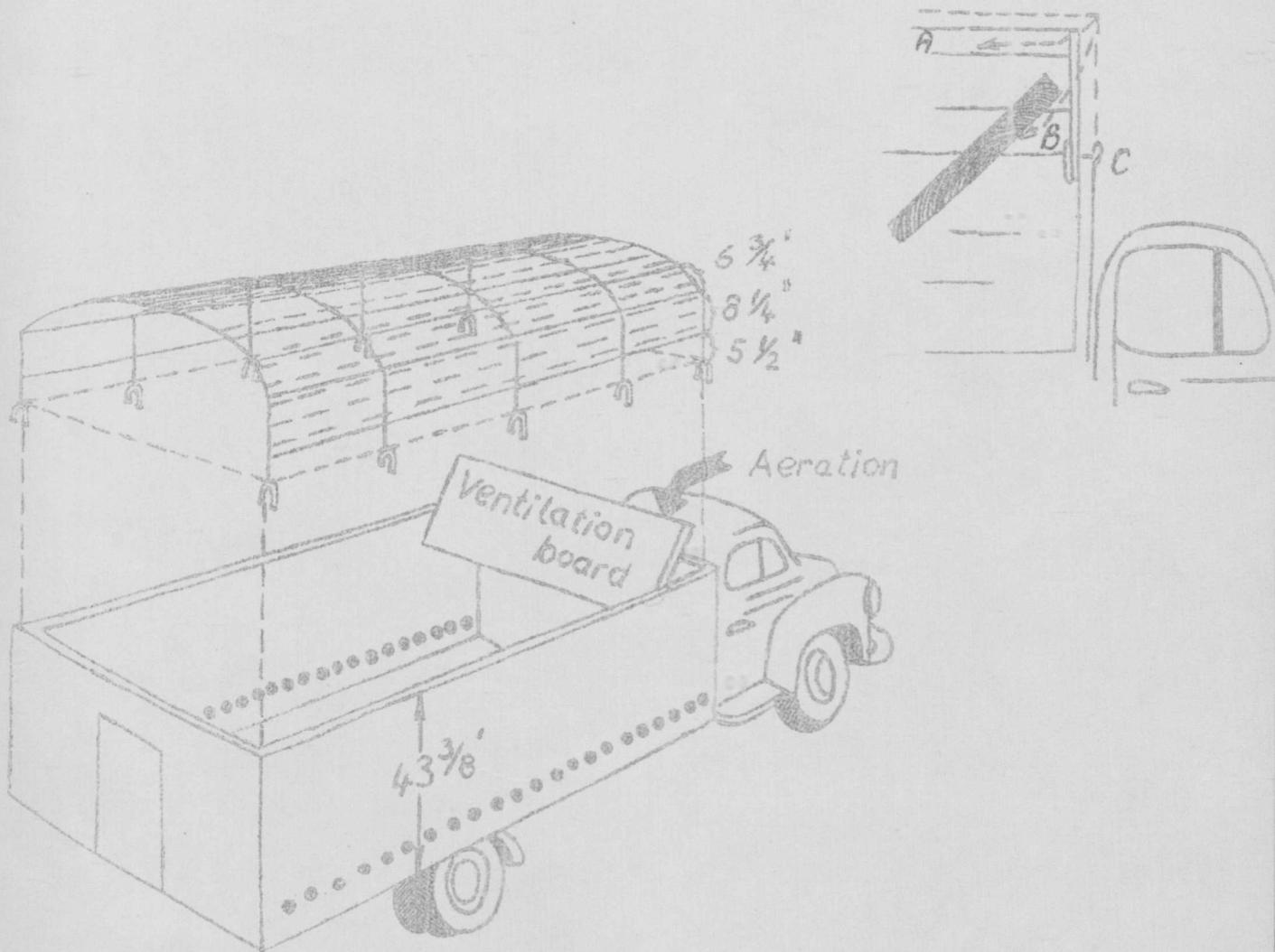
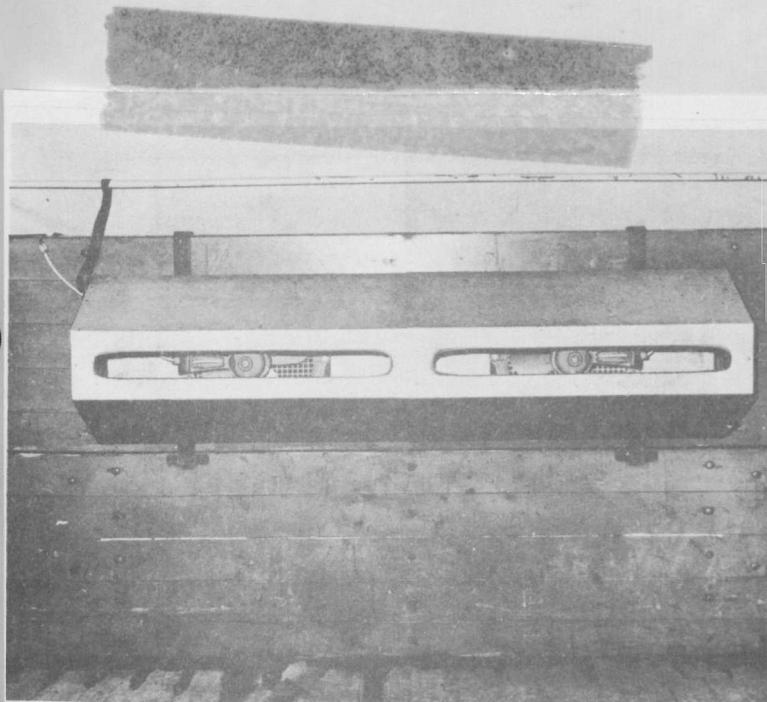


Figure 6. Example showing mechanical ventilation of stationary lorry.



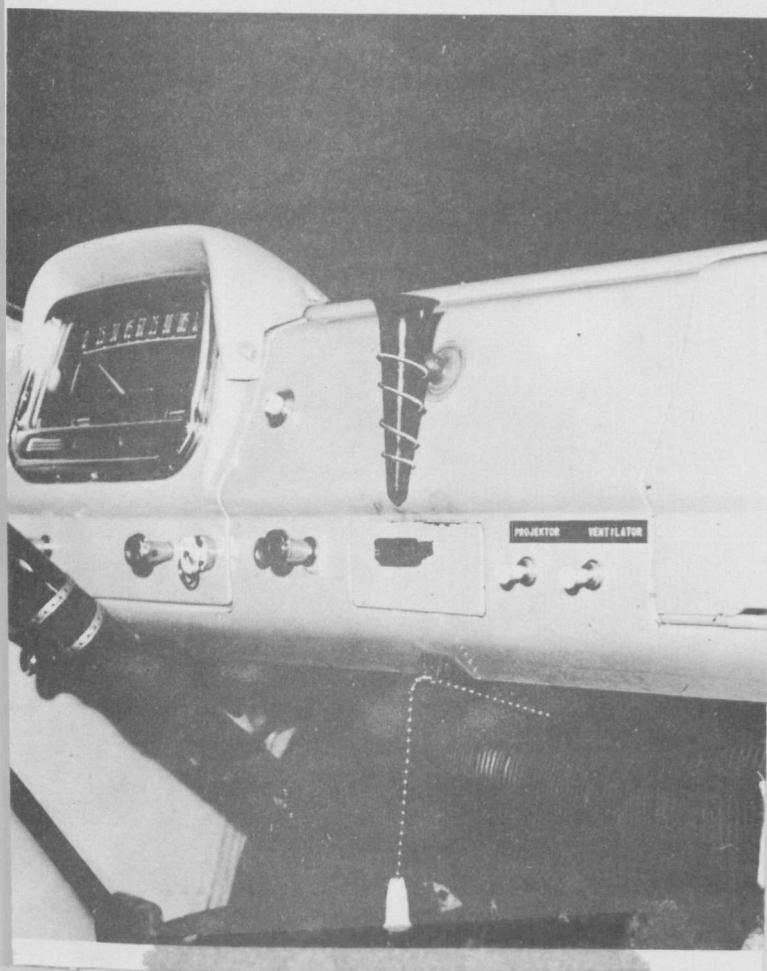
In the cabinet are 2 built-in fan blowers.

The cabinet is mounted on the front board of the lorry. Assembly and dismantling are easily carried out by means of a pair of wing nuts.

The ventilation here consists of 2 300 mm AGIR-ventilators of 12 volts.

The ventilators are driven from the battery of the lorry and blow fresh air down to the pigs in the body of the lorry.

The air shift in a covered body, the inside measure of which are 4.40 x 2.35 m, was 30 times per hour.

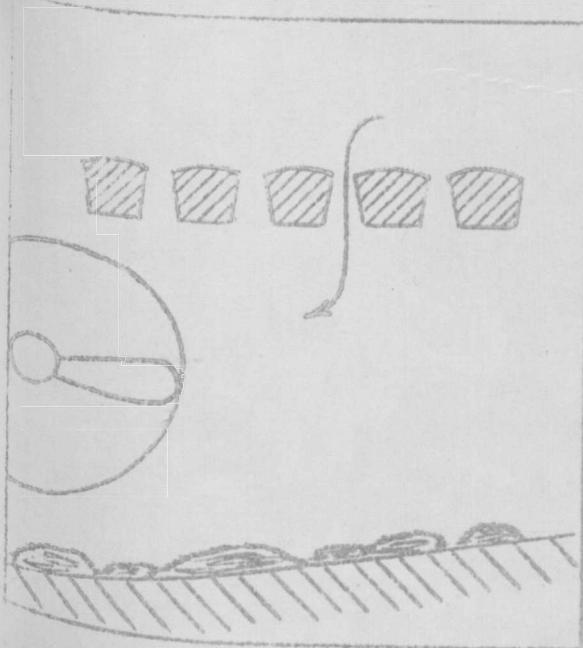
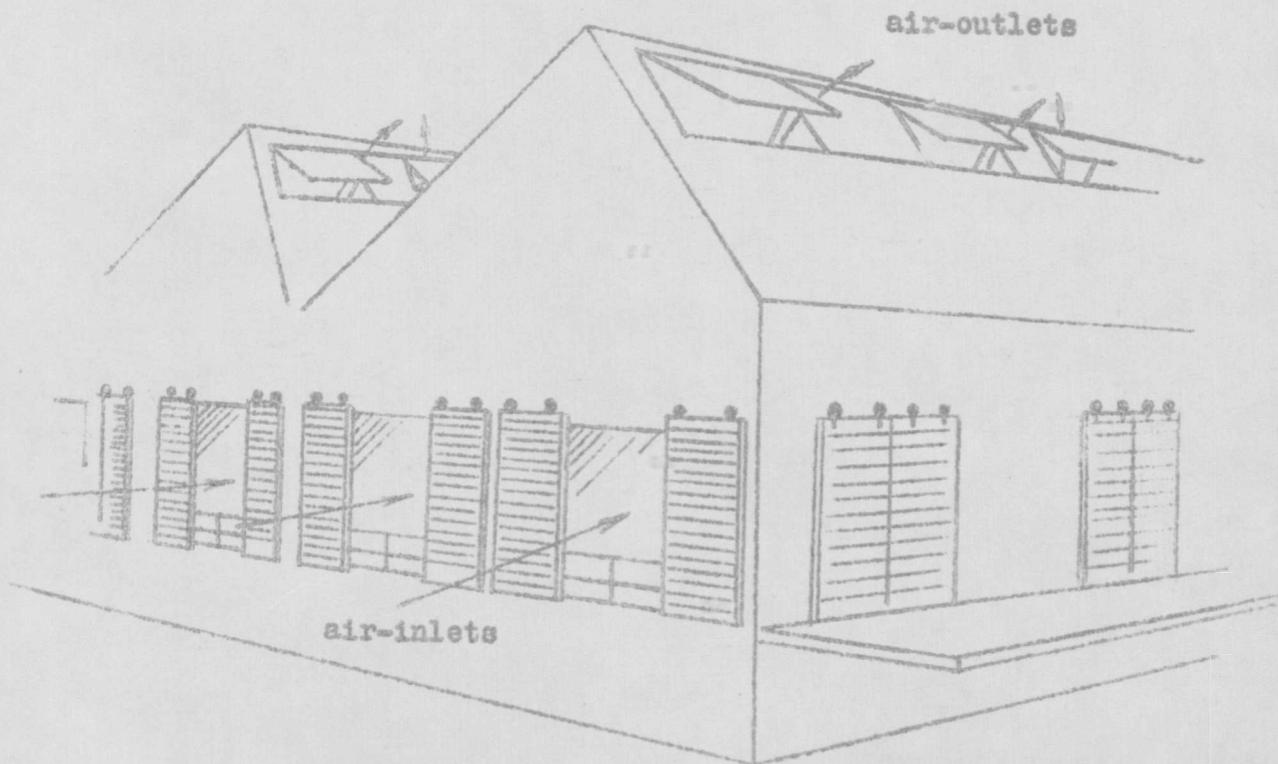


The switch for the ventilators is placed on the dashboard.

Figure 7. System for ventilation of pens.

The purpose of ventilation is for us to have the hot and humid air that gathers around the animals, removed and renewed by cooler and fresher air.

Admission of fresh air takes place through large sliding doors that may be pushed more or less according to the need for ventilation. The heated air is removed through adjustable windows in the ceiling.



Sketch showing the ventilation system in the pens with a slatted floor.

The air shift takes place when the air is distributed through the floor of bars; it is sucked by mechanical ventilators down in the low cellar.

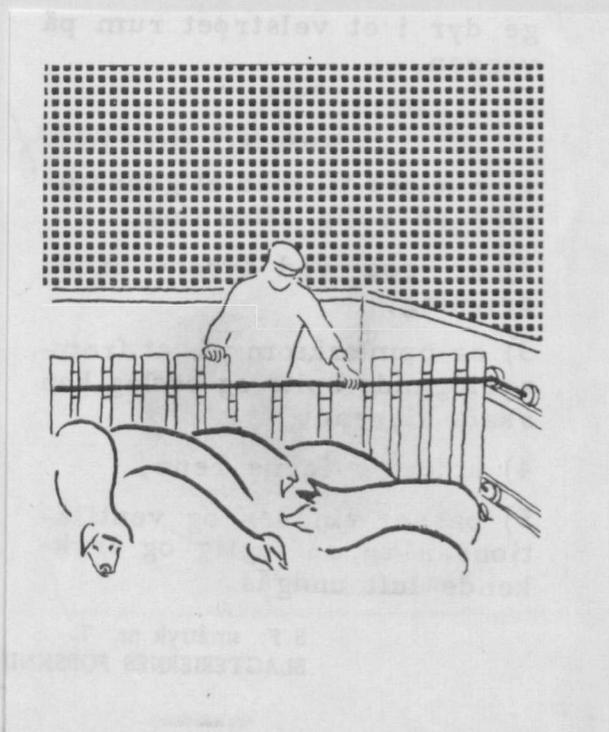
In cold weather there is a possibility to heat  $1/3$  of the air, that is blown into the pens, when it passes over a heating element.

Heating and ventilation are steared full-automatically.

Figure 8. Use of droving board.

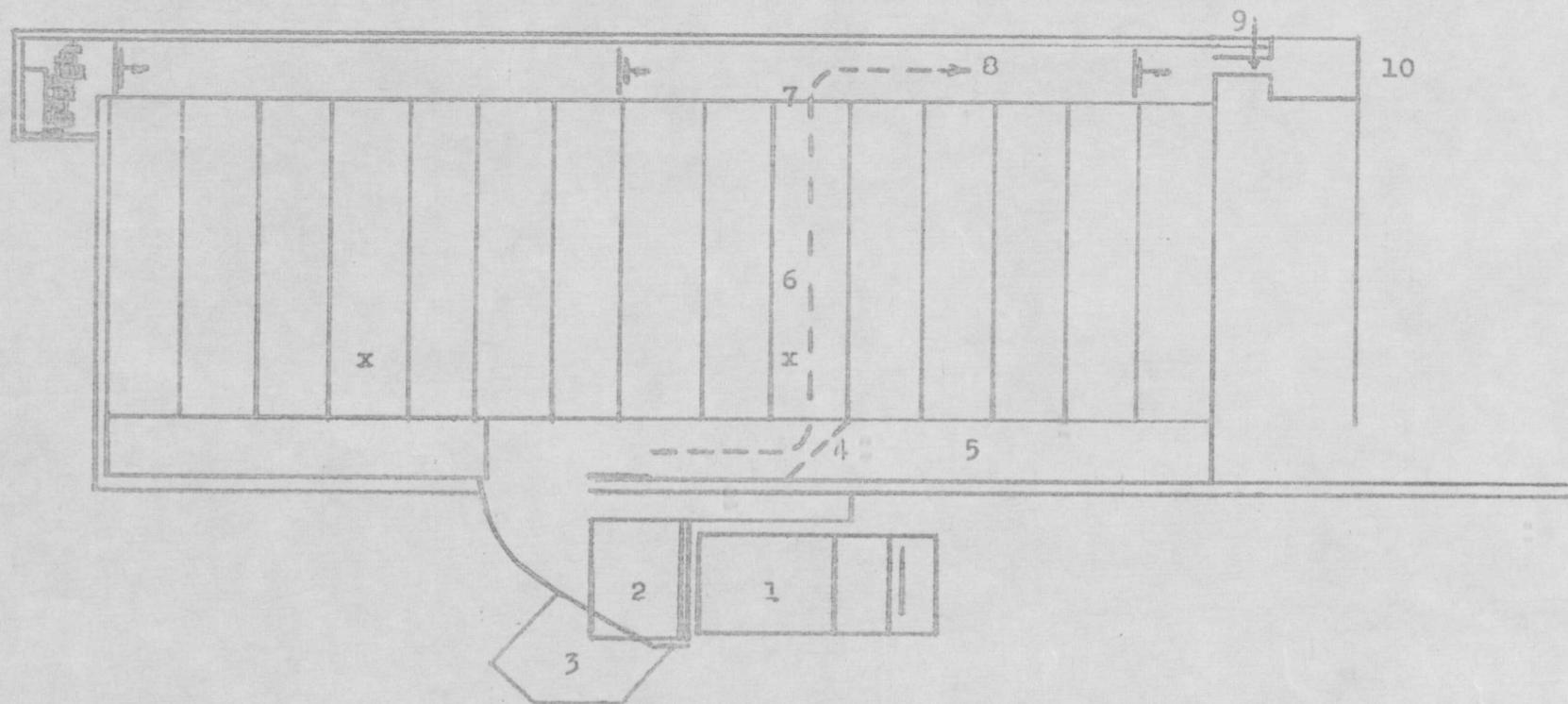


The group is kept together and holding the droving board prevents distribution of blows and kicks to possible obstinate animals.



The droving board on wheels pushes the pigs carefully from the pen towards the sticking pen.

Figure 9. Sketch of a lairage-house with manual and mechanical droving



1. Lorry    2. Ramp    3. Recipient-kiosk    4. Gate, which is used as droving-board, when the pen is to be emptied.  
5. Passage to pens    6. Pen    7. Hoist-gate    8. Passage to gate    9. Running-gate  
10. CO<sub>2</sub>-immobilizer

The arrow indicates the pigs' route from unloading via pens (2-3 hours' lairage) to stunning. The pens are emptied two by two - as x in two of the pens indicates.

Figure 10. Arrangement of sticking pen adapted to the pigs' natural behaviour.

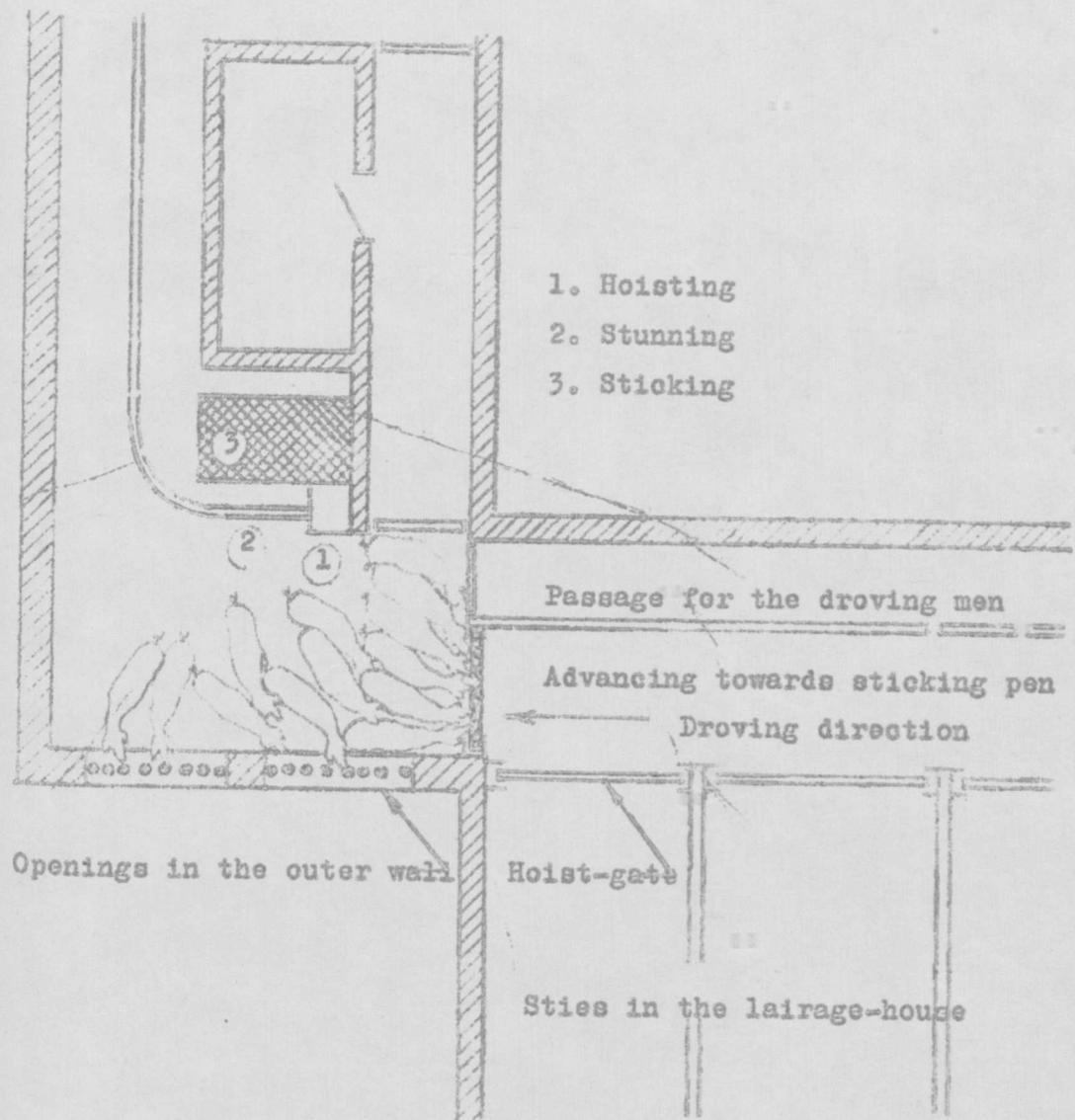
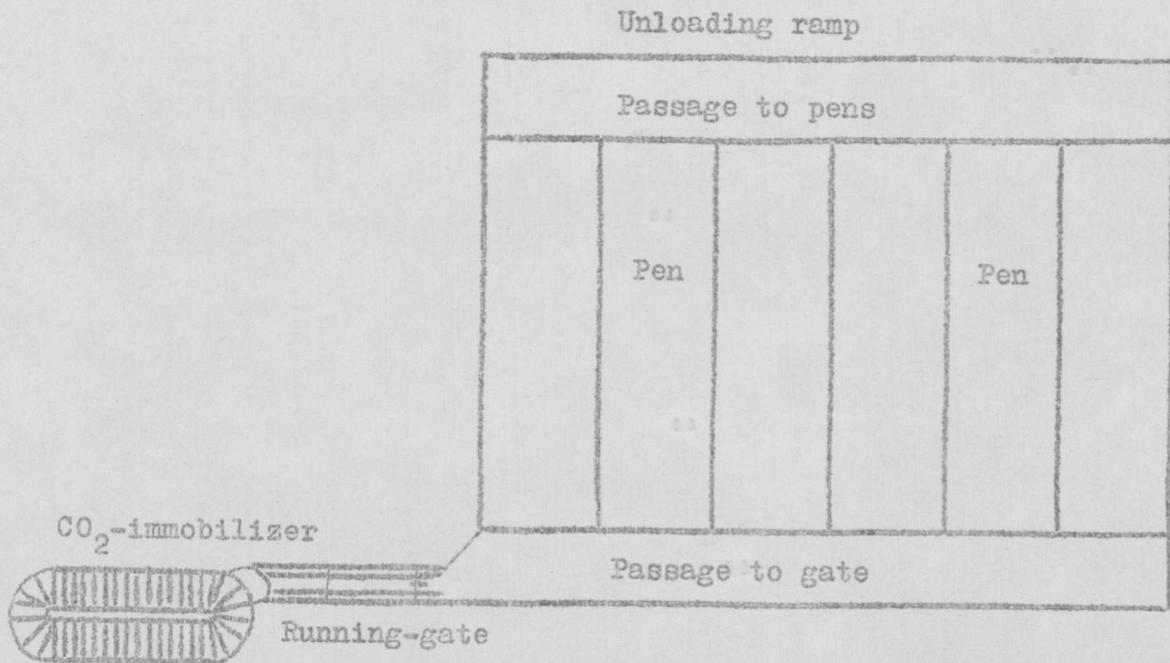
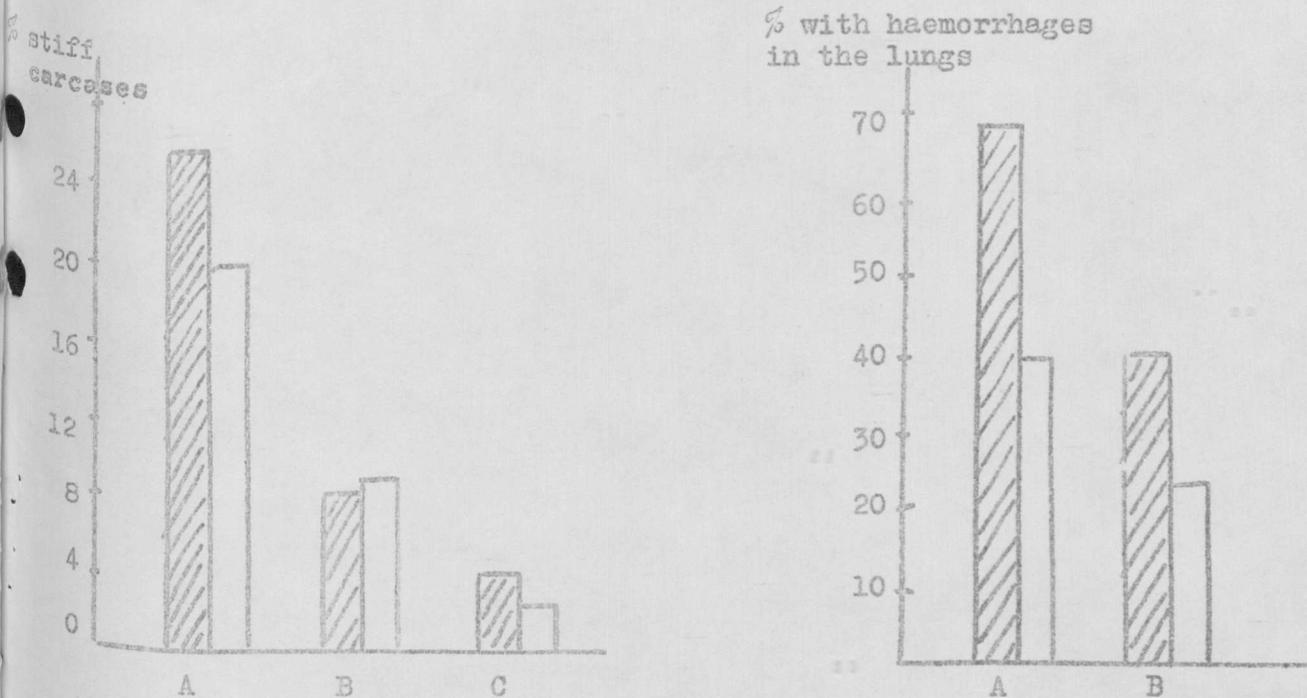


Figure 11. Sketch showing the mutual placing of droving passages, pens, and the CO<sub>2</sub>-immobilizer.



The pigs' route from unloading via pens to the CO<sub>2</sub>-immobilizer should be as uncomplicated as possible. Droving round corners or too frequent changes in direction should be avoided, and it is important that the pigs are led to the immobilizer continuously and at a steady pace.

Figure 12. The importance of the pigs' treatment prior to slaughter



There have been carried out experiments to investigate the influence of the handling method of pigs a short time before slaughter on the appearance of stiff carcasses (premature rigor mortis) and haemorrhages in the lungs. At the same time we have investigated if droving by the electric prod has bad influence on carcass quality.

The stiff carcasses is a phenomenon characterised by some of the slaughtered pigs a short time after slaughter going into rigor mortis and already after scalding strong tonic contraction of the muscles is apparent. Such carcasses are difficult to treat and such carcasses also have a more rapid pH fall than common and often it is connected with muscle degeneration or watery pork.

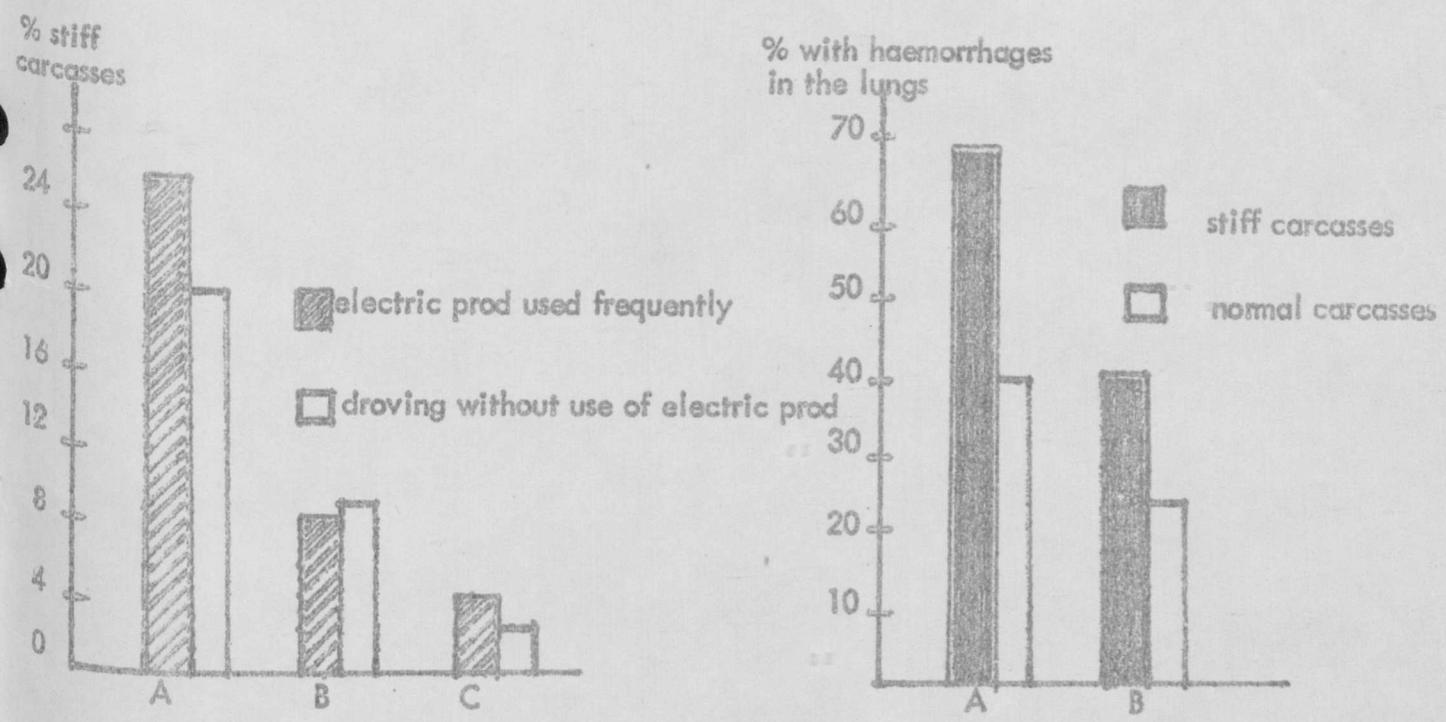
Some Observations of Pig Behaviour with Special  
Reference to Pre-Slaughter Treatment

By T. Wichmann Jørgensen, Agricultural Engineer  
The Danish Meat Research Institute, Roskilde

Erratum:

- p. 1, heading: Behavioural Characteristics, line 3  
For "territory" read "territorial"
- p. 2, heading: Group Formation, line 5  
For "markedly" read "marked"
- p. 4, heading: Sensory Abilities, line 2  
For "kinaesthetic and .....cues" read "the kinaesthetic sense"
- p. 4, heading: Sensory Abilities, line 3  
In "auditory cues" omit "cues"
- p. 5, line 3: For "be part of .....as to the work with".  
read "contribute to the work on ....."
- p. 5, line 5: The heading  
(For "Pig - Fights" read "Pigs - Fighting")
- p. 6, line 5: For "of 27.4 % compared to 27.0 % for ....."  
read "of 27.0 % compared to 27.4 % for ....."
- p. 7, line 28: For "runs" read "run"
- p. 9, line 11: The heading  
For "the treatment ....." read "the treatment....."
- Figure 2: Beneath Fig. 2 include "Patent has been applied for"
- Figure 7: Paragraph 2, line 3  
For "pushed more or less" read "opened or closed to a greater or lesser extent"
- Penultimate line:  
For "steared" read "controlled"
- Figure 12: Is completely replaced by the enclosed sheet.

Figure 12. The importance of the pigs'treatment prior to slaughter



- A: discontinuous droving to the CO<sub>2</sub> - immobilizer
- B: continuous droving to the CO<sub>2</sub> - immobilizer
- C: continuous droving of pigs, which have had a regular period of rest before the slaughtering

There have been carried out experiments to investigate the influence of the handling method of pigs a short time before slaughter on the appearance of stiff carcasses (premature rigor mortis) and haemorrhages in the lungs. At the same time we have investigated if droving by the electric prod has had influence of carcass quality.

The stiff carcasses is a phenomenon characterized by some of the slaughtered pigs a short time after slaughter going into rigor mortis and already after scalding strong tonic contraction of the muscles is apparent. Such carcasses also have a more rapid pH fall than common and often it is connected with muscle degeneration or watery pork.

Some Observations of Pig Behaviour with special  
Reference to Pre-Slaughter Treatment

by T. Wichmann Jørgensen, Agricultural Engineer

The Danish Meat Research Institute, Roskilde, Denmark

Summary

In order to reduce the consequences of stress resulting from the transport of pigs and the lairage of pigs at bacon-factory it is important that technical developments which aim at a rational preslaughter working method are adapted to the fundamental behaviour of the pig. Some examples of preslaughter treatment based on this idea are given in this paper.

It is explained how the aggressive nature of pigs is eliminated by means of a special halter with a rubber bit which is put into the mouth of the pigs. (1)  
The bit prevents effectively the pigs from biting one another and it draws the animals' attention from the other animals to the bit of the halter. The halter has a marked sedative effect on the pig, which is reflected by improved meat quality.

For the loading of pigs a hydraulic pig-lift is recommended. In contrast to manual loading it is by means of the piglift unnecessary to handle the animal during loading. Such manual handling excites and exposes the animal to strain. (2)

The pigs social instinct lead them together in groups. When using a droving-board during the unloading and droving of pigs, the group is kept together (3)  
and the more cautious and nervous animals are guided forward by the more curious and bolder animals in the herd.

By making use of the behaviour patterns of the pigs a more satisfactory procedure in the handling of pigs in connection with the stunning and sticking pen is obtained.

It should be emphasized that our approach to the problems of correct pre-slaughter treatment of pigs and the technical developments which we have made in the field of handling, transporting, and slaughtering is only one out of several possible approaches. However, previous studies have too often neglected the fundamental behaviour of the pig, and we hope that our results may make some contribution towards a better understanding of what principles are involved and how these may be used to modify existing practices.

(c) Tumlutus