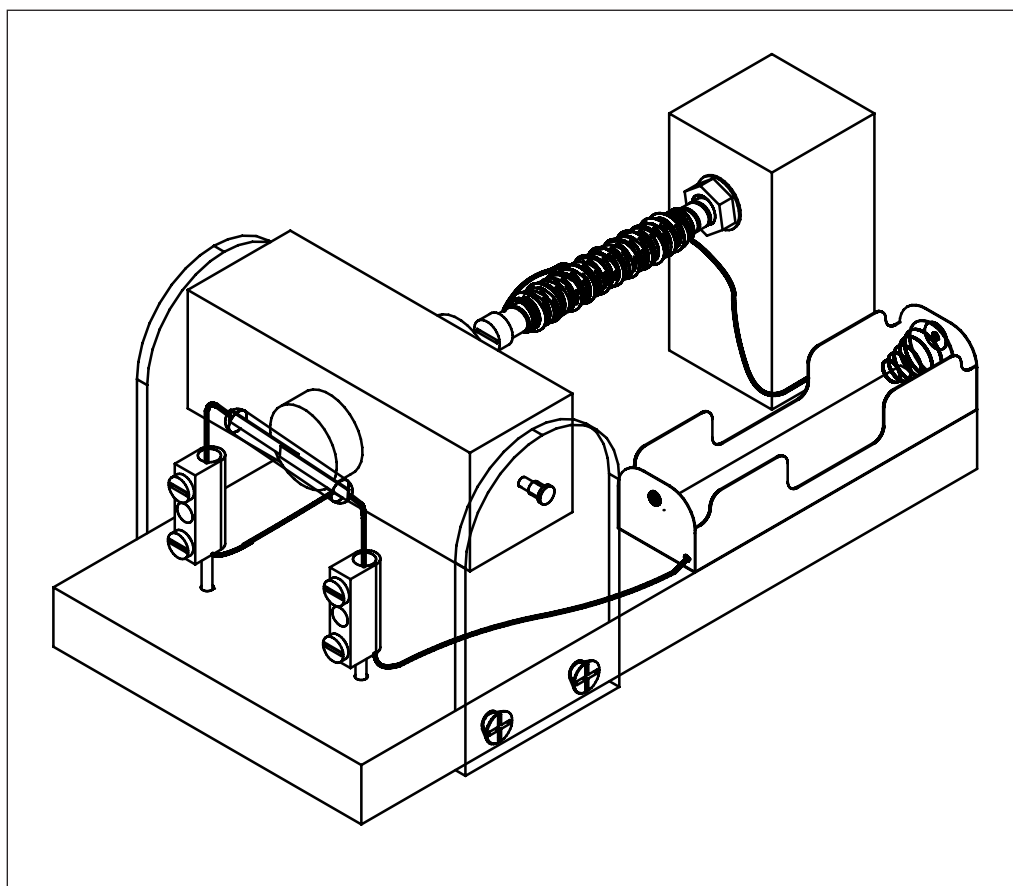


# OPITEC

**1 0 5 . 1 8 0**

## ***Reed Contact - Motor***



### **Please Note**

The OPITEC range of projects is not intended as play toys for young children. They are teaching aids for young people learning the skills of Craft, Design and Technology. These projects should only be undertaken and tested with the guidance of a fully qualified adult. The finished projects are not suitable to give to children under 3 years old. Some parts can be swallowed. Danger of suffocation!

### **Warning!**

This product contains small parts that can be swallowed. There is a danger of choking!  
This product contains a magnet.  
Swallowed magnets can block the intestines and cause severe internal injury.  
If a magnet is swallowed by accident contact a doctor as soon as possible.

## Safety notes for working with magnets



Permanent magnets and magnetic article are technical products that require safety knowledge. All persons experimenting or working with magnets should read these note and keep them in mind!



### Articles that can be influenced by magnets

- Computers or electronic data
- Electronic machines
- Heart pacemakers
- Injuries caused by crushing or pinching
- Danger caused by magnetic splitters
- Danger of fire and explosion
- Health dangers caused by contact with drinking water, food or ski



### Working with magnets

- People with heart pacemakers should avoid contact with all types of magnetic fields
- Computers and other data storage units should be kept away from magnetic fields
- Magnets must be carefully handled in the presence of other magnets and objects made from iron  
There is a danger of injury caused by pinching or squashing-wear safety protection
- Magnets must not be used in an atmosphere where there is a danger of explosion
- Items made from iron should not be left near magnets
- Strong magnets can splitter when under attraction , to avoid injury when working with magnets wear safety glasses
- When working with magnetic properties in mechanical projects there is a danger of fire
- Glowing or burning magnets should not be extinguished with water, Co2 or halogen – use sand or powder extinguisher
- The presence of hydrogen can cause magnets to deteriorate and lead to them breaking up- avoid all contact between magnets and hydrogen
- Some magnets have a nickel coating which can cause skin allergy- handle – if this happens avoid all contact



### Be careful with magnetism

- Be careful of magnetic fields, magnets can spring apart and cause accidents
- Fix magnets in a holder and never hold them freely in your hands
- Magnets can shatter
- Keep your working area free from magnetic pieces
- Read any special makers instructions that come with the magnets



### Transport

- When transporting magnets by air there are special regulations that must be followed
- This also applies to appliances with built in magnets- contact airline
- There are also regulations for sending magnetic goods by post – see Post Office



## 1. Product Information:

**Article:** Functional model in project pack format

**Use:** In Design Technology, Key stage 3,4

## 2. Material Information

**2.1 Material:** Pine (Coniferous) softwood  
Wood must be relatively dry before working  
Plywood, multi-layered with each layer set in the opposite direction

**Working:** The wood parts must be sawn, shaped drilled and sanded  
Measure out according to the plans or use patterns

**Joining:** Glue (PVA), screws

**Finish:** Wax (Solid or liquid)  
Wood varnish (Base and top coat)  
Staining (Coloured, water soluble and then varnish)

**2.2 Material:** Acrylic: Thermoplast  
PMMA (Polymethylmethacrylate), transparent

**Working:** Acrylic parts must be sawn (Fine saw blade) drilled, shaped and sanded

**Joining:** Screws, slotting together

**Finish:** No special finish necessary

### 2.3 Electro-parts

**Battery Holder:** Holds Mignon cell batteries-

**Reed contact:** switch

**Windings:** Copper wire with varnish insulation (0.3mm)

**Brass Nails:** Fixings for Reed switch

## 3. Tools

**Saws:** Use a Fretsaw for all curves and round shapes that cannot be sawn with a Tenon saw

**Note!** Fretsaw blades are inserted with the teeth facing forward

Use a Fretsaw board and work with slow constant strokes turning the work as you go

Use a fine toothed saw for cutting dowel and strip wood

**Note!** For safety hold the wood on a bench hook when sawing

**Files /Rasps:** Use the correct grade of file or rasp according to the work in hand

**Sanding:** Use a block and glasspaper for all flat surfaces and loose sheet for individual forms

### 3. Tools

Drilling: Use a hand drill or Pillar drill

**Note:** Please pay attention to the safety rules : Tie all long hair back, remove jewellery, wear safety glasses and an apron. Hold all work in a machine vice.

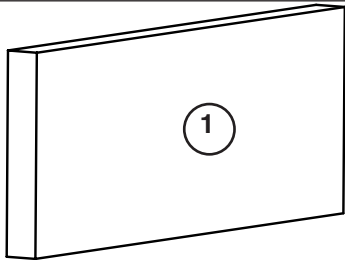
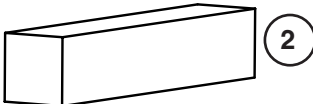

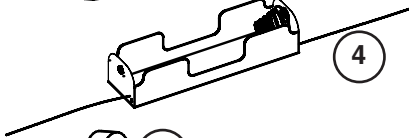





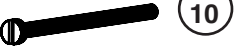


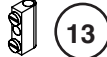
Cutting: Use side cutter for the insulated wire

Soldering: When soldering use a 15-30 Watt soldering iron with a fine point, use a flux to ensure good joints

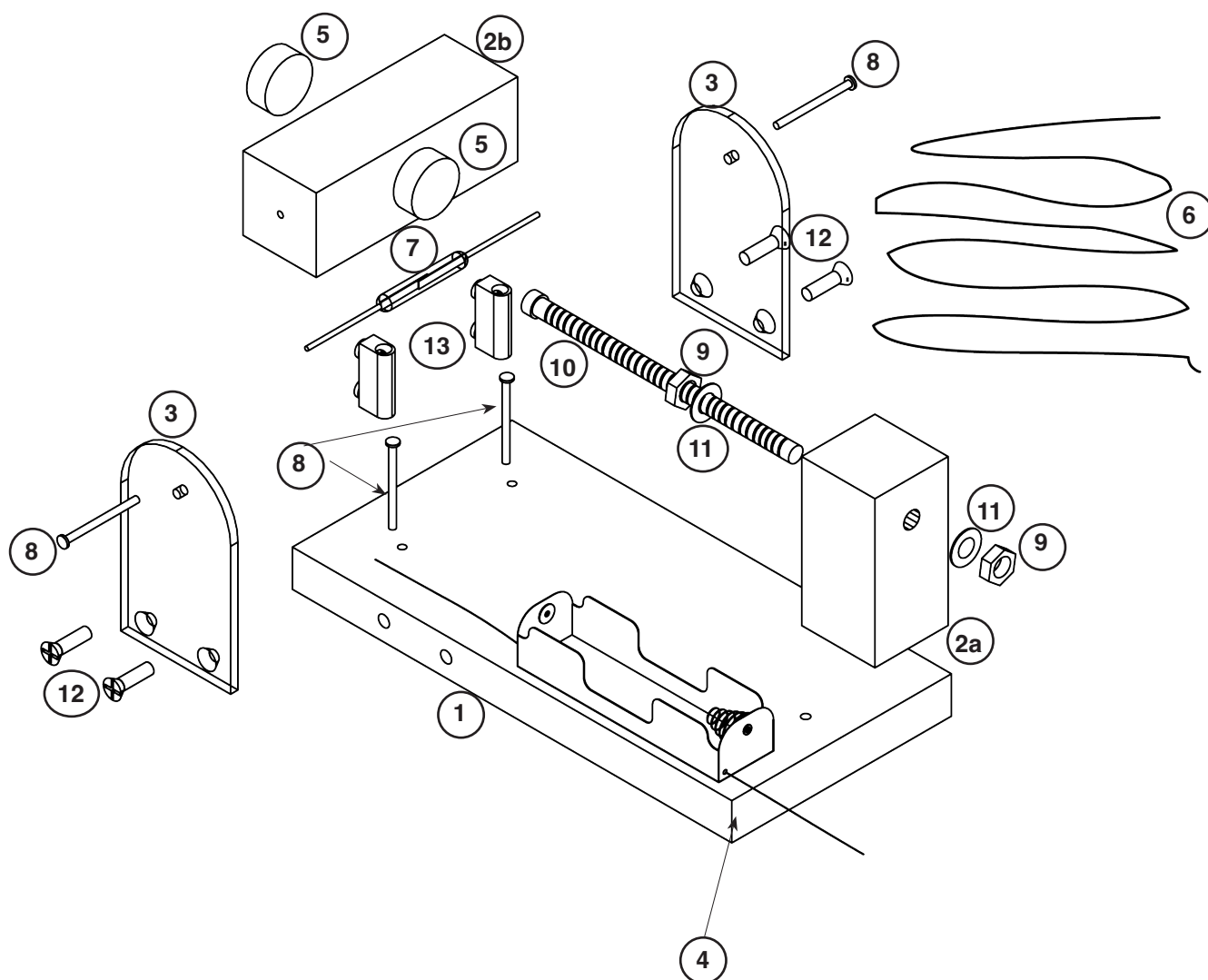
**Attention!** Soldering irons are hot, and can cause burns use them with care and wear safety glasses when soldering.

Electronic solder contains its own flux

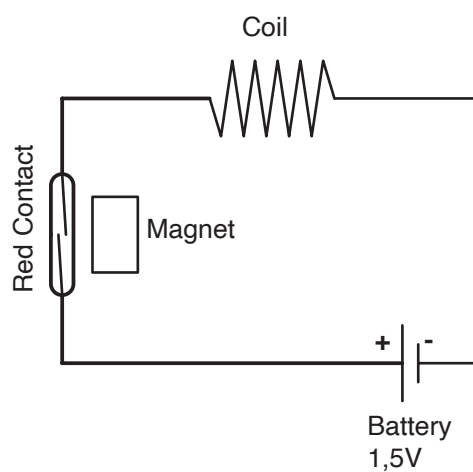
### 4. Parts list:

Parts	Material	Quantity	Diagram / Part N°	Size
<b>Base</b>	Plywood	1		10x60x160 mm
<b>Coil holder (2a)</b> <b>Magnet carrier (2b)</b>	Pine	1		20x20x95-100 mm
<b>Side brackets</b>	Acrylic	1		3x10x110mm oder 3x60x145 mm
<b>Battery holder</b>	Plastic	1		1xMignon
<b>Disc magnet</b>	Ceramic	2		ø 15x6 mm
<b>Copper wire</b>	Copper (Insulated)	1		5000 mm
<b>Switch</b>	Reed contact	1		14 mm
<b>Fixings</b>	Brass nail	4		20 mm
<b>Sundries</b>	Nuts	2		M 4
	Set screw	1		M4 x 70 mm
	Washers	2		M4 mm
	Screws	4		3x10 mm
	Lüsterklemmeinsatz	2		ø 3 mm

## 5. Exploded diagram:



## 6. Circuit diagram:



## 7. Planning and making overview

### 7.1 Making the side supports

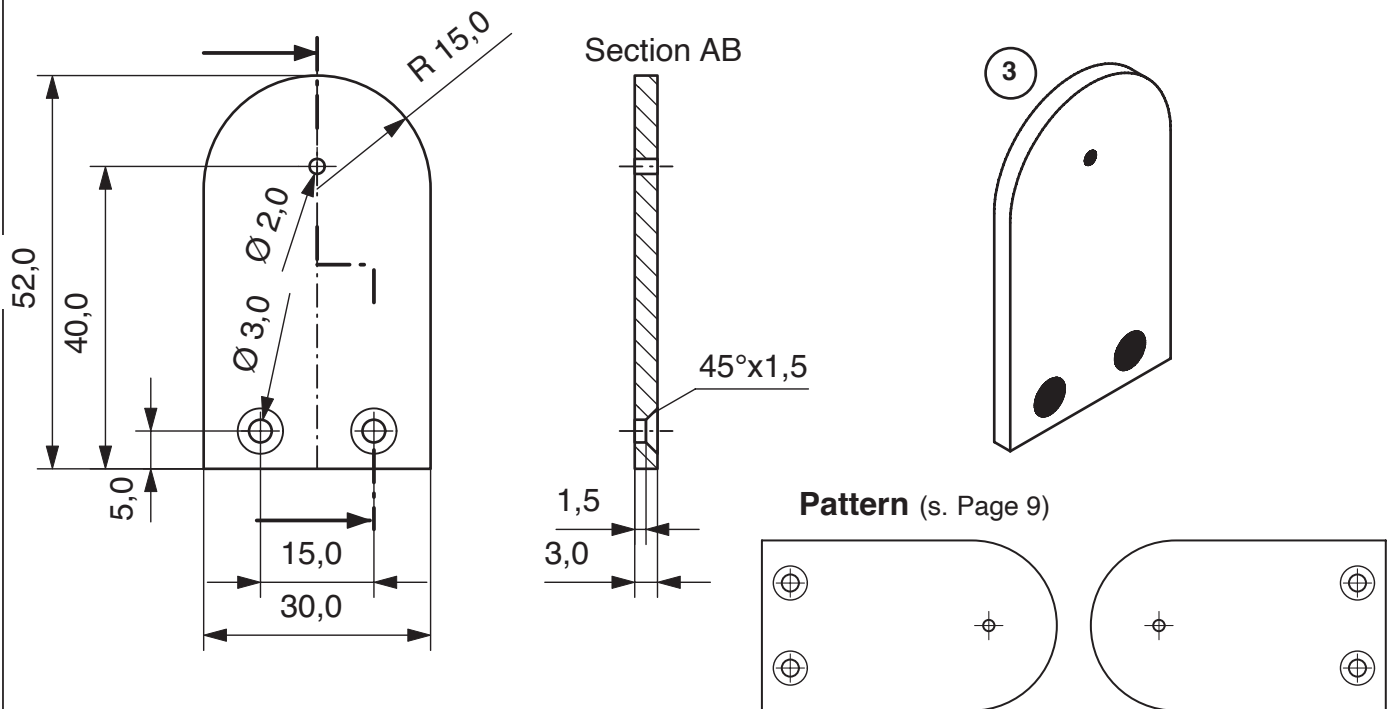
#### 7.2 Making the rotor and coil holder

#### 7.3 Making the parts on the base

#### 7.4 Making the electro-magnet and testing

### 7.1 Making the side supports

7.1.1 Measure or use a pattern ( Page 9) to mark out the shape of the side supports on the acrylic sheet, drill, countersink and then saw out. Clean up the edges with a file, then finish with wet and dry paper

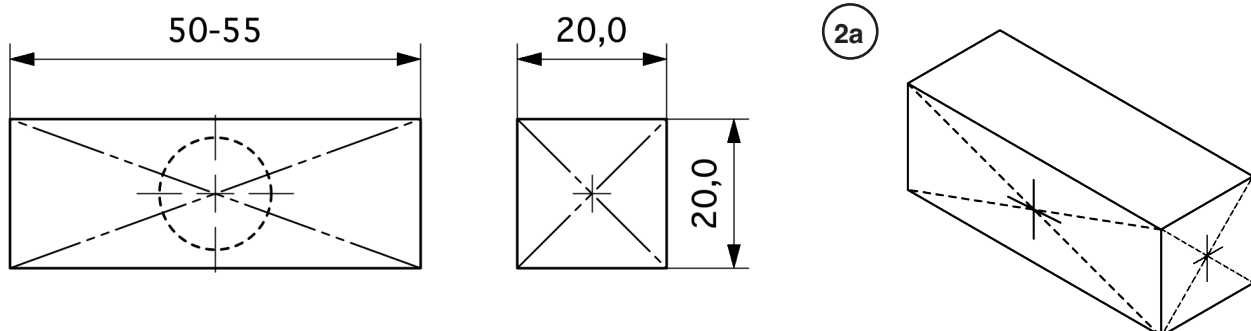


**Note:** Keep the protective foil ( blue or green) in place as long as possible!

7.1.2 Clean up the saw cuts

### 7.2 Making the rotor and coil holder

7.2.1 Saw off a 50-55mm length from the pine strip (2) 20 x 20 x 95-100mm for the rotor (2a) and sand the ends.



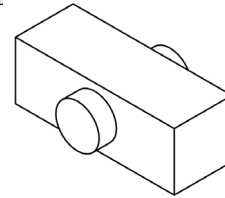
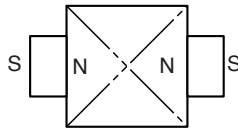
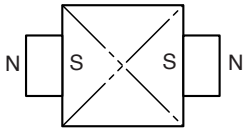
ends as shown

7.2.2 Draw two diagonals on the face and

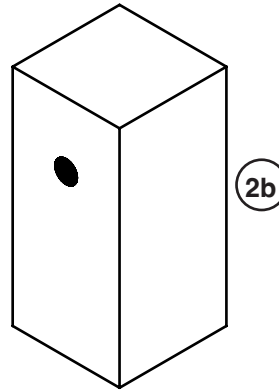
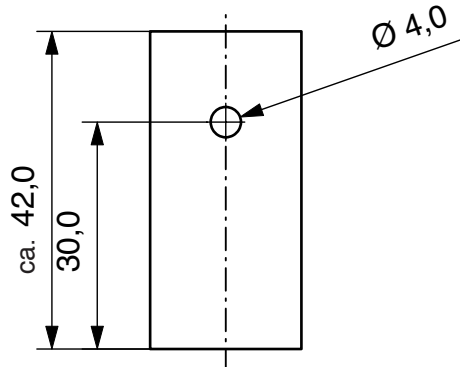
**Note:** Draw these lines accurately as it will effect the balance of the rotor when it is running!

### 7.2.3 Glue a disc magnet on either side, in the middle of the rotor, as shown

**Note:** Watch the polarity!



### 7.2.4 The remainder of the sawn piece (2) is the coil holder and should be drilled and marked as shown



### 7.2.5 Clean up all the sawn edges

## 7.3 Assembling the parts on the base

### 7.3.1 Saw the base (1) 10 x 60 x 160mm down to 120mm long:

### 7.3.2 Mount the side supports the side of the base as shown, left and right, using 2 screws (12) 20mm in from the end of the base

**Note:** Make a hole with a bradawl first before inserting the screws

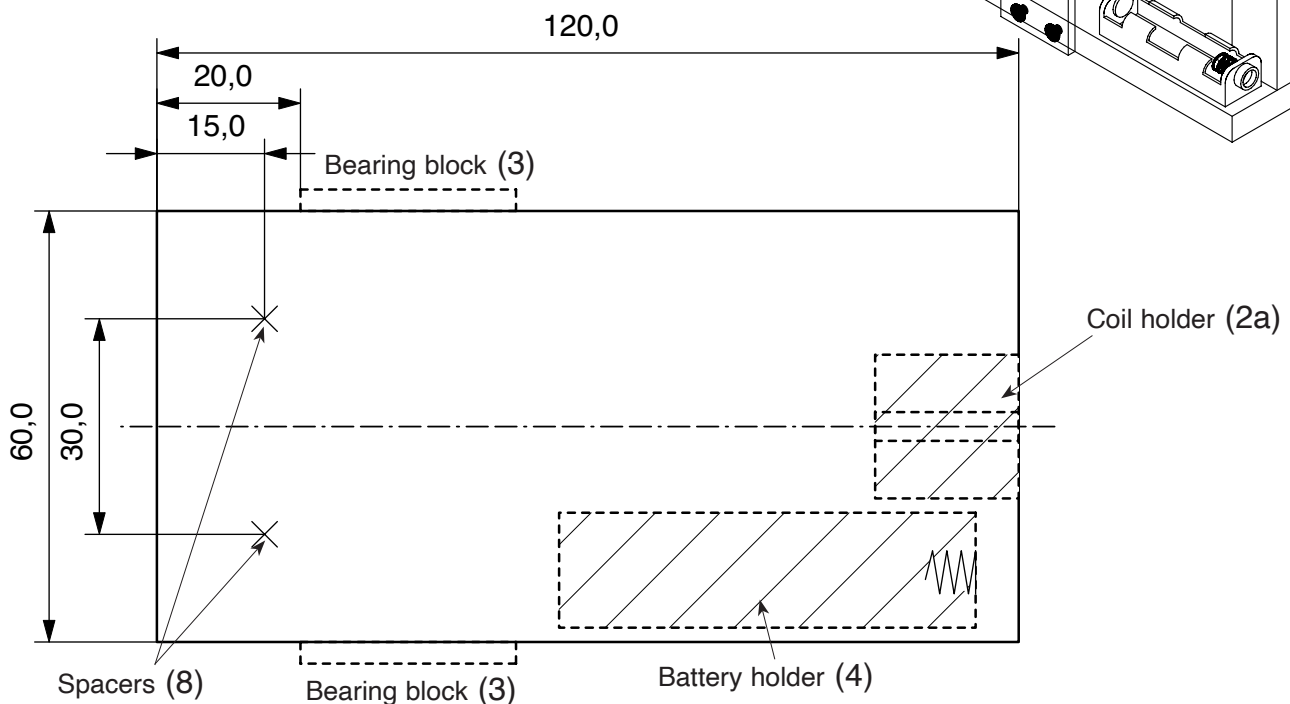
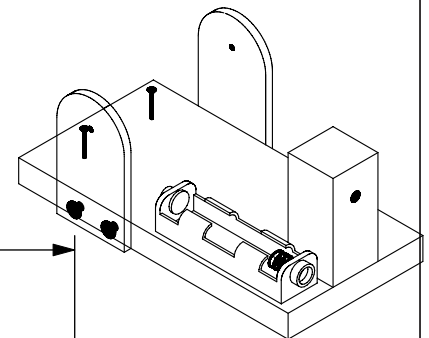
- Insert the two brass nails (1/8) 30mm apart, 15mm in from each side

**Note:** Do not bang the nails all the way through the base, otherwise the points will protrude through the bottom

- Glue the coil holder (2a) block in the centre of the base as shown

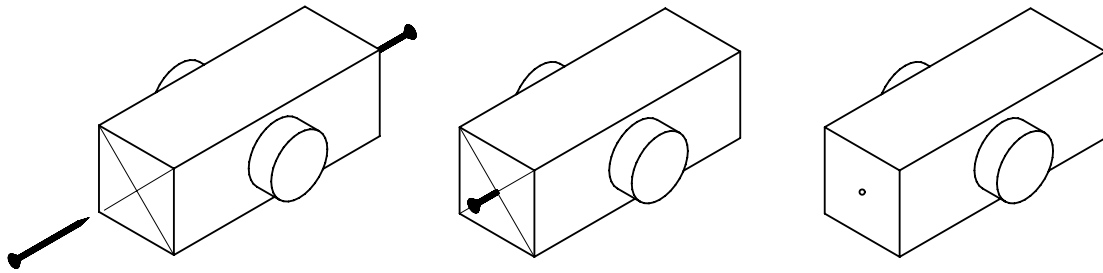
**Note:** The hole must be in line with the centre of the base!

- Glue the battery holder on the base in the position as shown on the plan (Use a hot glue gun or UHU kraft glue)



### 7.3.3 Insert a brass nail (8) in either end of the block with the magnets, exactly in the middle

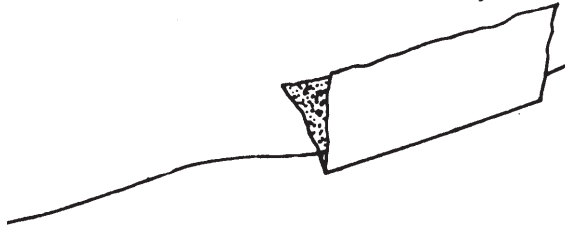
**Note:** It is important that the nails are accurate inserted, as this will effect the performance of the motor



## 7.4 Making the electro magnet and testing the motor

### 7.4.2 Remove the varnish from the ends with sandpaper!

**Note !** If you do not remove the varnish from the ends you cannot solder the wire.



### 7.4.3 Take the rotor bolt (10) and screw on the nut (9) and then add the washer (11) up to the nut

### 7.4.4 Wind insulation tape or sellotape around the bolt from its head to the nut ( ca 35mm ) in order that it is insulated and that the varnished wire is not damaged when winding the coil

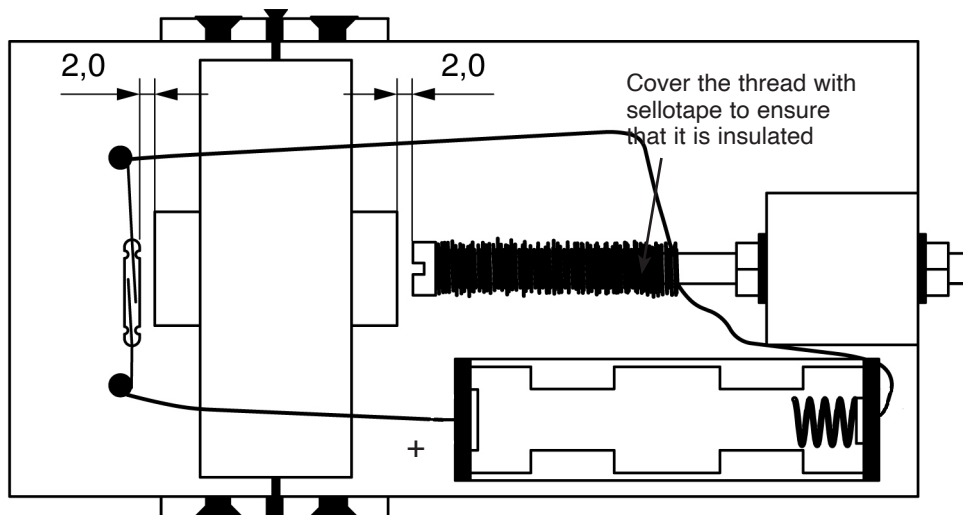
### 7.4.5 Tin the ends of the long length of varnished copper wire (Remove varnish first) with solder

### 7.4.6 Solder one end of the short wire (80mm) to the + pole on the battery holder and then the other end to the drawing pin ( See diagram )

**Note!:** Be careful not to overheat the battery holder otherwise the plastic of the holder will melt !!!

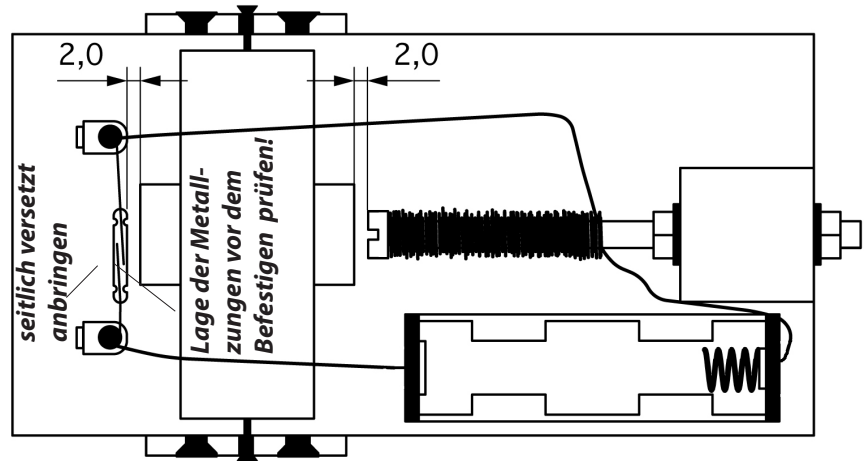
### 7.4.7 Take the long wire, starting at the insulated head of the bolt wind the insulated around the bolt in the same direction up to the nut . Leave about 100mm free at both ends of the coil. The coil should be about 30mm long and have 3-4 layers.

### 7.4.8 Finally insert the rotor bolt with the coil into the holder, add the washers (11) on either side and then secure with a nut (9). Solder one free end of the coil to the drawing pin and the other to the battery holder ( -Pole) See diagram





#### 7.4.9 Locate the rotor in the supports on the two brass nails (8) so that it rotates easily

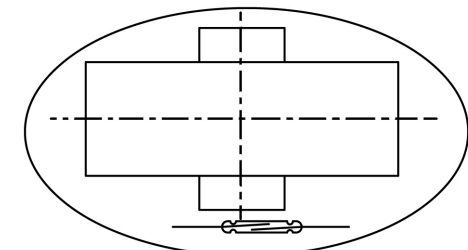


7.4.10 Now turn the rotor so that one of the magnets lines up with the set screw head ( see diagram) The distance between the head of the magnet and set screw should be about 2mm. This can be adjusted by turning the nuts on the set screw

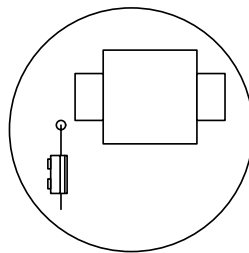
**Note:** By spinning the rotor slowly make sure that it does not catch or rub on the set screw  
Adjust if necessary

7.4.11 Die Lüsterklemmeinsätze auf die Abstandshalter aufsetzen und mit den Schrauben befestigen. Die Beinchen des Reedkontakt in einem Abstand von 30 mm abwinkeln, so daß die Kontakte im Glaskörper parallel zum Magneten stehen. Die Oberkante des Reedkontaktes soll mit der Unterkante des Magneten abschließen und so in den Lüsterklemmeinsätzen festgeschraubt werden.

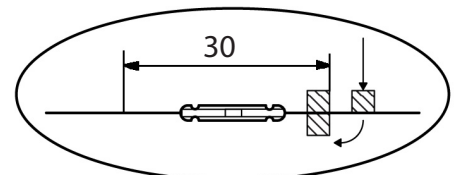
**Hinweis:** Beim Abwinkeln der Beinchen eine Zange als Biegekante verwenden, damit der Glaskörper nicht bricht!!



set to one side  
Placement of the reed contact



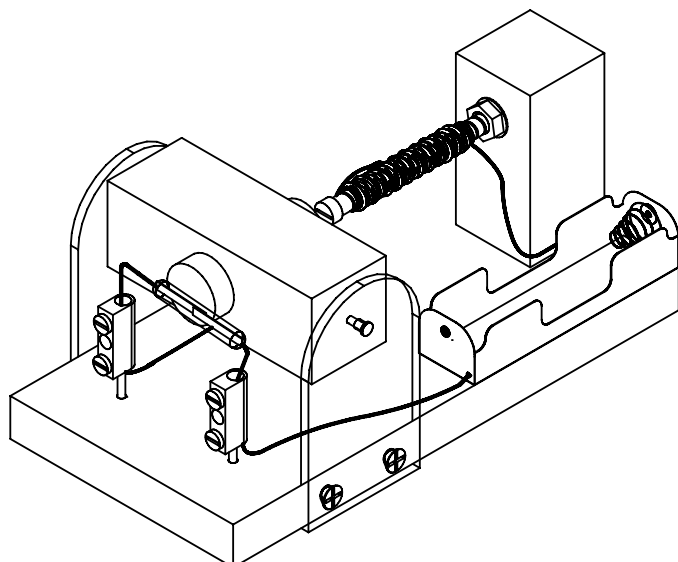
use combination pliers and wood to bend the Reed contact ends!



Insert a battery into the holder and turn the rotor. The motor should begin to rotate ( direction is dependant on the polarity of the magnets)

If the motor does not start , unsolder the reed switch and move its position to the optimal position and then re-solder it

When testing, check the rotor by hand, to make sure that it does not hit the Reed switch as it turns!





Side support (3)

