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The Winnower

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THE WINNOWER



Technical report
of the working-group
Microprojects of the
Technische Hogeschool Eindhoven

Technical report

No. 1

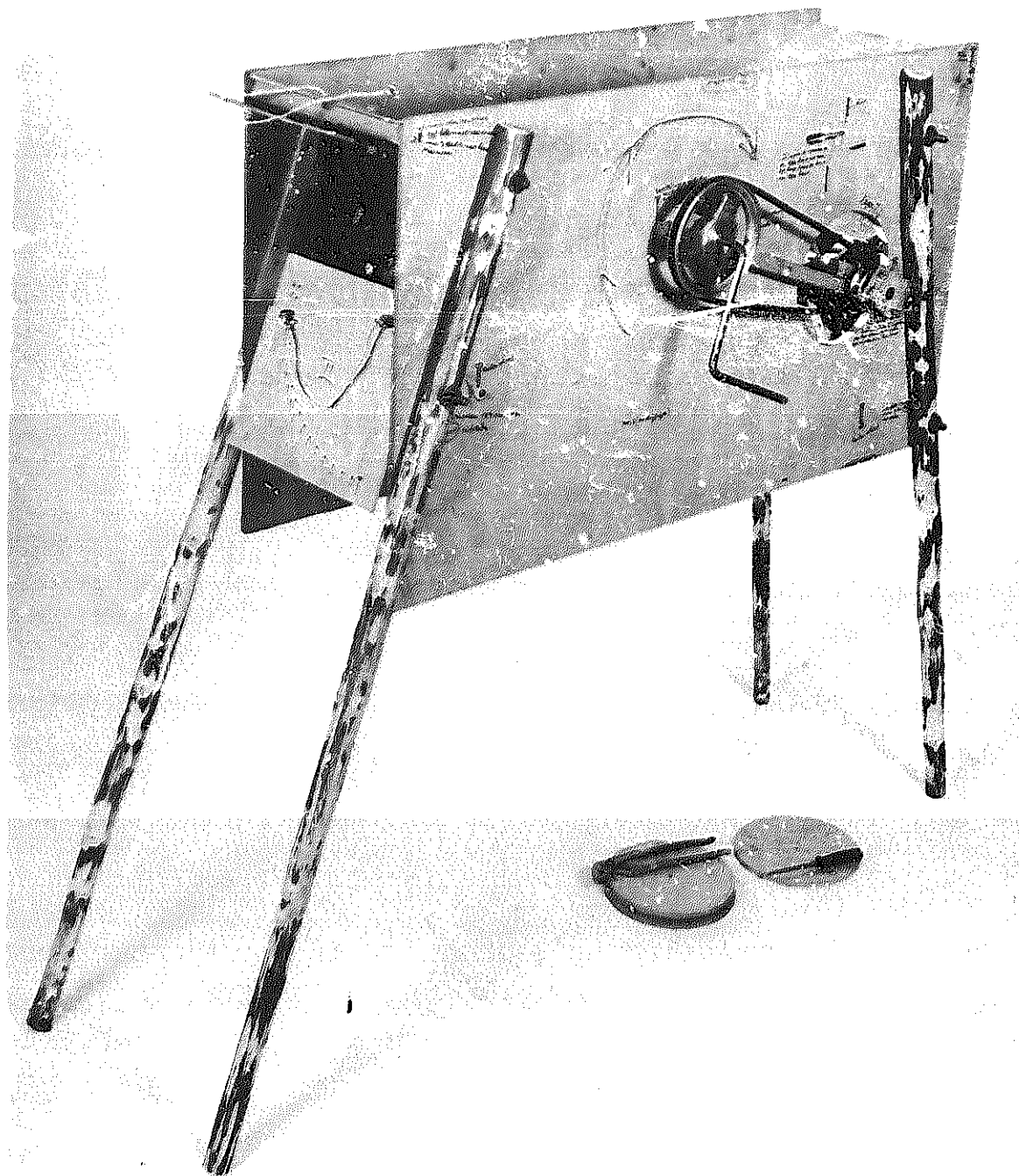
W A N M O L E N

the Winnower

Editor: Werkgroep Mikroprojecten
der Technische Hogeschool
Eindhoven
Buro Ontwikkelingssamen-
werking
Postbus 513.
EINDHOVEN

Eindhoven, May 1973

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WANMOLEN

The winnower

Designed and produced by B. van Wulfften Palthe and
drawn by P. Doorakkers, conducted by the Working Group
Microprojects of the Technische Hogeschool Eindhoven

I. Introduction.

The winnowing-mill, referred to in this technical report has had a long previous history. This history was especially dominated by the design, the testing and the experimenting. Much patience was asked of the applicants, who were informed of our plans by us directly or through other institutions such as the Agromisaweek-Comité of Wageningen. To shorten a long story, the designer, Mr B. van Wulften Palthe found an elsewhere made prototype which could be improved in such a way that it would function under circumstances we thought the future winnower-mill had to comply with.

Those circumstances can, among others, be translated in the following conditions:

- It had to be a product which could be easily sent.
- The mill had to be light to assemble on the spot, also by non-skilled.
- If possible an assembly-drawing without text had to be made and enclosed, to avoid language problems.
- The winnowing-mill had to be easy to reproduce, even if there was the lacking of a modern workshop or modern working material or if the supply of non-wooden materials was impossible.
- It had to be a product which could be easily handled and maintained by one person, so as to change a more or less heavy day's work in a more easy one.
- The mill had to be a man-power operated machine, independant on other power sources.

Mr. van Wulften Palthe has, in this design and production, mostly considered the applicants local circumstances in the developing countries, as far as these were known.

Whether the result in all countries and under all circumstances will be satisfactory is a question we naturally can't answer.

Since the carrying out had to be done in their spare time and to the staff this meant engaging it into their daily activities, the results kept the workers-in-the-field waiting much longer than had been originally planned.

Today, however you are (as a result of the cooperative working and thinking of a lot of your friends over here) presented a study-report which contains the following:

1. Introductory remarks
2. A set of drawings, subdivided in:
 - a) a packing-drawing of the kit.
 - b) an assembly-drawing for assembling the kit
 - c) a production-drawing for the one copying the kit, without having one available.
3. A, maybe needlessly enclosed, explanatory list concerning both the assembling, the production and the use of the winnowing-mill.
4. A questionnaire in order to evaluate our activities.

The one among you wondering now or in the future, whether they can obtain a kit besides this study-report, may know that at this moment (may 1973) twenty kits are being produced. Some of these twenty already have a destination.

The remaining part will be available at cost price.

At this very moment the price is not known yet. The working-group Microprojects is exploring the possibility to get a guarantee of the building of these kits in the future, for example by housing it in Elementary Technical Schools.

IMPORTANT HOWEVER IS THAT YOU CAN OBTAIN OR REPEAT YOUR ORDER FOR THIS WORKFILE WITH CONTENTS FREE, AT NO COST, EVEN IF YOU DON'T WANT THE KIT.

To conclude we may remark that we hope the winnowing-mill, at least to a great extend, will meet our expectations and may meet the demands of many.

To be more certain of this we would like to put you some questions as formulated in the latter part of this report.

You would do us, and many others a favour using this list when sending your remarks. Using this information we hope to go on working for you and your colleagues.

Would you still have questions we'll be remaining at your service.

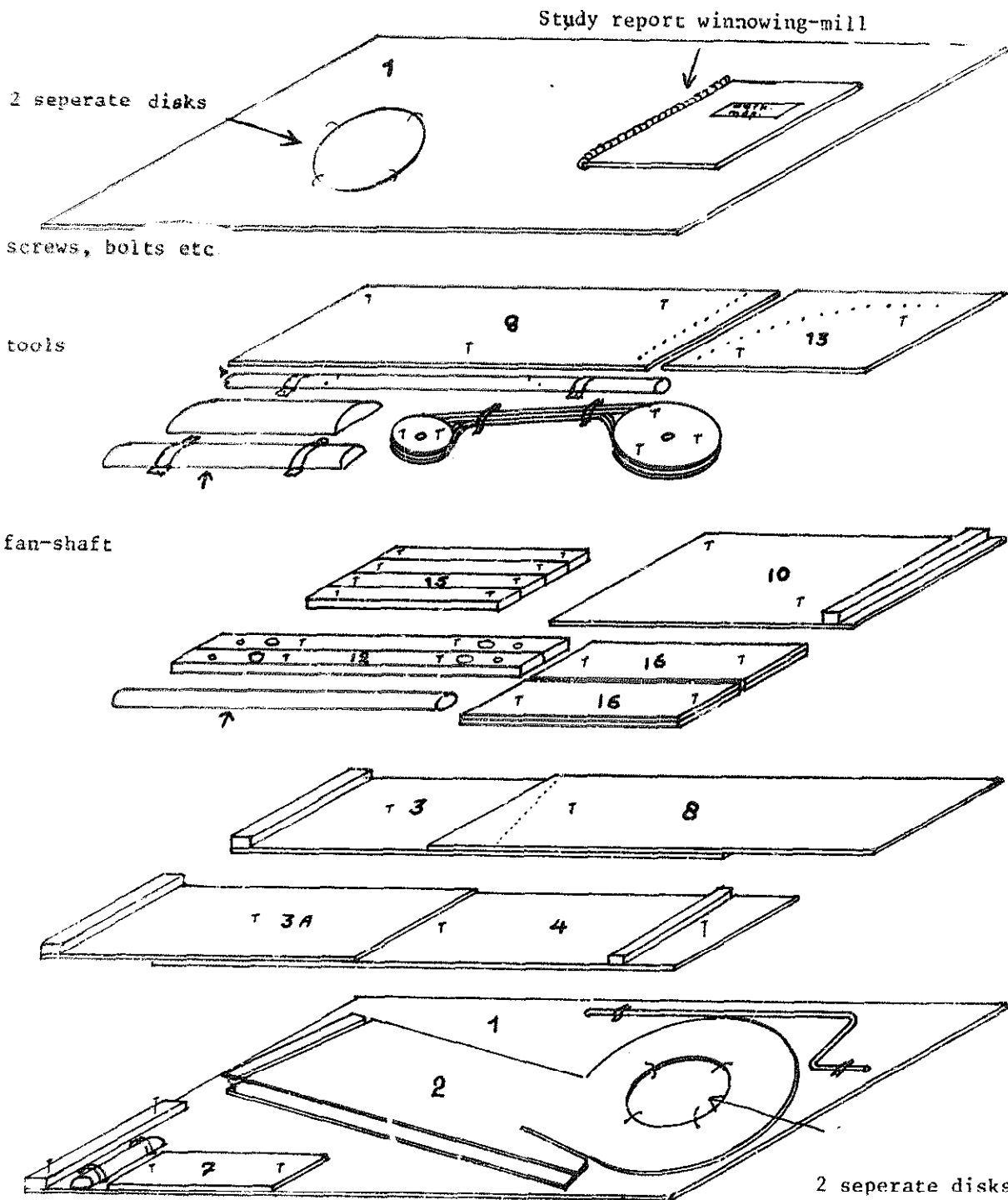
Meanwhile we wish you all the best with your work.

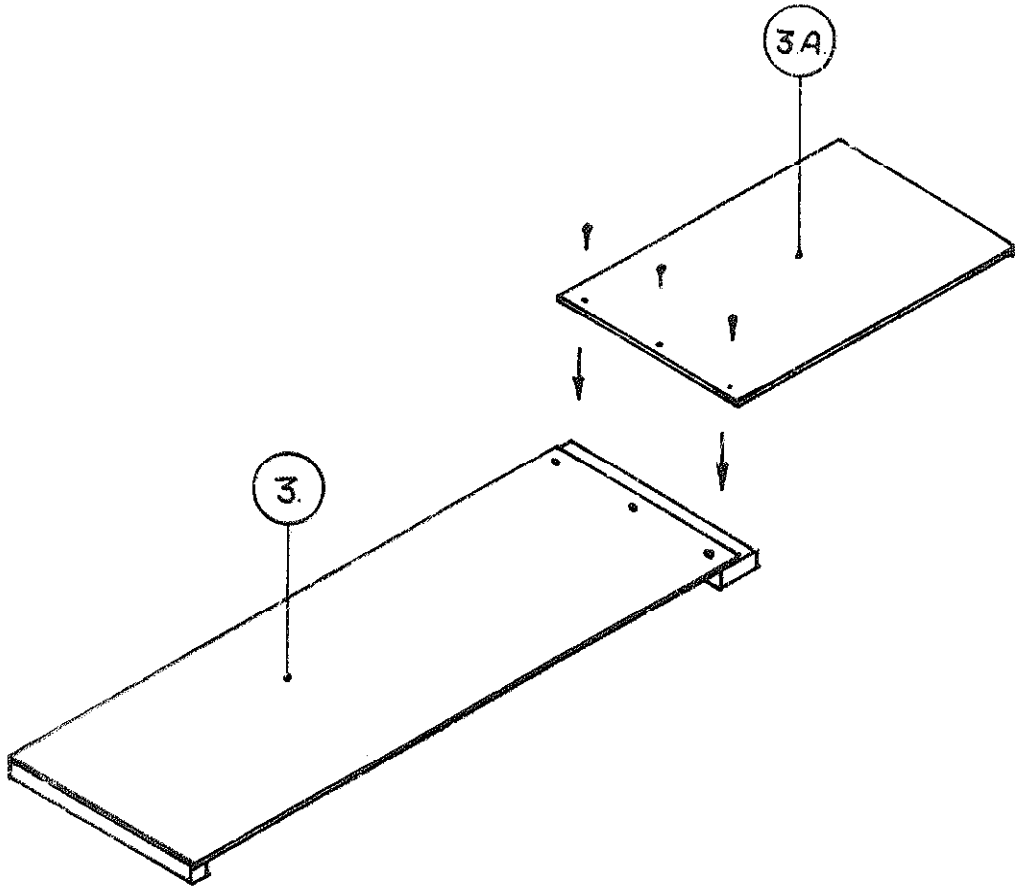
J.J. van Thienen.

II. Drawings for the unpacking, the assembly and the reproduction of the kit.

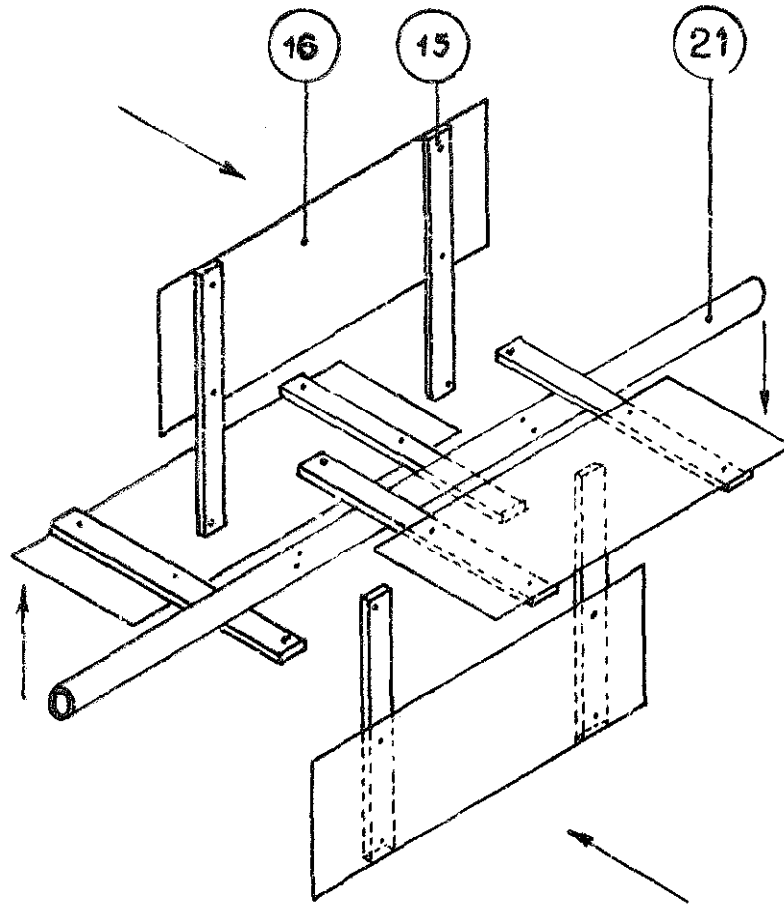
PACKING OF THE KIT OF THE WINNOWING-MILL

Box: interior 11,5 x 65 x 7 cm., gross weight 29,7 kg.



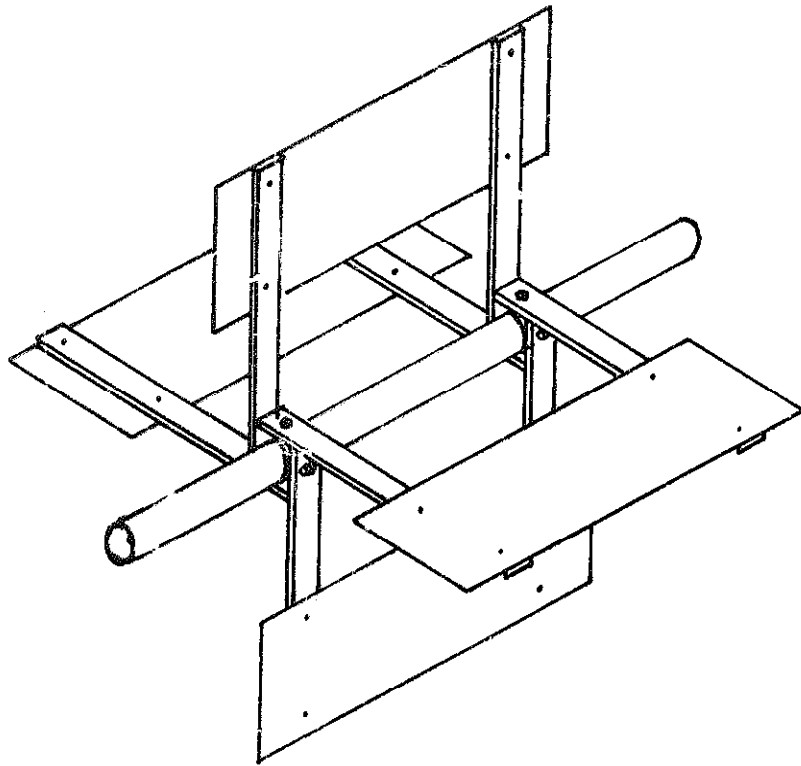


Join pos 3 and 3A by means of three screws.

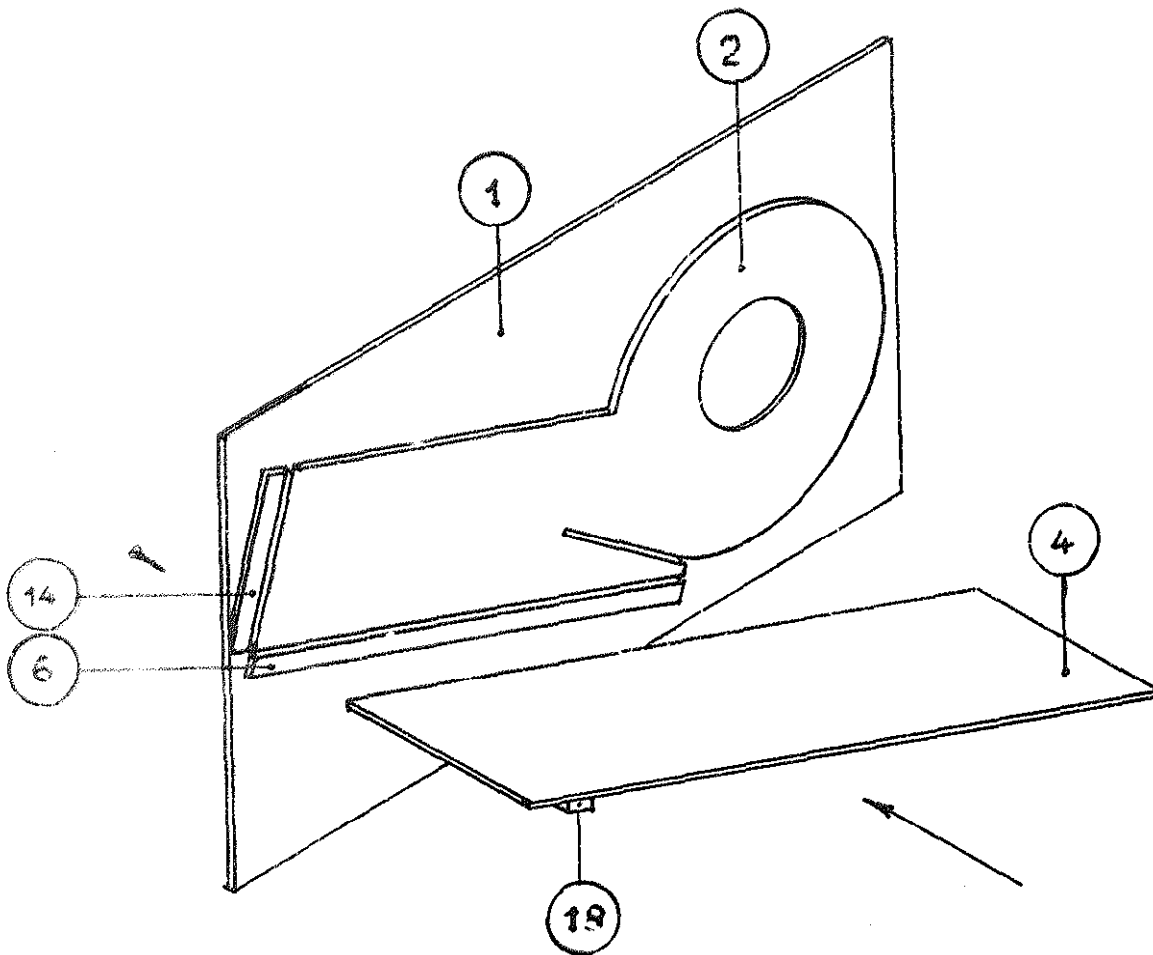


Adjust pos 15 (fan-arm) to pos 16 (fan-blade) by means of screws.

Mount the assembled blades on pos 21 (fan-shaft), using bolts M4x50 with nuts and washers.



The assembled fan.



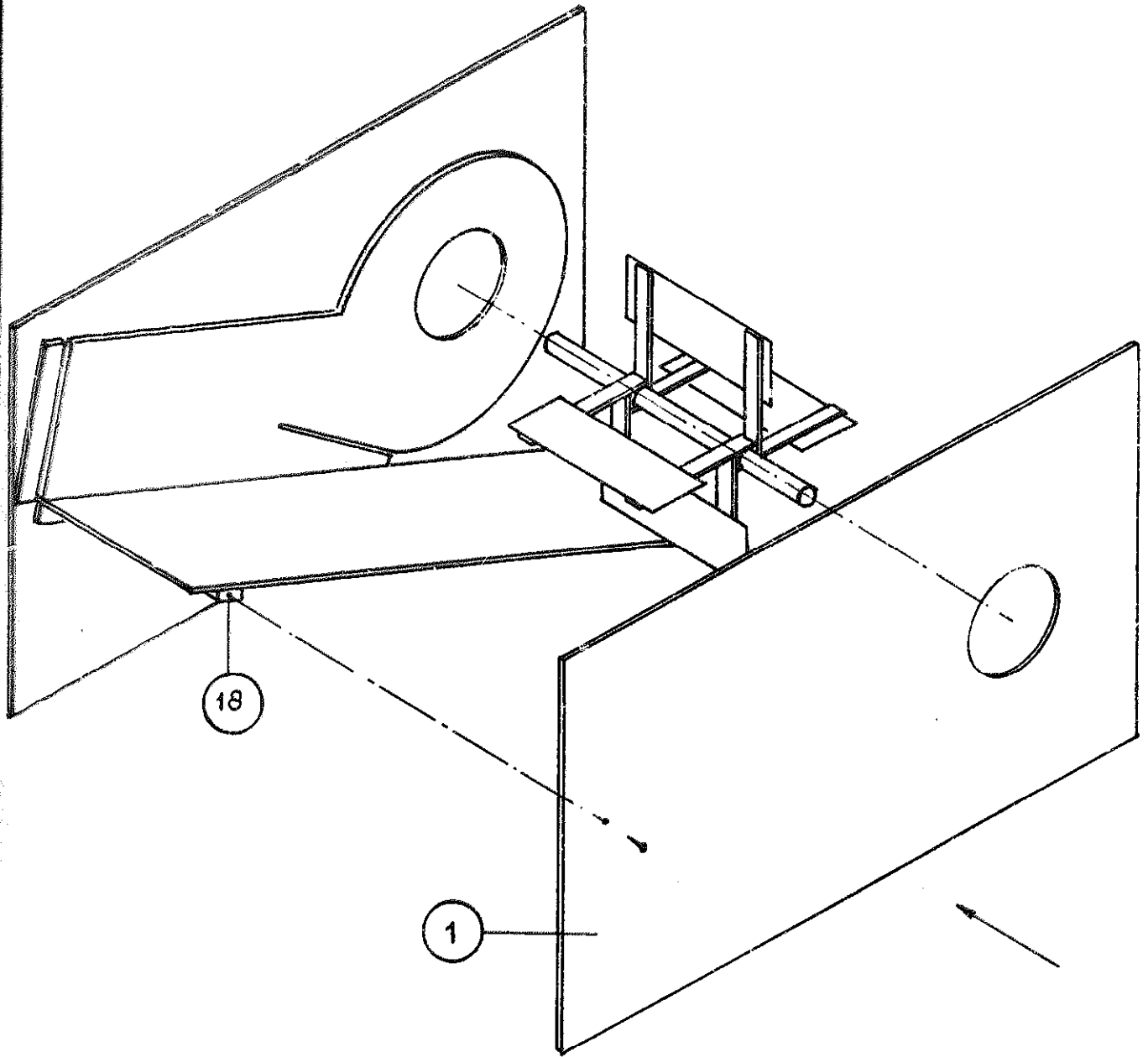
Sequence of the assembly of various parts.

Adjust pos 2 to pos 1 by means of screws.

Next adjust pos 6 and pos 14 at the right distance
(Notice the slit width has to be 7 mm).

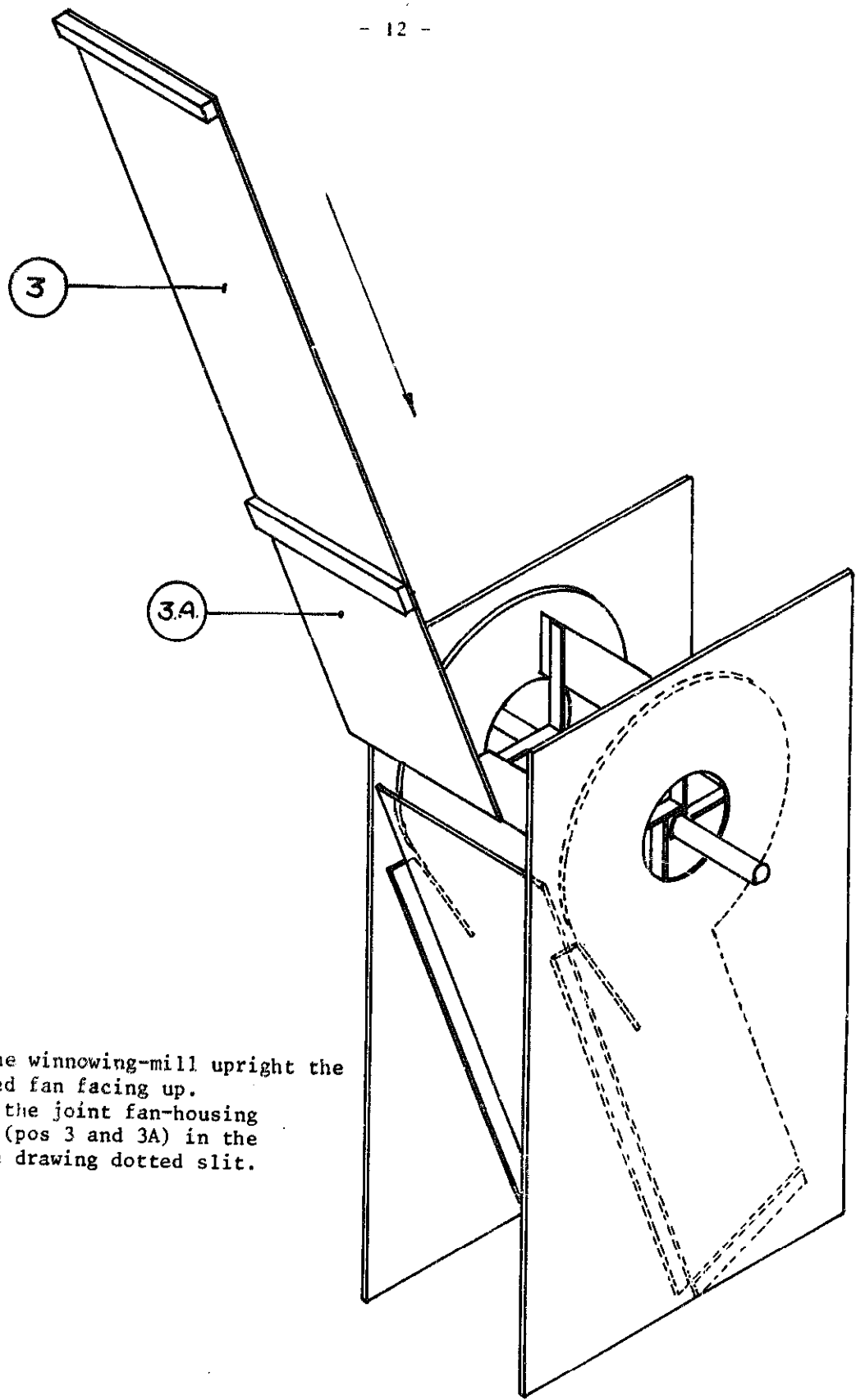
Slide pos 4 into the slit and fix the screw to
pos 18.

You'll have to do this twice, once for the left
and once for the right side-wall.

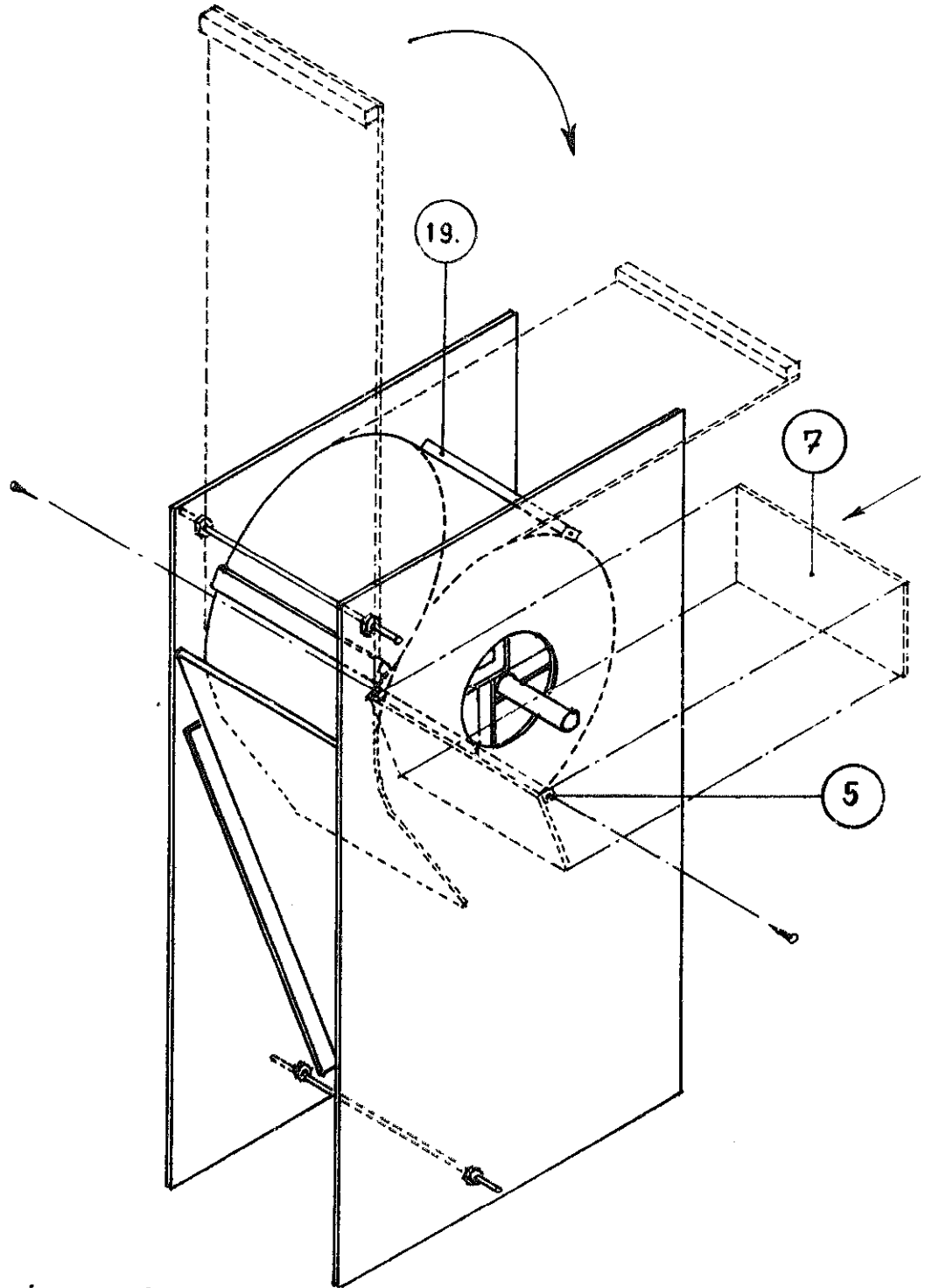


Next you'll have to join the side-walls.

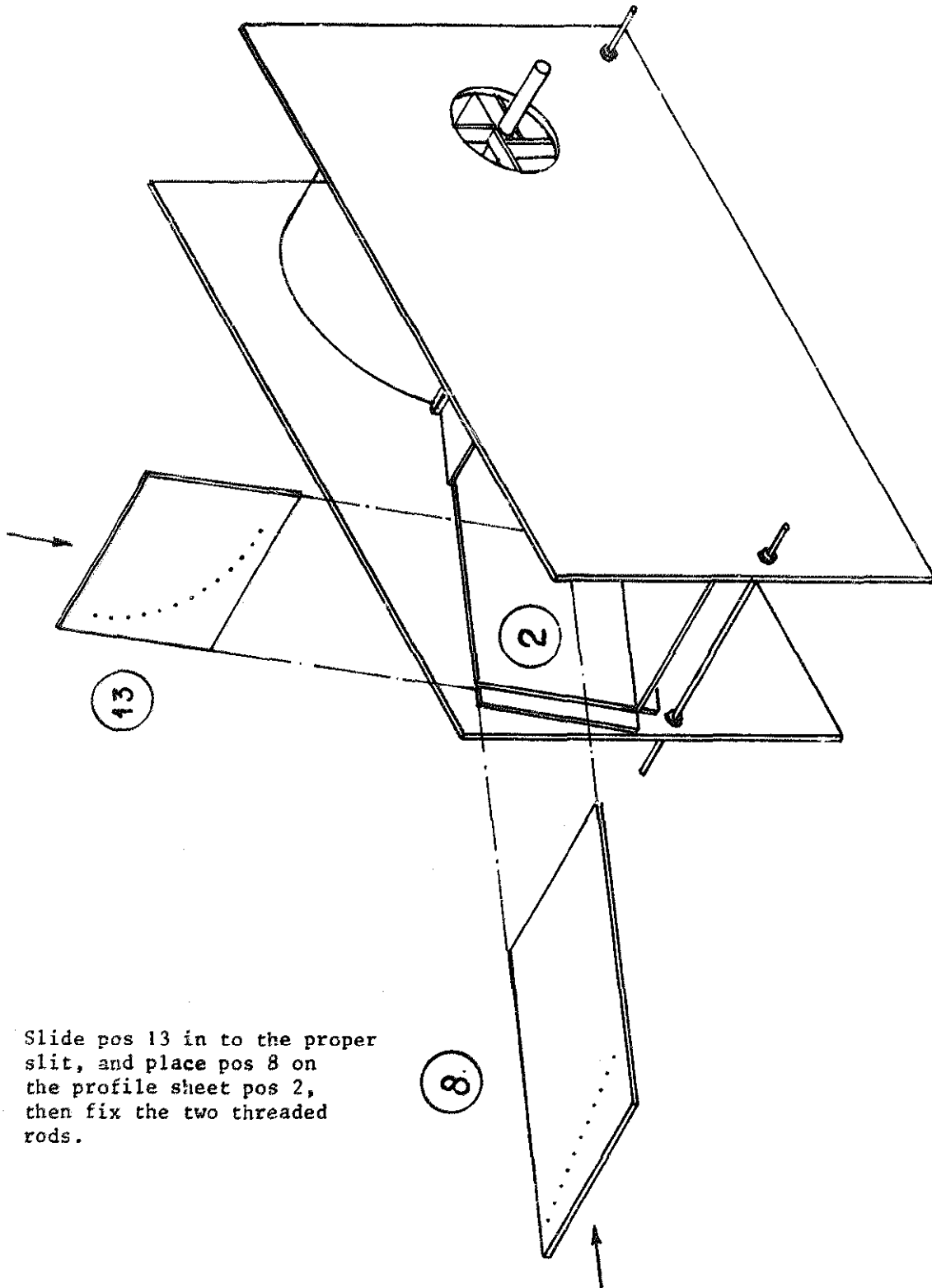
Situate the fan-shaft between the side-walls.
Clamp the funnel-bottom in the slit and fix
a screw into the side-wall (pos 1) adjusting it
to pos 18.



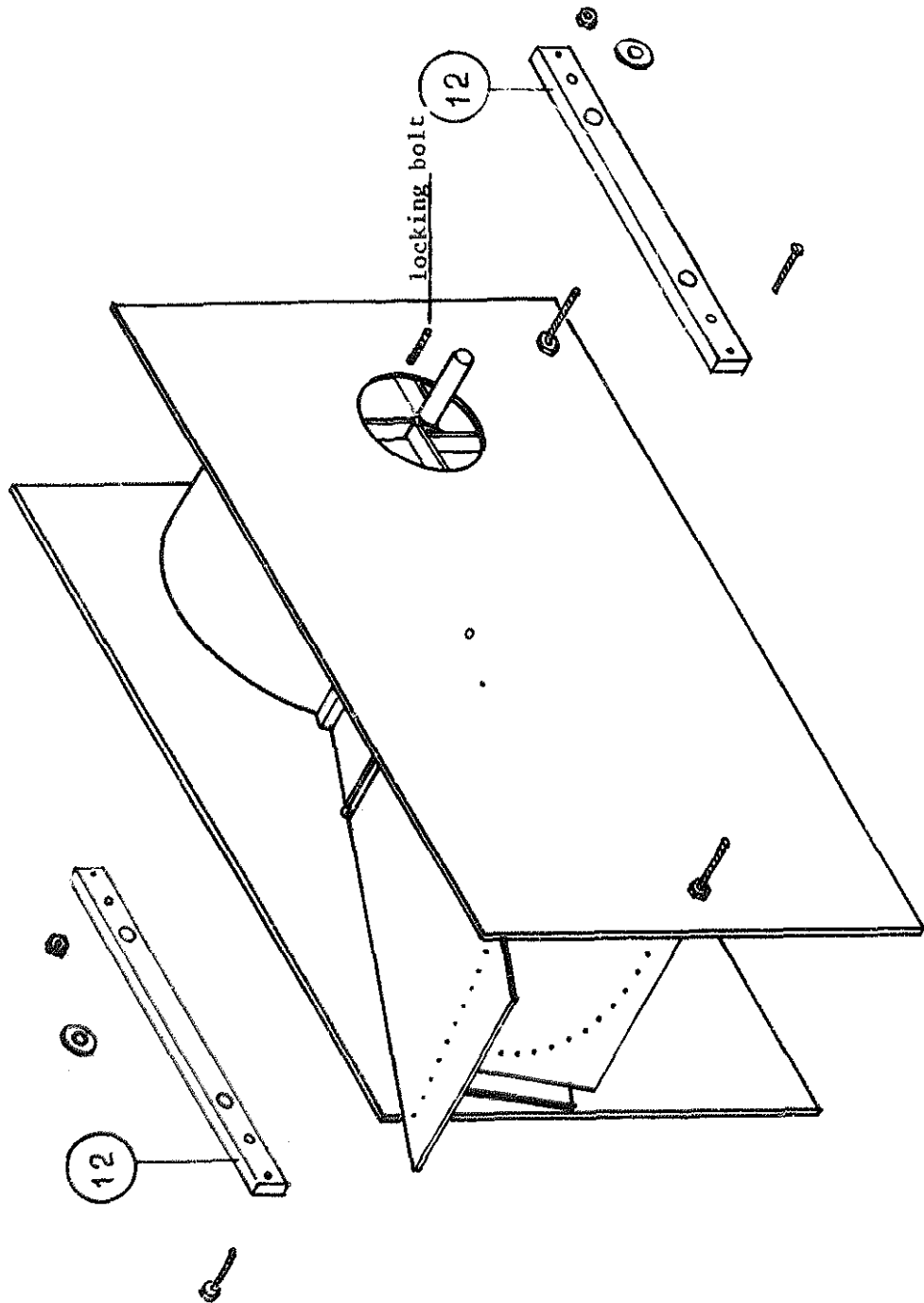
Put the winnowing-mill upright the mounted fan facing up. Slide the joint fan-housing parts (pos 3 and 3A) in the in the drawing dotted slit.



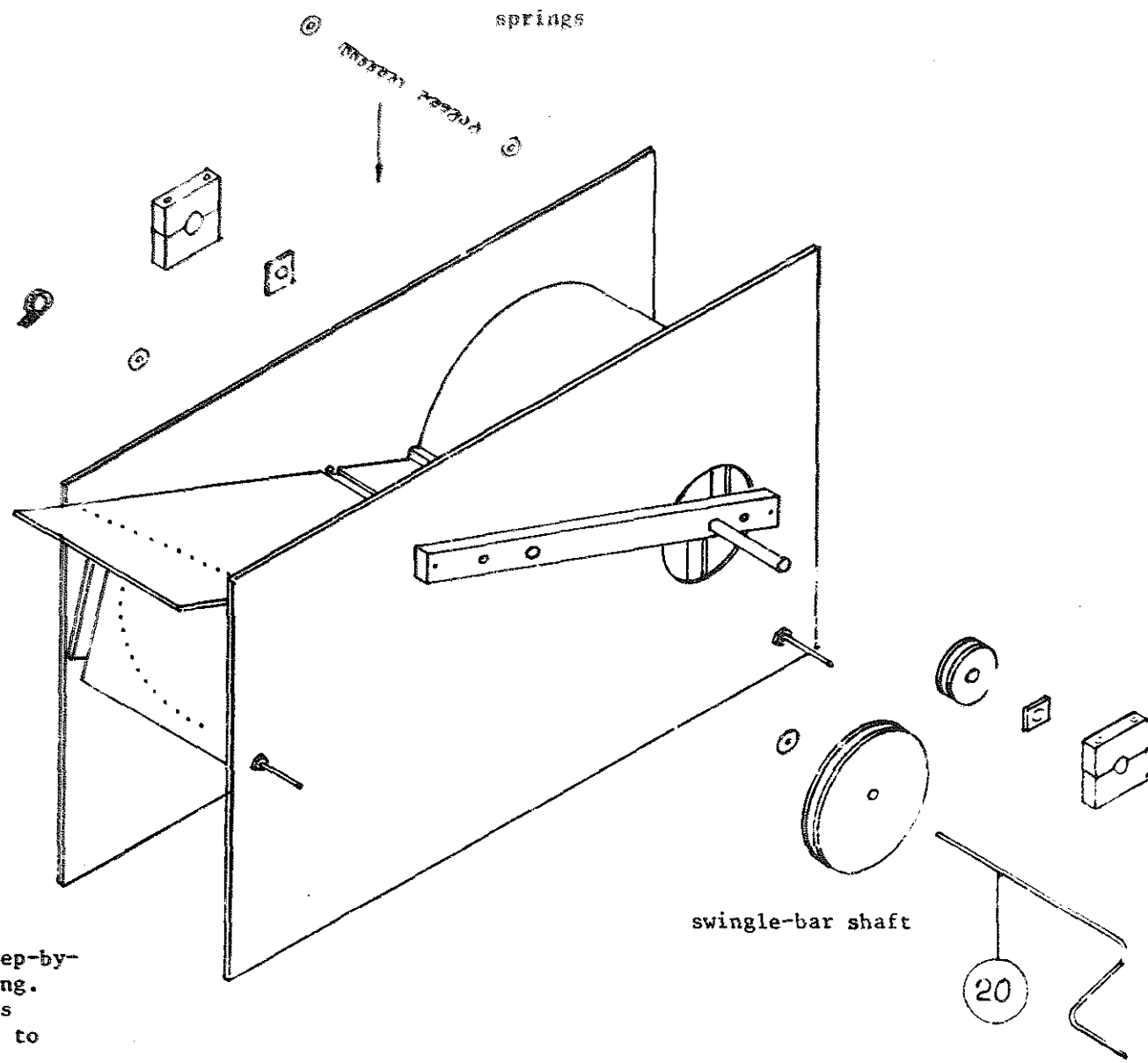
Shape the fan-housing pos 3
and 3A in the right position.
Slide the funnel-roof pos 7 under
the fan-housing.
Next fix the two screws into the
clamping lath.
Press the distance lath on to
the fan housing and tighten
with screws.



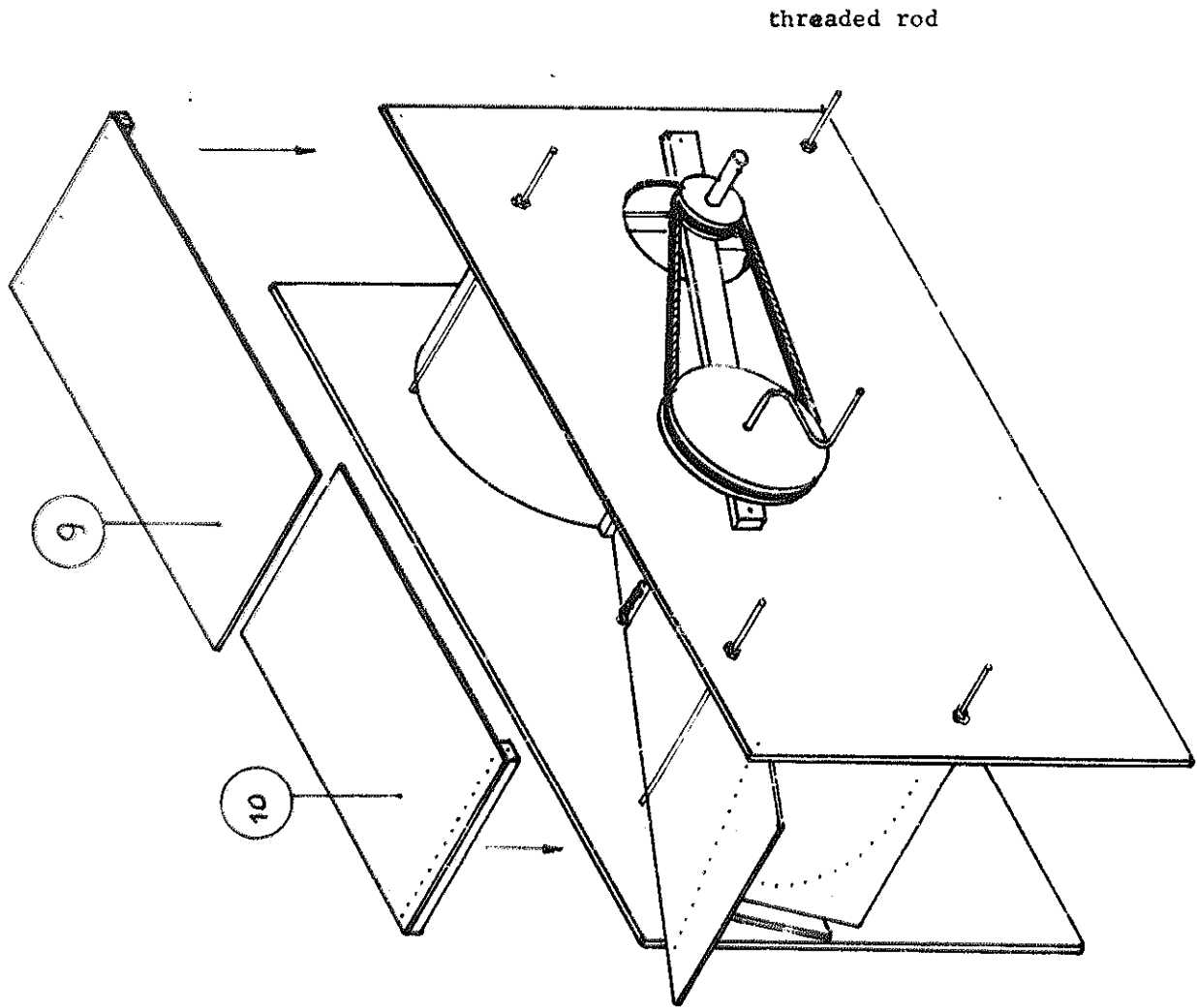
Slide pos 13 in to the proper slit, and place pos 8 on the profile sheet pos 2, then fix the two threaded rods.



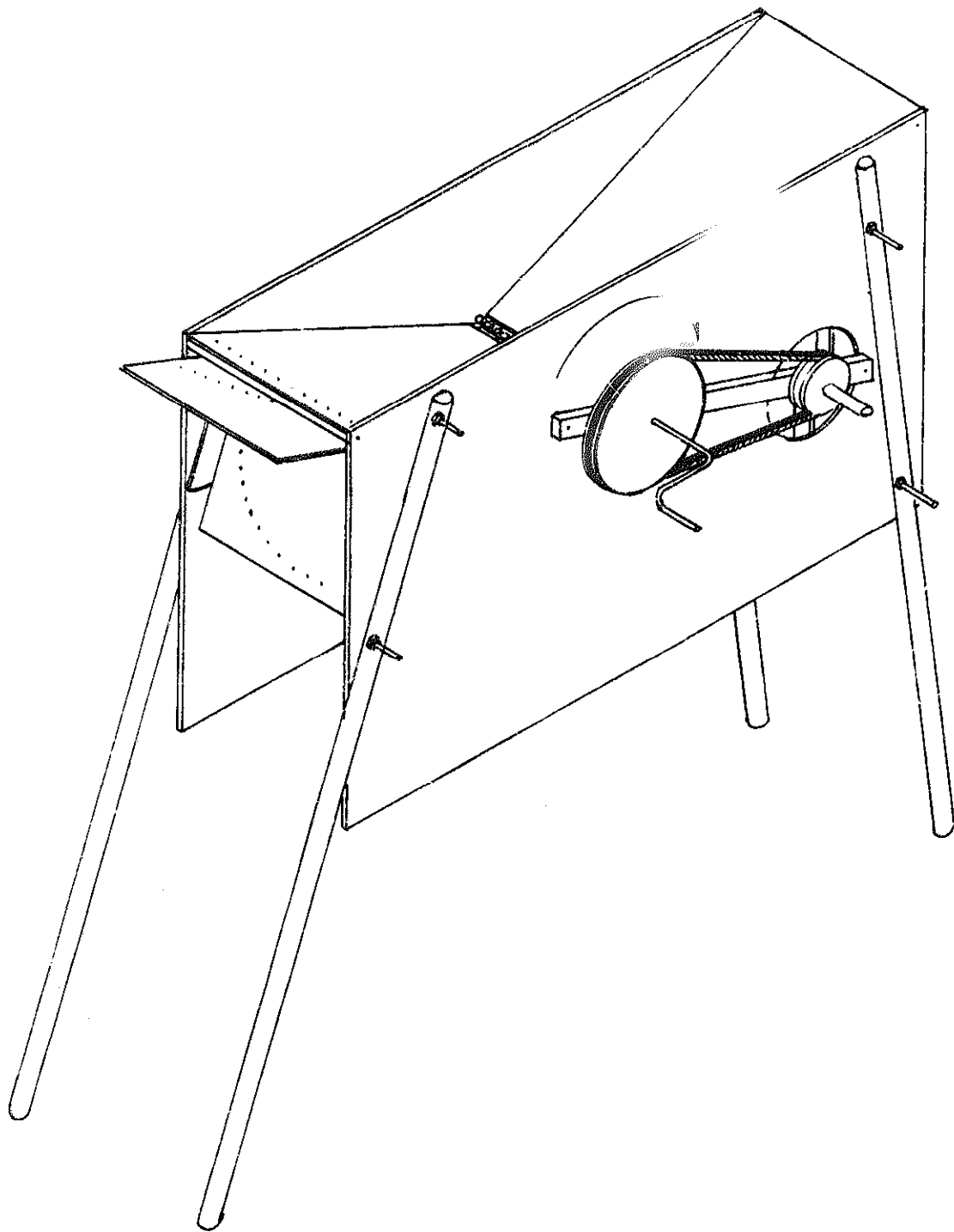
1. Adjusting the bearing beams.
First adjust the two locking bolts near the fan shaft (heads of the bolts on the inside)
2. Afterwards adjust the other two locking-bolts, but now the heads have to be on the outside
3. Finally fix the washers and nuts.



Adjust the pulleys, etc, step-by-step as shown in this drawing. Mind the springs and washers which have to be slipped on to the swingle-bar wheel.

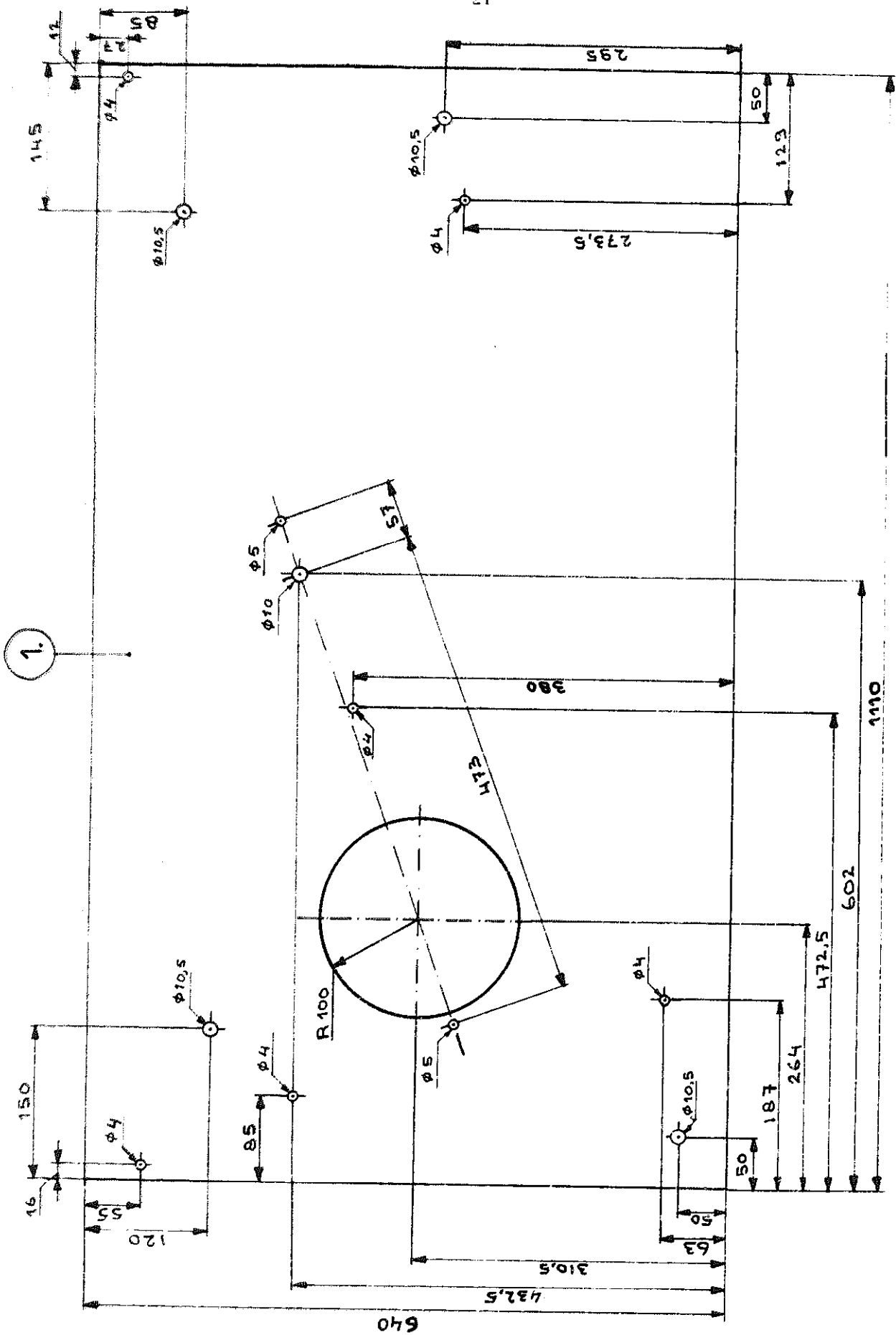


Adjust the two other threaded rods
Next fix pos 9 and pos 10 to pos 1.



Pos	Subject	Number	dimensions	Material
1	Side-wall	2	1110x640x8 mm	plywood
2	Profile sheet	2	995 x461x8	"
3	Fan Housing long	1	900 x300x2	"
3A	Fan Housing short	1	460 x300x6	"
4	Funnel Bottom	1	920 x300x6	"
5	Clamping beam fan housing	1	300 x 24x24	oakwood
6	Support strips	2	565 x 20x6	plywood
7	Funnel-roof	1	300 x140x6	"
8	Funnel-roof movable	1	584 x298x6	"
9	Tray-bottom above fan-housing	1	620 x300x6	"
10	Tray-bottom above funnel	1	520 x300x6	"
11	Support lath	1	300 x 40x20	oakwood
11A	Support lath	1	300 x 40x20	"
12	Bearing beam	2	570 x 50x25	"
13	Sliding lid	1	298 x270x6	plywood
14	Sliding lath	2	220 x 20x6	"
15	Fan-arm	8	194 x 20x10	oakwood
16	Fan-blade	4	274 x100x4	hardboard
17	Cover lath for the fan-housing	1	300 x 40x20	Oakwood
18	Mounting beam	1	300 x 40x20	"
19	Distance piece	1	300 x 40x20	"
20	Swingle-bar	1	760 x \emptyset 10 mm.	free cutting steel
21	Fan-Shaft	1	\emptyset 18/16x550 mm	pipe
22	V-belt	1	10x104 optibelt	
23	Swingle-bar pulley	1	spz 160 m	
24	Fan-shaft pulley	1	spz 50 m	
25	Thumper	4	60 x 30 x 24 mm	oakwood

<u>description</u>	<u>Material</u>	<u>Number</u>
26 nut m 10	Steel	12
27 nut m 5	Steel	9
28 nut m 4	Steel	5
29 washer 18m	Steel	2
30 washer 10 mm	steel	16
31 washer 5 mm	Steel	9
32 washer 4 mm	Steel	5
33 Cheese-head screw m 4x15 mm		2
34 Cheese-head screw m 4x25 mm		2
35 Cheese-head screw m 4x50 mm		4
36 coach bolt m5x50 mm		4
37 self-tapping screw typ A nickel flat headed hardened steel no. 6 3,4"x 3,5		12
38 self-tapping screw typ A nickel flat headed hardened steel no 4. ½"x 2,8		20
39 screw countersunk headed 6 x ½"		70
40 screw countersunk headed 5 x ½"		10
41 hose-clamp "Victory" No. 8656		
42 Threaded pin No 29060120 C.T.D.		2
43 hoseclamp "Victory" No 8656		
44 Threaded pin No 29060121 CTD		1
45 spring steel wire 500 mm		
46 Cheese-head screw		4
4 pair of tongs		1
48 screwdriver		1
49 round file		1
50 box steel wool		1
51 Thredded rod m 10x500 mm		4



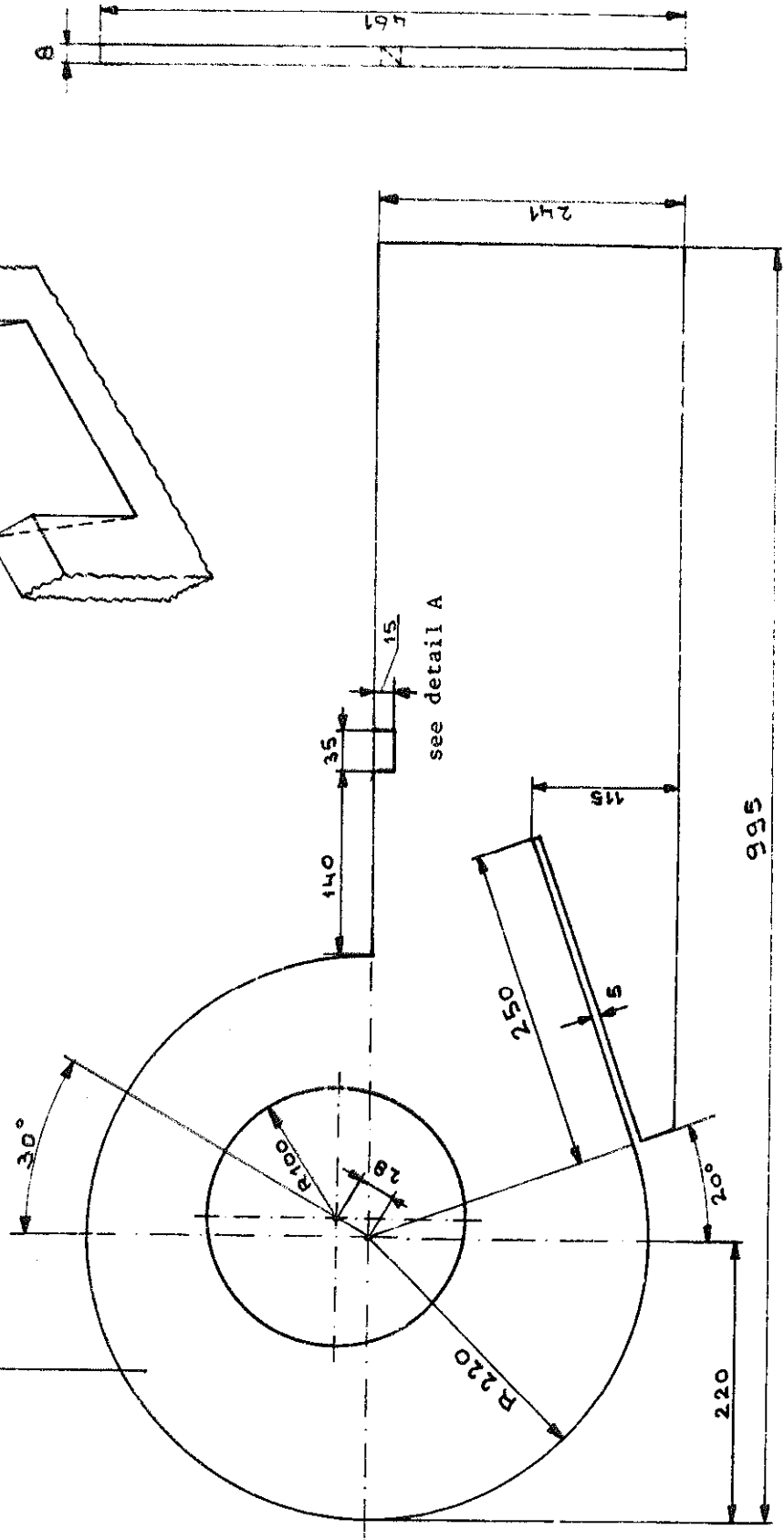
7.

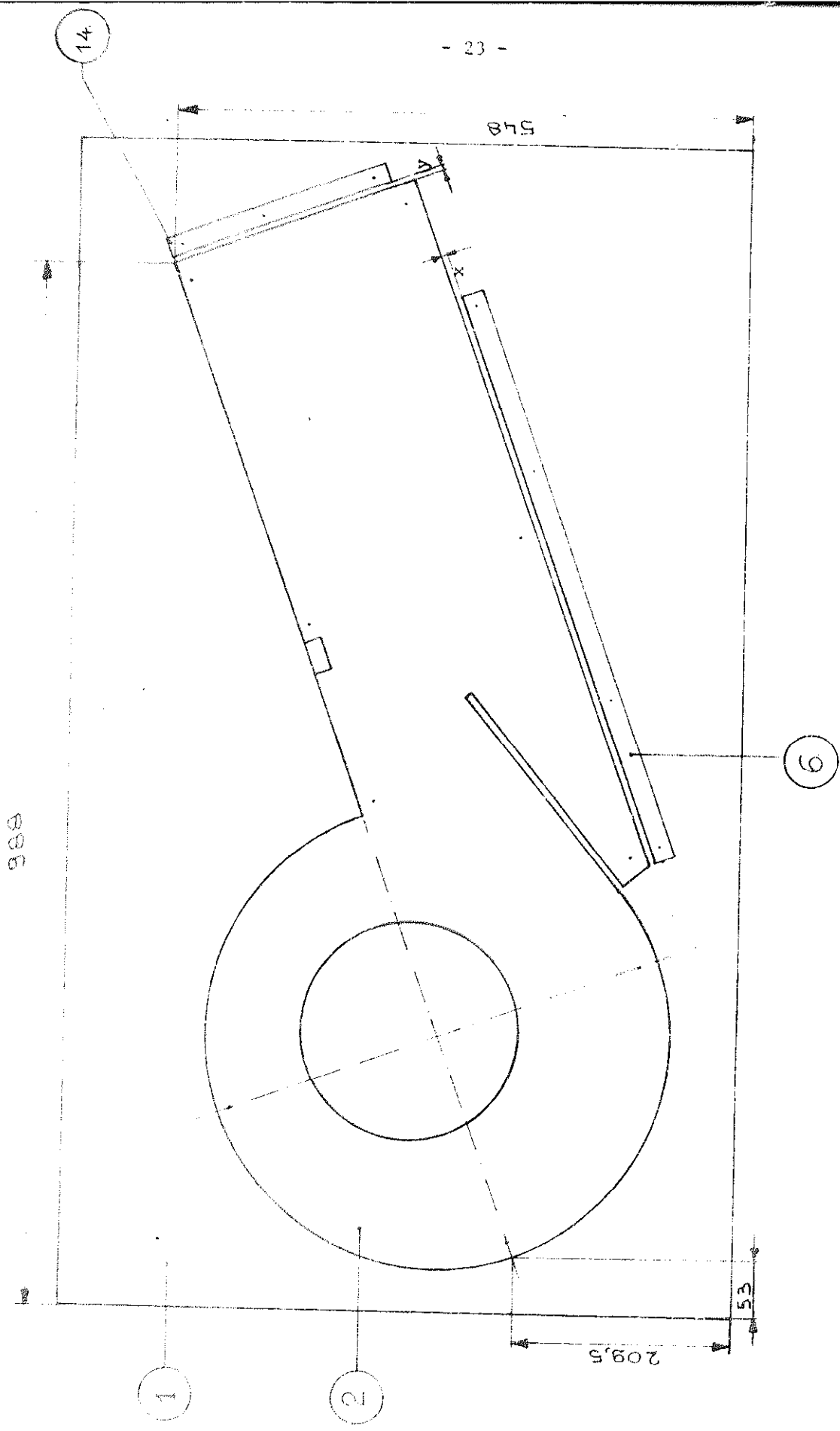
Pos. 2 total 2 parts

Detail A one in drawn position, the other in opposite position

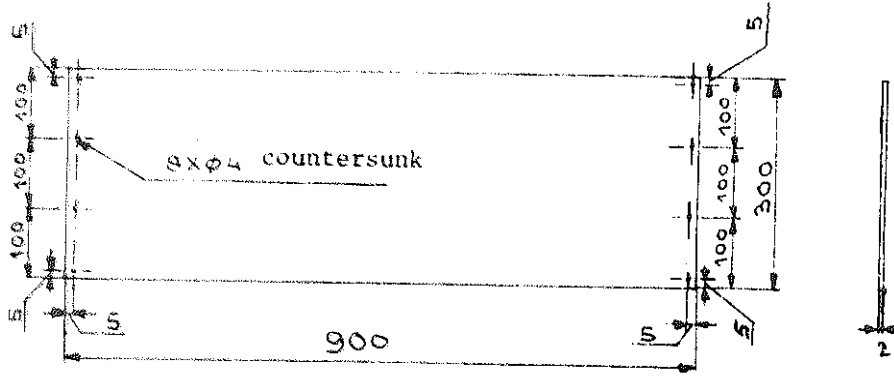
2

detail A



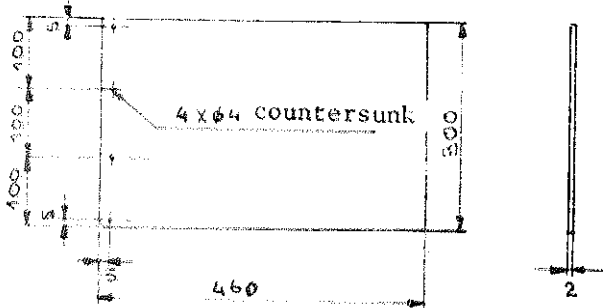


- fix pos 2 to pos 1
- x) fix sliding to the tunnel-bottom pos 4.
- y) fix sliding to the sliding lid pos 13

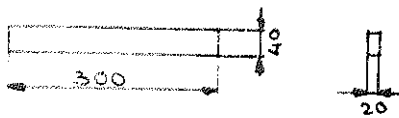


3

1 10



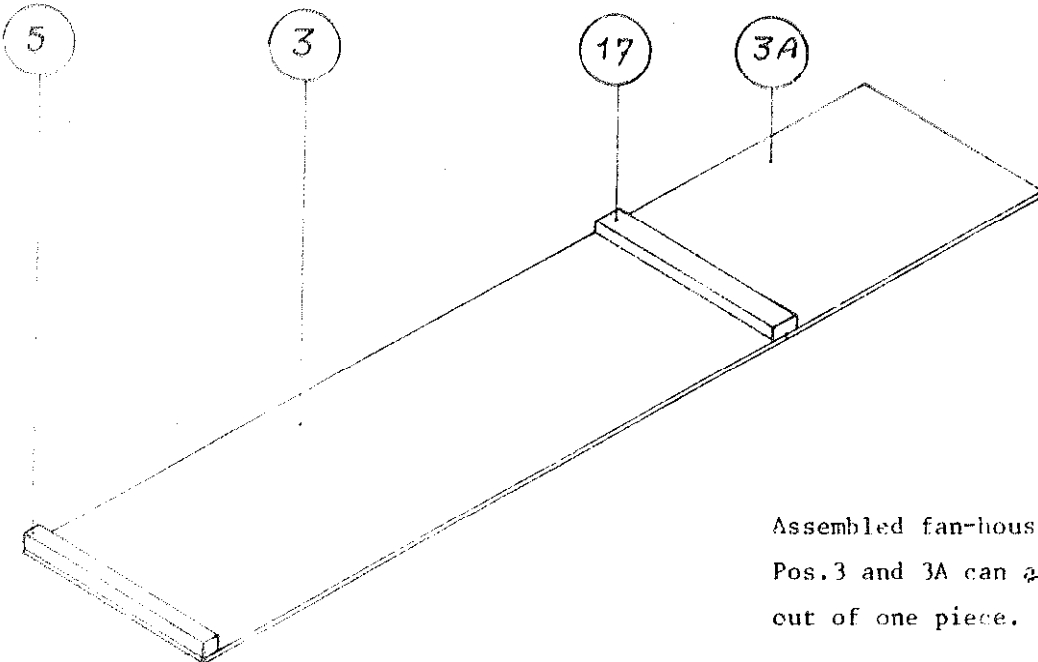
3A



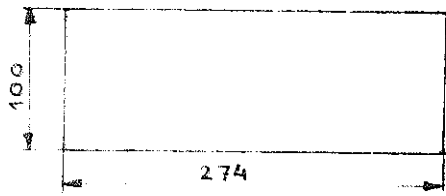
17



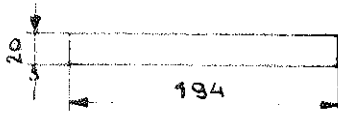
5



Assembled fan-housing
Pos.3 and 3A can also be made
out of one piece.

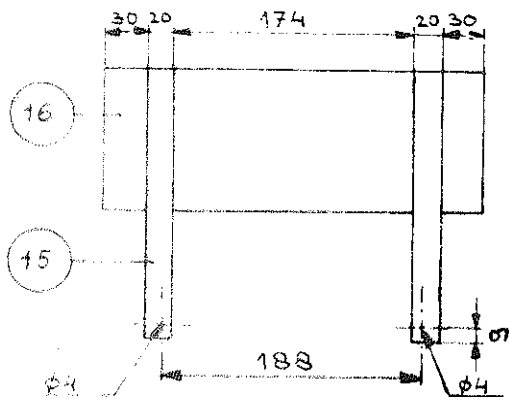


4 pieces

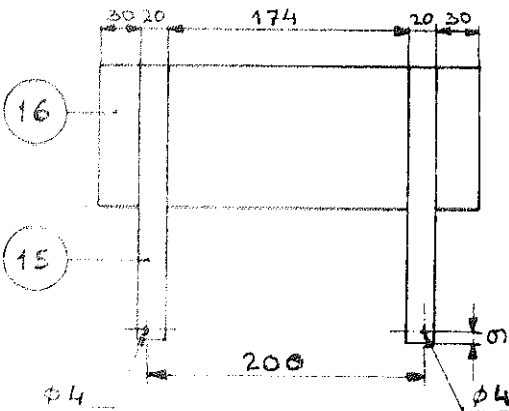


8 pieces

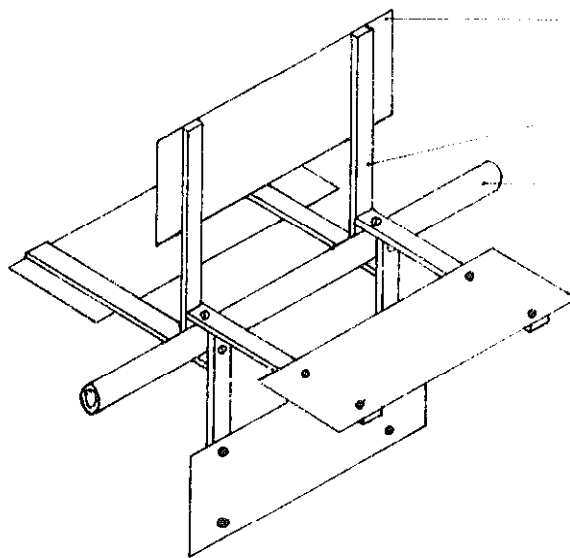
15



important dimension
188 mm 2 pieces



important dimension
200 mm 2 pieces

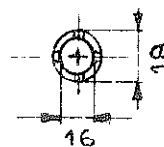
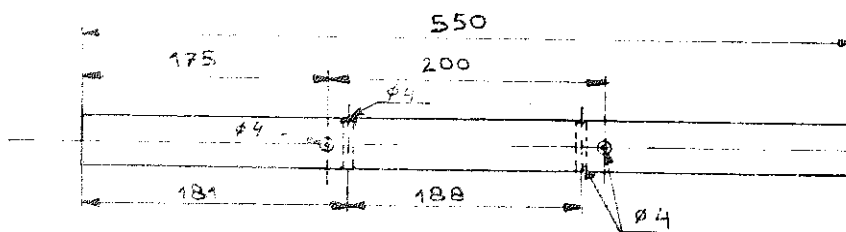


16

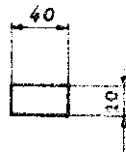
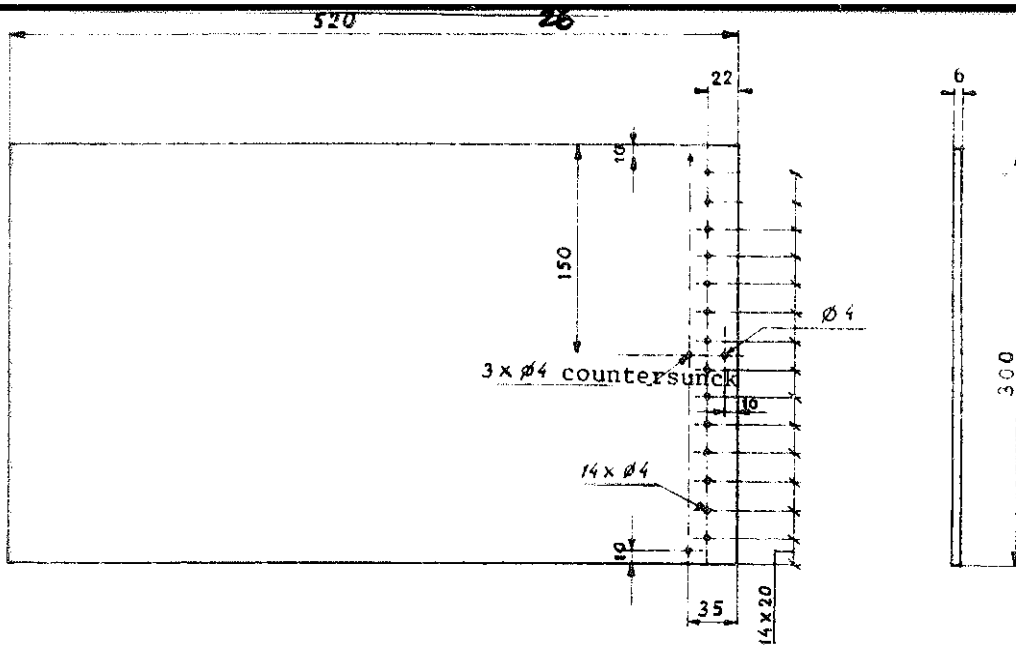
15

21

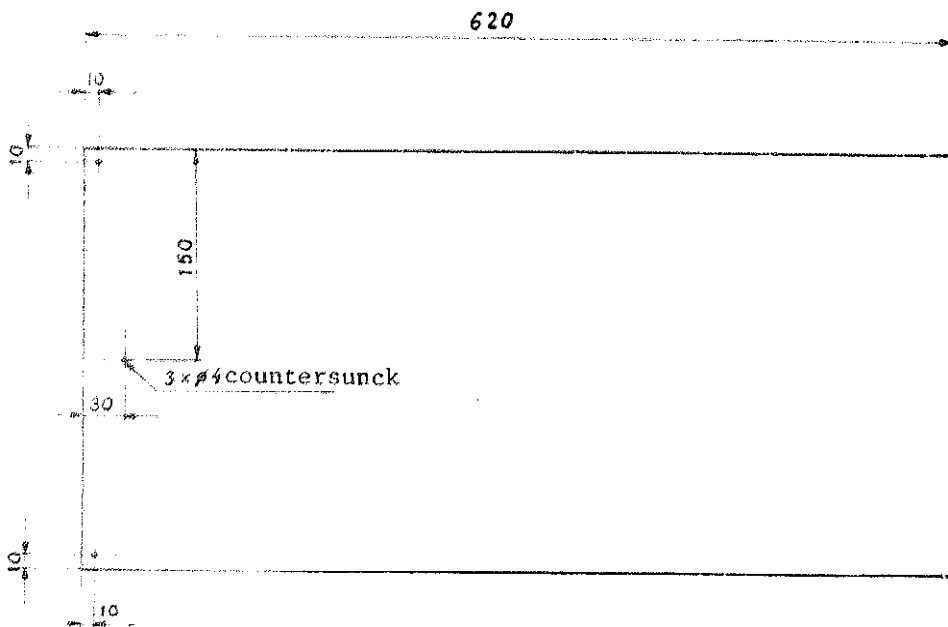
assembled fan



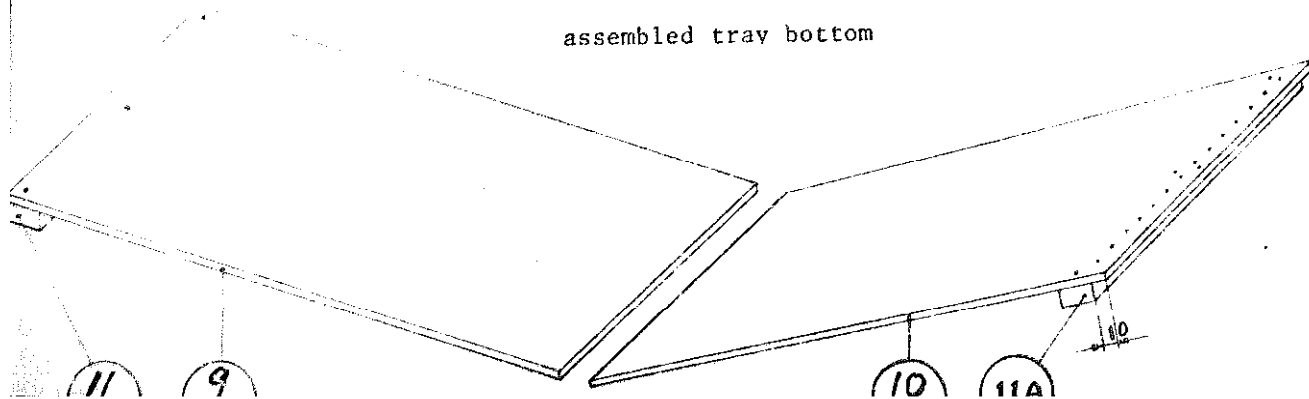
21



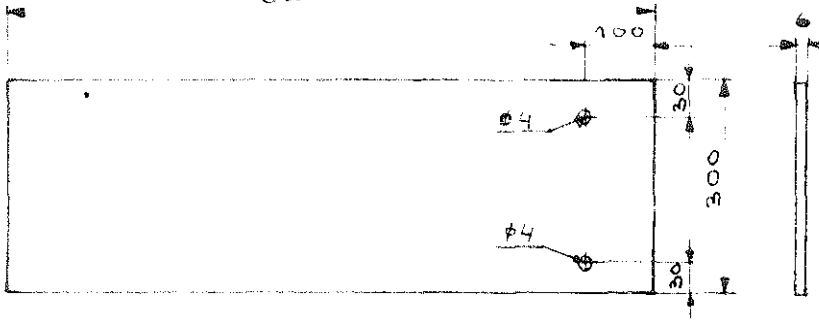
11 11A



assembled tray bottom

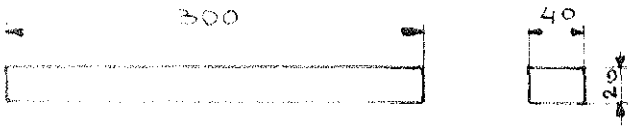


320



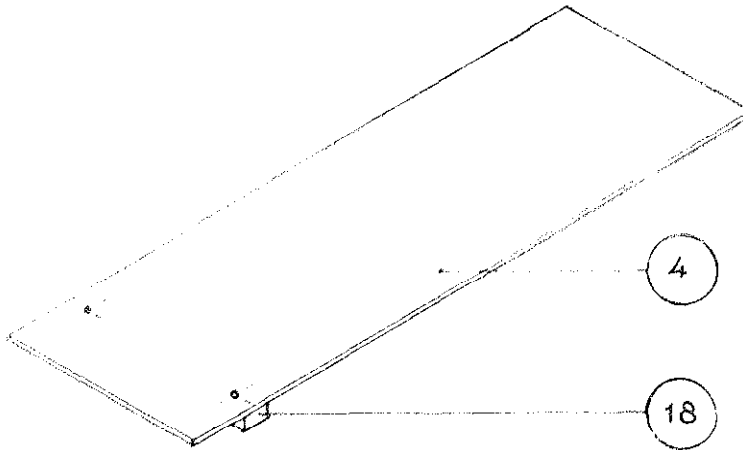
4

1:10



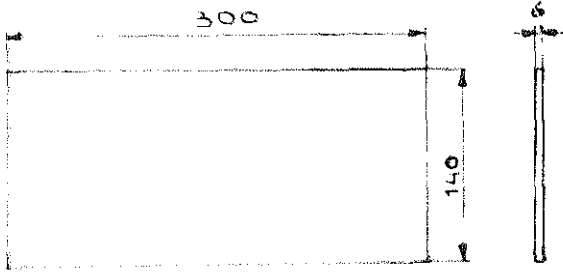
18

1:5



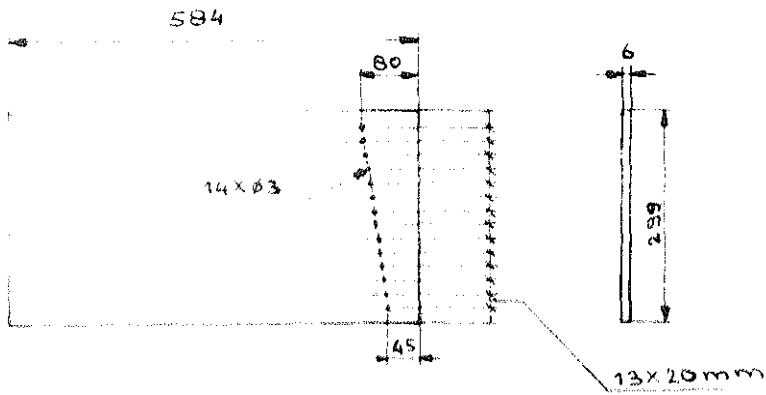
joining

pos 4 en pos 18



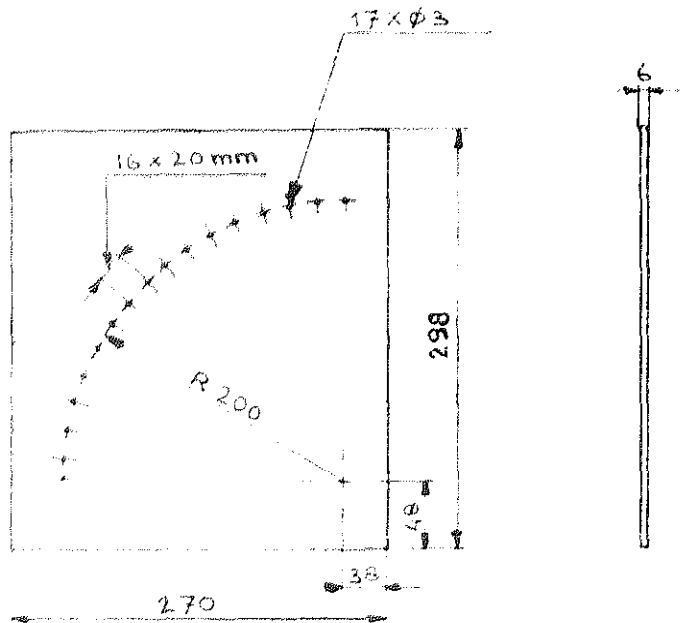
7

1.4



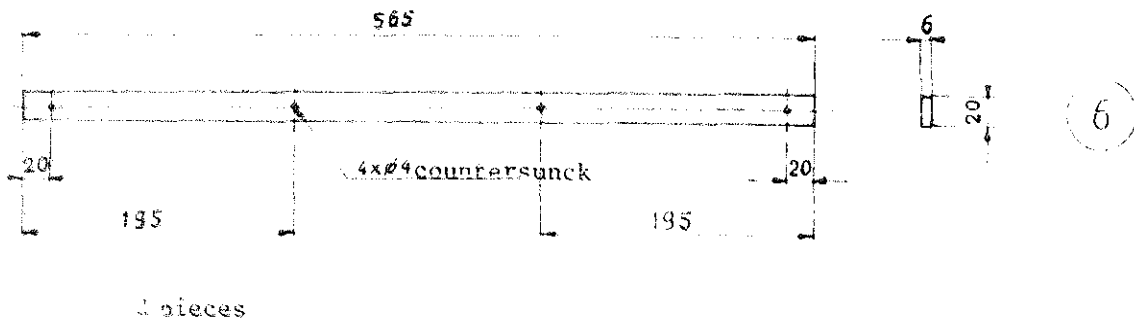
8

1.5

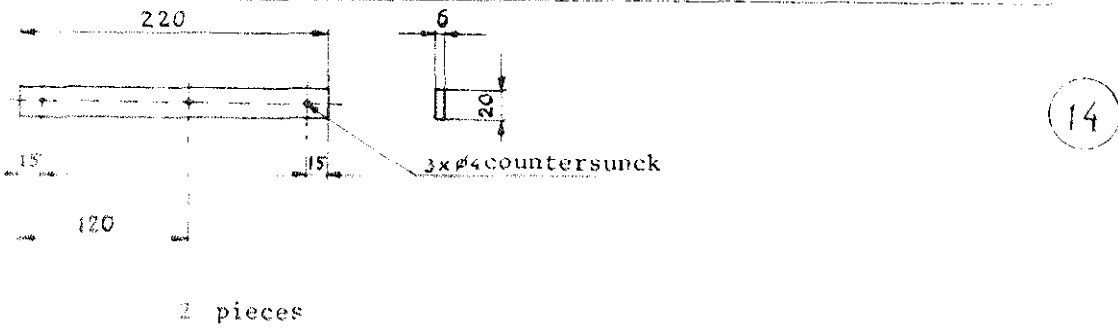


13

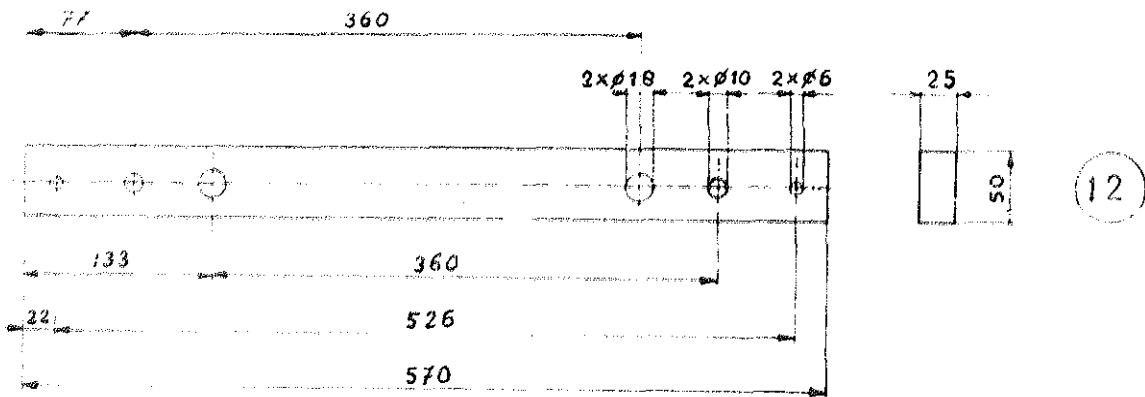
1.5



1 pieces



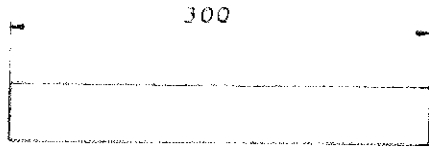
2 pieces



2 pieces

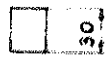
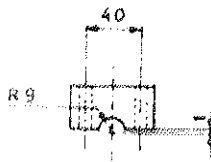
The bearing beams have to be drilled at the same time.

The bearing holes for the fan-shaft and the swingle-bar have been double performed as to reverse the beam when one pair of holes has been worn out.



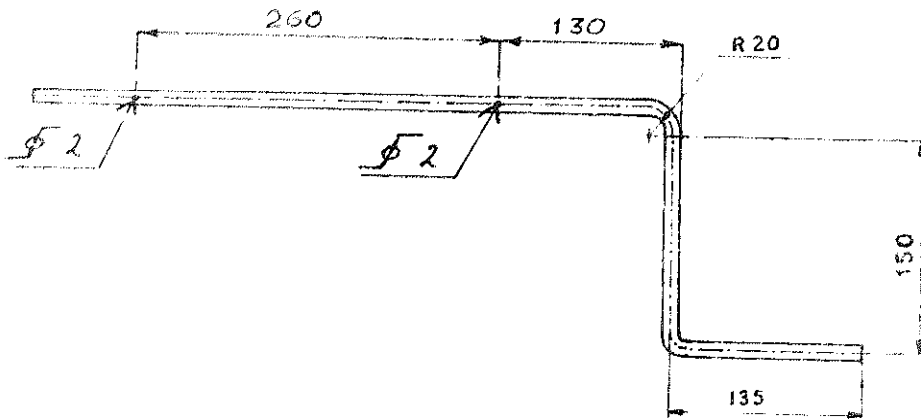
19

1 piece



25

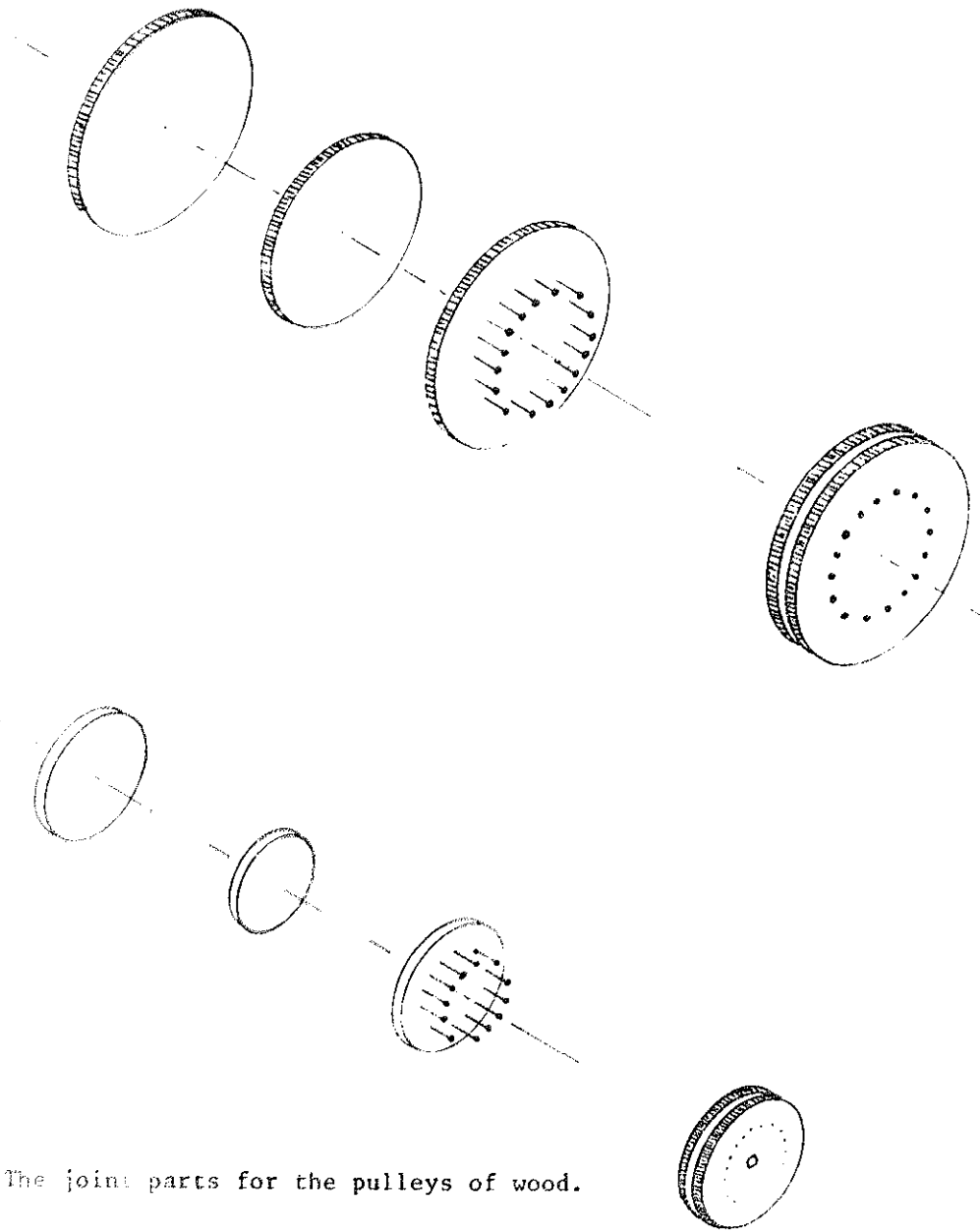
4 pieces



20

1 piece

Ø 10 x 760 mm.



The joint parts for the pulleys of wood.

III. EXPLANATORY TEXT

- 33 -

Explanatory text.

Hints for the unpacking
 for the assembly
 for the reproduction
 for the use.

1. The unpacking.

1.1 First of all you will have to study the instructions about the unpacking and the assembly carefully, don't get carried away taking everything apart leaving it all over the place. Unpacking and assembling isn't difficult if you read and study the drawing carefully.

1.2 To prevent rattling and consequently damaging it, all parts have been joint by nails or wiresticks, with exception of the upper plate, which is the side (operating-side and position no 1 of the detail list) on which the "stories" are written.

1.3 You'll find the assembly-tools packed, consisting of one pair of tongs, one screwdriver and one round file or rat's tail. Unpack them.

1.4. Take the parts apart with the tongs and the screwdriver and pull out the (small) nails. Don't take apart the screwed parts, we already assembled them as you can see in the packingdrawing. Take it easy and damage as little as possible.

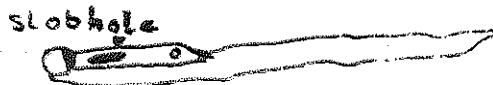
1.5 Open the little boxes with the greased parts (only iron parts have been greased and oiled, except the steelwool). Put the parts on the paper you have taken them out from, text facing up.

1.6 Line up all parts well-ordered on the assembly spot.

1.7 Because the cleaned grain has to slide down the inclining tunnel-bottom it has to be as smooth, as a mirror. You will have to fill up the naitholes by driving small pins of wood (matches) into them. Polish the tunnel-bottom firmly with bee-wax in such a way that you are filling up all pores. Rub it out afterwards, preferably with a wool cloth. Take a tuft of the steel wool (inserted) and polish the whole bottom in a circular form till it is smooth. Whipe out the dust (grindings) and rub the bottom again with a wool cloth. It's up to your own judgement to repeat this procedure, remember the surface has to be smooth.

Use only bee wax without honey-rests otherwise the thing stays sticky. We didn't send wax because it is always locally available. The honey-comb is always resistant to high temperatures.

- 1.8 Try to find wood for the legs, they may be small balks, but also stems will do, preferably already dried. If you use logwood you should flatten the side you are connecting to the side-wall of the mill.



The maximum diameter of the legs is 6 cm, you need two legs of 125 cm (4'2") and two legs of 135 cm (4'5"). Two holes have to be drilled in each leg. On the side-wall the centre-to-centre distance of the holes is indicated. If there is an extreme fluctuation in humidity the legs' length will vary. Therefore it is advised to elongate the upper hole \pm 1 cm with a file. The effect will be that the upper spindle-ends can slide and the winnowing-mill will not be wrenched.

2. The assembly.

- 2.1. The winnowing-mill has been assembled complete and has run on trial. The glued joints of the plywood are waterproof. All wood is oak wood.
- 2.2 We recommend to use a platform on a table for the assembly of the kit.
- 2.3 While bending the fan-housing 3+3A you should hold on to the covering slat (19) till it has been screwed to the side-wall. The heads of the brass screws, which fix 3 and 3A to 19, might break out through the plywood.
- 2.4. There is a possibility that humidity has swollen the oak wood and the holes for the fixing bolts don't correspond with the holes in the side-wall. In this case you should elongate the bolt holes in the bearing-beam (at the side of the fan-shaft)
- 2-5 Adjusting the V-belt you should start with the small pulley to go on to the big pulley.
- 2.6 Mount the big pulley on the swingle-bar shaft in such a way that it does not slip. Do the same with the small pulley but don't den the pipe. Both "thumpers" at the end of the fan-shaft have to be in the same position, for example placing both with one flat side horizontal.

- 2.7 Don't panic if some parts are left over you are left with an extra four discs from the fanholes, two eccentric blocks and some-spare fixing material. Later on we'll explain about the extradiscs and eccentric blocks.
- 2.8 If the cleaned grain (regardless your polishing) still doesn't slide down the tunnel-bottom easily you can incline the tunnel-bottom by raising the legs of the discharge-end by means of some stones or a beam. If it suits better you can leave the stones and cut off a piece of the other pair of legs. Take into account the length of your operators, if there are both smaller and taller ones you can have the smaller ones stand on a raised area.
- 2.9 Now you can start assembling according the enclosed drawing, which shows you exactly the step-by-step procedure.

3. REPRODUCTION

- 3.1 The material we used was 8 and 6 mm plywood and 3 mm "aircraft-plywood" (slayers). The latter is hard to get by, instead you can use many thin small laths (plywood) or tin plate or aluminium (flattened corrugated sheet). Of course you need waterproof-glued plywood indicated in Holland with W.B.P. (waterproof bonded). In the States it is called Exterior Plywood in France Contreplaque Exterieur. C+T.B.-X+
- 3.2 Aluminium pulleys can be replaced by pulleys of wood. If you are reproducing our pit exactly as described you can make one big pulley out of three of the four discs. In order to do so you'll have to make.
- two accurate circular discs radius (R) 95 mm
 - one accurate circular disc. R. 90 mm.
 - one swingle-bar
 - one grip
- } see drawing
- 3.3. You can make two small pulleys (one spare) out of the fourth disc. In order to do so you'll have to make two sets of
- two accurate circular discs R 30 mm.
 - one accurate circular disc R 25 mm.
- 3.4 For the swingle-bar construction we advise to use a hardwood stick or bar with the same radius as the fan-shaft. The advantages of the use of a thick swingle-bar are:
- a. Clamping the big pulley and "thumpers" is much easier.

b. It makes it easier adjusting a distribution-system in the stock-bin, for instance by drilling a hole in the middle of the bar, in which you insert a spring steel wire which you bend spiral-shaped around the bar in such a way that the grain is screwed from the sides to the middle.

3.5 The square clamping-blocks adjusted at the ends of the fan-shaft are called "thumpers". Holding a lath on them while the fan is turning makes them push or thump and the lath makes an up-and-down going movement, which can be transmitted, via a hinged lath, to a vibrating strainer, which is suspended above or under the winnowing-mill.

4. TO WINNOW

4.1 The winnowing-mill has four re-adjustment possibilities:

- 4.1.1. the r.p.m. (revolutions per minute) of the fan, by turning the swingle-bar faster or slower;
- 4.1.2. the grain-supply by increasing or decreasing the supply slit by moving the tunnel-roof; (pos.8)
- 4.1.3. the exhaust by opening the discharge sliding lid more or less (pos.3);
- 4.1.4. the bottom-inclination: lengthening one pair of legs by means of stones or if you only use one adjustment, shortening the other pair.

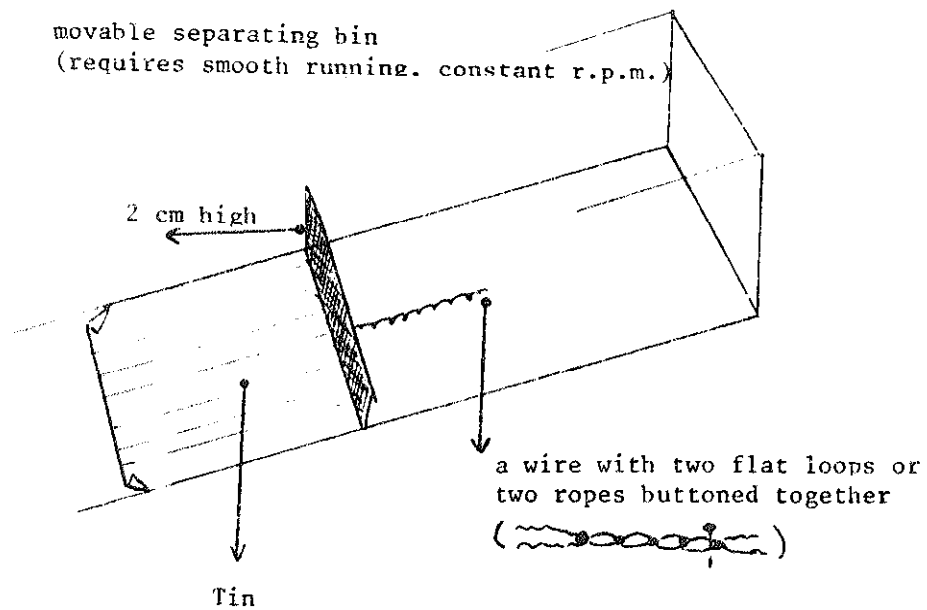
4.2 Because it is quite senseless to summarise what results we had with grains which differ from your anyway, we restrict ourselves to the following indications:

<u>growth</u>	<u>supply</u>	<u>exhaust</u>	<u>r.p.m.</u>	<u>remarks</u>
rye + a lot of dirt	6	8	+ 80	
oats + a lot of dirt	9	open, take sliding lid out	70	incline the bottomstant 10 degrees
beet	6	"	80	"
timothée (grasseeds)	5	"	40	25 degrees inclination

4.3 As you will notice the "hail-shower" is quite sharply marked off. This has brought one of the users to the idea to lay a movable tin-bin on the bottom (see drawing). This bin was flat and smooth so the acceptable grains and grains of sand (which also come in) slid down more easily than down the polished tunnel bottom. Particularly the light fine-grained timothée tends to obstruct the sliding.

4.4. Keep all iron parts well oiled and greased so your winnowing-mill will live a much longer life. Don't forget to oil the heads of the bolts and nuts and the fan shaft from the inside. Check whether the bolts, nuts or screws have gone loose at the same time. If so tighten them.

Sketch referred to on page 36. (4.3.)



EVALUATION- Questionnaire

In order to evaluate, the unpacking, the assembly and the reproduction of the winnowing-mill we would like you to answer the following questions. Please don't use this sheet, but a separate one answering the questions. You only need to cite number and letter of the question.

1. Difficulties concerning the shipment.
 - a. How long did it take to get to you, keeping in account the day of outgoing from the T.H. Eindhoven?
 - b. Has more than 25% of the kit costs been paid as import duties?
2. Difficulties concerning the unpacking.
 - a. To what extent had the package been reliable?
 - b. Has everything been found fixed as shown in the package-drawing?(6)
Which differences were established?
3. Difficulties concerning the assembly.
 - a. Was it easy to understand the assembly drawings? (page 7-21).
 - b. Have you been able to follow all procedures which could only be estimated on the "static" drawings, for example by a dotted line?
 - c. Which drawings have according to you been unintelligible or could be made more clarifying?
 - d. What common difficulties have you met while assembling?
 - e. Are the native inhabitants able to assemble the kit using exclusively the drawings?
4. Difficulties concerning the use.
 - a. Is the mill of the kit functioning properly?
 - b. If the mill has been readjusted by you, is it functioning properly?
 - c. What difficulties have you met concerning the mechanical part of the mill?
 - d. What difficulties have you met concerning
 - the various cereals
 - the sifting of the chaff from the grain
 - the output receiving

- e. What improvements or changes would you like to have fitted to the machine.
 - f. What improvements or changes have you already fitted yourself?
 - g. Are you having maintainance problems?
 - h. Is the mill satisfying the social requirements?
 - i. Are there of have there been difficulties with the native inhabitants concerning the assembly, the installment or the use of the mill?
5. Difficulties concerning the reproduction.
- a. Have the production drawings been clear enough to you?
 - b. Are the native inhabitants able to build the mill using only the drawings?
 - c. What difficulties have you met studying the drawings?
 - d. What difficulties have you met while building?
 - e. Have the wooden and iron parts been easy to get in your field of operations.
 - f. Is the mill operating properly as been build by you or others?
(see also question 4(c)-(i).
6. Other difficulties or wishes.
- a. Do you have any other remarks or questions concerning the winnowing-mill?
 - b. What are the costs of the mill locally produced, specify material and labour costs.

We would like to welcome your answers to the previous question (please use separate sheet). Please send them to Werkgroep Micro-projecten Technische Hogeschool Eindhoven, P.O.Box 513, Eindhoven.