

OCR GCSE IN MANUFACTURING (DOUBLE AWARD)

1496

EXEMPLAR MATERIALS

This collection of exemplar work is designed to accompany OCR GCSE specification Manufacturing for teaching from September 2002.

First certification will be available in June 2004 and every June thereafter.

This document aims to demonstrate the relationship between candidates' work and the assessment criteria statements. The examples provided represent just a few approaches from a small number of candidates and are not intended to be comprehensive or interpreted prescriptively.

The examples exemplify different standards of work. Some of the examples demonstrate a consistent approach across the objectives, whereas others demonstrate a different standard of achievement for each objective.

Teachers are referred to Section 2.3 of the Teacher Guide (Determining a Candidate's Mark) to further assist their marking.

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Coursework Exemplification for Unit 1 - Designing Products for Manufacture

Candidate Projects

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Food	28
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Textiles	77

Coursework Exemplification for Unit 2 - Manufactured Products

Candidate Projects

Resistant Materials	100
Food	123
Graphics	145
Textiles	169

GCSE in Manufacturing (Double Award).

Unit 1: Designing Products for Manufacture



Proposed marks for Unit 1—Resistant Materials

			Allocated mark	Location of evidence
a1 produce a design specification from a given design brief. 0 1 2 3	a2 produce a detailed design specification, using customer feedback and associated information. 4 5 6	a3 justify the final design specification by explaining how customer feedback and associated information were used. 7 8 9	7	Page 1 shows a customer design brief and specification. Further information is gathered relevant to the project on pages 2 and 3. The findings are reported back to the customer and a revised design brief and key issues are detailed on page 4. However this work could have been developed still further.
b1 use their design specification to produce ideas for a design solution. 0 1 2 3	b2 explain the use of their design specification in developing ideas for their final design solution. 4 5	b3 fully justify their choice of a final design solution from a range of ideas. 6 7	5	Pages 5, 6 and 7 show a range of ideas for the unit and some reference is made to why the designs are appropriate and how they will work but greater reference should be made back to the specification. Page 7 also briefly details the idea which will be developed into the final design solution.
c1 identify health and safety issues that may arise in making their product. 0 1 2 3 4	c2 identify the quality control procedures that would be used in each stage of making their product. 5 6 7	c3 evaluate quality control, quality assurance and total quality management applied to making their product. 8 9	6	Health and safety issues and quality control checks are dealt with in the folder. Pages 8 and 11 detail health and safety issues but these need to be more specific to the product being designed. The points in the folder are too general. Similarly the candidate realises that quality control procedures (pages 9, 10 and 11) are very important but they need to be more focussed on the project.
d1 use diagrams, sketches and other appropriate methods to present their design solution to the customer. 0 1 2 3 4 5	d2 use diagrams, sketches and other appropriate methods, including modelling, to explain their design solution to the customer. 6 7 8	d3 use diagrams, sketches, working drawings and other appropriate methods, including modelling, to justify their design solution to the customer. 9 10	9	Page 12 shows computer generated drawings of the unit selected on page 7. The following pages up to page 19 do show a variety of alternative views of the unit and it is also modified separately to card. The later pages (16 - 19) would be suitable to show to the customer as they do include important information on materials and sizes. However more notes to justify the work carried out would have been performed.
e1 identify the manufacturing processes that would be used to produce their product in quantity. 0 1 2 3 4 5 6 7	e2 identify the stages and associated quality assurances that will be used to manufacture their product. 8 9 10 11	e3 evaluate and justify the stages and associated quality assurances they will be use in the manufacture of their product, with particular reference to "real world" situations. 12 13 14 15	9	Suitable processes have been identified on pages 20 to 22 that could be used to produce the product in quantity. However there are rather general and need to be developed further with reasons given for selecting a particular manufacturing process. Quality standards are identified on page 22 but once again these are general systems and need to be directed to the product designed.
Total mark			36	

CUSTOMER DESIGN BRIEF

Our place is a retail outlet that sells a variety of household items. They pride themselves in new and innovative ideas. The products that they sell range from large items of furniture such as dining tables and display units down to smaller gadgets that can be used around the home. The company is always looking for new ideas and has decided that timing devices used in the home need to be reviewed.

I have been commissioned to evaluate existing timing devices, especially those used when boiling eggs and produce drawings for a new product that can be mass produced and sold in stores throughout the country.

Key features of the design brief

Timing device.
Used when boiling eggs.
Situation—kitchen area.

SPECIFICATION

- The item should fit in the kitchen as this is the area used for boiling eggs.
- The item should be of a size that is not too big and will not take up too much space on the kitchen work surface or wall.
- The unit should be capable of being wall or bench mounted.
- It should be stable so that it will not fall over in use.
- As the unit is to be used mainly in the kitchen it is important that it can be wiped clean - hygiene reasons.
- It should have a device to indicate that it is in use so that the user knows when it has been switched on.
- A method of indicating when the set time is reached should be included so that the user can remove the egg from the heat.
- The design and colour system used should fit in with the décor of the room in which it is to be used.
- A power source will be needed on the unit and access should be available to it so that the battery can be exchanged easily when required.
- Any electronic components used on the product should be kept away from users to avoid damage to the device and its circuit as well as preventing any danger to the user.

To find out what people wanted from an egg timing device I decided to carry out a survey on a range of people.

1. Do you use timing devices in the kitchen when you are boiling eggs?

YES
NO

2. What type of eggs do you boil most?

SOFT
HARD
BOTH

3. What qualities do you look for when buying or using an egg timer? (you may select more than one)

EASY TO SET
APPEARANCE
COLOUR
RELIABLE
OTHER

4. Is it important that the unit can be easily cleaned?

YES
NO

5. Should the device indicate that it is in use?

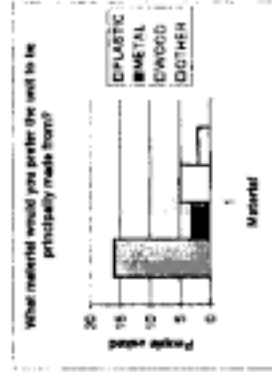
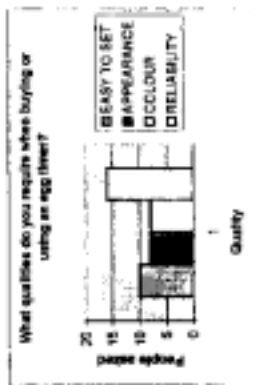
YES
NO

6. What material would you prefer the unit to be principally made from?

PLASTIC
METAL
WOOD
OTHER





RESULTS OF SURVEY

I carried out my survey by asking 26 people their opinions. The people that I asked covered a wide age range from some of my friends at school to people who are my neighbours. The results from my survey are shown below.



From my survey I have found that the majority of people asked did use timing devices in the kitchen when cooking soft and hard boiled eggs. Out of all the qualities offered by these devices people were mainly looking for products that would be reliable, however they also wanted the item to be easy to use. It was found to be very important that the unit was easy to clean. There was a mixed response from people when asked if an indicator should be used to show that the item was in use. However people were far more interested in the material used to construct the unit with plastic being very popular.

EVALUATING EXISTING ITEMS

	GOOD POINTS	POINTS FOR IMPROVEMENT	MATERIALS	RATING
	<p>Easy to use how much time has passed due to the sand in the glass. Has quite a sturdy base which will stop the timer from falling over when in use, similarly the top is large so that when the timer is turned it will remain to be stable in use. Not very big therefore will not take much space up either when stored or whilst in use. Quite cheap to buy.</p>	<p>Quite a traditional and dated shape which may not fit in well in the modern kitchen. May be difficult to clean due to the turned uprights being close to the glass. Polished surface may not last too long especially if the timer is cleaned using water. If sand glass breaks the item will be useless.</p>	<p>Hardwood with glass front.</p>	<p>**</p>
	<p>A rotary timer that is in the shape of an egg. The device has quite a wide base area and should prove difficult to knock over. Easy to use by twisting the top of the unit to set the time. Digital time is clearly shown. As the main casing is made from plastic it can be wiped down for cleaning.</p>	<p>A different colour scheme may be considered with units possibly available in alternative single colours or matching combinations to fit in with individual kitchens décor. Quite expensive to buy. Time could become difficult to read if light shines onto surface. Could be difficult to grip if hands were wet.</p>	<p>Coloured acrylic with transparent front to allow time to be seen.</p>	<p>*****</p>
	<p>Flat compact unit which is easy to hold due to the flat sides while the time is being set. When in use it can be laid flat on the work surface. Good contrast of colour with the shiny aluminium surface combining well with the black indicator. Small therefore will not take up much space either in use or when stored.</p>	<p>A functional device rather than a decorative unit. Numbers are not very decorative and take up a large area of the front surface.</p>	<p>Aluminium casing with nylon dial.</p>	<p>***</p>
	<p>The unit is quite heavy towards the base and therefore will be stable in use. It is quite colourful and is a "cheerful" design. Time is easy to set by twisting the top and bottom sections.</p>	<p>Will only appeal to certain groups of people as not a lot of people will want a chicken sitting on their work bench. May be difficult to grip if the users hands are wet. Numbers could wear off the surface after a period of time.</p>	<p>Moulded plastic shape coloured to represent a chicken.</p>	<p>****</p>

3

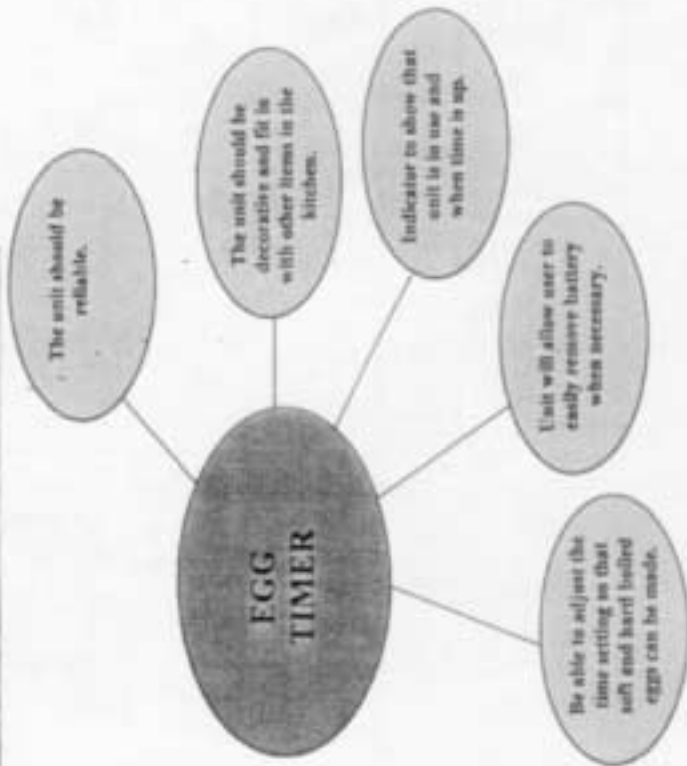
Conclusion - All the units featured above will do their jobs well, however the style of the sandglass model is a little old fashioned. The other devices all rely on a twisting movement to set them which may be difficult for older people to do. The egg and hen appear to be the more popular choice although they may be difficult to hold if the users hands are wet. Best design is the egg, although an alternative colour may have been preferred.

After carrying out initial research with potential customers their views need to be considered when designing the new product for the client. Such views are vital as without them I may design a unit that no one particularly wants and time as well as a great deal of money, which will be spent developing the product, will be wasted.

The key points from my research are listed below and this has resulted in a revised design brief.

WHAT ARE THE NEEDS OF THE USER?

Key issues from customer feedback.



Customer feedback

After carrying out my initial research I took my findings back to Curplace who considered the response of the people surveyed. After looking at the information gathered the initial design brief was reviewed.

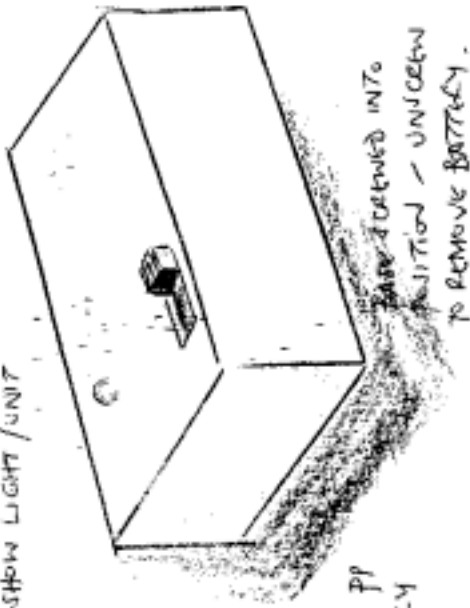
Revised Design Brief

To produce a range of ideas for an egg timing device that can be used in the kitchen work area. The item should be principally made from a plastic material. The timer should be of a quality and standard expected by the high profile company. As well as being functional the unit should also be aesthetically pleasing and not take up a lot of space when stored.

4

BLACK BOX -
LED TO SHOW LIGHT / UNIT
ON

BZZZEE WILL SOUND
AFTER 3 MINUTRS.



SHAPED
SOUND
OUTLET.

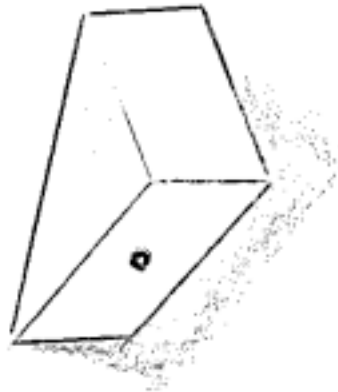
USE A PP
BATTERY

SLIDE FORWARDED INTO
POSITION - UNUSUAL
TO REMOVE BATTERY.

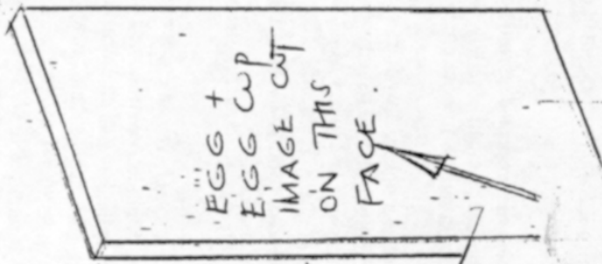
SLIDE SWITCH OR OTHER
METHOD OF TURNING UNIT
ON/OFF WILL BE NEEDED
- TOGGLE SWITCH
- PUSH TO MAKE SWITCH
COULD ALSO BE CONSIDERED.



BLACK BOX
UNITS AS
RECTANGLE -
BUT LOOKING
AT ALTERNATIVE
SHAPES.



Ideas for the packaging of the egg timer.



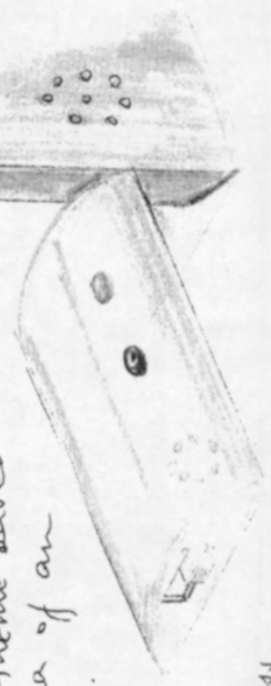
This is the idea that I would like to develop further as I feel it is a common breakfast first shape and people will associate the egg in the egg cup with an egg timer. The straight forward L shape package should be fairly easy to manufacture.

package in the style of an egg in an egg cup.
Use of an LED to show ON and a second LED to show time required is met.



Some of the diagrams shown try to use a theme based upon the idea of an egg or hen.

Semi circular package making use of drilled holes to allow sound come out.



Side switch used to start timing process.

7

Health and Safety Issues

Many potential hazards exist and it is important that care and caution is exercised in many different areas as well as when using and designing products.

Product safety

Many products have labels on them or attached to them to show that the product has passed a series of quality and safety tests. This is the user's guarantee that the product is safe to use for the purpose specified. Warning signs are also used to indicate that a product may not be suitable for a particular age.

Designed to be safe

All products should be safe to use and this should be included in every product's design specification. Materials and components used should be suitable for the situation that they are to be placed into. Manufacturing processes must also be considered as the final product must function as intended e.g. Toy parts must be secure.

The end use of the product must be considered throughout the designing and making process.

Look out for - sharp edges, loose parts, toxic surface finishes, small parts.

Safety in the workplace

Hazards can be reduced by the way in which the workplace is laid out, with areas identified for particular activities. Areas should be clearly marked and kept clean and tidy, with waste materials disposed of correctly. Some materials could be collected for recycling.

The work area should be large enough for the number of workers identified and adequate heating, ventilation and light or lighting should be provided.

Many processes that are carried out produce dust and fumes which can cause damage to the workers lungs and throat if they are breathed in. They can also irritate the skin and eyes. Extractor fans can be installed to help overcome these problems and/or fume cupboards could be used.

Storage of chemicals

The majority of chemicals used in the workplace have some sort of risk element to those using them. Some can be poisonous if inhaled or swallowed others cause irritation or damage to the skin or eyes. It is the law that chemical containers carry labels to indicate the nature of the hazard. Chemicals should always be stored in their original container with instructions on as how to use them.

They should be procedures set up in any work place to check and deal with any use of chemicals such procedures must fit in with regulations set up by the government in 1994 known as The Control of Substances Hazardous to Health Regulations (COSHH).

Machine guards

Fingers, hands and eyes are mostly at risk when operating machines. Many machines have guards on them and these must be used. Sometimes they have to be removed when a machine is being set up but once it is in operation the guards must be used.

Protective clothing

In industry and in school protective clothing should be worn. It may be fairly basic depending upon the task carried out but it should be used regardless as its sole purpose is to protect the worker.

Gloves made from plastic, fabric or chain mail may be needed they can be used when handling hot objects, chemicals or cutting tools.

Strong shoes should be worn to protect feet.

Goggles should be worn to protect the eyes and when there is a possible danger of splashing or flying objects when cutting a visor should be used which will protect the eyes and face.

Face masks and respirators should be used when there is a risk of dust and fumes.

Ear protectors should be worn when cutting materials on machines that produce a high pitched noise.

Hard hats are needed to protect the head.

Aprons, overalls and chemical suits should be worn for increased protection as well as protecting the users clothes.

RISK ASSESSMENT

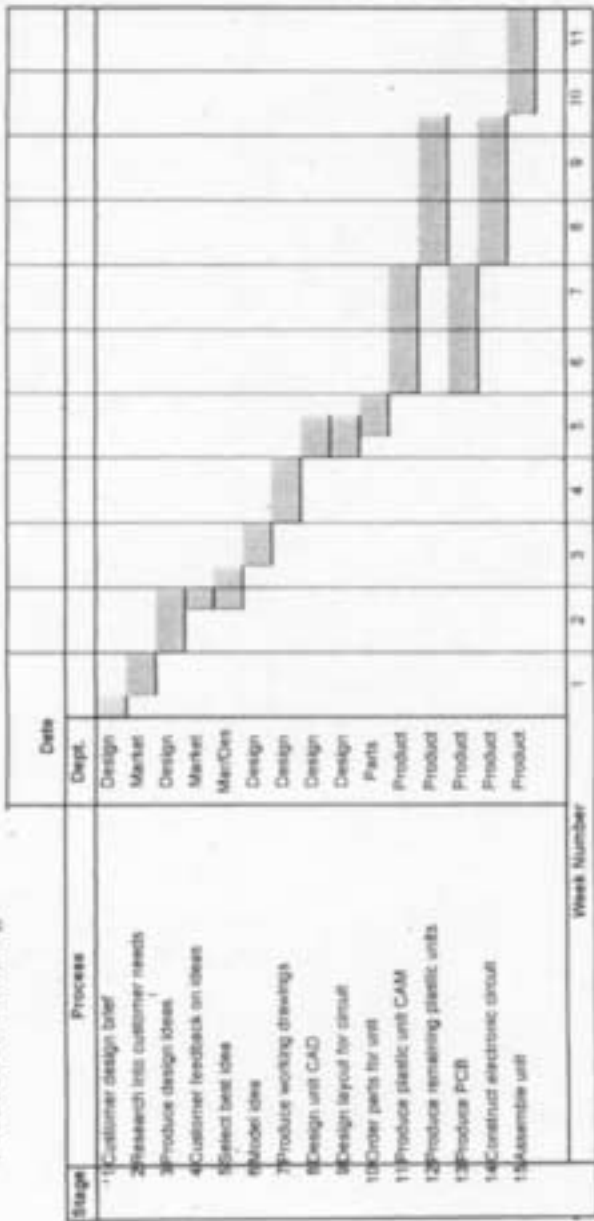
Although it is impossible to avoid every type of risk it is important that steps are taken to identify what the risks are and how they can be minimised. When manufacturing processes involve hazardous situations it is necessary to analyse and assess each particular risk situation and ensure that adequate precautions are taken to minimise the potential danger.

Ergonomic studies and anthropometric data can be used to determine best positions for displays and controls on products and machines, and the most suitable sizes for workspaces and conditions e.g. the distribution of light, noise, heating and ventilation.

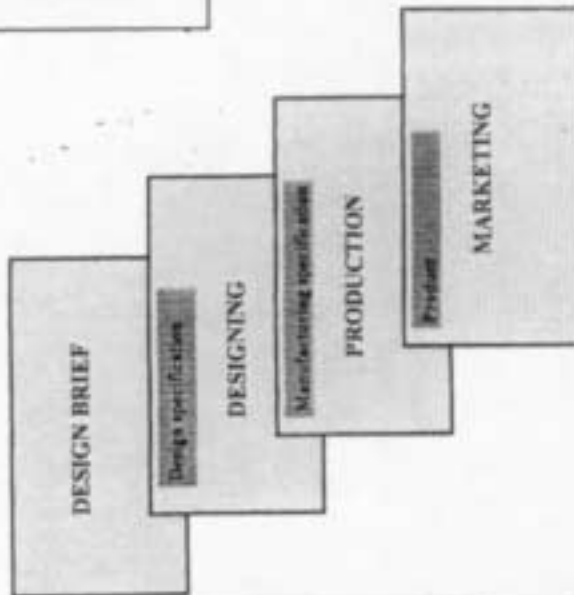
It is the employers responsibility to carry out RISK assessments and set procedures up that will keep the Health and Safety Inspector satisfied that the working environment is a safe one to be in.



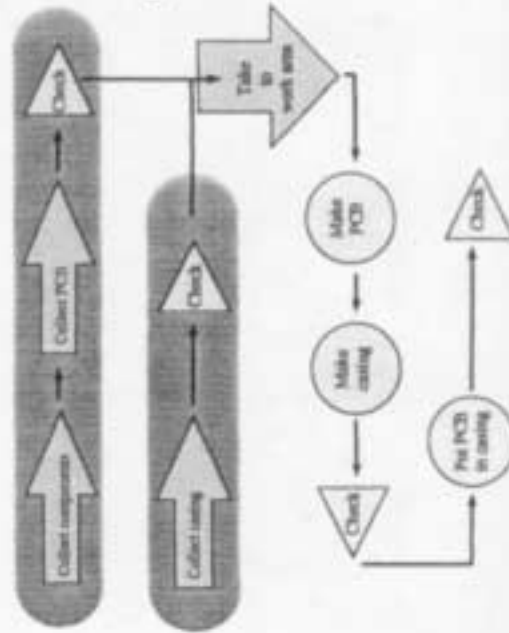
Production Planning



THE DESIGN PROCESS



Quality control checks incorporated into manufacturing plan.



9

Quality Counts

The product must be of a quality that the customer expects and must work as the customer desires.

The manufacturing company has an obligation to meet these requirements when it produces its product. By doing so the company will have success selling the product and increase its reputation with its customers.
How can the company guarantee quality?

TOTAL QUALITY MANAGEMENT - is when the manufacturing company has an aim to "delight the customer". The attitude of these companies is one of continuous improvement, trying to continually improve the performance of its organisation and its products and services.

The research and marketing sections of the company have an important role to play here as they need to know what the customers requirements are and how they feel about new products as they develop.



QUALITY ASSURANCE

Is carried out by the company to see that the product meets the quality standards set. A series of planned actions and procedures will set up to check the product before, during and after manufacturing operations have taken place. The aim of the process is to prevent failure and to make sure that quality of the product is right first time and every time. Quality assurance is the responsibility of everyone and it should be built into the process from the beginning of day one until the end of the production process.

QUALITY CONTROL

Follows the quality assurance process and is used to set up ways of checking quality against the set standards or to see that items have been made within set tolerances. It involves using an inspection team who are looking for items that are not up to standard. Inspections will take place at identified stages in manufacturing as well as after the final item has been assembled.

WORKING TO SET STANDARDS

Manufacturers try to work to a set standard when producing items and guarantee this quality when selling the items to customers. There is an agreed UK/International standard BS5750/ISO 9000.

British Standards Institute produces documents which detail technical requirements for a product, material or process so that it will be fit for its purpose. There are a range of over 10000 British Standards which cover almost every industry. Certification that a product meets a British Standard provides the customer with an assurance that an acceptable quality of product can be expected.

A kitemark may be seen on products that have met British Standard and a CE sign is used to show that European safety standards have been met.

Electrical appliances should only be used if they carry a British Electrotechnical Approvals Board (BEAB) mark and in industry they should be tested annually.



Quality assurance and my product.

When manufacturing my product I will need to carefully select the correct materials and processes. As the project is going to be used mainly in the kitchen it is important that the materials selected can be kept clean as hygiene is an important issue. Plastic is therefore a good choice of material as it is fairly light weight and can easily be cleaned. While carrying out the manufacturing processes it is vital that checks are made at regular intervals in order to ensure that the product is up to quality.



Review of Issues related to my product. Quality Control and Quality Assurance.

It is vital that customers view my company as one that is reliable and produces a quality outcome that is worth owning. Without gaining the confidence of the market then the goods will not sell as well as they possibly could with customers looking at products that other companies make in preference to mine.

During the manufacturing stages it is therefore vital that the product is made to the highest standards. To ensure that this happens checks will be made at a variety of stages as outlined on the Manufacturing Plan (shown earlier in the folder). These inspections will be carried out by the Quality Control team to make sure that the product meets the specification fully and that standards are maintained throughout the whole process.



Identified stages where checking/testing will take place:

- Component delivery - items bought in will be checked to see that they meet the standards required. Tests will be carried out on a sample of parts to ensure they perform as required.
- Material delivery - materials purchased will be checked to see that they are in perfect condition prior to any cutting, shaping or forming taking place. Colour will be checked as will the surfaces for any imperfections such as cracks or scratches.
- PCB - after the circuit boards have been produced they will be checked that they function as required and that they can be set to the times specified.
- Casings - will be checked to see that they are formed to the correct shape and that there is no evidence of any fault..
- Final assembly - the completed product will be viewed to see that it has been assembled correctly and that there are no loose parts. It will then be tested to see that it functions safely and as expected. A label will be allocated to each product to reassure the customer that the product has been thoroughly tested and meets the requirements of the company.



Health and Safety Issues related to my product.

As outlined previously it is vital that COSHH regulations are observed with the storage and use of substances including materials when making my product.

Ferric Chloride and developing fluids should be stored and used as advised on the container labels.

RISK Assessment should be carried out for all the procedures to be followed during the manufacturing process. Hazards should be identified and all the necessary precautions taken to minimise the risk element to its lowest possible level.

Operators of any machine should be completely familiar with its working and be aware and fully trained of the processes that can be carried out on it.

When using chemicals and soldering a well ventilated area should be available so that fumes will not cause a problem to breathing. Protective goggles and mask should be worn. Gloves may also be needed when lifting boards from the developing fluid and etch tank.

When manufacturing the PCB a sink should be available close by so that any splashes can be washed away quickly.

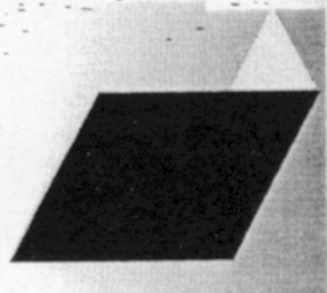
Protective footwear and clothing should be worn at all times, with long hair tied back and jewellery removed.

A dust mask and goggles should be worn when sanding plastic.

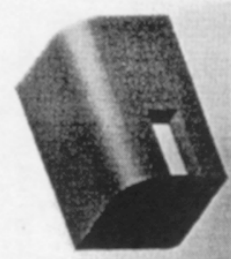
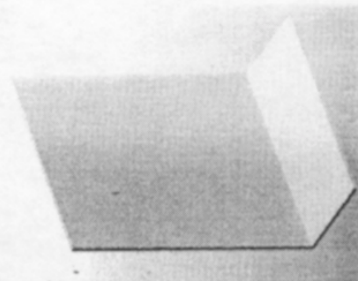


Any accident, no matter how trivial should be reported and noted in the accident book.

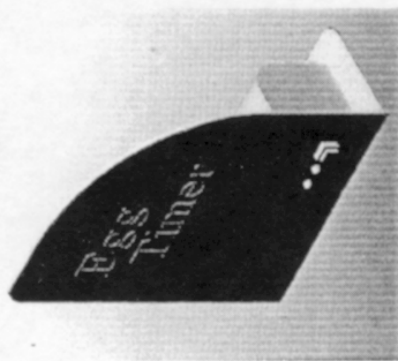
Ideas for the Egg Timer unit produced using ProDesktop.



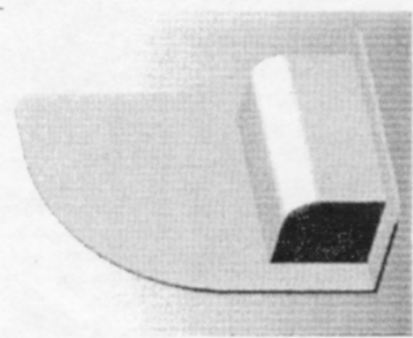
Front of unit bent to a right angle using strip heater ready for other parts and components to be added.



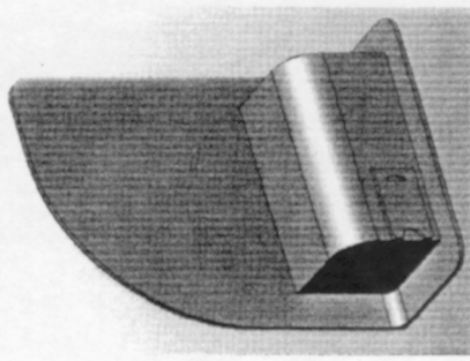
Battery cover ready for positioning onto main unit.



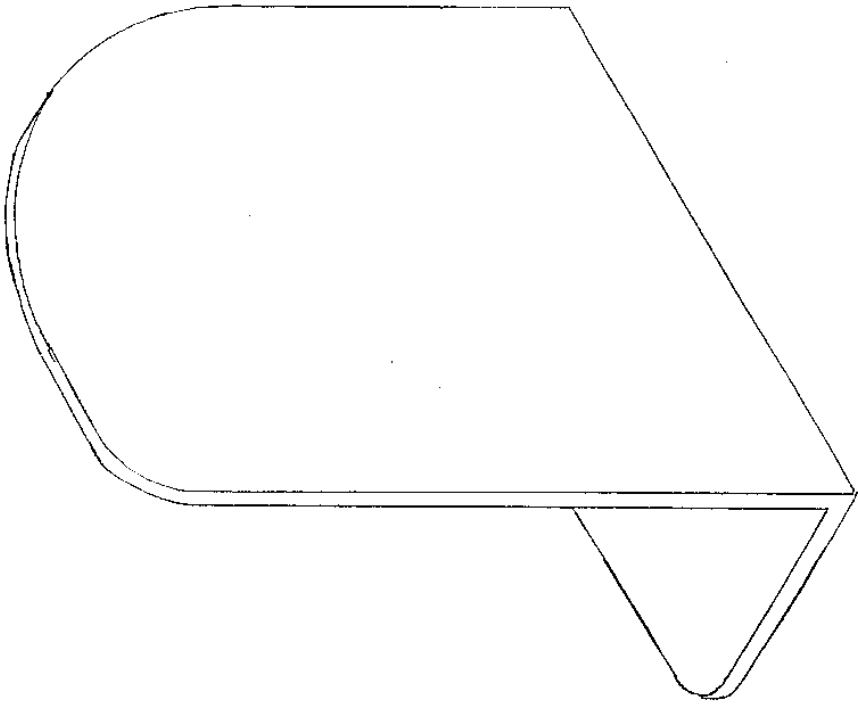
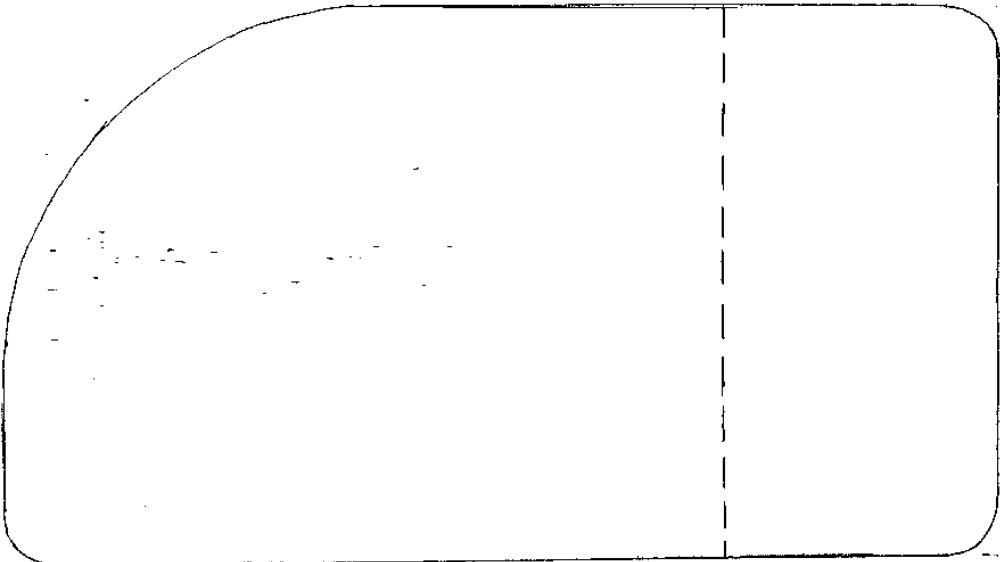
Completed unit showing front view with extruded lettering. Circuit cover is also shown in position.

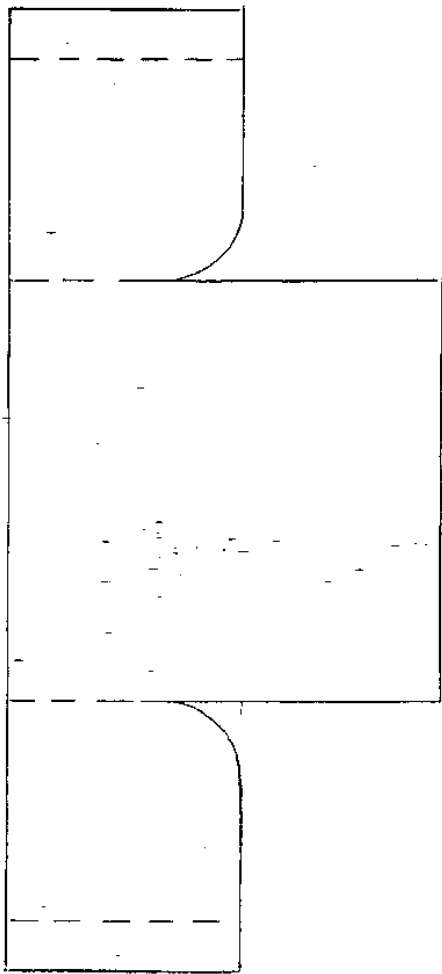


Rear view of unit showing door for battery removal.

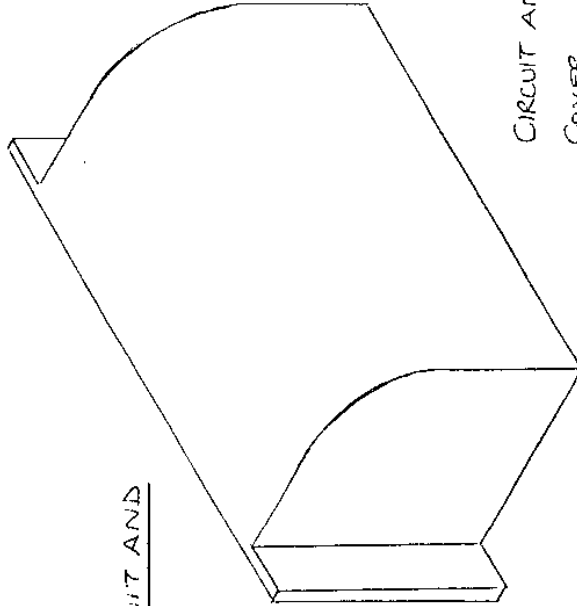


SURFACE DEVELOPMENT
OF FRONT OF EGG TIMER



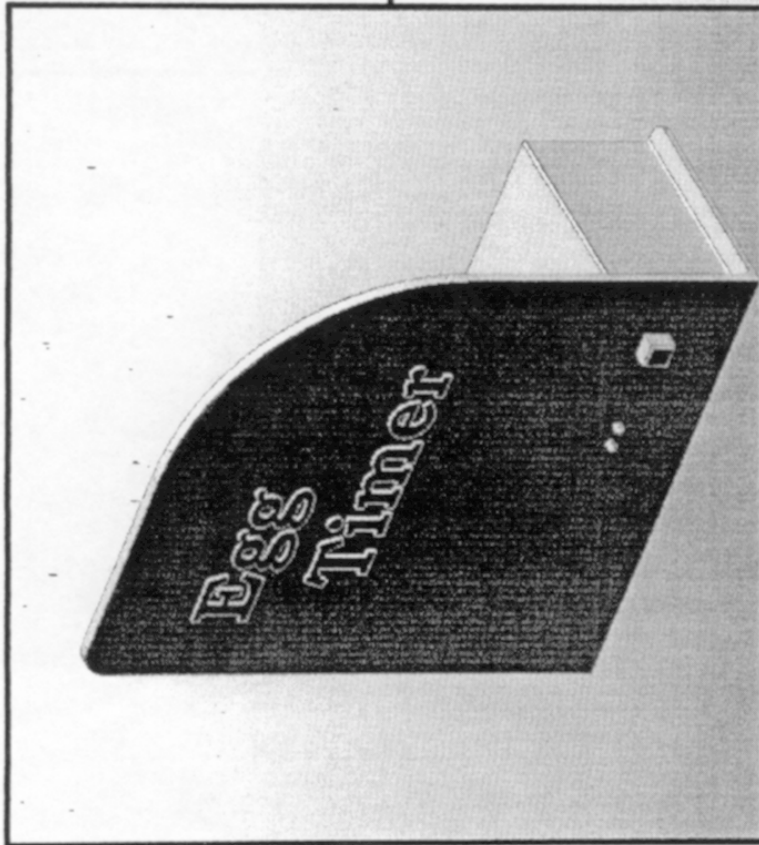


SURFACE DEVELOPMENT OF CIRCUIT AND BATTERY COVER.

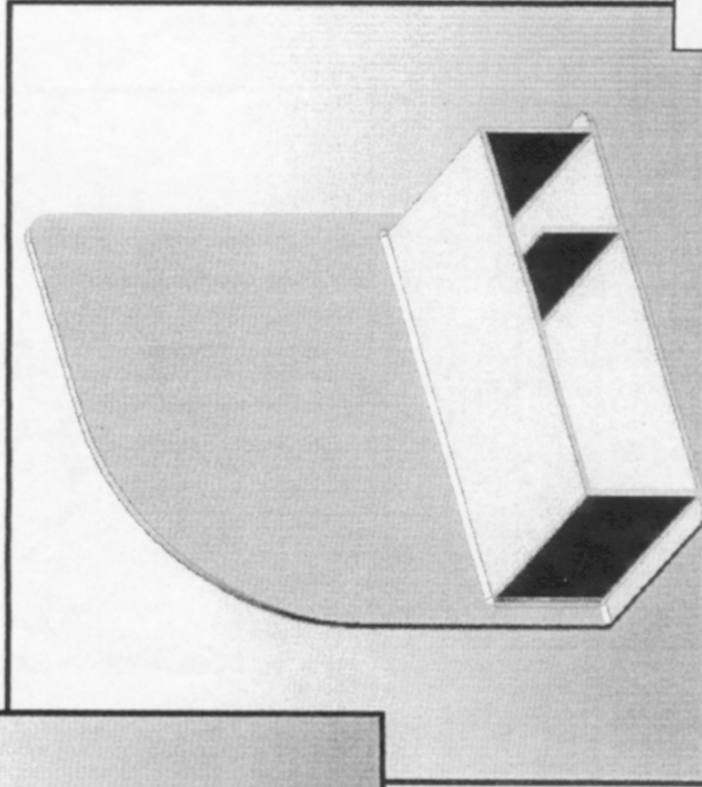


CIRCUIT AND BATTERY COVER.

Egg Timer

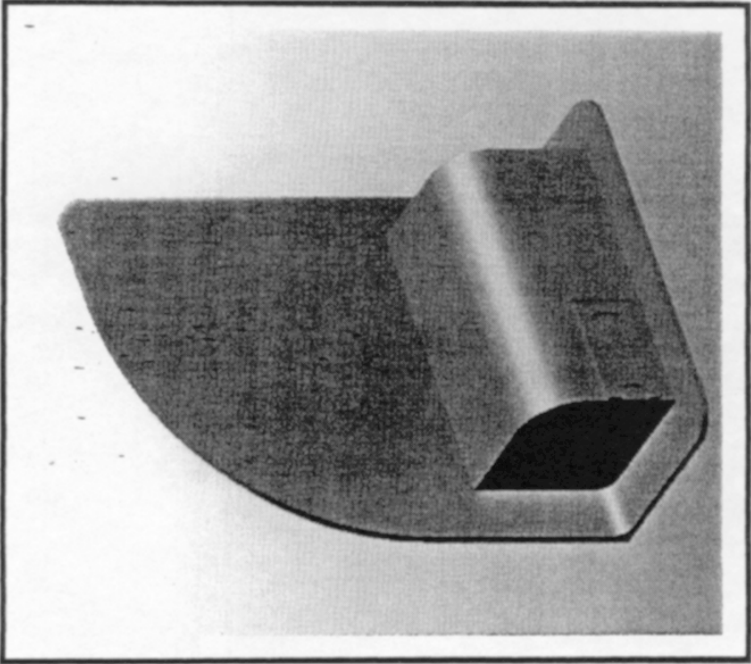
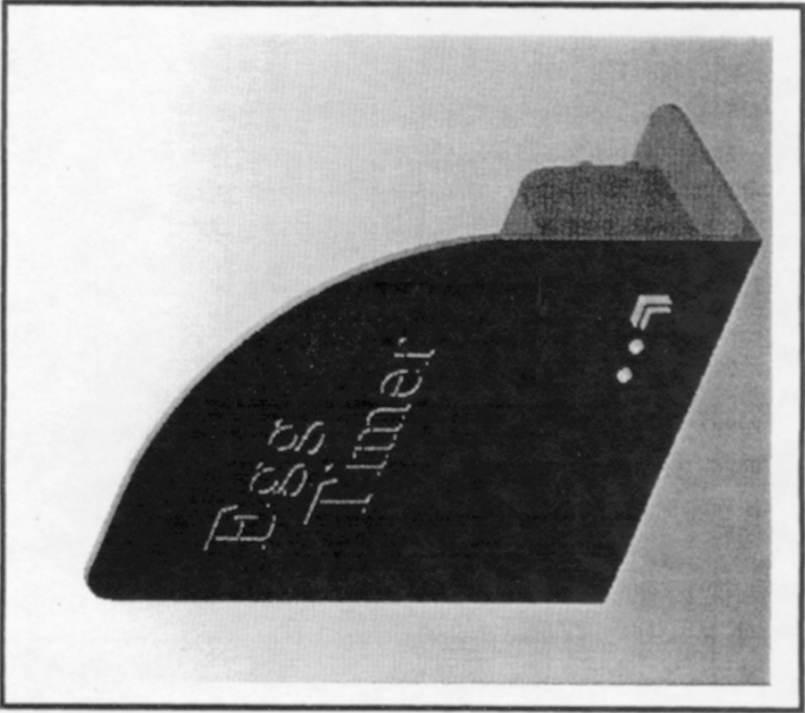


Egg timer viewed from the front showing the location of the switch and LED's.

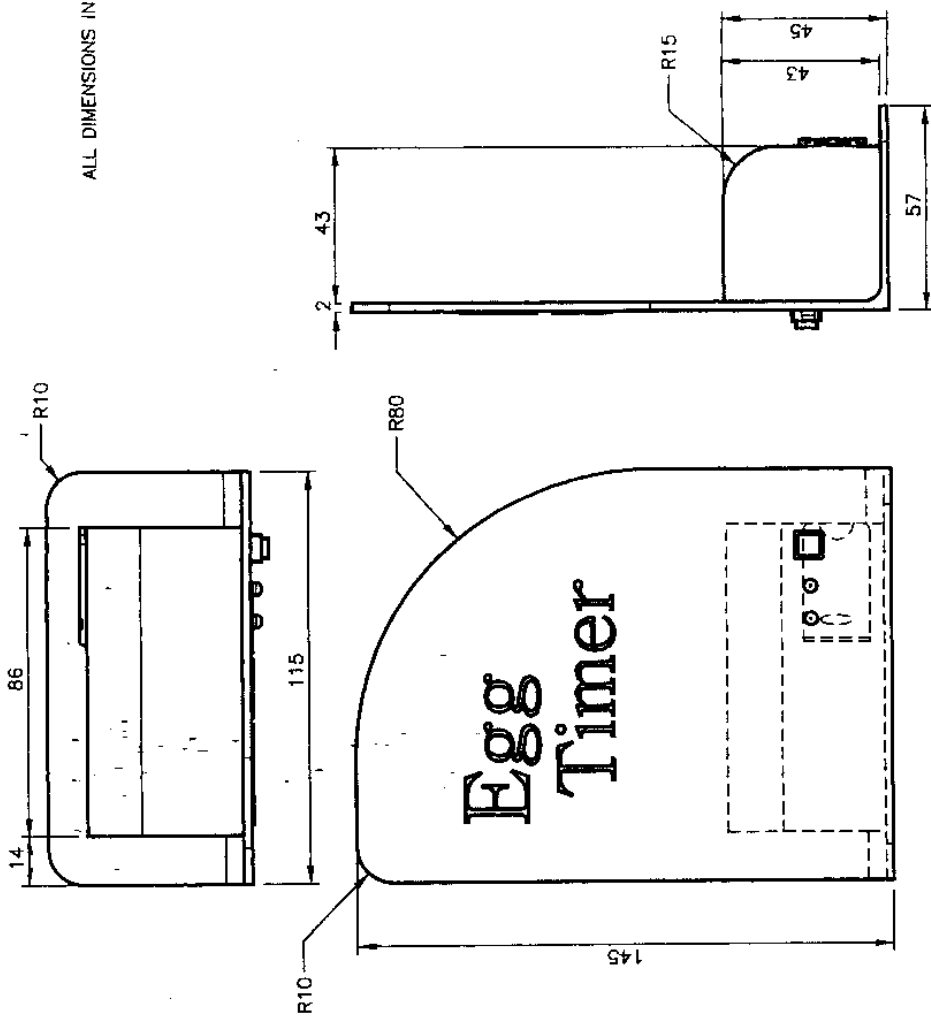


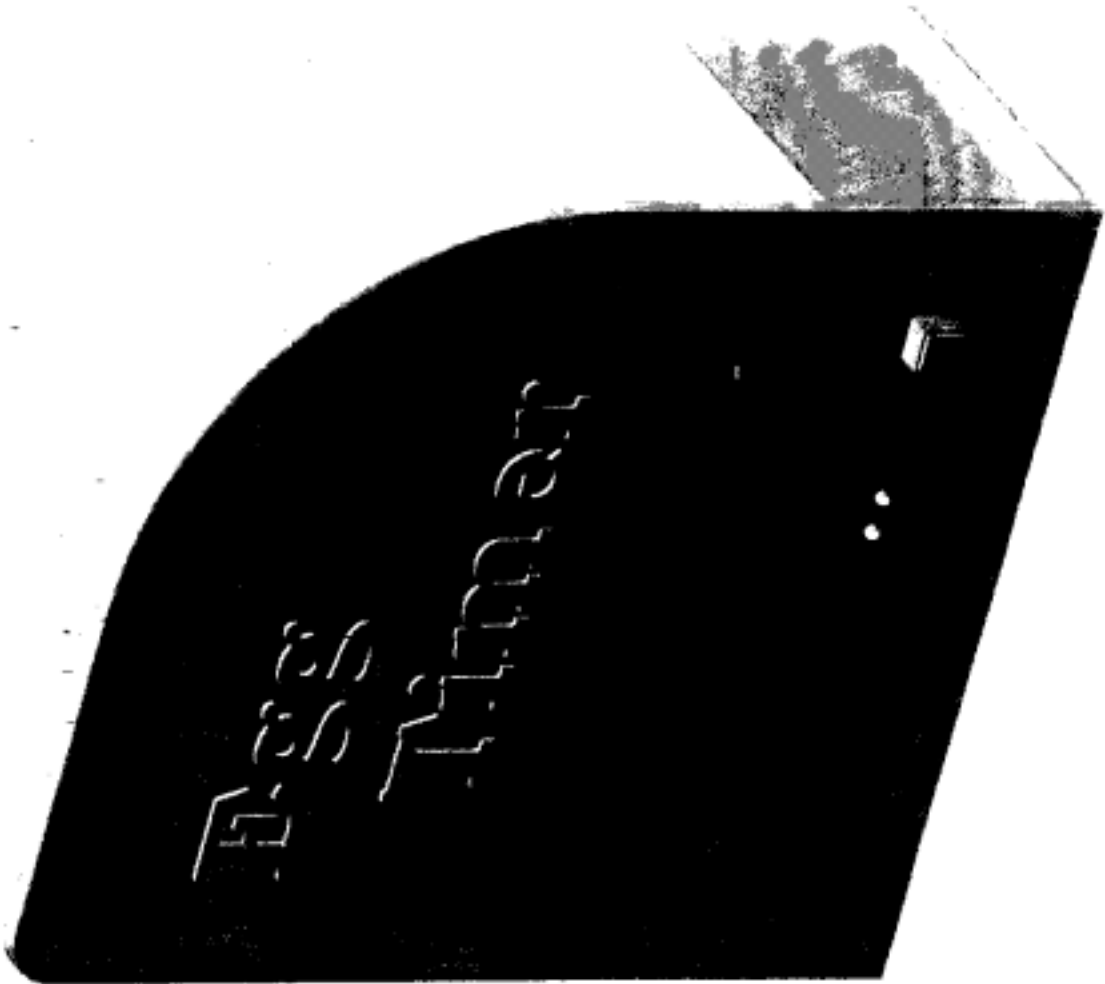
Egg timer viewed from the rear showing the location of the PCB and the battery compartment.

Front and rear views of selected idea.



ALL DIMENSIONS IN MILLIMETRES



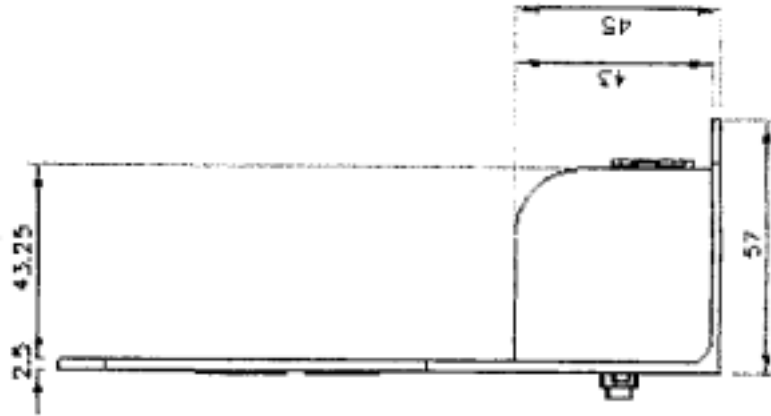
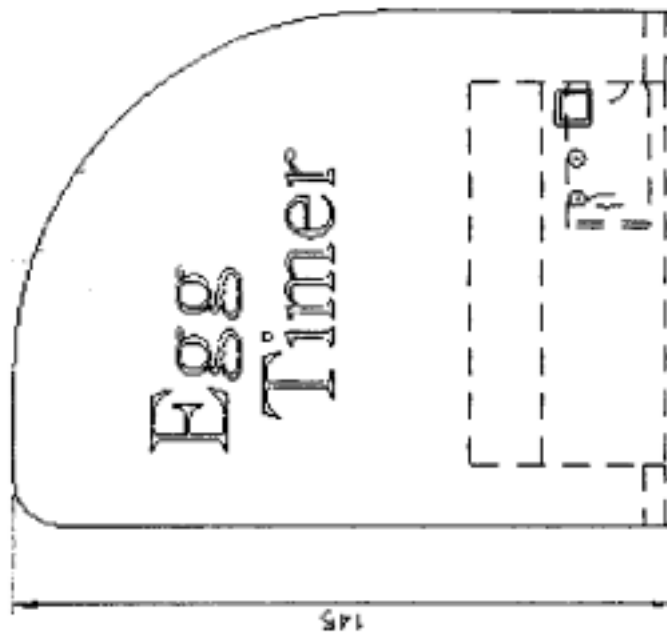
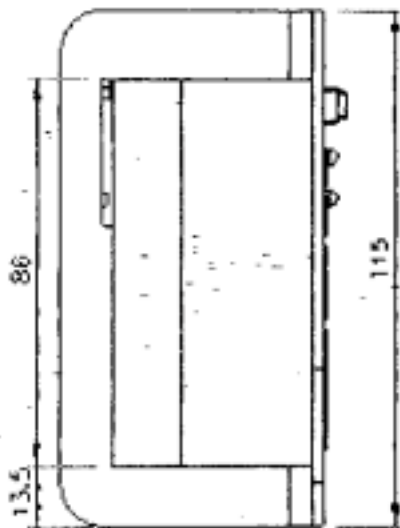


No.	PART	No OFF	MATERIAL	L	W	Th
1	Front of Timer	1	High Impact Polystyrene	200	115	2
2	Circuit cover	1	High Impact Polystyrene	90	80	2
3	Battery box divider	1	High Impact Polystyrene	75	40	2
4	Battery box cover	1	High Impact Polystyrene	40	25	2

All other items to be used in producing this artefact are listed on a separate page.

ALL DIMENSIONS IN MILLIMETRES.

SCALE 1:1

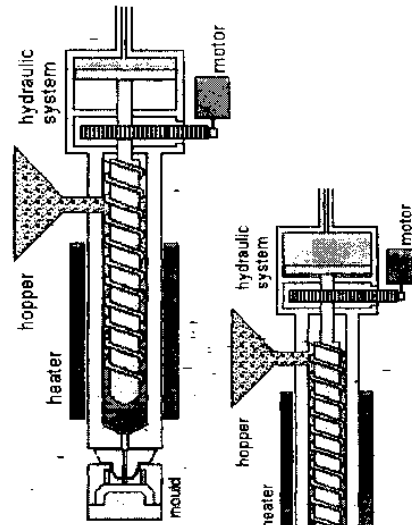


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PRODUCTION METHODS - PLASTICS



Industrial injection moulding machine.



Injection moulding.
Diagrams show the process with the plastic being loaded, heated and then forced (injected) into the mould. The second diagram shows the blank being removed ready for final machining.



Line bending in Industry



Line Bending

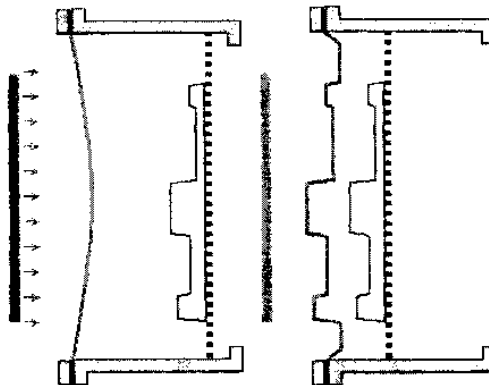
The line to be bent is marked onto the surface of the acrylic sheet. It is heated until it becomes soft (as shown in the diagram above). It is then removed from the heat and folded to the required angle and kept in that position until cool (as can be seen in the diagram below).



Industrial vacuum forming machine.

Vacuum forming

The top diagram shows the pattern in position and the polystyrene sheet being heated. The second diagram shows the plastic cooling after the pattern has been pressed into it and a vacuum formed. Once cool the plastic needs to be removed and machined to the required shape.



MANUFACTURING THE PRODUCT IN INDUSTRY..

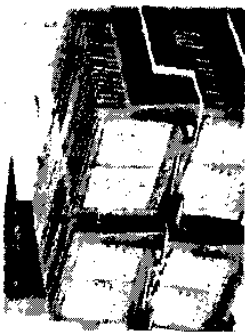
PRODUCTION METHODS USED TO PRODUCE A BATCH OF THE ELECTRONIC CIRCUIT BOARDS FOR THE EGG TIMER.



The first stage in producing the circuit boards is to screen print them with solder paste this allows a solder pad to be added that will hold the components in place. The boards are then placed on a surface mount machine and a computer controlled process follows where miniaturised components are picked from large reels and placed in the correct position on the circuit board. At this stage the circuit boards are kept together in large groups as it makes them easier to handle and can be processed more efficiently.



The boards are then placed on a slow moving conveyor belt which passes over heating elements. This process melts the solder and permanently fixes the components in place.



After the heated conveyor belt the boards are separated from each other. They are placed on a jig which keeps them together, larger components are added by hand and then soldered into position.



The electronic circuit is then checked that it works as required before final assembly.



The required shape produced using the injection moulding process.

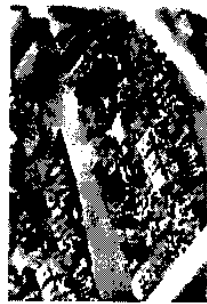


Once the casing has been formed the circuit board is then screwed into position.



After the circuit has been positioned the door for the battery box is then fitted.

The screwdriver which is used for this process is driven by air and powered from a central compressor. This system far more cost effective than electrical or manual counterparts.



MANUFACTURING THE PRODUCT IN INDUSTRY.

MANUFACTURING PROCESSES AND QUALITY STANDARDS.



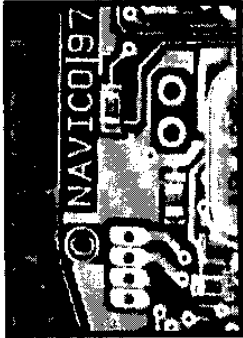
CNC pick and place machine.

Before any item is put onto the assembly line quality checks are performed at the goods inward stage. After production has started on the assembly of the boards they are checked by a comparator to ensure that the components have been placed correctly.



Comparator machine.

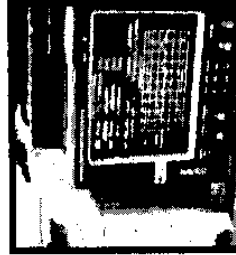
Quality assurance of the product is important and with having a variety of electronic components making up the product it is vital that checks are carried out to verify function, dimensional accuracy and cosmetic quality. A comparator is used to monitor the quality of the CNC pick and place machinery. Faulty circuit boards are discarded and any incorrectly placed components can be removed.



Enlarged view of PCB through comparator.



Samples of Circuit Boards are inspected under a special microscope, which enables the board that is being inspected to be rotated on two axis. This shows the quality of the soldering in the minute detail.



The assembled unit undergoes further testing under a variety of situations with performance being monitored.

