Ref : D.Ph.II/AM/ge

Date : 31.8.1970

Memorandum

To : Prof. J. Steinberger

From : SFM Detector Group

Subject : SFM Instrumentation

In this memorandum we summarize the group's activities and program. We separate into the sections of

1. SFM detector;
2. peripheral preparations;
3. pre-magnet operation;
4. budget and personnel.

cc : Director General
Prof. Ch.Peyrou
ISRC (25)
Mailing list

1. DETECTOR, i.e. proportional chambers and corresponding wire electronics. The work of the group until now consists of :

(i) systematic investigation of proportional chamber properties with respect to time resolution, spatial resolution, efficiency, efficiency as a function of the angle of incidence, and gas composition;

(ii) design, construction and tests of a large prototype chamber (fig.1) The active area is 44 x 161 cm^2, the total vertical height of 52 cm is adapted to the gap height of the SFM and a standard ISR vacuum pipe. The dimensions of the epoxy-fiberglass frame were reduced, and towards the vacuum chamber full sensitivity at 18mm from the outer chamber edge was obtained. The prototype chamber has three sensitive planes of 0^o, and $\pm 60^o$, and a total of 1400 wires;

(iii) development of the wire electronics and construction of 4 prototype cards with a total of 128 channels. A technique making use of standard integrated circuit chips and discrete components is applied.

Based on the experience with the prototypes, the group envisages the construction of a "zero series" consisting of

- 4 chambers of one type with the active dimensions 38 x 153 cm^2 and 3 planes with modular construction ;
- 5000 channels of wire wlectronics.

This series can be constructed until the beginning of 1971, and made operational as a system, including a decision logics interface and computer, during the year 1971.

In order to investigate new construction methods and to imporove on geometry, a research program will be performed in parallel. The study consists of the following steps :

(i) adaption of the detector geometry to the dimensions of the magnet gap, the vacuum chamber and the shims on the incident beams. The final dimensions of the latter two will become available during 1970;

(ii) further chamber developments in order to reduce dead regions due to chamber frames. Dramatic reduction of frame dimensions cannot be expected in the present construction technique, so that improvements should come from self supporting planes with transparent frame constructions (honeycomb);

(iii) development of chambers for the downstram compensators; these are small chambers which require minimum frames;

(iv) development of chambers for the central region;

(v) integration of the wire electronics for the full system. The techniques exist, first contacts with industry were established, the organisational and financial implications have to be settled.

The study must be concluded not after april 1, 1971. At that moment a decision has to be taken on the final layout of chambers to be installed in the SFM by the end of 1972. Production should be organized before April 1971. A time schedule is given in table 1.

Fig. 2 and 3 show a tentative layout of a main detector using the present fiberglass technique. Table 2 represents a list of chambers, adding up to a system of 48000 wires.

Fig. 4 and 5 gives a tentative layout of a detector based on a "transparent frame" technique the feasibility of which has to be shown. The chamber list in table 3 results in a system of 57000 wires.

Compensator chambers have to be added (~6000 wires).

Detailed calculations have been formed to optimize position, size and acceptance, and methods for track finding have to be developed.

2. PERIPHERAL PREPARATIONS for the SFM facility at I4 are proceeding, with most of the work being done by support groups from DD, ISR NP and TC.

(i) Construction of a control room (available March 1971);

(ii) purchase of the on-line computer EMR 6130 (installation at I4 March 1971); link to the Omega main computer CII (operational 1972);

(iii) development of a data acquisition system on the Omega EMR 6130;

(iv) development of a data analysis system with magnetic field representation,

track recognition and geometrical reconstruction;

(v) other items :
- read-out electronics
- decision logics
- automatic gas handling system
- computer controlled a.d.c. for voltage and pressure measurement.

3. PRE-MAGNET OPERATION at the ISR. From the beginning of ISR operation a program of tests and experimentation will take place at the location of the SFM. The plans are summarized in the following:

(i) The tests will consist of the operation of a limited number of SFM chambers (zero-series) in a simple configuration, using the final components for logics, interface, computer, data acquisition system and a simplified version of a data analysis;

(ii) the experimentation will aim at a study of the particular environment at the ISR, problems as trigger conditions for beam-beam interactions, vertex reconstruction, background processes;

(iii) after the implementation of the equipment the physicists of the group plan physics measurements. The ISRC has requested and received a proposal on the possible scope of these measurements (CERN/ISRC/70-5). The approval gives priority to tests of the SFM equipment and the installation of the magnet.

4. BUDGET AND PERSONNEL

In a memorandum to Prof. G. Cocconi and Ch. Peyrou from October 20th 1969, the group requested a total budget for 1970-71-72 of 8.21 MsFr. including computers (~2 MsFr.). We still consider this request as adequate. For 1970 a budget of 0.75 MsFr. was attributed.

In a memorandum to the same persons from October 24th 1969, we requested a total of 8 new posts for the year 1970. 5 posts were attributed, 2 are filled.

Table 1

TENTATIVE TIME-SCHEDULE

(1.9.1970)

	Wire Chambers		Electronics	
September 1970	prototype		prototype	
	Construction of 4 chambers	Study of new construction methods	Construction of 5000 Channels (discrete)	Study of integration
April 1971		design		design
	D E C I S I O N			
	Construction of complete detector			
October 1972	Beginning of Installation			

TABLE 2

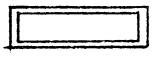
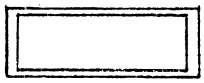
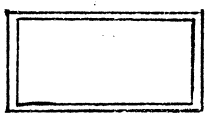
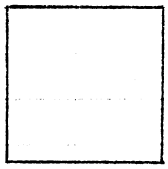
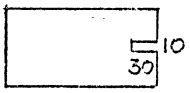
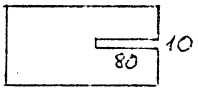
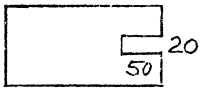
CHAMBERS	DIMENSIONS	SHAPE	WIRES
24 OF TYPE 1	38 x 153		29 100
8 OF TYPE 2	76 x 230		12 300
4 OF TYPE 3	114 x 230		6 900
36 CHAMBERS (WITHOUT COMPENSATOR)			48 300

TABLE 3

CHAMBERS	DIMENSIONS	SHAPE	WIRES
A, B, C, D	200 x 200		10 000
E, F, G, H	200 x 100		8 000
K, L, M, N, O, P I, J	200 x 100 CUT		15 500
Q, R, S, T, U, V	200 x 100 CUT		14 000
W, X, Y, Z	200 x 100 CUT		8 200
a, b, c, d	60 x 16		1 400
30 BIG + 4 SMALL CHAMBERS (WITHOUT COMPENSATOR)			57 100

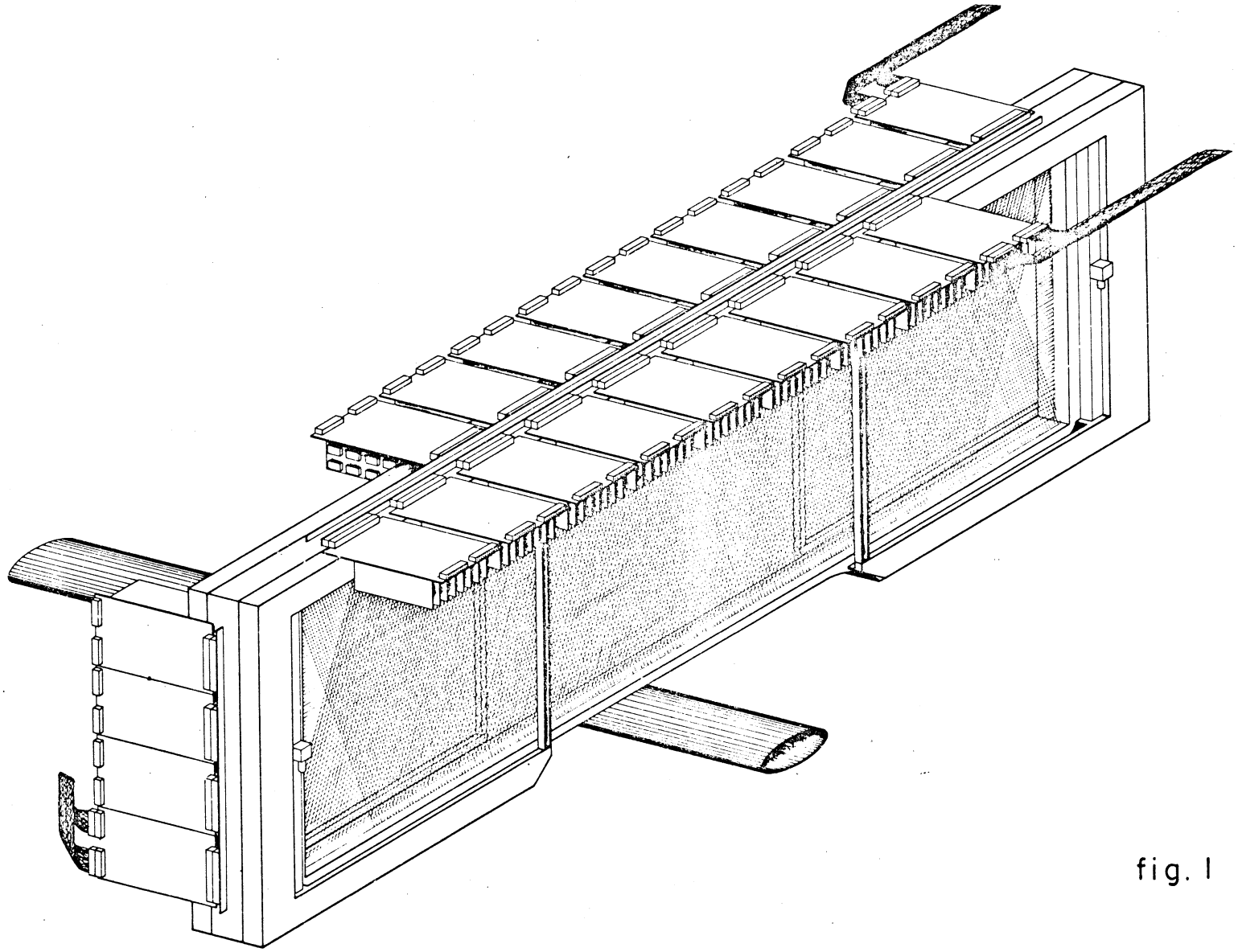


fig. 1

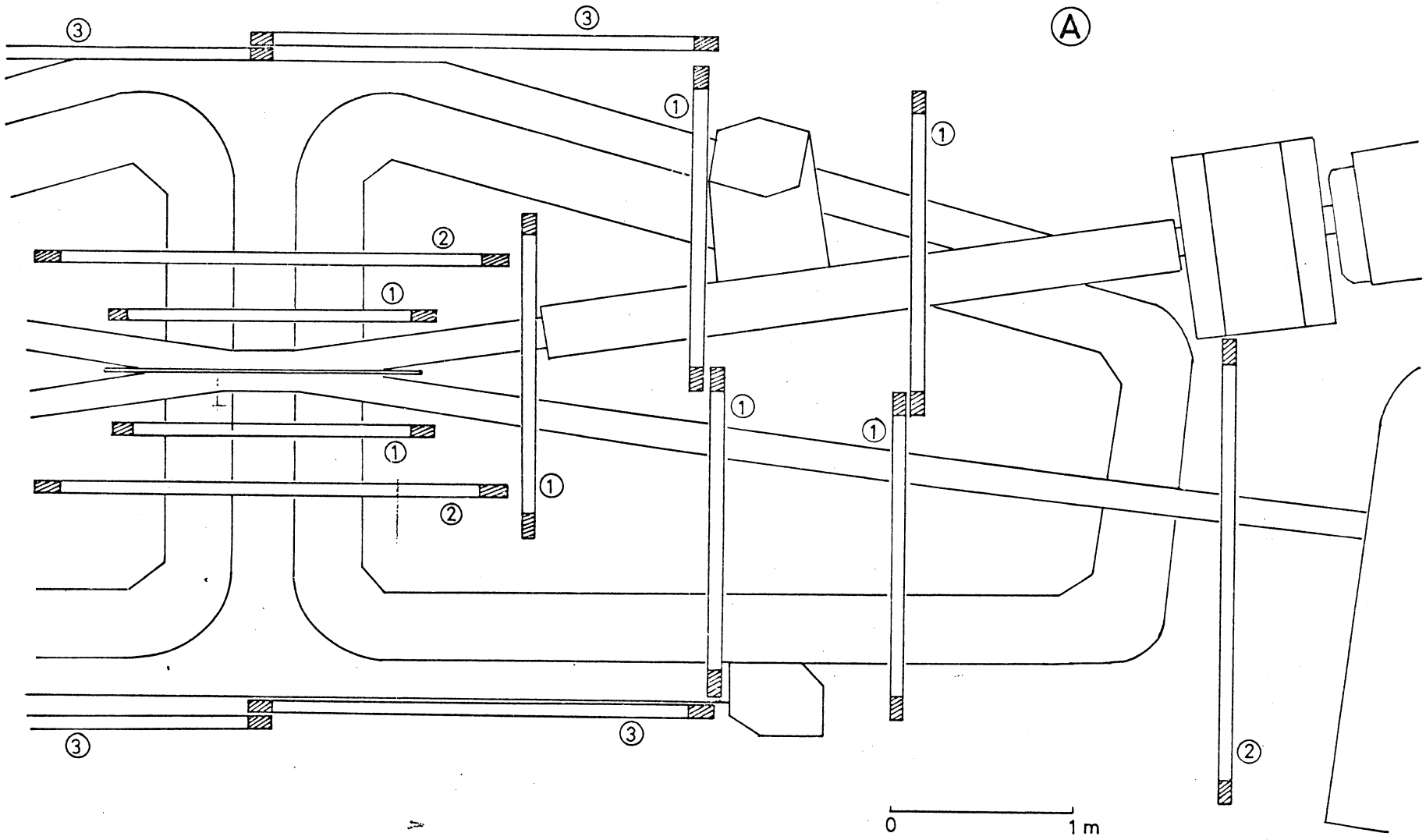


fig. 2

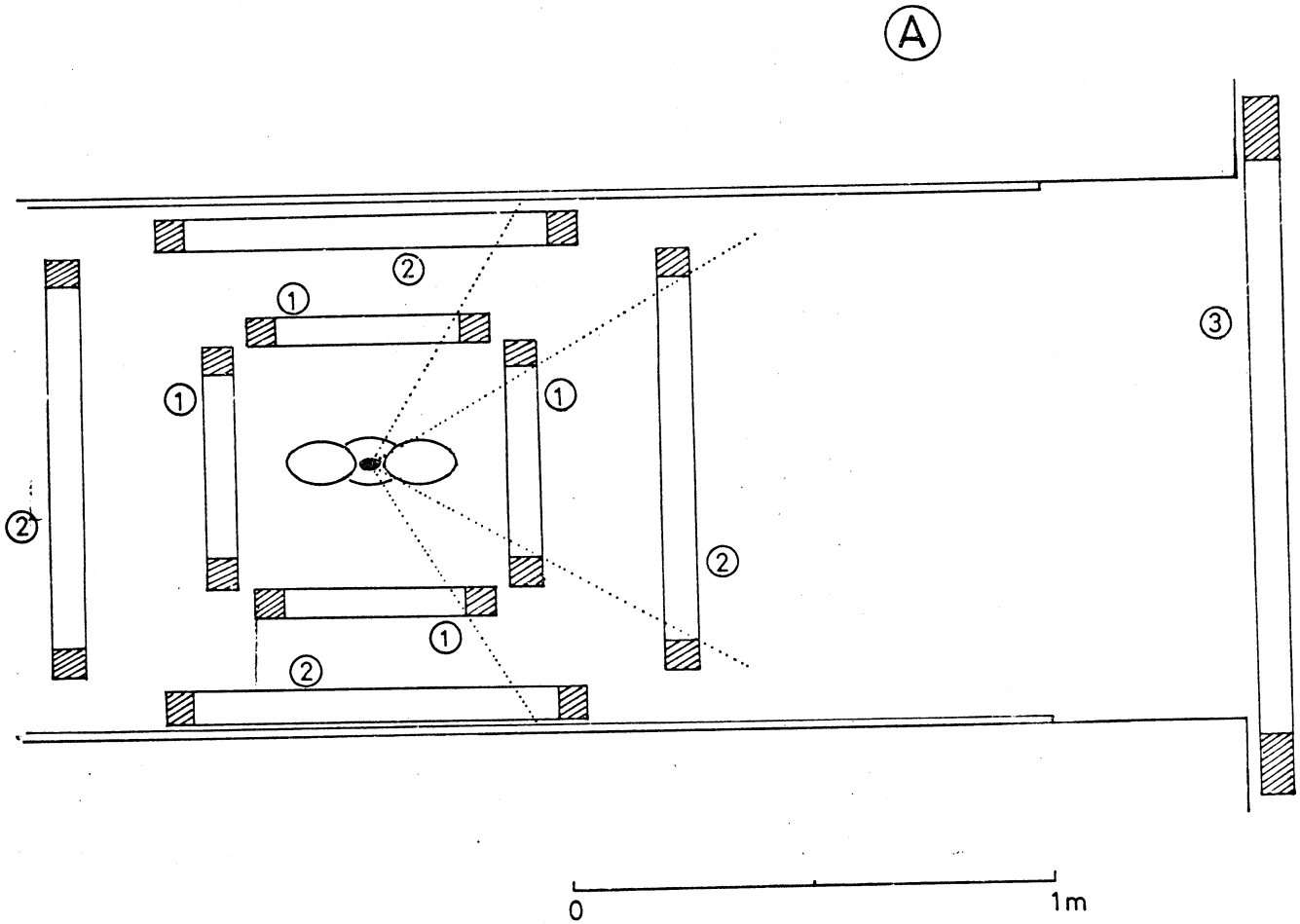


fig. 3

4-pit
0
1m

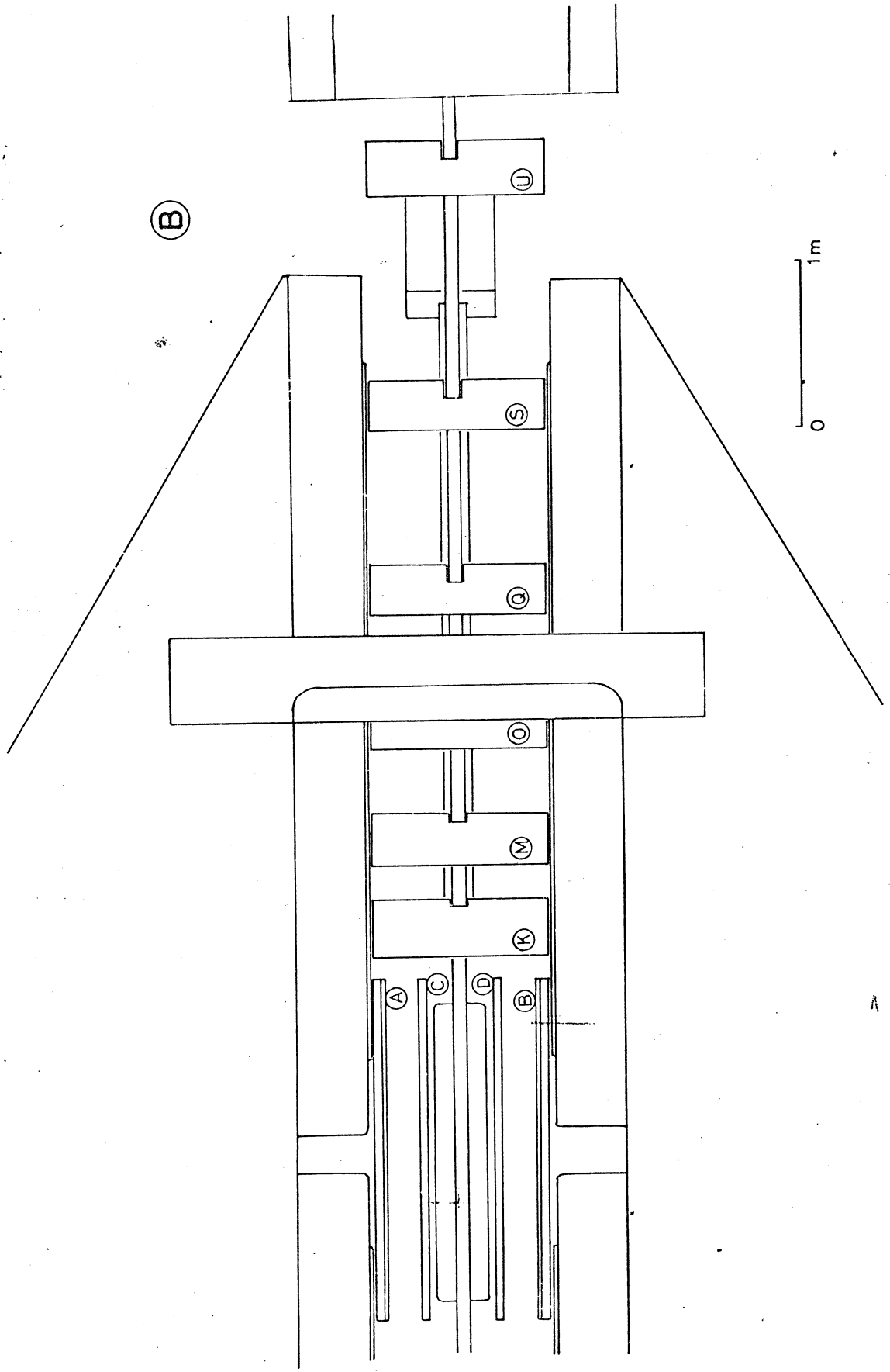


fig.5