

„A Self-made Wind Turbine“



Green Desert e.V. & Lebenshilfe Werkstatt Seelze
- an integrated Workshop on the subject of „a self-made wind turbine“ -

according to the original manual of

„A Wind Turbin Recipe Book - The Axial Flux Windmill Plans“

by Hugh Piggott

and

„Drei Flügel im Wind - Eine Selbstbauanleitung für Kleinwindturbinen“

a translated version by GREEN STEP e.V. (Hrsg.)



BEFORE STARTING

For using this guide it's important to consider that it only serves as support.

It is assumed that the original manual („A Windturbine Recipe Book“ by Hugh Piggott or „Drei Flügel im Wind“ by Green Step e.V.) is used as main instruction.

This tutorial is also not entitled to completeness.

Please note that many dimensions used on the following pages only refer to the specifically builded windturbine (here: turbine diameter = 1800mm).

Every chapter deals with a related named section in the original manual.

For a better overview the accordant page numbers are listed:

ENGLISH VERSION („A Windturbine Recipe Book“ by Hugh Piggott)

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GERMAN VERSION („Drei Flügel im Wind“ by Green Step e.V.)

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THE BLADES



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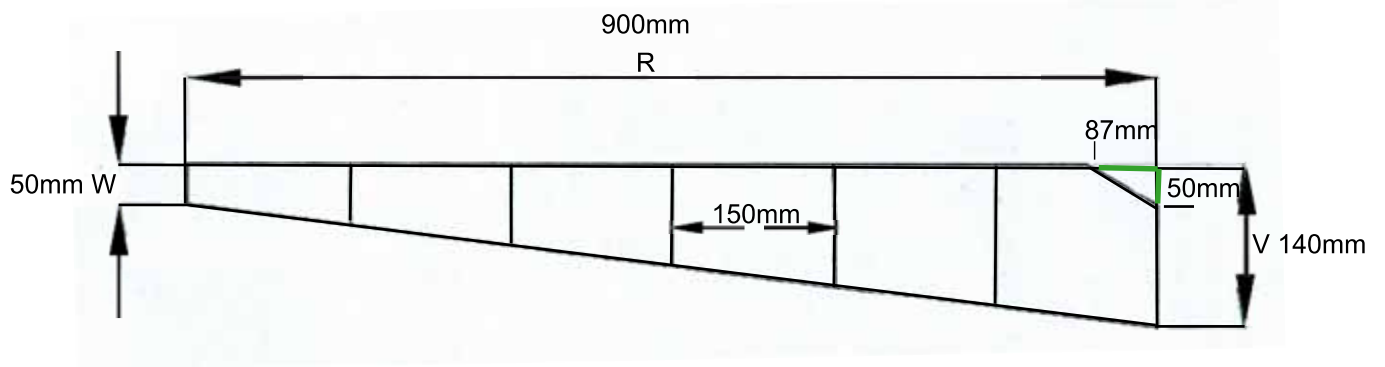
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1: PREPAIR THE TEMPLATE



1. To obtain uniform blades prepare a thin template out of plywood template in the first place. First draw the outlines.

Dimensions are shown.

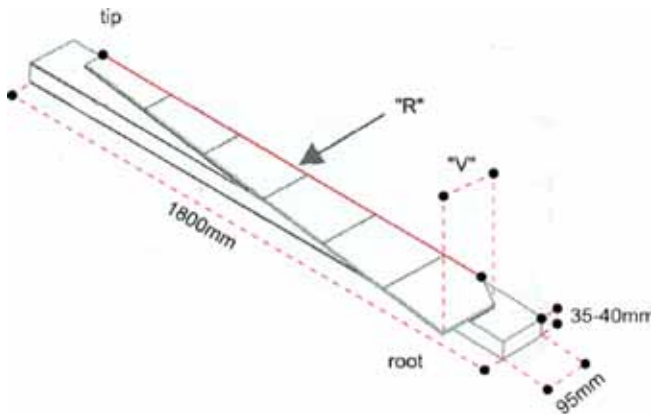
2. Mark six intervals with a length of 150 mm.



3. Cut out the template.



2: PREPAIR THE BLADES



1. Use the straight edge of the wood and put the template on it.
2. Take care that the length of „R“ is completely on the bladewood.
3. It's OK, if the length „V“ of the template is wider than the wood.
4. Draw the blanks at the tip a bit longer than the plywood template (approx. 5cm).
5. Draw blades outlines and transfer the 6 stations, following the lengths of blade.



3: CUT THE BLANKS



1. Cut out the shape with the wood saw (no. 84).



2. Small inaccuracies can be corrected with a smoothing plane (no. 85).



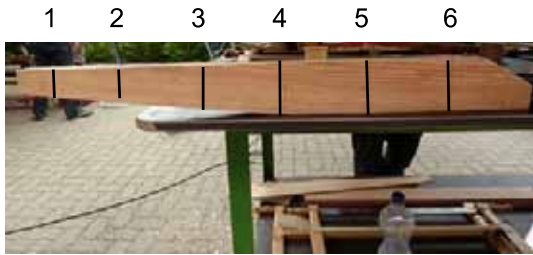
3. Large-scale inaccuracies are better handles with a belt sander (no. 38), ...



4. ... and edges can be smoothed with a rasp (no. 76).

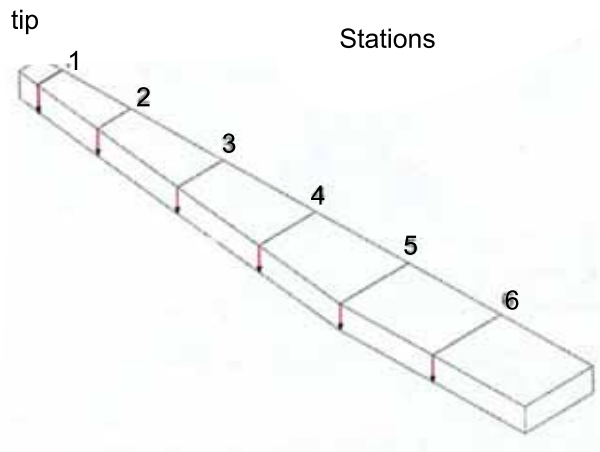


3: CUT THE BLANKS



5. This is the blank shape of the blade. Pay attention to the 6 stations with a distance of 15mm.

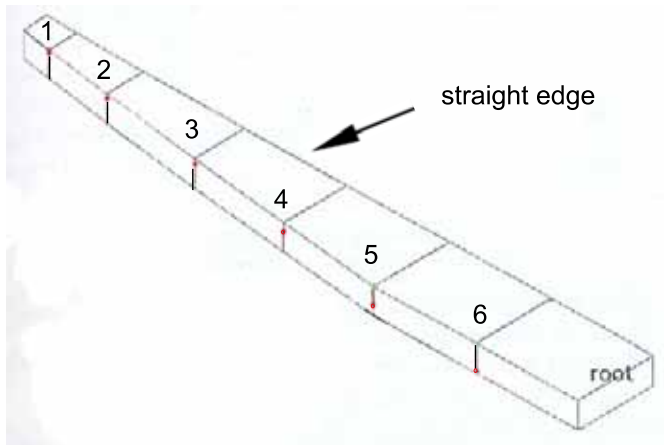
(dimensions depending on windturbine size, here 1800mm)



6. Use the square to extend the lines to the 90° edge (no. 73).

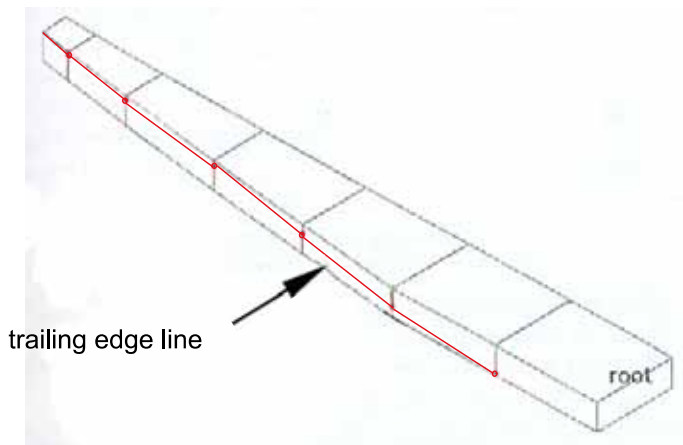


4: THE TRAILING EDGE LINE



1. According to these lines measure down and mark the following scales:

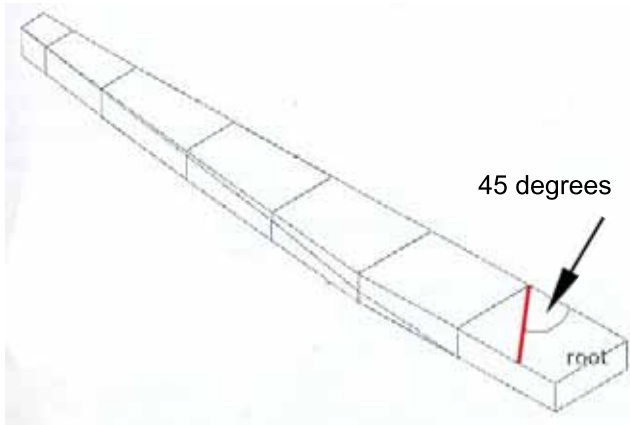
- Station 1: 2 mm
- Station 2: 4 mm
- Station 3: 8 mm
- Station 4: 14 mm
- Station 5: 28 mm
- Station 6: full thickness of the wood



2. Draw a line trough connecting the points.
This line is called „trailing edge line“.

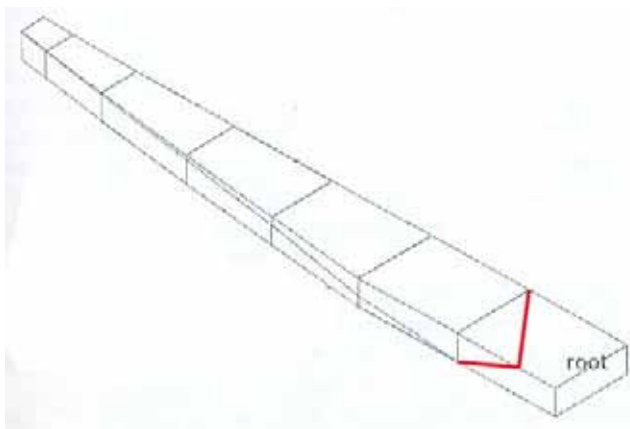


4: THE TRAILING EDGE LINE

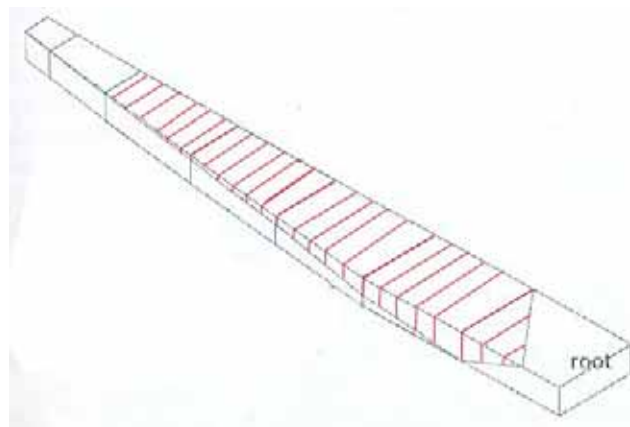


4. Use the set square (no. 70) and measure a 45° angle from the „straight edge“ like shown in the picture.

Draw the line.



5. Join the end of the line from step 4 with the point in station 6 from step 2.



6. Draw lines between the straight edge and the lines you have drawn in step 3.



5. CUT THE TRAILING EDGE



1. Caution:
Cut the lines with the wood saw (no.84) exactly as deep as marked!



2. Remove the wood in this area with mallet (no. 82) and chisel (no. 83).



5: CUT THE TRAILING EDGE



3. It's important, that the surface you have cutted is leveled.



4. Use the rule to check if the surface is leveled.
Correct with a plane if necessary ...

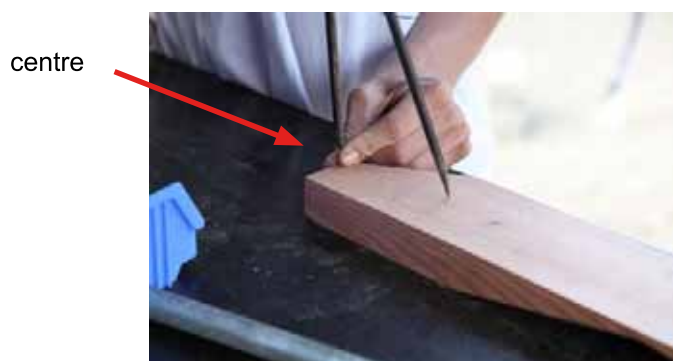


5. ...until it's shown in the picture 5.



6: BLADE THICKNESS

1. Shave off the backside of the blade to achieve the appropriate thickness of the blade.



2. Draw a circle with the compass (no. 74) at the backside of the blade, with a radius of 100 mm. The centre of the circle is the angle, as shown at the picture.



3. Measure again the thickness at each station. It's the same procedure like that one in chapter 4. But this time you have to mark the thickness from both sides of the blade.

Blades-Tip:

Station 1: 6 mm

Station 2: 8 mm

Station 3: 11 mm

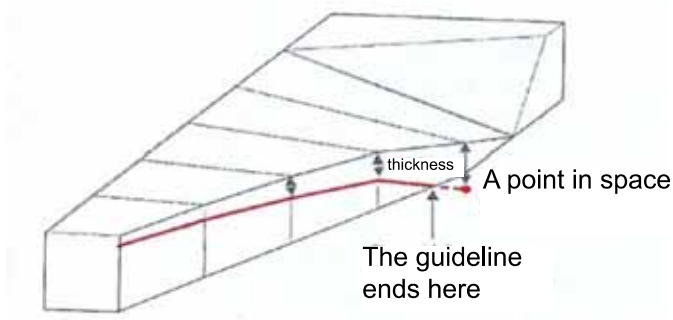
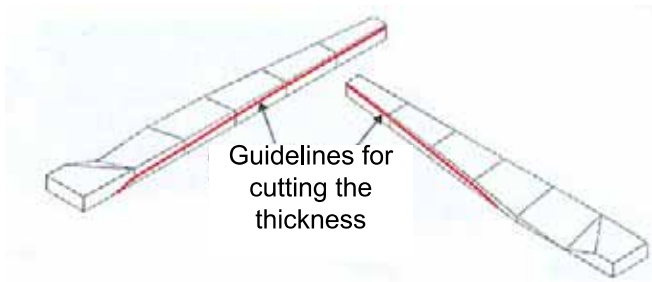
Station 4: 14 mm

Station 5: 20 mm

At this point you need a trick watch out for step 5!



6: BLADE THICKNESS



4. The picture shows one blade from both sides. There are some tricks how to draw the line besides the trailing edge (shown at the picture). Therefore watch out the following steps.
5. At station 5 you have to mark a wider distance on the wood than you possibly can. Draw the line as far as possible, towards a virtual point where vertical and horizontal lines would theoretically hit each other.
6. Turn around the blade and draw the line around the corner as well as diagonally across the workpiece to the angle marked in the picture.
7. Carve the blade down (selected field in the picture) to the correct thickness and create a plain surface. Proceed as in chapter 5, but this time, take the backside of the blade. Leave the root untouched.



6: BLADE THICKNESS



8. For removing the wood, draw and cut lines in equal intervals of 3 cm.



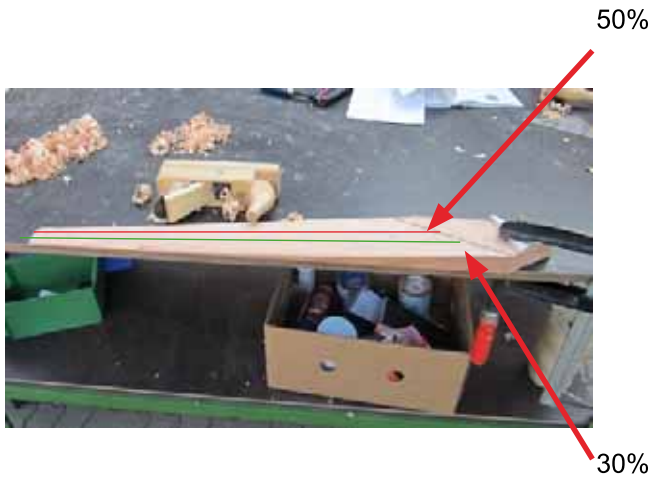
9. Use mallet and chisel ...



10. ... and finally the plane.



7: AIRFOIL SHAPE



1. Draw 2 lines parallel to the straight edge.
The red line indicates 50% of total the blades wide and the green line 30%.



2. Use the plane and cut down the marked side of the 50% line. It should be a leveled surface. The edge, marked by the arrow, should not be wider than 1 mm. Don't cut the edge itself.



3. Use the plane and round the edge in the 30% area (green arrow). Don't cut the edge above.



4. At least round the hole backside of the blade.
Caution:
Take care that the thickest point is not left as a flat spot nor cut a sharp summit.
Avoid carving off any wood within the circle zone.



7: AIRFOIL SHAPE

5. Finally it is supposed to look like this.



rounded edge



1 mm edge



THE MAGNET ROTOR MOULD



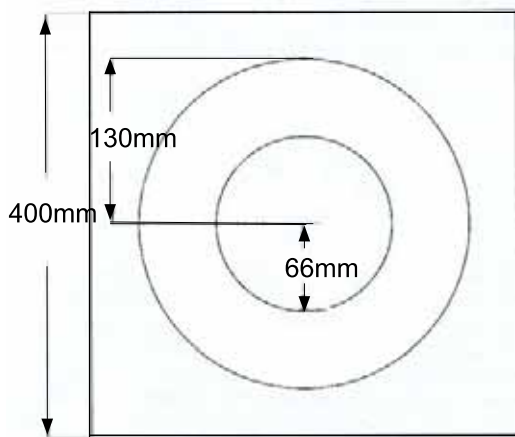
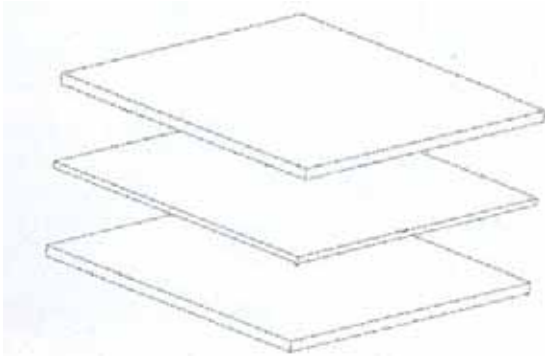
BUILDING MATERIAL



TOOLS



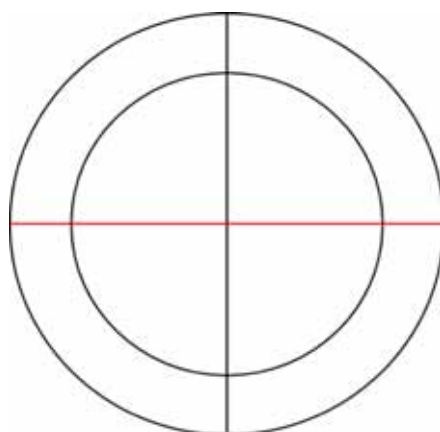
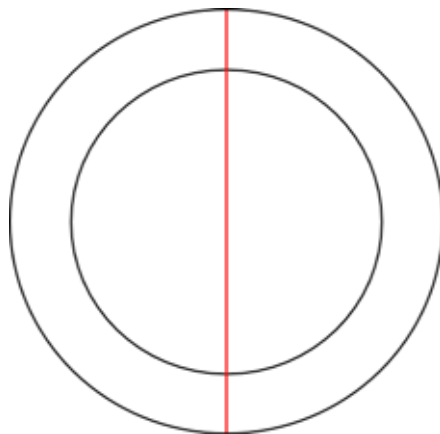
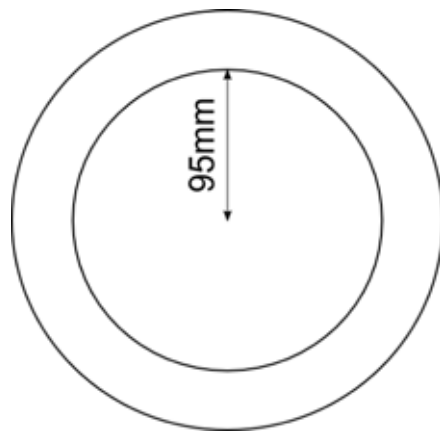
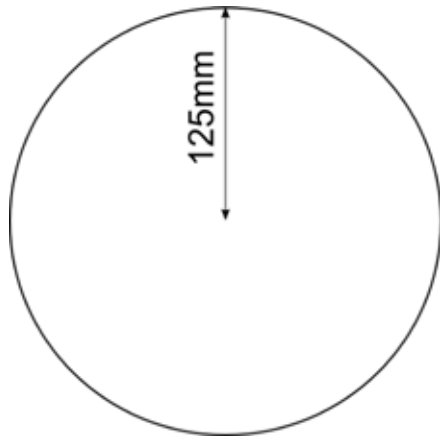
1: THE MOULD



1. Cut out 3 square pieces of plywood, with side length 400 mm.
2. The thickness of the middle piece don't has to be thicker than the steel disk plus magnets.
3. Work with the middle piece.
4. Draw 2 circles with the measures you can see in the picture. Use the compass (no. 74)
5. Cut out both circles. First the small one then the big one. Be careful with the small one you will need it after.
6. Sand the edge with the sandpaper.



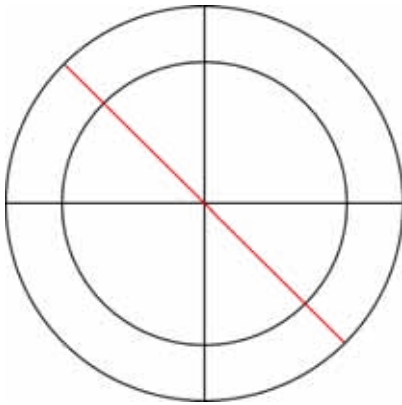
2: THE MAGNET POSITIONING JIG



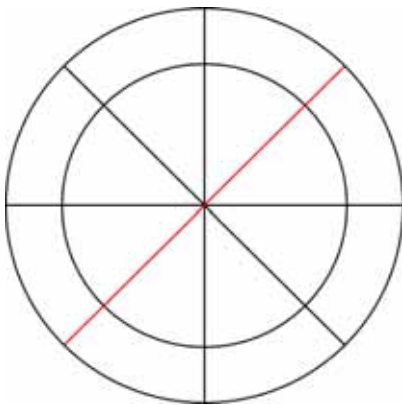
1. Take another plywood plate.
2. Take the compasses (no. 74). Draw a circle with radius 125 mm.
3. Draw again a circle now with radius 95 mm. (Use the same centre)
4. Draw a line through the centre.
5. Draw a new line through the centre at right angles to the other line.



2: THE MAGNET POSITIONING JIG

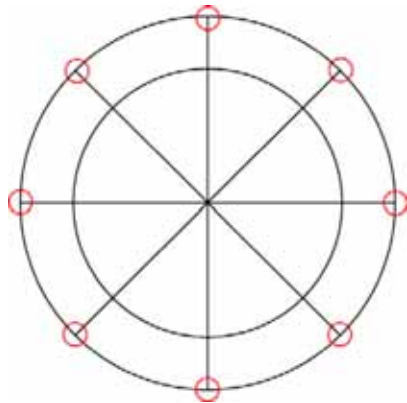


6. Use the set square (no. 70).
Draw a line with 45 degrees from your last line.

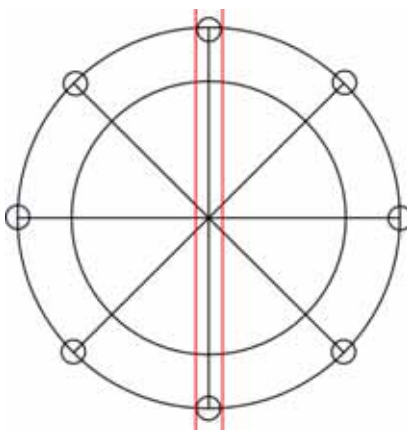


7. Draw a line at right angle to that line from step 6.

Now you have 8 equal pieces on the disk.



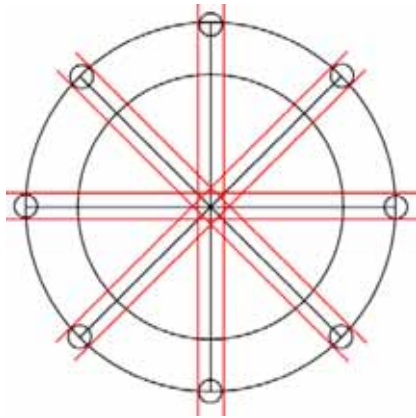
8. Use the compasses (no. 74).
Draw 8 circles around the intersection points (red arrow).
The radius should be half the wide of the magnets.



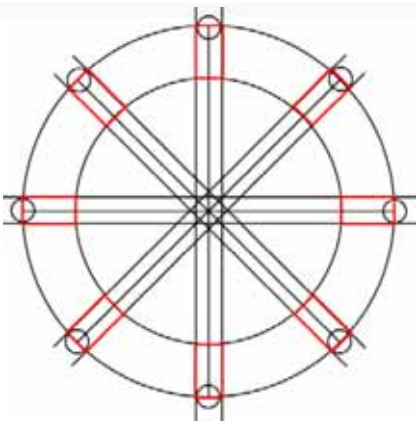
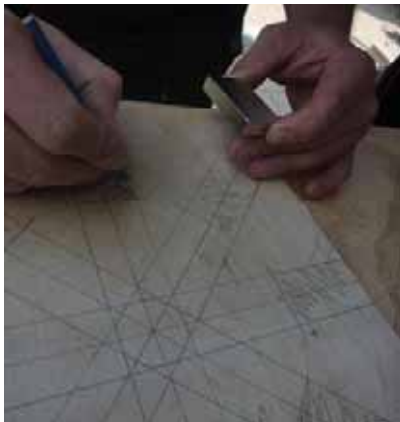
9. Draw parallel lines that just touch the small circles.
The red lines show how to draw.



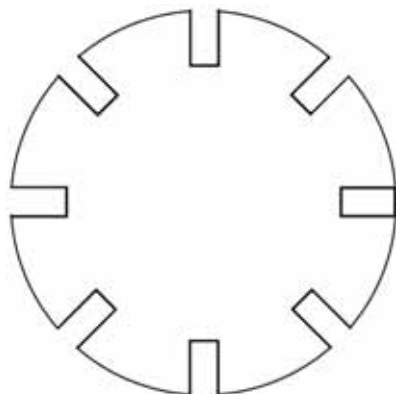
2: THE MAGNET POSITIONING JIG



10. Repeat it at every small circle.



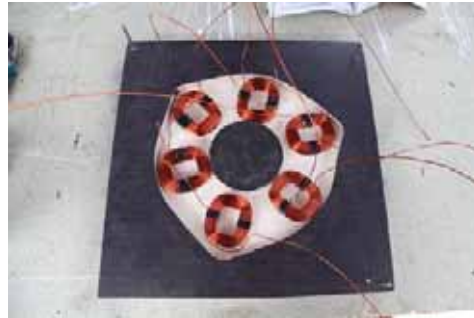
11. Cut the red marked areas.



12. After all your jig should look like that.



THE STATOR MOULD



BUILDING MATERIAL

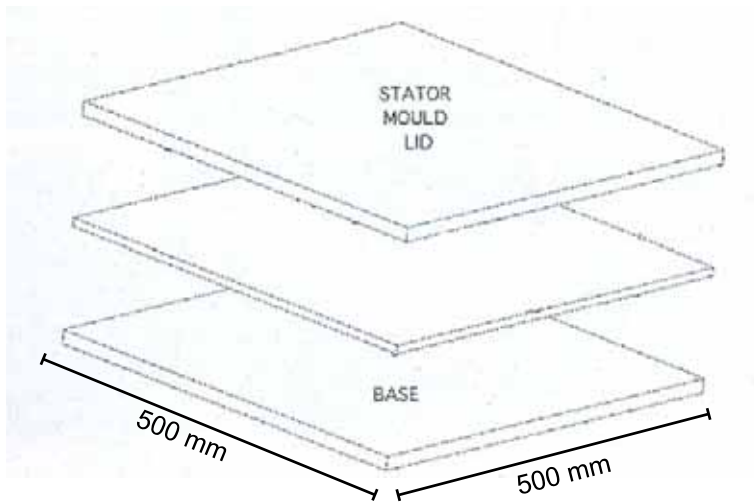


3 long bolts, nails or screws

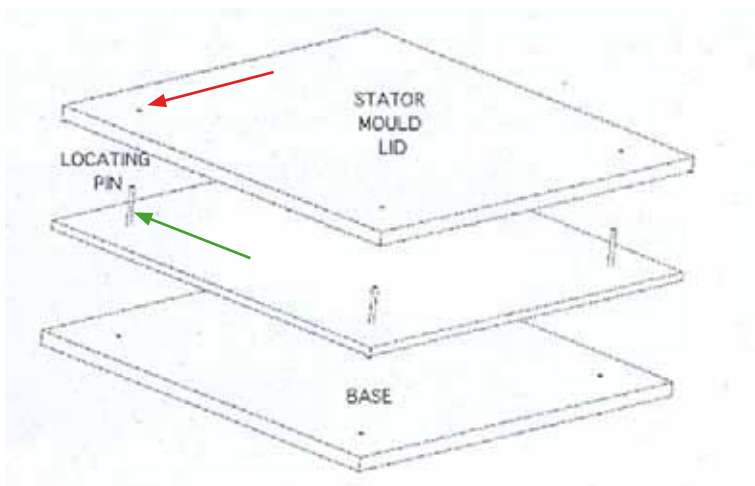
TOOLS



1: CUT THE SQUARE PIECES



1. Cut out 3 square pieces of plywood, with side length 500 mm.
2. The middle piece should have the same thickness as a coil.



3. Fix the stack for example with nails or bolts (green arrow), in order to keep same hole-position.
4. Drill 3 holes through the stack (red arrow).
5. Remove nails or bolts.



2: MARK OUT THE SHAPE

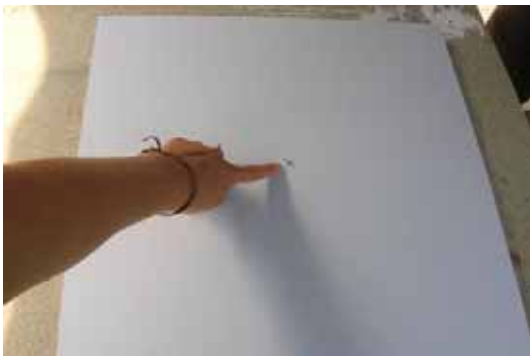


1. Work with the middle piece.

2. Find the centre of the piece by drawing diagonal lines.



3. The intersection point of both lines is the centre point of the piece.



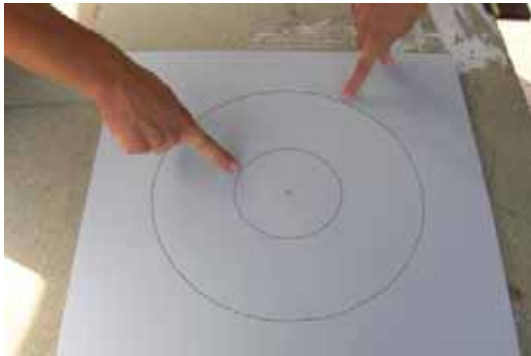
2: MARK OUT THE SHAPE



4. Draw with the compasses (no. 74) a circle with a radius of 66 mm around the centre.



5. Proceed as in step 4. Draw a circle with a radius of 167 mm.



6. Now you have a centre and 2 circles.

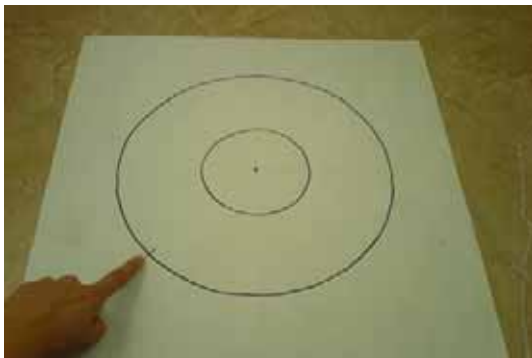


2: MARK OUT THE SHAPE

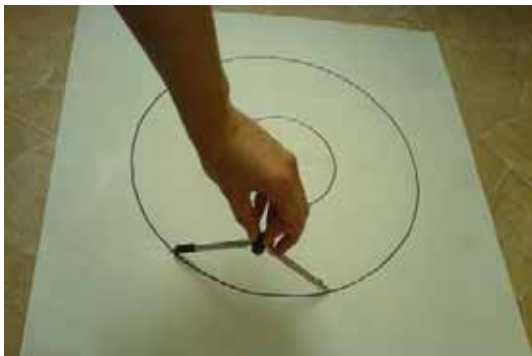


7. Now we need 3 mounting holes. They should be at the outer circle.

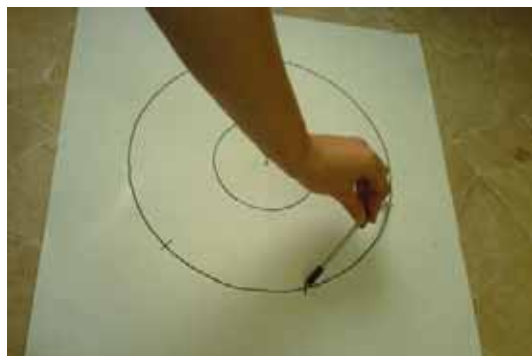
8. Take the compasses and set it to a radius of 167 mm.



9. Choose any point at the outer circle.



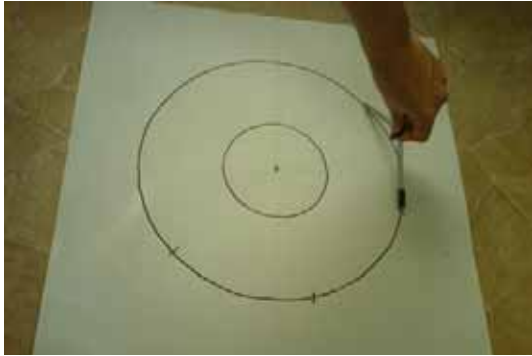
10. Use the point as the new centre and mark a intersection point of the old circle and the new circle. (Don't draw the new hole circle, only that part you need to have the intersection point).



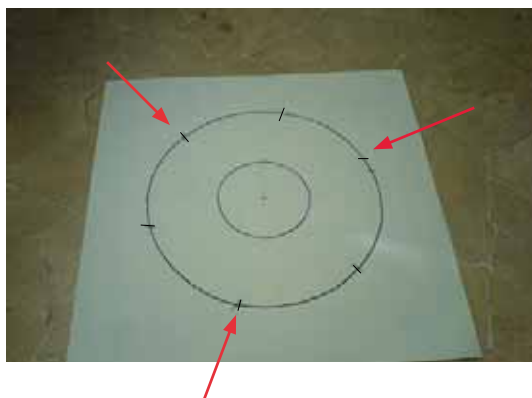
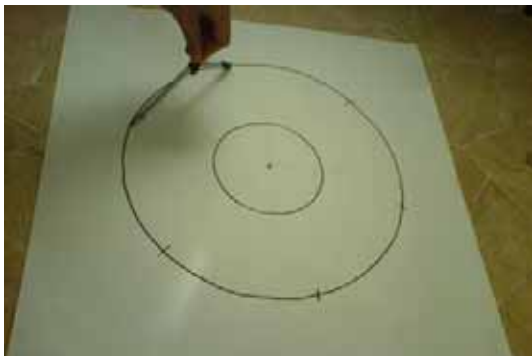
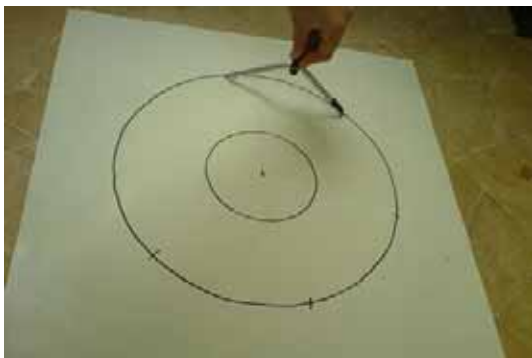
11. Now take the intersection point as the new centre point and draw again a mark with the compasses.



2: MARK OUT THE SHAPE



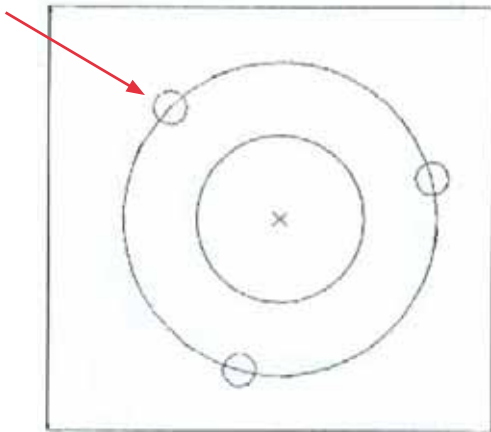
12. Do this again until you return to your starting point.



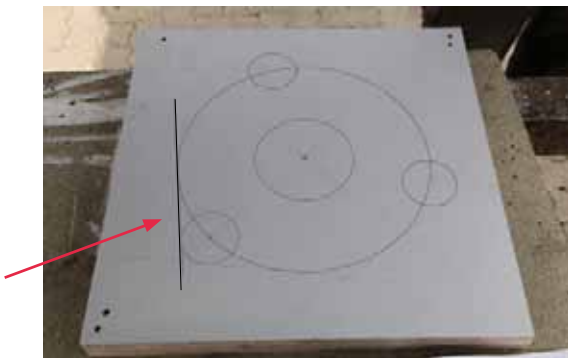
13. Now chose every second mark. This 3 marks are your mounting points.



2: MARK OUT THE SHAPE

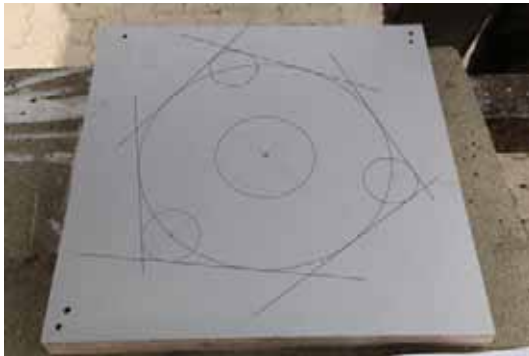


14. At each mounting point, draw a circle with radius 25 mm.



15. Place a square (no.73) so that it just touches the big circle and one of the 3 small circles.

Draw a line like that one in the picture.



16. Do it at every small circle as you can see it in the picture.



17. Now cut the red circle. Use the pad saw (no. 56).
Be careful you need the disk!

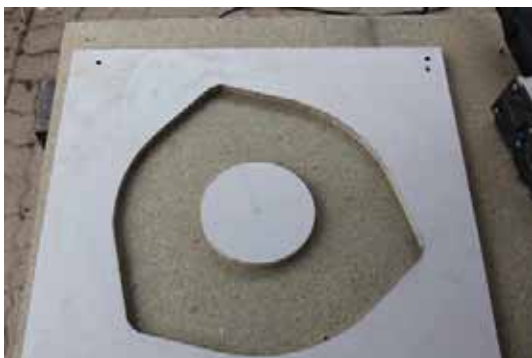
Before sawing drill a hole in the circle line. Now you can use the pad saw.



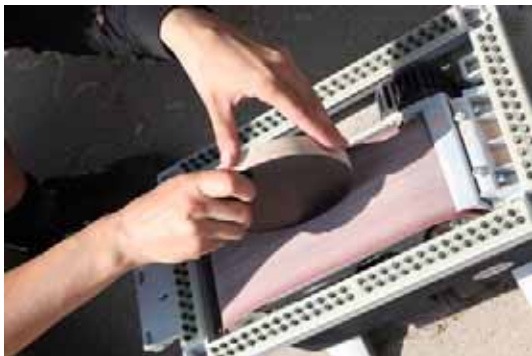
2: MARK OUT THE SHAPE



18. Cut out the shape of the stator (red line).



19. Now you have the mould for the stator.



20. Clean off any ragged edges of the island use the sandpaper (no. 86).

Screw the island into the middle of the mould.

Use the cordless screwdriver (no. 53) and the spax screws (no. 24).



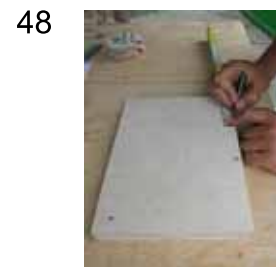
21. Cut out a exit notch for the cables. Do not cut it through the hole thickness of the woodpiece. Cut the notch until the half thickness of the wood.



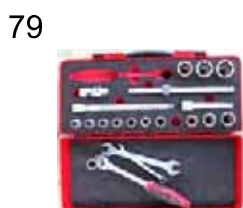
MAKING THE COIL WINDER



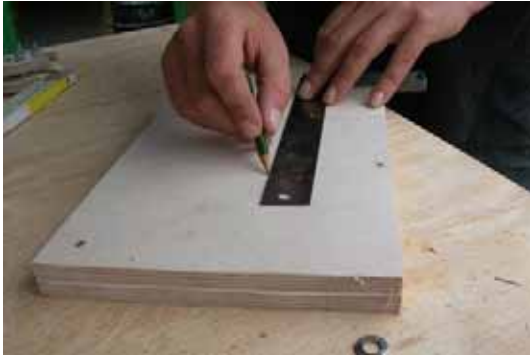
BUILDING MATERIAL



TOOLS



1: MAKE THE „CHEEK PIECES“



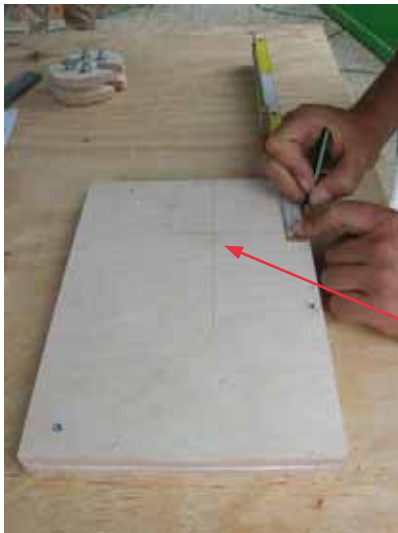
1. You need 2 „cheek pieces“ (12mm) of plywood.
Screw them together to draw the line just one time but getting 2 identic pieces in the end.

Start at the edges of the plywood.

Use the square (no. 73) to draw parallel lines.

Keep a distance of 80mm and draw 2 lines parallel to both edges of the plywood.

2. Now you have an intersection point, the „centre point“.



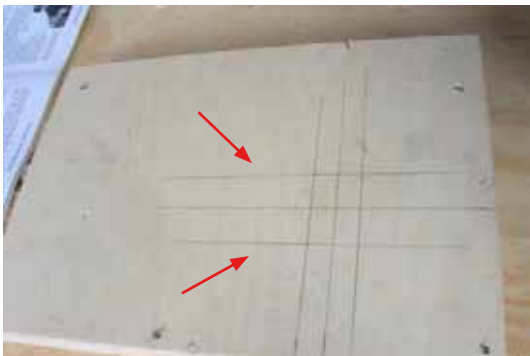
centre point



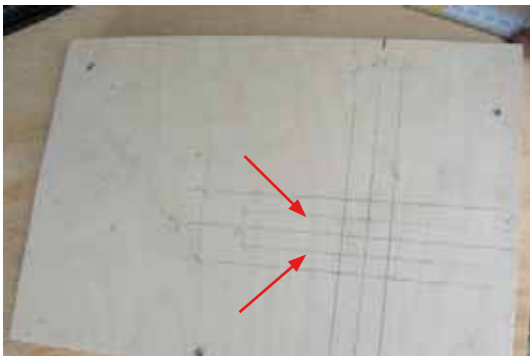
1: MAKE THE „CHEEK PIECES“



2. Draw 2 parallel lines with a distance of 12,5mm to both sides of one of the lines.



3. Now take the other line. (You need 4 lines). Draw 2 parallel lines with a distance of 20,5mm to each side.



4. Draw 2 parallel lines with a distance of 10 mm to each side.



1: MAKE THE „CHEEK PIECES“



5. Take the compasses (no. 74).
Set a radius of 60 mm.



6. Overall draw a circle on the centre point.



Compare the drawing to the picture of the left.



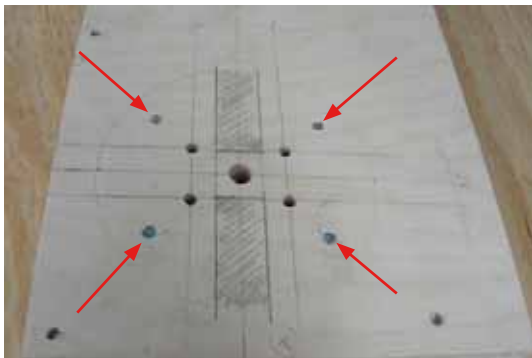
7. Shade the marked area you see in the picture.



1: MAKE THE „CHEEK PIECES“



8. Drill 1 big hole (10mm) and 4 smaller holes (5mm).
(You can see the pencil marks in the left picture)



9. Now fix the disk with 4 screws.



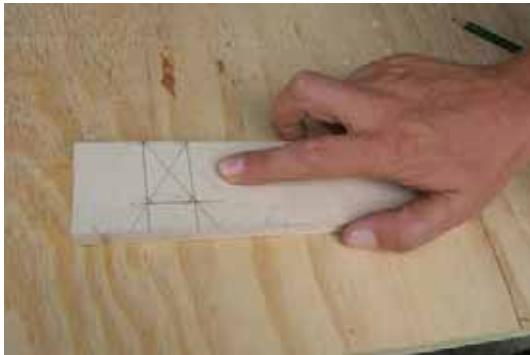
10. Now fix the sheet of plywood with a screw clamp (no. 75) and cut out the disc with the jig saw (no. 56).



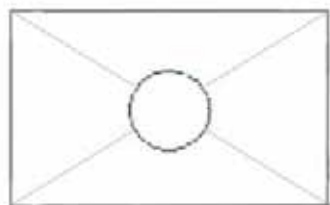
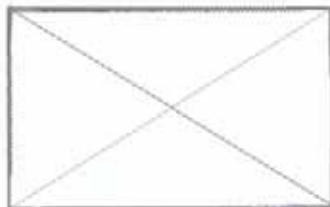
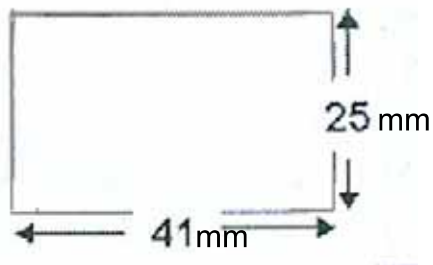
11. Loosen the 4 screws.
Now you have 2 identical cheek pieces.



2: MAKE THE SPACER



Spacer 12 mm thick



1. For getting the correct distance between the „cheek pieces“ take a 12 mm thick piece of plywood.

2. Cut out the measures shown in the picture.

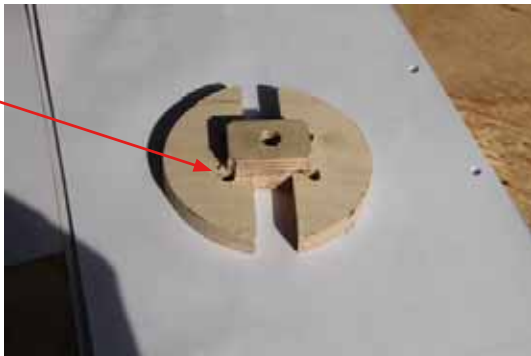
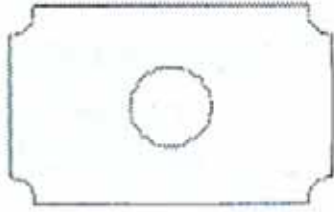
3. Draw 2 diagonal lines.

The intersection point is the centre of the spacer.

4. Drill a hole exactly in the middle of the spacer (same size as the hole in the middle of the cheek piece).



2: MAKE THE SPACER



3. The corners need to be cut out like this.
The cutted corners should fit to the holes in the „cheek piece“ (5mm holes).
The easiest way is to put the spacer on one of the „cheek pi-eces“, fix it with the screw clamp and drill 4 more times through the holes.
Use the rasp (no. 76) for little inaccuracies.

5. Glue the spacer on 1 cheek piece.
The drilled holes should fit exactly.



3: COMPOSE THE „CHEEK PIECES“ AND THE SPACER



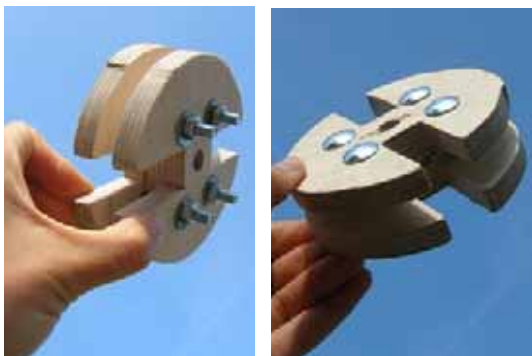
1. Take 4 of the saucerhead screws (no. 30).



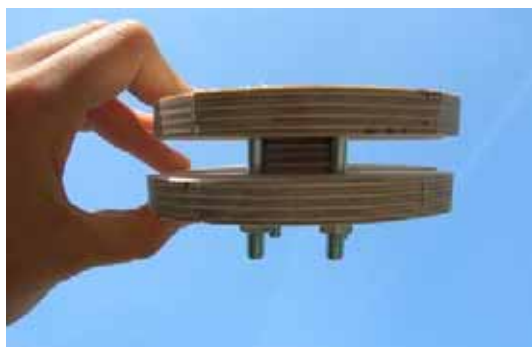
2. Set the „cheek pieces“ with the spacer in the middle together.

Put the screws through the 4 holes.

Place one washer under the screw head and one under the nut.



3. Finally it should look like that.



4: THE CRANK



1. For preparing the coil winder take the threaded rod (no. 45). Bent it to a crank shape with the help of a screw clamp.
2. Take a wooden lath as a handle. Drill a hole through the handle.
3. First put a pair of nuts and a washer on the crank.
4. Guide the crank through the hole.
5. Put again a washer and a pair of nuts tightened securely against each other on the crank.
6. Now place the disc on the crank.
7. Put a washer and a nut on the end of the threaded rod and tighten it.



THE ALTERNATOR FRAME



BUILDING MATERIAL

42



43



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38



TOOLS

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73



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63



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1: THE FRAME



1. Take the angled steel.
2. Cut 2 equal pieces with a length of 187 mm.



3. Remove rust if necessary.



4. Weld them together.



5. Supposed to look like this.



1: THE FRAME



6. Cut a 319 mm piece of angled steel.



7. Weld the pieces from step 5 and 6 together.
It has to look like a „T“.
Caution:
Fix it square and symmetrical.
Lay the frame face down on the bench while welding.



8. Cut a 10 mm piece of angled steel.



9. Weld it to the opposite of the „T“



1: THE FRAME



10. It supposed to look like this.



2: THE SMALL STEEL



1. Take the flat rolled steel (no. 42). Its end has to be in right angle. Use the square (no. 73) to draw a line parallel to the end with a distance of 37 mm.



2. Draw another line in right angle to the first one with a distance of 9 mm from the edge.



3. Take the tube (no. 37). Line around the pipe. Put the tube on the steel. The tube has to touch each line in only one point.



4. It supposed to look like this.



2: THE SMALL STEEL



5. Draw a line parallel to the long side of the steel where both lines intersect (red arrow).



6. Draw another line parallel to the short side of the steel. It has to cross the point where the arc touches the line from step 2.



7. Shade the area marked on the picture.



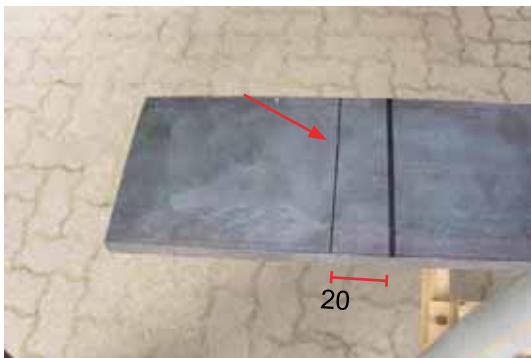
8. Use the angle grinder (no. 58).
Cut out the marked area.
Use the angle grinder (no. 58) and round off the marked corner (red arrow) carefully.



3: THE BIG STEEL



1. Take the rest of flat rolled steel (no. 42).
Its has to be in right angle.
Use the square no. 73) and raw a line parallel to the end with a distance of 90 mm.



2. Draw another line in 20 mm distance parallel to the first one.



3. Draw a third line parallel to the long side of the steel in a distance of 9mm. It has to be in right angle to the other ones.



4. Put the tube (no. 37) on the steel and mark it in the same way as in step 2.4.



3: THE BIG STEEL



5. Draw a point in the centre of the circle.



6. Use the angle grinder and cut the out line with the angle grinder (no. 58).



7. Use the metal driller (no. 67) and drill a hole where you marked the point.



8. Use the angle grinder (no. 58) and round off the marked corner carefully.



4: THE FIXING



1. Use the angle grinder (no.58) and cut a metal tube (no.37) of 240 mm.



2. Next step is to connect the 3 pieces...



3. ... like shown in the picture.



4: THE FIXING



4. First fix the tube with its open end at the big steel and weld both pieces together.



Make it a solid connection.



5. Now weld the small steel to the tube. Fix it to the position as shown in step 3.



rounded corners

It's important that the rounded corners are in the same direction. The long sides of the steel pieces have to be parallel.



4: THE FIXING



6. Now take the frame.



7. Weld the workpiece from step 5 to the long angled steel of the frame.

Set the rounded corners into the corner of the angled steel.

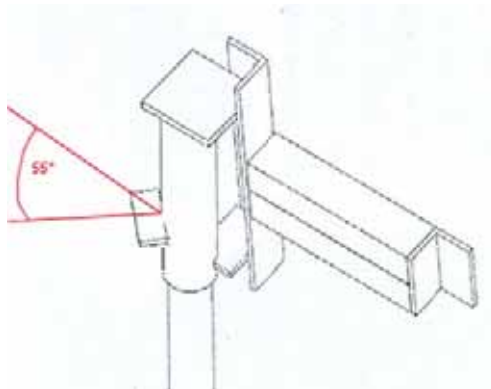
The big steel has to close with the end of the long angled steel.



5: THE HINGE



85 mm



1. Use the angled grinder (no.57).
Cut a 30 mm wide piece of flat steel (no. 43).
Weld it to the tube positioned 85 mm from the end.

But don't weld it parallel to the frame.
Weld it like shown in teh drawing.



2. Now take the metal tube (no. 38) and the angled grinder (no.57) to cut 200 mm of it.
Weld the 200 mm piece onto the tube of the frame with a distance of 10 mm to the end.
Weld at the marked positions (red arrows).



3. Finally add 2 cheek pieces (no. 43) to both sides for a better fixing.



6: FIX THE WHEEL BEARING



1. Take the wheel bearing (no. 40).



2. You only need one piece.



3. Position it in this way.
The shaft centre has to be 55 mm.
away from the long angled steel.

(Take care the picture it is not 55 mm away from the long angled steel.

The shaft centre has to be at the red cross.)



4. Mark the positions of the drill holes.
Use the shaft as a template.



6: FIX THE WHEEL BEARING



5. View from the backside.



6. Now fix it with 5 screws.



7. View from the backside.



8. Finally compose the hole wheel bearing.



THE TAIL BOOM



BUILDING MATERIAL

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1: MAKE THE HINGE OUTER



1. Use the angle grinder and cut off a piece of 100mm from the tube (no. 37).



2. Put the tube on the flat steel and draw around it. Cut out the disc.



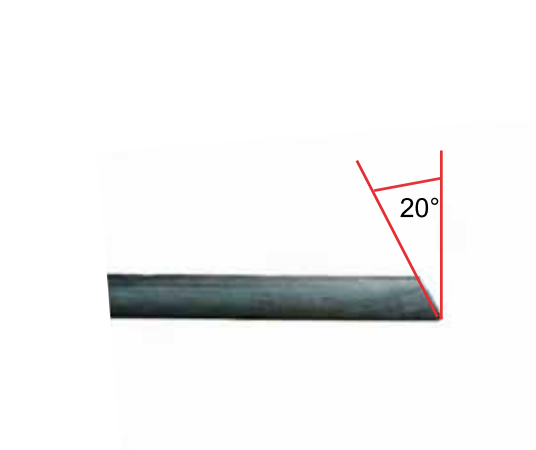
3. Weld the 2 pieces together.



2: MAKE THE BOOM



1. Use the angle grinder and cut off 800mm from the tube.



2. Draw a line with an angle of 20° at the end of the tube. Cut afterwards with the grinder.



3. Supposed to look like this.



4. Weld the end with the angle at the tube from step 1.
Caution:
closed side is on top.



3: MAKE THE FLAT BAR LUG



1. Use the angle grinder (no. 57) to cut out 2 pieces of 300mm from the flat rolled steel (no. 43).

2. Use the set square (no. 70) and cut an angle of 45° at one end of both pieces.

3. Use the metal drill (no. 67) and make 2 holes (middle and end) into each steel.
Keep same distance on each steel.

4. Take the tube from step 4.
Weld the both steels at the free end of the tube.
Caution:
Keep it in 180° vertical angle.



THE STATOR



BUILDING MATERIAL



TOOLS



63



1: CASTING THE STATOR



1. Take the stator mould and grease all its areas with the multi-purpose grease (no. 9). This includes the whole interior: the edges and all surfaces, also the wiring exit notch, every screw head and bolt
Do not grease any piece of coils or glass fibre mats.



1: CASTING THE STATOR



2. Cut out 2 pieces of glass fibre mats (no. 4) to the shape of the stator mould.



3. Put on the disposable gloves (no. 89) and take the disposable bucket (no. 89).
Mix 200 grams of resin with 3 ml of catalyst (no. 3).
Use the electric scale (no. 60).
Stir for 1-2 minutes.



4. Pour this liquid mix into the bottom of the mould.



5. Take 1 of the glass fibre mats.
Lay it on the bottom of the mould and soak it with the resin.
6. To chase out air bubbles poke with a piece of wood.



1: CASTING THE STATOR



7. Place the coils in the mould.



8. Then put small pieces of wood of equal size between the coils and the middle slice.



9. Make sure that there is no wire above the edge of the mould.



1: CASTING THE STATOR



10. Mix 400 grams resin with 6 ml catalyst (no. 3).
Use the electric scale (no. 60).
Stir it for 1-2 minutes.
Use a piece of wood.



11. While stirring add 200-300 grams of powder (no. 4) gradually.



12. At first pour the mix into the middle of the coils.



13. Then pour the rest of the mix in the whole mould. Keep going until it starts to get full.



1: CASTING THE STATOR



14. Take away the pieces of wood and fill up the mould.

15. Place a small bead of silicone caulk around the surround.

16. Bang the mould with a hammer to encourage air bubbles to rise out of the casting.

17. Place the other piece of glass fibre mat on the full mould.



18. Mix 200 grams of resin with 3 ml catalyst (no. 3)
Use the electric scale (no. 60).



1: CASTING THE STATOR



19. Wet out the glass fibre mat with the resin.



20. For spreading it steady use a piece of wood.



21. Set the lid onto the mould. Care for the 3 locating sticks. Then bring the lid down, carefully aligning the 3 locating pins.



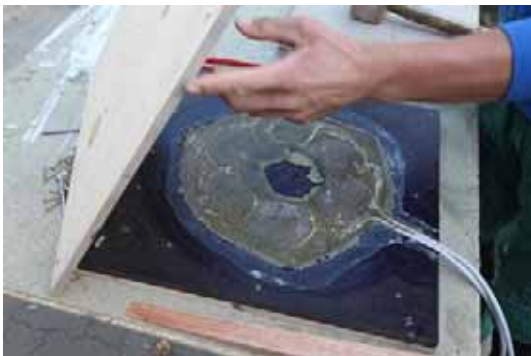
22. Screw it down hard in the wooden areas. Use the cordless screwdriver (no. 53) and the spax screws (no. 24).
23. Leave polyester casting overnight to set and cure.



1: CASTING THE STATOR



24. When the resin is set hard remove the lid for taking out the casting. Be careful!
Invert the mould, keeping hold of the casting.
Knock the edges of the mould carefully against the table until the casting drops out.



Be careful with the cable.
Do not pull or drag it!



25. Cleanit the casting with terpentin substitut (no 10).



1: CASTING THE STATOR



26. Clean off any ragged edges before the resin reaches full hardness. Use the cutter (no. 91).



27. If possible use the chisel (no. 83).



28. Now use the sandpaper (no.86) to make it smooth.



29. Finally spray paint the casting (no. 11).



List of materials

1



name:
quantity:
use:

protection/ Rostschutz(W, M, E)
1x
for priming the metalpieces

2



name:
quantity:
use:

paints/Buntlack (W,M,E)
1x
for varnishing the mast, alternator frame
and tail boom

3



name:
quantity:
use:

polyester resin/ Polyesterharz (E)
2x in total ca.1,4kg
for varnishing the mast, alternator frame
and tail boom



4



name:
quantity:
use:

glass fibre mat/Glasfasermatte (,E)
2m²
for stabilizing the polyester resin

5



name:
quantity:
use:

talkum powder/ Talkum Puder (E)
ca 700g
to dilute the polyester resin

6



name:
quantity:
use:

silicone/Silikon(E)
1x
for caulking the pouring templates

7



name:
quantity:

silicone gun/ Silikonpistole (E)
1x



8



name:
quantity:
use:

all-purpose adhesive/ Alleskleber(E)
1x
for caulking the magnets

9



name:
quantity:
use:

multi-purpose grease/ Mehrzweckfett(M)
1x
for greasing the connecting joints, alternator frame, mast and tail boom

10



name:
quantity:
use:

turpentine substitute/ Terpentinersatz (E)
1x
for cleaning the magnets and brushes

11



name:
quantity:
use:

spray paint/Sprühlack (W,M,E)
1x
for spraying components made of polyester resin and damaged spots of the copper wire



12



name:
quantity:
use:

brush/ Pinsel (W,M,E)
3x
for painting the alternator frame, mast,
tail boom, componets made of polyester
resin

13



name:
dimension:
quantity:

cablе/ Kabel(E)
diametеr 6mm²
10 m

14



name:
quantity:

cablе tie/Kabelbinder (E)
1x

15



name:
quantity:

cablе tie/ Kabelbinder(E)
1x



16



name: lacquered copper wire/
lackierter Kupferdraht (E)
use: for winding the coils

17



name: die-cast aluminium box/
Aluminiumdruckgussbox (E)
dimension: 20x100x50 cm (HxBxT)
quantity: 1x
use: enclosure for bridge rectifier and cables.
weather resistance is very important

18



name: insulating tape/Isolierband (E)
quantity: 1x
use: for insulating (damaged parts of copper wire)

19



name: bridge rectifier/Brückengleichrichter (E)
dimension: at least 100V and 15A
important: contact surface with heat dump
quantity: 3x
use: for converting alternating current (AC) to continuous current (DC), it is located in the enclosure at the top of the alternator frame



20



name:

insulating tube (for electronic applications)/ Isolierrohr (für elektrische Anwendungen) (E)

dimension:

L = 10m, D= 15mm flexible,

quantity:

1x

use:

weather-resistant also at low temperature, to protect the cables

21



name:

magnets/ Magnete (E)

place of purchase:

www.Kleinwindanlage.de

quantity:

10x (including reserve)

use:

for the generator

22



name:

solder/ Lötzinn(E)

quantity:

1x

use:

for connecting the coils

23



name:

adhesive tape/Klebeband (W,M,E)

quantity:

1x

use:

varied usable



24



name:
dimension:
quantity:

wood screws/Holzschrauben (W)
50mm
20x

25



name:
dimension:
quantity:

wood screws/Holzschrauben (W)
30mm
40x

26



name:
dimension:
quantity:
use:

nuts/ Muttern(W,E)
M8
10x
as a fixture, for balancing the rotor

27



name:
dimension:
quantity:
use:

nuts/Muttern (W,E)
M10
40x
as a fixture, for balancing the rotor



28



name:
dimension:
quantity:

washers/ Unterlegscheiben(W,,E)
8,4mm
5x (5 single washers)

29



name:
dimension:
quantity:

washers/ Unterlegscheiben(W,,E)
10,5
20x (20 single washers)

30



name:

dimension:

quantity:

saucerhead screws with square neck /
Flachrundschrauben mit Vierkantansatz
(W)
40mm length; 15mm length of thread;
with washers and nuts
M6 oder M8
4x

31



name:

dimension:

quantity:

saucerhead screws with square neck /
Flachrundschrauben mit Vierkantansatz
(W)
30mm length; full-length thread with self-
retaining nuts and washers
M6 oder M8
6x



32



name:

stainless steel nuts / Edelstahlmuttern (W)

dimension:

M10

quantity:

60x

33



name:

stainless steel washers / Edelstahlunterlegscheiben (W)

dimension:

M10

quantity:

20x

34



name:

blade wood /Holz (W)

dimension:

90cm x 9,5 cm

quantity:

3x

use:

for the blades

35



name:

wooden disk /Holzscheibe (W)

dimension:

diameter 20cm, thickness 9mm

quantity:

1x

use:

keeps the blades together at back



36



name: triangle/Dreieck (W)
 dimension: all edges 27,4cm, thickness 9mm
 quantity: 1x
 use: keeps the blades together ahead

37



name: metal tube/ Metallrohr (M)
 dimension: 2"- tube; 60,3mm x 2,5mm (55,3mm inside)
 quantity: 1x 34 cm
 use: for the alternator frame

38



name: metal tube/ Metallrohr (M)
 dimension: 1,5" ; 1,4m
 quantity: 1x
 use: for the tail boom

39



name: angled steel /Winkelstahl (M)
 dimension: 50mm x 50mm x 5mm
 quantity: 1x 319 mm ; 2x 187mm ; 1x 100mm
 use: the alternator frame will be welded out of it



40



name: wheel bearing/Radlager (M)
 place of purchase: junkyard
 quantity: 1x
 use: for turning the rotor will be fixed on it

41



name: mast/ Mast (M)
 quantity: ca 6m
 use: for erecting

42



name: flat-rolled steel /Flachstahl (M)
 dimension: 70mmx8mm ; 70cm lenght
 quantity: 1x
 use: for the alternator frame

43



name: Flat-rolled Steel /Flachstahl (M)
 dimension: 30x8mm ; 700mm length (as a reserve 900mm)
 quantity: 1x
 use: connection between wooden and metallic components of the tail boom; ahead of the alternator frame

44



name: threaded rod/Gewindestange(M)
 dimension: M10 ; ca 2m
 quantity: 1x
 use: as a winder for winding the coils



45



name: threaded rod/Gewindestange(M)
 dimension: M6 oder 8 ; ca. 60cm
 quantity: 1x
 use: as a winder for winding the coils



46



name: wooden panel/ Holzplatte (W)
 dimension: 400 mm x 400mm
 quantity: 3x
 use: as a template for the platter made of polyester resin

47



name: wooden panel/ Holzplatte (W)
 dimension: 500 mm x 500 mm
 quantity: 3x
 use: for the template of the coil-elements made of polyester resin; centrepiece as thick as the coils



48



name: wooden panel/ Holzplatte (W)
 dimension: 200 mm x 200 mm ; 12 mm thickness
 quantity: 2x
 use: for the coilwinder

49



name: wooden panel/ Holzplatte (W)
 dimension: 300 mm x 300 mm
 quantity: 1x
 use: to seat the magnets exactly on the plat-
 ter

50



name: wooden panel/ Holzplatte (W)
 dimension: 1000x40 mm; thickness 6mm
 quantity: 1x
 use: for the tail boom

51



name: steel-rope/ Stahlseil (M)
 dimension: 6m
 quantity: 1x
 use: for unclamping the mast



52



name:

ferro-magnetic steeldisc/

dimension:

ferro-magnetische Stahlscheibe(M)

quantity:

diameter 250 mm ; thickness 6mm

use:

1x

for blocking off the rotor from the magnetic field

53



name:

cordless screwdriver/

quantity:

Akkuschrauber (W,M,E)

1-2x

54



name:

bit box/ Bitkasten (W)

quantity:

1x

use:

for different screw heads

55



name:

Drills (wood) / Bohrer (W)

dimension:

different thicknesses

use:

for (pre-)drilling the holes



56



name:
quantity:

Pad Saw/ Stichsäge(W)
1x

57



name:
quantity:

angle grinders/ Winkelschleifer (M)
with a metal cutting disk and one for
deflashing
1x

58



name:
quantity:
use:

belt sanders/ Bandschleifer(W)
1x
not compelling necessary
for fasten sanding of cutting edges

59



name:
quantity:
use:

digital multimeter/
digitales Multimeter(E)
1x
for scaling resistance, power and vol-
tage



60



name: electronic scale/ elektronische Waage (E)
 quantity: 1x
 use: for scaling the polyester resin, talcum or coils

61



name: welding set/ Schweißgerät (M)
 quantity: 1x

62



name: welding electrodes/
 Schweißelektroden(M)
 quantity: 1 package

63



name: protective shield/
 Schweißerschutzschild (M)
 quantity: 1x
 use: very important for skin protection



64



name:
quantity:
use:

welder's gloves/ Schutzhandschuhe (W)
1 pair
for safety! very important

65



name:
quantity:
use:

ear-protection/ Gehörschutz(M)
2x
for safety! very important

66



name:
quantity:
use:

centre punch/ Körner(M)
1x
for marking the drilling site of metal pieces

67



name:
quantity:

metal drills/ Metallbohrer (M)
1x



68



name: rubber and pencil/ Radiergummi und Bleistift (W)
 quantity: 2x

69



name: yardstick/ Zollstock (W)
 quantity: 3x

70



name: set square/ Geodreieck (W)
 quantity: 1x

71



name: calipers/ Messschieber (W,M,E)
 quantity: 1x
 use: for exact scaling



72



name:
quantity:

measuring tape/ Maßband(W,M)
1x

73



name:
quantity:
use:

square/ Winkelmaß (W,M)
2x
for exact marking

74



name:
quantity:

compass/ Zirkel (W,M)
1x

75



name:
quantity:
use:

screw-clamp/ Schraubzwinde(W,M,E)
7x
for chucking the wooden pieces of the blades;
for compressing the polyester moulds



76

name:
quantity:
use:

file/ Feile (W)
1x



77

name:
quantity:
use:

pincers/ Kneifzange (W)
2x
varied usable



78

name:
quantity:
use:

slotted screwdriver/
Schlitzschraubenzieher (W)
2x
varied usable



79

name:
quantity:

screw-wrench/Schraubenschlüssel (W)
1x



80



name: carpenter's Hammer/
Zimmermannshammer(W)
quantity: 2x

81



name: pick hammer/ Spitzhammert (M)
quantity: 1x
use: for cleaning the weldseam (only for electroslag welding ESW)

82



name: mallet/ Holzhammer (W)
quantity: 3x
use: combined with a broach/chisel for working on wood

83



name: chisel/Stecheisen(W)
quantity: 3x
use: combined with a mallet



84



name:
quantity:

wood Saw/ Holzsäge (W)
2x

85



name:
quantity:
use:

plane/ Hobel (W)
3x
to work on wood (the blades)

86



name:
quantity:
use:

sandpaper/ Schleifpapier (W)
3x
for sanding the blades

87



name:
quantity:
use:

adjustable working angle/
Einstellbarer Winkel(W), Schmiege
1x
for exact angle drawing



88



name: disposable container/
Einwegbehälter (E)
quantity: 2 litres should fit into
3x
use: for scaling and mixing the polyester
resin

89



name: one-way gloves/
Einweghandschuhe (E)
quantity: 6 pairs
use: especially needed while mixing the poly-
ester resin

90



name: scissor/
Schere (E)
quantity: 1x

91



name: cutter/
cuttermesser (E)
quantity: 1x



Tips and tricks

BLADES

1. The wood for the blades must be very dry. If there's a poor availability of dry wood, it's better to buy the wood one year in advance. Store it dry, away from termites and if possible indoor.
2. Buy a wood which won't be devoured by animals, e.g. one with natural pesticides. The main problem is normally caused by termites.
3. As an illustration for the work on the blade, it's useful to prepare an exemplary blade. If you would like to realize this prototype, buy one blade wood (no. 34) more.
4. Add security markings, which are lying a half centimeter above the original lines, before starting to shape the blades. Due to this lines, the blades won't get any damage if mistakes are made (e.g. planed too deeply).
5. It's useful to create a template for the necessary markings on the blades, to make sure, that the blades are totally similar.
Pay attention about:
 - Outline
 - the 3D aspect of the blade
 - mark the positioning points clearly
6. Stop planing shortly before reaching the right shape. Instead use more manageable tools like sandpaper or chisel.
7. Try to work with the local tools, e.g. wooden hook instead of plane.
8. Weight every of the three blades separately. Afterwards the balancing is much easier.



9. To check the imbalance you will need a test weight. Prepare one by putting six to eight heavy nuts on a cord. Hang the weight around the blade and move it step by step outward until the blade is moving downwards. If every blade is moving downwards, while the test weight is at every blade at the same point as on the others, the rotor is well-balanced.



10. To balance the rotor, you can fix nuts on the blades. Fix them near the hub.



POLYESTER RESIN

1. It's difficult to impossible to wash out resin from clothes. For this take attention. It's recommendable to wear plastic gloves.
2. Take attention: Thin plastic gloves can be spoiled by resin.
3. To remove trapped air bubbles, put a bucket filled with the mixture on the grinding machine. Put a plank between bucket and grinding machine to prevent damage on the ground of the bucket.
4. For mixing the adhesives you will need old containers or buckets, which can be disposed after. (in all 3)
5. For the part "Casting the stator" you need a solid and level surface. Otherwise you will get a misshapened casting.
6. First pour the resin in the middle of the coils.



7. The connection cables of the coils must lay flat, so that they can't protrude over the casting compound.
8. To ensure that every coil is enclosed by resin –even if the centrepiece is outside- make sure, that the coils doesn't touch the wooden disc.
9. The centrepiece of the casting mould shouldn't be fixed at the lid, which covers the mould finally. Instead the centrepiece should lay in the middle of the magnets before starting the casting.
10. Instead of glueing the mould, screw it. So you will get the casting later much easier out of the mould.
11. The piece which includes the coils must be handled very carefully at the cable connections. Don't move the cables back- or forwards or pull them, nor during the removing process neither after.



MAGNETS

1. If you are carrying the magnets in your hand, always assure that the back of your hand is pointing downwards. Otherwise the magnet can fall down or (he) it can be pulled out by the attraction of other magnets.

3. To clean the magnets and their position on the plate always use turpentine substitute.



4. The position of the magnets - or rather their poles pointing upwards - must always alternate with the neighbours. This means: If (for example) the minus pole of the first magnet is pointing upwards, the second magnet needs to point upwards with the plus pole, the third with the minus pole, the fourth with the plus pole,... (plus - minus - plus - minus - ...).

You can check this alternate rhythm by putting the magnet in your hand (back of hand must point downwards!) and while passing over the inserted magnets you should feel the alternate of attract and repulse. If the last inserted magnet repulses the one in your hand, you have to insert the next magnet exactly in this position. But if the last inserted magnet attracts the one in your hand, you have to turn the magnet before the insertion.

5. Take care during the process of insertion! Magnets are porous! Don't let it "heavily click".



6. The magnets need to have their proper position before you fill in the glue. D

ensive layer the glue will dry very fast.



WINDING THE COILS

1. The coil winder shouldn't wiggle.

Accuracy during the construction is important. Sometimes it's recommendable to take along a finished appliance.

2. In order to produce very similar coils, it's important to use the same coil winder for each coil.

3. The number of windings must be the same for each coil. In order to assure the same winding number, use a tally sheet.

4. Make a marking (e.g. a red line) on the coil winder. So you can count each rotation.



5. Take care that every single wire lays close and parallel to the one you wound before. So you prevent the coil of getting too large.



6. In case that the wire gets hurt, especially its insulation, the damaged part has to be sprayed with varnish. Also isolate the part with tape.

7. To be quite sure that each coil has equal numbers of windings weigh each of them.

At the end weigh each coil to be sure that each one has equal numbers of windings.



SOLDERING

1. After dismanteling use sandpaper for cleaning the plain wire

WELDING

1. Some dimensions for the angle steel - which is used for the alternator frame - are not correct (refers only to the 1800mm diameter variant).

- angle steel „length of upright A“ + 5cm
- angle steel „channel pieces B,C“ + ~5cm
- that means lenght of „position of shaft X“ also changes

2. The wheel bearing is required without the break drum.
needed:

- A wheel bearing for cars without the break drum but with axle pin (CV joints)

3. It's difficult to detach the wheel bearing from break drum.

- It's easy to unpick the wheel bearing with fire, but after it is most probably not entire round. This leads to an imbalance while rotating.

- It is much more precisely to work with a lathe. But firstly you need to have the possibility and secondly it is actually too dangerous.

4. While welding you better use a welding shield than just glasses. So the whole skin of your face will be protected (from a kind of sunburn).

CAUTION:

Never look directly into the welding light. This will damage your eyes permanently or at least it will pain strongly the next day.



ELECTRIC

1. The bridge rectifiers need to have heat-conducting contact surfaces.

