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## AN IMMOBILISATION UNIT FOR USE DURING THE HALAL SLAUGHTER OF CATTLE

BY

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SUMMARY

The use of an immobilisation unit for the humane processing of Halal slaughtered cattle which have received an electrical stun is discussed in this paper, as is the description of an immobilisation unit that should conform to Australian electrical standards.

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CONTENTS

## INTRODUCTION

At present, an acceptable method for the Halal slaughter of sheep and lambs is available. There are still however considerable problems associated with the Halal slaughter of cattle. The use of percussion ('mushroom head') stunners is acceptable to the Islamic authorities only if the animal is not physically injured or killed by the stun. Unfortunately it is difficult to humanely stun cattle with this equipment without producing a proportion of fractured skulls. Bleeding from the nose frequently occurs with this method of stunning and is an indication that injury has occurred. If the power of the percussion stun is reduced to meet Islamic ritual requirements, then the effectiveness and hence the humaneness of the stun may come under question.

An approved electrical stun from which cattle will recover is now available and satisfies Islamic requirements and is humane. It is necessary to cut the blood vessels in the animal's neck while it is insensible due to the stun so that the animal then bleeds to death without suffering pain. While it is generally accepted that the stun itself is humane, there are doubts as to whether the complete stun/bleeding process is humane because of the likelihood of the animal regaining sensibility before succumbing to the effects of exsanguination. It has been suggested (Gilbert, 1984) that a further application of an electrical current to immobilise the animal and extend the period of insensibility is necessary to ensure that the total process is humane.

After the animal has been electrically stunned it experiences a grand mal epileptic seizure. During the first 12 seconds from the beginning of the 4 second electrical stun, an intense muscle tetany is induced and respiration ceases. During the next 20-30 seconds the muscle tetany eases and the animal makes paddling or kicking movements which sometimes become violent. Immobilisation is applied to the animal before the onset of the paddling movements to maintain muscle tetany and the inhibition of respiration, extending the period of insensibility and inhibiting the paddling or kicking movements.

It is for the following reasons that an immobilisation unit was developed for the Halal slaughter of cattle in Australia:

1) to ensure the animal is slaughtered humanely;

2) to ensure safety to slaughter personnel by control of animal movements produced by the epileptic seizure;

3) presently available immobilisation units do not satisfy Australian electrial standards.

A square wave pulse with a peak voltage of 45V derived from a 32Vrms sine wave is the highest voltage allowable by the Australian electrical authorities which can be classed as 'extra low voltage' and therefore subject to minimum protection requirements.

The output characteristics of the unit described herein are as follows:-

- Pulse peak voltage (square wave) 45 Volts
- Pulse duration 5 milliseconds
- Duration between pulses 65 milliseconds
- Pulse current 300-350 milliamps

The above mentioned current is applied using insertion electrodes (Fig. 5) at either end of the animal.

The output of the unit is floating (isolated from earth potential). This is to minimise the chance of an operator receiving an electrical shock from earth leakage. A transformer is also only failsafe when it is completely isolated from earth potential.

It is important to note that the immobilisation unit was designed to be used after the electrical stunning of cattle for Halal slaughter, and should never be used on a live, conscious animal.

DESCRIPTION

A complete specifications listing of all componentry is given in Table 1.

Figure 1 is the cicuit diagram of the power supply. The secondary winding of the transformer T1 supplies 32Vrms which is rectified by the bridge rectifier D1 and smoothed by the capacitor C1 to produe a nominal dc voltage of 45V.

Variable resistor RV1 is used to select a voltage suitable for supplying the electronic control and pulse configuration circuitry. This voltage is regulated to 12V by the voltage regulator IC1.

The circuit in Figure 2 governs the period of time the immobilisation unit is activated.

The momentary depression of switch S1 produces a negative going pulse which is applied to pin 2 of IC2. This pulse is required for the timing period to commence. As IC2 is configured as a monostable timer, the timing period will not restart until switch S1 is again depressed. When the timer is activated, pin 3 of IC2 goes 'high'. It return to a 'low' state at the end of the timing period.

The timing period is governed by resistor RV2 and capacitor C6.

The formula for the timing period is:-

$$T = R \times C$$

where the timing period (T) is measured in seconds;
resistance (R) is measured in Ohms;
capacitance (C) is measured in Farads.

TABLE 1: COMPONENT LISTING

| | |
|---|---|
| **INTEGRATED CIRCUITS** | |
| IC1 | LM 7812 |
| IC2 | ICM 7555 |
| IC3 | ICM 7555 |
| **SEMICONDUCTORS** | |
| D 1 | Bridge rectifier - 15 A, 400 V |
| D 2 | 1N 914 |
| Q 1 | PN 2907 |
| Q 2 | MJE 340 |
| Q 3 | MJE 340 |
| Q 4 | BUX 80 |
| **CAPACITORS (CERAMIC UNLESS SPECIFIED)** | |
| C 1 | 4700 uF Electrolytic |
| C 2 | 0.47 uF Tag |
| C 3 | 0.1 uF |
| C 4 | 0.01 uF |
| C 5 | 0.01 uF |
| C 6 | 47 uF Electrolytic |
| C 7 | 0.01 uF |
| C 8 | 0.1 uF |
| C 9 | 0.01 uF |
| C10 | 0.1 uF |
| **RESISTORS (½ WATT UNLESS SPECIFIED)** | |
| R 1 | 1M |
| R 2 | 100k |
| R 3 | 1k |
| R 4 | 500k |
| R 5 | 150k |
| R 6 | 100k |
| R 7 | 2k2 |
| R 8 | 10k |
| R 9 | 1k 10 Watt |
| R10 | 1M |
| RV 1 | 0-20k |
| RV 2 | 0-1M |
| RV 3 | 0-200k |
| RV 4 | 0-100k |

**TRANSFORMERS**

Gayrad 240 - 32 Vac, centre tapped, 2 A secondary winding, isolated from earth.

| | |
|---|---|
| **SWITCHES** | |
| S 1 | Single pole, momentary on/off |

Figure 3 is a diagram of the circuit which configures the pulse timing parameters.

Again, the formula 'T = R x C' is used to determine the pulse width and duration between pulses. The pulse width is governed by the capacitor C8 and the total resistance of R4 and RV3. The duration between pulses is governed by the capacitor C10 and the total resistance of R5 and RV4.

Pin 3 of IC2 (Fig. 2) is connected to pin 4 of IC3. When pin 4 of IC3 goes 'high', the timer is activated. As this circuit is configured as an astable timer, it will continue to output pulses from pin 3 of IC3 until pin 4 of IC3 returns to a 'low' state.

Pin 3 of IC3 (Fig. 3) is connected to point C in Figure 4. Figure 4 is a circuit of the output amplifier stage which amplifies the pulses produced by the pulse configuration circuit to a peak voltage level of 45V.

## ELECTRODES

Two eletrodes are connected to the output of the immobilisation unit. The present designs of these electrodes are shown in Figure 5. These eletrodes are placed at either end of the animal; one is inserted in the rectum and the other in one of the nostrils (Fig. 6). This is necessary to achieve a minimum resistance connection with the animal to ensure maximum current flow through the animal using the maximum allowable peak voltage of 45V. Although easier to use, external clip electrodes on the anus and nostril will significantly increase the contact resistance and therefore reduce the current flow to an ineffective level when using a pulse peak voltage of 45V.

## FUTURE RESEARCH AND DEVELOPMENT

There are still some limitations associated with the use of the immobilisation unit.

At present the immobilisation unit is activated for a period of 35 seconds which slows the animal production rate to a point which is uneconomical in some works. Research is being carried out to decrease the on-time of the unit and to determine if the unit can be used at a different stage in the slaughter process.

One additional problem is that due to the length of the present nasal electrode, the nose sometimes bleeds. Research is being carried out into the redesign of this electrode to overcome this problem.

## CONCLUSION

An approved electrical stun may be used in the Halal slaughter of cattle in Australia to overcome the problems associated with percussion stunners. The use of an electrical stun in the Halal slaughter process can be made more humane by the introduction of an approved supplementary procedure to extend the period of insensibility after the stun until succumbing to the effects of exsanguination. The use of the immobilisation

unit as described will meet this requirement. The immobilising current also produces a continuous muscle tetany which results in a much safer operating enviornment for the slaughter personnel.

The immobilsation unit should meet the requirements of the Australian electrical authorities, however, any company or person undertaking to construct and use the described immobilisation unit should first have the unit inspected and approved for use by the local electrical authority.

ACKNOWLEDGEMENTS

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FIGURE 1 - POWER SUPPLY CIRCUIT

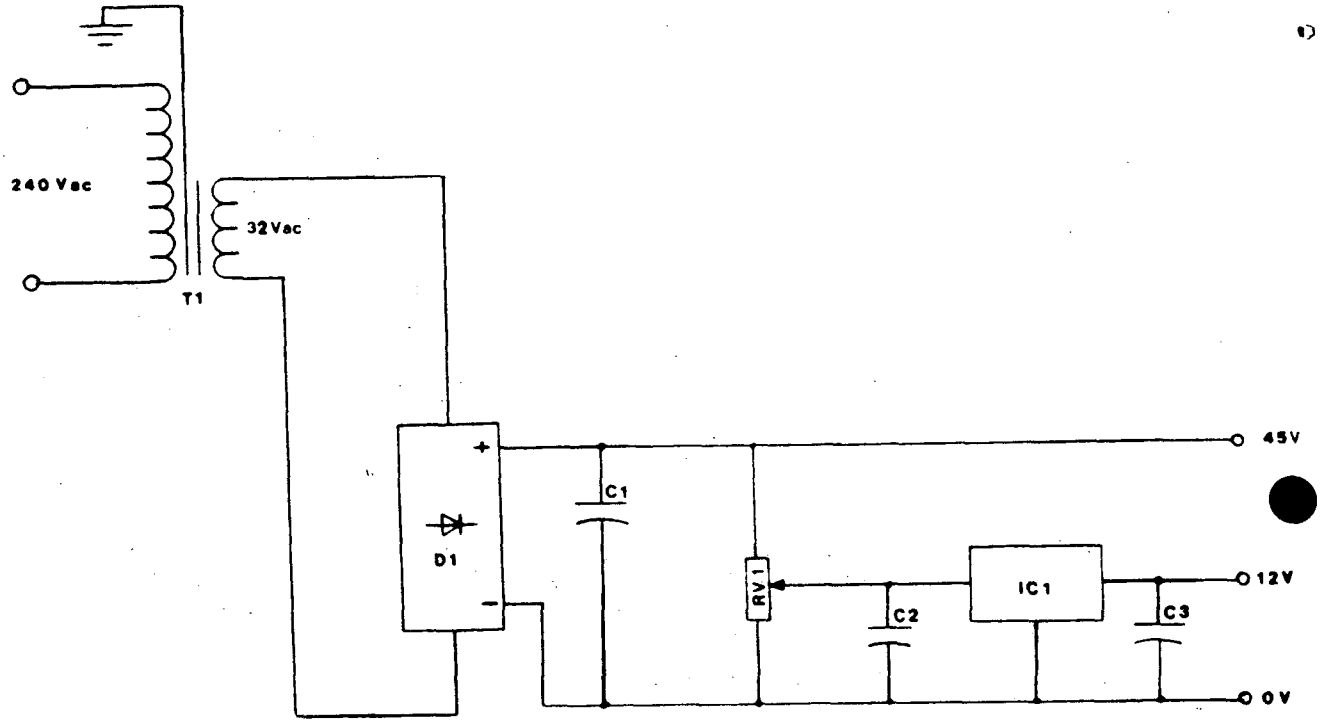



FIGURE 2 - TIMING CIRCUIT

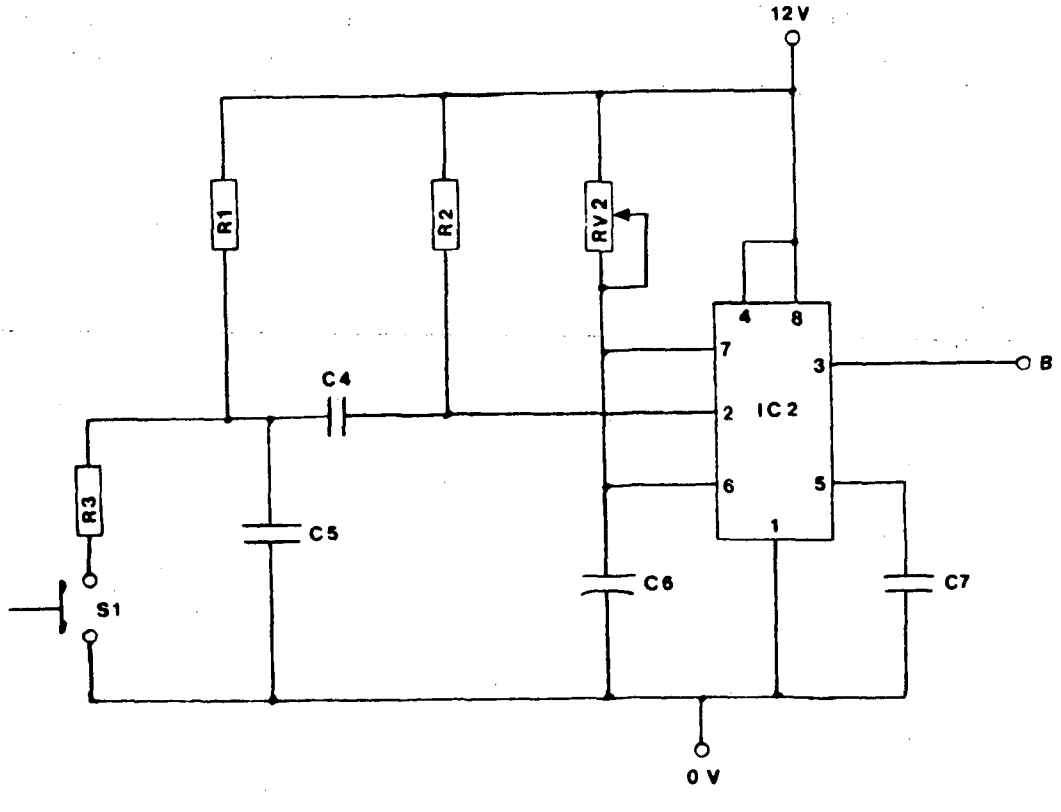


FIGURE 3 - PULSE CONFIGURATION CIRCUIT

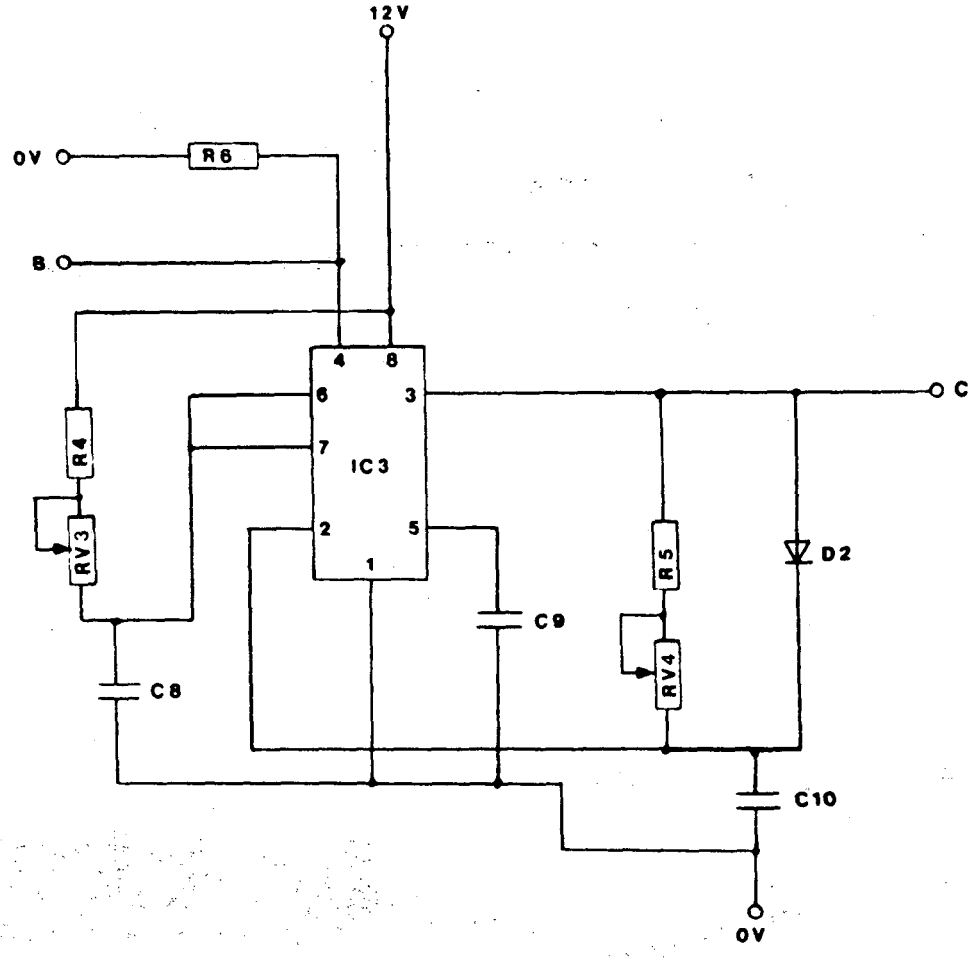
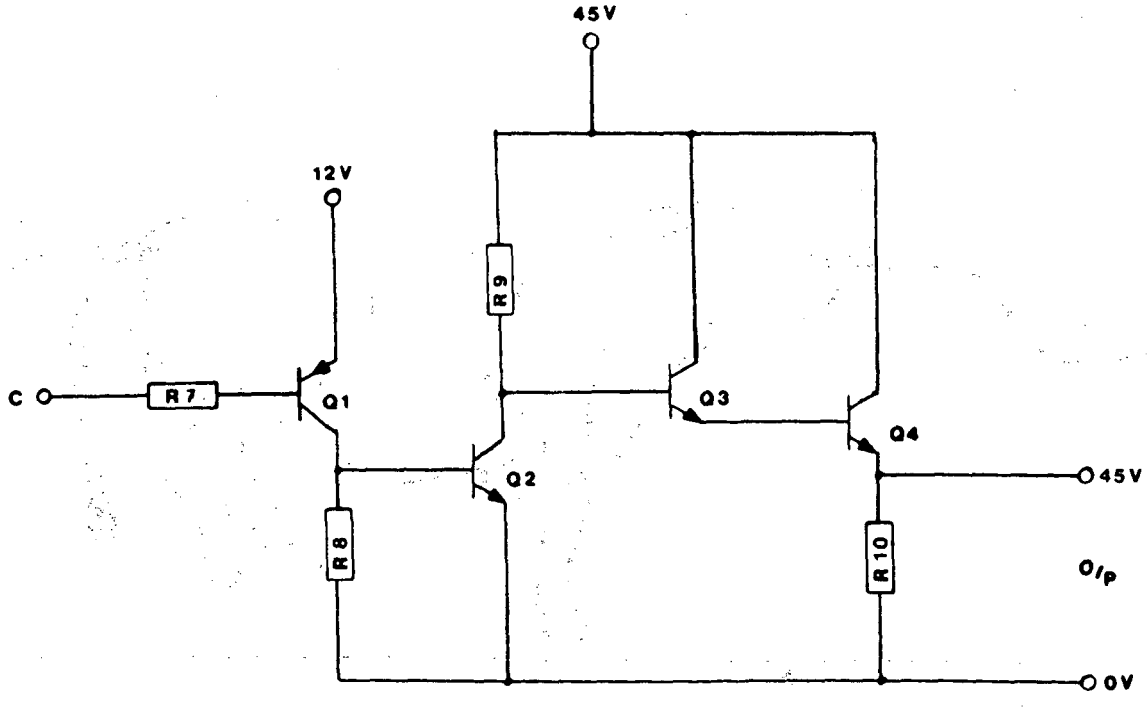
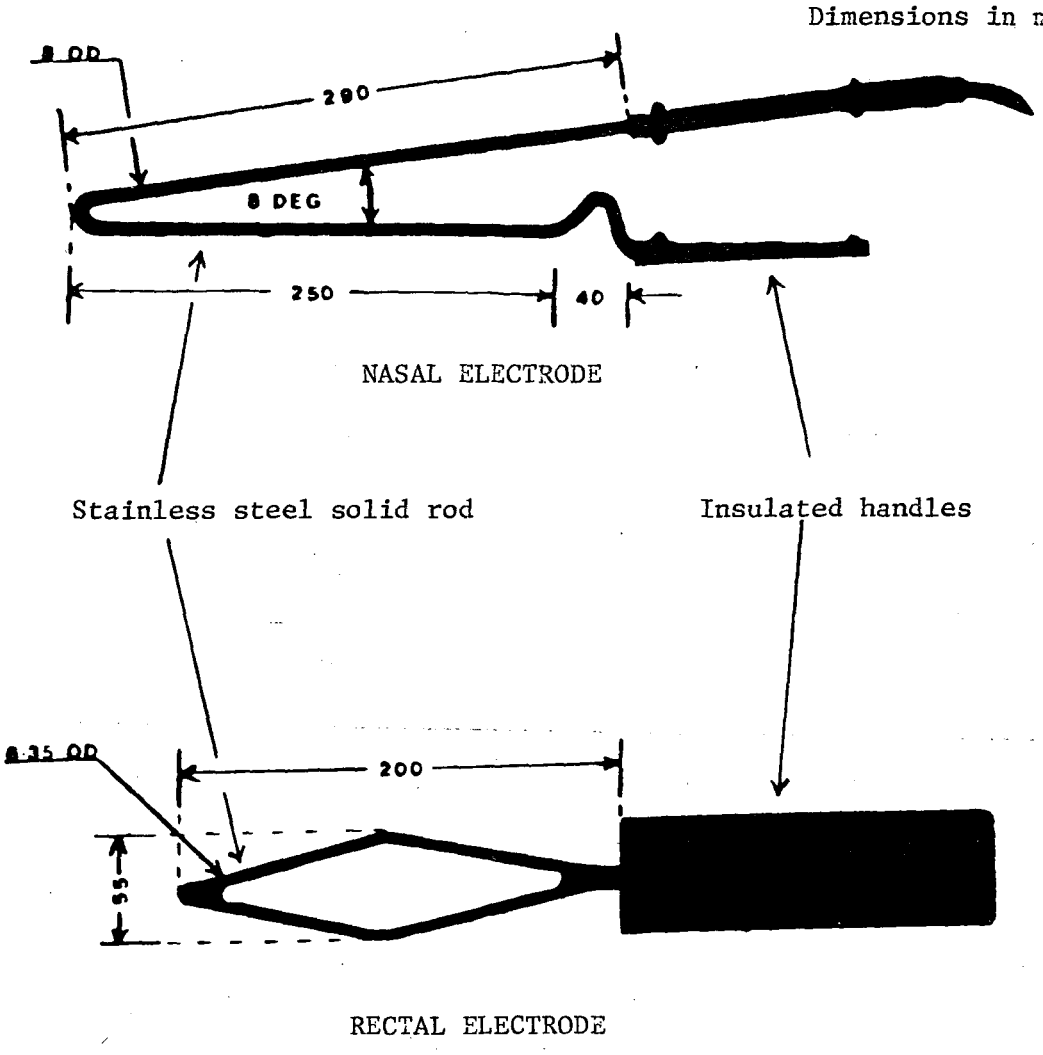



FIGURE 4 - OUTPUT AMPLIFIER CIRCUIT



## FIGURE 5 - TYPICAL NASAL AND RECTAL ELECTRODES




## FIGURE 6 - ELECTRODE INSERTION INTO CATTLE