PORTABLE ELECTRIC HYPODERMIC NEEDLES FOR HEAT HOUSES

Joseph Morán, Gustavo Mosquera

Universidad Técnica del Norte, Carrera de Ingeniería en Mecatrónica
Av 17 de Julio 5-21, Ibarra, Ecuador

jhmorana@utn.edu.ec

wgmosquera@utn.edu.ec

Summary

Nowadays, the different health institutions do not have a suitable system for the elimination of cut-sharp wastes, the most dangerous are the disposable syringes, it is why there is an imminent danger of contagion of dangerous diseases by cuts or accidental punctures with infected elements, such as HIV-AIDS, hepatitis B or C, these have been the most dangerous and contagious diseases.

Because of this problem, a prototype capable of incinerating the hypodermic needle has been developed, eliminating the risk of being accidentally cut or punctured by these objects. Destruction of the needle occurs at a temperature of approximately 2000 ° C.

The device was developed applying the principles of magnetic induction, the designing of this transformer was developed to have a very low voltage avoiding accidents for the device user.

These also has three protections, which will guarantee the safety of the machine as well as the operator, if one of the protections does not work the device will not do any work.

For the design of the transformer the calculations were presented in addition to the electric mechanical planes and electronic board, which were used in the construction of the hypodermic needle incinerator device.

The varied used materials were also presented for both mechanical, electrical and electronic construction, in addition tables with the results of tests performed on different transformers which are on the market.

Introduction

Data provided by the WHO (World Health Organization) estimates that around the world 16 billion injections are applied worldwide. But not all needles and syringes are properly disposed of, which poses a risk of injury or infection, in addition to facilitating their reuse (World Health Organization, 2006).

Ecuador has been the subject of research for Fundación Natura together with key players, local governments and international cooperation, the implementation of actions to mitigate waste generated by health facilities has been identified as a necessity from the generators, local governments , The provincial health authorities and the Ministry of Public Health, these initiatives allowed the publication in 1997 of the National Regulations for the management of waste from health facilities whose regulations are mandatory national compliance (Ministry of Public Health of Ecuador, 2009).

Currently the management of these bio-hazardous waste is carried out by the municipalities who are in charge of approaching health homes and collecting waste, which are transferred to the respective garbage dumps (Ministry of Public Health, 2010). Garbage dumps who handle this type of biohazard waste come into contact with syringes that are sometimes punctured or punctured with infected syringes and contract various very

dangerous diseases.
For this reason, it is proposed to carry out an electric incinerator that will incinerate the hypodermic needle in the same health home, eliminating any risk of contagion of diseases and leaving as only waste the plastic, thus contributing to the reduction of diseases caused by Cut or prick of infected syringes.

With the implementation of this incinerator will avoid that the hypodermic needles go to the garbage dumps since they will be destroyed in the same health homes soon after their use avoiding that the personnel who handle this type of bio-hazardous waste suffer a cut or a puncture Accidental, improving the environment, making it safer for all people.

The construction of the electric needle incinerator prototype was carried out based on the principles of direct magnetic induction using a transformer, for this the pertinent calculations were made and the construction was carried out with this information.

Material and method
The following is a description of the processes for the construction of the hypodermic needle incinerator prototype, which is based on the requirements of the future users of the device, as well as based on the information of products that are marketed, patents previously discussed in the Background and based on the information in Table 2.

User requirements

Light
-Easy to transport
- Insurance
- Fast incineration action
- Little
- Power supply 120V / 60Hz
- Easy cleaning of the waste tray

Engineering requirements

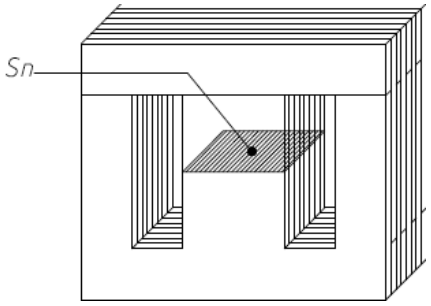
- Low Power Consumption / Energy Efficiency
- Protection of electrical and electronic circuits

Transformer Design

The design of the transformer was performed with similar values of voltages and power used by the devices currently marketed.

Coefficients K depending on the Power

Values of the iron coefficient (k) for excellent quality magnetic sheet (grain oriented sheet)	
Potencia Del Transformador	Coeficiente (k)
25 a 100 VA	Entre 0.7 y 0.85
100 a 500 VA	Entre 0.85 y 1
500 a 1000 VA	Entre 1 y 1.1
1000 VA	Entre 1.1 y 1.2



Section where the magnetic flux circulates
Sn = Is the section through which the magnetic flux

Density of wire as a function of current

Current (Amper)	Density (A/$\boldsymbol{mm}^2$)
0.005	2.5
0.007-319	3

For the calculation of the cross-section of both the primary and secondary cables, equation

$$S = \frac{I}{D}$$

Equation 8.Section of conductors
Fuente: (Rivas, 2005)

$$S1 = \frac{0.41}{3} \qquad S2 = \frac{10}{3}$$

$S1 = 0.13mm^2$ $S2 = 3.33mm^2$

Commercial standard wire size

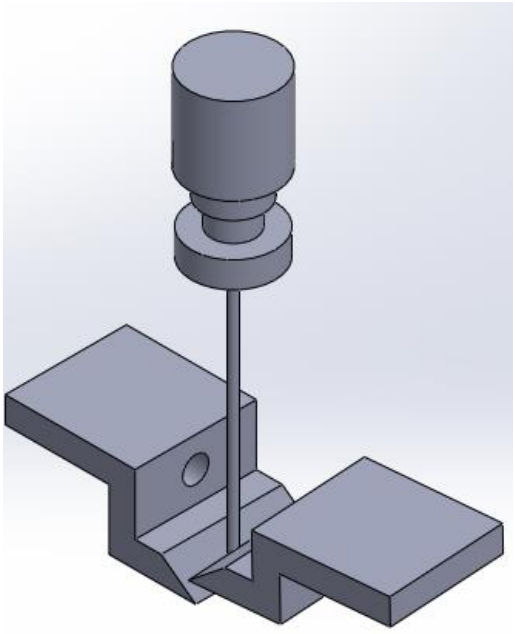
$S1 = 0.13mm^2$	$S2 = 3.3mm^2$
AWG= cable of copper # 26	AWG= cable # 12
D1= 0.40 mm	D2= 2.053 mm

Fuente: (Rivas, 2005)

Based on the calculated data, the transformer was constructed.

Electrodes Design

Figure 2 shows the type of contact that exists between the hypodermic needle and the electrodes, this type of contact is designed with a sloped part at the tip of the electrodes so that the material that is incinerated falls to the waste tray.



Design of contact between electrodes and needle

Copper was chosen for its low cost, easy access, as well as offering great properties as an electric conductor.

Carcass construction material

The selection of material for the construction of the housing of the device was made on the basis of materials that are easily found in the medium and that fulfill the following characteristics: low cost, machinable, impact resistant, not electric conductor, resistance to Weather and weight, Table 8 shows a comparison of materials

Comparison of materials for housing construction

Material	Acylic	Glass	ABS	Wood
Impact Resistant	Yes	No	Yes	Yes
Weight	Low	Hihg	Bajo	Medium
Resistance to The Weather	Yes	Yes	Yes	Yes
Electric Conductivity	No	No	No	No
Cost	Low	Hihg	Medium	Medium
Machinable	Yes	No	Yes	Yes

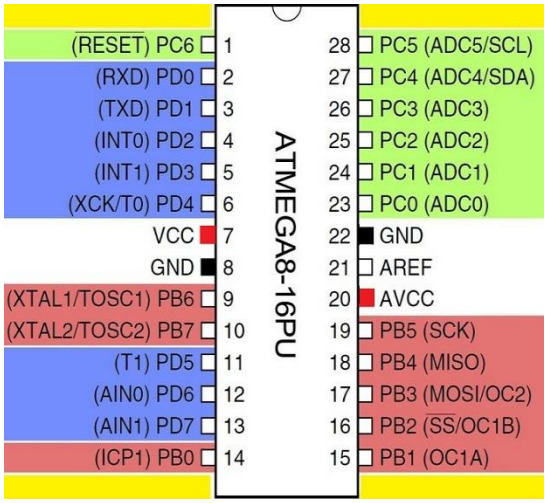
When comparing the different characteristics of the materials was chosen to choose the acrylic, since it fits more to the construction needs of the housing of the device.

Micro-Controller Selection

To realize the electronic circuit that will allow the control of the prototype incinerator of needles the different characteristics of microcontrollers that can be easily found in the market and meet the necessary requirements for the control circuit are:
- An analog-to-digital converter port for temperature sensor
- 3 output ports for LED indicators
- One output port for relay activation
- 12 ports for 16X2 LCD connection
- An interrupt port for system power-up
- Power supply 5VDC

After comparing the different characteristics of the microcontrollers and

electronic board that are in the middle was chosen by the ATMEGA 8 microcontroller, since it has the necessary ports of input and output, the number of appropriate interrupts, has useful analog conversion ports For the temperature sensor, memory required for instructions and fast response speed, in addition to the price and taking into account also that it will work with a 5VDC source.



Atmega8 connection pins

Fuente: (Electro Schematics, 2017)

IMPLEMENTATION AND TESTING

The results obtained in the incineration process of the hypodermic needle and an approximate temperature at which the destruction takes place are shown.

50W transformer built			
Voltage (V)	Current (A)	Destruction (s)	Temperatur (°C)
3	23.2	10	2477
5	31.8	5	2477
7	33.1	3	2477

50W Transformer Power Consumption Built					
Empty Testing			Testing On Load		
Voltage (V)	Current (A)	Power (W)	Voltage (V)	Current (A)	Power (W)
5	0.61	3.05	5	31.8	159

CONCLUSIONS

The information in table 2 allowed to establish a model to follow for the prototype needle incinerator, based on the results obtained and that met the requirements of the user it was possible to conclude that, in order to carry out the process of elimination of the needle, the method of Magnetic induction is suitable. Copper electrodes have been used in different needle destroyers that are already commercialized, in addition to its low price, accessibility and being a great electrical conductor was a good alternative that was used as an electrode in the prototype built. The implementation of a control circuit guaranteed the safety of the operator, because if one of these securities did not work, the device did not perform the process.

The operation and effectiveness of the prototype was reflected in the tests that were performed when incinerating hypodermic needles of different sizes, destroying the same in acceptable times and eliminating the danger that exists of a puncture or accidental cut with the needle.

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