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GIHOC PHARMACEUTICALS CONSULTANCY SERVICES, PHASE II.

SI/GHA/75/818.

GHANA.

Technical report: Pharmaceutical industry construction.

Prepared for the Government of Ghana by the
United Nations Industrial Development Organization,
executing agency for the United Nations Development Programme

Based on the work of Fritz Brennig, expert in construction

United Nations Industrial Development Organization
Vienna

id. 78-4316

Explanatory notes

References to dollars ($) are to United States dollars.

The monetary unit of Ghana is the new cedi (N¢). During the period covered by this report, the value of the new cedi in relation to the United States dollar was $1 = N¢ 1.15.

A full stop (.) is used to indicate decimals.

A comma (,) is used to distinguish thousands and millions.

GIHOC refers to the Ghana Industrial Holding Corporation.

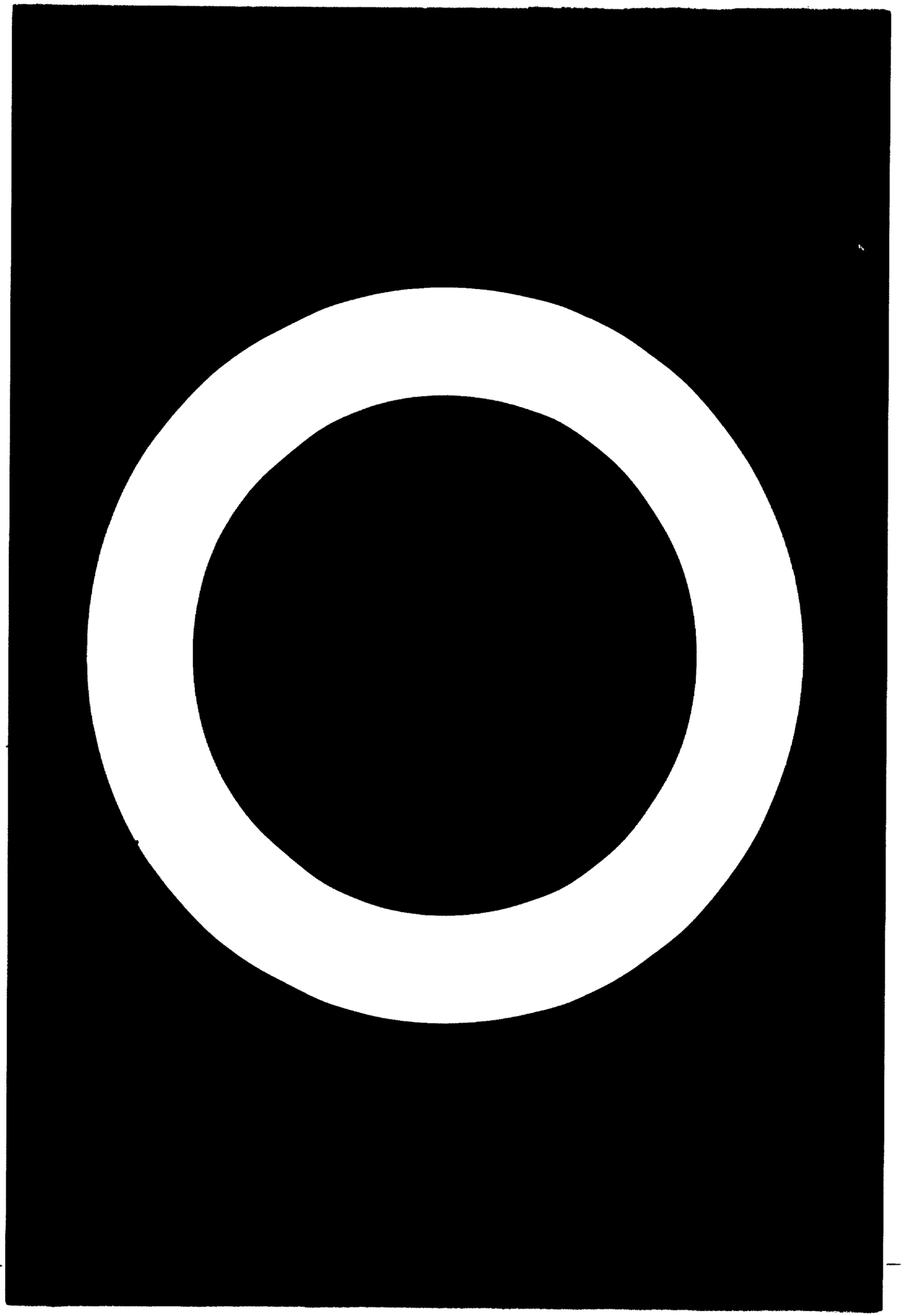
ABSTRACT

At the request of the Government of Ghana to the United Nations Development Programme (UNDP), a construction expert was sent on a six-month mission, later extended by eight months, to advise the Pharmaceutical Division of the Ghana Industrial Holding Corporation (GIHOC) on the construction of a new warehouse and production block. The expert also advised the contractor on the manufacture of prefabricated structural elements, the use of which reduces construction time considerably.

The project, entitled "GIHOC Pharmaceutical Construction Consultancy Services"(SI/GHA/75/818) began on 2 February 1977 and ended on 2 April 1978. The United Nations Industrial Development Organization (UNIDO) was the executing agency.

The expert was financed for six months from a voluntary contribution to UNIDO from the Federal Republic of Germany, two months from UNDP country programming funds, and six months from UNIDO Special Industrial Services (SIS) funds.

The expert strongly recommended that reinforced concrete to be used in the construction of the new building instead of an imported steel construction.



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INTRODUCTION

At the request of the Government of Ghana to the United Nations Development Programme (UNDP), a construction expert was sent on a six-month mission, later extended by eight months, to advise the Pharmaceutical Division of the Ghana Industrial Holding Corporation (GIHOC) on the construction of a new warehouse and production block. The expert also advised the contractor on the manufacture of prefabricated structural elements, the use of which reduces construction time considerably.

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The expert was financed for six months from a voluntary contribution to UNIDO from the Federal Republic of Germany, two months from UNDP country programming funds, and six months from UNIDO Special Industrial Services (SIS) funds.

GIHOC Pharmaceutical Division was provided with a construction adviser for an additional eight months to assist in the finalization of the layout and the detailed planning of GIHOC Pharmaceuticals' new warehouse and production block. The adviser also provided construction advisory services to the contractor in the manufacture of prefabricated structural elements,the use of which reduces the actual construction time considerably.

The pharmaceutical factory at Kwabenya was built between 1965 and 1967 at an approximate cost of N¢ 3 million under a prefinancing arrangement between the Government of Ghana and the French firm of Sodefra. It was commissioned in January 1970, having been idle for about two years, and embarked on full-scale production as a division of the Ghana Industrial Holding Corporation.

The factory was originally designed to produce 100 million tablets and 1 million ampoules annually. However, owing to increased demands for the division's products, currently about 60 items, production has been increased considerably under extremely difficult conditions.

At full capacity, on double-shift operations, the current maximum output per annum is as follows:

700 million tablets (three-shift operation)
28 million capsules (two-shift operation)
6 million ampules (two-shift operation)

representing an annual turnover valued at approximately N¢ 7.0 million, or just under 20% of the total value of drugs currently consumed in the country.

The production level of the factory could obviously be raised to meet a greater proportion of the country's drug requirements. More important still, the current production lines exclude the division, which is the biggest Ghanian wholly owned pharmaceutical factory, from the more profitable areas of drug manufacture, such as syrups, suspensions, ointments, creams, antiseptic powders and vials.

The main problems of the division are due to limited production space, limited production machinery and inadequate warehousing facilities.

There are virtually no storage facilities at the factory for raw materials, packaging materials and finished goods. Almost all raw materials and packaging materials are stored in two rented warehouses, located six miles from the factory premises, and as much as 20% of the stock in the factory premises is stored in the open corridors. This situation reduces production efficiency and increases production cost.

The packaging section is too small and crowded to permit efficient and modern packaging methods. Work in the section often lags behind production.

The Quality Control Department is inadequate both in terms of equipment and space. As a result, it is unable to cope satisfactorily with the factory's increased production.

The Tabletting Department, which also has inadequate space and equipment, requires the most urgent attention. As indicated above, this department, which was originally intended to produce 100 million tablets, is now producing seven times this figure. However, of the 700 million produced annually, only 150 million are processed from raw materials. The rest is obtained from semi-finished or granular forms imported from different manufacturers, which makes it difficult for the division to guarantee uniform quality for all its products. Furthermore, the 700 million tablets that the division is currently producing constitute approximately 55% of the drugs the Ministry of Health requires annually from the division. To be able, therefore, to meet the requirements of the Ministry of Health and also those of the private sector, it is proposed that a new tabletting block be built to increase the division's current production of tablets by about 300%.

There is no research and development section to handle and test new products and improve the quality of existing drugs, activities that are essential in a viable pharmaceutical plant.

These difficulties clearly point to the need for expanding the division to increase production and cut down on the heavy imports of drugs into the country, which will increase the profitability of the division.

In specific terms, the objectives of the expansion programme are:

(a) Raising annual factory output from:

700 million to 2,000 million tablets
28 million to 100 million capsules
10 million to 25 million ampoules

(b) Introducing new machinery and equipment for manufacturing the following:

5 million units of antiseptic powders
5 million tubes of creams and ointments
3 million bottles of aerosols
3 million vials
0.2 million litres of syrups

Consideration will also be given to the production of vaccines.

In co-operation with the GIHOC Pharmaceutical Division, the construction adviser's assistance in the preparation of the design of the new warehouse has been essentially completed. The Quality Control Department will be housed in its own building.

The adviser, to ensure that the warehouse should be built in the shortest possible time, designed the building in reinforced concrete.

After consultations with a local concrete construction company, GIHOC and the construction adviser have decided to use the above-mentioned construction method for the following reasons:

(a) Actual construction time will take 6-8 months, instead of 1.5 years;

(b) Significant savings will be realized;

(c) The building can readily be extended according to needs;

(d) It permits flexibility in using space.

The tasks of the expert were:

To harmonize the preliminary design with the production flow

To evaluate bids of contractor and engineering service firms and to co-ordinate their activities subsequently

To plan in detail the machine installations, including the supply of water, electricity and gas

To design a central fire detection and extinguishing system

To select appropriate floor and wall materials

To determine requirements for room ventilation and air conditioning

The conception and implementation of flexible yet adequate design to meet not only the existing requirements but also the future needs of GIHOC

The work plan of the expert is given below.

Task	Duration (months)
Preliminary design	1
Work drawing and detailed drawing	2
Design of supply system and automatic fire detection and extinguishing system plus laboratories	2
Design of machine and equipment to be installed	1
Cost accounting and calculation of bill of quantity	1
Establishment of work plan for factory expansion project	1

I. FINDINGS

Warehouse

The planning of the warehouse was based upon the expansion programme of the Pharmaceutical Division after the new production block had been constructed (see annex II for the design and layout).

The capacity of the planned warehouse must be sufficient to store the raw materials for the increased production expected over the next 10-20 years and to store the anticipated finished product.

The plans for the building are based on a reinforced concrete construction and not on a steel construction. The most important advantages of a reinforced concrete construction over a steel construction are as follows:

(a) Local materials such as sand, cement and steel can be used;

(b) Local labour can be employed;

(c) The air conditioning as well as the overall standard of the building will be better (90%-100% atmospheric humidity means great susceptibility to rusting);

(d) The foreign exchange saved by not importing a steel construction, which would have to be completely insulated by foreign contractors because of storage of flammable chemicals, can be used to purchase raw materials urgently needed.

To sum up one may say that, considering the present stringent financial situation in the whole country, it would be extremely uneconomical to misuse the available letter of credit by unnecessarily importing a steel construction.

The construction of the warehouse can start immediately, since planning has been completed in detail. At present, a large amount of the raw materials stored in the warehouses of the Pharmaceutical Division is ruined through incorrect storage; the transport routes to and from the warehouses, which are dispersed through Accra, are too long, which puts an unnecessary burden on the vehicle pool. In addition, because it is scarcely possible to supervise the personnel working in the warehouses, difficulties in the provision of raw materials arise repeatedly. Thus, the construction of a central warehouse on the production site is urgent; further hesitation regarding the project will only bring about further, unjustifiable expenses.

Quality control

The original intention was to house the quality control centre in the new production block building, but after several discussions with the officials concerned, it was decided to build a separate building for quality control to avoid false readings from the instruments arising from extreme vibrations in the building brought about by the tablet presses.

For this reason, the expert was also charged with planning the quality control centre. The building, which is planned in accordance with the most modern standards of laboratory technology, could be one of the most modern quality control laboratories in Africa. All anticipated new inspection requirements for pharmaceuticals have already been taken into account in the planning.

The lack of space in the current premises does not permit the use of several new pieces of equipment already present there. In addition, the working areas are too small for the volume of work arising, and the building is to some extent out of date.

The planning of the new building has largely been decided upon. In addition, the detailed planning of the entire laboratory technical equipment has already been completed (for the design and layout, see annex III).

Production block

Working together with the local architect, the expert devised and planned the new production block. At the end of the expert's stay, the planning had been finalized to such an extent that the detailed planning could begin.

On the occassion of his last visit the Senior Industrial Development Field Adviser from UNIDO, Ivan F. Contreras, discussed with J.A. Blukoo-Allotey, General Manager of the Pharmaceutical Division, the production of oral contraceptives. It was estimated that the yearly requirements of oral contraceptives amounted to approximately 200 million tablets. However, with current efforts in the country to educate the rural community, the figure is expected to double or triple in the near future.

Because of this anticipated increase and because also of the possibility of exporting oral contraceptive tablets to neighbouring countries, it is estimated that the annual capacity of the contraceptive production unit should be about 400 million tablets.

A specially designed oral contraceptive section has been incorporated in the plans of the new production block. The expert planned this section alone, and the architect incorporated it in its entirety in his plans.

II. RECOMMENDATIONS

1. Construction of a central warehouse on the production site and quality control laboratory should start as soon as possible. The preparatory work on these buildings has been completed; the drawings are ready and the ground has been tested.

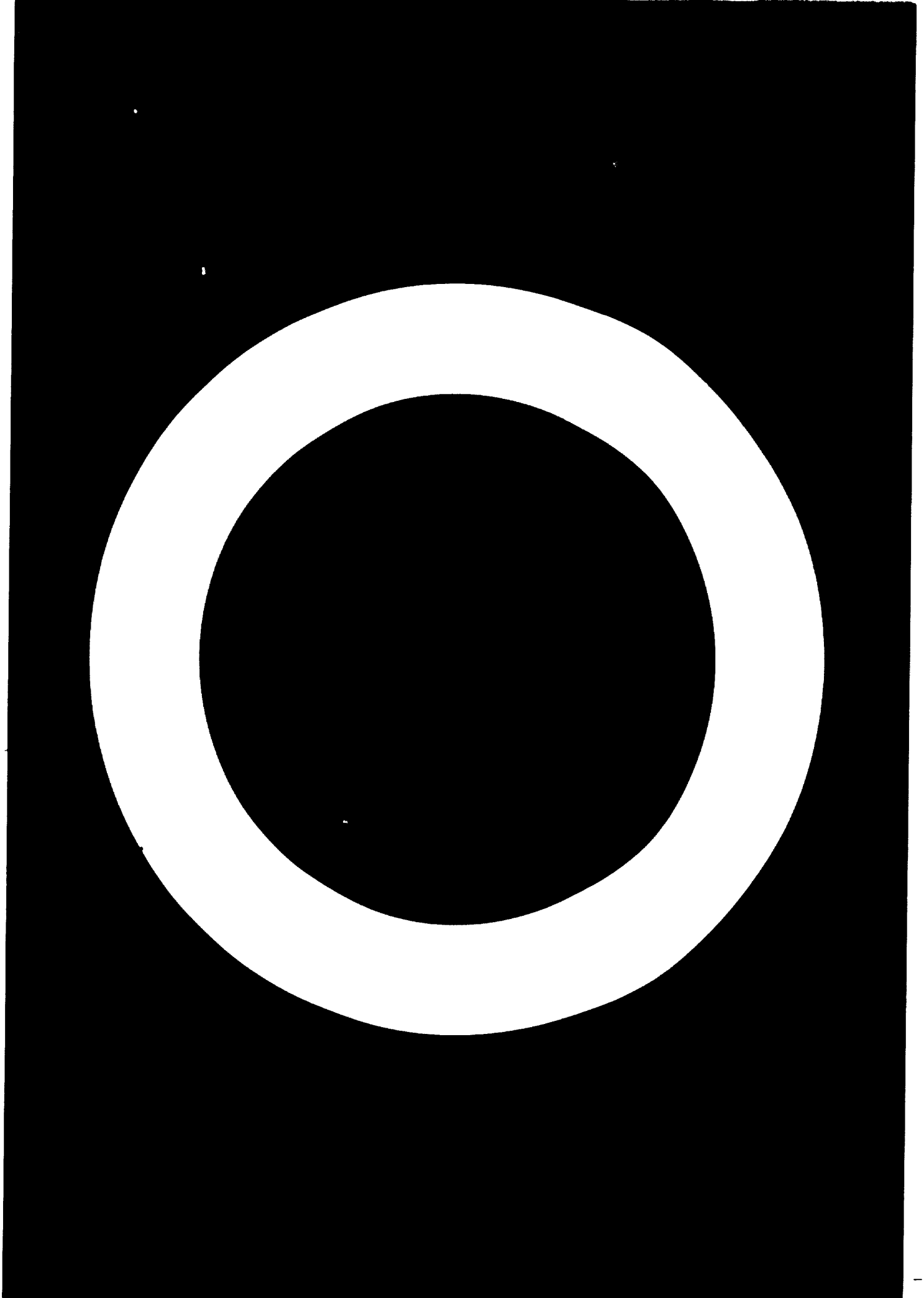
2. The warehouse and quality control laboratory should be constructed from building materials available in the country; it is not necessary to import a steel construction. Therefore, as described in the report, a building in reinforced concrete is recommended as the most appropriate.

3. Construction should be carried out by local companies according to the drawings and specifications shown in this report.

Annex I

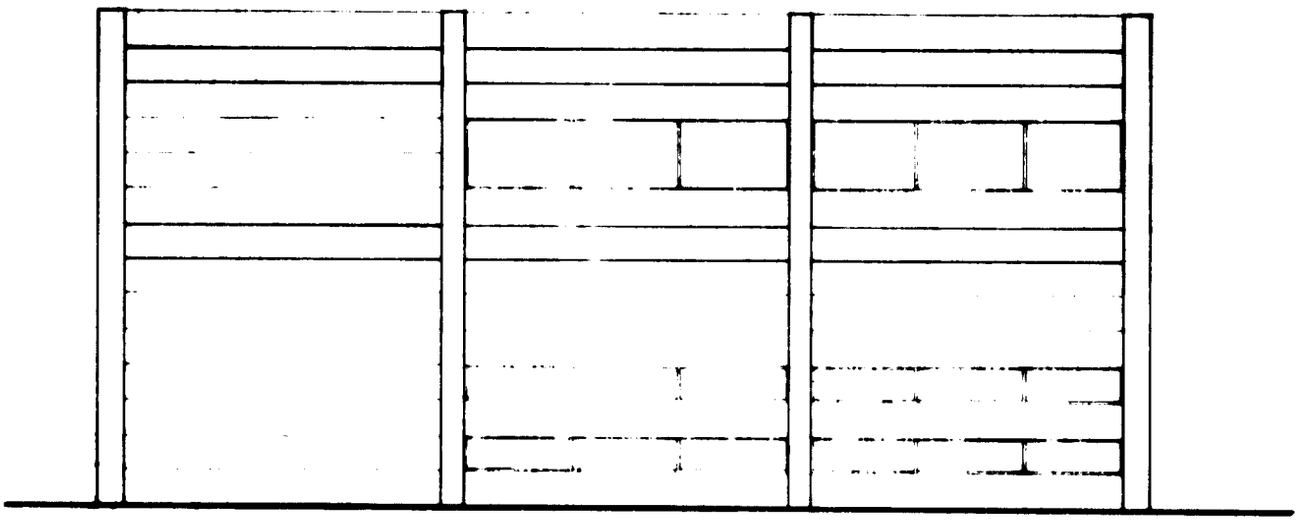
JOB DESCRIPTION

POST TITLE:	Construction expert
DATE REQUIRED:	February 1977
DURATION:	February 1977 - April 1978
DUTY STATION:	Accra, Ghana
DUTIES:	The expert will assist the Pharmaceutical Division of the Ghana Industrial Holding Corporation (GIHOC) in establishing a temporary pharmaceutical production unit in addition to the existing one. Specifically he will be expected to: Examine the possibility of using existing space for such a unit; Study in co-operation with GIHOC the layout of the planned warehouse and means of efficiently using part of it temporarily for production operations; Determine the production space needed for installing new equipment; Advise the local design team on all aspects of construction design concerning the new pharmaceutical production unit.
LANGUAGE:	English
QUALIFICATIONS:	Civil engineer with wide experience in industrial construction design and implementation of industrial projects. Familiarity with organization of construction work for industry.
BACKGROUND INFORMATION:	The Pharmaceutical Division has already prepared the layout of a new warehouse through a Ghanaian consulting firm, and funding for the construction is being programmed. Because of rapid expansion and the importance of activating the planned new production line as soon as possible, GIHOC would like to use part of the new warehouse as a temporary production unit.

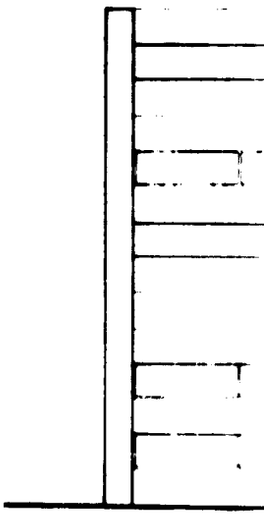


Annex II

DESIGN AND LAYOUT C



LEFT SIDE VIEW



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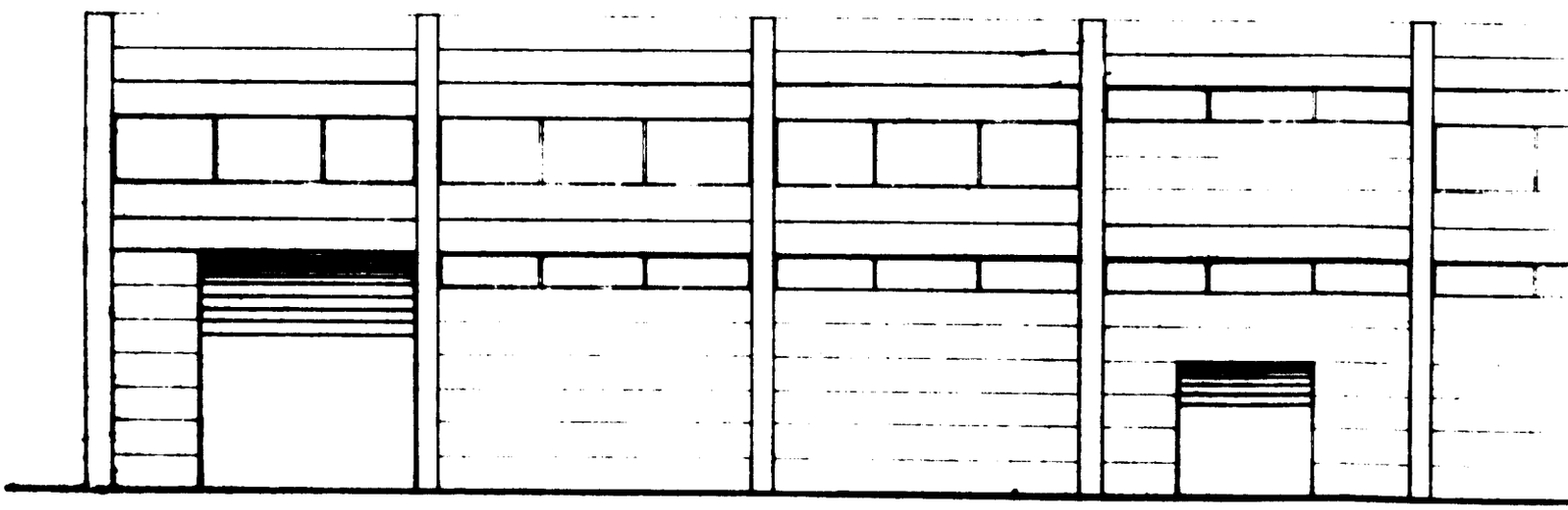

FRONT VIEW

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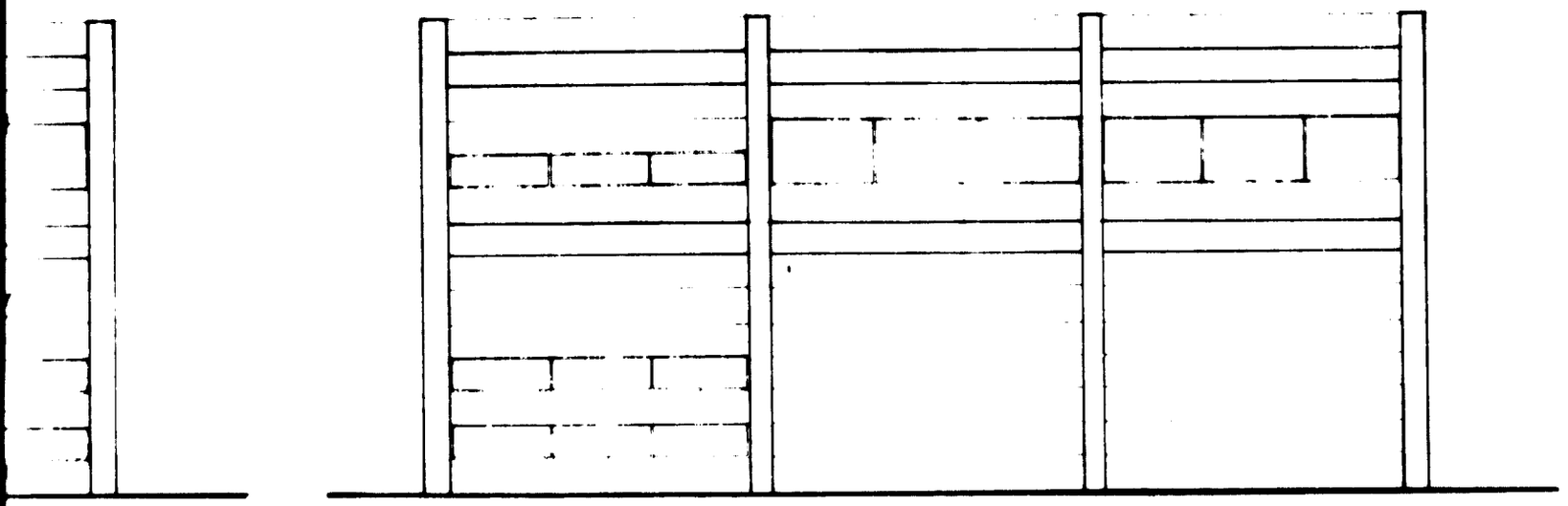
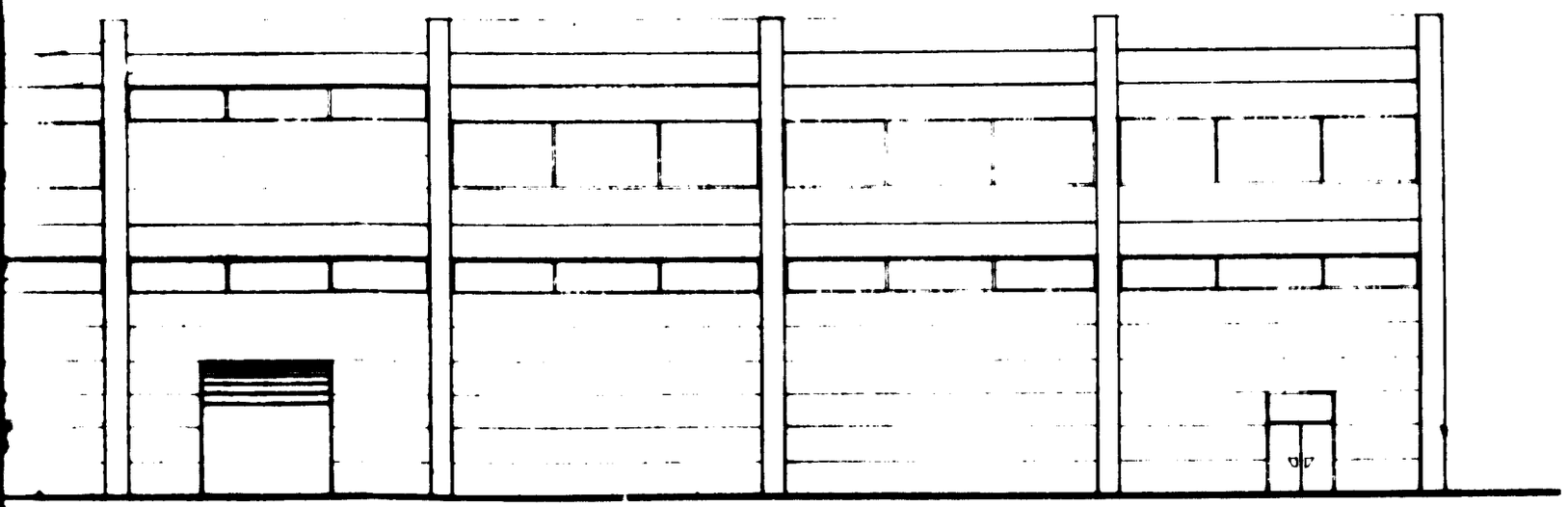
Annex II

DESIGN AND LAYOUT OF WAREHOUSE



RIGHT SIDE VIEW



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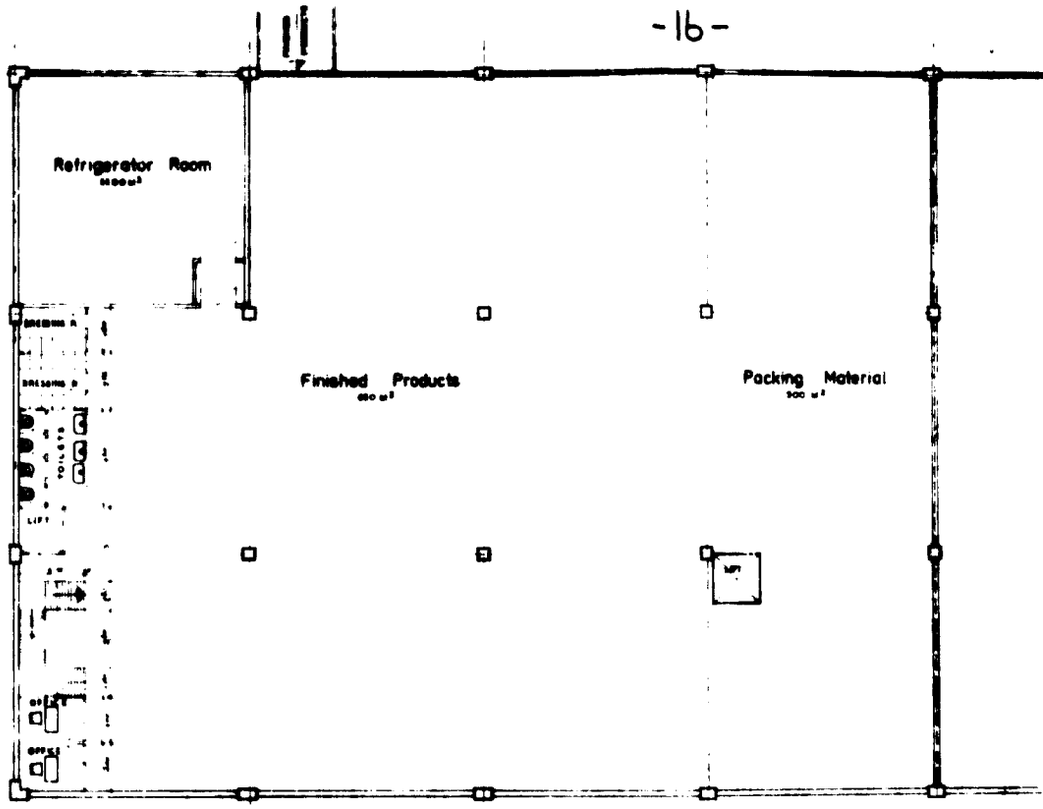
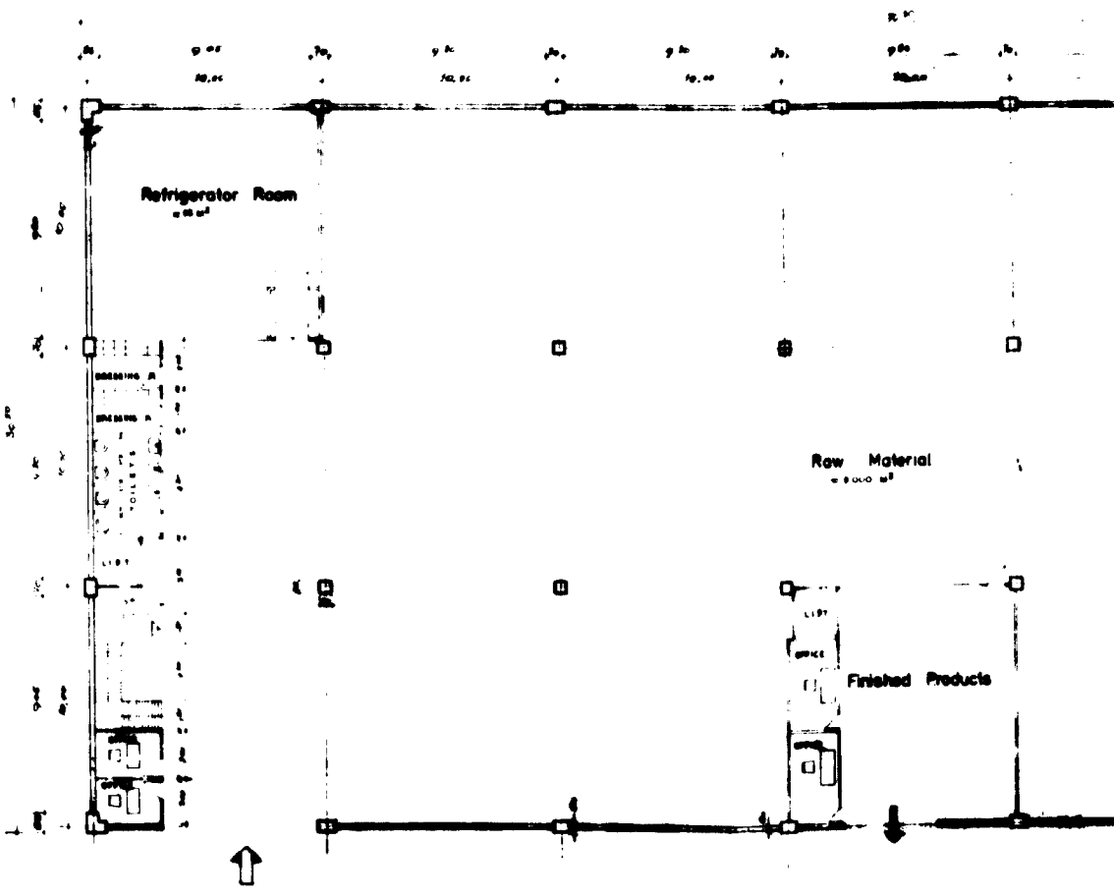


FIRST FLOOR PLAN



GROUND FLOOR PLAN

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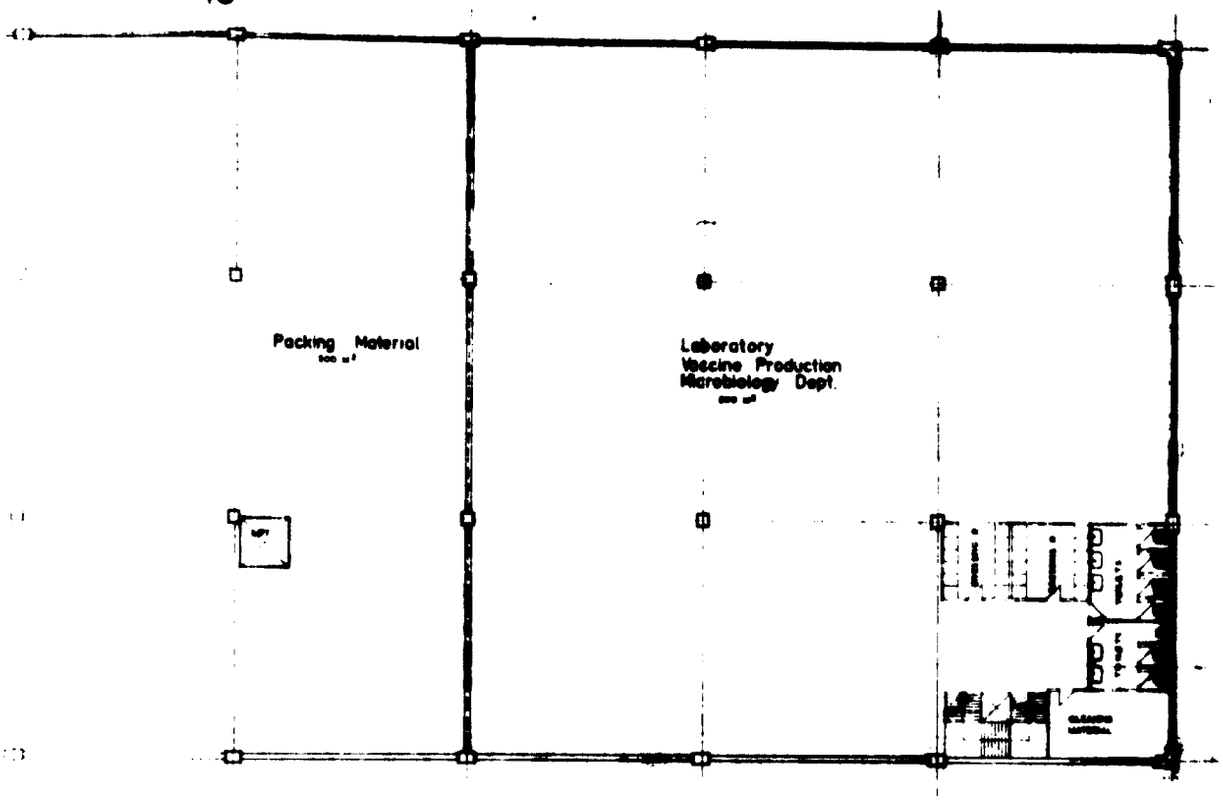
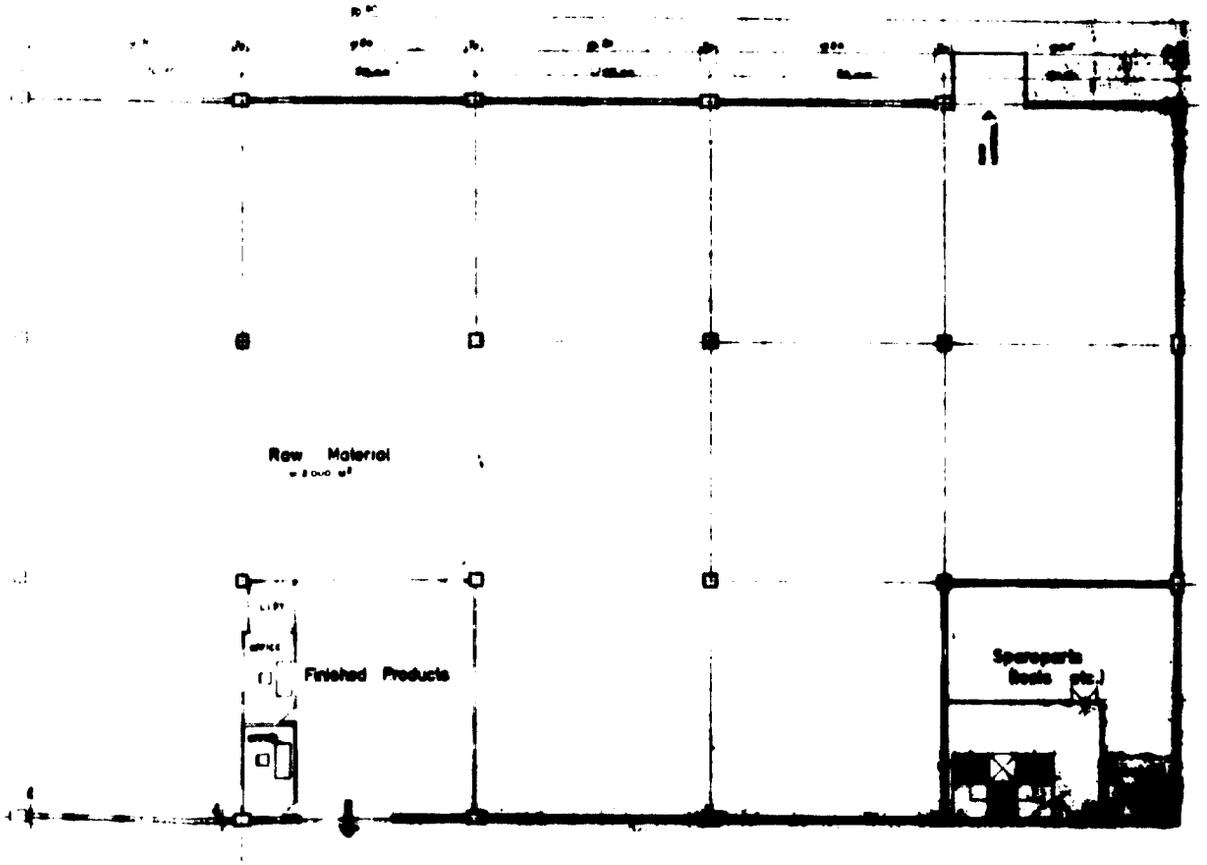
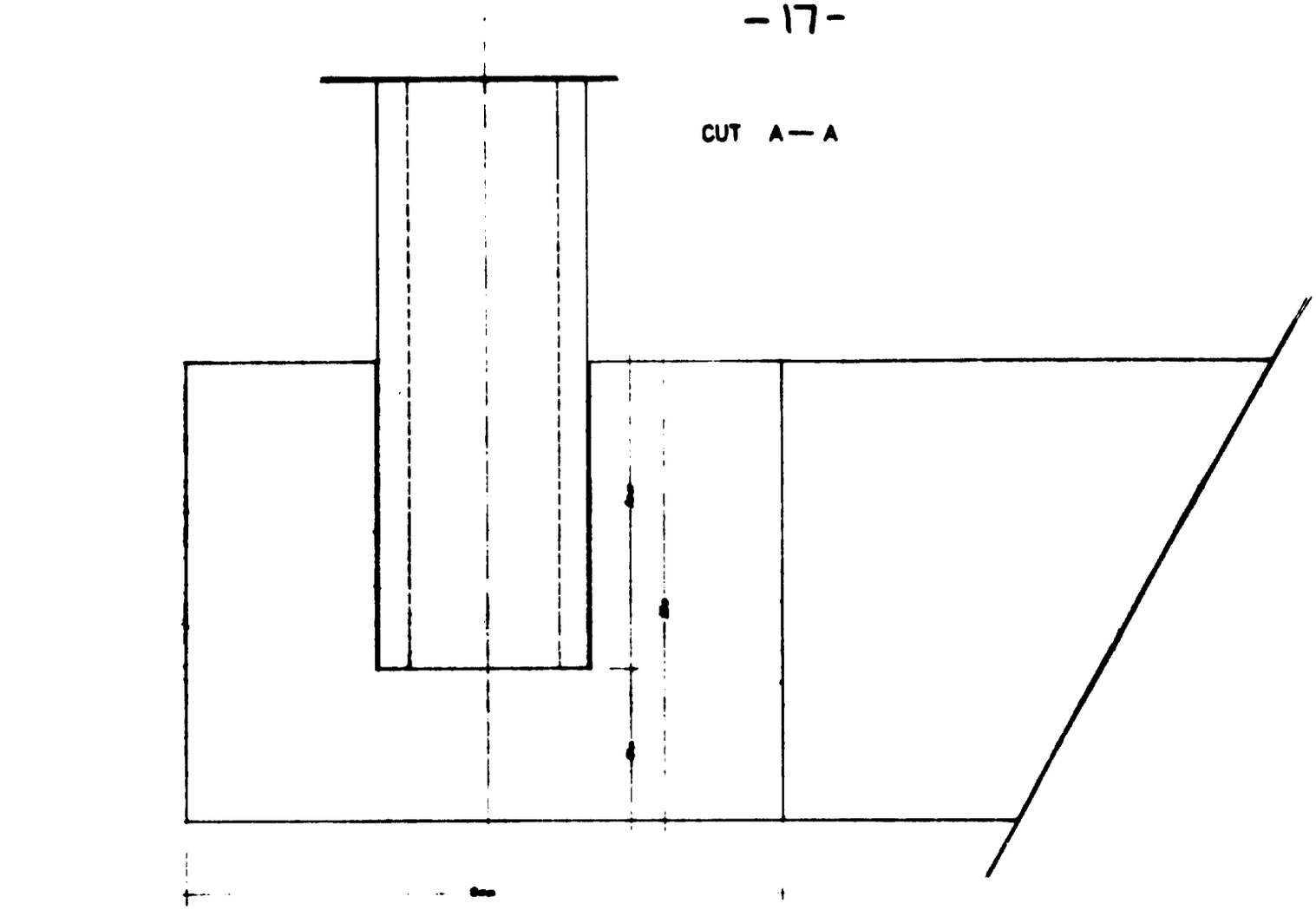
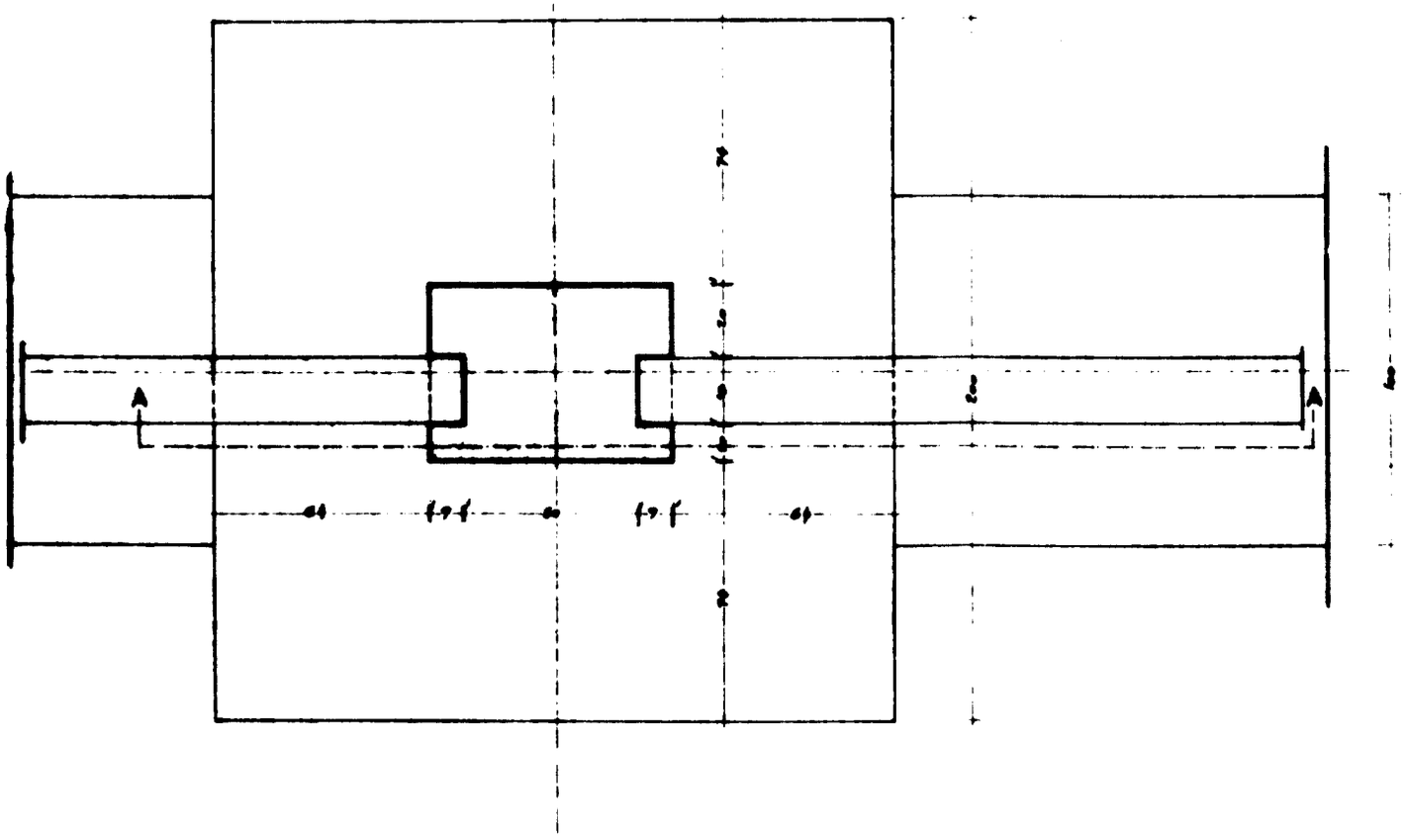
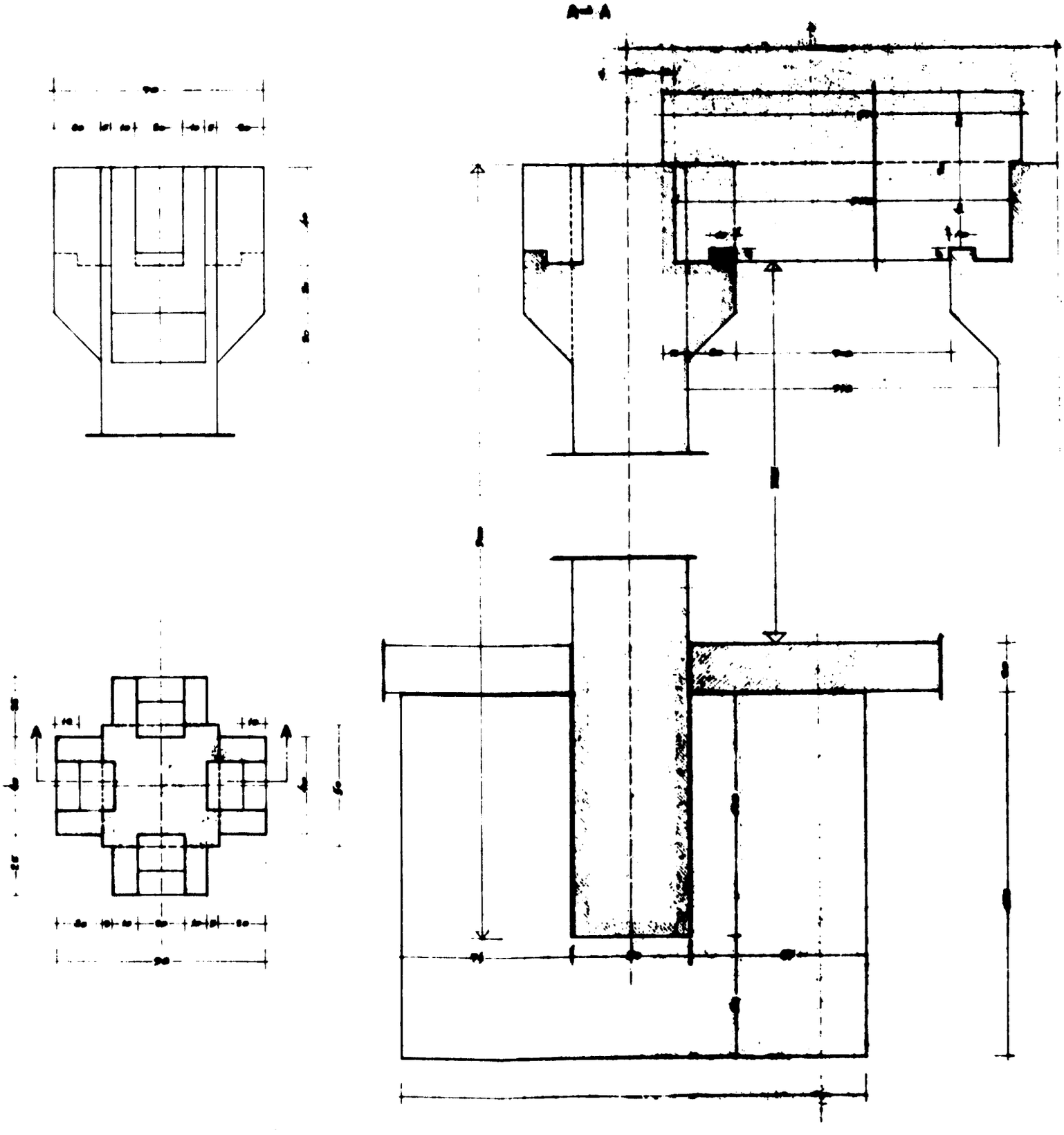

Packing Material
Laboratory
Vaccine Production
Microbiology Dept.

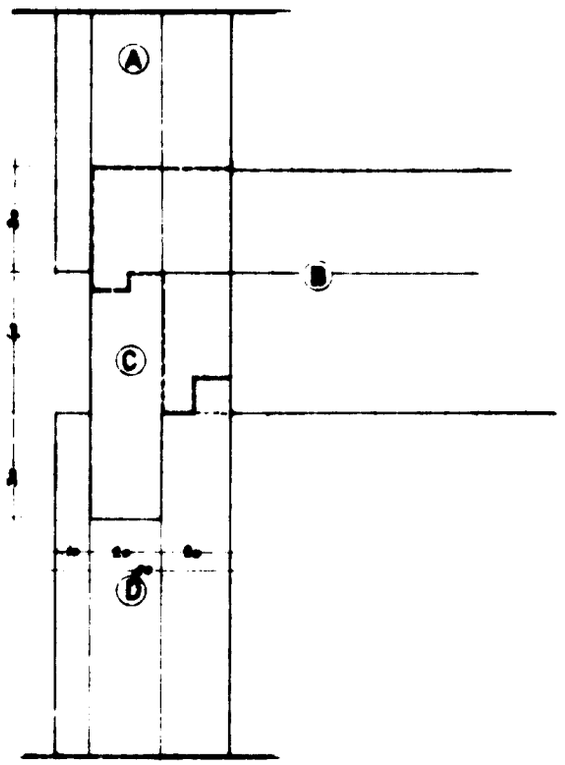

Raw Material
Finished Products
Spareparts
Tools etc.)

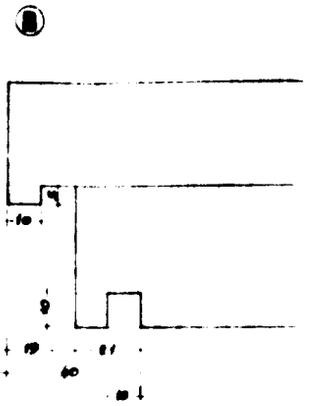
CUT A — A

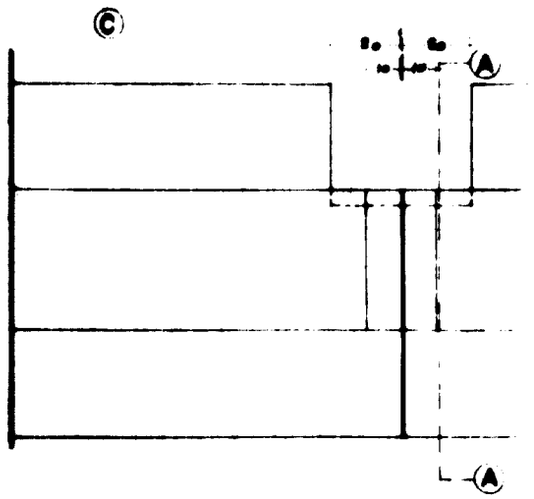


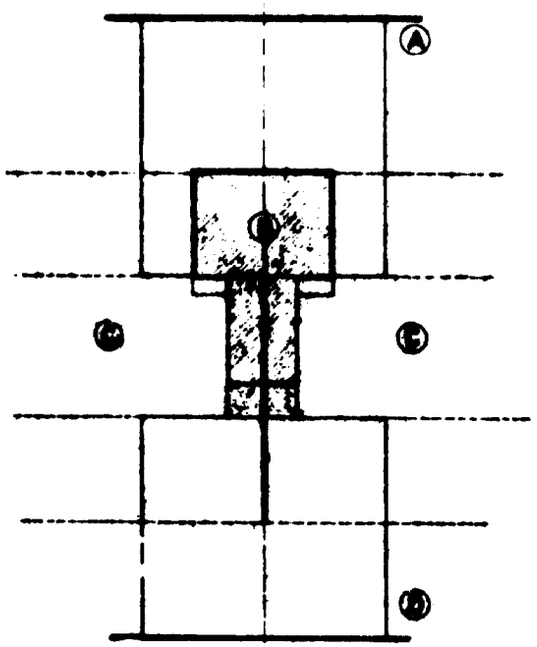


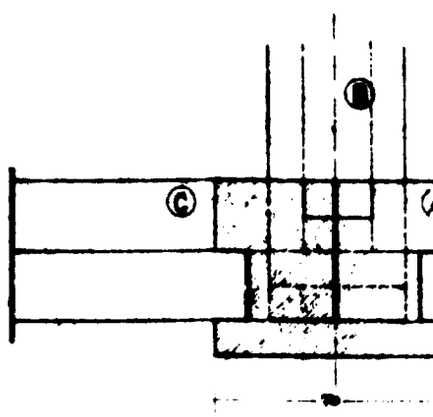












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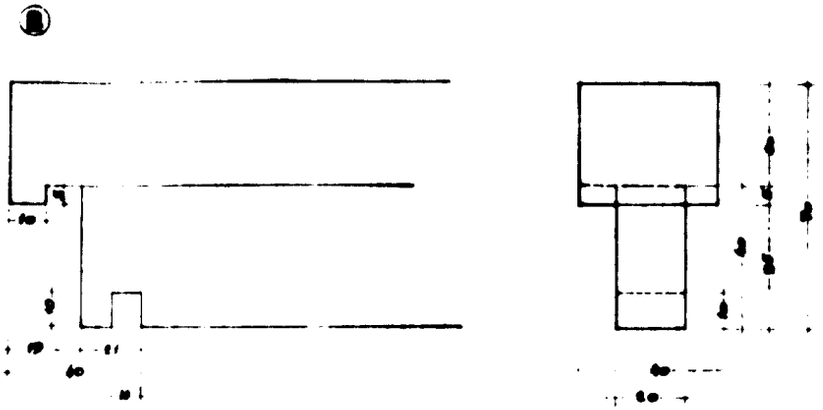

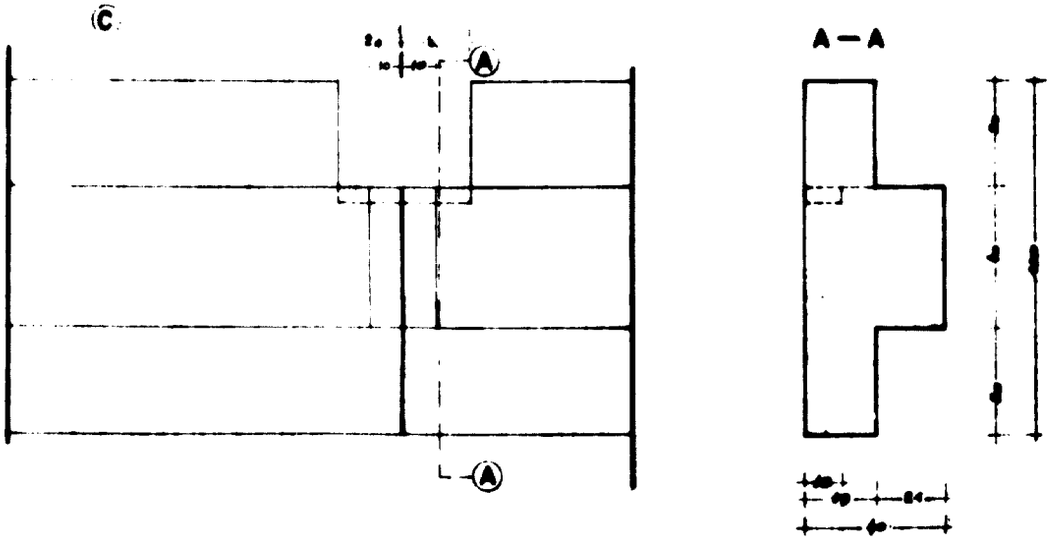

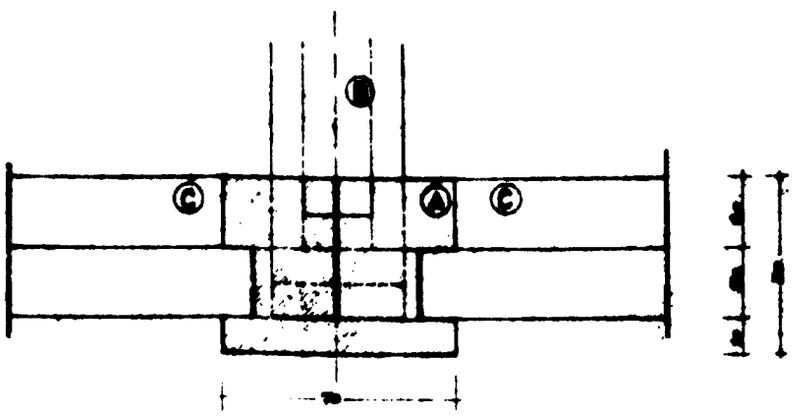

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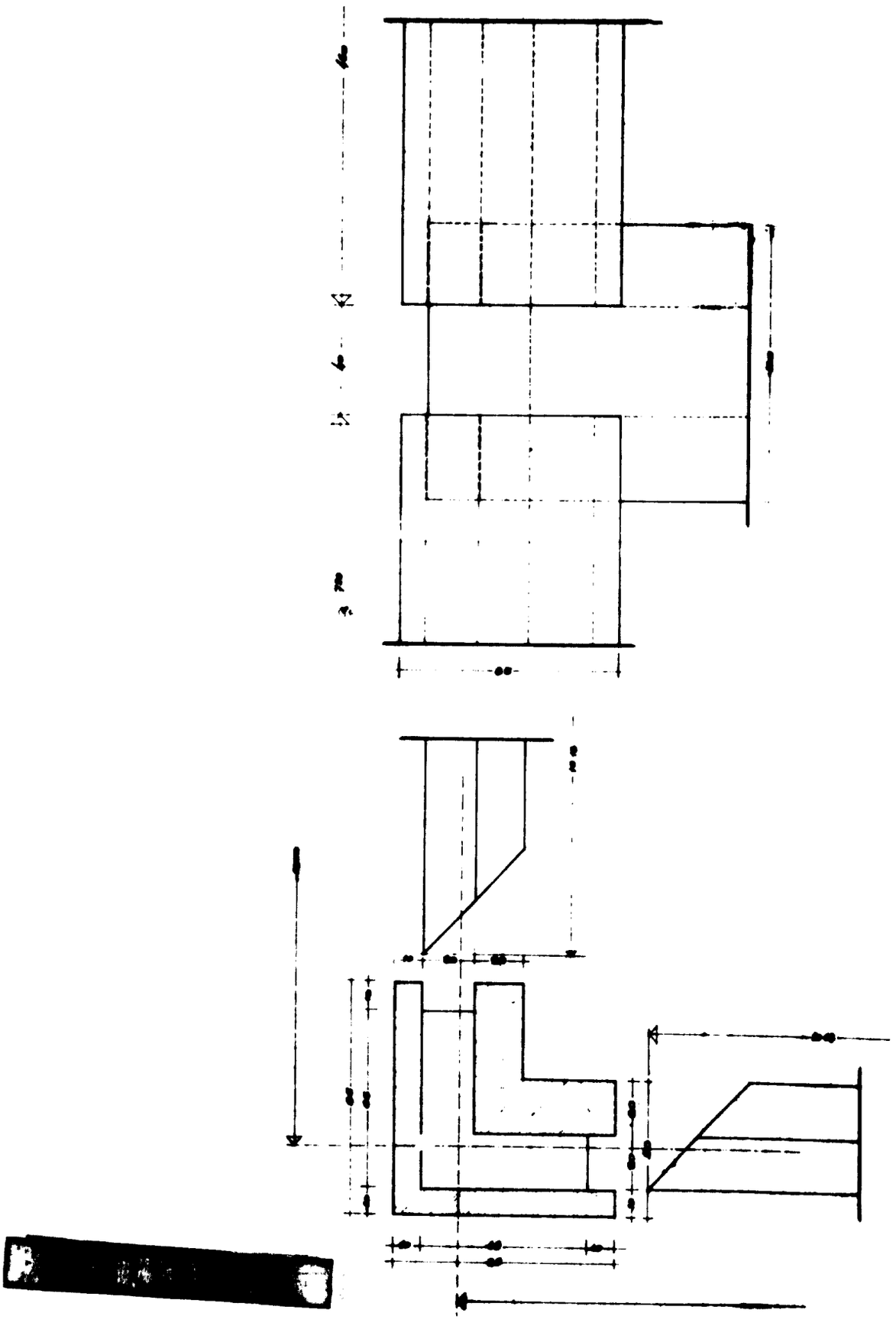

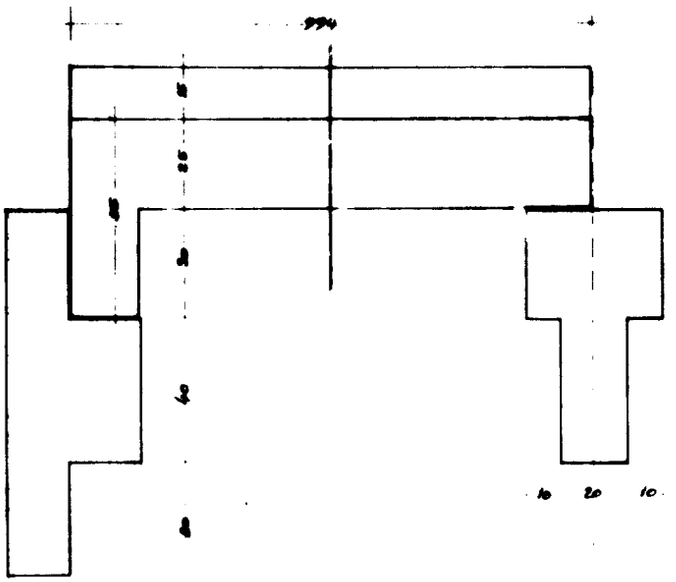
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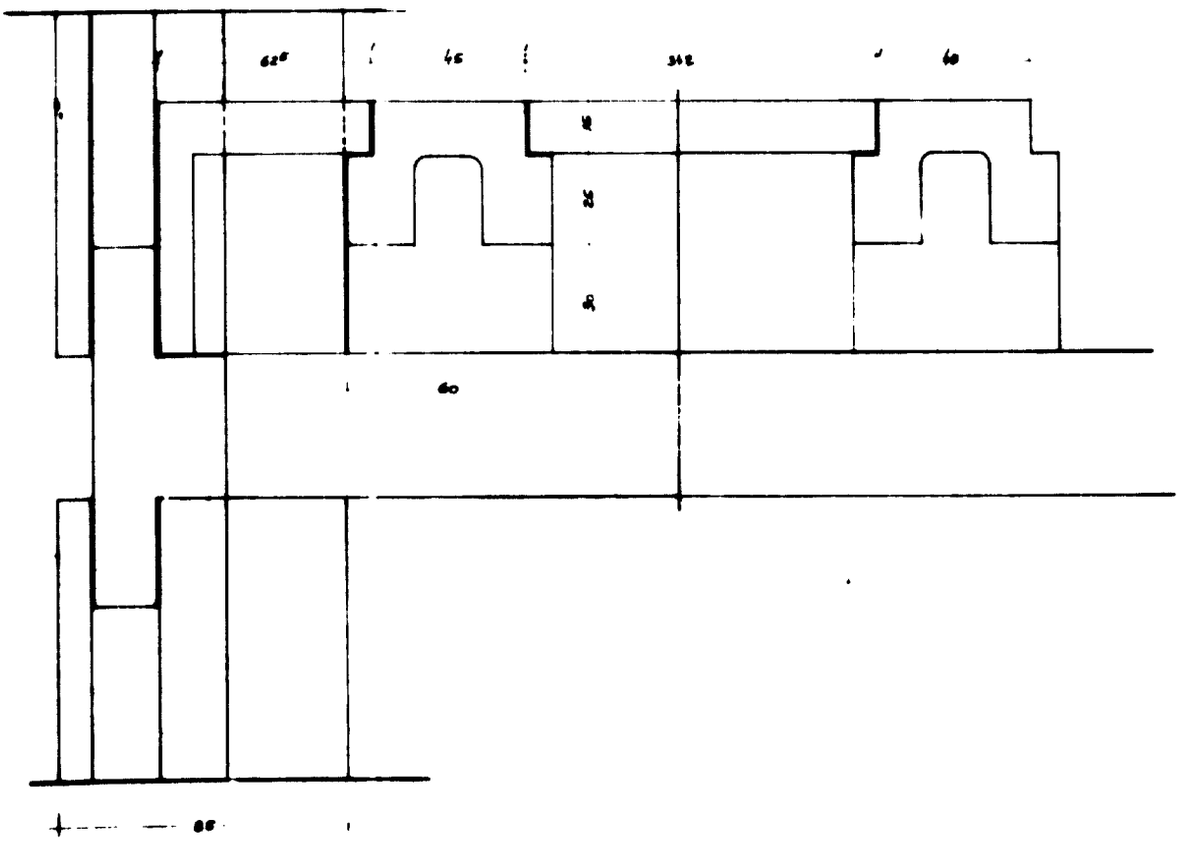
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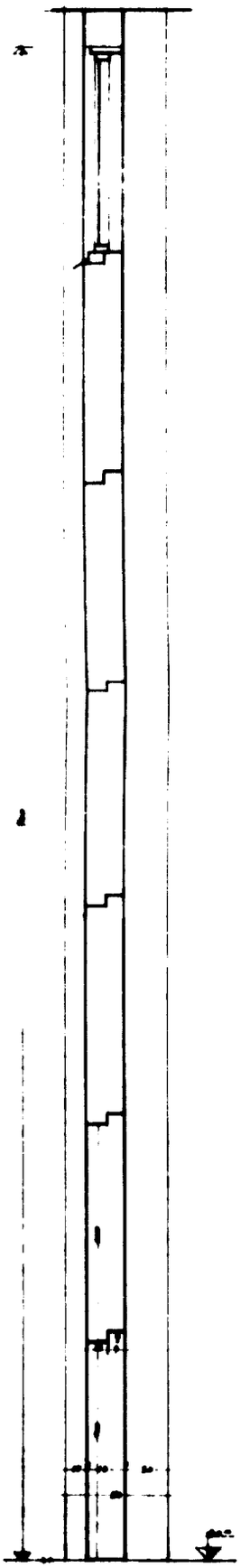
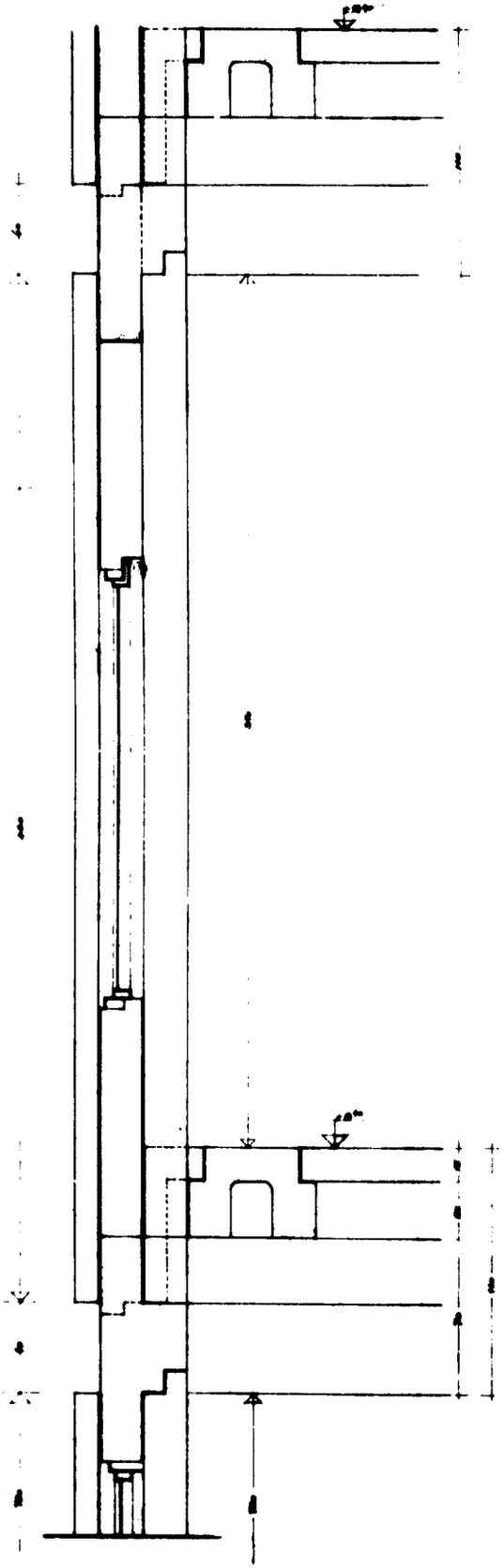
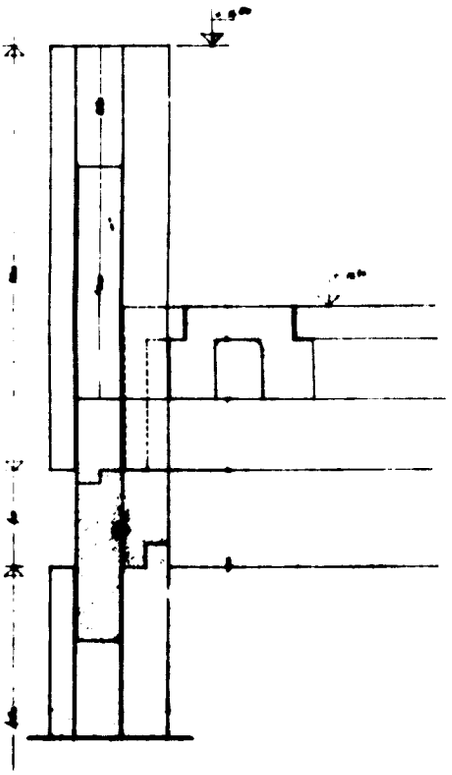
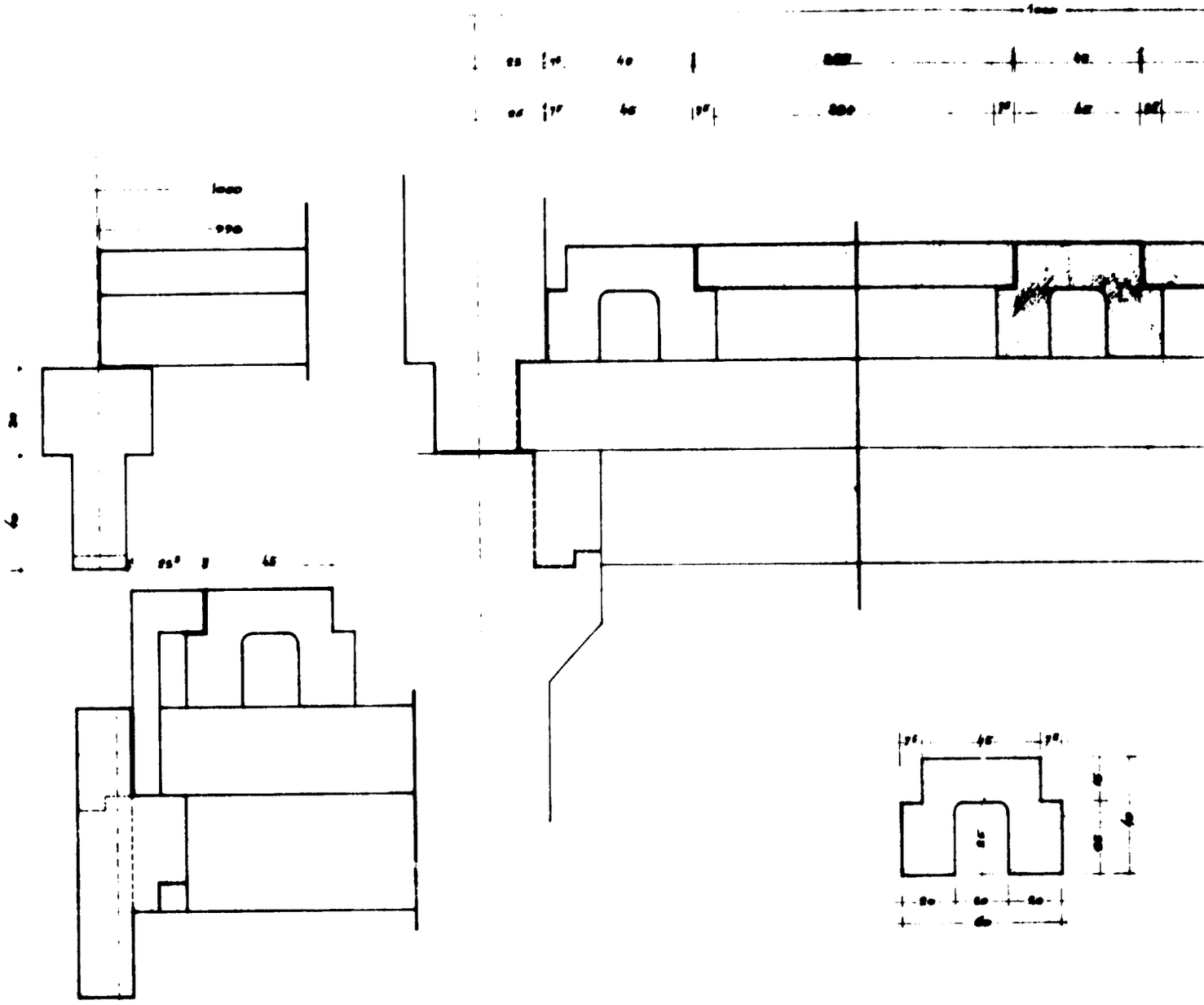
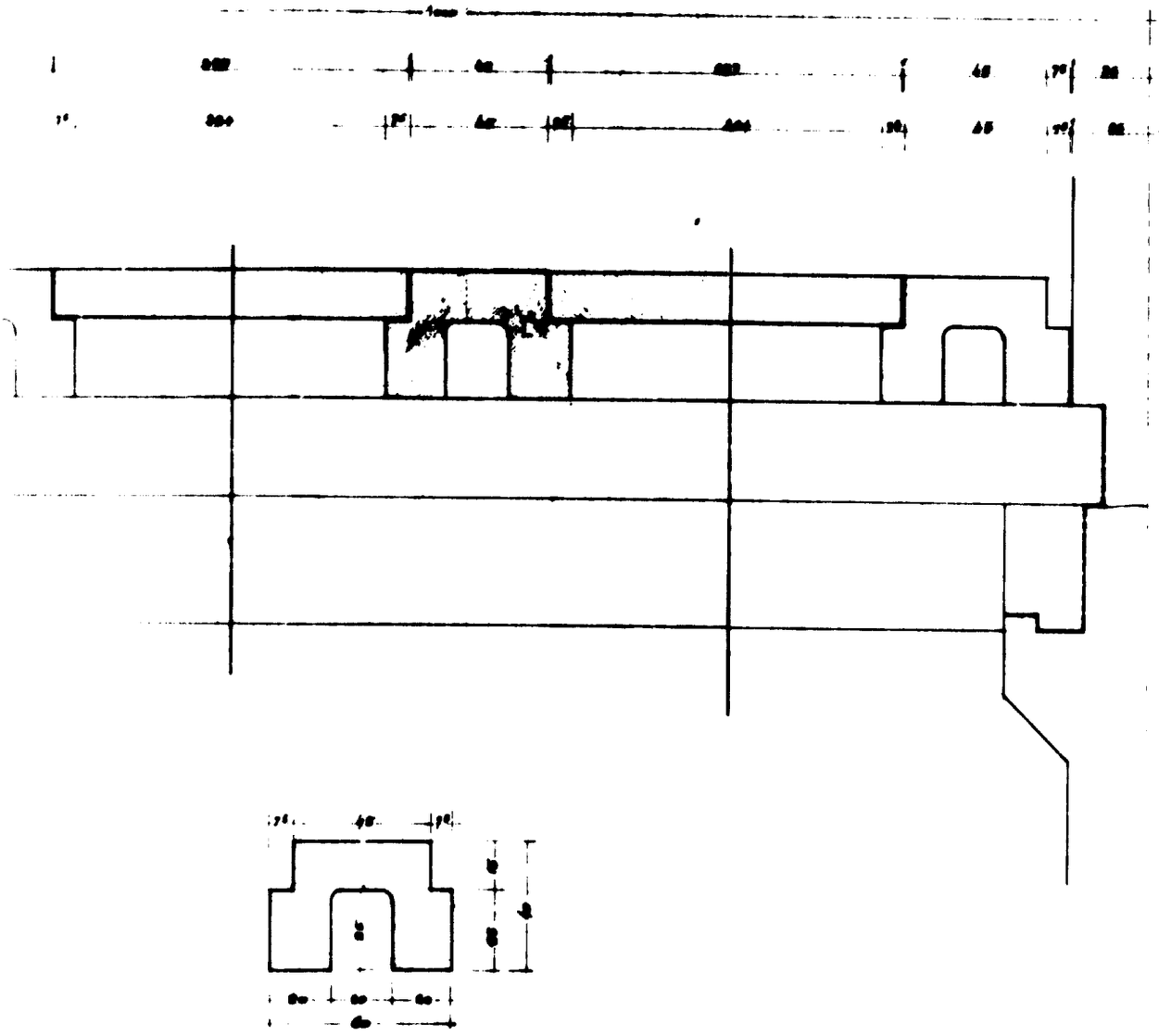


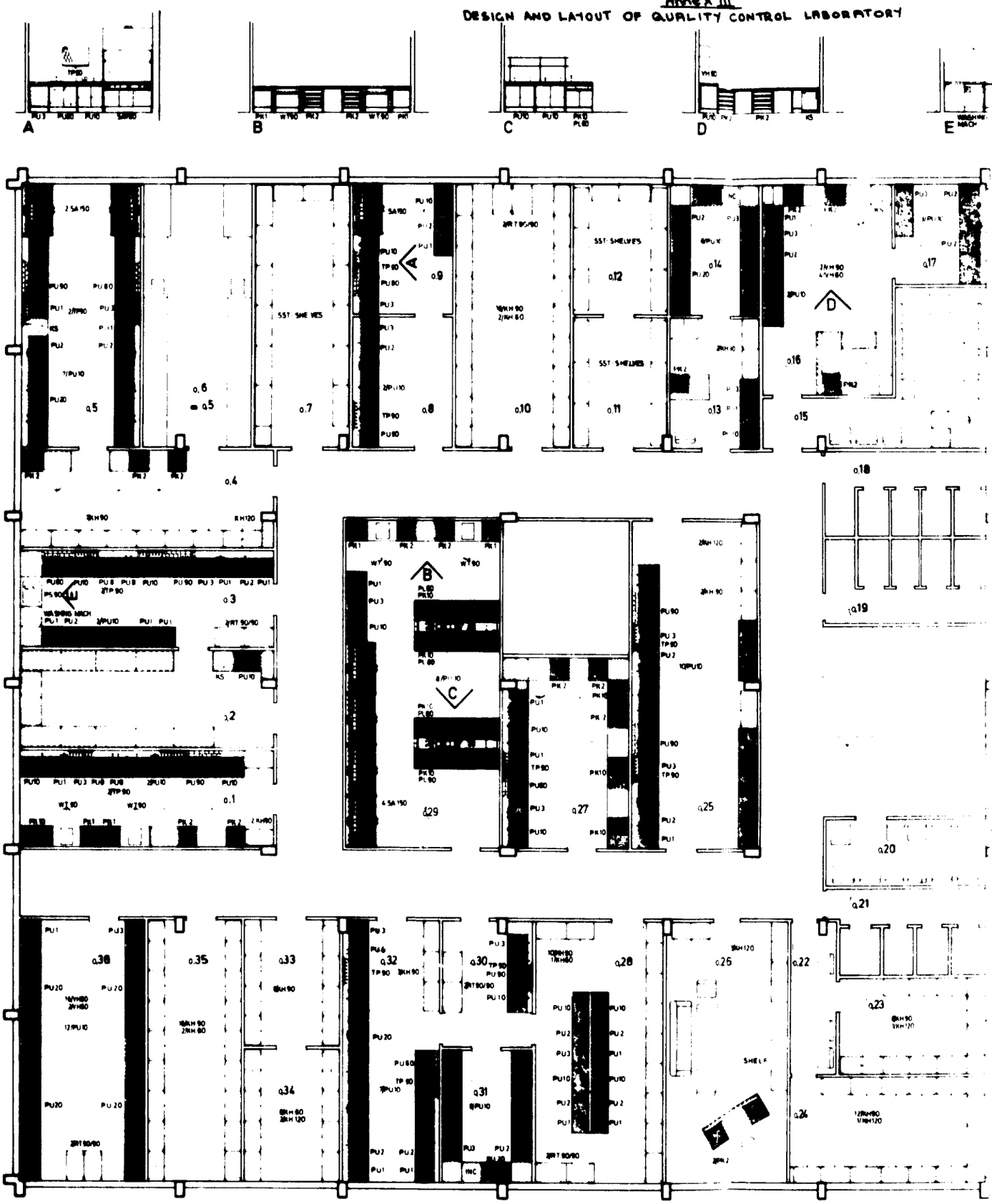






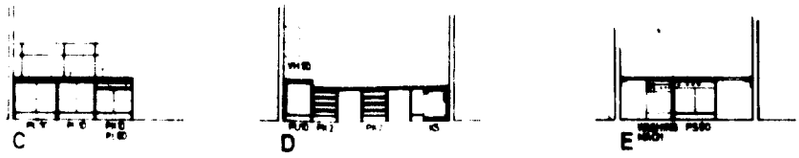


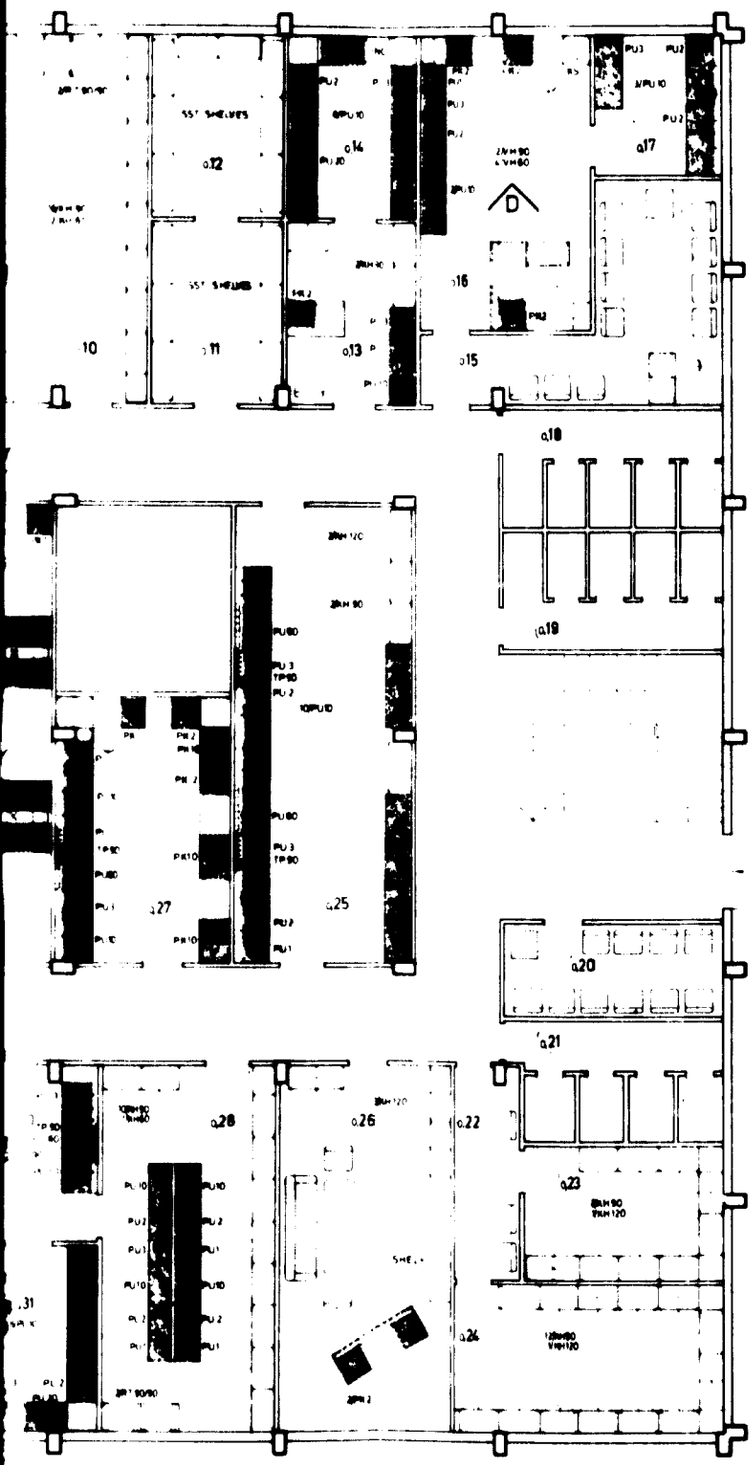
DESIGN AND LAYOUT OF QUALITY CONTROL LABORATORY



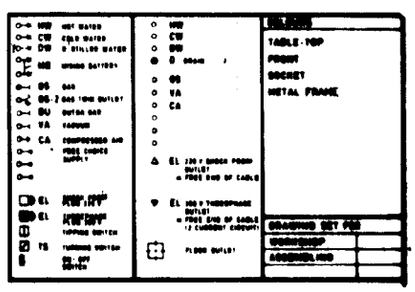
Annex III

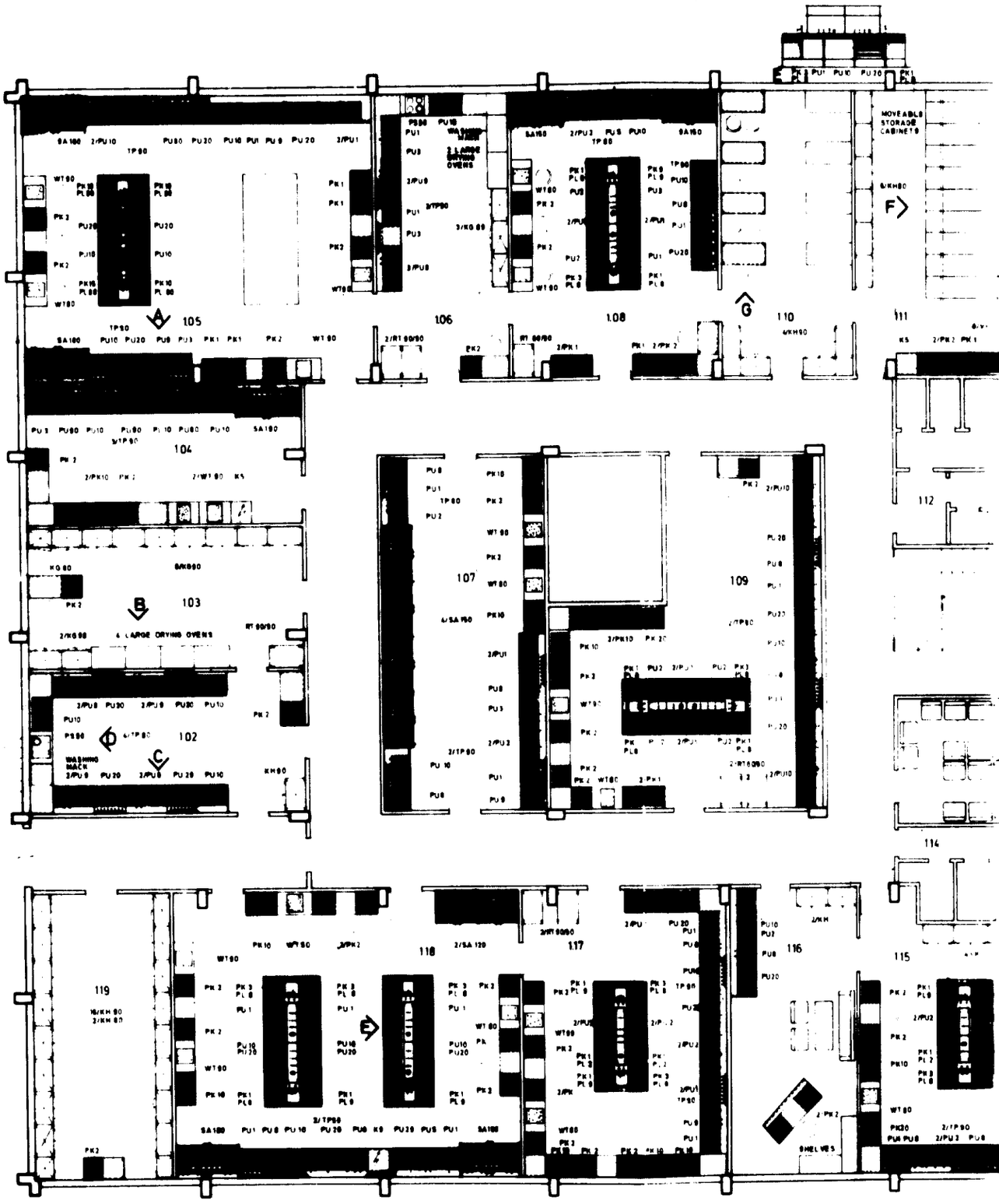
SIGN AND LAYOUT OF QUALITY CONTROL LABORATORY





Q 1 PYROGEN TESTING ROOM
Q 2 STERILIZATION ROOM
Q 3 WASHING ROOM
Q 4 INSTRUMENTS ROOM
Q 5 RESEARCH LAB
Q 6 DIAGNOSTIC LAB
Q 7 COLD ROOM
Q 8 MEDIA POURING
Q 9 MEDIA MAKING
Q10 STORE
Q11 COOL ROOM
Q12 WARM ROOM
Q13 STAFF OFFICE
Q14 STERILITY ROOM
Q15 WAITING ROOM
Q16 OFFICE MICROBIOL
Q17 BIOASSAY LAB
Q18 MENS TOILETS
Q19 WOMENS TOILETS
Q20 WAITING ROOM
Q21 SENIOR STAFF TOILETS
Q22 HALL
Q23 GLASSWARE STORE
Q24 REAGENTS STORE
Q25 STABILITY TESTING
Q26 OFFICE
Q27 CHROMATOGRAPHY ROOM
Q28 TABLETTING ROOM
Q29 GENERAL LAB
Q30 WASHING ROOM
Q31 DRYING ROOM
Q32 INJECTIONS, SOLUTIONS, SUPPOSITORIES, OINTMENTS, CREAMS
Q33 RAW MATERIAL
Q34 MACHINE PARTS
Q35 ROOM FOR DANGEROUS CHEMICALS
Q36 SPARE PARTS STORE




MOVEABLE STORAGE CABINETS
4 LARGE DRYING OVENS
WASHING MACHINE
SHELVES
101
102
103
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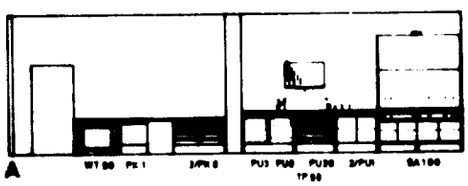
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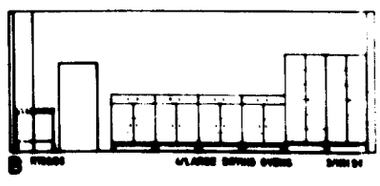
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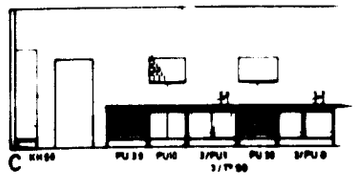
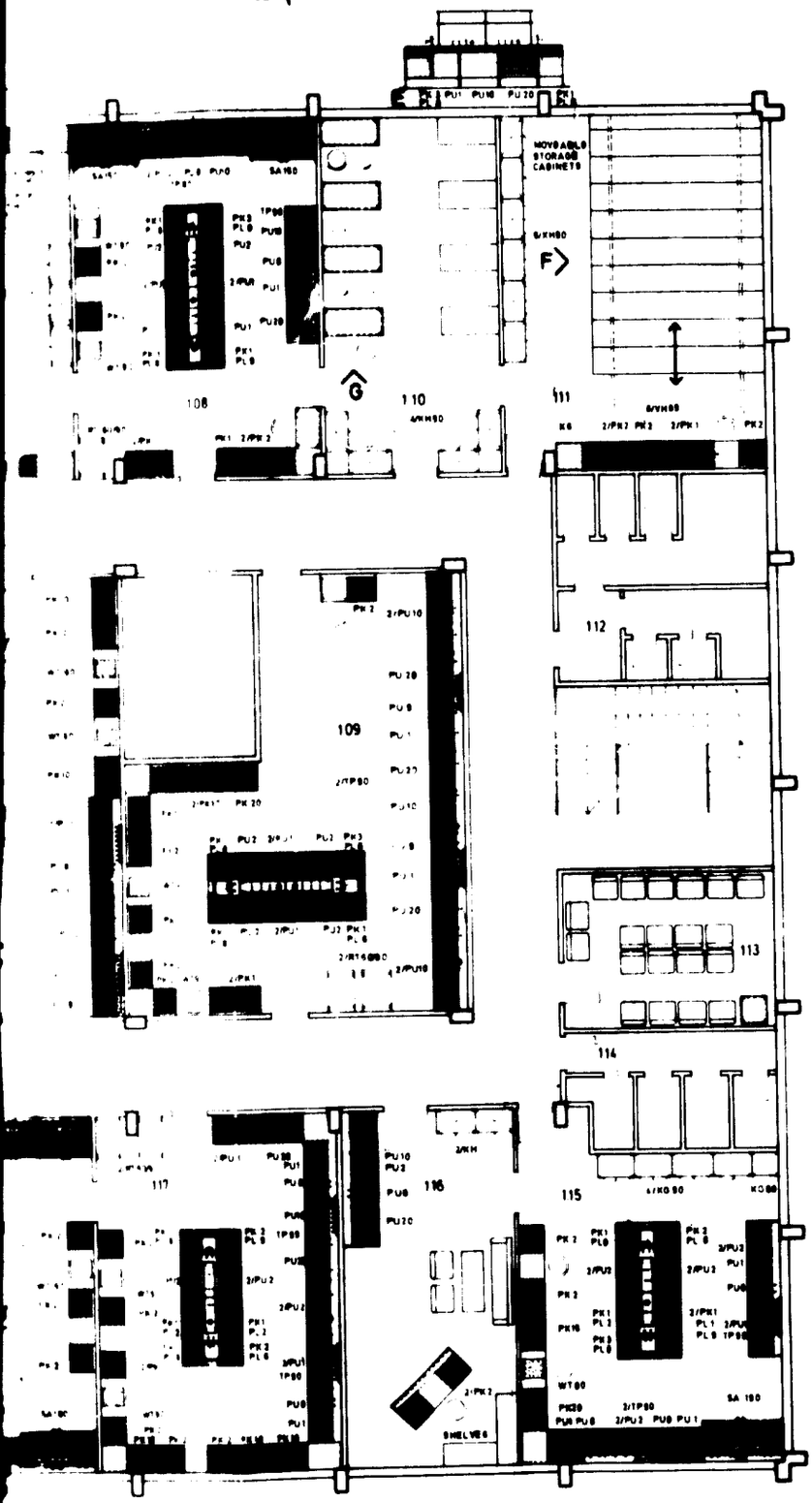
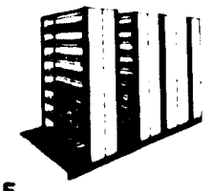
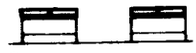
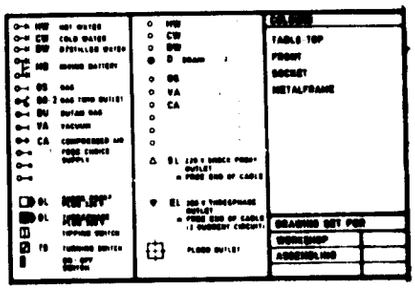

C

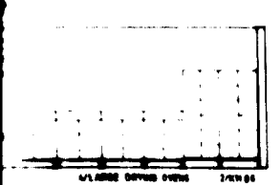


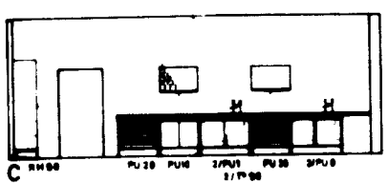


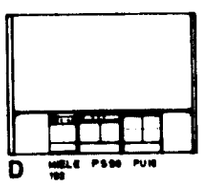


101	HALL
102	WASHING ROOM
103	DRYING ROOM
104	ROOM FOR BIOAVAILABILITY TESTS
105	LAB FOR WORK ON GRANULES
106	WASHING ROOM
107	GENERAL LAB
108	LAB FOR TESTING OF RAW MATERIALS
109	CHROMATOGRAPHY ROOM
110	READING ROOM
111	SAMPLE KEEPING ROOM
112	TOILETS
113	WAITING ROOM
114	TOILETS
115	INCOMING SAMPLES AND RECORDS
116	QUALITY CONTROL MANAGERS OFFICE
117	LAB FOR PHYSICALS ON TABLETS
118	LAB FOR ANALYSIS OF TABLETS
119	REAGENTS ROOM

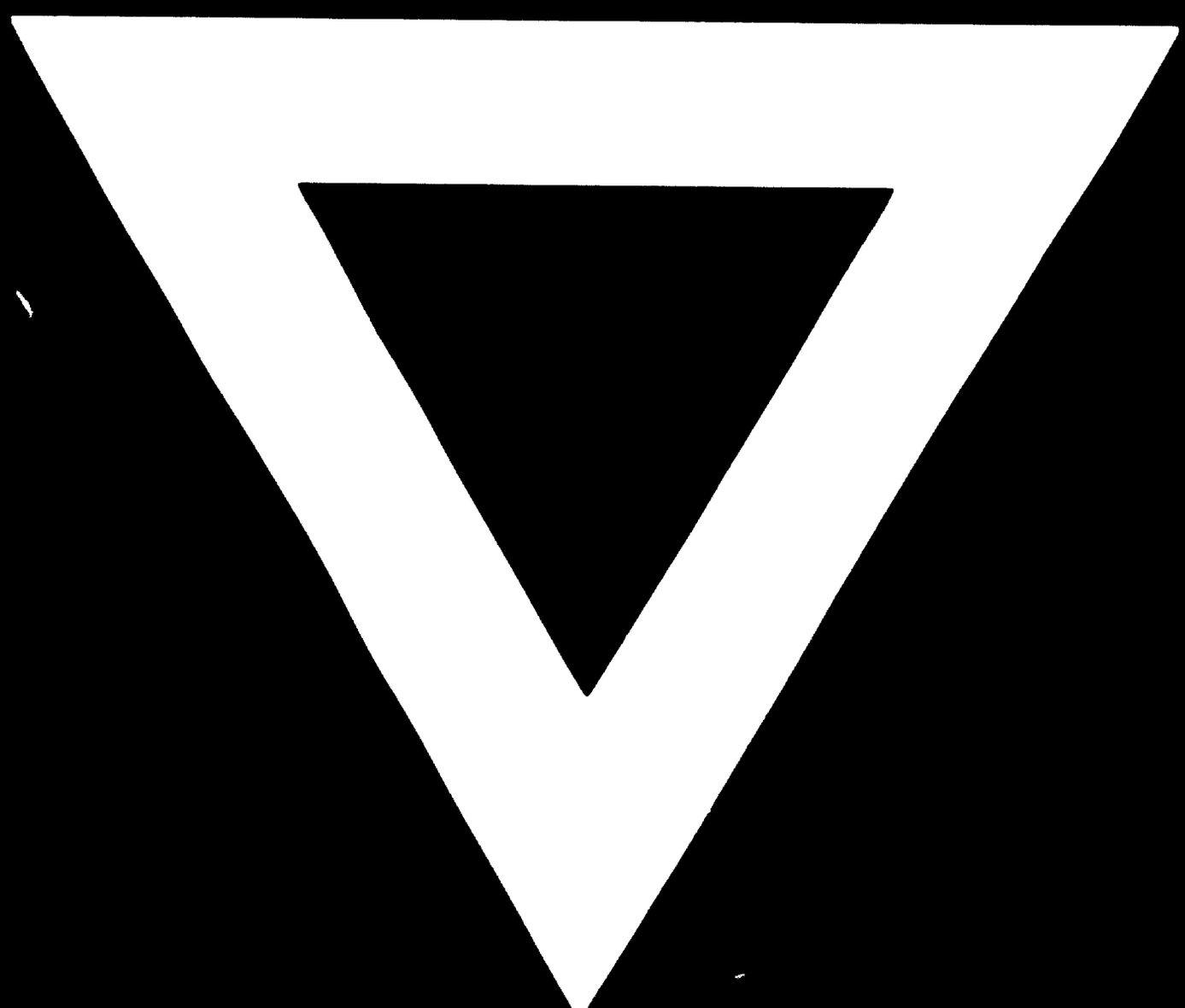








C-700



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