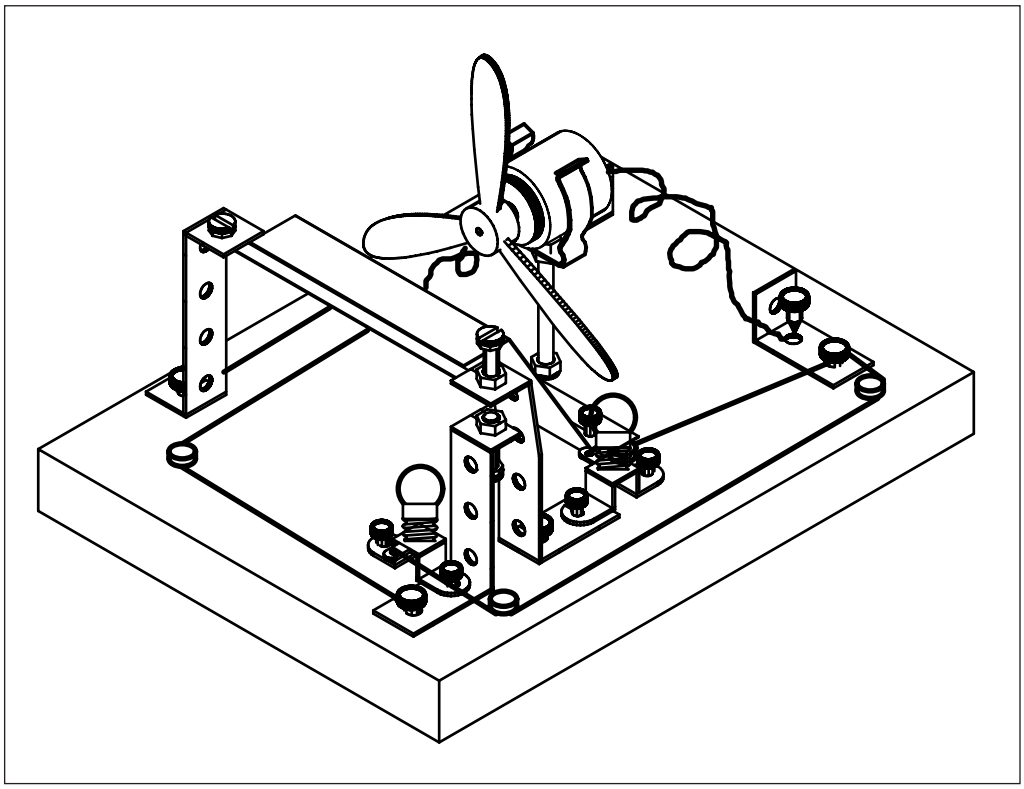
105.434

Thermo fan



Important Notice:

Beware of fire, never leave a burning candle unattended!!

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 Technolo- gy. 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. Dan- ger of suffocation!

1. Product information:

Article: electro-mechaniacal model

Use: in Design Technology Key stage 3

2. Material Information:

2.1. Material: Pine (confirous), soft wood
wood should be relativly dry before working

Working: Pine can be sawn, planed, shaped and drilled
mark out with measurements or use paper patterns

Joining: screws

Finish: wax (liquid or solid)
wood varnish (undercoat/clear)
stain (water soluable then varnish)

2.2. Material: Zinc sheet

Working: cut with metal shears / tin snips
fold using a vice
mark out by measurement or use patterns
drilling;

Joining: screws

Finish: none necessary, could be sprayed with clear varnish

2.3. Material: holed metal strip (zinc plated)

Working: cut with a Hacksaw
Bend using a vice
mark out with a scriber

Joining: use screws

Finish: no special finish necessary

2.3. Electro components:

Bulb holder: with 2 soldering tabs
suitable for E10 bulb

Bulb: 3.5 volts, 0,2A to fit E10 holder

Insulated wire: single strip wire 0.5mm

Bi metal strip: a fusion of two different metals, with different expansions rates

Motor: DC 1.5-4.5 Volt

3. Tools:

Saws: use a hacksaw for the holed metal strip

Note! hold the work in a vice
make sure that the blade is inserted with the teeth facing forward

Filing: choose a suitable grade of file

Note! files only cut on the foward stroke

Finishing: use a glasspaper and block for all flat surfaces
and loose paper for curves;

Drilling: use a handrill or electric pillar drill

Note! take care when drilling, wear safety glasses, tie all long hair back, remove rings and jewellery. Wear an apron and clamp the work to be drilled safely

Bending: use a vice or folding irons

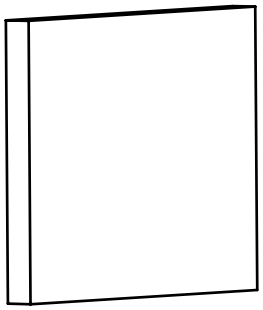
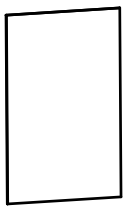
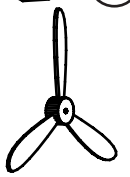
Note! soft jaws are neede!

Cutting: use side cutters to strip the plastic fom the insulated wire
Tin snips for cutting the metal sheet

Soldering: for soldering use a 15-30Wat fine tipped iron, in conjunction with flux

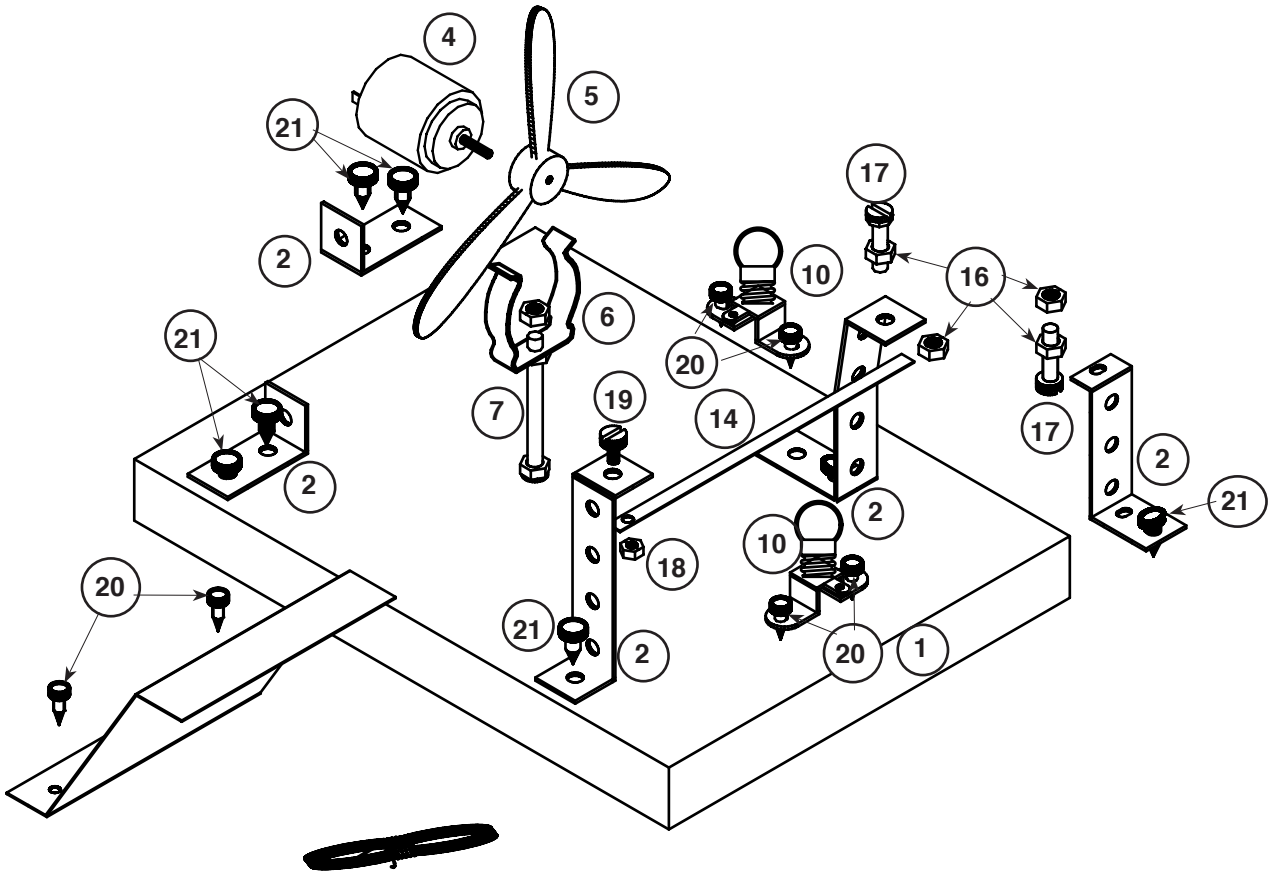
Note! the soldering iron tip becomes very hot
If you use electronic solder the flux is in the core!

4. Parts list

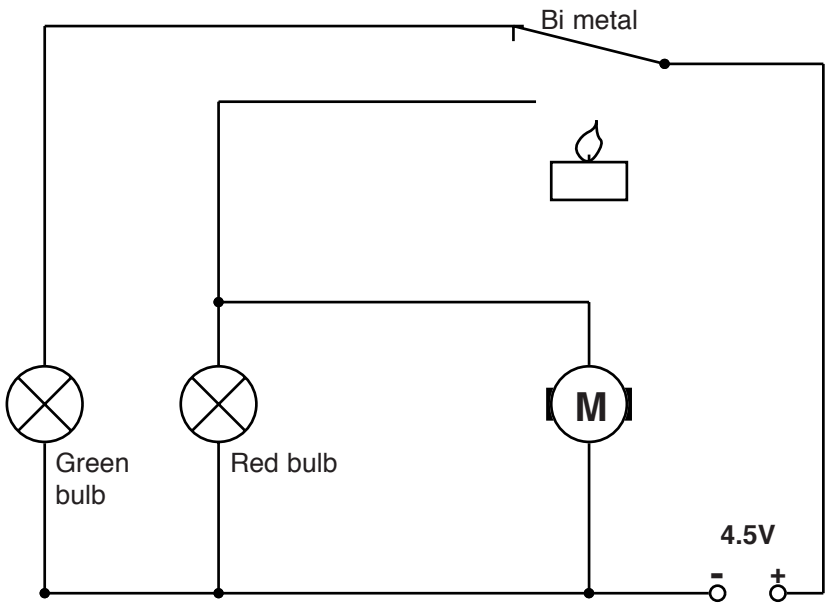
Description	Material	Quantity	Diagram	Size
Base	Wood	1	 1	15 x 150 x 200 mm
Holder	Metal	2	 2	1 x 15 x 255 mm
Shield	metal	1	 3	0.29 x 100 x 100 mm
Fan				
	Motor	1	 4	1.5V -4.5Volts
	Propellor	1		115mm dia
	Spring clip	1	 6	23 - 27 mm
	Set screw	1	 7	M4 x 50/60 mm
	Nut	1	 8	M4
	Washer	2	 9	M4
Electro components				
Bulb holder	metal	2	 10	E10
Bulb	3.5 V/0.2A red	1	 11	E10
	3.5 V/0.2A green	1	 12	E10
Insulated wire	500 mm	2	 13	500 mm
Bi-metal strip	Typ 206-1	1	 14	0.4 x 4.7 x 200mm
Sundries				
	Washers	12	 15	M4
	Nuts	4	 16	M4
	Set screws	2	 17	M4 x 16 mm
	Nut	1	18	M3
	Set screw	1	 19	M3 x 6 mm
	Screws	6	 20	2.9 x 9.5 mm
	Screws	12	 21	3.9 x 9.5 mm
	Candle	1	 22	32 mm dia

5. Exploded diagram

Scale 1 : 2



6. Wiring diagram



7. Planning overview

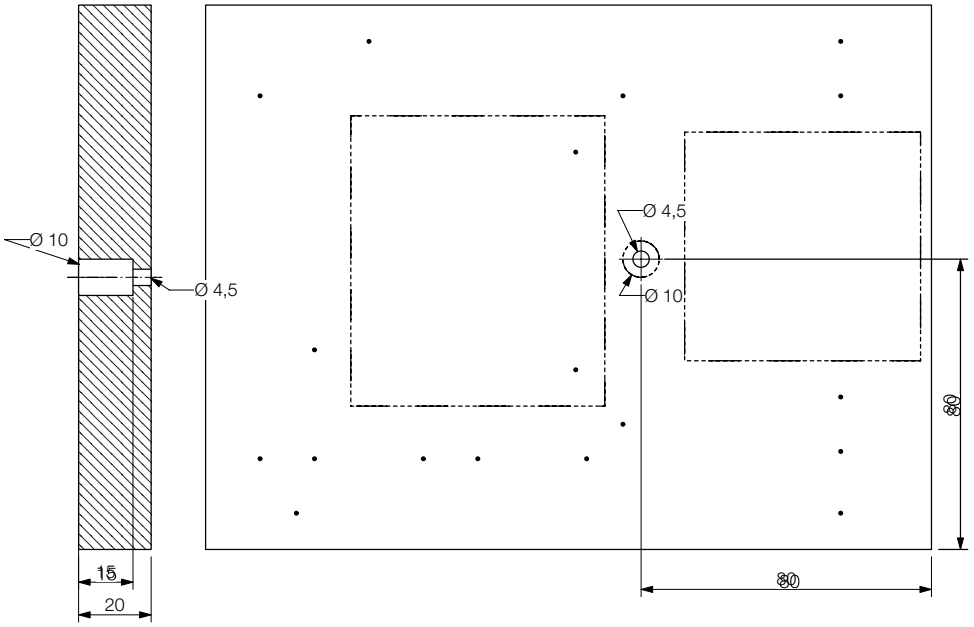
7.1. Planning and making the base

7.1.1 Mark out or trace the pattern (page 13) on to the base 10-20 x 150 x 200mm

7.1.2 Mark out the holes for the screws, approx 5mm deep with a bradawl using a bradawl

7.1.3 Drill the 4.5mm dia hole through the base as shown, turn the base over and counter drill on the same spot a 10mm dia hole, 5-15mm deep blind hole, depending on the thickness of the base

Note: do not drill the blind hole (underneath the base) all the way through

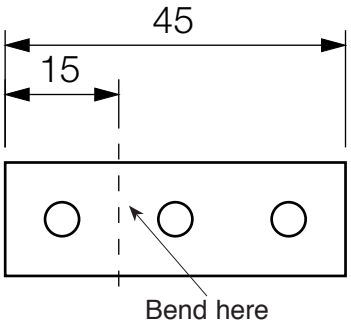


1

7.2. Making the supports

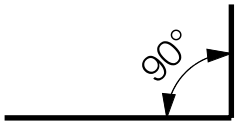
7.2.1 From the holed metal strip (2) saw off a 2 pieces each 4 holes long (approx 45mm) and file the ends smooth Bend both pieces of metal as shown Bendin pattern

Tip: use protective vice jaws!



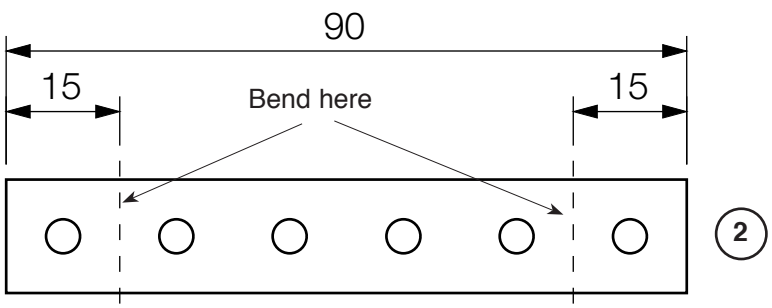
2

Bending pattern

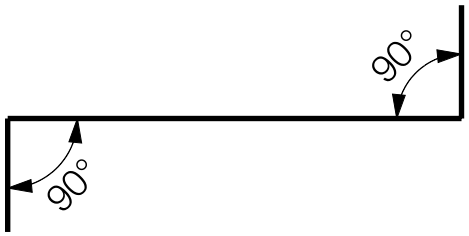


7.2.2 From the holed metal strip (2) mark out and saw one piece 6holes long (approx 85mm) and clean up the ends with a file. Bend the contact strip for the bi-metal strip as shown in the diagram

Tip: use protective soft jaws in the vice !



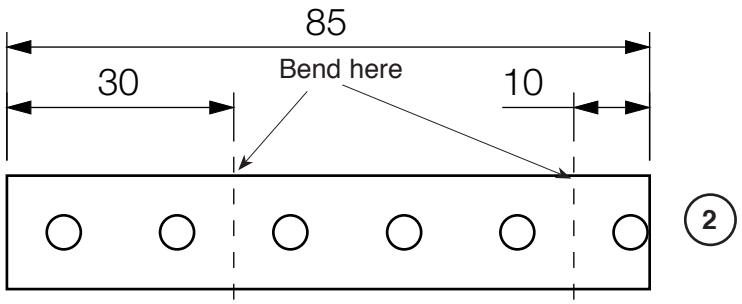
Bending pattern

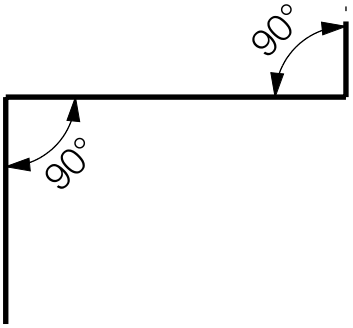


7.2.3 From the holed metal strip (2) cut a piece 6 holes long (approx 85mm) Then bend it as shown to form the contact strip for the red bulb and motor

Tip: use protective soft jaws in the vice !

Bending pattern

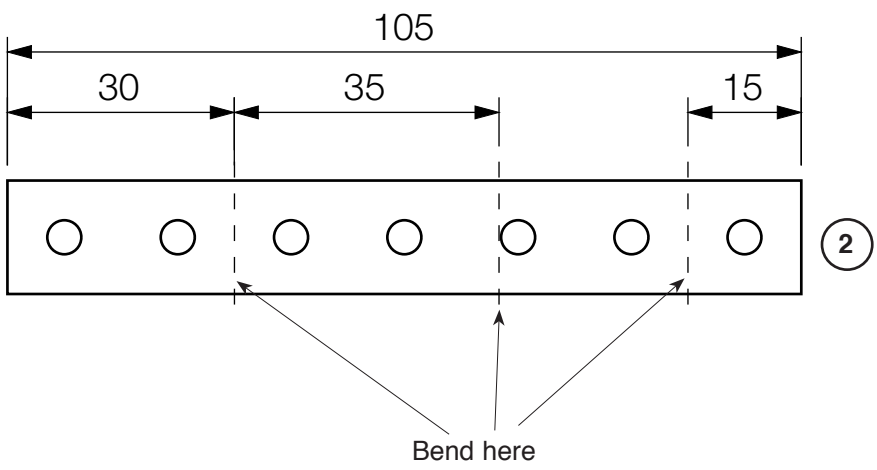


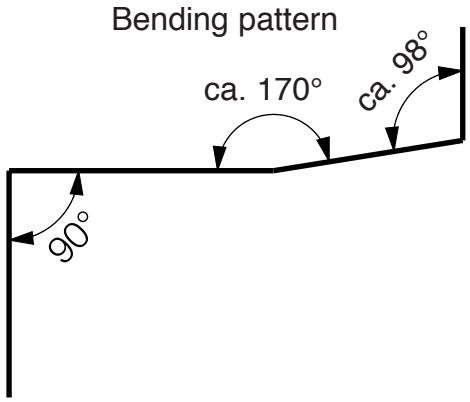


7.2.4 From the holed metal strip (2) saw a piece with 7 holes (approx 105mm long) clean up the ends. This will be the contact strip for the green bulb

Tip: use protective soft jaws in the vice

Bending pattern

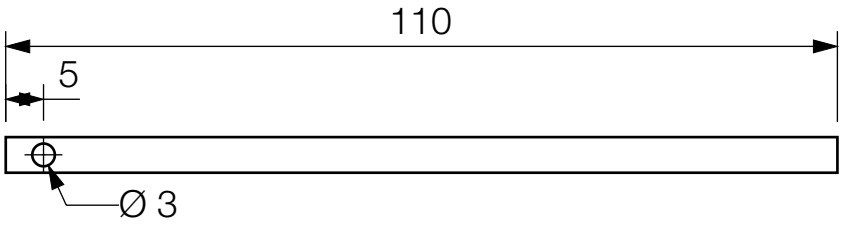




7.3. Making the bi-metal strip

7.3.1 Shorten the bi-metal strip to 110mm long and drill the hole in one end

Note! remember the safety rules when drilling

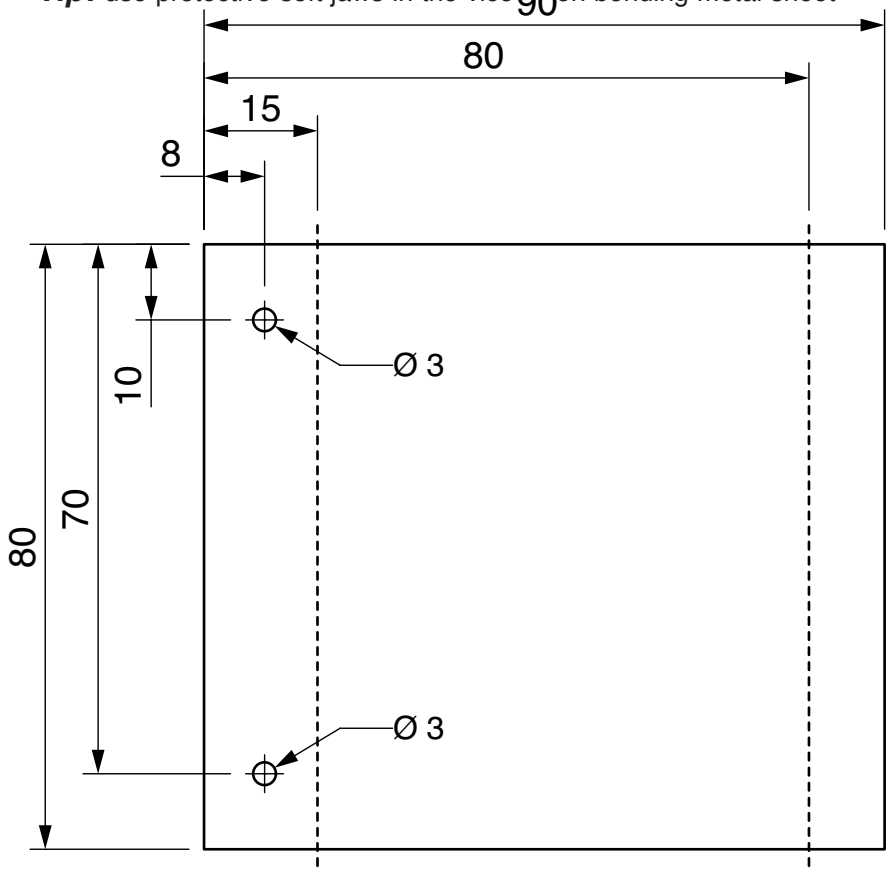


14

7.4. Planning and bending the shield

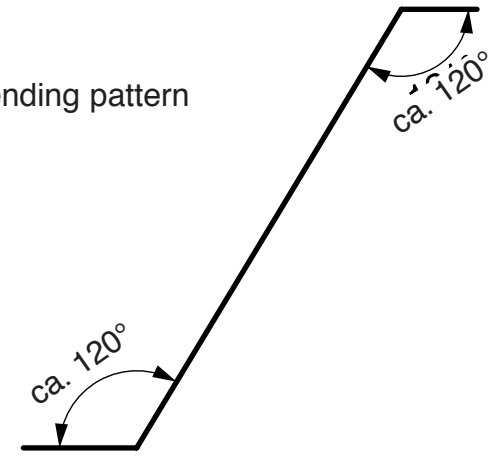
7.4.1 Mark out the measurements as shown on to the metal sheet, drill the holes and clean up the edges with a file

Tip: use protective soft jaws in the vice when bending metal sheet



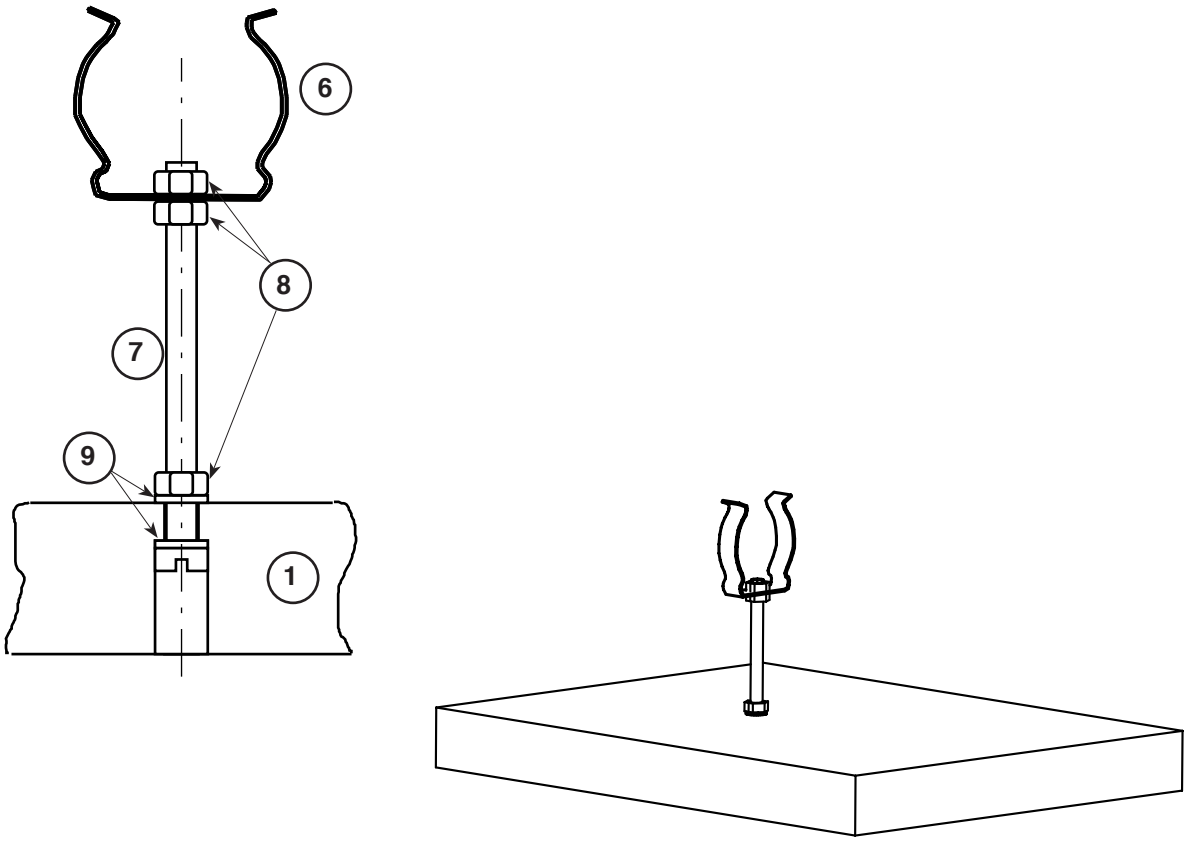
3

bending pattern



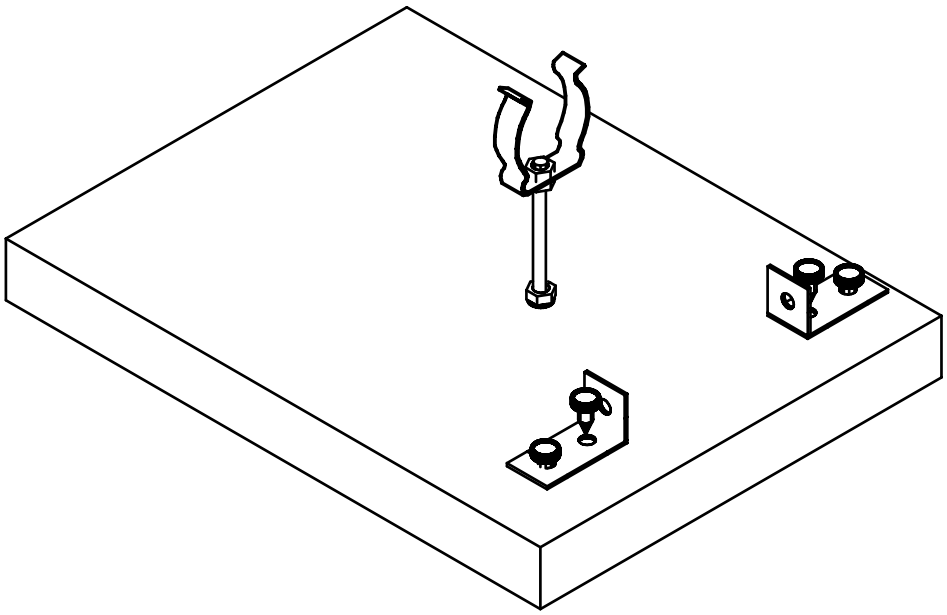
7.5. Assembling the parts

7.5.1 The holder for the fan is made up from the parts as shown



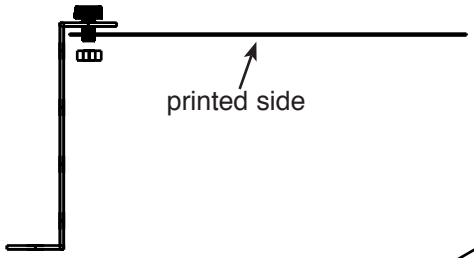
7.5.2 Screw the two battery contact holed metal strips (made in step 7.2.1) to the base (1) as shown

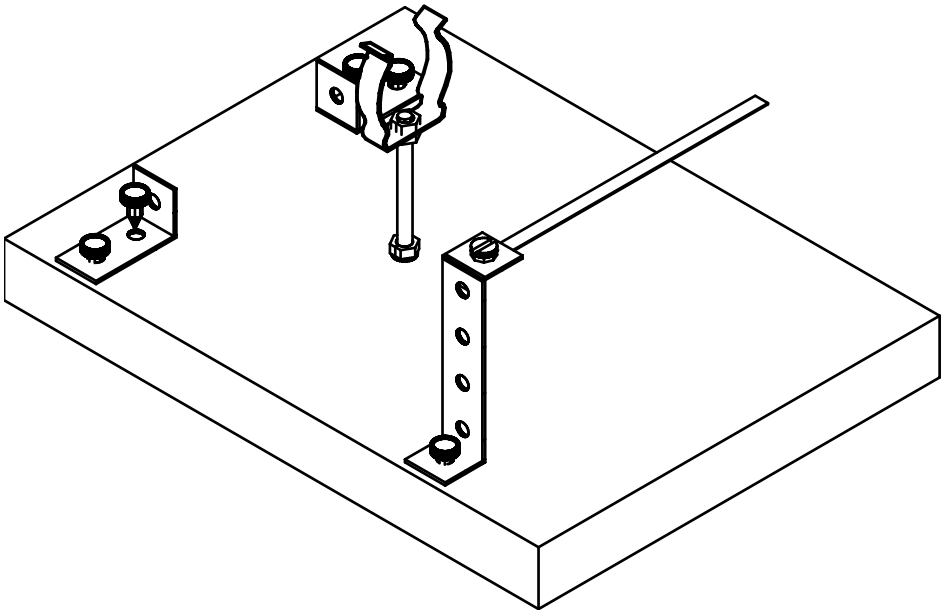
Tip: do not insert the screws too tightly. They can be fully tightened after the cable has been added



7.5.3 Fix the bi-metal strip (printed side down) to its holder with a nut and screw (19) and (18) and then mount (21) the holder, made in step 7.2.2, to the base

Note: do not tighten the screw (21) fully until the wiring has been completed

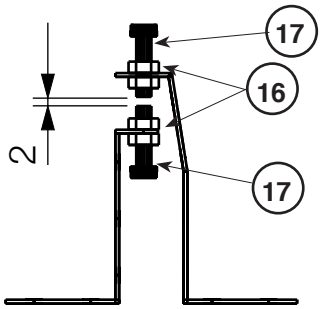


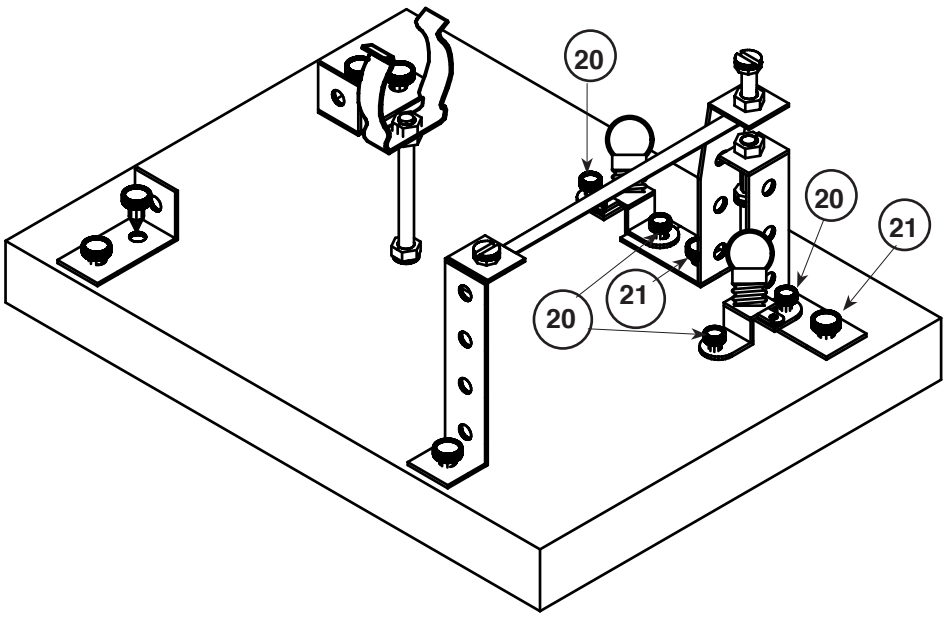


7.5.4 Mount the sets screws and M4 nuts on the contacts holders made made in steps 7.2.4 amd 7.2.4 as shown in the diagram

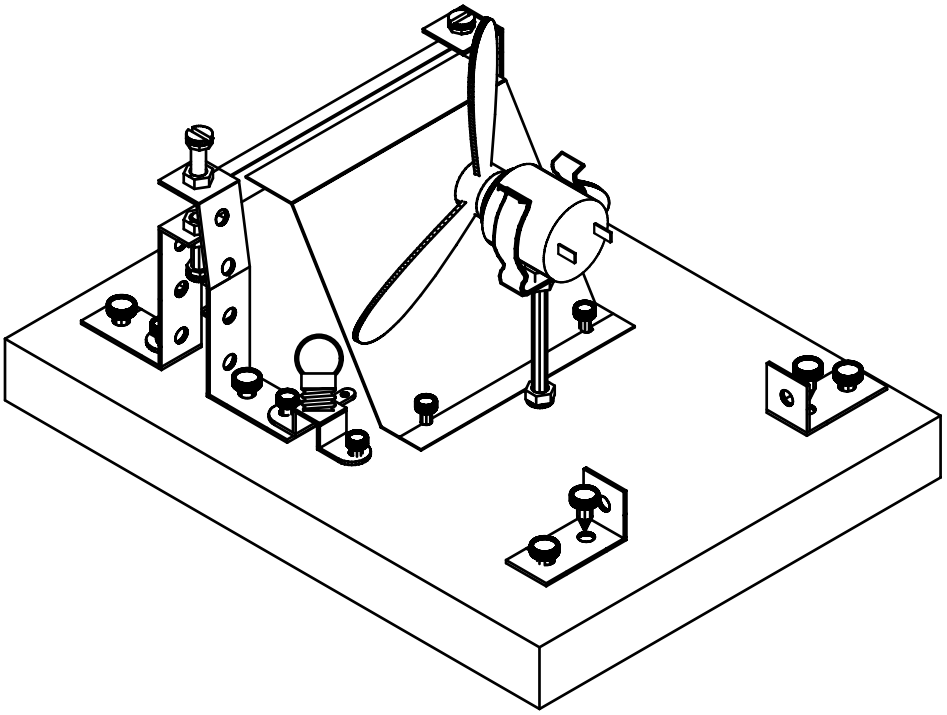
Finally screw the metal strip to the base, adding the two bulb holders at the same time, using screws (20 and 21)

Note: do not tighten the screws fully until the wiring is complete also the contact strip for the green light may have to be bent slightly





7.5.5 Screw (20) the fan shield to the base as shown
Push the propellor (5) on the motor shaft and insert the motor (4) into the spring clip



7.6. Wiring the circuit

7.6.1 For the motor connection take 2 lengths of different colour cable 100mm long and remove the insulation from both ends. Twist the cables around a pencil to make them curly and solder one end of each cable to the motor
The other ends are clamped under the screws as shown on the plan

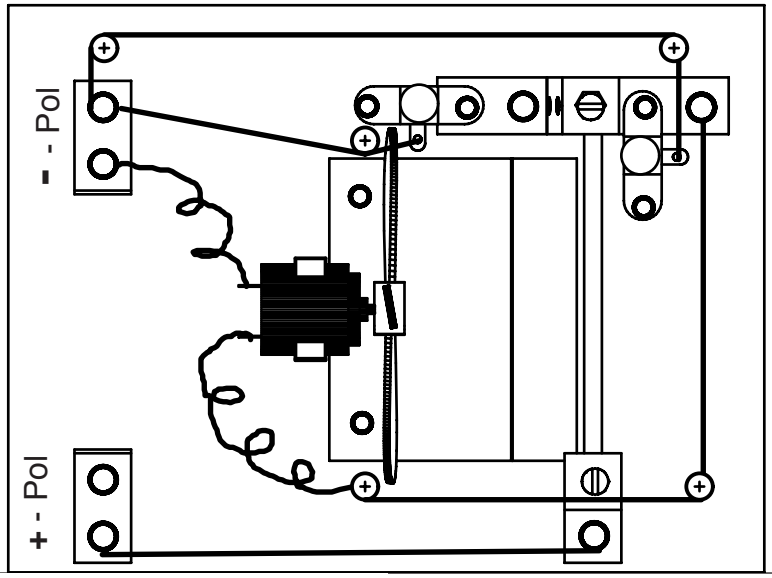
Tip watch for the polarity of the motor!
the air should blow in the direction of the bi-metal strip

7.6.2 Insert small screws and washers into the remaining holes on the base

Note: do not fully tighten them yet

7.6.3 Complete the remainder of the wiring as shown on the plan

Note: solder the cable to the connections on the bulb holders



7.7. Testing the circuit

7.7.1 Screw the red and green bulbs into the holders

7.7.2 Set the distance between the bi-metal strip and the contacts on the metal strips for the red and green lights. The contact screw for the green light should be adjusted so that it touches the bi- metal strip and the other screw so that there is a gap of 2mm.(step 7.5.4)

7.7.3 Place the battery onto the correct contacts on the base

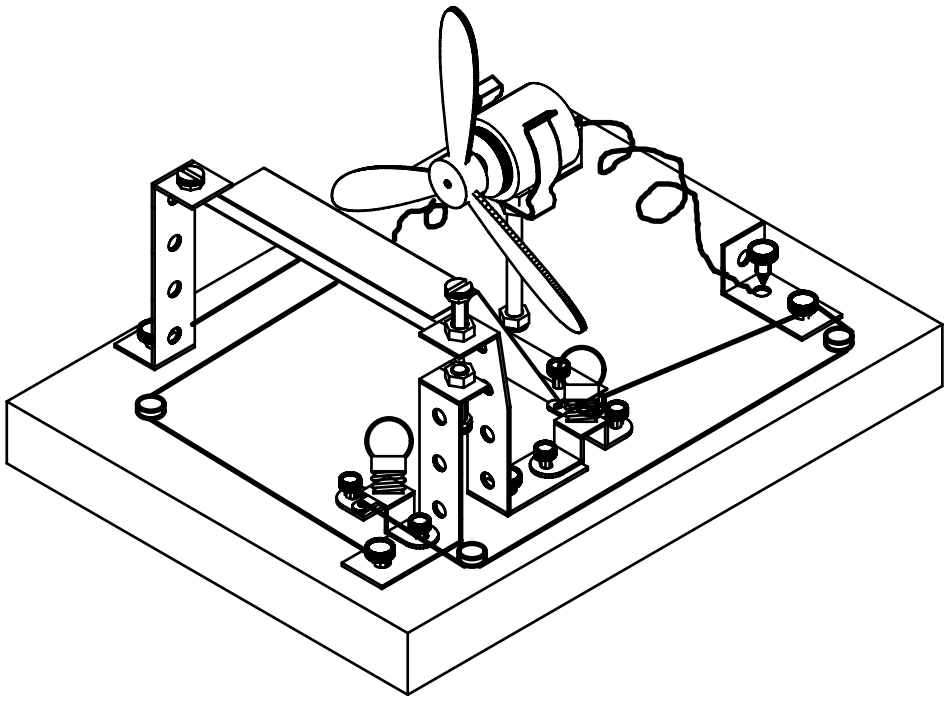
Note: Be careful of the polarity

Now the green bulb should light
Light the candle under the bi-metal strip

Note: Never leave a lit candle unattended

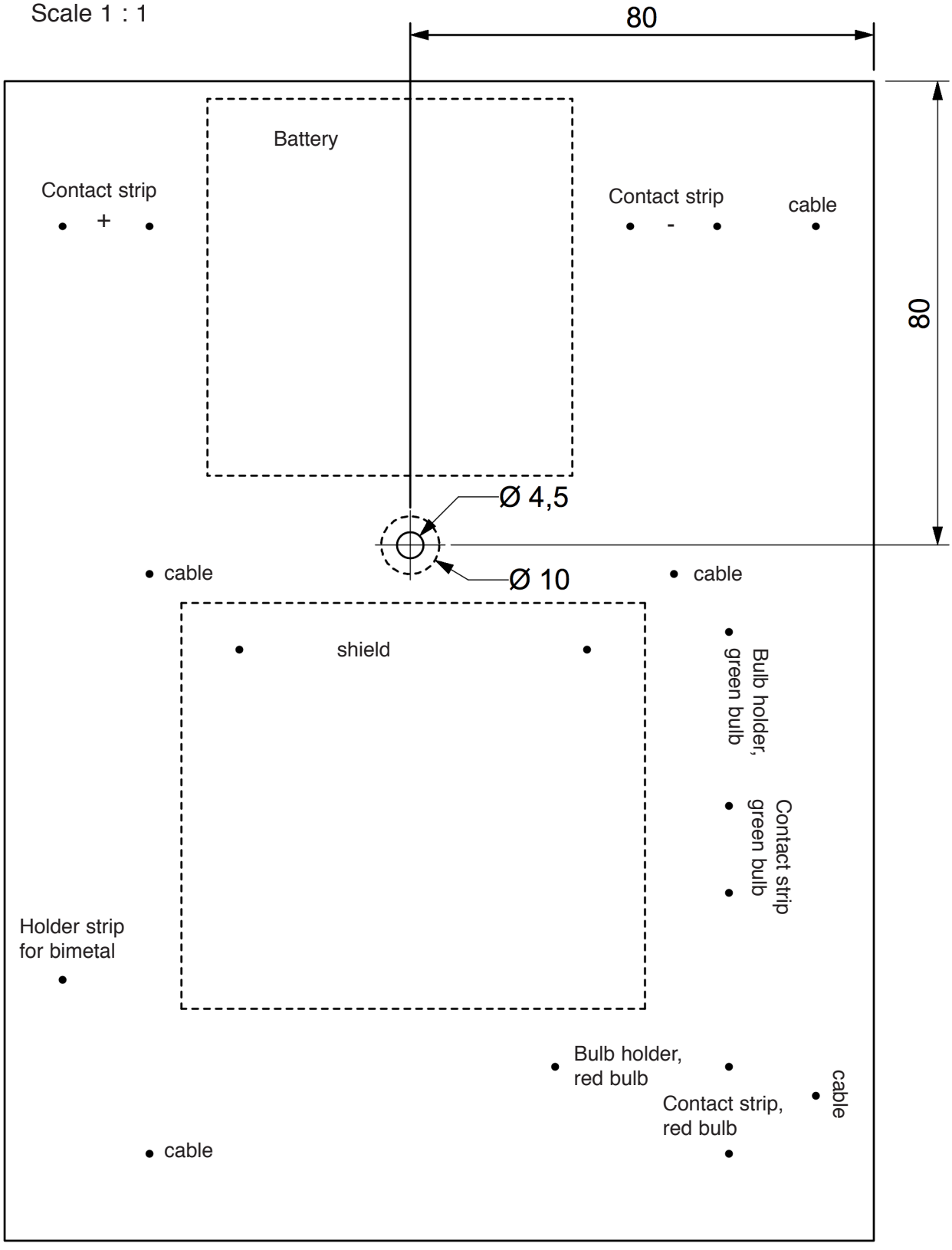
In a relatively short time the bi-metal strip will bend towards the contact for the red bulb and the fan will start up As the fan starts to cool the bi-metal strip it will bend back again.The green bulb will light up and the fan switch off. The flame warms up the bi-metal and the cycle will start up again

Probelems:	**Cause:**
- Bi-metal strip does not switch	- wrong way up,print showing on top
- Motor stays on too long	- the rotation is wrong
- The green or red bulb does not light	- Bad conection between the contact set screws and bi-metal strip
- Fan blows the candle out	- Tea light in the wrong position behind the shield



Driling pattern

Scale 1 : 1



Blind hole in the base shown in section