October 17, 1968
IK/ch

The shielding of the local control room and the two equipment rooms in the ejection building in Serpukhov

I. Kamber

During years of operating and constructing the multi-megawatt pulse equipment for fast ejection and pulsed beam transport at CERN it has proved overwhelmingly difficult to eliminate the interference between adjacent high level pulse equipment. Furthermore virtually every measurement is rendered impossible near this working pulse equipment. In view of this and in view of the great number of such equipment concentrated in this building, it is judged essential to group the high voltage pulse equipment on one hand and high current pulse equipment on the other hand in two separated, shielded rooms. In addition the local control room must be shielded. Failing to follow these recommendations will result in a loss of many months time in "debugging" the systems, with a remaining probability of inadequate results. Following preliminary indications about this matter at the joint meeting of ejection experts in November, 1967 and discussions between Serpukhov and CERN specialists around this problem in March 1968 and June 1968, the present paper formulates specifications for the shielding, doors, windows, cable traverses and earthing of these rooms.

The following description shows a fundamental design idea for Faraday rooms which does not necessitate special cares during the construction of the building itself. Such Faraday rooms are already existing in some institutes similar to CERN.

The use of wire meshes, even very fine ones, for covering the floor, the walls and the ceiling are not recommended because :

a) The shielding efficiency is a function of the frequency. Fig. 1 (Break down of the damping characteristics in function of the frequency).

b) The technical difficulties to weld or solder the wire grids to wire grids and the grid to window and door frames.

c) The perturbated passage for cooling air and day-light through a fine wire grid. In particular the cooling air will be filtered by a mesh and the holes are closed by dust rather soon.

Guidelines for Faraday Rooms

1) The rooms must be laid out completely with steel plates (Fig. 2).

2) The welding seams must be absolutely tight. Also the welding seams to the door and window frames must be welded tight together, since screwed contact lines are not sufficient (Fig. 3).

3) The bolts for the steel plate fixation are shown in (Fig. 4).

4) The frames for all openings in the room : ventilation, windows, cable passages and doors shall be equipped with a high frequency gasket. These gaskets must clean the contact surface themselves (Fig. 5).

5) In the cooling air inlet and the window frames, diaphragm should be inserted which guarantees a good damping for frequencies between 100 kc/s and 1000 Mc/s (Fig. 6).

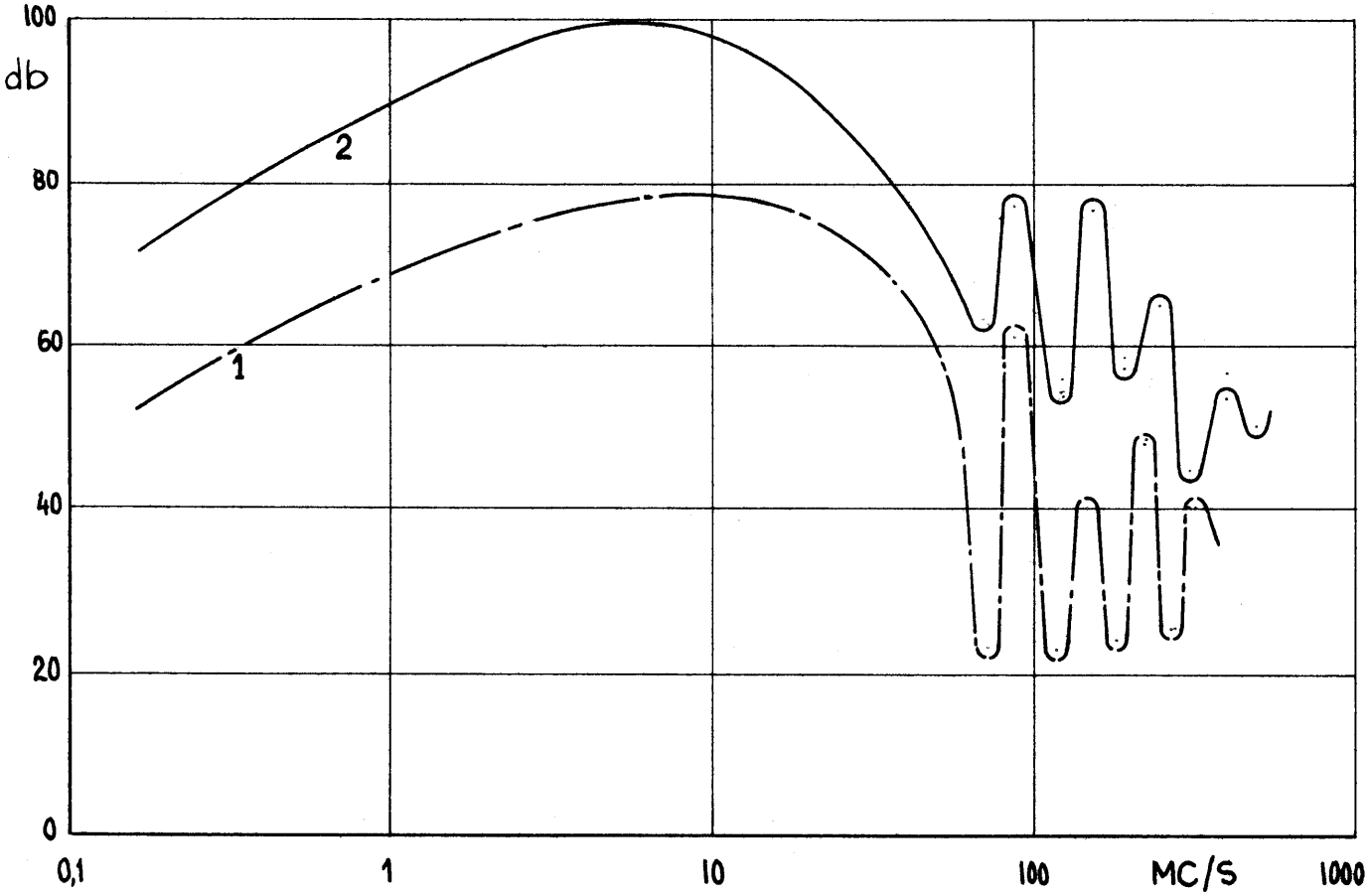
6) No Faraday room is better than its weakest point. Therefore, special care should be given to the mains feed-through. Multisection filters are certainly required, at least for the main control room. These filters must be mounted with their housings tight to the Faraday room shields. Fig. 7 a,b,c,d.

7) For the cable passages between the equipment rooms and the main control room and between the equipment room and the magnet area, special feed-through should be designed taking account of the character of the signal. This study may be realized later because all these feed-throughs are mounted on a plate with the same high frequency gasket as the window and doors. This plate can be inserted simply in a late state of the equipment installation (Fig. 8).

8) The pillars of the double floor which carry the equipment should be put on to the ground steel plate and not be fixed in the floor concrete plate. The feet of the double floor construction shall be welded together with the ground steel plate (Fig. 9). Therefore the floor plate must have a reasonable thickness ($\sim 3 \div 5$ mm) otherwise it will be difficult to weld the pillars and the floor plate together.

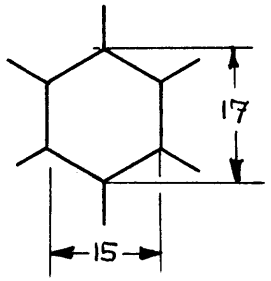
9) All shielded Faraday rooms must be grounded with individual earth cable - not the mains earth. The earth cable must terminate on an individual ground plate.

DAMPING CHARACTERISTICS OF DOUBLE WALL WIRE GRID CAGES

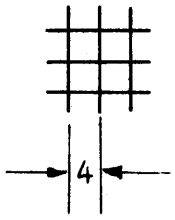


CAGE DIMENSIONS 3 m x 3 m x 3 m

MATERIAL STEEL GRID FIRE ZINC PLATED



CURVE 1



CURVE 2

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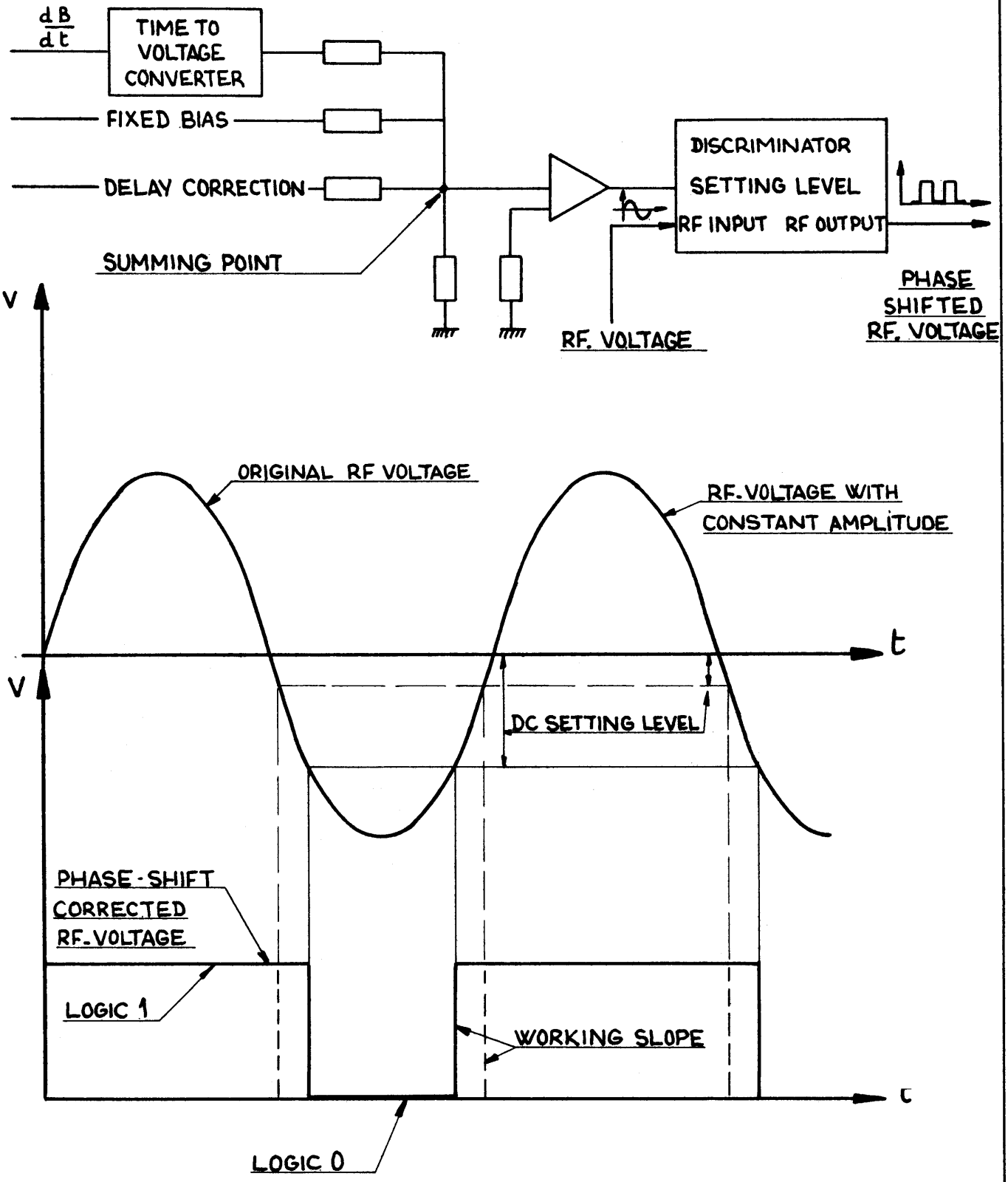
FIG. 1

300-185-4



CIRCUIT FOR THE PHASE SHIFT CORRECTION

CERN. PS/FES TN 34

FIG 2

300-174-4

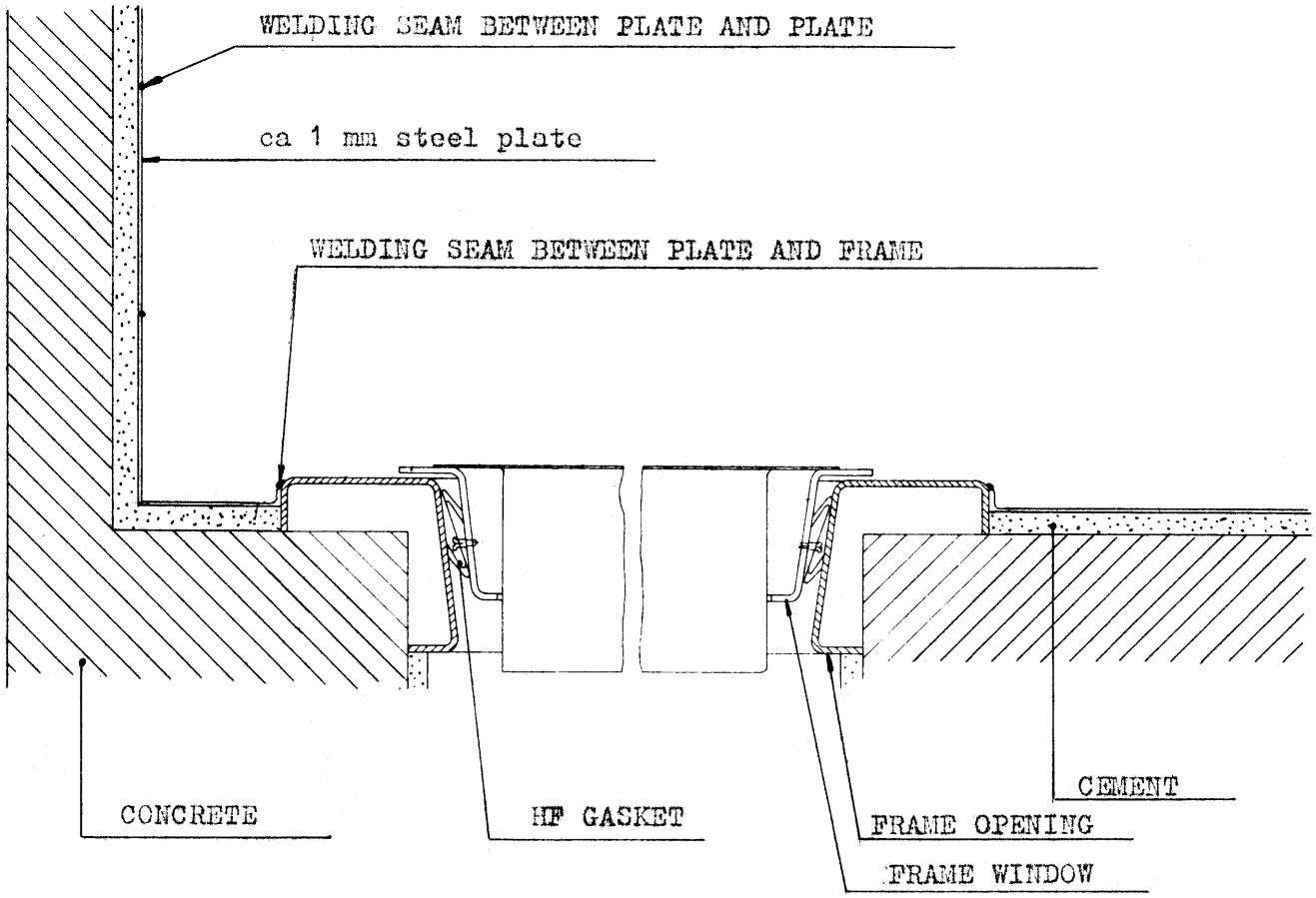
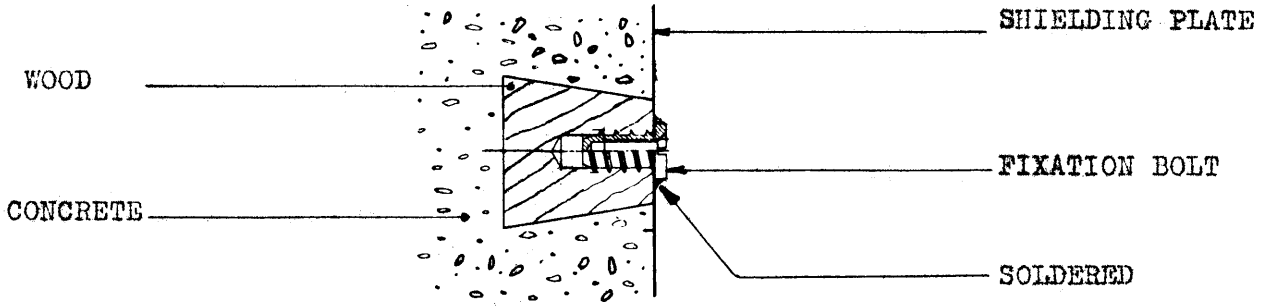
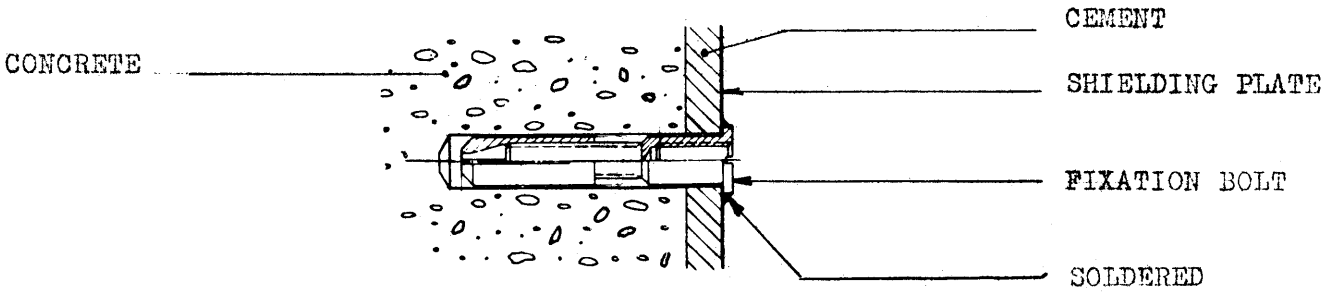


FIG 3

300-175-4





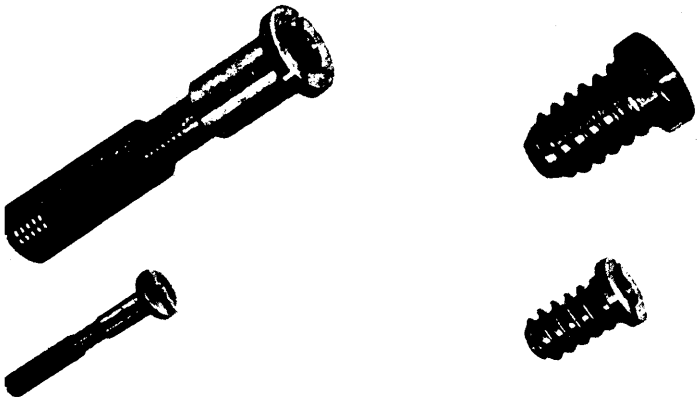
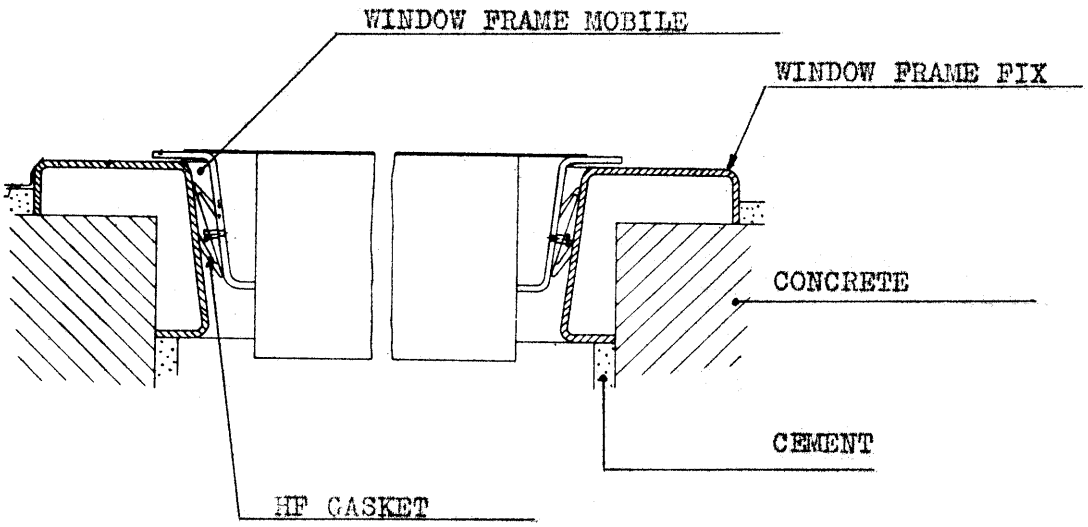
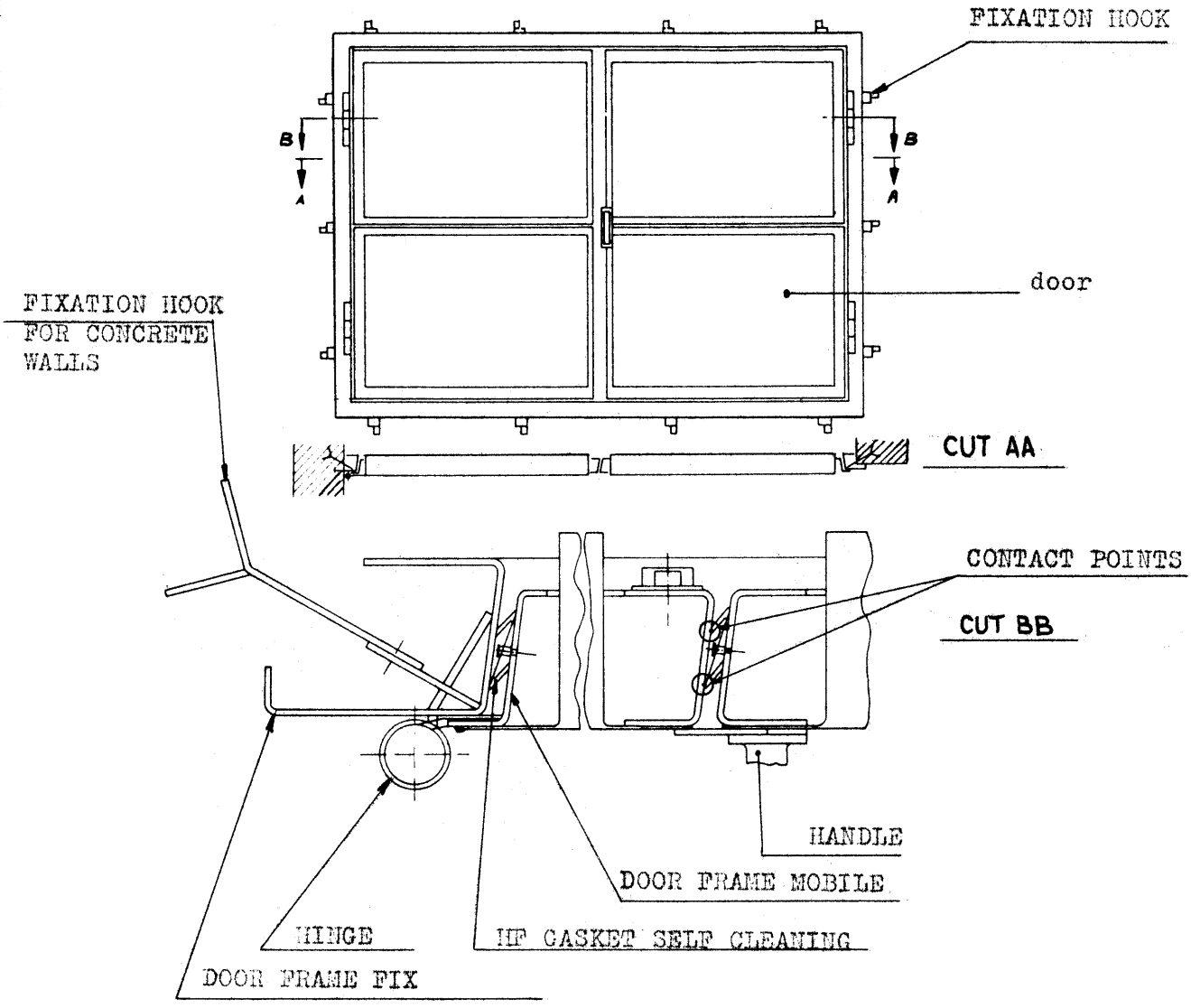
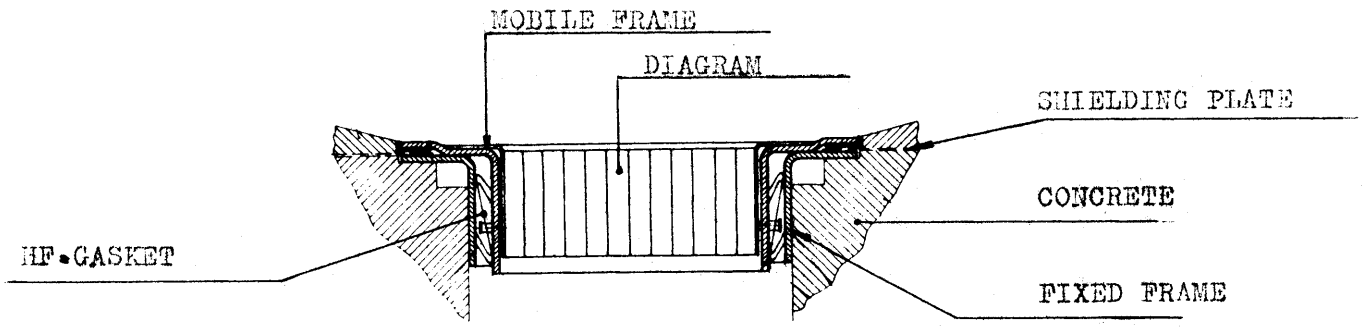


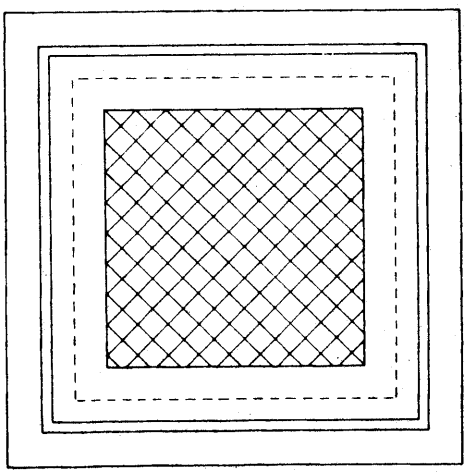
FIG 4

300-176-4


WINDOW FRAME MOBILE
WINDOW FRAME FIX
CONCRETE
CEMENT
HF GASKET


FIXATION HOOK
B
A
B
A
door
FIXATION HOOK FOR CONCRETE WALLS
CUT AA
CONTACT POINTS
CUT BB
HANDLE
DOOR FRAME MOBILE
HINGE
HF GASKET SELF CLEANING
DOOR FRAME FIX





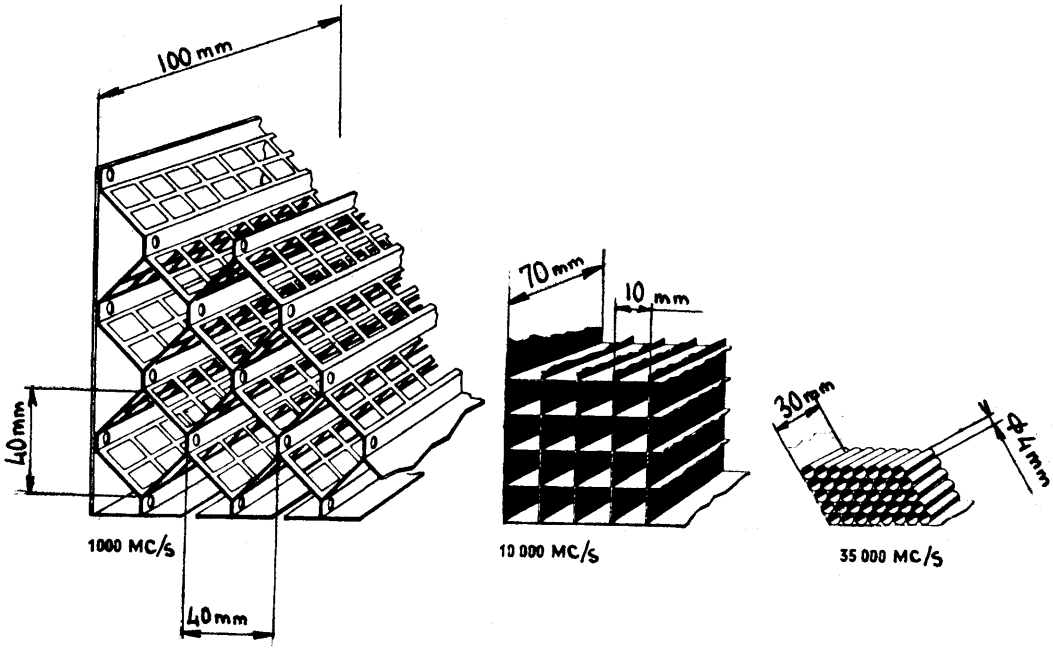


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FIG 6

300-178-4

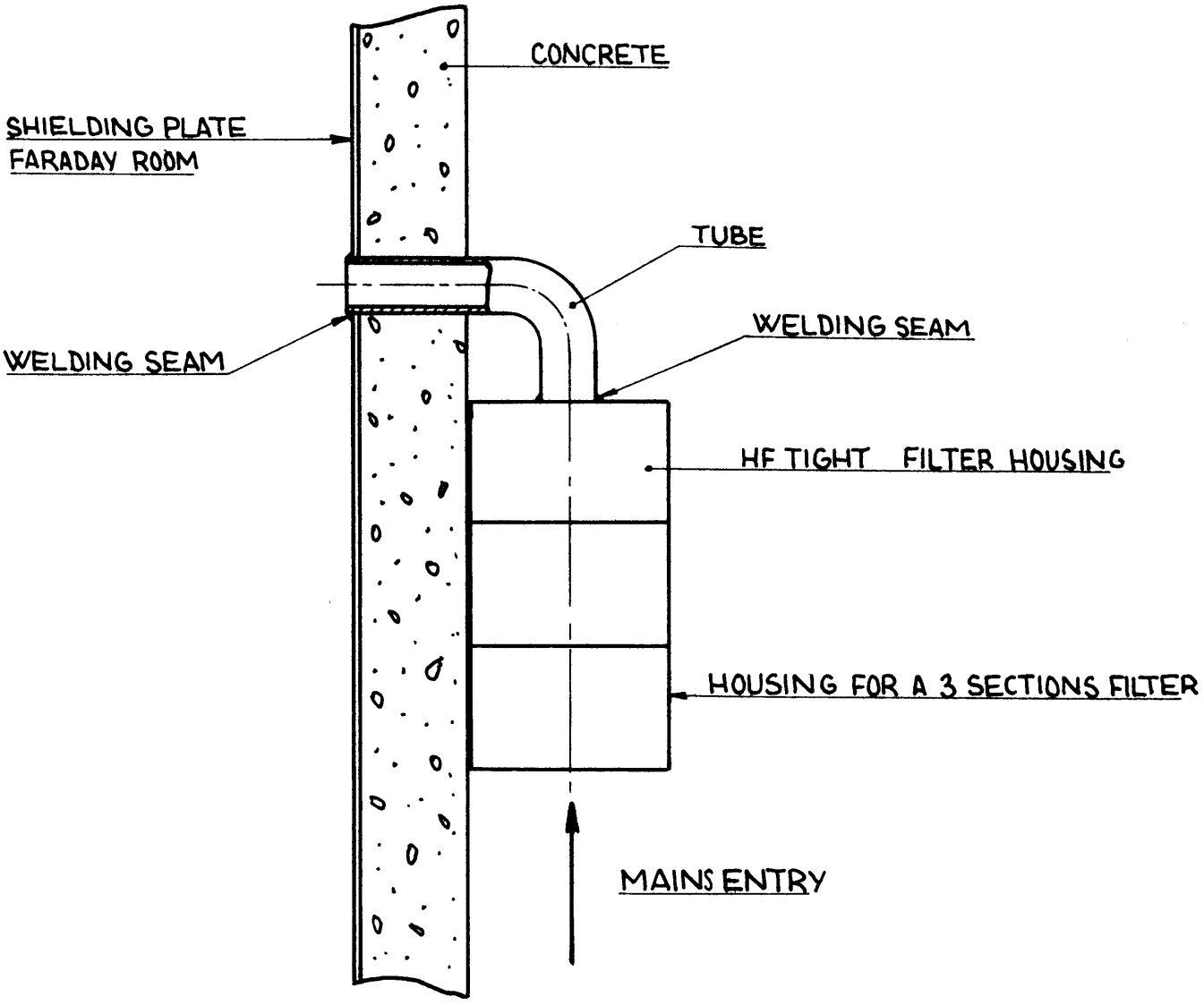

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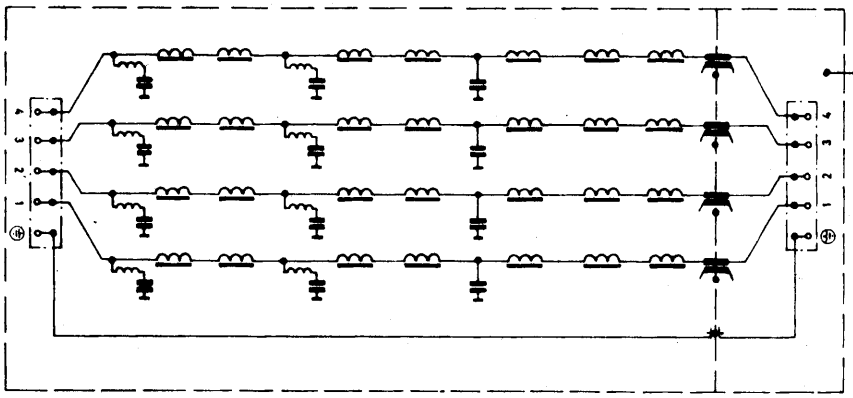
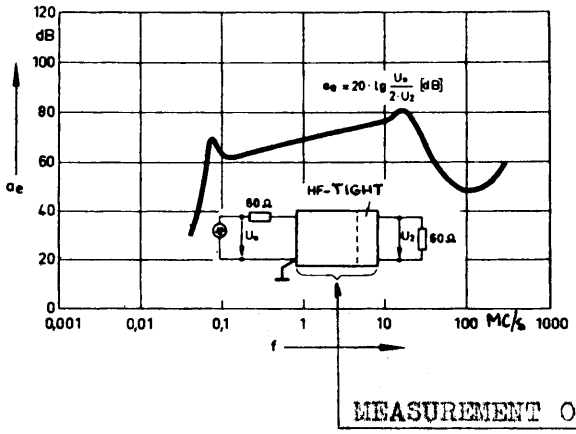
FIG 7A

300-179-4

HIGH VOLTAGE 3 SECTIONS π FILTER



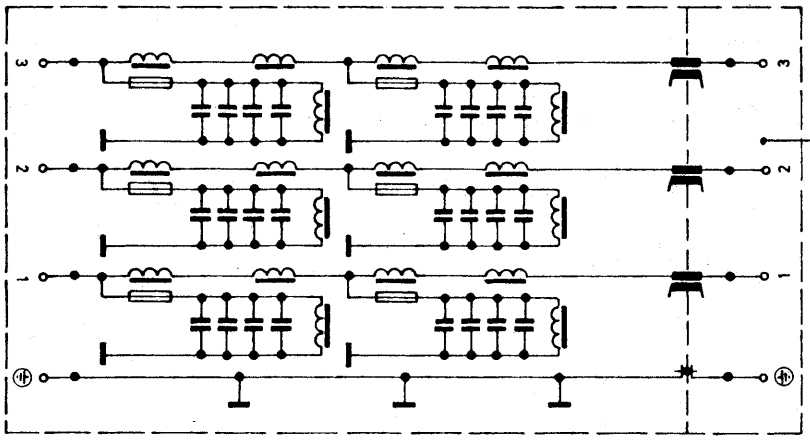
DAMPING VERSUS FREQUENCY



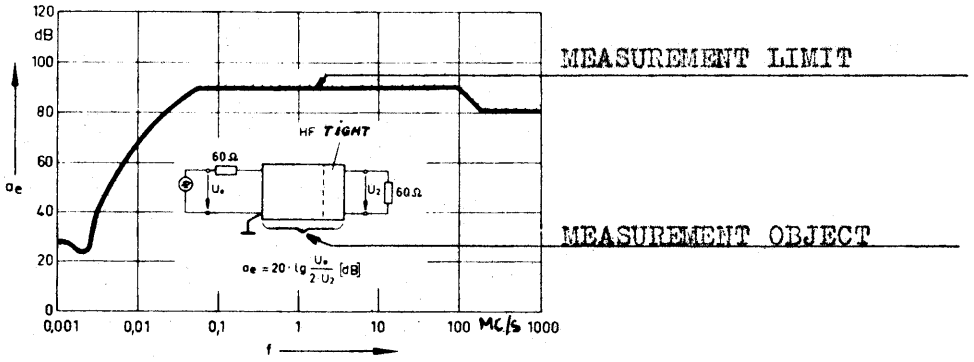
Nominal voltage	6000 v DC or AC
Nominal current	200 A
Number of lines	4
Capacity per line	1.75 µf

FIG 7B

380/220 V 50 c/s **AC** 3 SECTIONS π FILTER



DAMPING VERSUS FREQUENCY



Nominal voltage 380/220 V 50 c/s

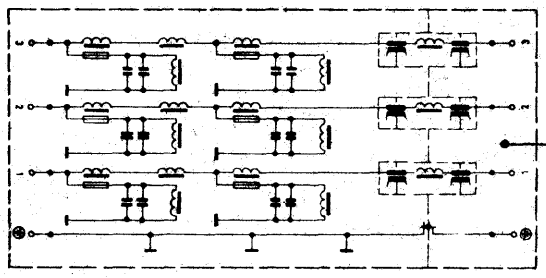
Nominal current 290 A

Number of lines 3

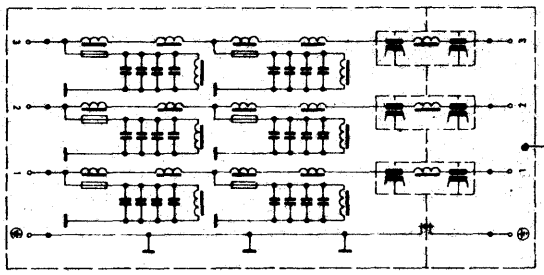
Capacity per line 280 µf compensated for c/s

380/220 V 50 c/s 3 section π Filter

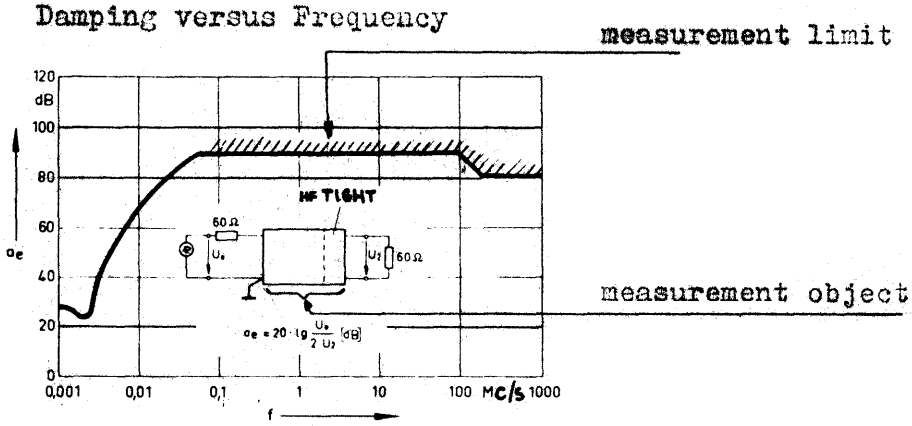
Version 1



Version 2



Damping versus Frequency



Nominal voltage 380/220 V AC 50 c/s

Nominal current 60 A Version 1 150 A Version 2

Number of lines 3

Capacity per line 140 µf version 1 280 µf version 2
compensated for 50 c/s

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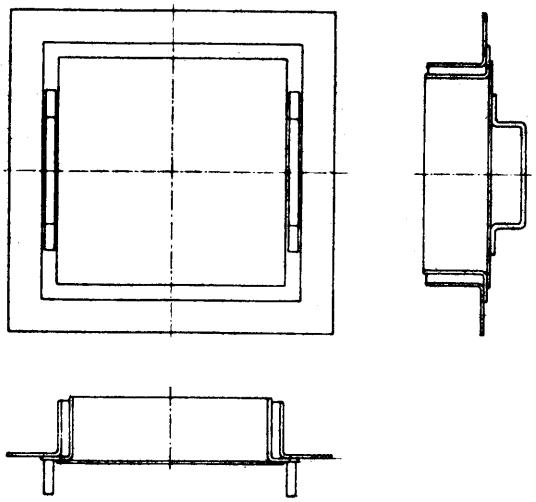
FIG 7D

300-182-4



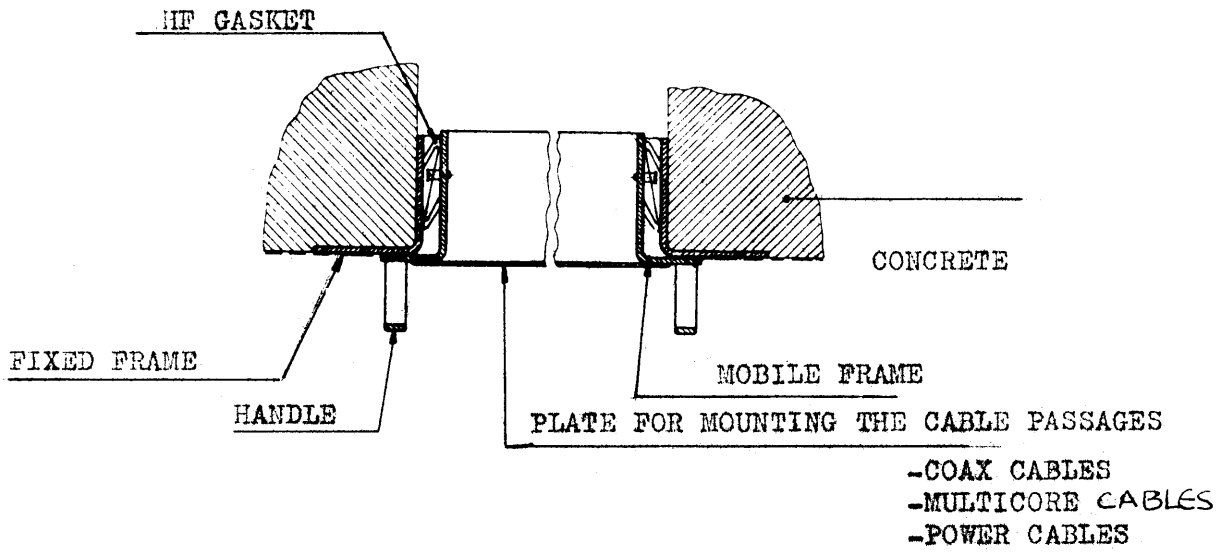


FIG 8

300-183-4

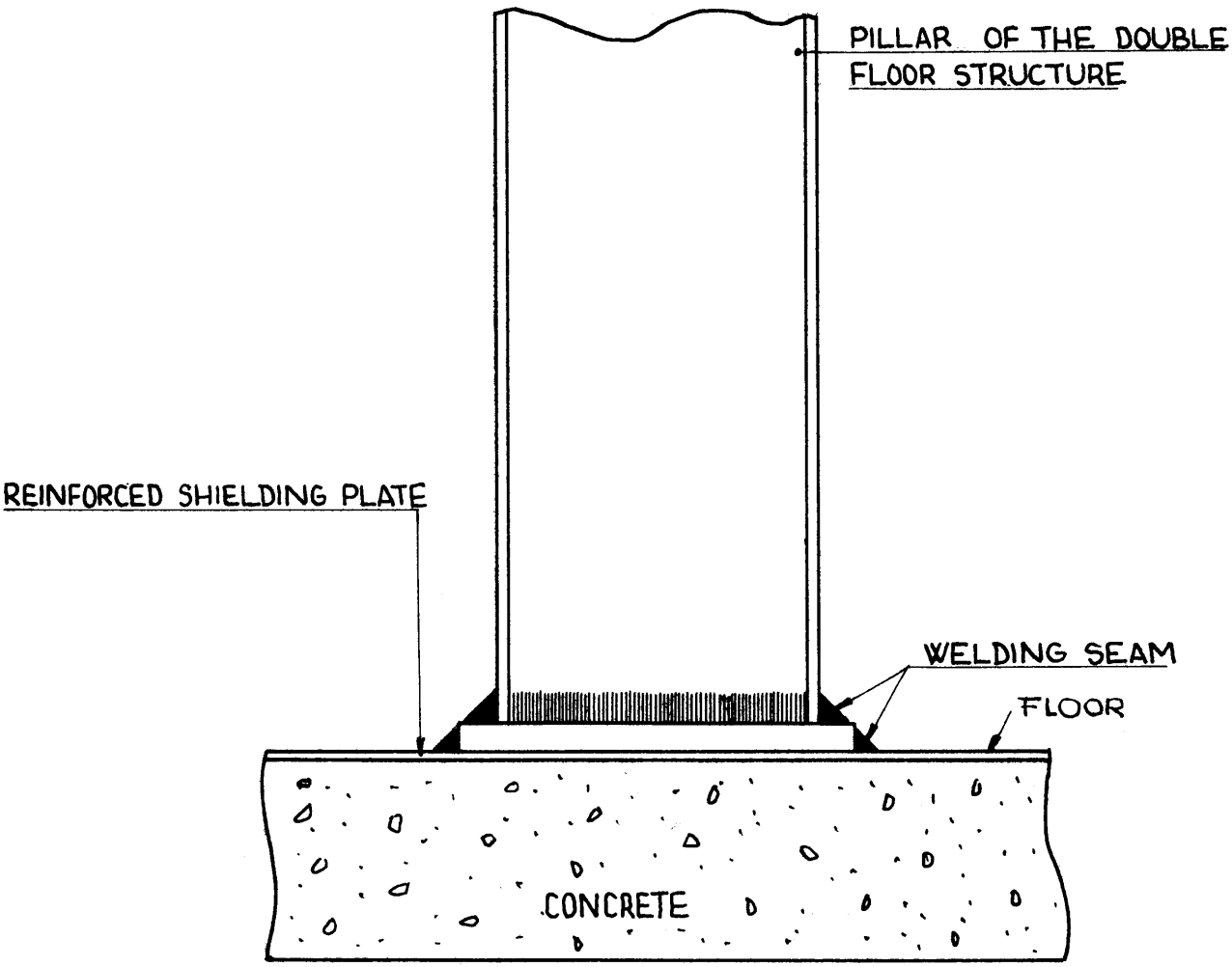


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FIG 9

300-184-4