

Solenoid Coil Winding for KEKB

K. Hosoyama

Task Force for KEKB Photo-electron Coil

Solenoid Coil Winding for KEKB LER

A Large Number of Coils

Coil Winding Directly on the Existing Beam Duct

Short Time & Low Cost

Phase I Long Solenoid Coils for Long Free Space Sections

Sep. 18 - Oct. 7 2 Weeks

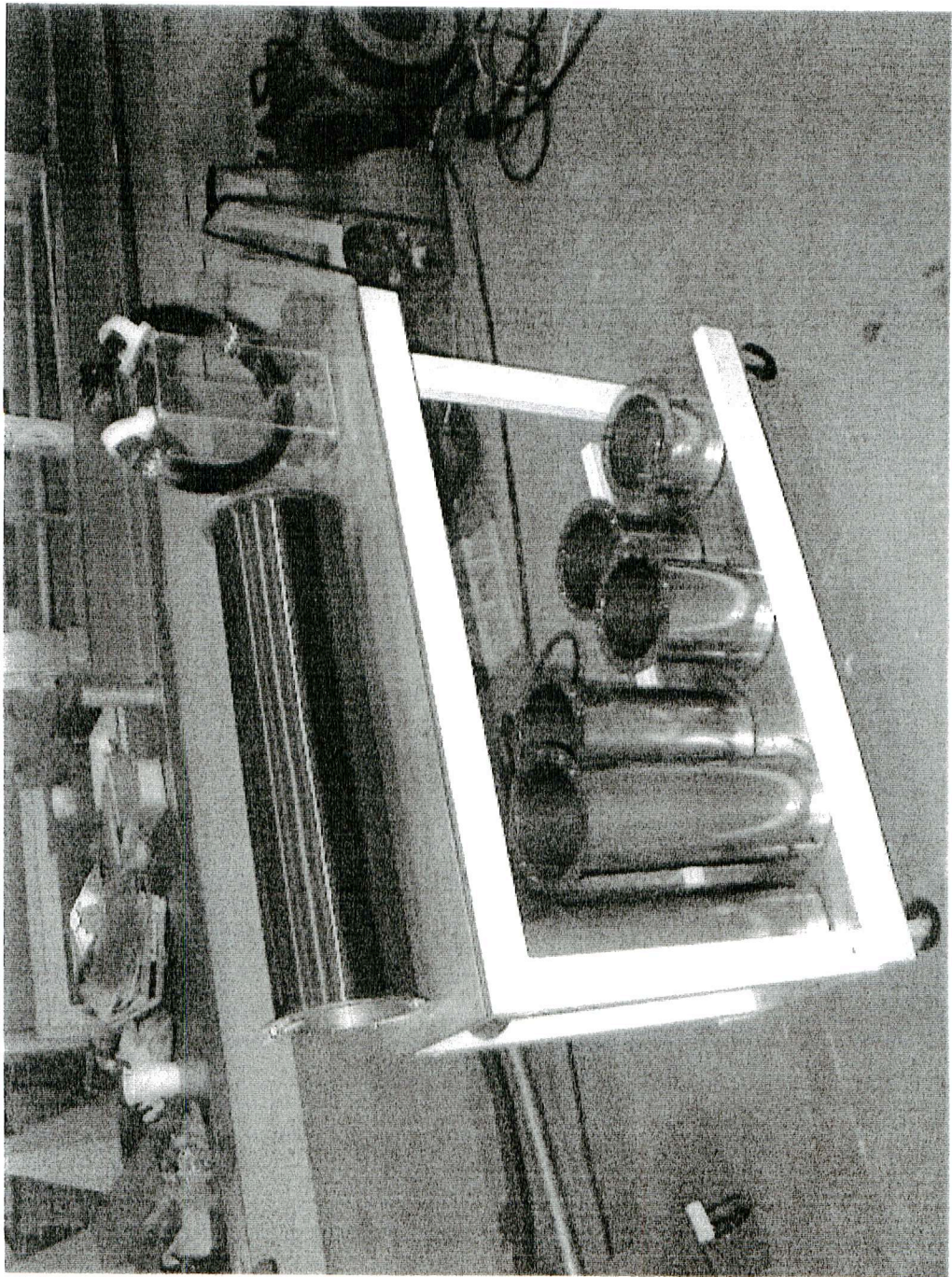
2237 Coils and Rewound about 100 Coils

Short circuit to ground
(546 Coils in Steering Magnet / Wound by Hands)

Phase II Short Solenoid Coils (Frameless Coil) for NEG and Bellows Sections

Dec. 28 - Jan. 11 1 Week

1950 Coils



Solenoid Coil Winding for KEKB LER

June	July	August	September	October
	Prototype Winding Machine Design & Fabri.	Aug. 28 Trial Winding	Sept. 18 Coil Winding	Oct. 7
	Coil Bobbines Winding Machine Type 1	Parts & Assem. Tool Production	Sept. 14	
Task Force for KEKB Photoelectron Permanent Magnet Type Solenoid Coil Type	Solenoid Coil Type for Long Space Section Aug. 2, 17, 24	Fabrication Type 2	Cable Connection	Test Operation
June 9, 15, 30	July 12, 19, 25	Aug. 29, 31	Sept. 1, 5	Oct. 10
KEKB Operation	July 25	SLAC-LBL-KEK TV Meeting on Photoelectron	KEKB Operation	KEKB Operation

Specification of Solenoid Coils for KEKB LER

Magnetic Field 50 Gauss (Hight 30 Gauss at Minimum Filed point)

Solenoid Coil Dimensions and Specification

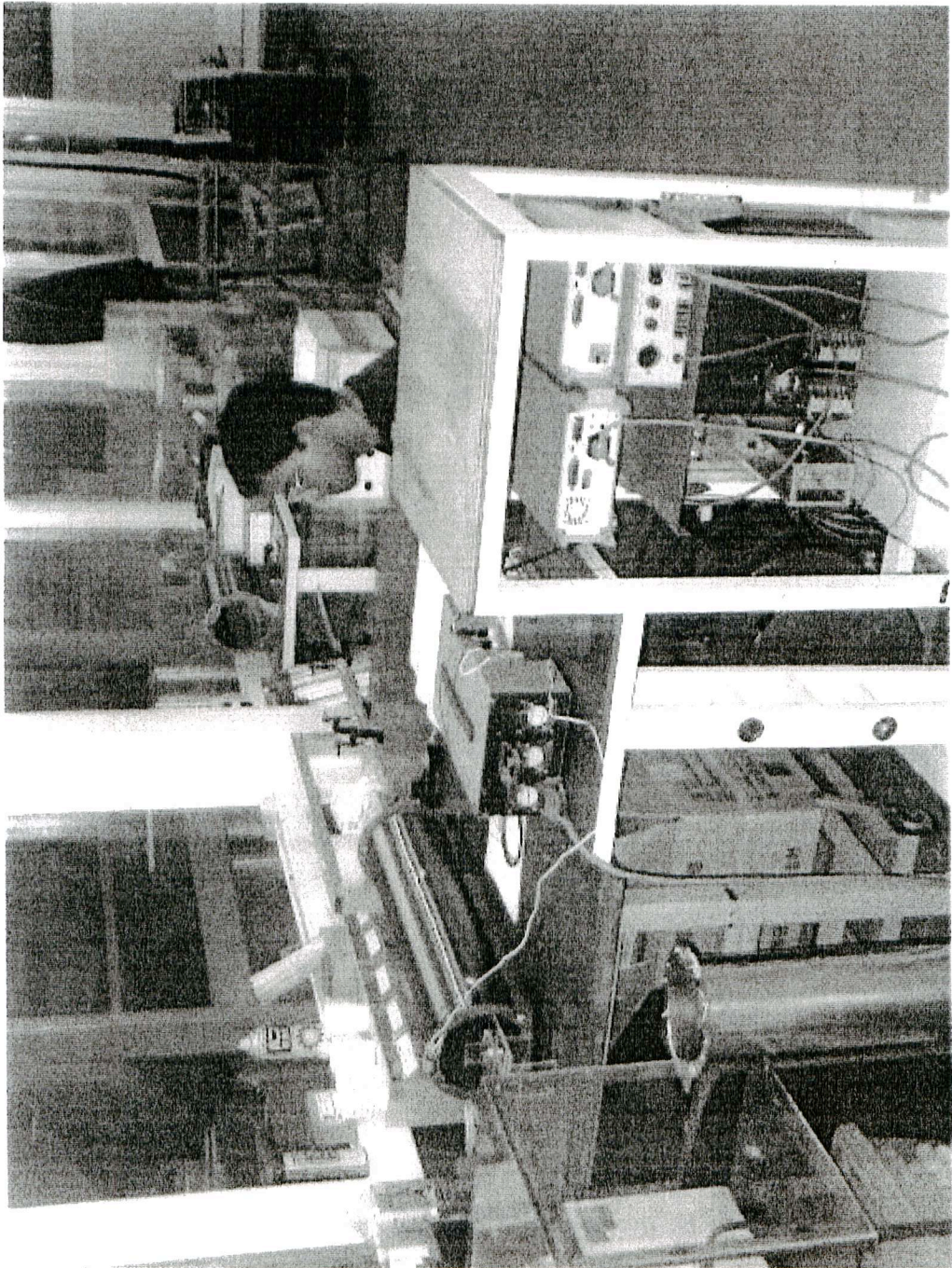
120 mm in Inner Diameter Long Solenoid Coil
220 mm in Inner Diameter Short Solenoid Coil

2mm in Diameter Cu Wire Coated with Polyester Varnish

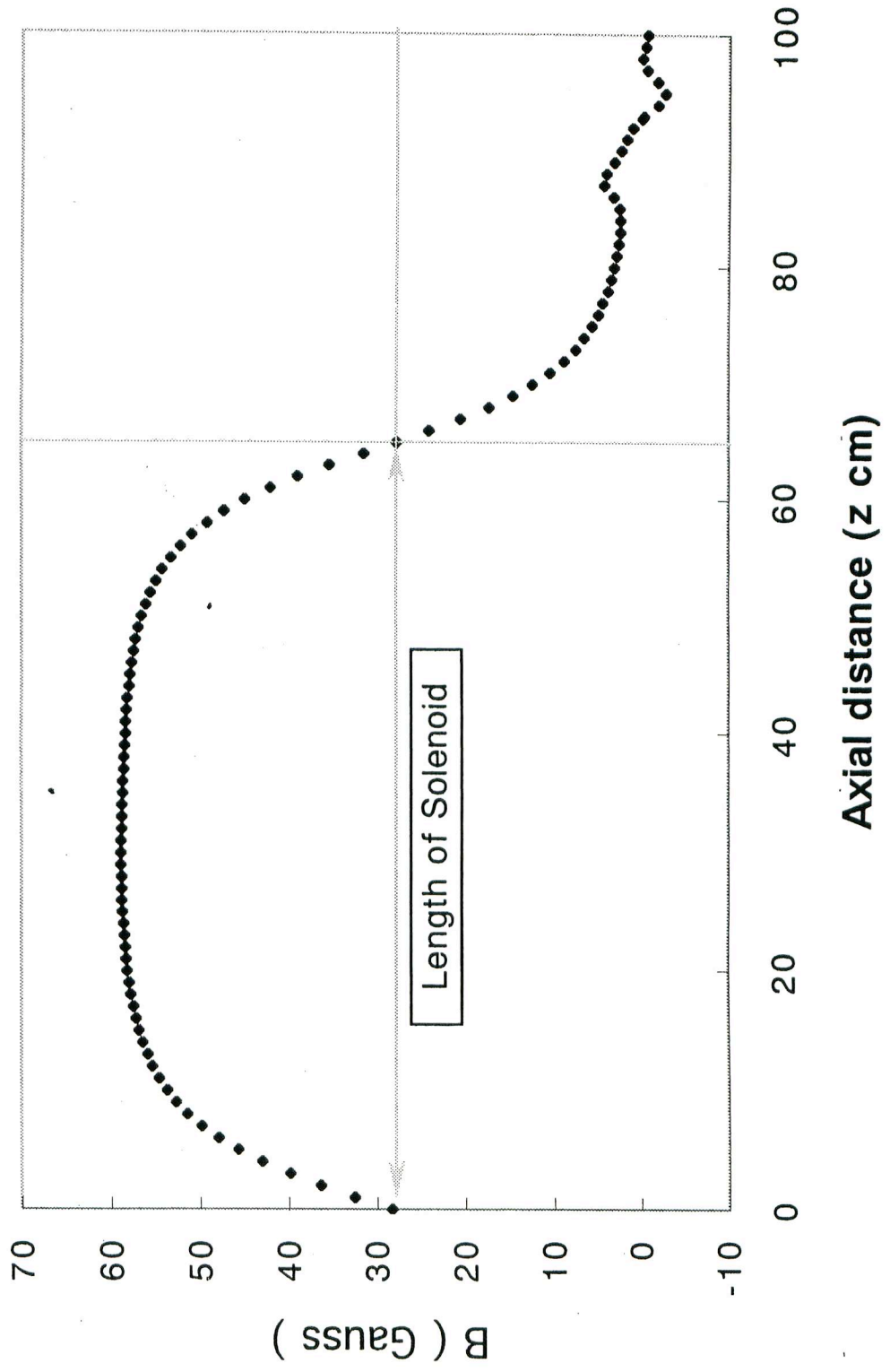
Double Layer Winding on Stainless Steel Bobbine
25 μm Polyimid Film for Grand Electric Insulation

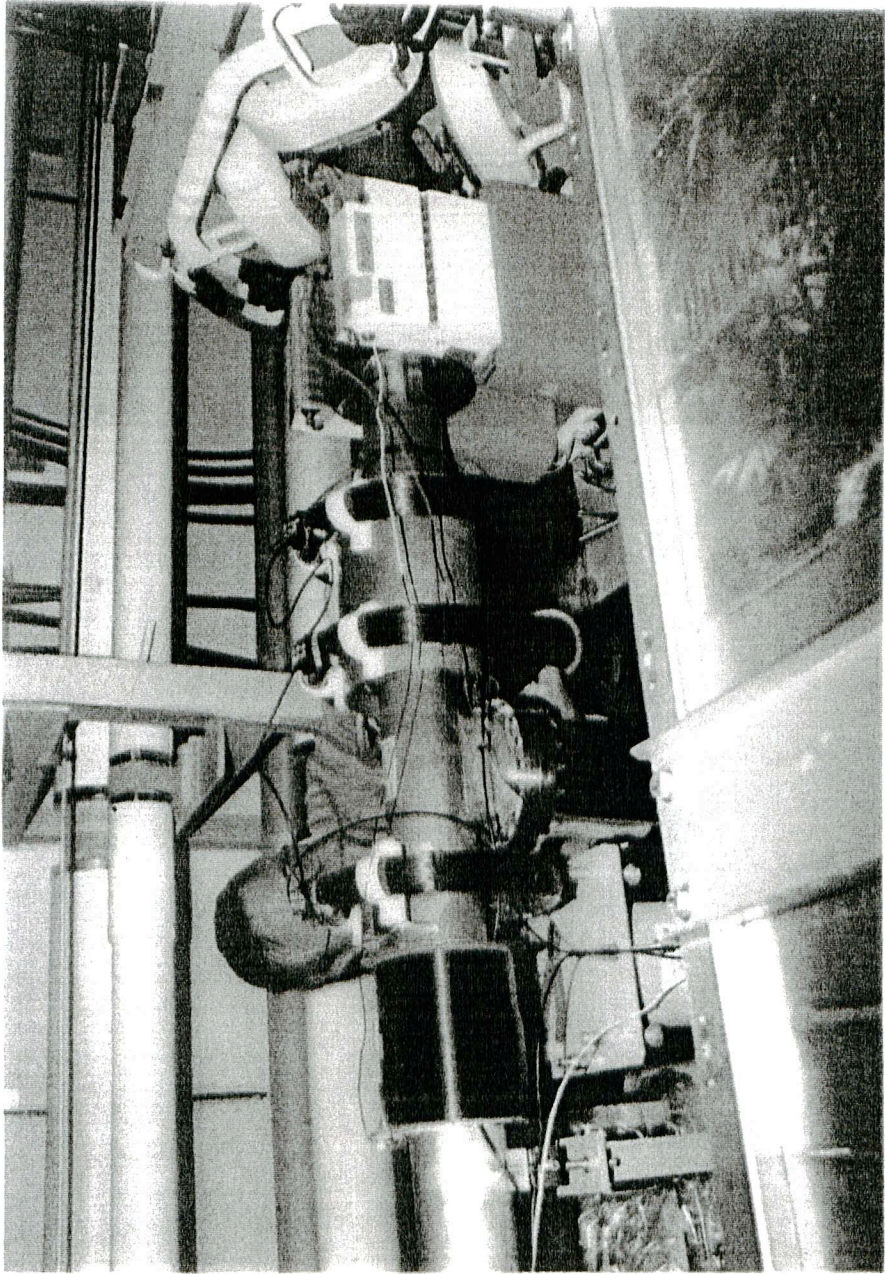
Operation Current 5 A / Use Existing DC Power Source

Temperature Rise $\Delta T = 10$ degree in Celsius for Long Coil
 $\Delta T = 16$ degree in Celsius for Short Coil



Profile of B of a Solenoid





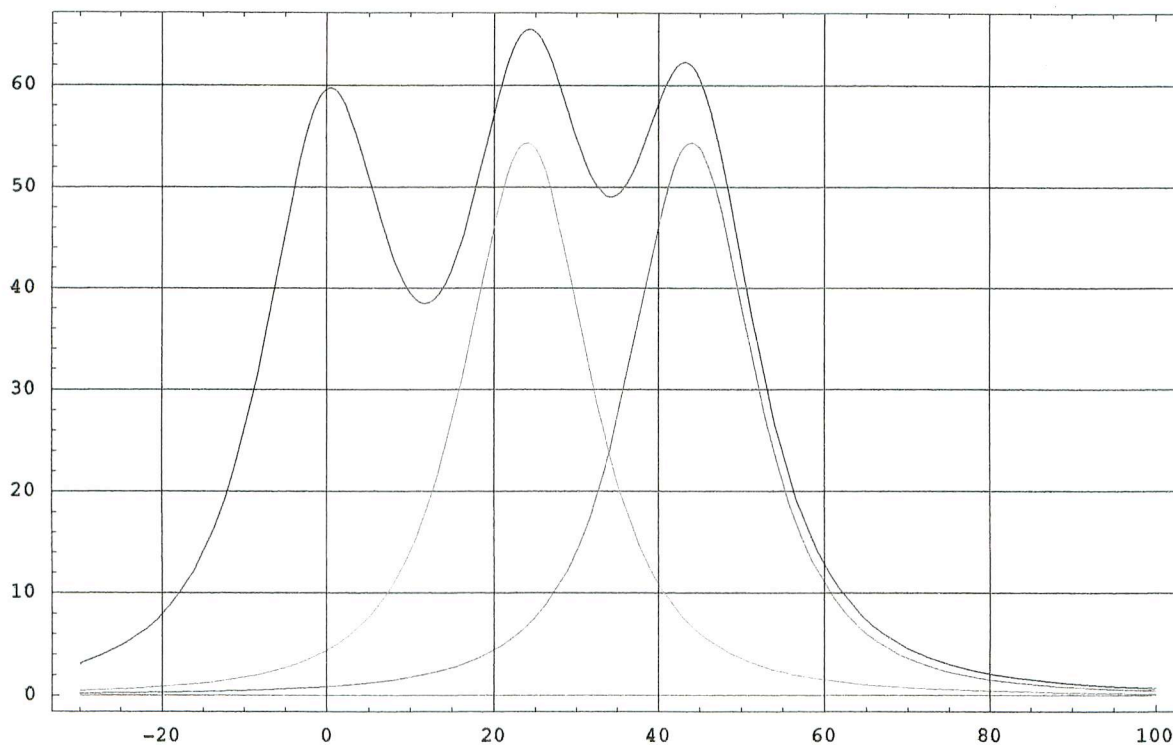
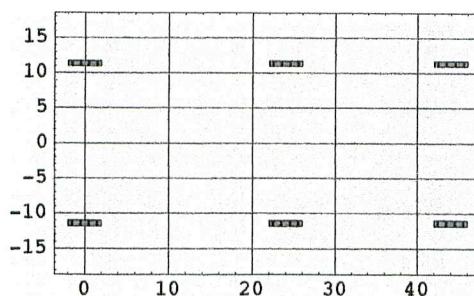
Magnetic Field by 3- Solenoid Coils

Aug.10, 2000

Nov.14, 2000

K.Hosoyama

■ **3 Coils 200 Turn x 5 A**



Development of Coil Winding Machine and Coil Winding

Development of Prototype Winding Machine Driven by Motor in Short Time

Modification of It In Parallel with Coil Winding in the Tunnel

Number of Winding Machines about 20 for Phase I
12 for Phase II

Manufacture of Coil Bobbines (Phase I)

Construction of Fabrication Line in KEK 300 sets / day

Rolling Body Part of Bobbine from Sheet
Tapping of Screw-thread
Assembling by Weilding

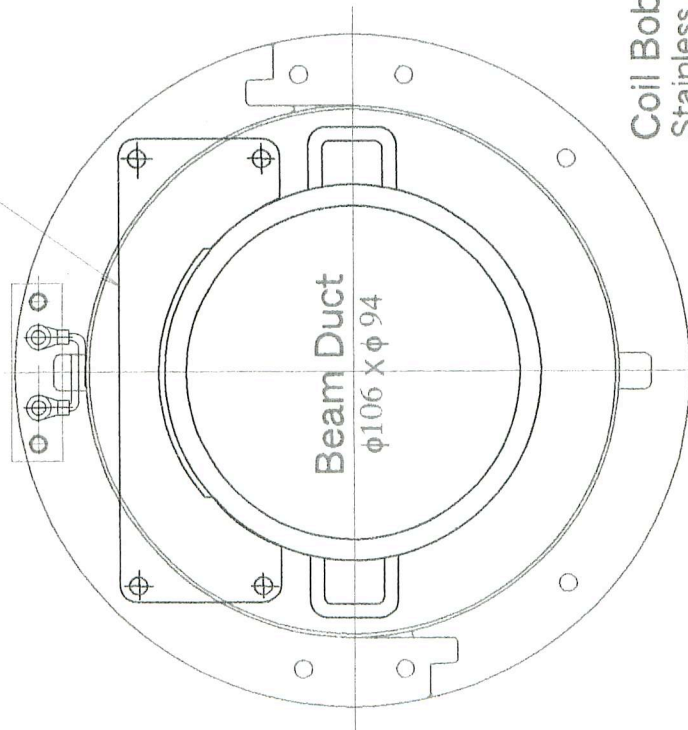
Coil Winding in the Tunnel About 10 – 12 Teams

Solenoid Coil for KEKB LER

Coil Winding

- 2 Layers
- 2 mm in Diameter Copper Cable
- Coated with Polyester Varnish

Coil Support
Aluminum Plate 2 mm t



Beam Duct

Coil Bobbine
Stainless Steel

$1.5t \times 2$

$\phi 150$

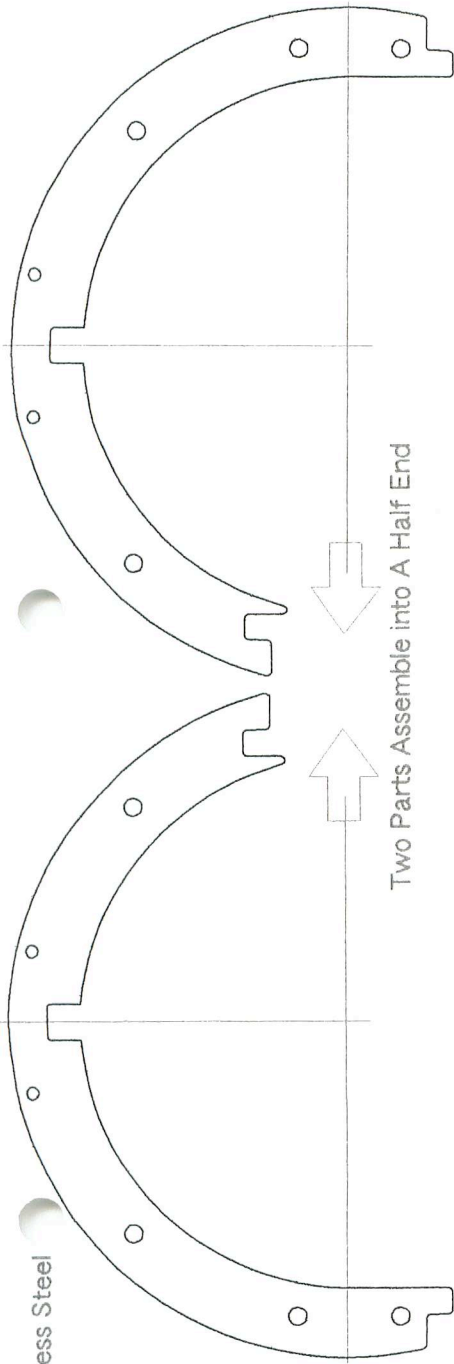
$1t$

L = 100, 190, 250,
300, 400, 500, 650 mm

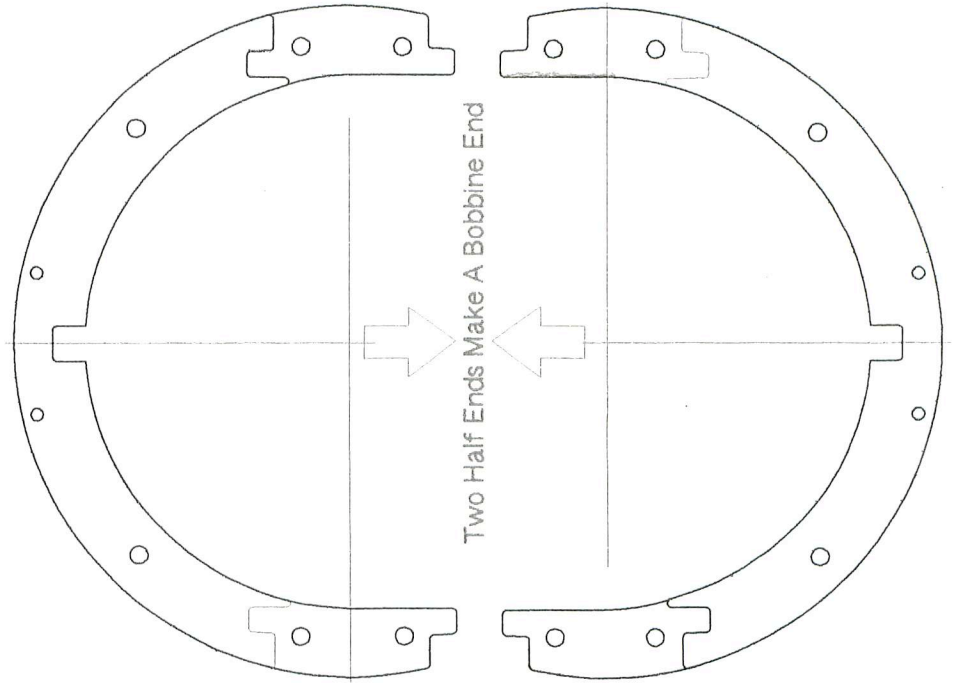


Coil Bobbine End

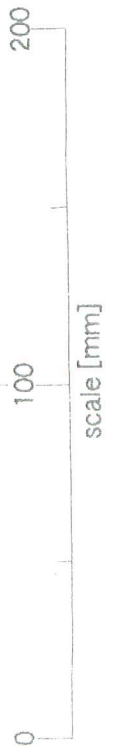
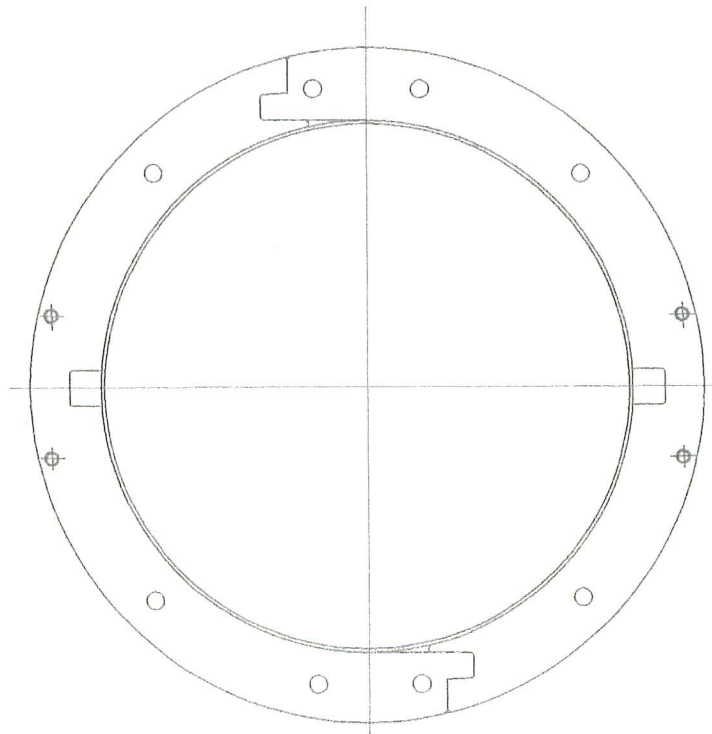
Stainless Steel
1.5 t

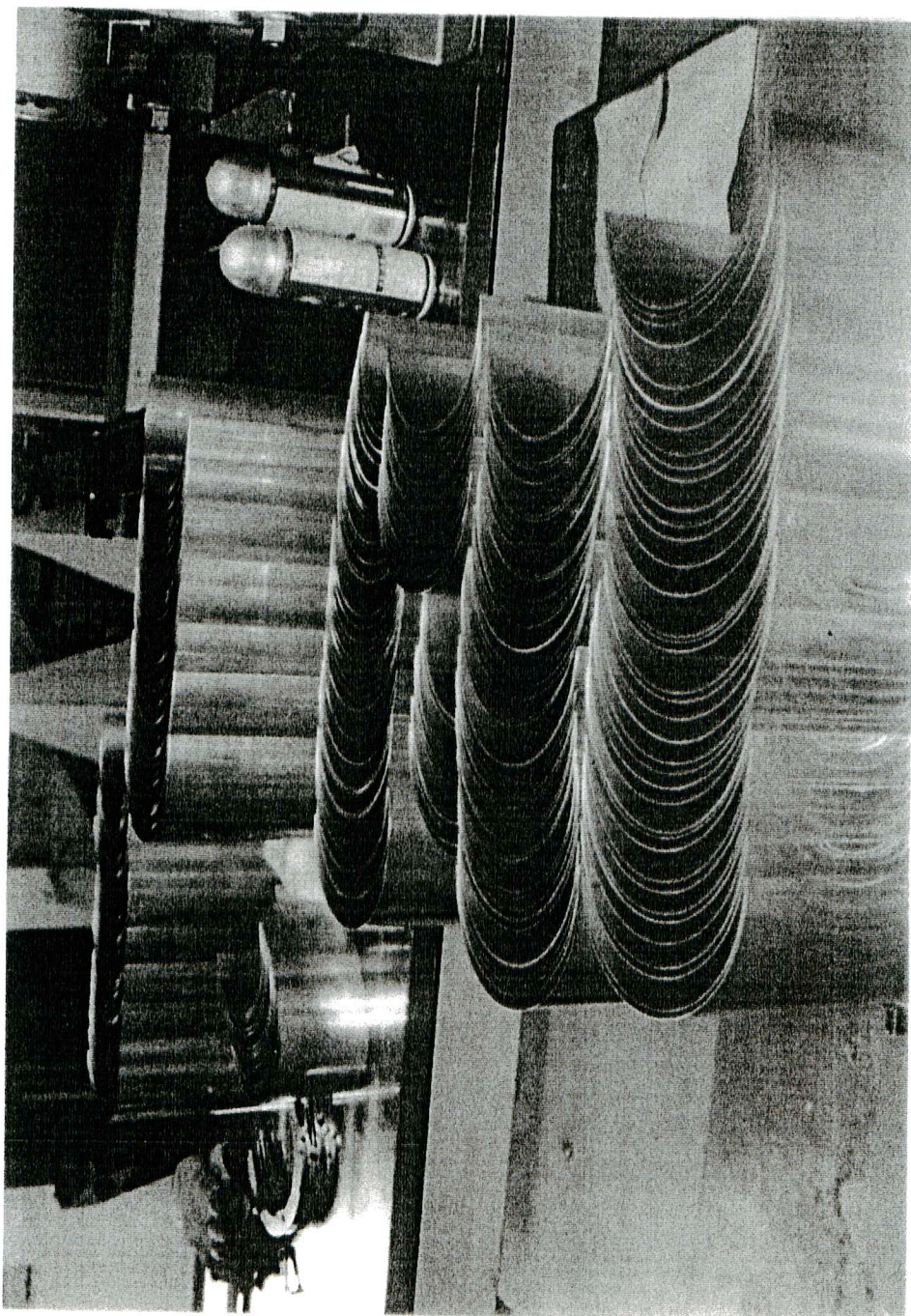


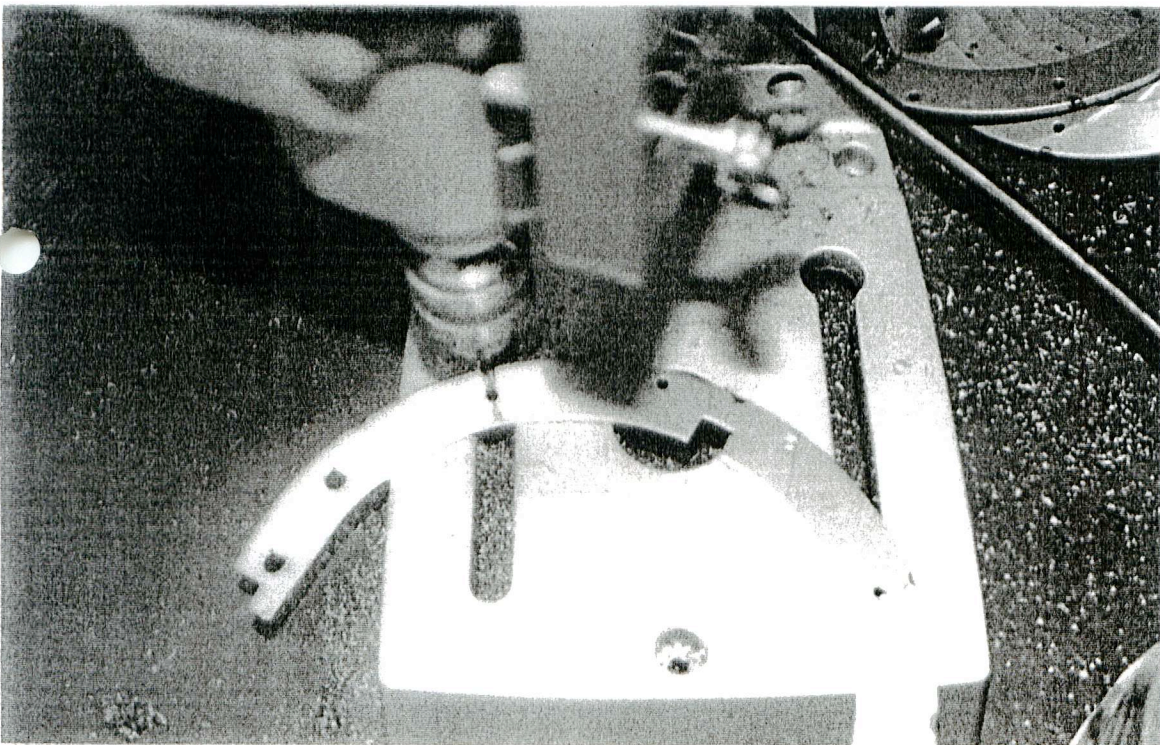
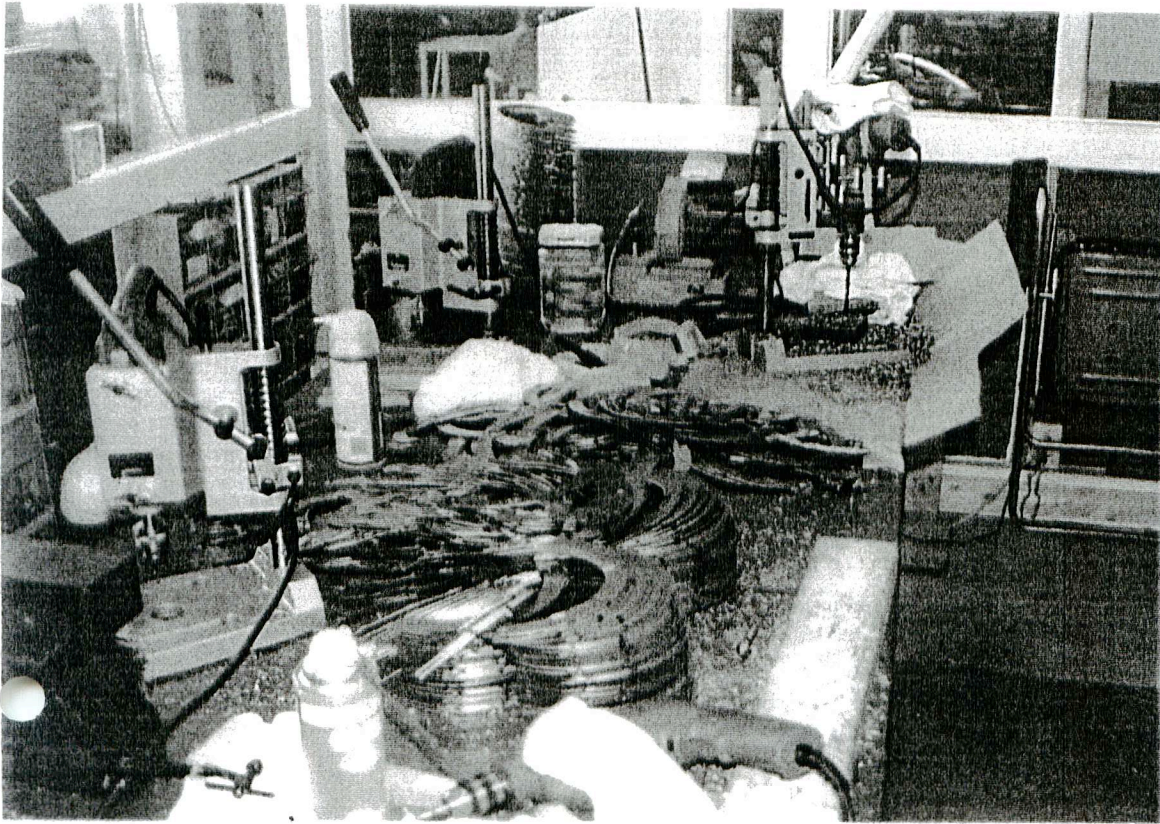
Two Parts Assemble into A Half End



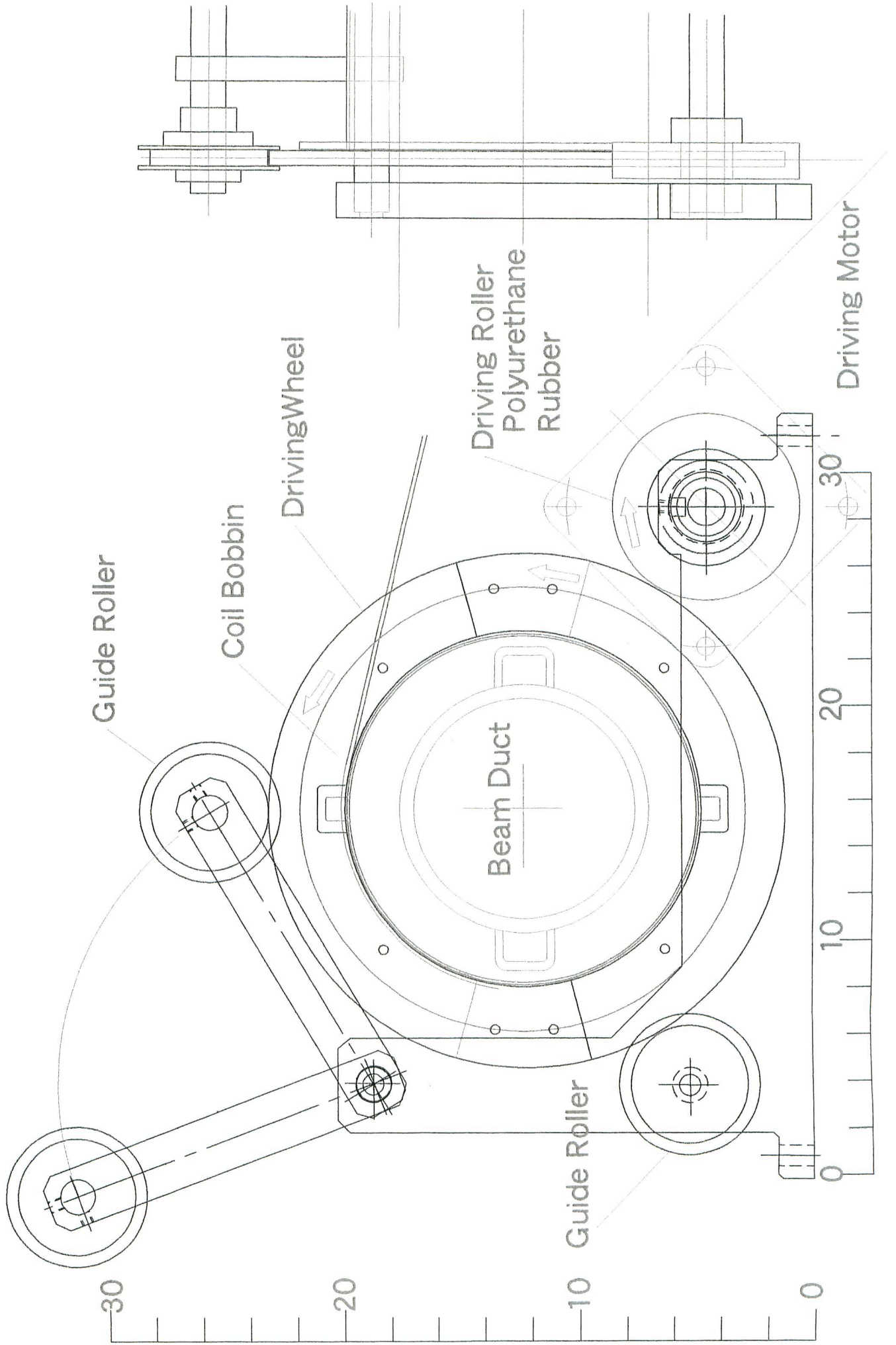
Two Half Ends Make A Bobbine End

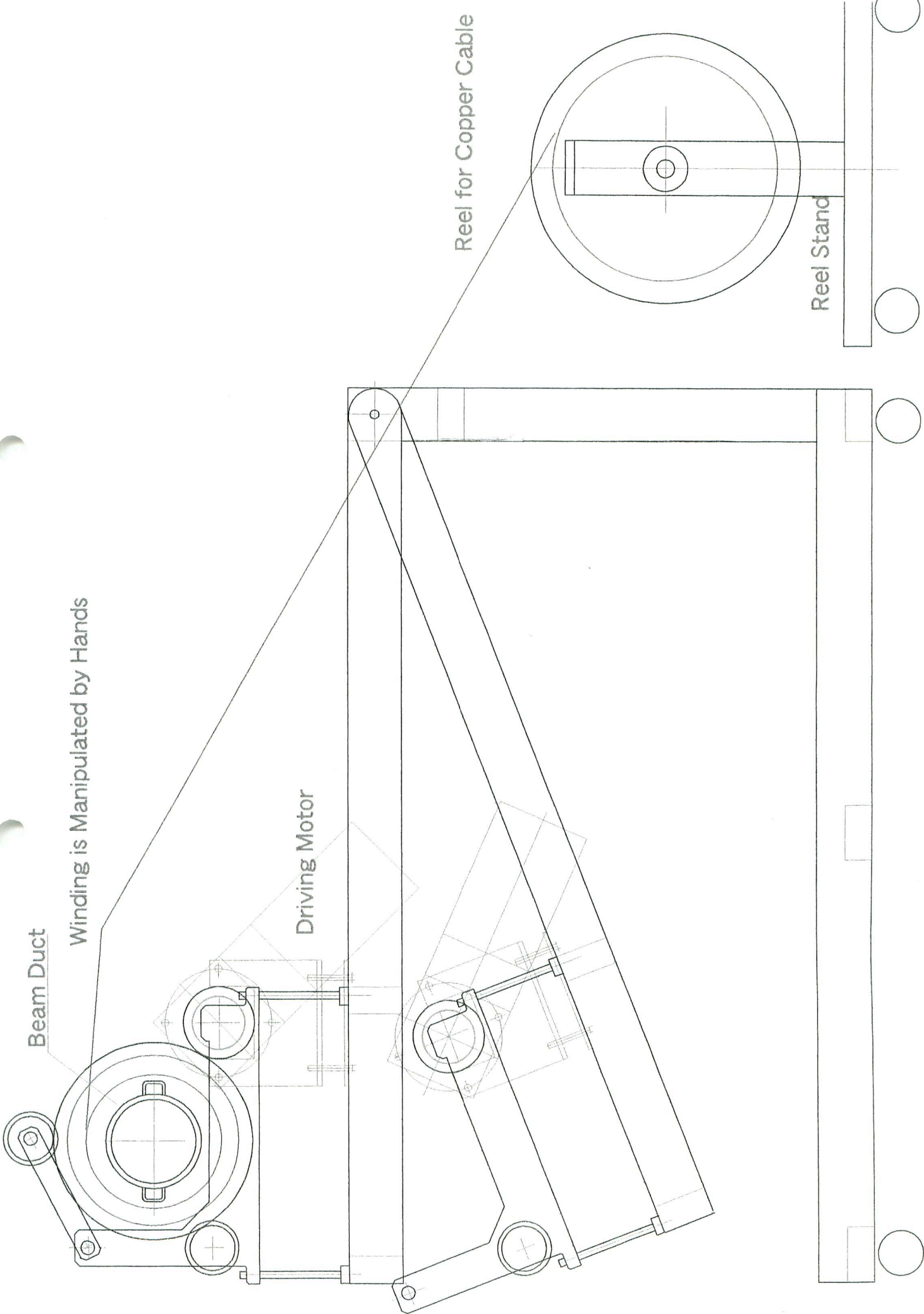






Slenoid Coil Winding Machine





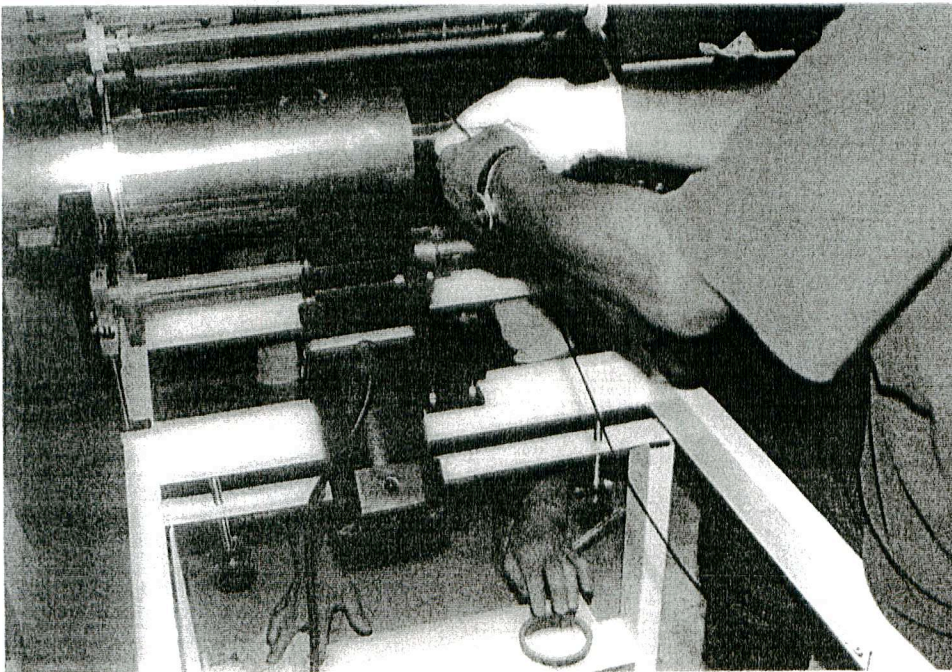
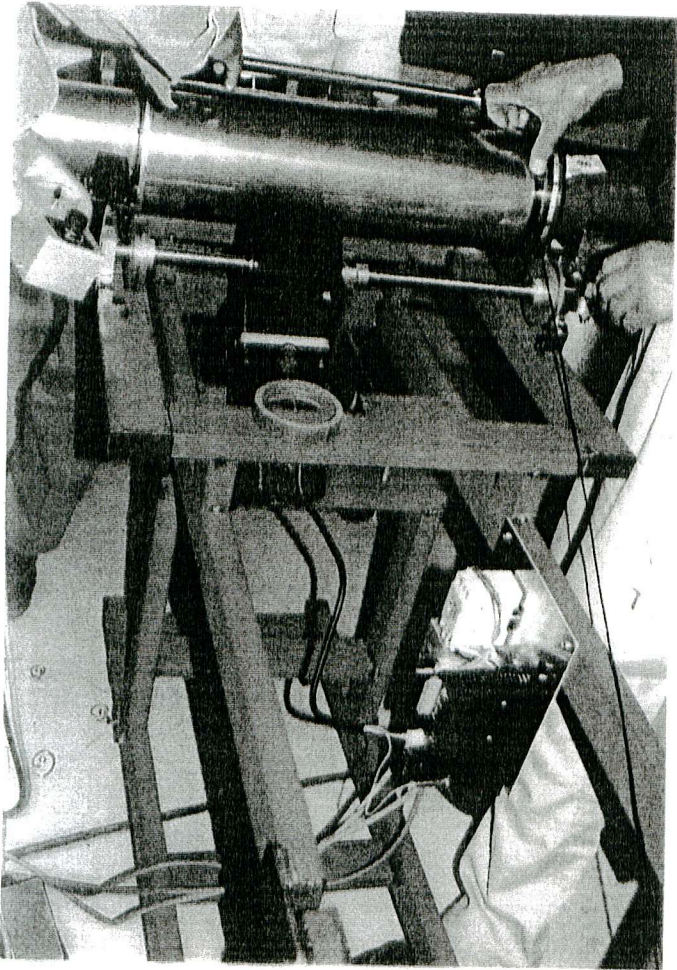
Beam Duct

Winding is Manipulated by Hands

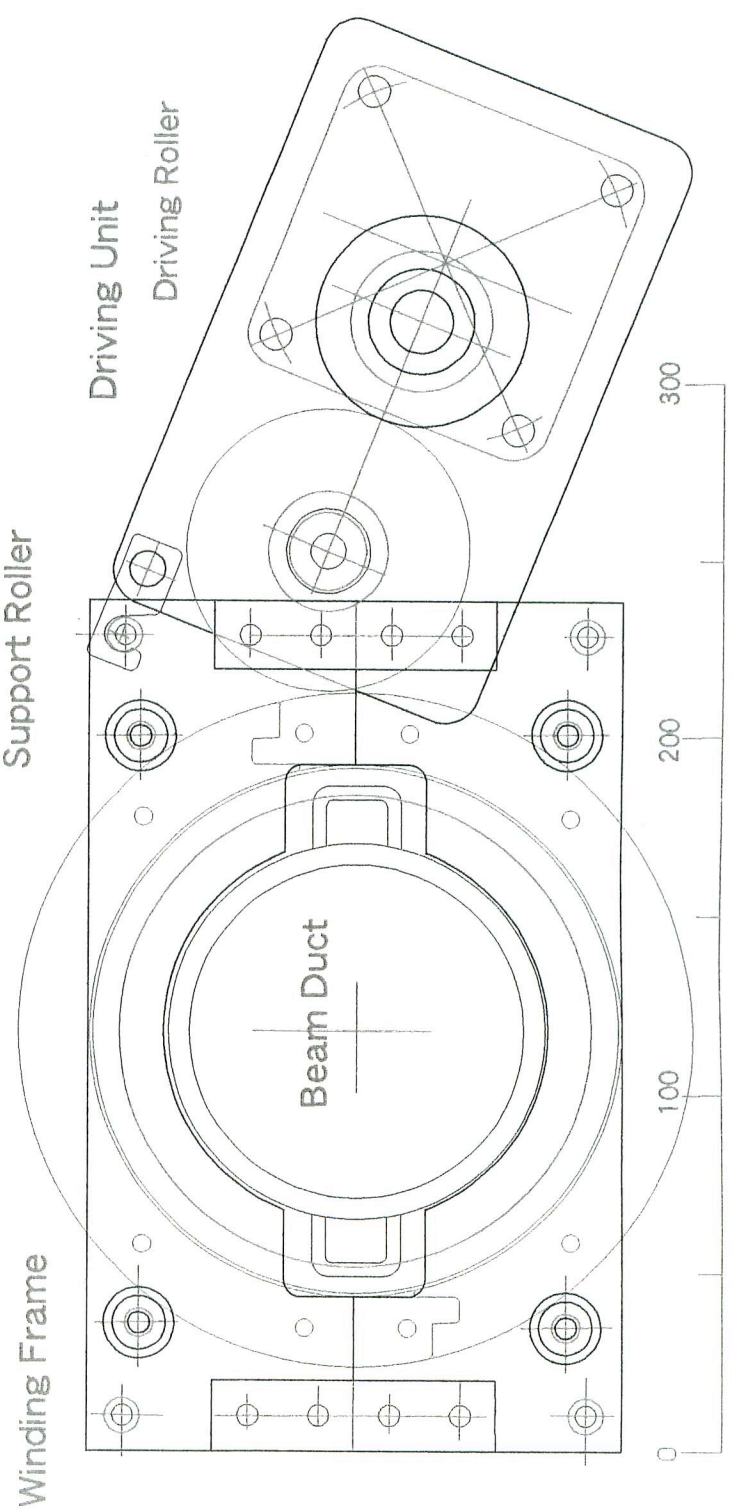
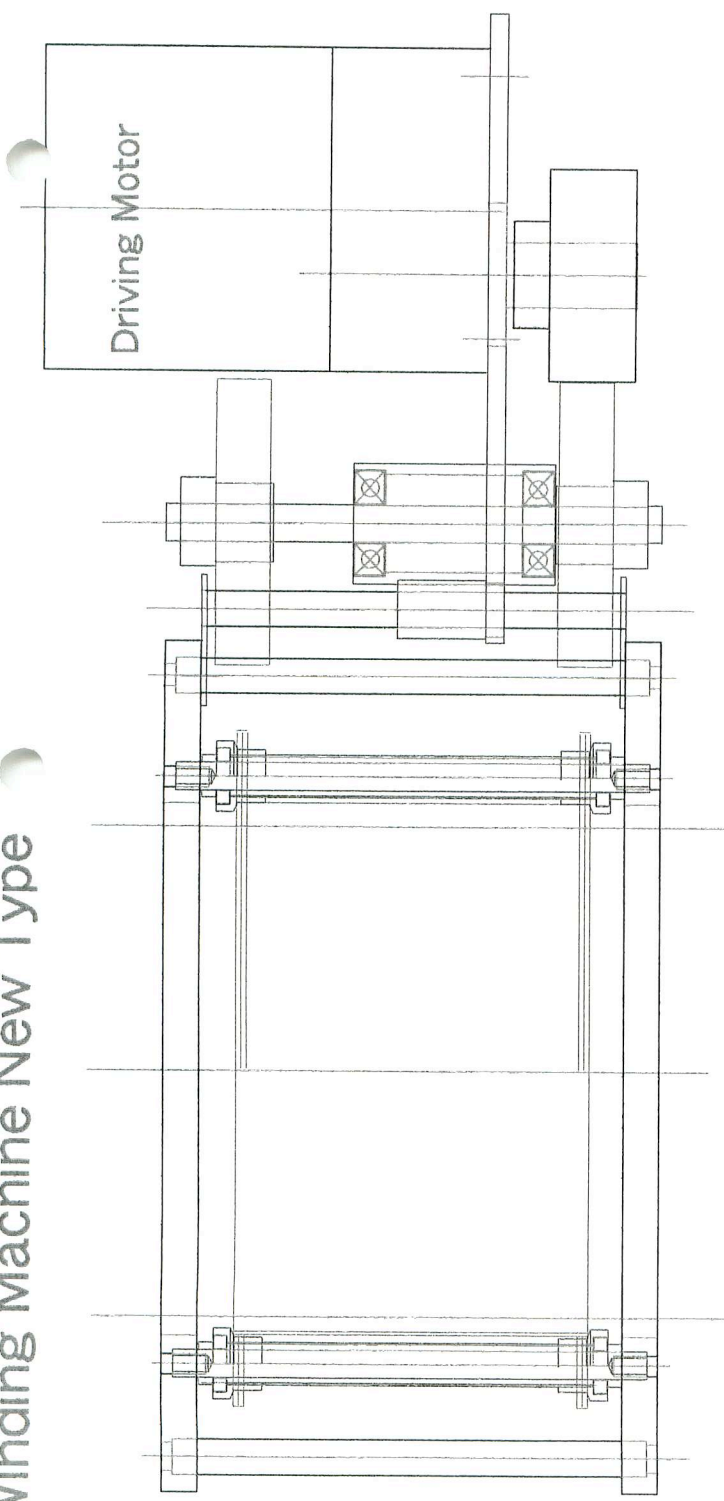
Driving Motor

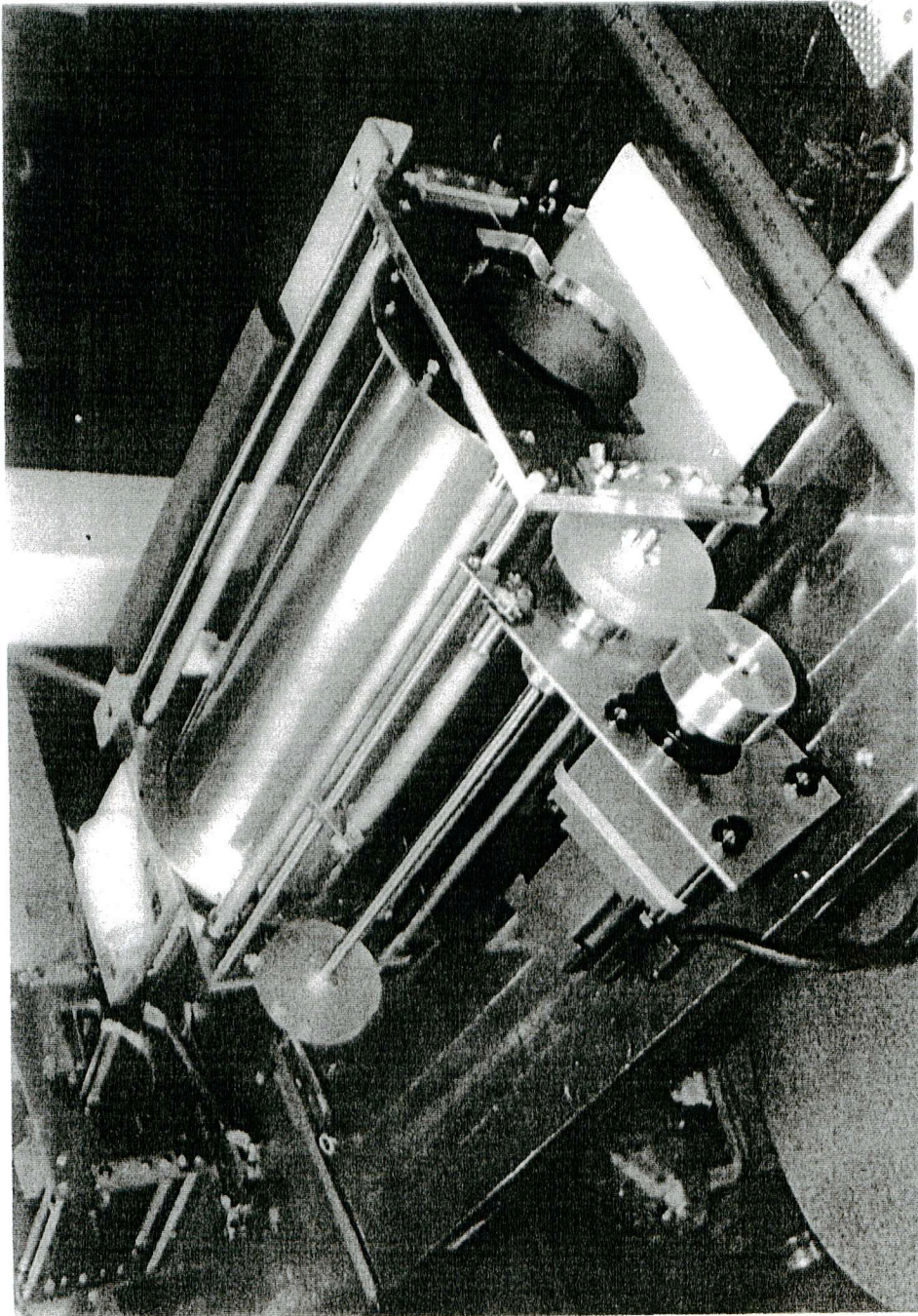
Reel for Copper Cable

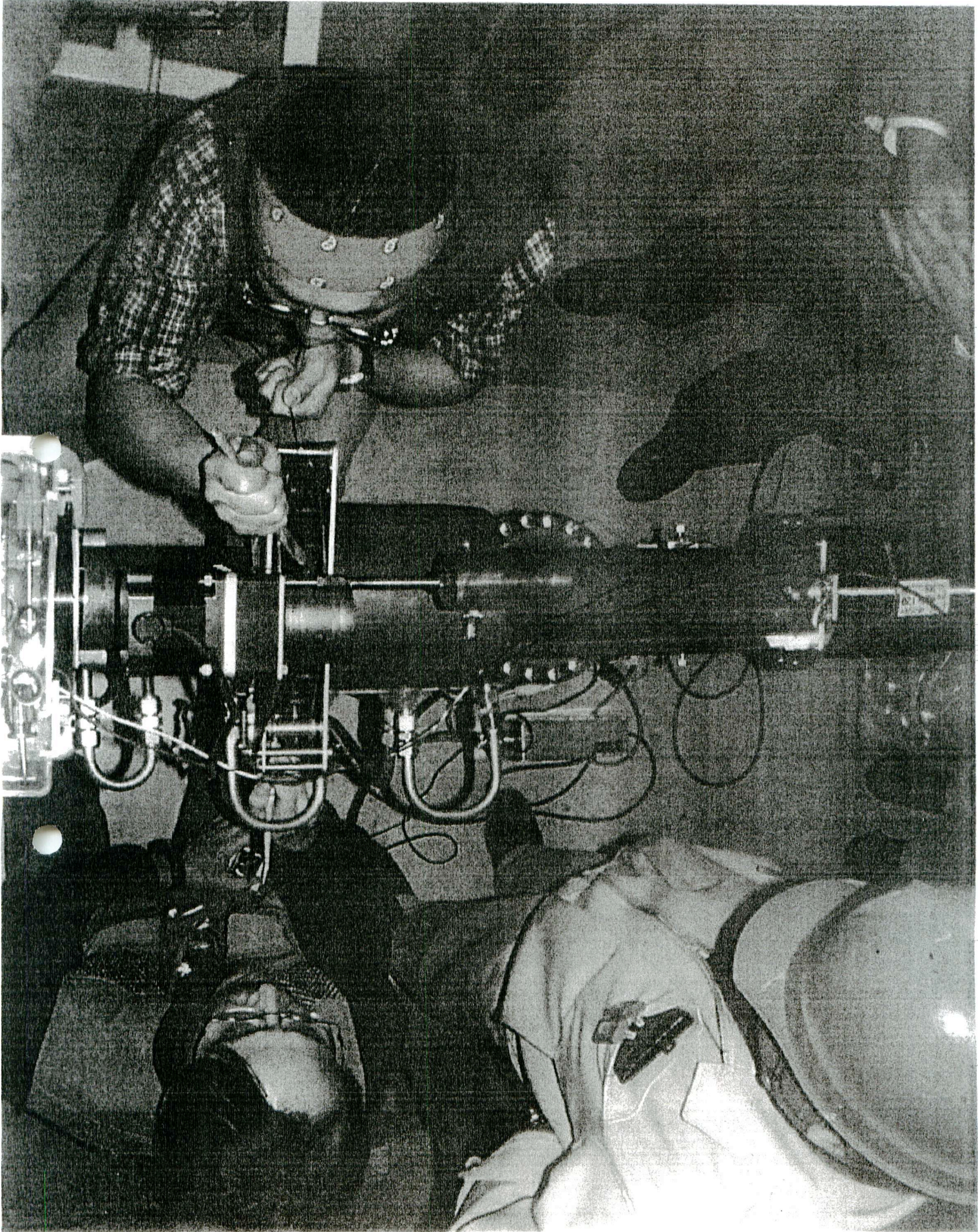
Reel Stand

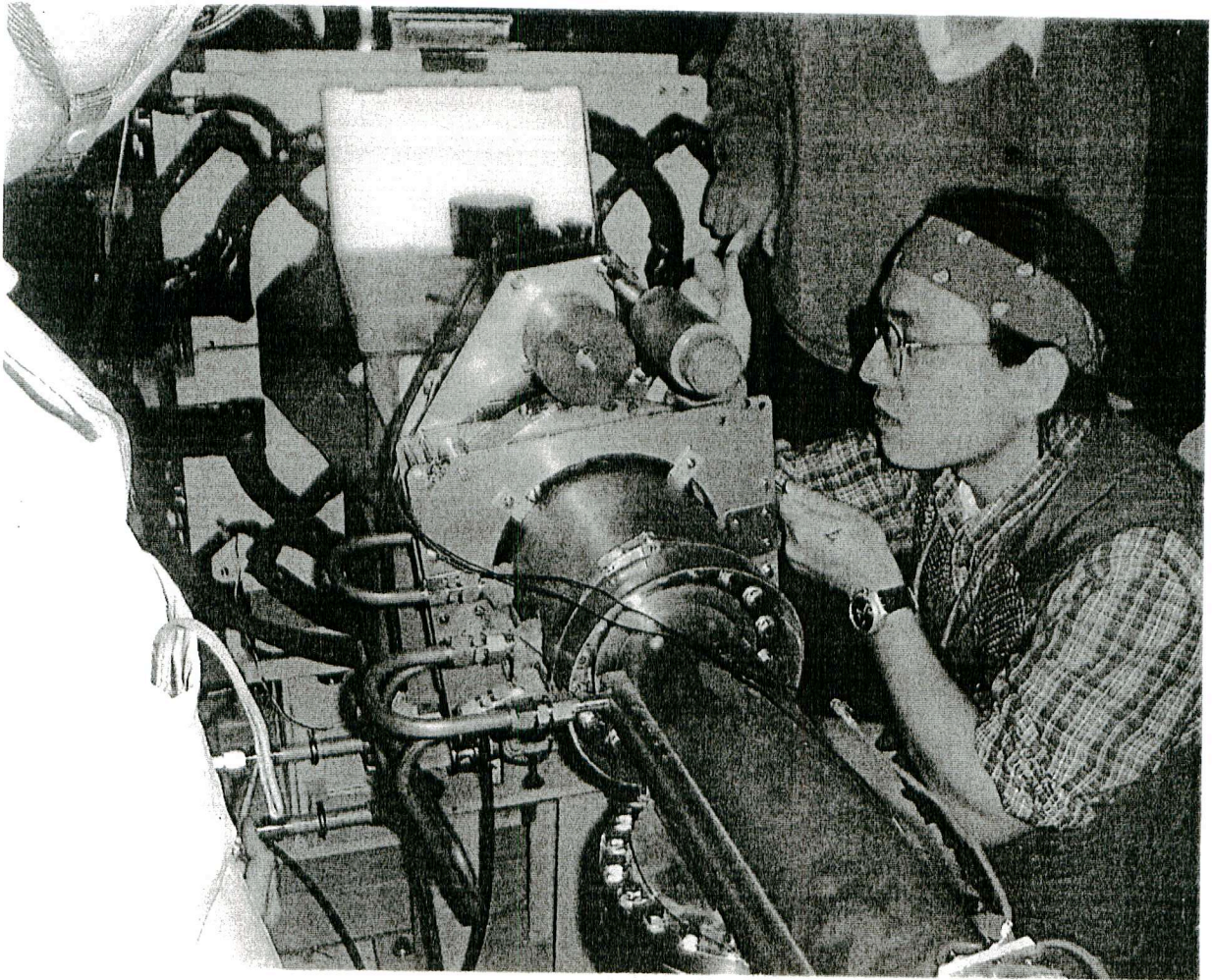


Winding Machine New Type

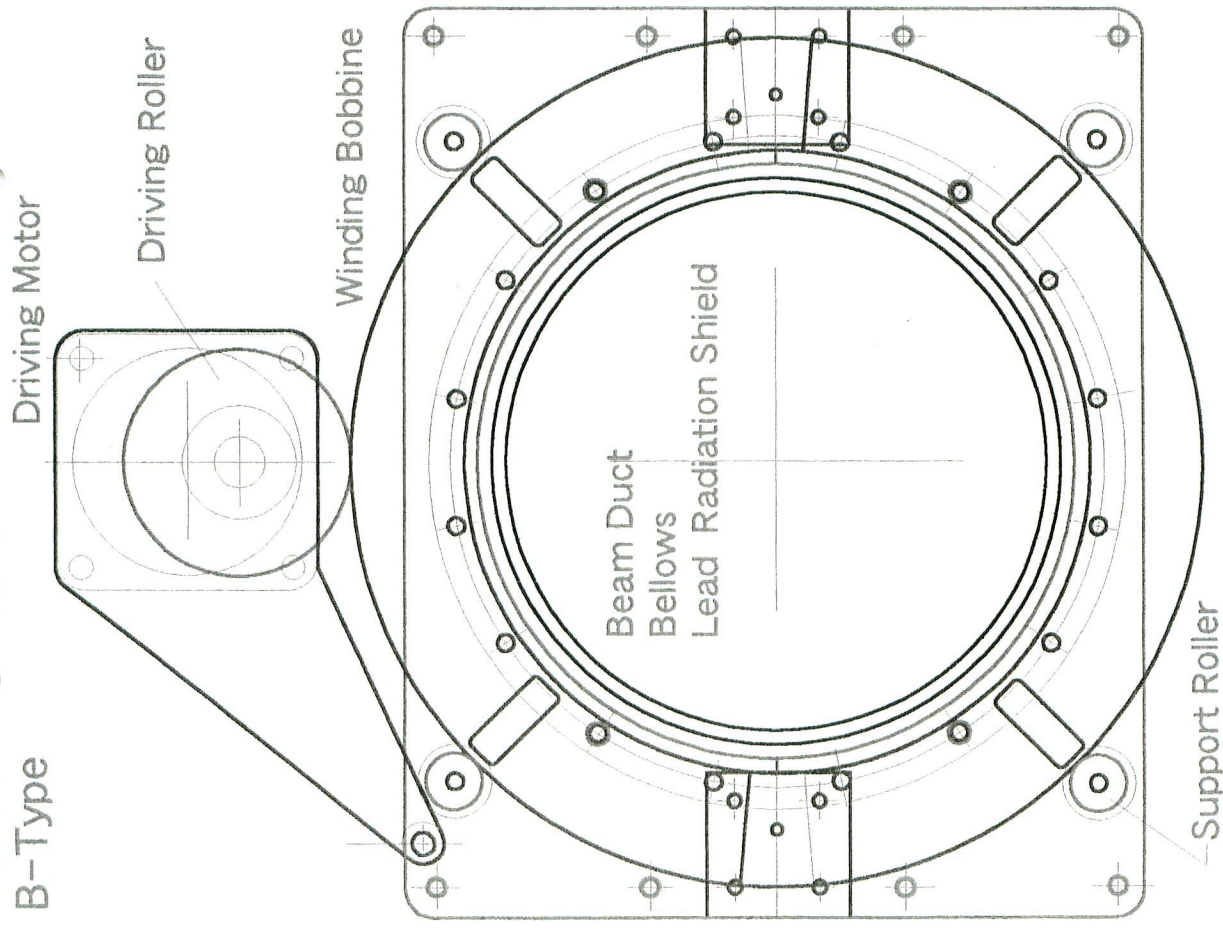
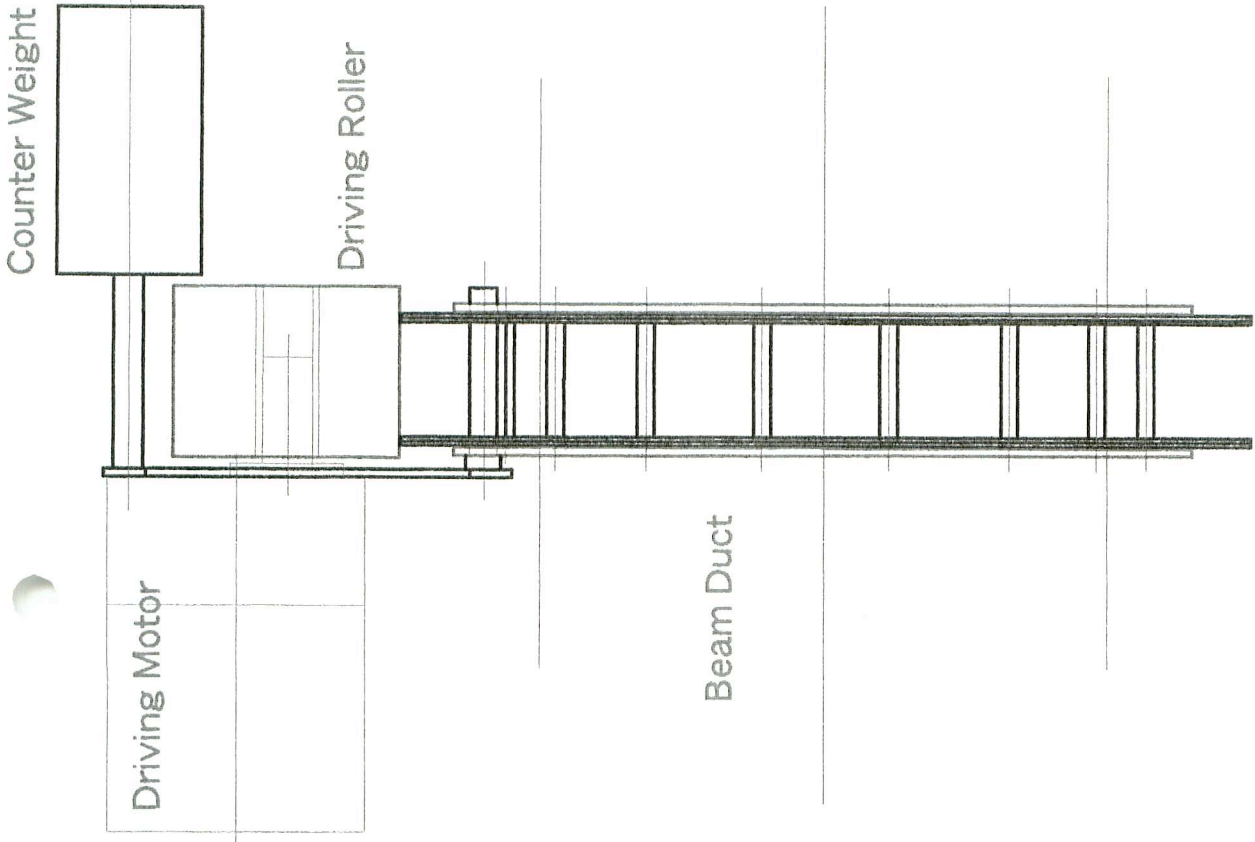






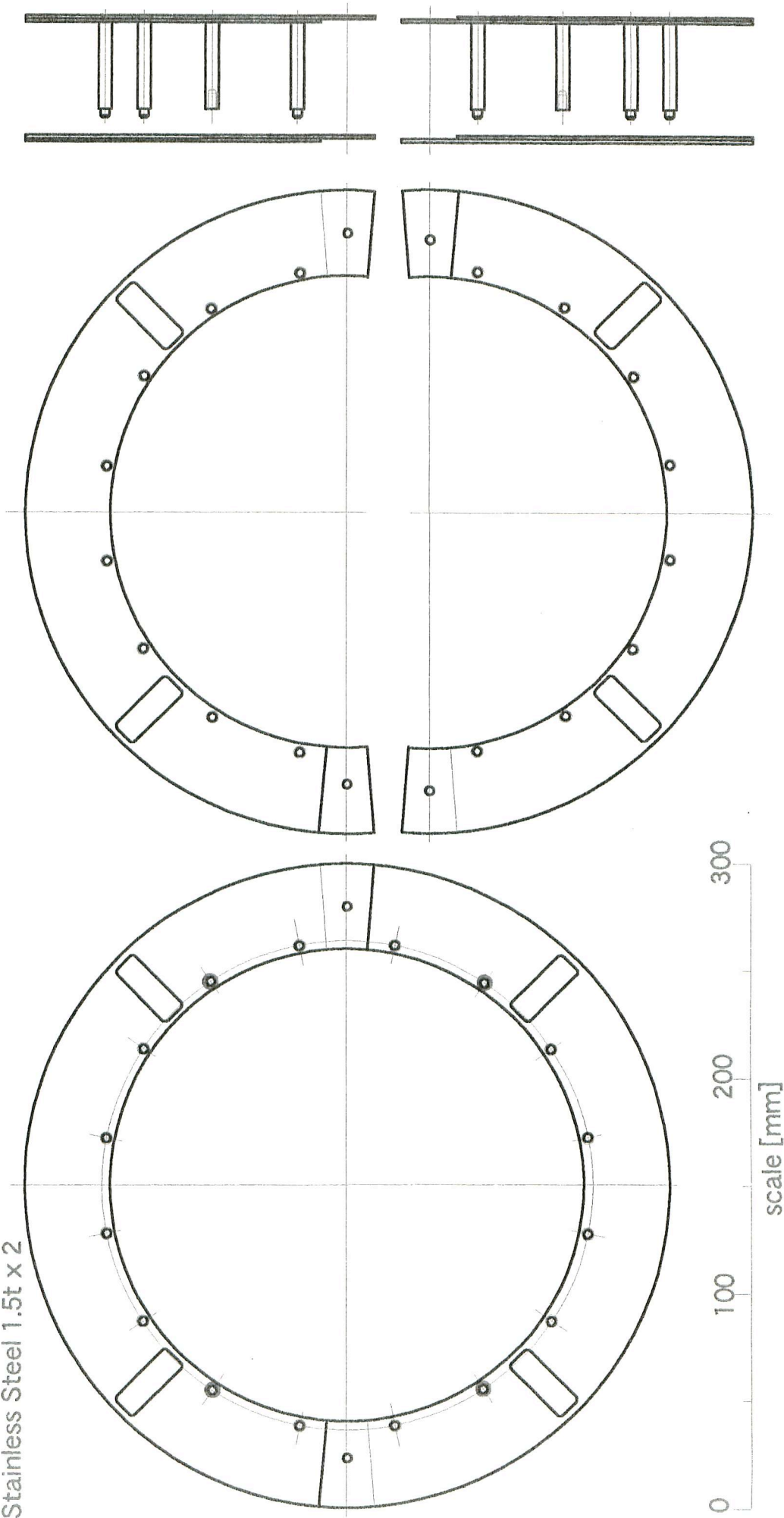


Coil Winding Machine B-Type



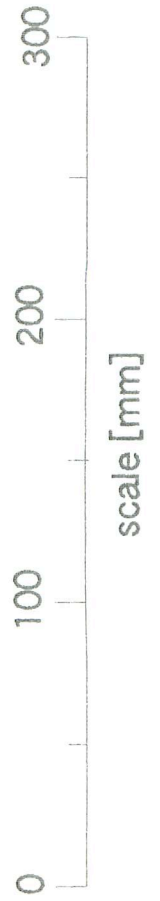
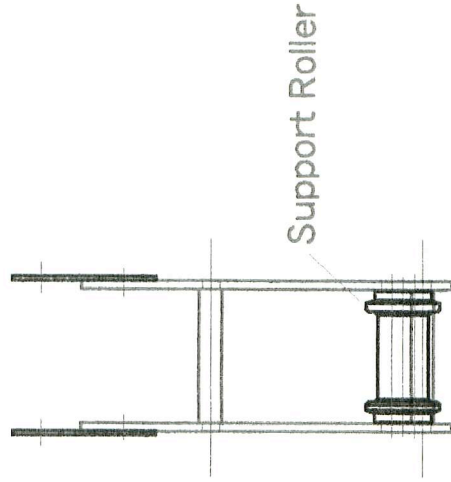
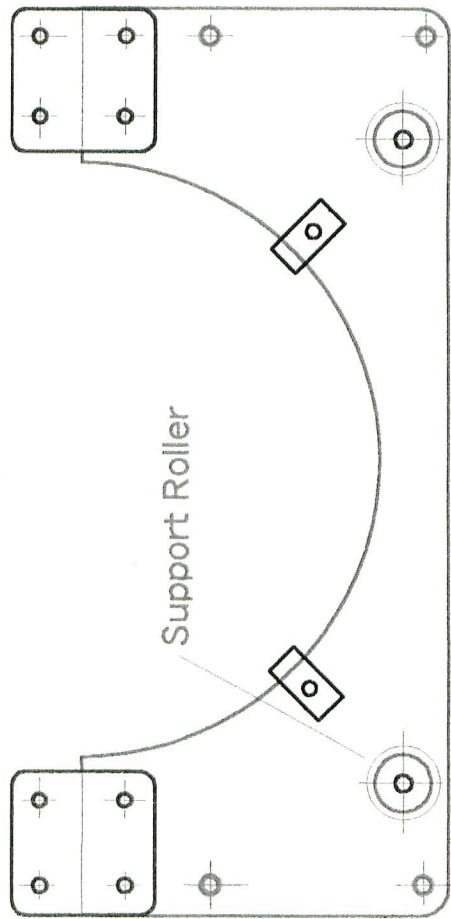
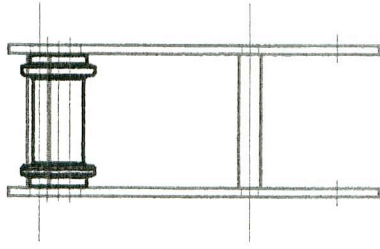
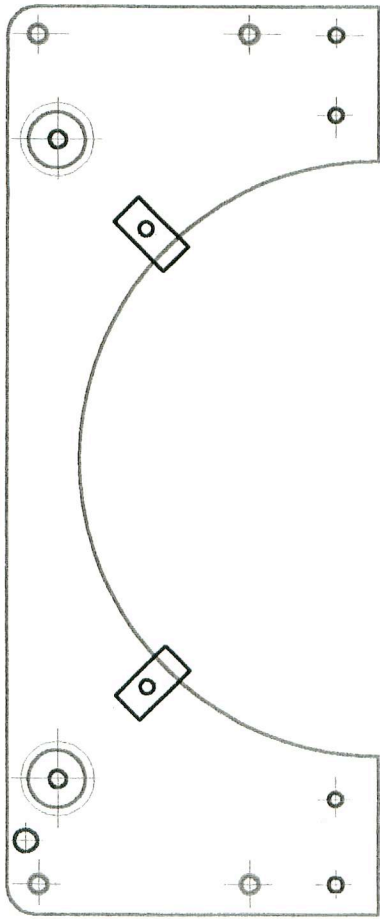
Winding Bobbine for Short Coil

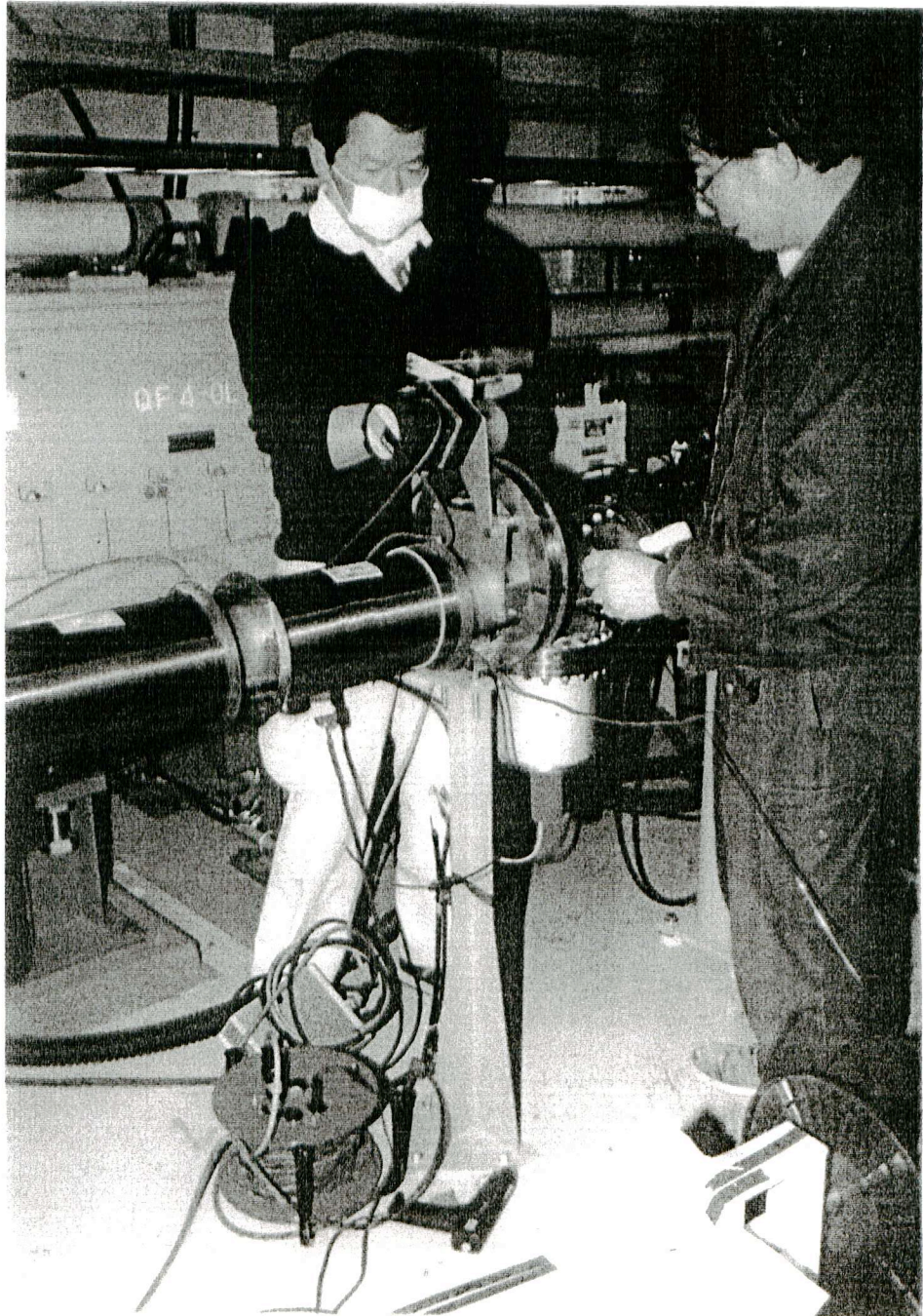
Stainless Steel 1.5t x 2



Coil Winding Machine B-Type

Coil Bobbine Support Frame



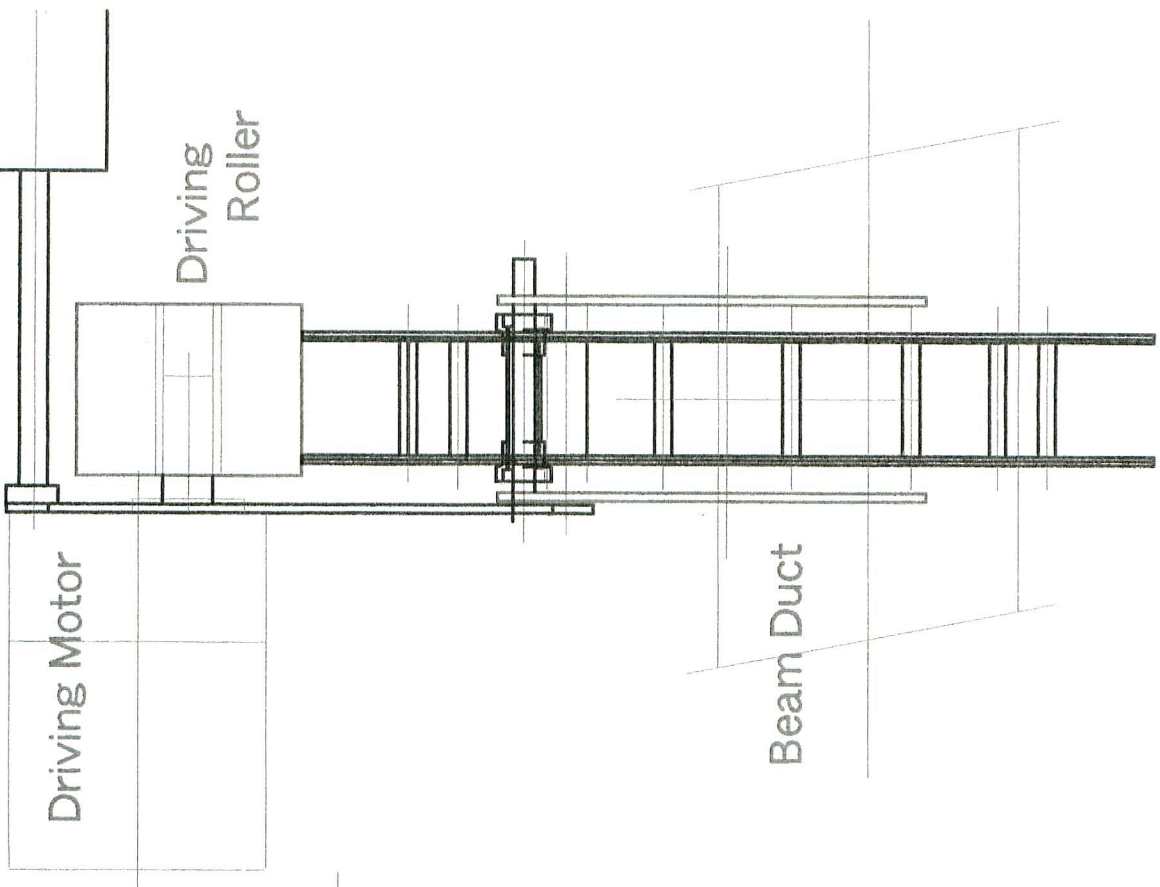
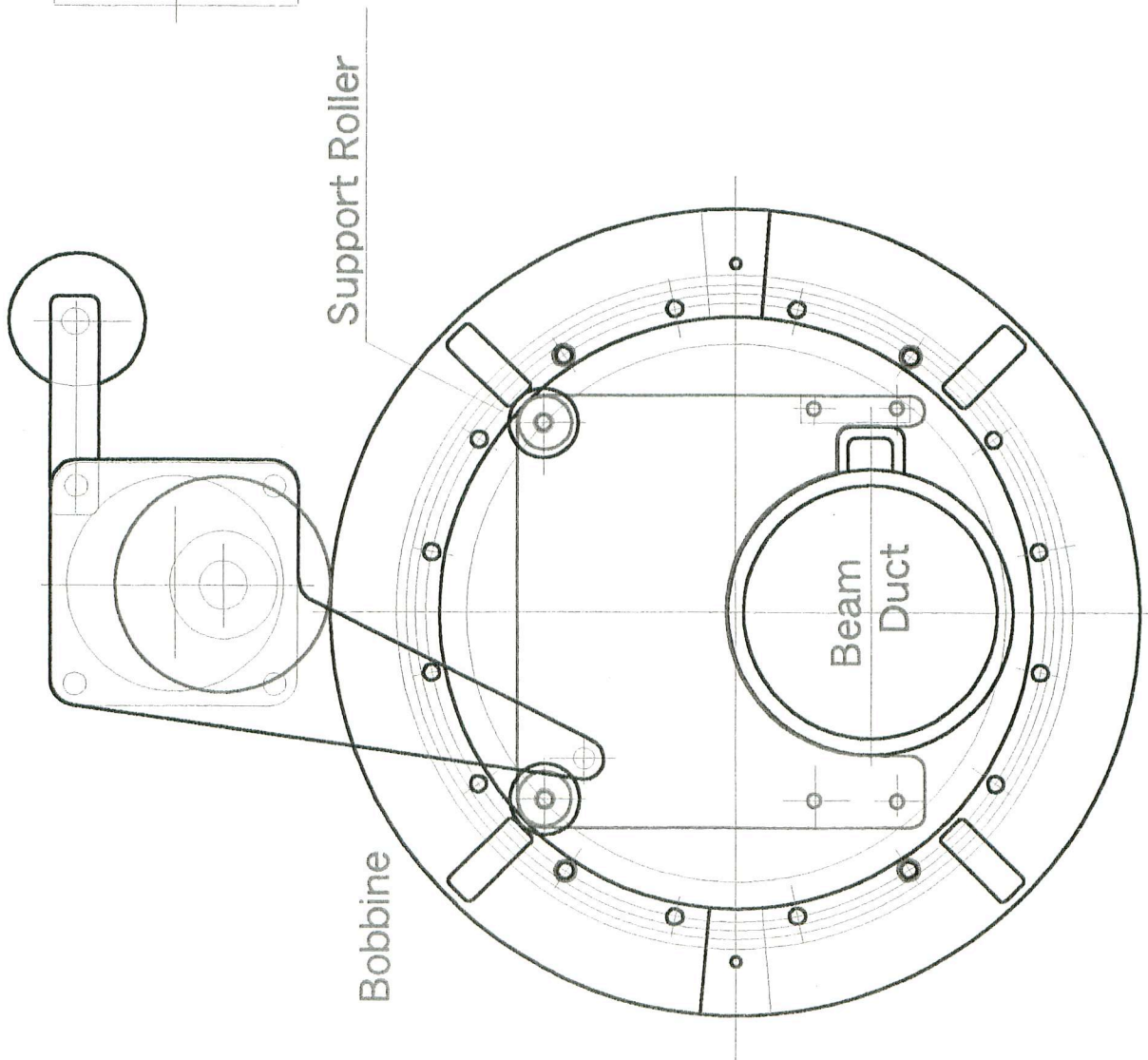


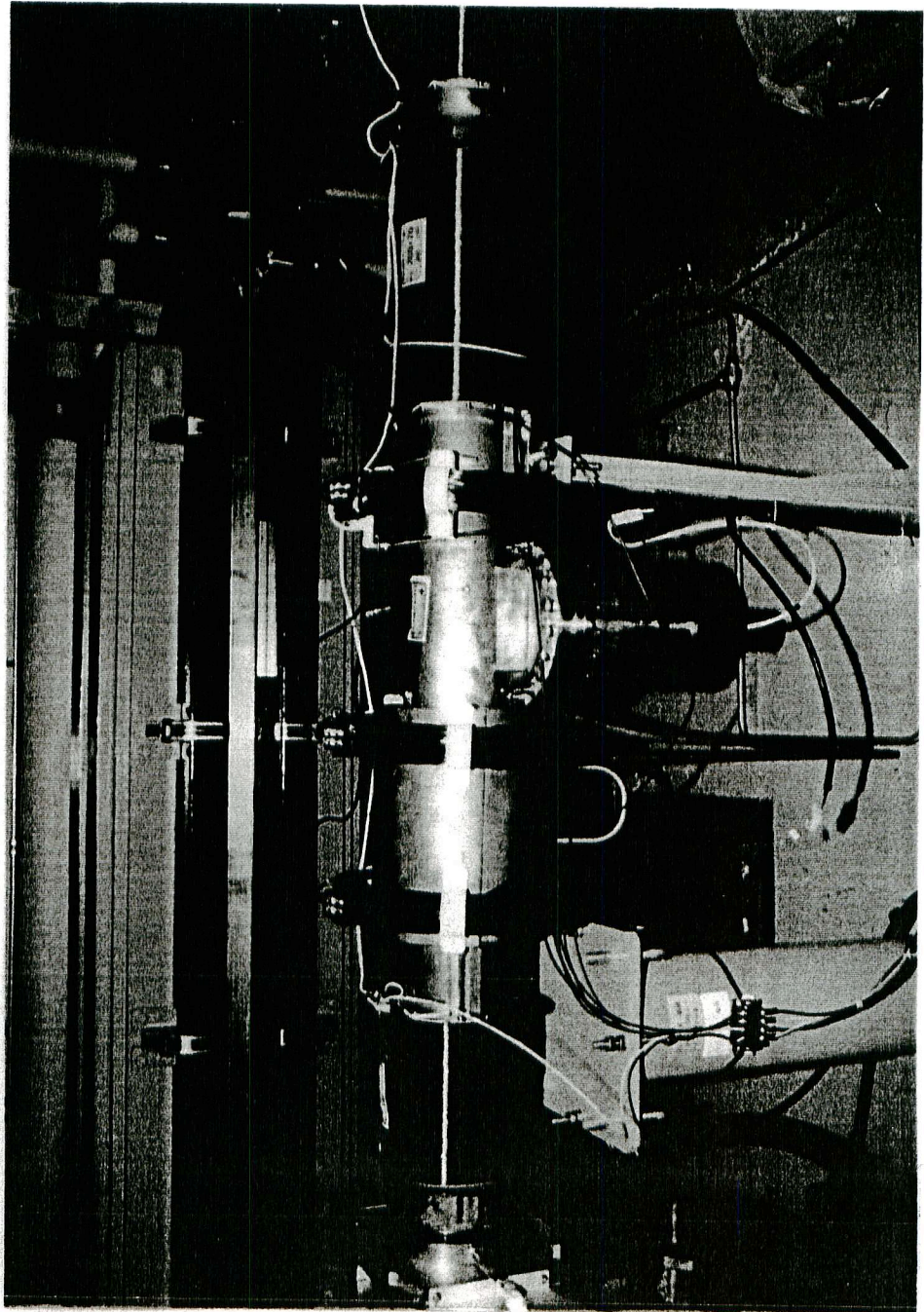
Coil Winding Machine

N-Type

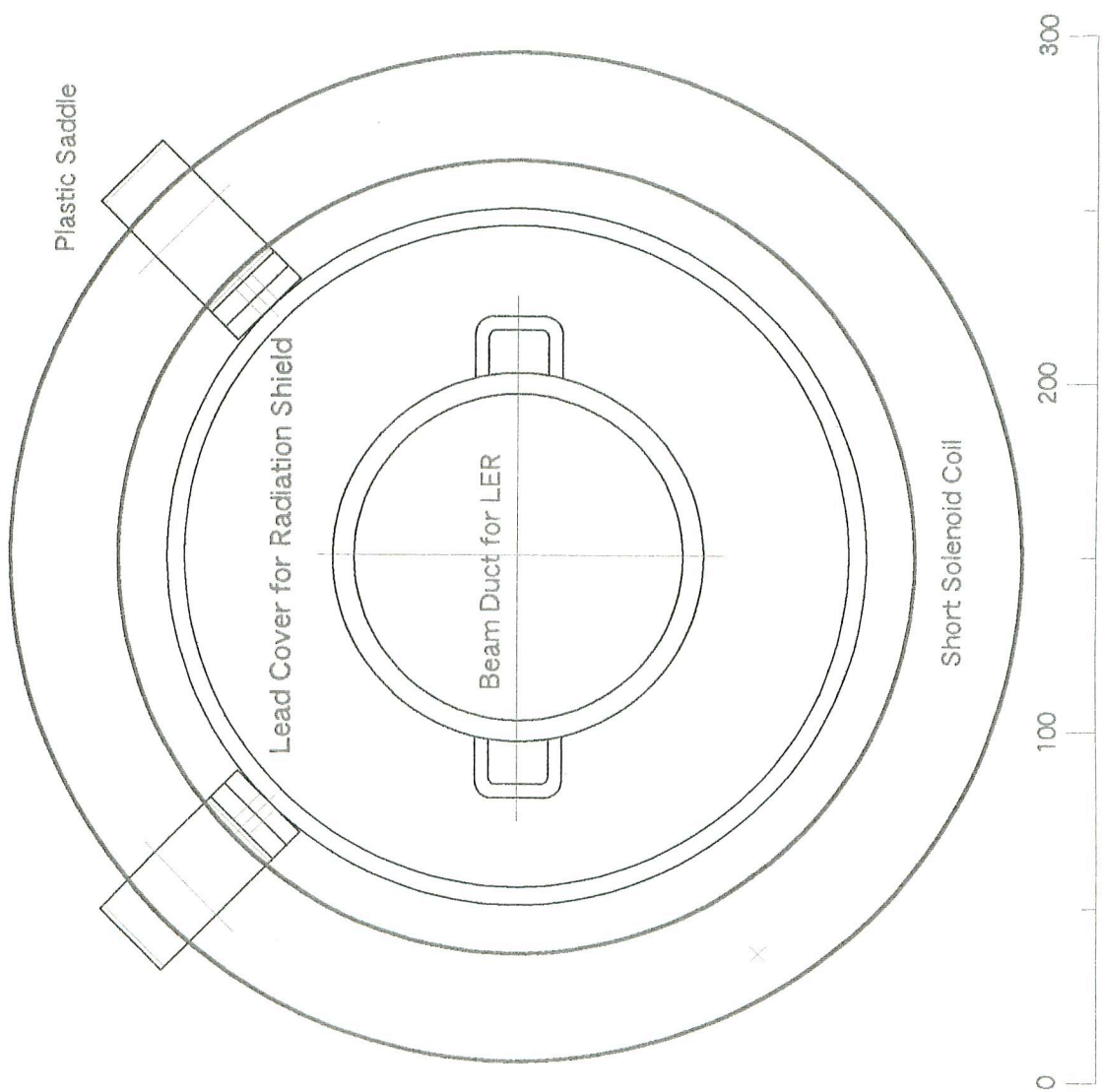
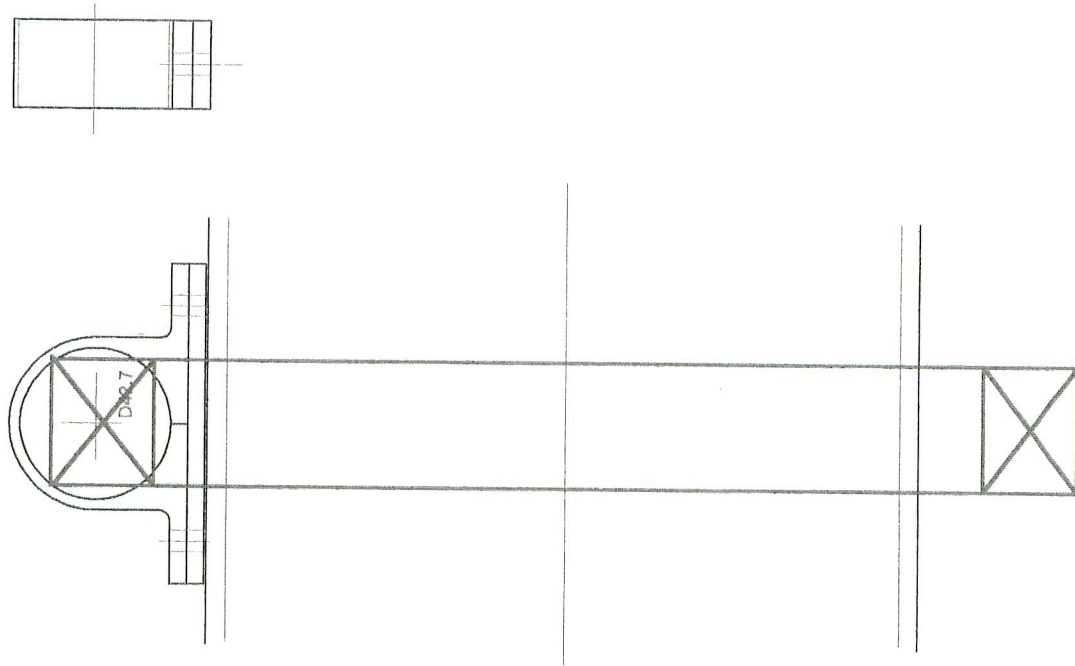
Counter-weight

Counter-v



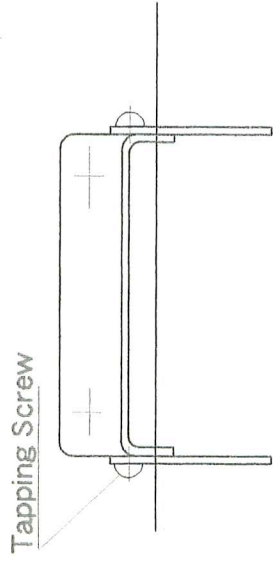
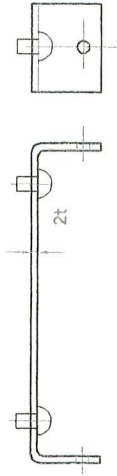
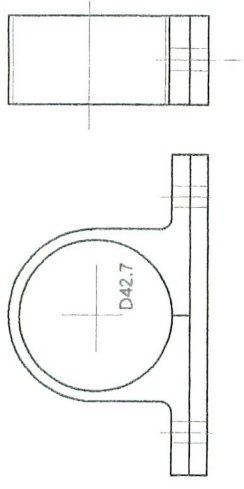
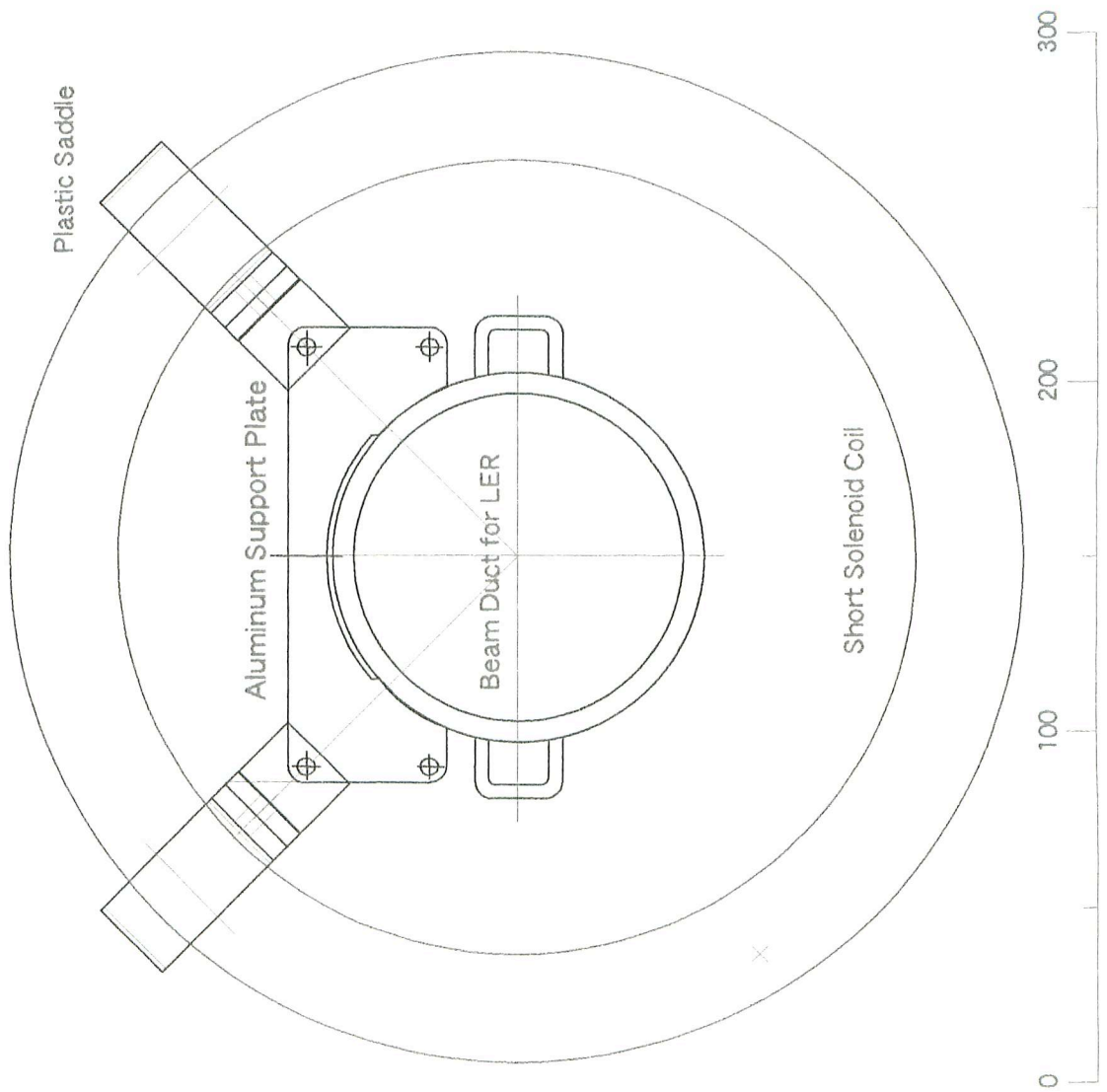


Frameless Coil B-Type



0 100 200 300
scale

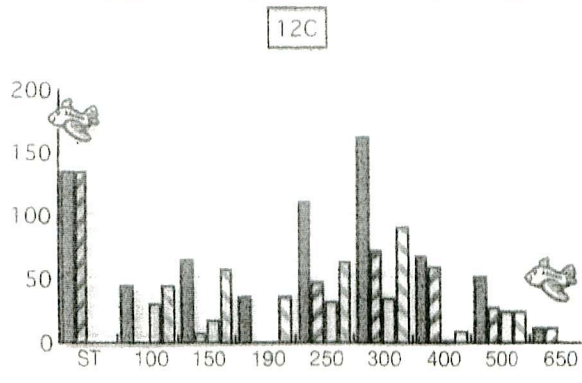
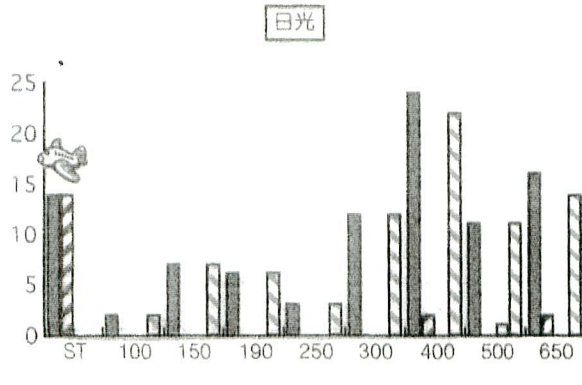
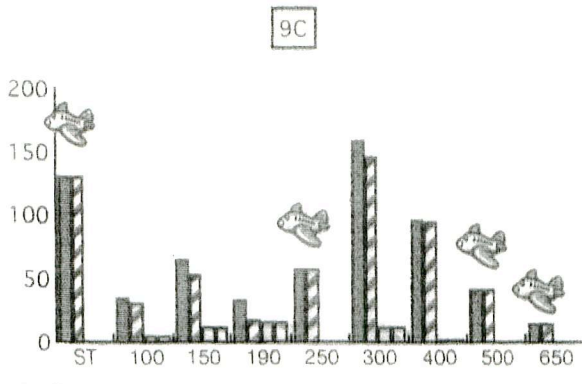
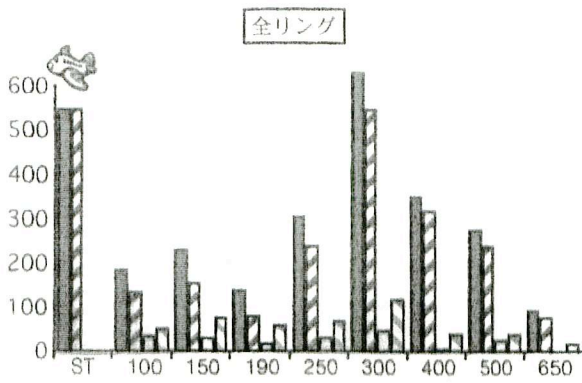
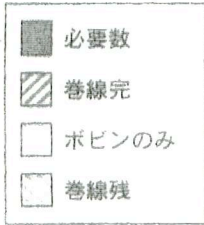
Frameless Coil N-Type



Beam Duct for LER

ソレノイド 進行状況

10/2 15:30



全リング	必要数	巻線完	ポビンのみ	巻線残
ST	546	546	0	0
100	185	135	34	50
150	231	155	28	76
190	136	78	16	58
250	305	239	31	66
300	662	545	46	117
400	352	316	4	36
500	274	238	26	36
650	91	76	0	15
総計	2782	2328	185	454
ST除く	2236	1782	185	454

9C	必要数	巻線完	ポビンのみ	巻線残
ST	130	130	0	0
100	34	30	4	4
150	64	53	11	11
190	33	17	16	16
250	57	57	0	0
300	158	146	11	12
400	96	94	2	2
500	42	42	0	0
650	14	14	0	0
総計	628	583	44	45
ST除く	498	439	44	59

日光	必要数	巻線完	ポビンのみ	巻線残
ST	14	14	0	0
100	2	0	0	2
150	7	0	0	7
190	6	0	0	6
250	3	0	0	3
300	12	0	0	12
400	24	2	0	22
500	11	0	1	11
650	16	2	0	14
総計	95	18	1	77
ST除く	65	4	1	61

12C	必要数	巻線完	ポビンのみ	巻線残
ST	134	134	0	0
100	44	0	30	44
150	64	7	17	57
190	36	0	0	36
250	110	47	31	63
300	162	72	35	90
400	67	59	2	8
500	52	27	25	25
650	12	12	0	0
総計	681	358	140	323
ST除く	535	224	140	311

