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THE ELECTRICAL STUNNING OF PIGS OBSERVATIONS, CURRENT FLOW, STUNNING GRADE

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SUMMARY

Some stunning practices give reason to complaints in terms of the animal protection law.
An inquiry in various Swiss sloughterhouses showed that a multiple variation of stunning equipment was applied as well as large differencies in the stunning execution. In 11 of the visited sloughterhouses deficiencies in the construction of the leading tracks were noticed as well in the condition of the stunning material., in the stunning practices and in the time between current application and stichiry. A certain lack of precision and a misuse of stunning clamps were observed. The presentation gives information to the improvement of the present situation. Various parameters have shown the differencies between the stunning in a fixed position and in stunning railing. Further parameters were the current flow in dependence of the current voltage of 75, 220 and 260 volts.
In order to mesure the depth of the stunning an incision of the skin on the head of the animal was performed. This proved to be the only method to measure the sensoric response of a sufficient stunning grade. A voltage of 75V was proveb to be unsufficient; current voltages of 220, 260 and 320V have proven to be sufficient in 90% according to the animal law.

INTRODUCTION

Art.2/3 of the animal law: nobody is allowed to cause pain or harm or anxiety to an animal unjustified.
Art. 20/1 of the animal law: it is prohibited to slaughter mammals without stunning before stiching.
Art. 21/1 of the animal law: the stunning has to have his effect immediately; a delay must not cause pain.
This legal base seems to be clear.
The complaints received by the Federal Veterinary Office show that in the daily practice these legal regulations are often not observed. The complaints mainly are: hogs are needlessly chased, the electrodes are being aplied several times in short intervals, the fixation at stunning is unsufficient, and the time up to bleeding is too long.
This obvious difference between the legal requirement on the reality gave reason to prove the electrical stunning of hogs one more time on its reliability according to the animal law
The aim of this presentation was to prove the stunning practices in various sloughterhouses of our country regarding the requirements of the animal law. In addition a parameter should be found to set a sufficient stunning grade.

MATERIAL AND METHODS

1. Inquiry to the stunning methods: A questionaire was sent to 75 abattoirs. It was asked: brand of stunning system, the used voltage (70,180,220,300V,others), the most used position of the electrodes (bitemporal,neck-to-neck,ear-to-ear,eye-ear,others), the application time of current, if the animals are in a fixe position or not, and if the animals are being showered before stunning.
2. Sequencies of stunning: the stunning sequence was observed in 11 companies. The observations were articulated as follows: voltage, fonctionning of system, type and condition of electrodes, waiting galley, chasing track, type of chasing to the stunning station, position of electrodes, stunning time, time up to stiching, observations on the stunned animal and general judgment.
3. Measurement of intensity of current (Ampères) during stunning:
a.) Influence of the electrodes and the wetness of skin: mesurement between the clamp ends with Ampèremeter BBC Metrawatt M2030. First mesurement on dry animals, second during usual stunning and third with new electrodes, all 3 mesurements at 220V stunning voltage.
b.) Current flow: stunning clamp from the Hedro Comp., Zürich. A regulating transformer was connected to the system to change the stunning voltage. A connected recorder (Servogor S RE541, Goerz Comp., paper speed 120mm/min) enabled the registration of current flow in intervalls of 0.5, 1.0, 2.0, 3.0, ... 20,0 sec. These showed us eventual interruptions of the stunning and the duration of stunning.
4. Defining of the stunning grade: It was tried to prove an insufficient stunning. It was proven on: pupillary reflex, corneal reflex, reaction to pinching between the clows, reaction to the application of heat on the margo coronalis, reaction on a incision on the skin of the head. These parameters were tested at 20-30 seconds after the stunning at the stiching place at stunning voltages of 75,220,260 and 320 volts.

RESULTS AND DISCUSSION

1. Inquiry to stunning methods: From the 64 questionaires received the results were: 10 different stunning devices were applied, partially with automatic current interuptions after 3-4 seconds, with a switch for voltage release, voltage through closed circuit on animal, various lengh of clamps, the width of clamp, and various types of electrodes. The most used voltage is 220V (44 companies), but also voltages of 70,180,230,250,280,300 and 380 are being applied. In most companies various electrode positions are being combined. In 45 companies the animals are being showered before stunning, in 5 companies partially, and in 10 companies the animals are stunned dry. In 56 companies the animals are being stunned without being immobilized. The stunning times vary greatly (at 220 volt from 2-3 sec up to 60 sec).
2. Observations during stunning: the stunnings ebsued betwen 75 and 700 volt. In the visited 11 companies 8 different systems were applied. There are one hand clamps, two handed clamps with and without release button or automatic voltage interception, and fully automatic systems. The systems are fitted out with a fixation or with a conveyor system, or the hogs are being stunned in a stunning railing. The types of electrodes are manifold. Almost all of them are quickly worn-out. Blunt electrodes make it more difficult to hold securely the animal. Very often the hog escape loudly screeming the clamp after a short current pulse. Sharpe electrodes allow a safe holding of the animals and improve current flow. In 4 companies the waiting railings are equipped with showers for sedation. In some companies the animals are being wetted in the stunning emplacement. Due to time shortage this mostly happens with little care and briefly. In all companies there are obstacles in the chasing tracks like narrowings, narrow turns, edges in which the animals are jammed in. The more animals per hour are stunned, the more the importance of the obstacles gets. Partially these obstacles are conditioned by using the same chasing track also for beef. The handling of the animals also depends on the set up of the chasing track, the number of animals per hour, the group sizes and, last but not least, the skill of the drover to lead the animals. If the animals are jammed in a botle neck, the electrical driving aid being used unsystematically and sometimes unreasonnably (driving of the last animals). There are drovers who hardly use drive aids, and others who seem not to do without. With exeption of one company the electrodes are always applied on the head. The stunning procedure is being interupted through the fall of the animal. The wrong application of the electrodes was observed in all companies with two exeptions. In stunning places the electrodes are being applied on any part of the body, if the animal cannot be reached easely. The clamp is also being used to frighten away bothersome animals. By automatic stunning devices , the animals can escape the electrodes, or stunning is not sufficiently released. It seems that the demanded number of killed hogs per hour is more important than the applied voltage at the stunning place. When high voltage is used the applied time is 0.5 sec with the automatic systems and 30 sec in the stunning places. The time elapsed between the stunning and the stiching depends on the distance between the stunning place and the stiching station, on the elevator speed as well as on the coordination of the stunning operator and sticher. It can be very often observed that the sticher leaves his place while the work goes on in the stunning place. The stunned animals form a back log. Intervalls up to one minute and mor can occure. All animals show: a extention cramp during the current flow. The animal languish immediately as soon as the current flow stops. The start of the tonic-clonic cramp phase occurs at various spaces of time. There are abattoirs where these phases of cramps does not occure. Cramps disturb the work at the elevator and at the stiching place and are therefore not desired. The quality of the stunning of hogs in the stunning places depends mainly on the operators as well as on the condition of the material, on the reaction of the animals as well on the demanded hourly output. The reaction of the animals largely depends

on the treatment before the stunning. Unsuited driving tracks, unreasonable application of driving aids and too large groups of animals can strongly excite the animals. In the automatic systems the driving to the restrainer is an unsolved problem. The animals hanging in the conveyor systems fighting and partially cyanotic indicate that this stunning method does not correspond with our laws. Faulty stunnings in the automates can also not be excluded.

3. Ampère mesurements:

a.) Influence of the electrodes and the wetting of the animals: the indicated values demonstrate clearly that the effective stunning current depends not only on the used voltage to fulfill the demands of animal protection. It is possible that the current touchs only the wet surface of the skin and therefore does not reach the brain. With new electrodes and wet animals it is possible to reach the demanded Hoenderken minimum voltage even with 220 volts, whereas the tim of the build-up of that voltage is not taken i consideration.

Messung	n	$\bar{x}$ Ampère	s
1	50	0,668	0,256
2	50	1,036	0,298
3	100	1.14	0,28

Table 1: Influenced current flow by wetting of the animals , as well by the use of new electrodes.
1 = dry animals 2 = showered 3 = showered and new electrodes

b.) diagram and evaluation of the current flow: 75 volt stunning voltage, stunning in fixed position, 200 mesurements, reachable ampèreage: 0,6455 ± 0,1370 Ampère. The curves show uniformity of stunning when fixation is applied. The animals can only be chased to the fixation unit by using a current pulse. The corresponding pikes on the curves are marked with an asterisk *).

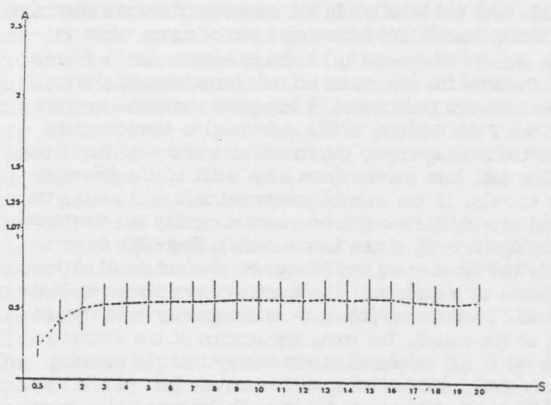

Fig. I: Average ampèreage with standard deviation at 75 V stunning voltage

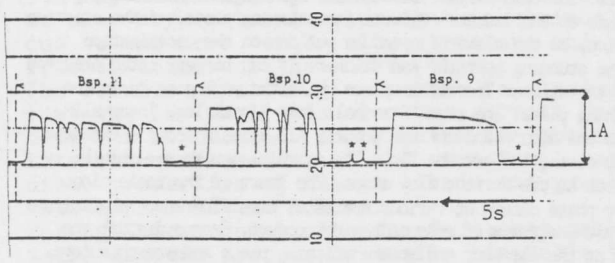

Fig. II: Examples of current flow curves

220V stunning voltage, automatic interuption of voltage after 4 seconds, animals free in a stunning place, 500 mesurements, maximal ampèreage 1,4976 ± 0,3250 Ampire.

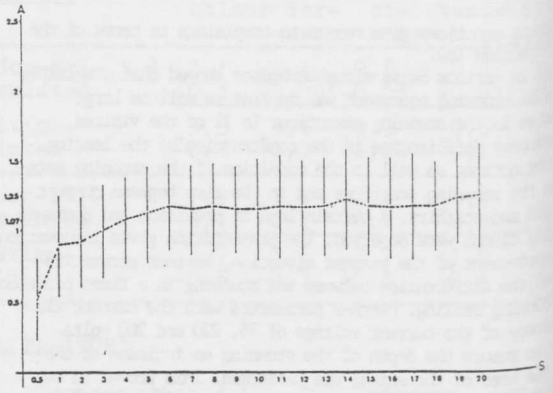

Fig. III: Average ampèreage with standard deviation at 220V stunning voltage.

c.) Discussion:

The stunning in a restrainer with a voltage of 75V, electrodes applied bitemporally eye-ear, results in a ampèerage of maximum 0.65 ± 0,14 Ampère. The advantage of stunning in a fixation unit is shown in the even current flow (examples) or in the fact that there are only few stunnings interrupted. Therefore it is recommendable that stunning is performed under fixation. At higher slaughter frequencies these advantages are outwaying the disadvantages of driving the animals to and into the fixation unit (examples *). According to the available litterature (Hoenderkan 1987) the 75V tension has to be regarded as insufficient.

The stunning with 220V in a stunning place reaches in the first 20 seconds an ampèreage 1 Ampère in 99,2% of the cases. This stunning procedure lays within the range of the 260V stunning, that means that the one ampère level is reached with 220V later than with 260V. Therfore the time factor can be eliminated since there is no pain during current flow (according to the available litterature [EWG-Kommission 1977; Mickwitz 1982]). At 260V stunning voltage the demanded ampèreage is only reached after 9 seconds (1,07A) respectively 19 seconds (1,25A). If these values are taken as minimum requirements, at least 19 seconds stunning time have to be demanded at 260V stunning voltage. Nevertheless it is questionable wether this citeria is of general value (see results objectivity of stunning grade).

At stunning in stunning places the sequence of stunning is often interrupted. This can result due to various methods or for technical reasons, like automatic voltage shut off, or misfunctions of the release button on the clamp. The two last mentioned prints are required for the safety of the operator but are hindering the current flow and diminuish the stunning success.

Spannung	n	Ampère-wert nach 1 Sekunde	≥ 1,0A erreicht () nach 1S	≥ 1,5A erreicht () nach 1S	≥ 2,0A erreicht () nach 1S	Max.-wert
75V	200	0,43 ± 0,15	1%	-	-	0,65 ± 0,1
220V	500	0,9 ± 0,36	99,2% (47,8%)	56,8% (7,9%)	9,2% (1,4%)	1,5 ± 0,3
260V	500	1,17 ± 0,48	99,8% (64,4%)	89,8% (25,8%)	50,8% (7,2%)	1,95 ± 0,4

Table II: Comparison of current flow at three tested stunning voltages

4. Objective value of stunning grade:

A serie of preliminary tests has proven that the corneal reflex and the reaction of certain extremities (like the pinching between the clows and heat application at the margo coronalis) can not be enterpreted in many cases. In comparison to this the skin cut

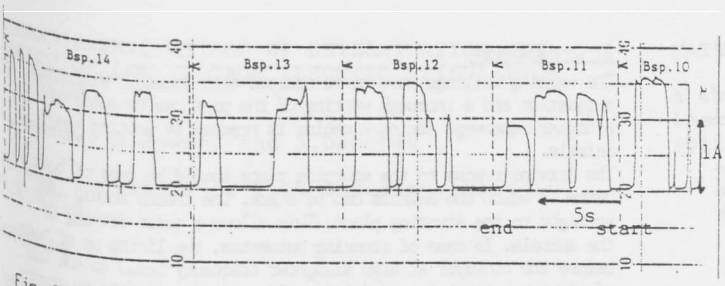

Fig. IV: Examples of current flow 220V voltage

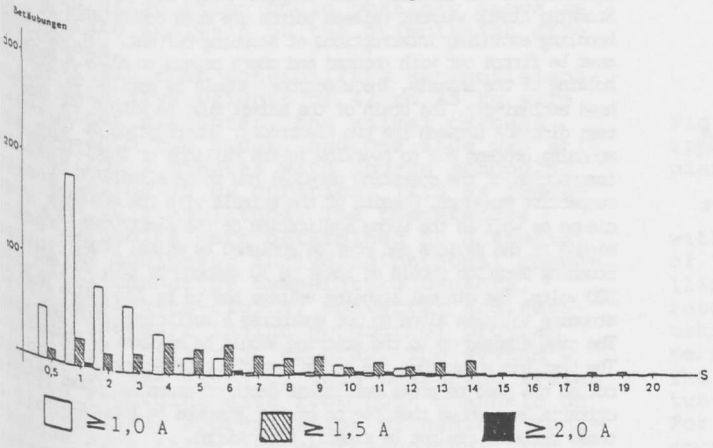

Fig. V: Moment of reaching a certain ampèreage at 220V voltage

260V stunning voltage, automatic interruption after 4 seconds, animals free in a stunning place, 500 mesurements, ampèreage 1,9539 ± 0,4024 Ampère.

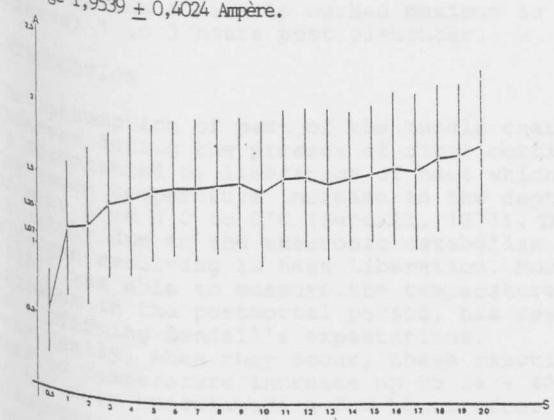

Fig. VI: Average ampèerage with standard deviation at 260V stunning voltage

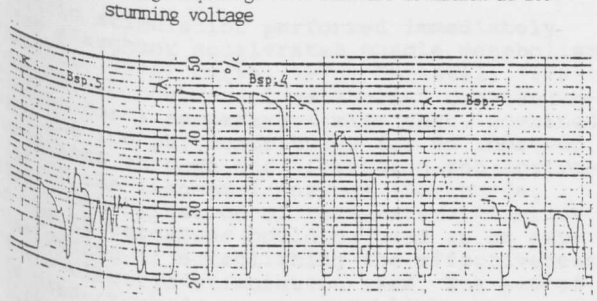

Fig. VII: Examples of current flow curves , 260V voltage

on the head shows a positive reaction in any case, which strongly differs from eventual cramps. It can be definitely interpreted.
A positive reaction consists in a movement of the head or in an eventual oral sign. A slighter reaction can be noticed if an extremity is held on a muscle reaction can be felt.
Our results show that high voltages alone do not guarantee sufficient stunning, and that by voltages over 200 volts the influence of stunning method is of more importance than the voltage itself.

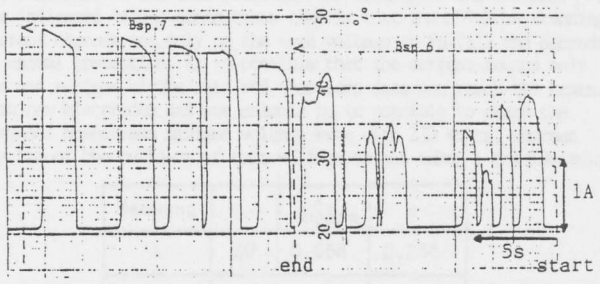

Fig. VIII: Examples of current flow curves, 260V voltage

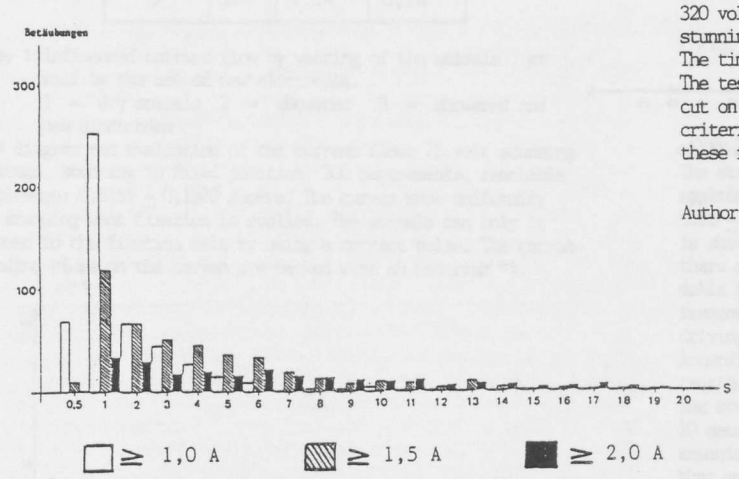

Fig. IX: Moment of reaching a certain ampèreage at 260V voltage

Betäubungs-spannung	Untersuchungs-tag	n	Hautschnitt +	Hautschnitt %	Pupillarreflex
75V	1	200	80	40	1 Fall positiv
220	1	100	10	10	negativ
	2	125	12	9,6	negativ
	3	150	20	13,3	negativ
	4	125	13	10,4	negativ
	total	500	55	10,4	negativ
260	1	175	28	16	negativ
	2	125	12	9,6	negativ
	3	200	12	6	negativ
	total	500	52	10,4	negativ
320	1	141	14	9,9	negativ
	2	165	23	13,9	negativ
	3	194	29	14,9	negativ
	total	500	66	13,2	negativ

Table III: Results of the observed stunning depth

5. Conclusions:

The waiting railings have to be equiped with showers. With this a sedation and a thorough wetting of the pigs can be achieved. A higher ampèreage during stunning is reached by wetting the animals.
The driving tracks to the stunning place should be free of bottle necks in which the animals can be stuck. The tracks should lead straight to the stunning place. This allows a quiet driving of the animals. In case of stunning automates, the lining up of hogs before the conveyor at high slaughter frequency leads to the use of massive application of driving aids and consequently to strong agitation of the animals. These methods should not be allowed.
Stunning clamps without release button are more comfortable in handling excluding interruptions of stunning current. The electrode must be fitted out with pointed and sharp prongs to allow a secure holding of the animals. The electrodes should be applied on the head exclusively. The brain of the animal must be within the shortest distance between the two electrodes. Interruption of the stunning process due to overflow in the railings or insufficient instruction of the operating personal has to be eliminated by respective measures. Chasing of the animals with the stunning clamps as well as the wrong application of the electrodes is a misuse of the devices and must be punished as animal cruelty.
Stunning duration should at least be 10 seconds by 220, 260 and 320 volts. The minimal stunning voltage has to be 220 volts. High stunning voltages alone do not guarantee a sufficient stunning. The time elapsed up to the stiching should be maximum 30 seconds. The test has shown that the safest symptom of reaction is a skin cut on the head to prove sufficient depth of stunning. Other reflex criteria have shown that due to cramps provoked by the current these reflexes can not be clearly interpreted.

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