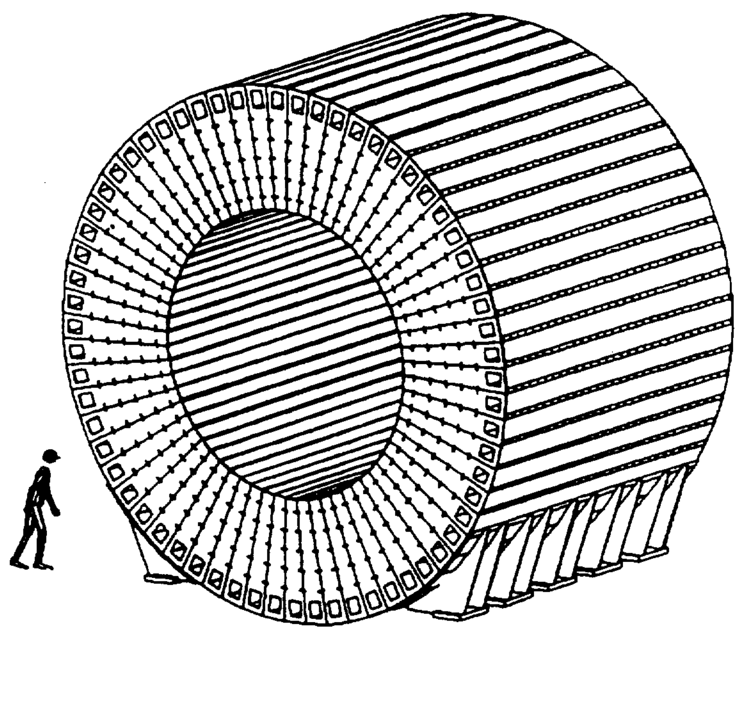
PART B

ATLAS Internal Note
TILECAL-NO-008 – B
10 February 1994

CERN / LHC 94
28 January 1994
Hadron Calorimeter of ATLAS
IHEP , Protvino , Russia

HADRON CALORIMETER OF ATLAS

CONCEPTUAL INTEGRATION PROJECT (PRELIMINARY)



INSTITUTE FOR HIGH ENERGY PHYSICS
Protvino, Russia

Mechanical fastening of supermodules in the girder zone and on surface along inner radius (in integrated assemblage from 4 supermodules) allows to minimize possible deformations of supermodules at assembly of them to barrel.

3. Assembly of lower barrel part consisting of 12 supermodules is carried out from integrated assemblages (Fig.33-35). Number of supermodules in this assembly is limited by capacity of surface crane (max 250 t).

4. Further assembly of barrel from assemblages consisting from 4 supermodules is shown on Fig.36-39 .

Effective control of formed barrel geometry has to be carried out at the all stages of assembly. Technological girders will be used to increase stiffness of lower bearing barrel part.

Depending on scenario barrel assembly can be carried out either fully above in the shaft zone or from integrated assemblages in experimental hall on supports of ATLAS detector.

Taking into consideration existence of surface crane with 2500t capacity and increased cost and duration of assembly in the experimental hall, version of surface assembly has to be prefered.

Scenario of barrel assembly has to be co-ordinated with assembly scenario of inner central detector (either simultaneous assembly or consecutive).

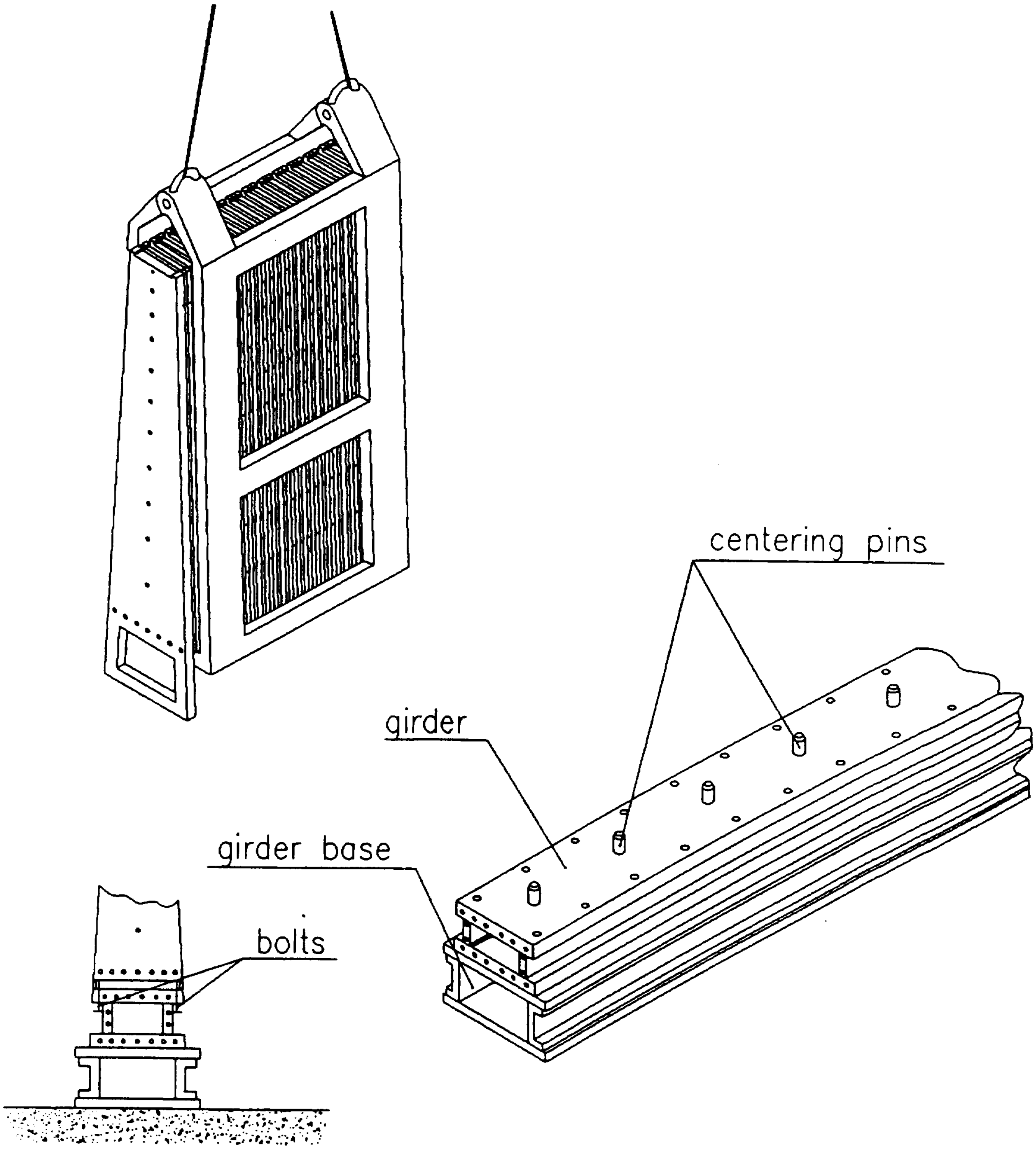


Fig. 22 Assembly of girder, mounting of modules on girder, prefastening of modules to girder.

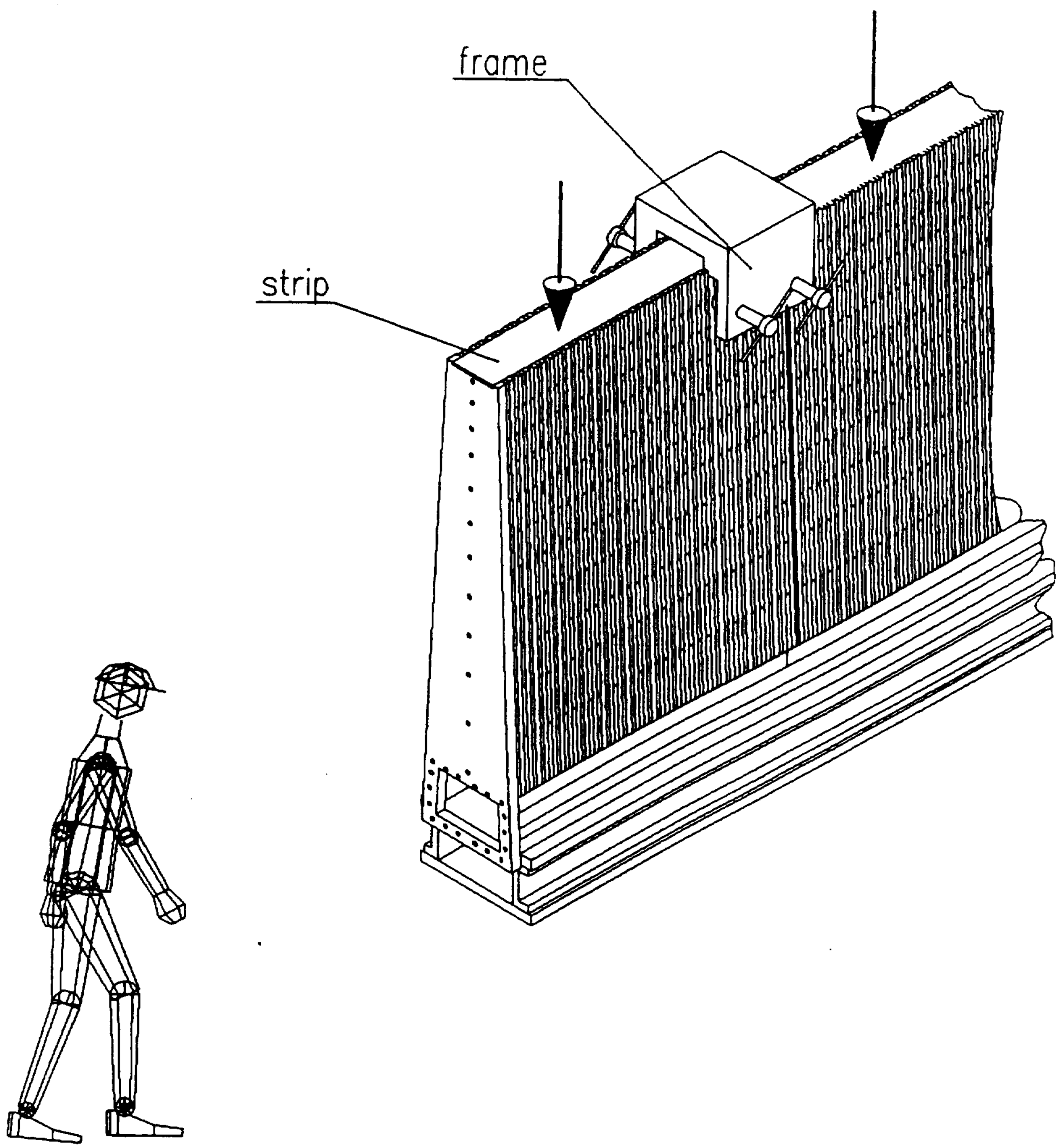


Fig. 23 Assembly of frame on supermodule in the inner radius zone, aligning of narrow module sides, press of stip (S=10mm, L=5900mm) into engagement with recess, linearing test of all supermodile sides.

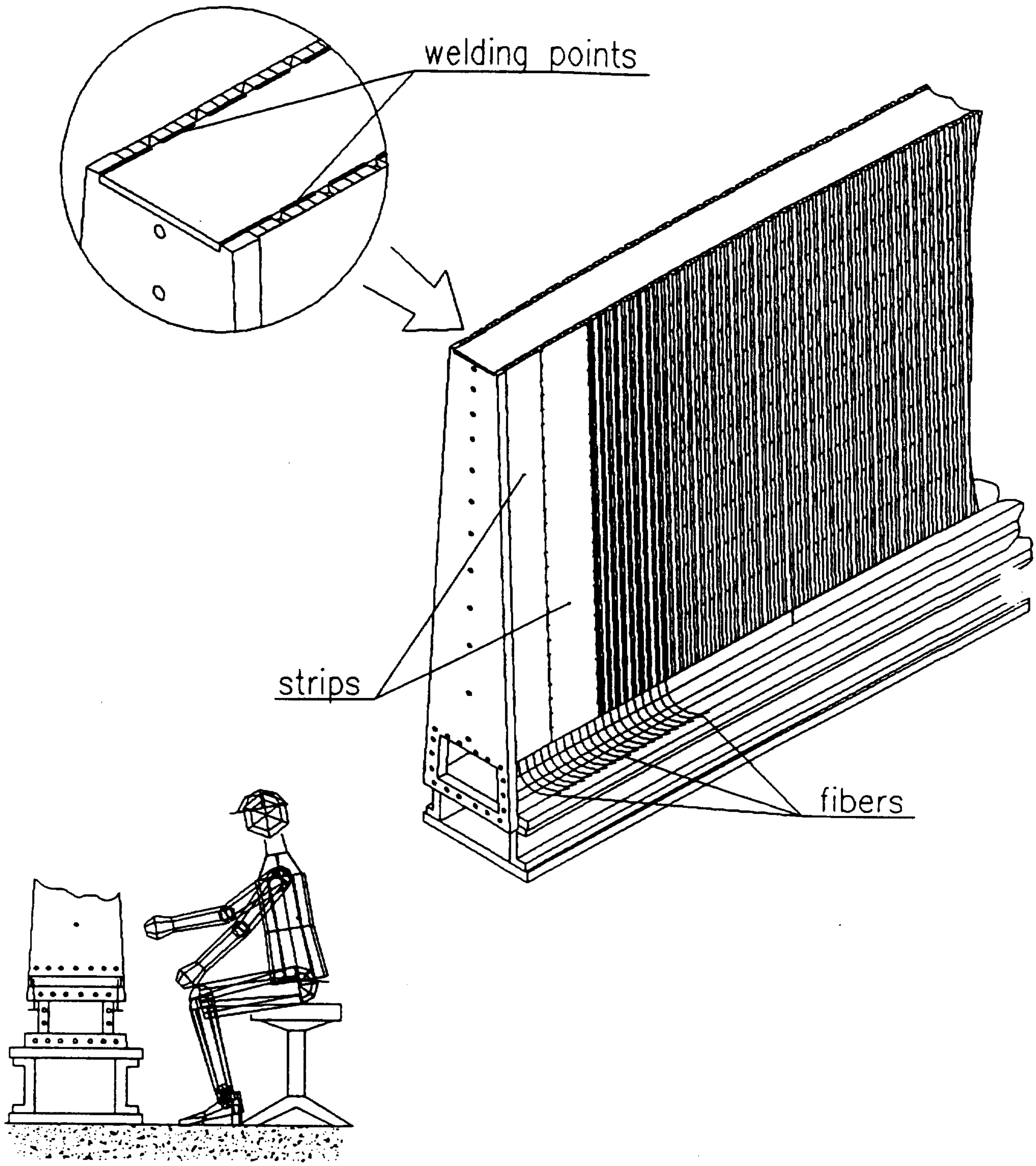


Fig. 24 Welding of strip, tigheting of bolts which fasten modules to girder, final of supermodule sides, assembly of lower tiles, stud and tube. Mounting of fibers and aluminium reflecftors, spot-welding of 0.1mm thickess steel strip, bundle fibers.

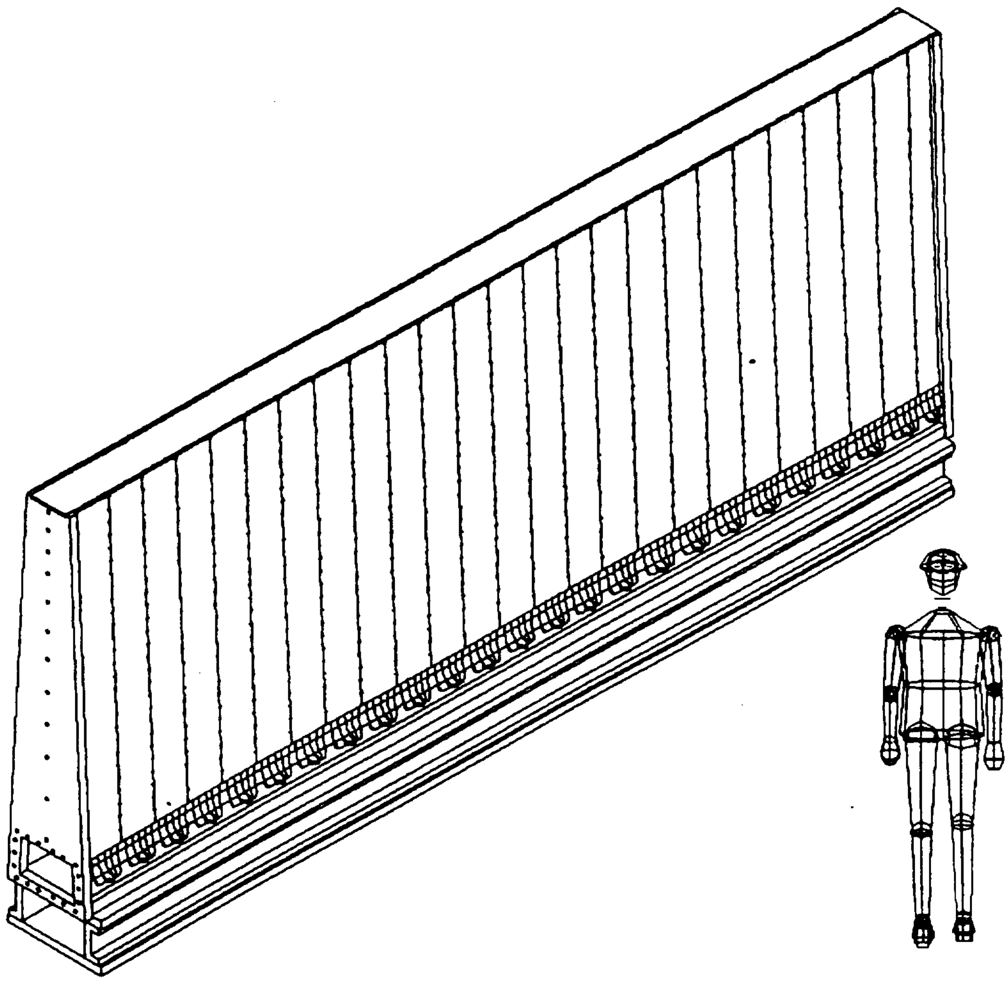


Fig. 25 Machining and polishing of fiber bundle ends, mounting of bundles to girder.

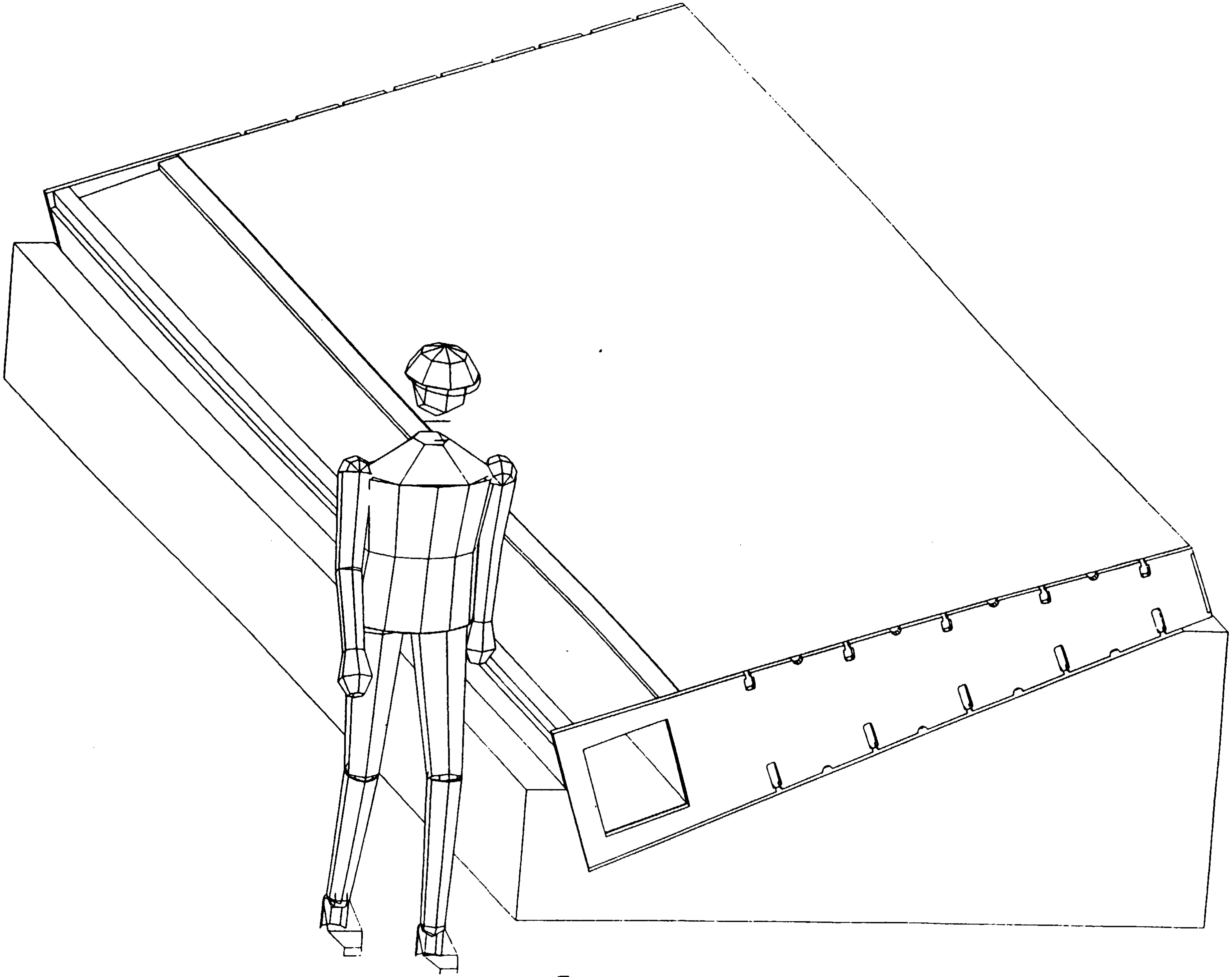
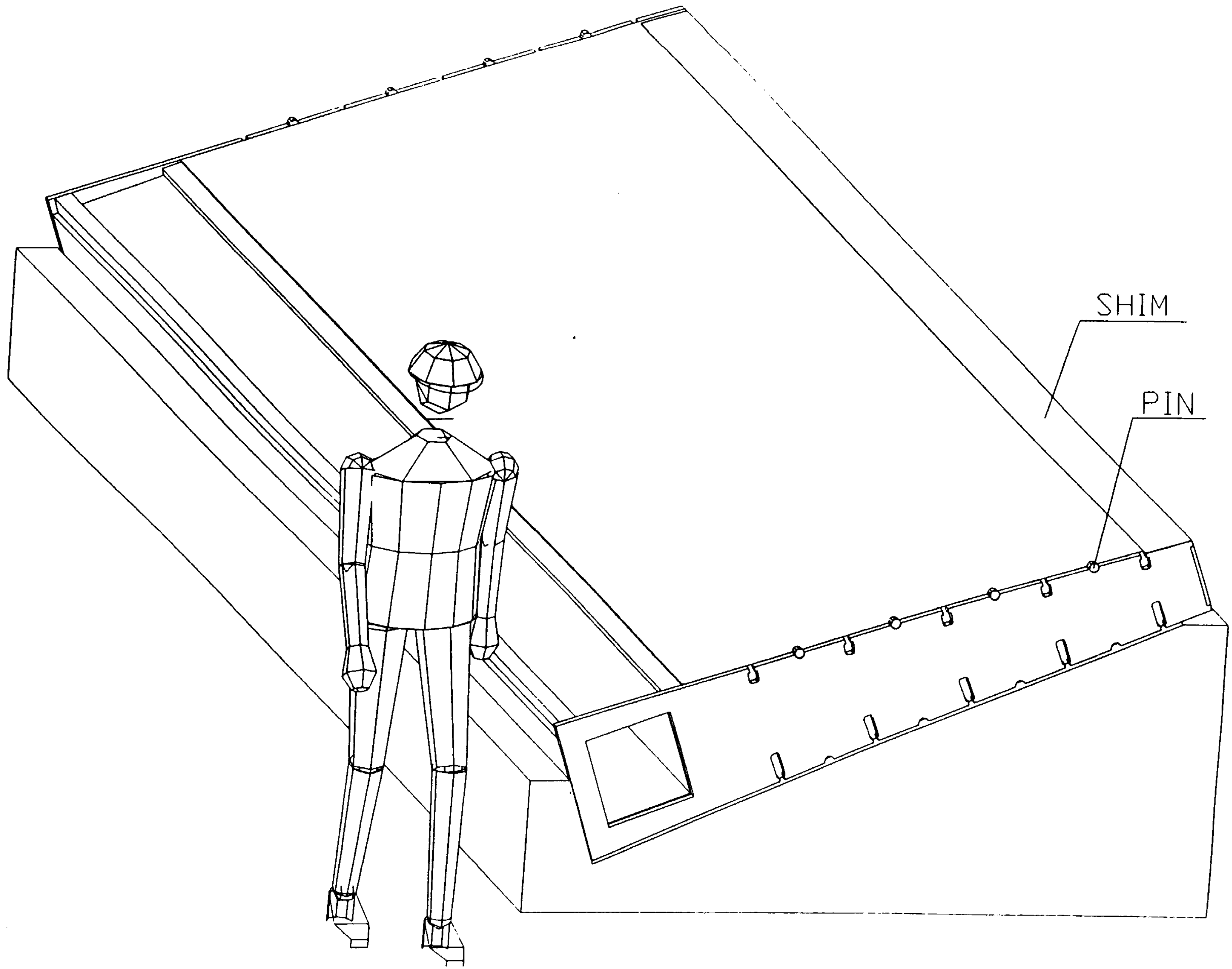
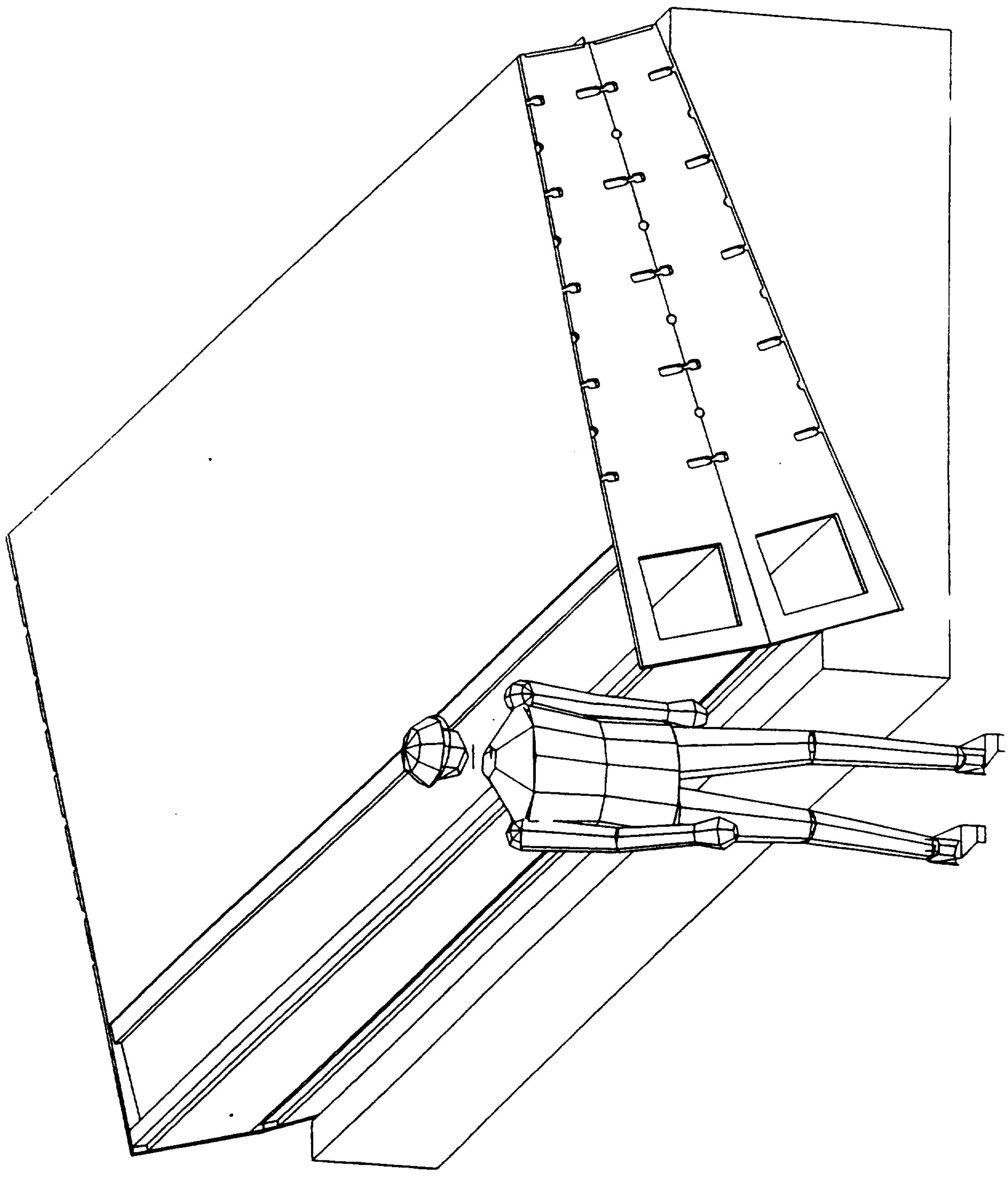
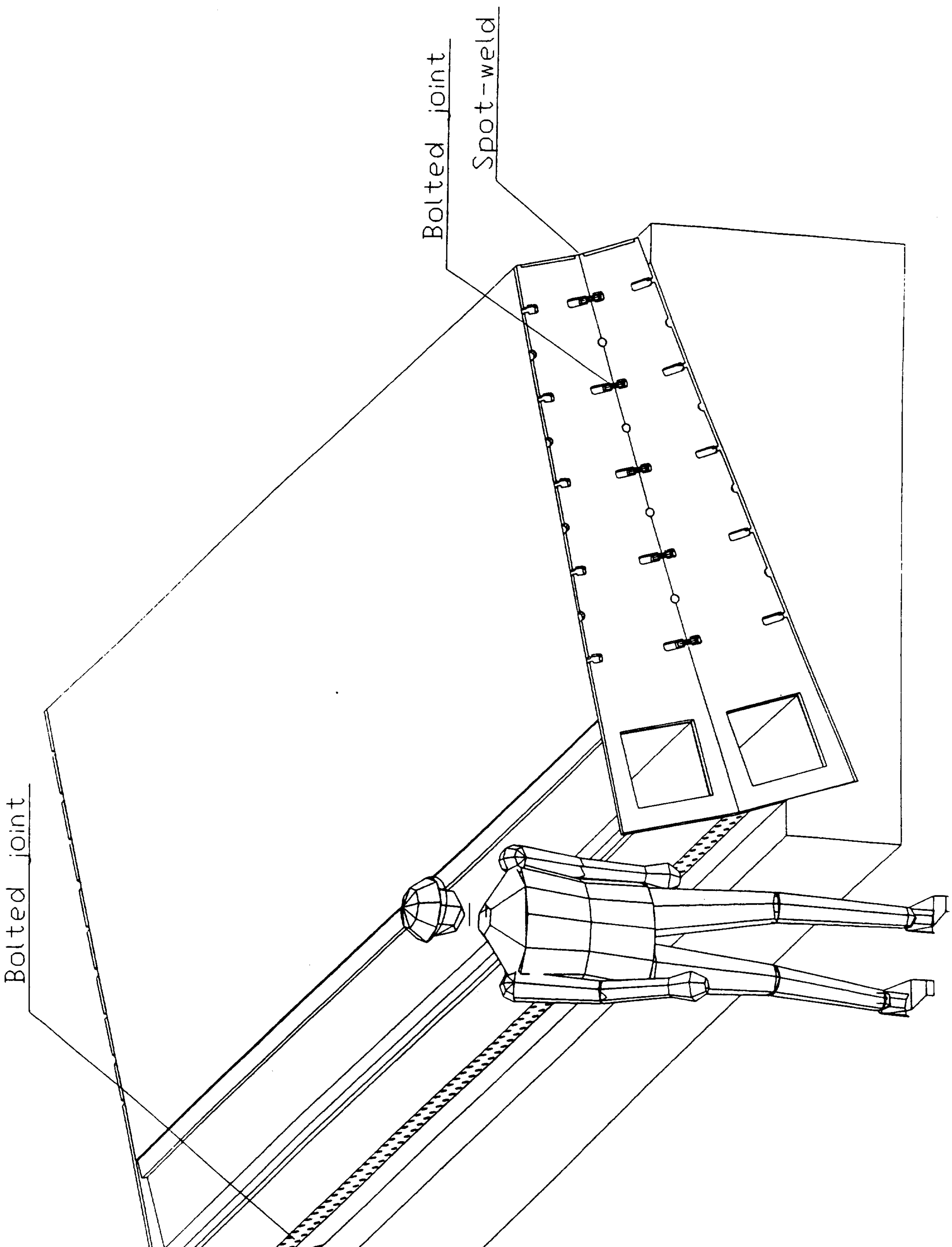
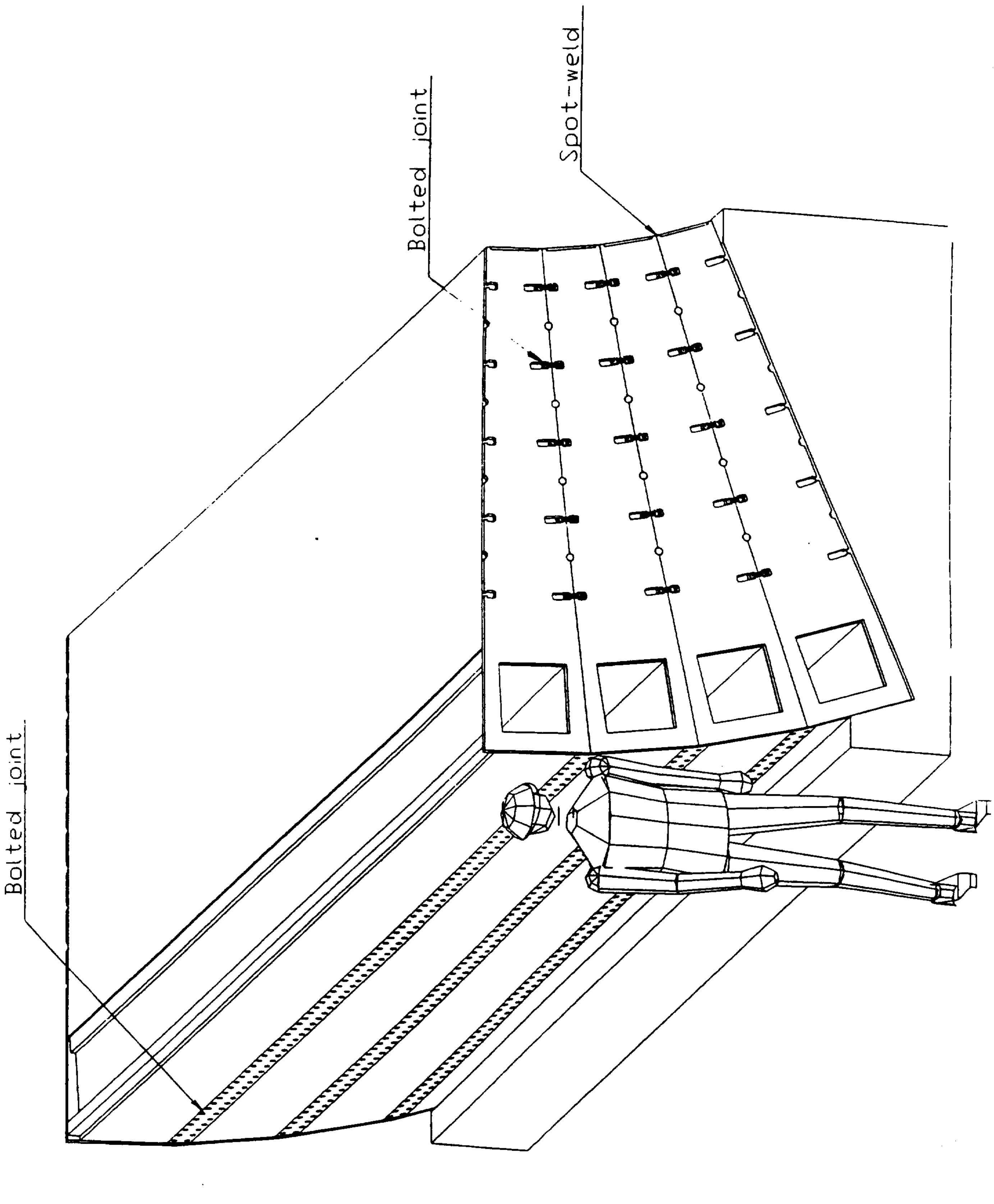


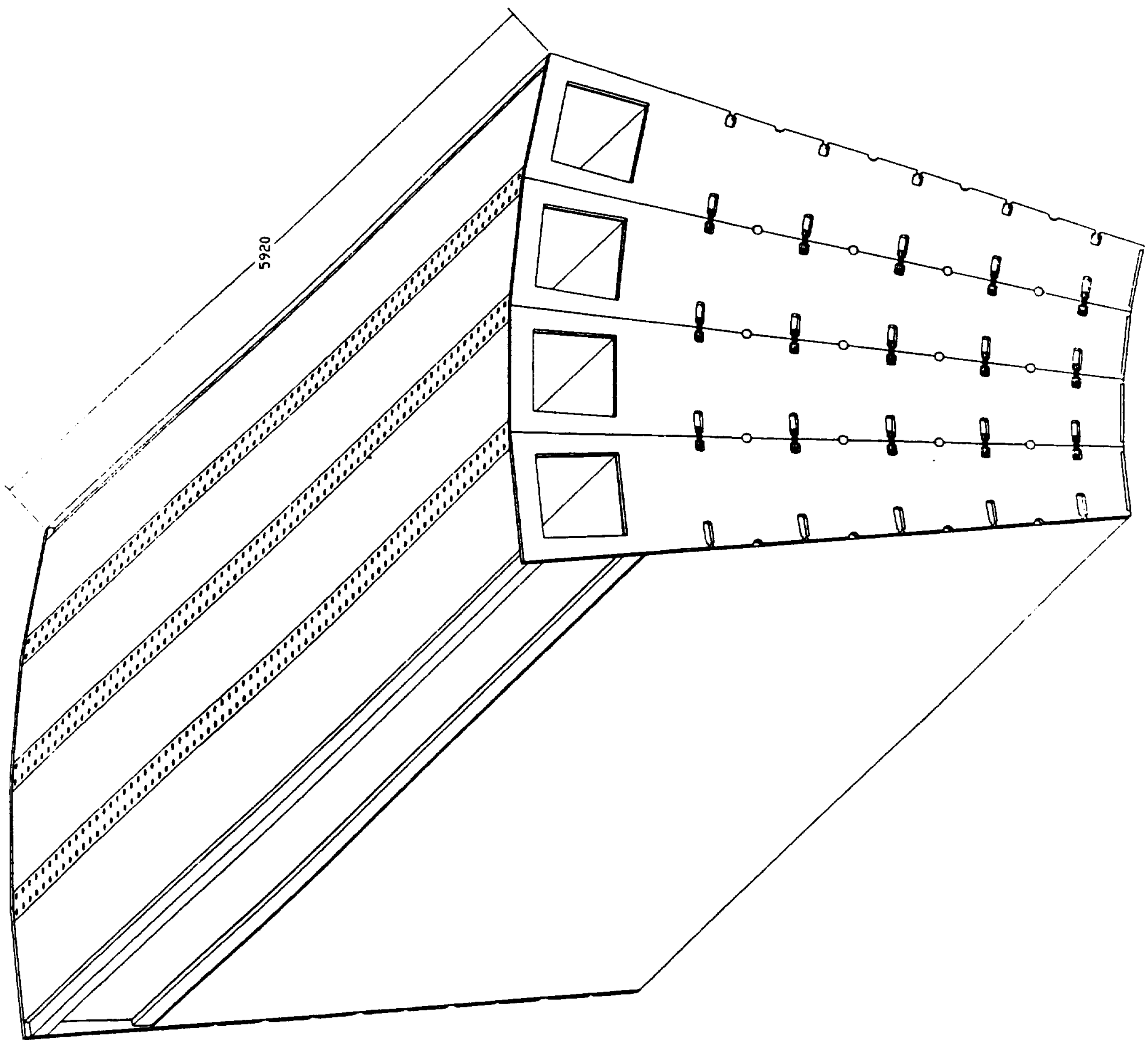
Fig. 26


SHIM
PIN




Bolted joint
Spot-weld
Bolted joint


Bolted joint
Spot-weld
Bolted joint



F . 21

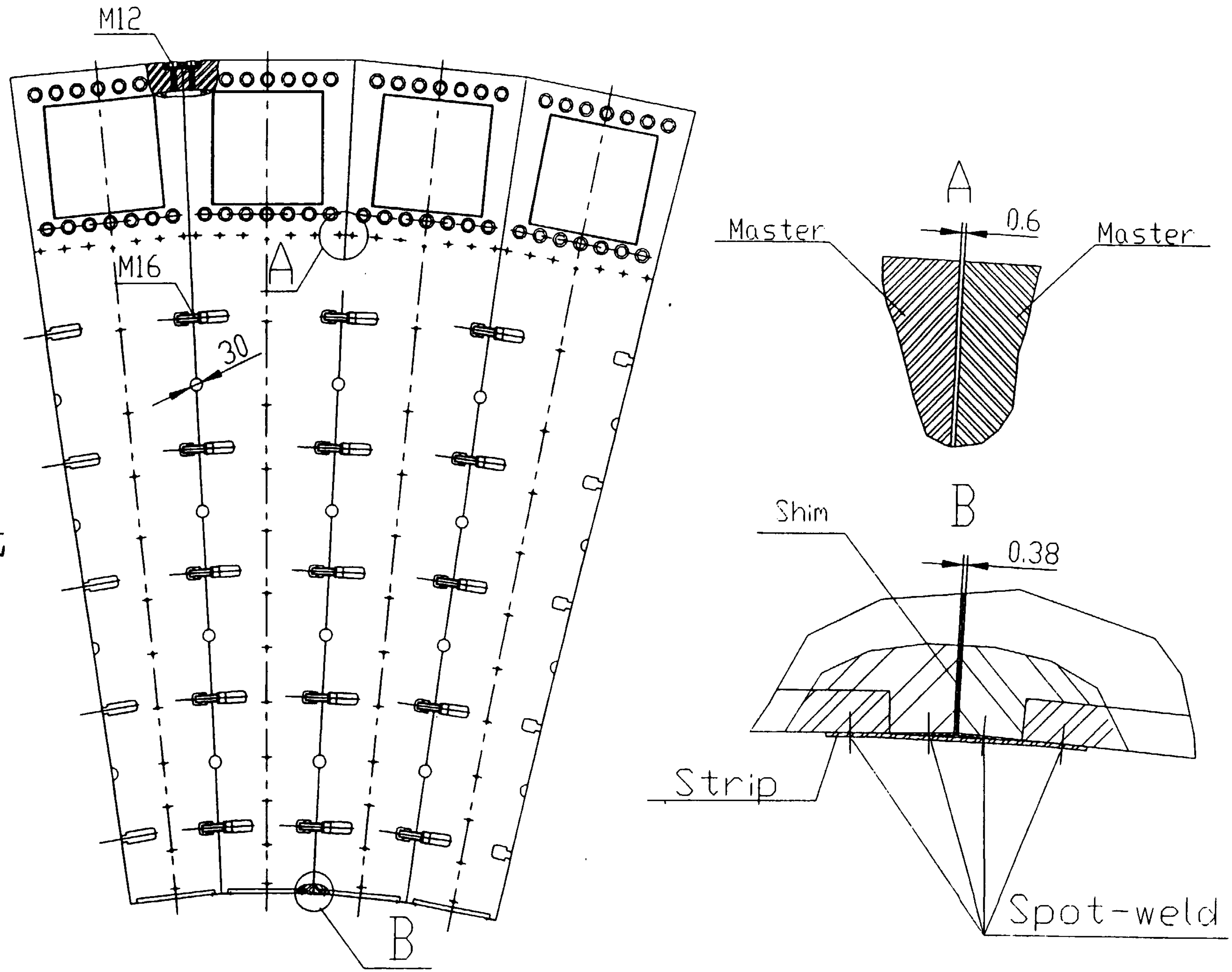
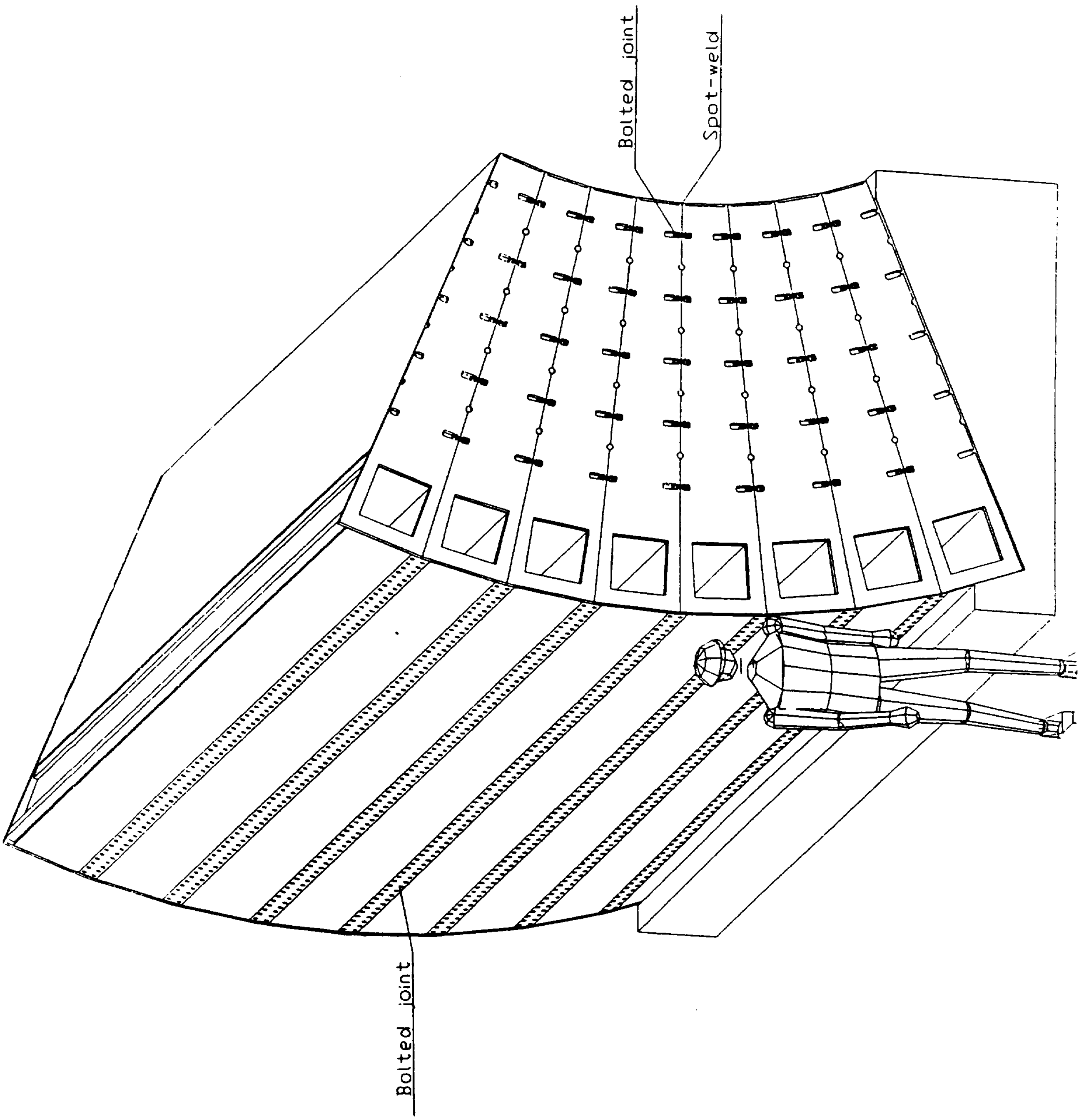
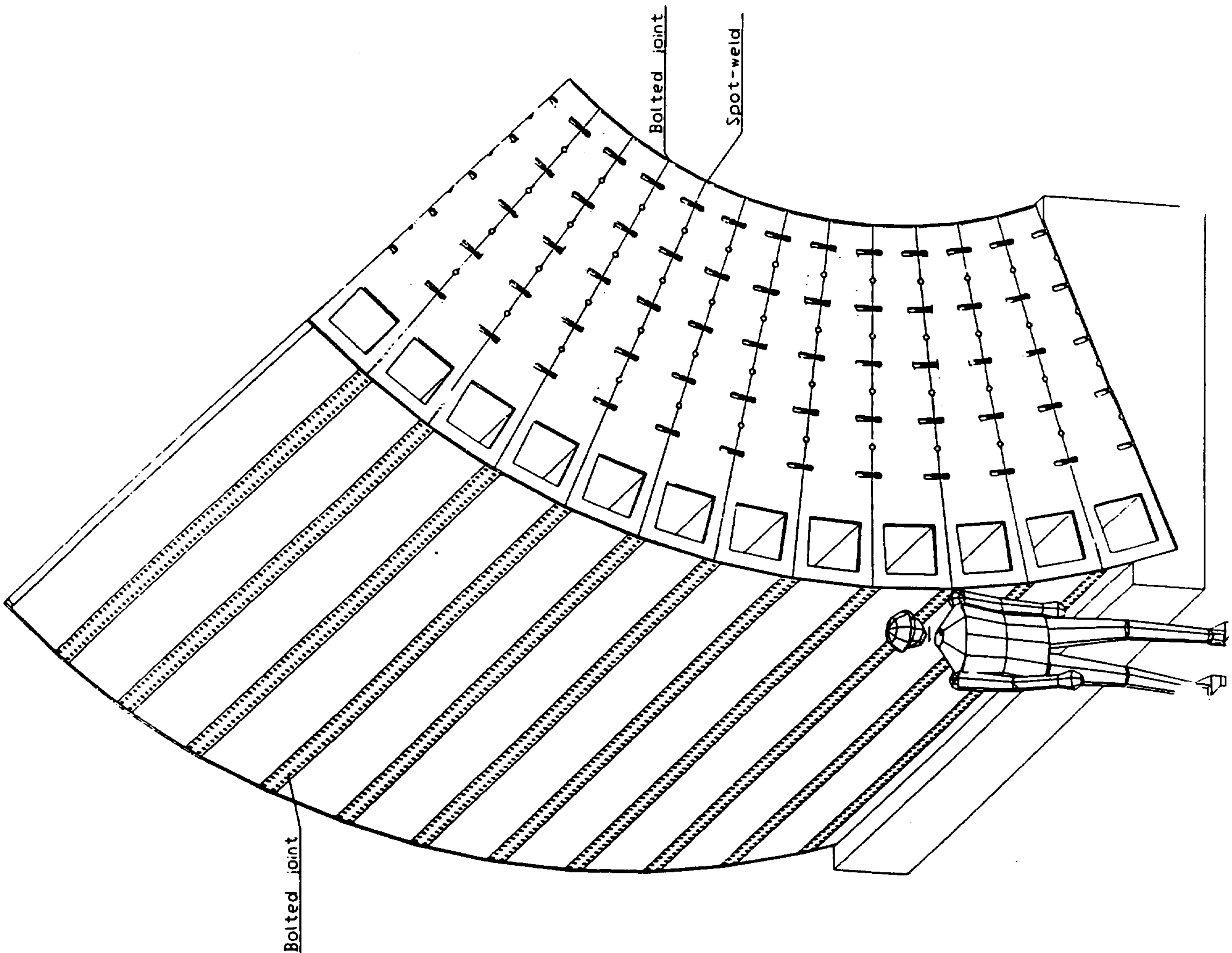
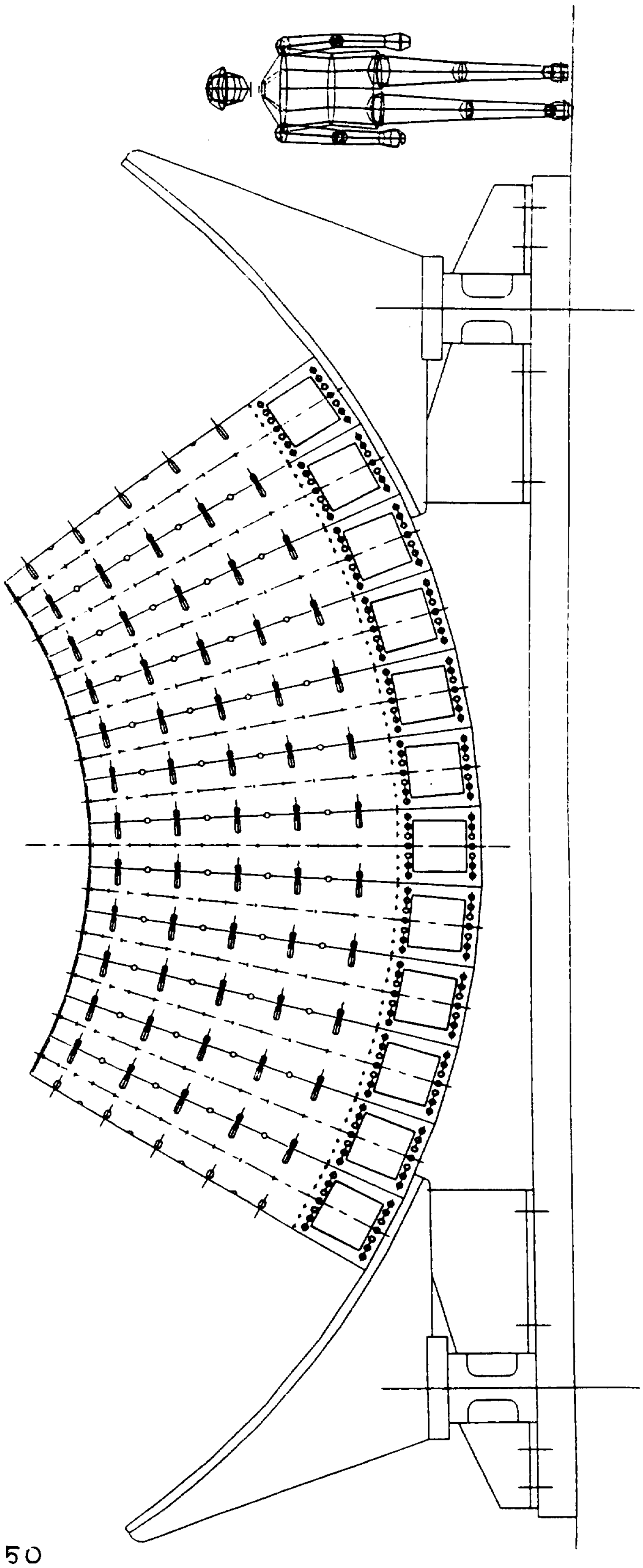
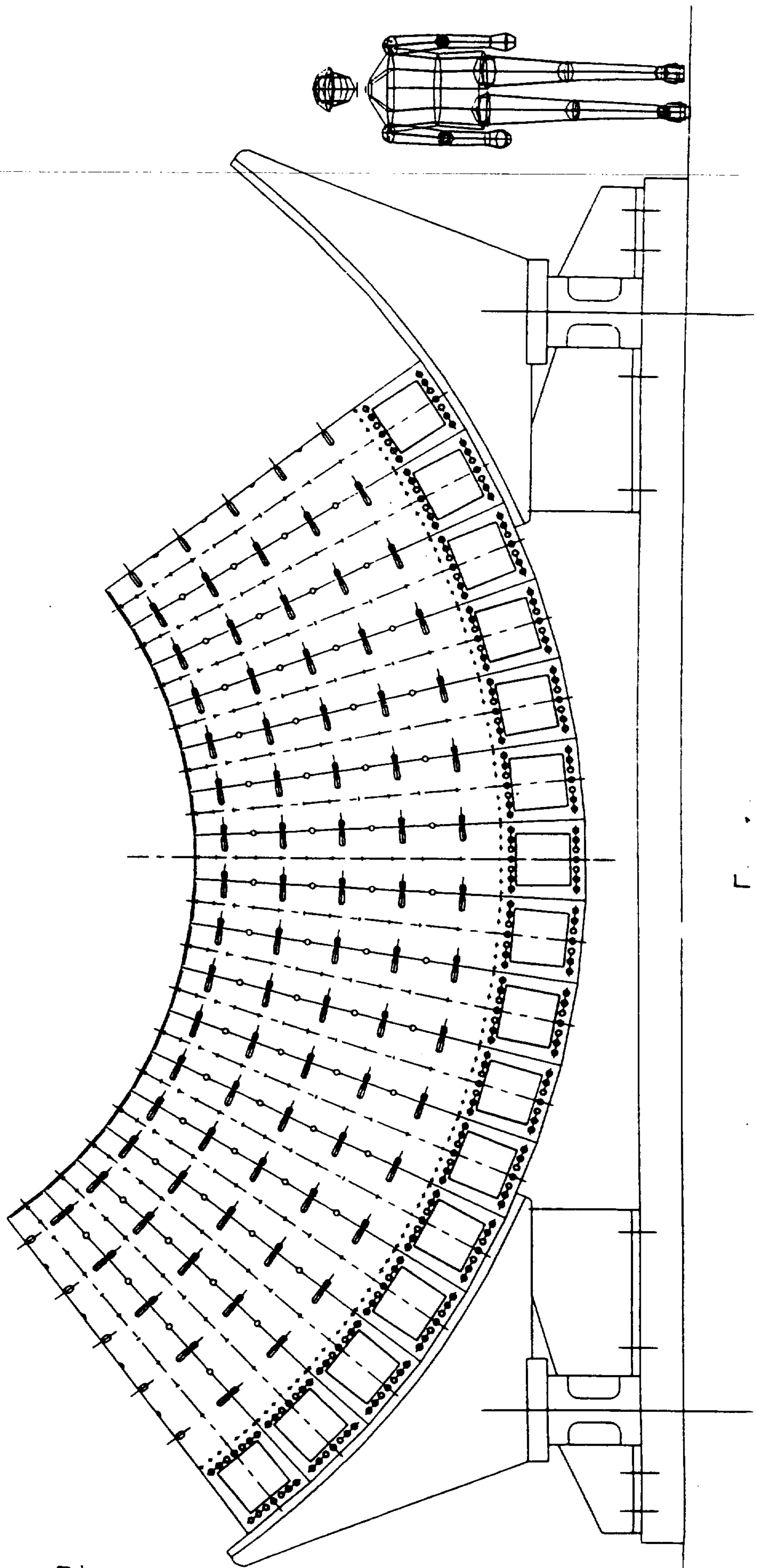


Fig. 32


Bolted joint
Spot-weld
Bolted joint


Bolted joint
Spot-weld
Bolted joint





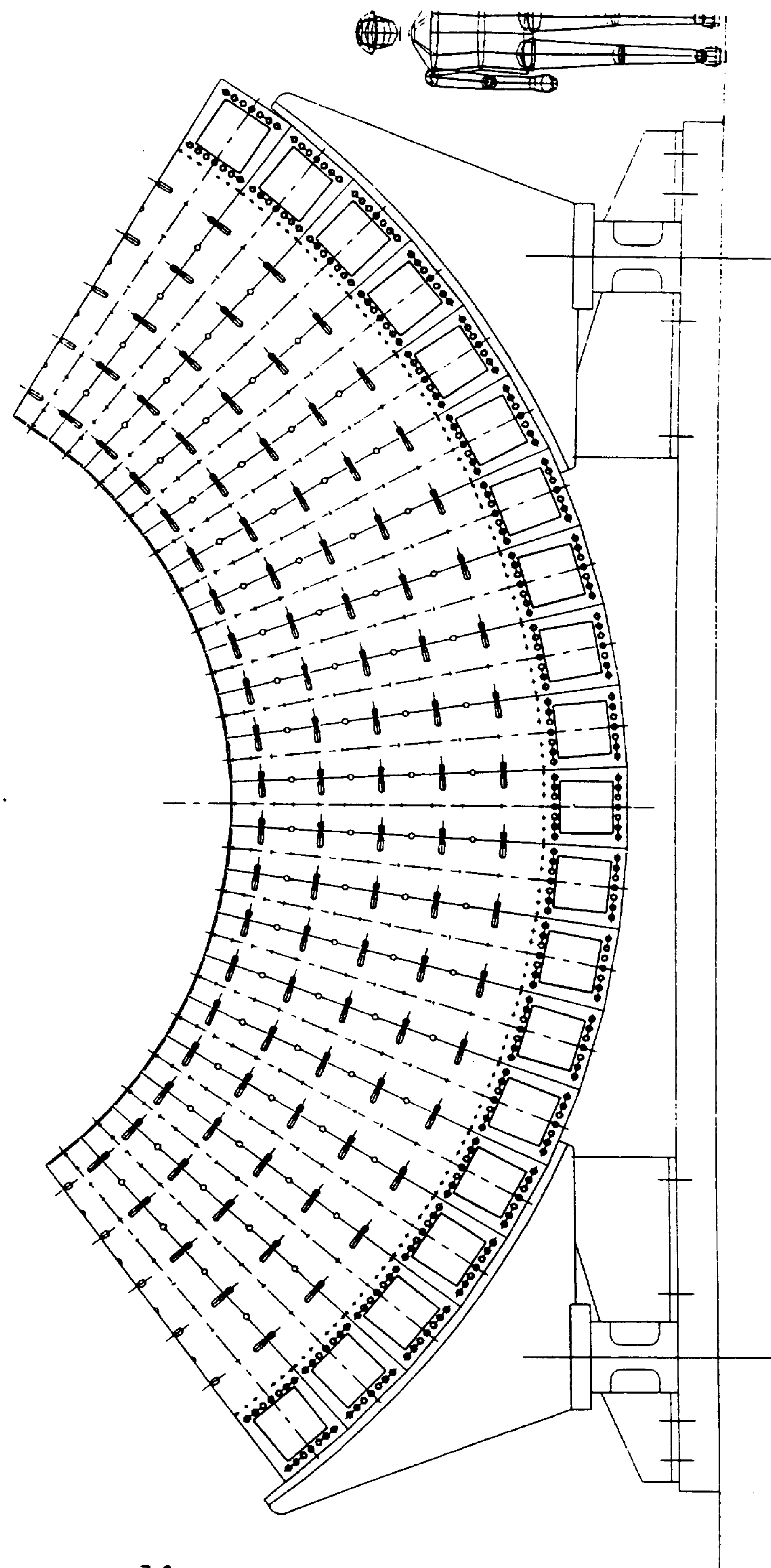


Fig. 37

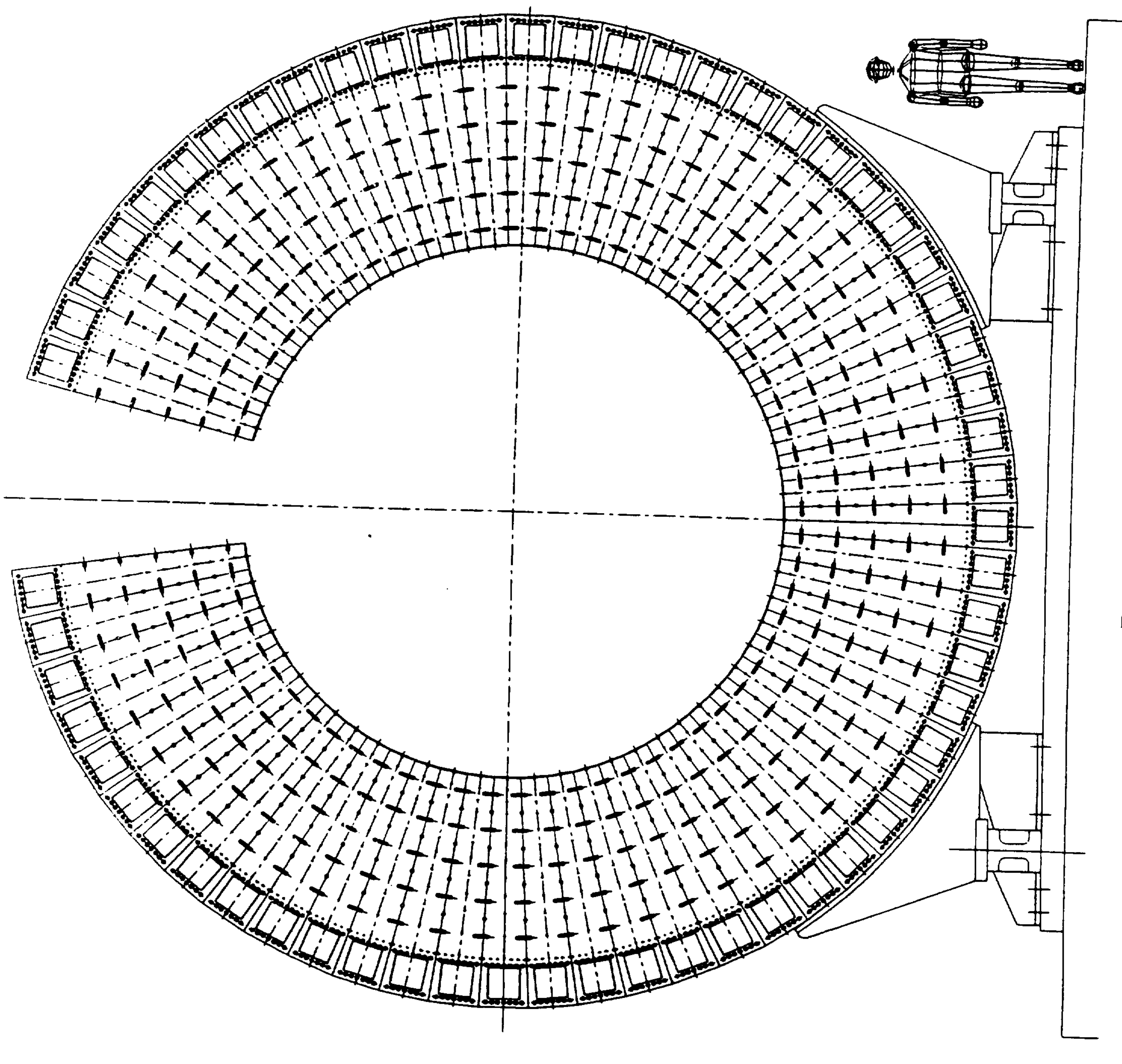


Fig. 39

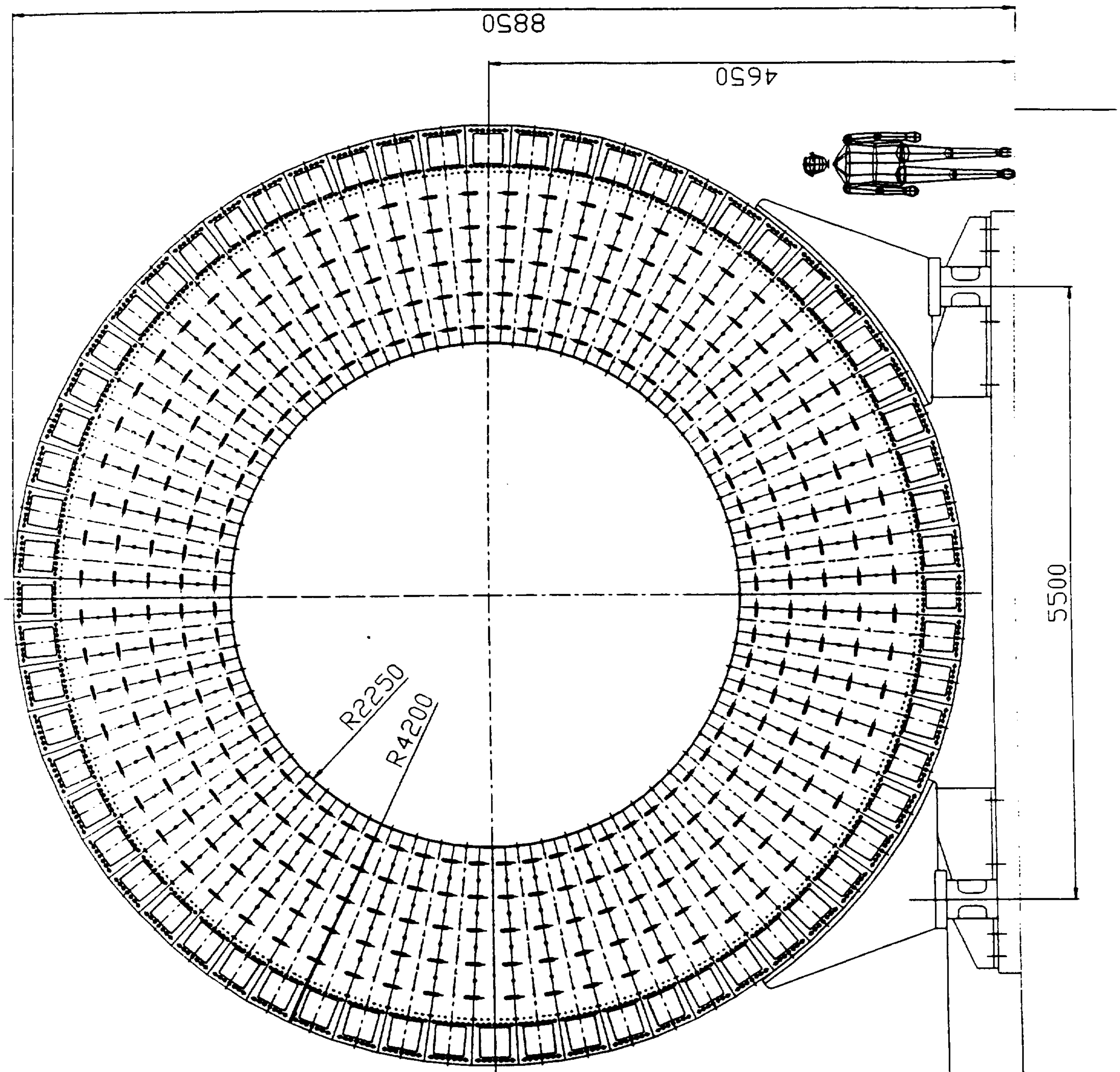


Fig. 39

6.0. Hadron Calorimeter. Design problems.

The further detailed development for the Hadron Calorimeter can be complicated if following problems remain unsolved:

1. The systematized technical requirements on barrel and its elements are absent (see section "Technical requirements").

2. There are no the technical requirements for the development of the photoregister system.

3. There are no the technical requirements for the development of the monitoring system.

4. The initial data for the development of the problems on the alignment of the Hadron Calorimeter relative to the beam axis are absent.

5. The schedule of designing and milestones remain uncertain.

6. The problems of the interface between the Hadron Calorimeter and its environment consisting of the ATLAS detector systems aren't formulated.

7. There is no assignment of personnel that have to get down to work on the integration problems.

8. The requirements connected with the slope of the beam orbit plane relative to the horizon plane are unclear.

9. The initial data concerning the radiation background in the detector are lacking.

10. The requirements for the problems on the access of the serving personnel to the Hadron Calorimeter systems are absent.

11. The detailed integrational scheme for ATLAS detector with the indication of the physical boundary for each subsystem and all gaps between them needs to be considered.

12. The conceptual scheme for the laying of the engineering networks (cables, water-supply, air system etc.) is lacking.

13. It's necessary to know the detailed place for the assembly in the surface hall, its sizes, the height up to a hook of the lifting crane and so on.

14. There should be no problems with the designing technology (program compatibility) and with information exchange.

7.0. Appendix.

7.1. Technology questions.

7.2. Control test bench of tiles.

Assembly scheme

Terminology:

- haft- period → master + spacers,
- module → set of ~ 990mm length and ~ 3.5t weight half-periods,
- supermodule→ consists of 6 modules, L=5.9m, weight ~ 20t.

1. Assembly of half-period

- Welding of spacers to master

2. Packing and assembly of modules

- Packing
- Setting of studs
- Welding of plate
- Weld of module along inner radius
- Setting of tiles with replacement of studs by tubes (tiles on inner radius rasen't set)

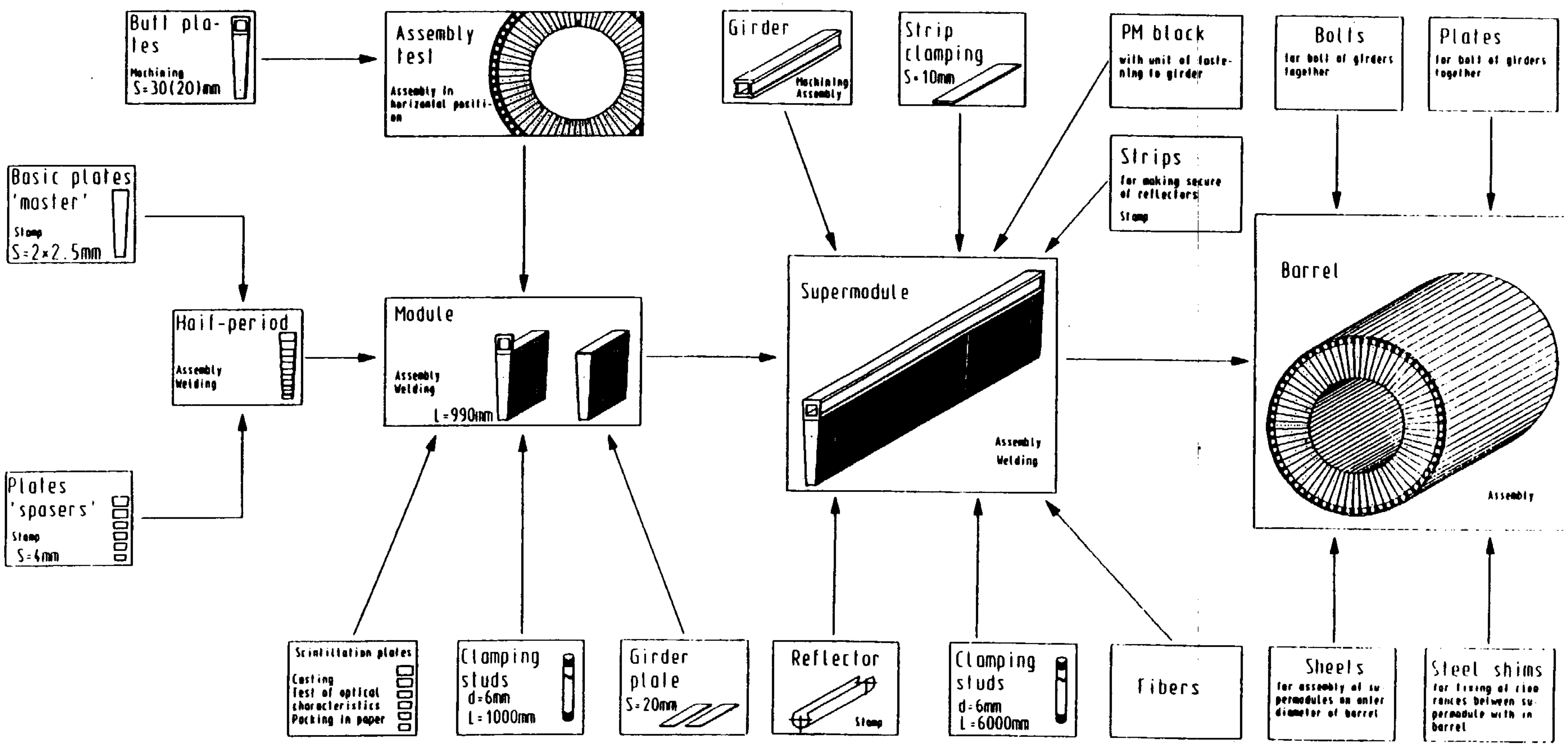
3. Assembly of supermodule

- Assembly of girder base
- Assembly of girder
- Mounting of modules on girder
- Prefastening of modules to girder

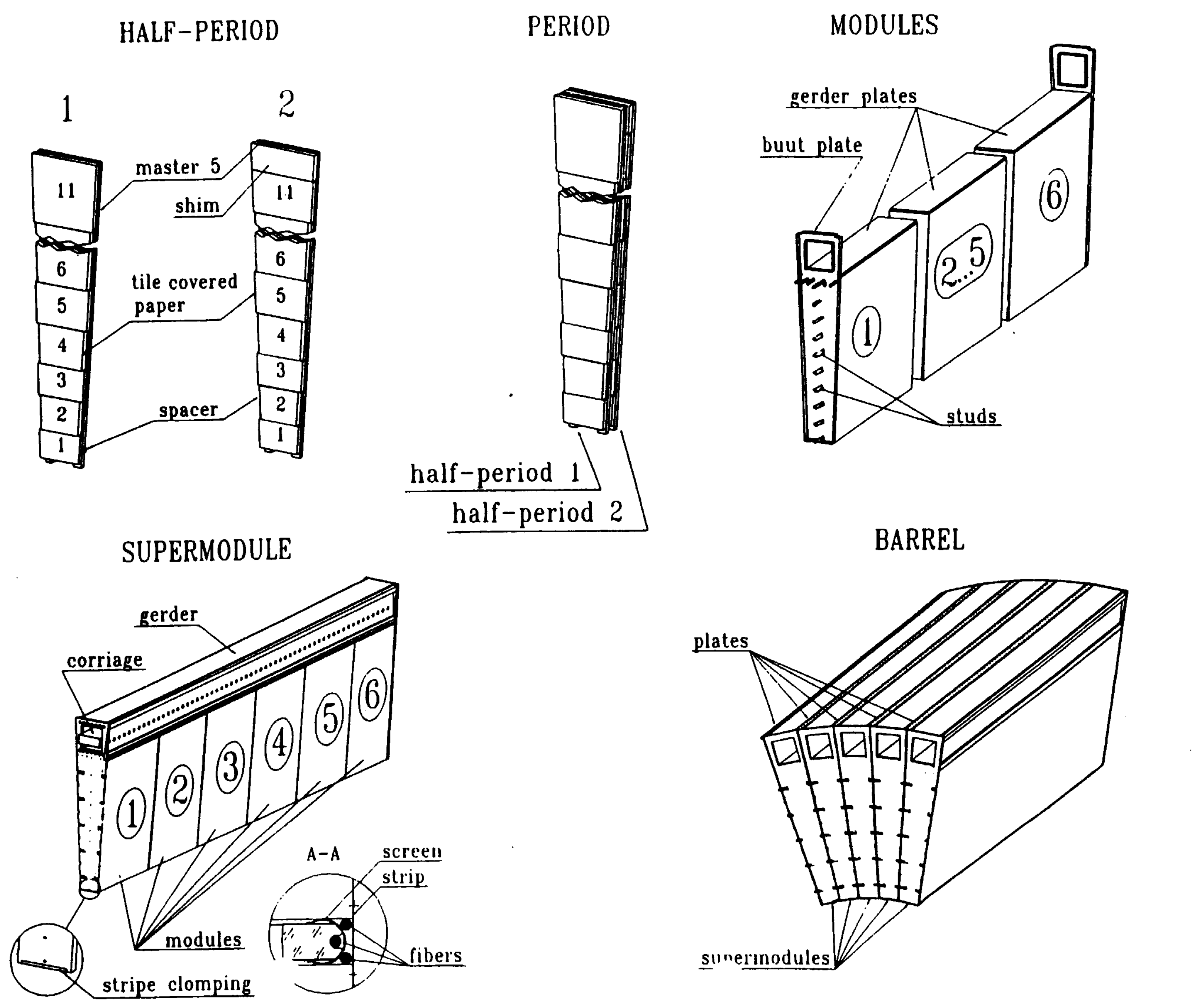
- Assembly of frame on supermodule in the inner radius zone
- Aligning of narrow module sides
- Press of strip (S=10mm, L=5900mm) into engagement with recess
- Linearing test of all supermodule sides
- Welding of strip
- Tightening of bolts which fasten modules to girder
- Final linearing test of supermodule sides
- Assembly of lower tiles, stud and tube
- Mounting of fibers and aluminum reflectors
- Spot-welding of 0.1mm thickness protective steel strip
- Bundle fibers in the PM zone
- Machining and polishing of fibers bundle ends
- Mounting of bundles to girder
- Assembly of PM carriage to supermodule girder and it's making secure
- Premonitoritg of supermodule

4. Assembly of barrel

- Mounting and assembly of subassemblies consisting of 2-4 modules
- Mounting and assembly of preassemlied assemblages consisting of 8-16 supermodules
- Assembly of barrel within detector



Preliminary block-scheme of barrel assembly


HALF-PERIOD
1
2
11
6
5
4
3
2
1
master 5
shim
tile covered paper
spacer
PERIOD
half-period 1
half-period 2
MODULES
gerder plates
buut plate
1
2..5
6
studs
SUPERMODULE
gerder
corriage
1
2
3
4
5
6
modules
stripe clomping
A-A
screen
strip
fibers
BARREL
plates
supermodules

Names, number and weight of Hadron Colorimetr Barrel elements

		HAIF-PERIOD 1		HAIF-PERIOD 2		PERIOD		MODULES 1		MODULES 2...5		MODULES 6		SUPER MODULE		BARREL	
		NUM	WEIGHT, KG	NUM	WEIGHT, KG	NUM	WEIGHT, KG	NUM	WEIGHT, KG	NUM	WEIGHT, KG	NUM	WEIGHT, KG	NUM	WEIGHT, KG	NUM	WEIGHT, KG
1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
MASTER.5		1	17.829	1	17.829	2	35.658	105	1872.04	109	1943.35	104	1854.21	645	11499.64	41280	735976.9
SPACER	1	1	0.702			1	0.702	53	37.18	55	38.58	53	37.18	326	228.71	20864	14636.1
	2			1	0.740	1	0.740	53	39.21	55	40.69	52	38.47	325	240.44	20800	15387.8
	3	1	0.771			1	0,771	53	40,87	55	42.42	53	40.87	326	251.40	20864	16090.3
	4			1	1.043	1	1.043	53	55.29	55	57.38	52	54.25	325	339.04	20800	21698.6
	5	1	1.096			1	1.096	53	58.09	55	60.29	53	58.09	326	357.33	20864	22869.0
	6			1	1.149	1	1.149	53	60.90	55	63.20	52	59.75	325	373.43	20800	23899.2
	7	1	1.390			1	1.390	53	73.67	55	76.44	53	73.67	326	453.10	20864	28998.4
	8			1	1.460	1	1.460	53	77.39	55	80.30	52	75.93	325	474.60	20800	30372.2
	9	1	1.531			1	1.531	53	81.12	55	84.18	53	81.12	326	498.94	20864	31932.4
	10			1	2.036	1	2.036	53	107.90	55	112.01	52	105.90	325	661.7	20800	42350.9
	11	1	2.368			1	2.368	53	125.50	55	130.25	53	125.50	326	772.03	20864	49410.1
	Σ	6	7.857	5	6.428	11	14.286	583	757.13	605	785.70	758	750.70	3581	4650.65	229184	297641.3
TILE	1			1	0.069	1	0.069	53	3.64	55	3.78	52	3.57	325	22.33	20800	1428.9
	2	1	0.072			1	0.072	53	3.76	55	3.91	53	3.76	326	23.15	20864	1481.3
	3			1	0.073	1	0.073	53	3.87	55	4.02	52	3.80	325	23.73	20800	1518.4
	4	1	0.101			1	0.101	53	5.36	55	5.57	53	5.36.	326	32.99	20864	2111.4
	5			1	0.106	1	0.106	53	5.63	55	5.85	52	5.53	325	34.95	20800	2211.0
	6	1	0.112			1	0.112	53	5.90	55	6.13	53	5.91	326	36.32	20864	2324.3
	7			1	0,136	1	0,136	53	7.18	55	7.45	52	7.05	325	44.04	20800	2818.4
	8	1	0.142			1	0.142	53	7.54	55	7.83	53	7.54	326	46.39	20864	2968.9
	9			1	0.149	1	0.149	53	7.91	55	8.21	52	7.76	325	48.52	20800	3105.4
	10	1	0.200			1	0.200	53	10.58	55	10.98	53	10.59	326	65.10	20864	4166.5
	11			1	0.212	1	0.212	53	11.24	55	11.66	52	11.02	325	68.87	20800	4407.5
	Σ	5	0.628	6	0.745	11	1.372	583	72.77	605	75.52	577	72.02	3580	446.87	229120	28600.0
PAPER	1			1	0.005	1	0.005	53	0.27	55	0.28	52	0.26	325	1.63	20800	104.0
	2	1	0.0052			1	0.0052	53	0.28	55	0.29	53	0.28	326	1.70	20864	108.5
	3			1	0.0054	1	0.0054	53	0.29	55	0.30	52	0.28	325	1.76	20800	112.3
	4	1	0.0074			1	0.0074	53	0.39	55	0.41	53	0.40	326	2.41	20864	154.4
	5			1	0.0078	1	0.0078	53	0.41	55	0.43	52	0.41	325	2.54	20800	162.2
	6	1	0.0082			1	0.0082	53	0.43	55	0.45	53	0.44	326	2.67	20864	171.1
	7			1	0.0099	1	0.0099	53	0.49	55	0.51	52	0.48	325	2.99	20800	191.4
	8	1	0.0104			1	0.0104	53	0.55	55	0.57	53	0.55	326	3.39	20864	217.0

In the plant conditions it is recommended to use source of ultra-violet radiation which operates in the light-flux stabilization mode or in the pulse mode as radiation source of scintillation plates made from polystyrol with repeated shifting spectrum POPOP reemiter with maximum of absorption spectrum on 362nm wavelength and maximum of emission spectrum on 418nm wavelength. Source of radiation based on DDS-30 deuterium lamp which has continuous radiation spectrum within wavelength range from 186 to 360 nm with 1.8 mWt/sr is most proper.

It is recomended to use PMs as receiver of radiation with maximum of spectrum on 418 nm wavelength and 56 nm half-width of spectrum. PM is one which most spectrum-matched with luminescence spectrum of scintillating dope and has linear output current/light-exposure relation and the most stable temperature and time characteristics.

At the less stringent requirements to linearing and accuracy it is possible to use photoresistors based on sulphide of cadmium.

CERN / LHC 94
28 January 1994
Hadron Calorimeter of ATLAS
IHEP , Protvino , Russia

Technical characteristics of test bench.

1. Control of geometrical dimensions of plates with ± 0.05 mm accuracy.

2. Scaning on the all length of plate with 10 mm spacing and 0.25 mm accuracy of placement at simultaneous reading optical characteristics.

3. Processing of got information with a computer and giving out of recommendations on utilization of plates.

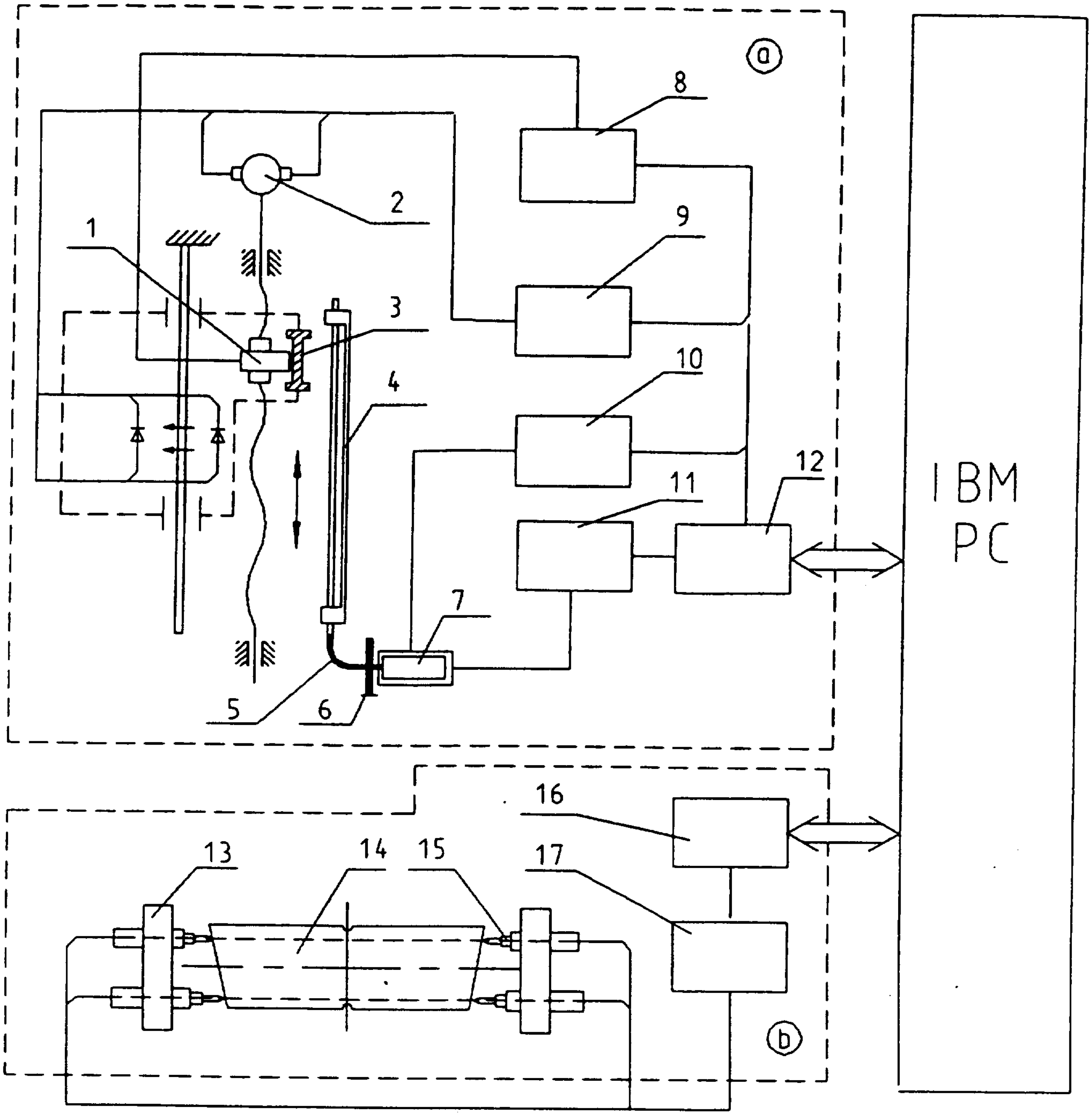
4. Control time of one plate is 5 min.

5. Number of plates tested in one day is 100.

6. Dimensions of controled plates are:
   - width is from 100 mm to 200 mm,
   - length is from 200 mm to 400 mm.

7. Dimensions of test bench are 600x250x600 mm.

8. Power supply of the test bench is supply line 220V, 50Hz.



Fiq.1 Control stand (functional scheme).

a-setup for optical parameters control of tiles.
b-setup for geometry control of tiles.
1-carriage with light source and step travel gauge. 2-driver. 3-light filter. 4-cassette with tile. 5-light guide. 6-light blind. 7-PM. 8-power supply. 9-control driver block. 10-PM power supply. 11-ADC block. 12-interface. 13-carriage. 14-tile. 15-linear travel transduser. 16-ADC block. 17-data aquestion block.

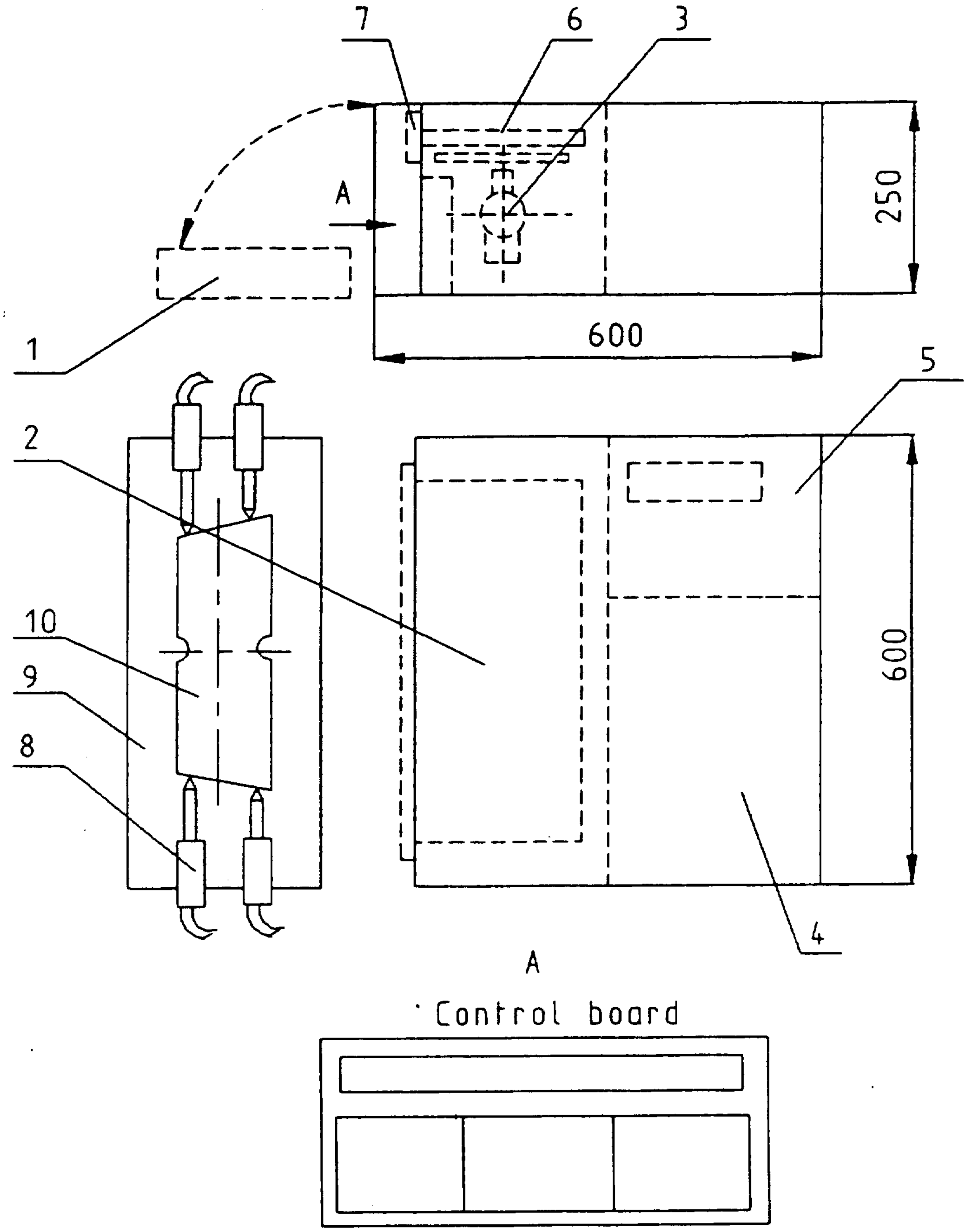


Fig.2 Control stand.

1-setup for geometry control. 2-setup for optical parameters control. 3-scanning setup. 4-control system. 5-PM power supply block. 6-cassette wiht tile. 7-light lock. 8-linear travel transduser. 9-carriage. 10-tile.