Supplement to
Question No 13

hot laboratory facilities at N

Standard Form 63
Jan. 1952

U. S. GOVERNMENT
MEMORANDUM OF CALL

Date 5/22/59

Time 10:55 am

TO— Mr. Brinkman

☒ YOU WERE CALLED BY— ☐ YOU WERE VISITED BY—

Mr. Murphy, Nuclear Development Corp.,
White Plains, New York

TELEPHONE: Number or code Extension

☐ PLEASE CALL ☐ WAITING TO SEE YOU
☐ WILL CALL AGAIN ☐ WISHES AN APPOINTMENT
☐ RETURNING YOUR CALL

LEFT THIS MESSAGE: The urgency for having this license by this week-end has been removed. If it is accomplished by the end of next week, it will be satisfactory.

Received by— mog

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NDA - NUCLEAR DEVELOPMENT CORPORATION OF AMERICA
WHITE PLAINS, NEW YORK

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hot laboratory facilities at NDA

NDA - NUCLEAR DEVELOPMENT CORPORATION OF AMERICA
WHITE PLAINS, NEW YORK

1. INTRODUCTION

Because of the growing need to provide laboratory facilities which would augment and support its activities in the reactor field, NDA erected a Hot Laboratory in the summer of 1956. This laboratory was designed, and has been used, for the performance of experimental work in support of NDA's major reactor projects as well as for experimental programs sponsored by various clients.

The keynote in the design of the Hot Laboratory has been flexibility and versatility. Toward this end, the facility has been designed to provide complete containment of all the experimental space in portable boxes independent of the shield structure. These boxes can be installed in the shield structure by means of electrical, mechanical and plumbing connectors in two to four hours.

This method of operation produces several advantages. Experimental equipment can be installed and tested outside the shield structure. Several equipment setups can be used in each shield position. All equipment repair and most decontamination is done outside the shield structure. The shield structure and the operating areas do not become decontaminated. If an extremely high degree of operating reliability is necessary, it is relatively inexpensive to provide duplicate equipment on standby since it does not occupy shield space.

The shield structure is constructed of blocks so that its dimensions and thickness can be varied if this is desired. The shield is designed so that either Castle or Master-Slave manipulators can be installed. At the present time only Castle manipulators are in use since they have been equal to all problems undertaken. Their freedom from breakdown and superior force handling ability lead us to believe that this will continue to be the case.

In the following sections the Hot Laboratory facilities are described in some detail. It should be noted that the modular design concept permits expeditious adaptation of the facilities to specific operations for which there may be no present provision.

The administrative aspects of hot laboratory operations are expedited by existing AEC clearance for the facility. Accountability procedures for fissionable materials have been established.

2. BUILDING

The Hot Laboratory Building is shown in Fig. 1. It is located at the NDA Pawling Site, approximately 50 miles from NDA's headquarters. The site consists of 1200 acres with truck and railroad access, and all necessary utilities. On this site, NDA also operates a critical facility, a research reactor, and various experimental engineering facilities.

The Hot Laboratory is a one story, fireproof, concrete building of about 5200 ft^2. Its floor plan is shown in Fig. 2. In addition to the cave, decontamination, and storage areas, the building provides space for necessary supporting facilities. Outside the building, and immediately adjacent to the cave area, is a concrete and earth storage area for high level materials. The supporting facilities are briefly described below.

Counting Room. A shielded, airconditioned room containing equipment for alpha and gamma scintillation counting and beta Geiger counting.

Chemistry Laboratory. Equipped for on-site "cold" chemistry operations, supplementing the main chemistry laboratories in White Plains. Also contains a dark room.

Machine Shop. Contains lathe, drill press, band saw, cut-off saw, grinder, and arc welder, in addition to the usual hand tools and hand-operated power tools. There is also a well-equipped machine shop in a nearby building, which serves the entire Pawling site.

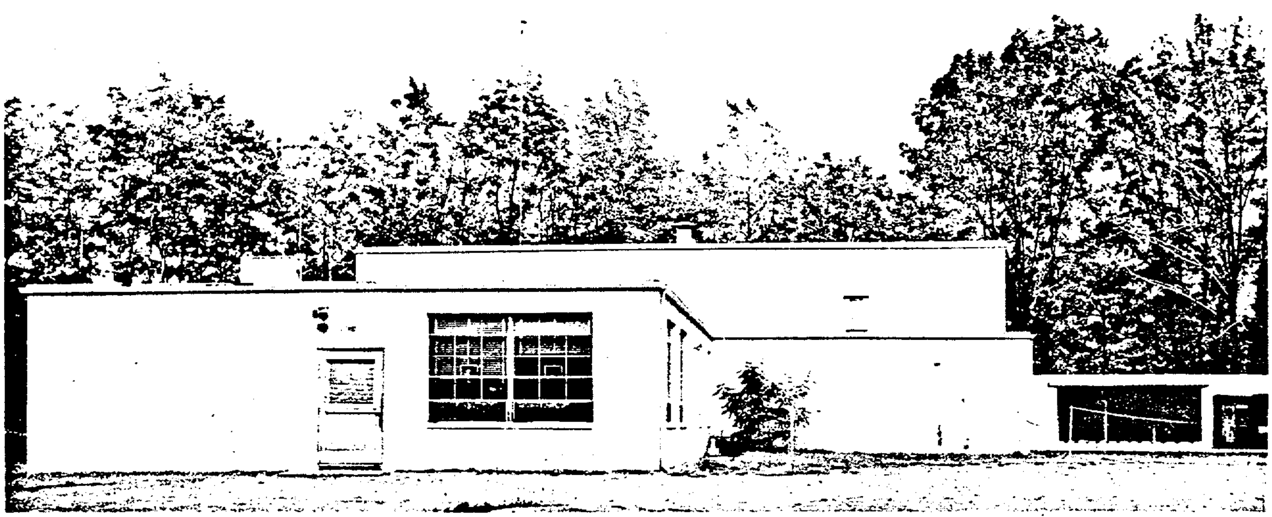

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Fig. 1 — View of Hot Laboratory

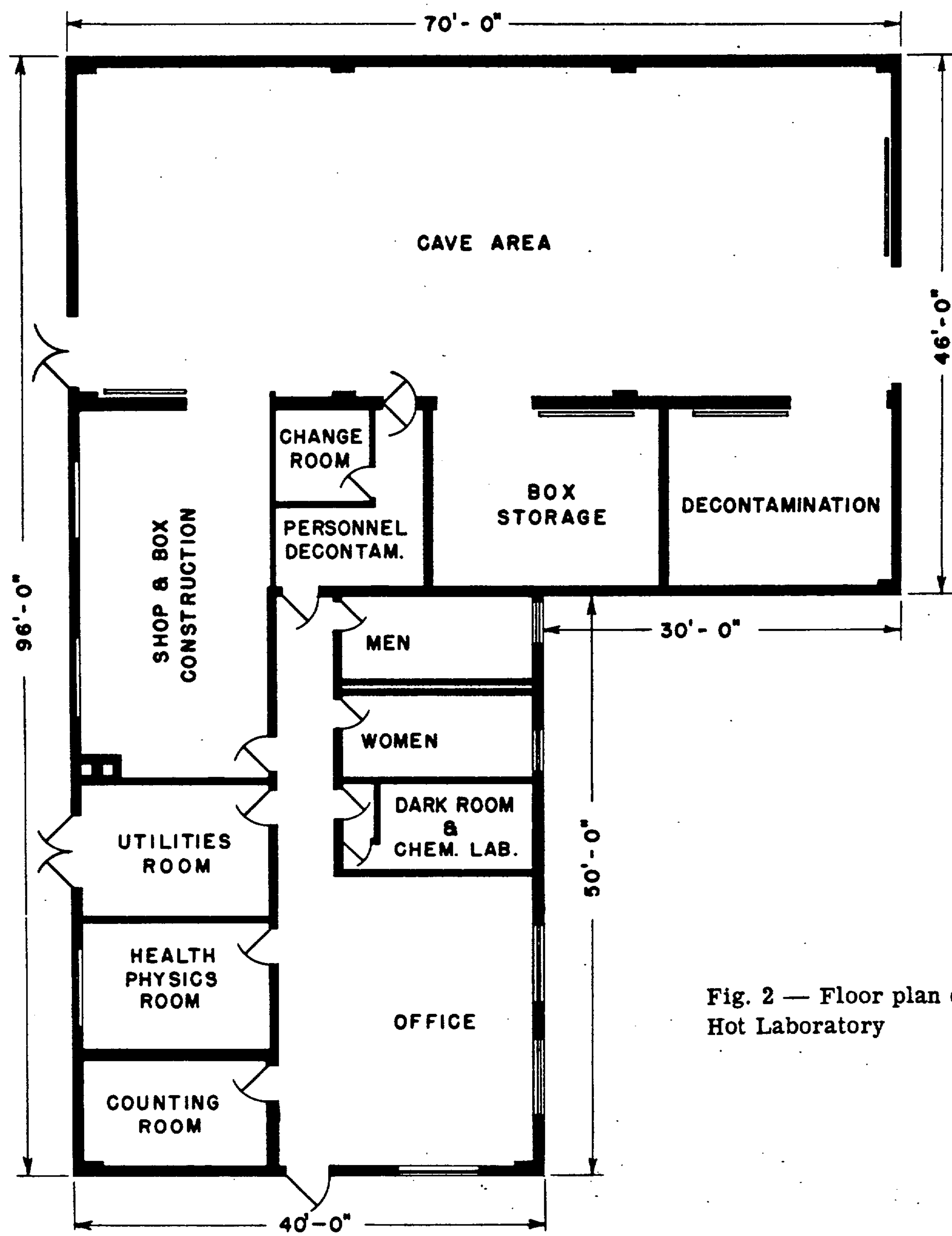

Fig. 2 — Floor plan of Hot Laboratory

3. CAVE

The cave area is designed to accommodate two caves, one of which is installed at the present time, and is illustrated in Figs. 3 and 4. Its building block construction provides 8 in. of lead shielding at the face and the equivalent in concrete on the other readily accessible walls. Sources of about 1000 curies of cobalt 60 or equivalent can be handled in each of the three cells provided. Cell configuration and shielding can be changed, since the shielding structure is easily dismantled and reassembled. The major cave specifications are listed below.

Cave Interior Dimensions:	Width	15 ft 0 in.
	Depth	8 ft 6 in.
	Height	10 ft 8 in.
Cells:	Number	3
	Width	4 ft 8 in.*
	Partitions	6 in. steel slabs
Windows:	One 16 in. (of 6.2 gm/cm^3 density) lead glass window per cell, protected by 1/4 in. non-browning glass.	
Manipulators:	One pair of Castle manipulators per cell.	
Controls:	One set of controls per cell, providing normal laboratory services.	

* Partitions are removable to permit handling of larger assemblies.

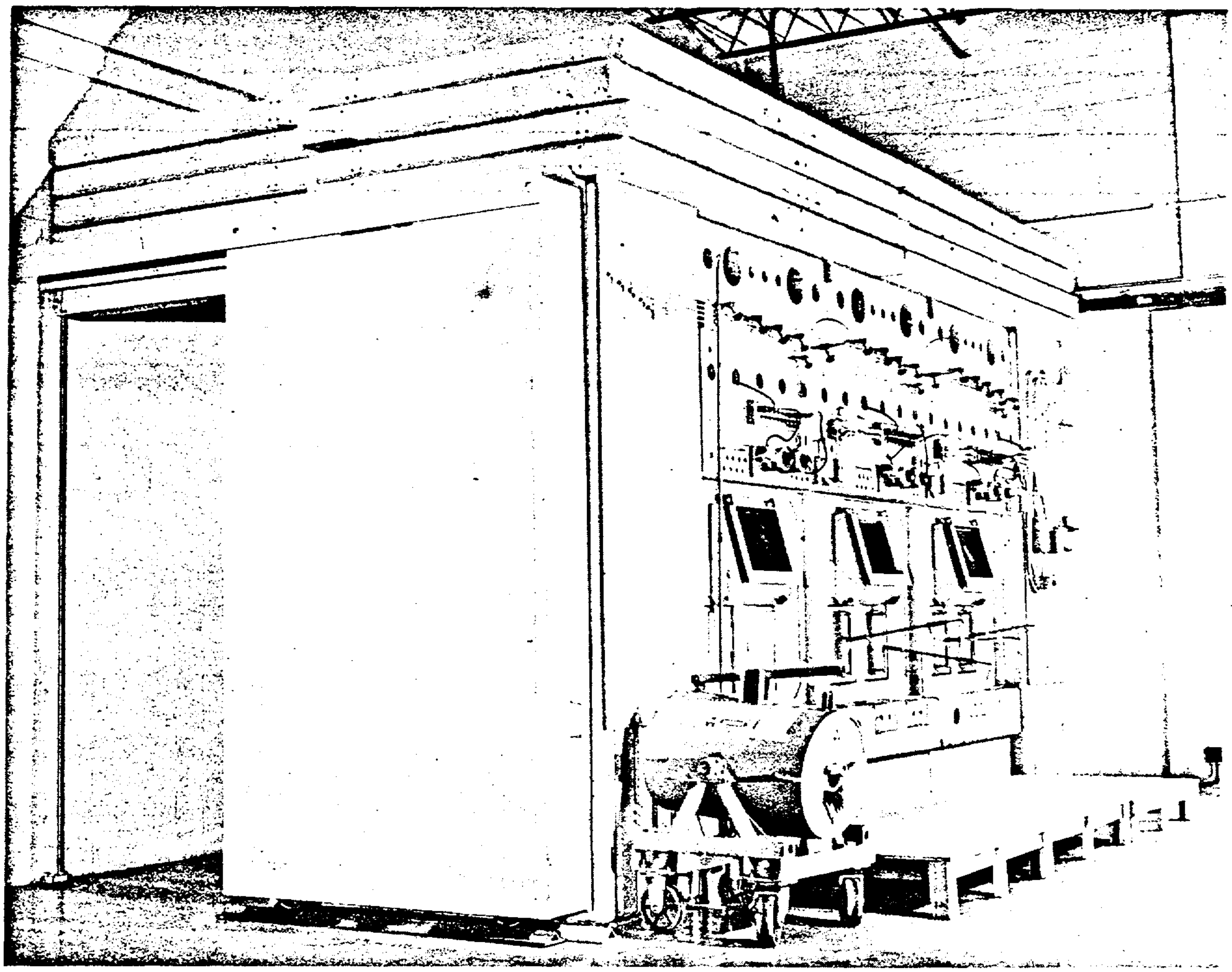

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Fig. 3 — View of cave face

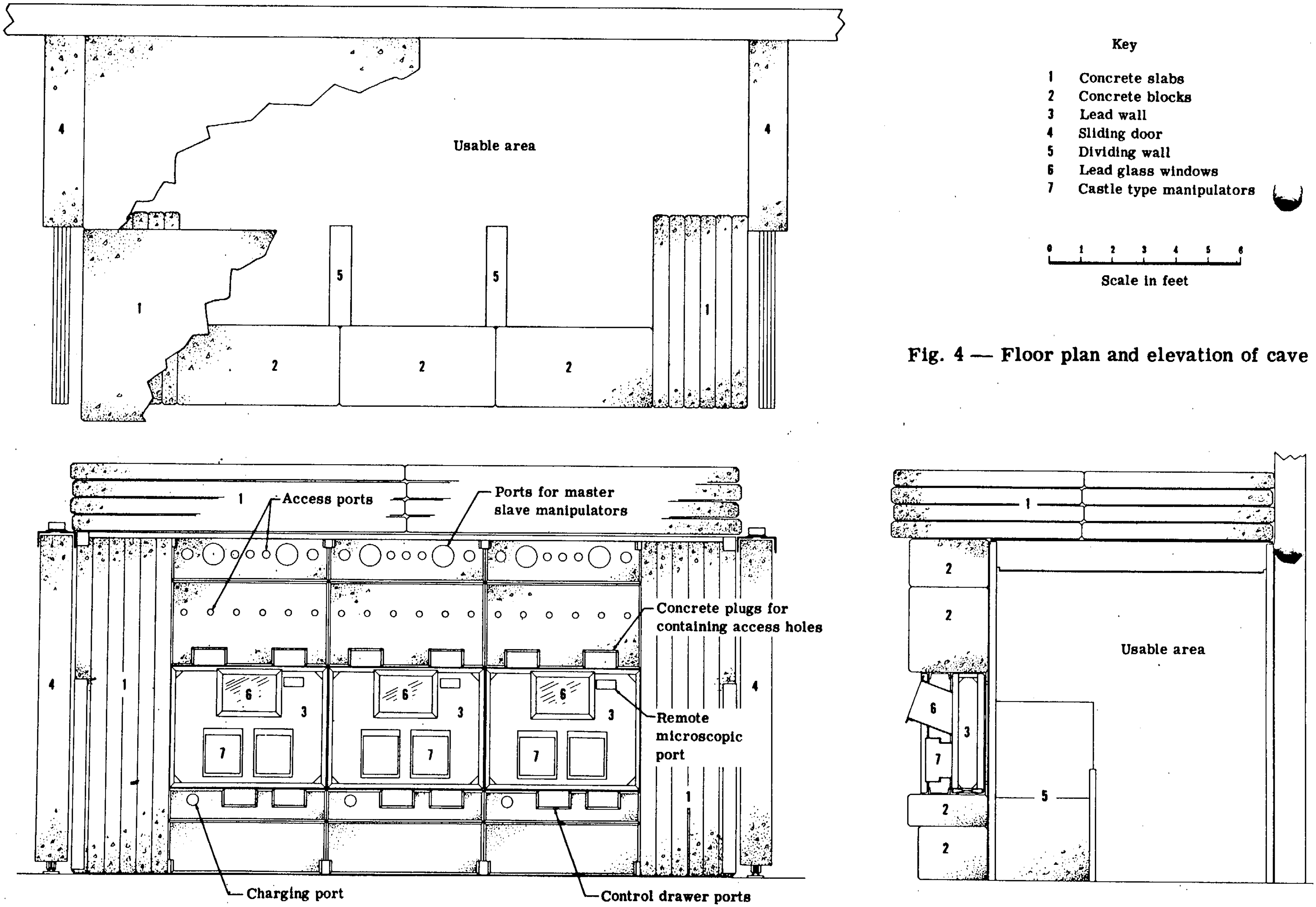

Fig. 4 — Floor plan and elevation of cave

4. MANIPULATORS

Each cell of the cave can be equipped with either master-slave, or Castle manipulators. The latter are installed at the present time and are illustrated in Figs. 5 and 6. They adapt easily to the containment scheme of operation using the cave boxes; and, in addition, are easy to operate, rugged, and free from maintenance problems.

The Castles are mounted in the shield wall. The manipulator arms extend through the Castles and can be remotely attached to the toolholding wrists which are sealed to the cave boxes. The cave boxes can, therefore, be disconnected from the manipulators without breaking the contamination seals.

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Fig. 5 — Operating side of Castle manipulators

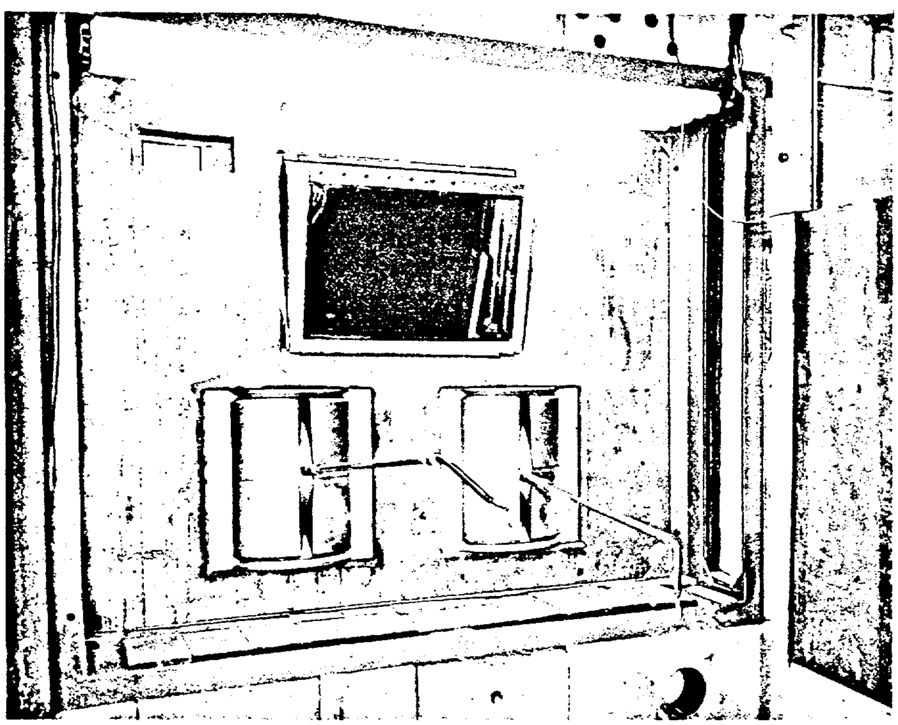

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Fig. 6 — ''Hot'' side of Castle manipulators

5. CAVE BOXES

The equipment and tools used in the cave have been grouped by functions in sealed enclosures, cave boxes, which are mounted on dollies. Boxes can thus be used interchangeably in the cave. Since contamination is contained by the boxes, the cave itself remains clean and work can continue in the cave while a box is being decontaminated outside the cave. In case of severe contamination, the cave box is remotely decontaminated to intermediate levels, within the cave. For ease of decontamination, auxiliary equipment (motors, controls, etc.) has been mounted on the outside of the boxes wherever possible. Walls and equipment are covered by removable plastic sheet to facilitate remote decontamination.

At the present time all boxes are of the same size, for most convenient access and placement in the cells. Larger boxes can be accommodated.

A typical box is illustrated in Fig. 7. Seals for mechanical actuators and service lines, and glove ports for manual access, are provided. Chemical, ventilating and vacuum lines are equipped with scrubbers and/or filters. The ventilating system, Fig. 8, maintains the box at a slight vacuum. When the charging port is opened, an auxiliary blower, actuated by the change in pressure, is automatically started to provide a strong inward flow of air.

Typical cave boxes now in operation are the lathe box, the measurements box, and the chemistry box. These are described below.

Lathe Box

The lathe box is used to cut open specimen containers, take gas samples, and extract specimens. It contains a lathe, gas venting system, and thawer.

The lathe, shown in Fig. 9, has a vertical spindle with an air-operated collet of $2\frac{3}{4}$ in. diameter capacity. A variety of tools and cutters can be attached to the indexing tool head, which is remotely operated. A high torque, variable speed, drive system, (Fig. 10) is mounted under the box.

The gas sampling system (Fig. 11) comprises a drill press for perforating the specimen container and equipped with seals preventing gas leakage during perforation; and a system for measuring gas pressure and for withdrawing a known proportion of the gas into a sampling bottle.

The thawer (Fig. 12) has been designed for withdrawing specimens from sodium-filled containers. While an electric furnace maintains the capsule at the proper temperature, and argon atmosphere is maintained over the molten sodium surface, the specimen is withdrawn with a remotely operated jack screw.

Measurements Box

The measurements box is used for the inspection of specimens. It contains a semi-micro balance, stereo microscope, a dimensional comparator, and a device for breaking off small pieces of specimens.

The balance (Fig. 13) is operated remotely and has been adapted for density determinations. It is readable to 0.01 mg and has a precision of 0.02 mg.

The stereoscopic microscope is equipped with remotely changeable objectives and provides magnification to 112×. Eye pieces or stereocamero equipment can be mounted at the cave face. The stage, (Fig. 14) is electrically driven, with remote controls for 5 degrees of freedom.

The comparator, (Fig. 15) uses a 0.0001-in. dial indicator. Measurements of specimen dimensions are made by comparison with a standard to insure that manipulator operation does not affect measurement accuracy.

A specimen fracturing device is used to remove small pieces of specimens for analysis. The minimum length which can be broken off is about one diameter. A transparent enclosure prevents contamination of the box during fracturing.

Dissolver Box

The dissolver box provides means for dissolving specimens without permitting the escape of gaseous or particulate activity (except for the rare gases). Fig. 16 is a diagram of the scrubbing and filtration equipment, while Fig. 17 illustrates the entire equipment.

The calibrated dissolver has a capacity of 0.5 to 1 mole of fuel material. It is electrically heated with radiant heaters of more than twice the capacity normally required.

A remote pipetting system is provided, to permit aliquoting the specimen solution.

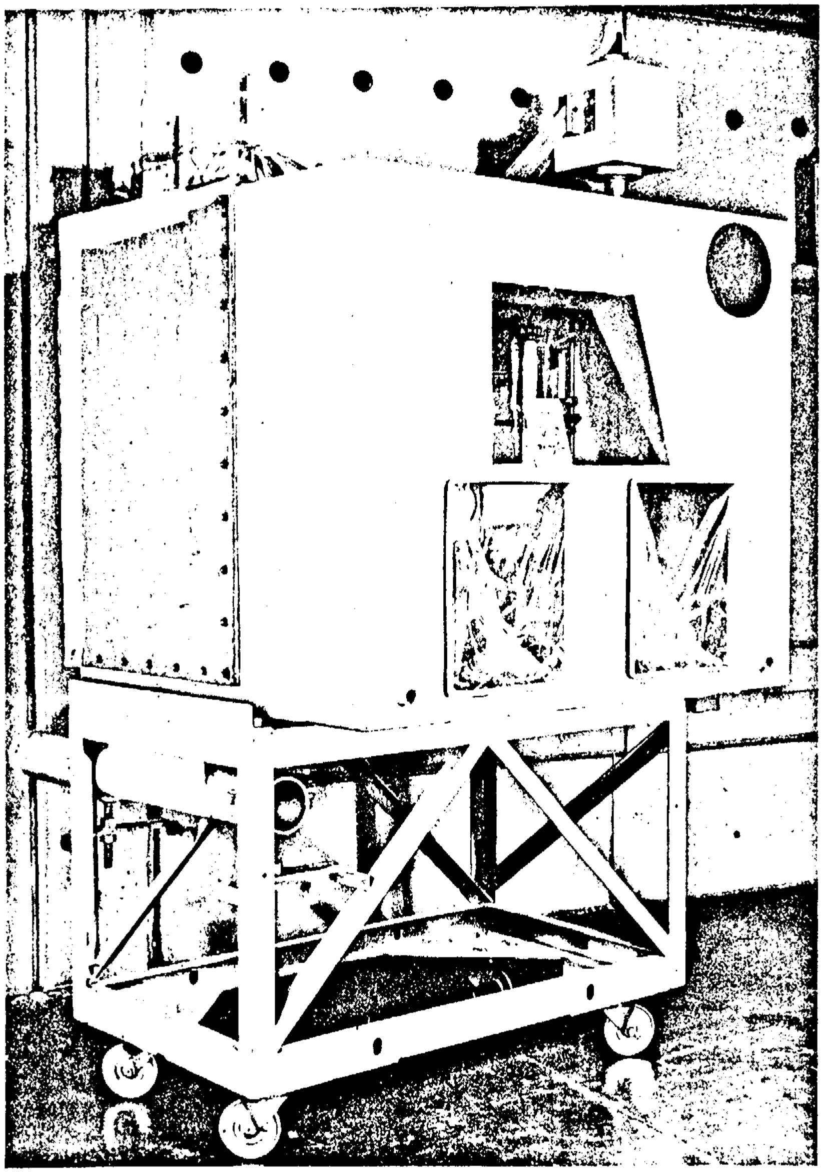

Fig. 7 — Typical cave box

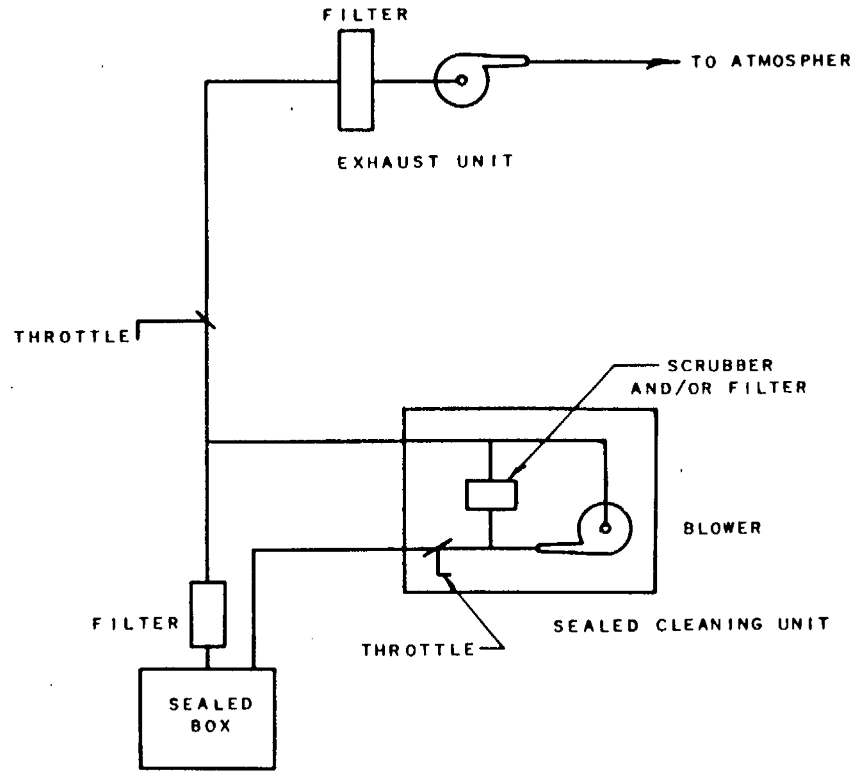

Fig. 8 — Schematic of ventilating system

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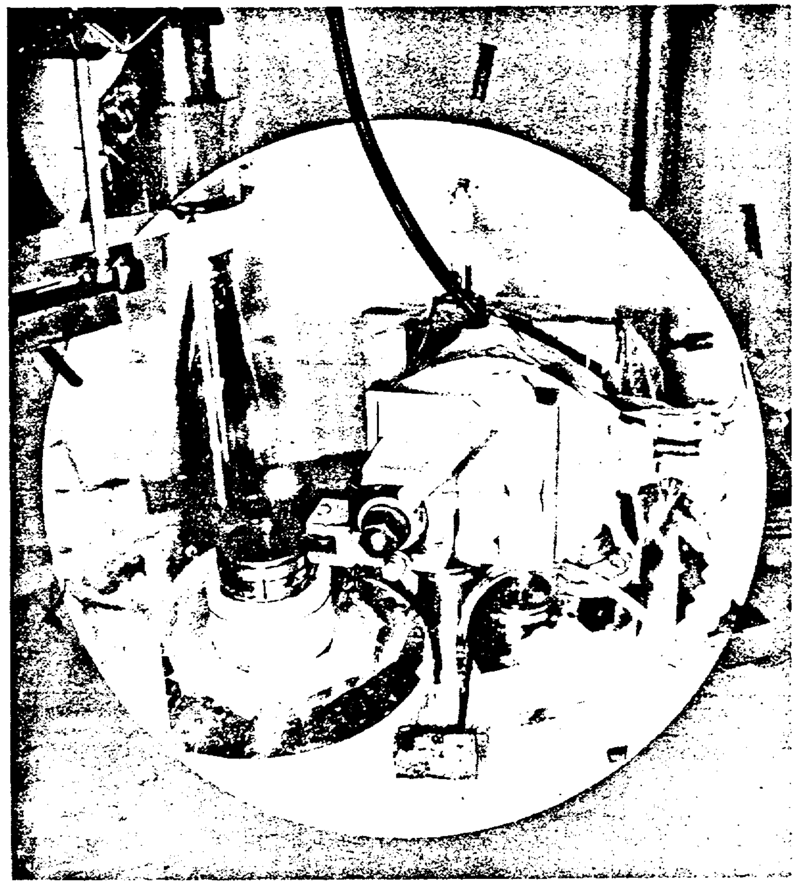
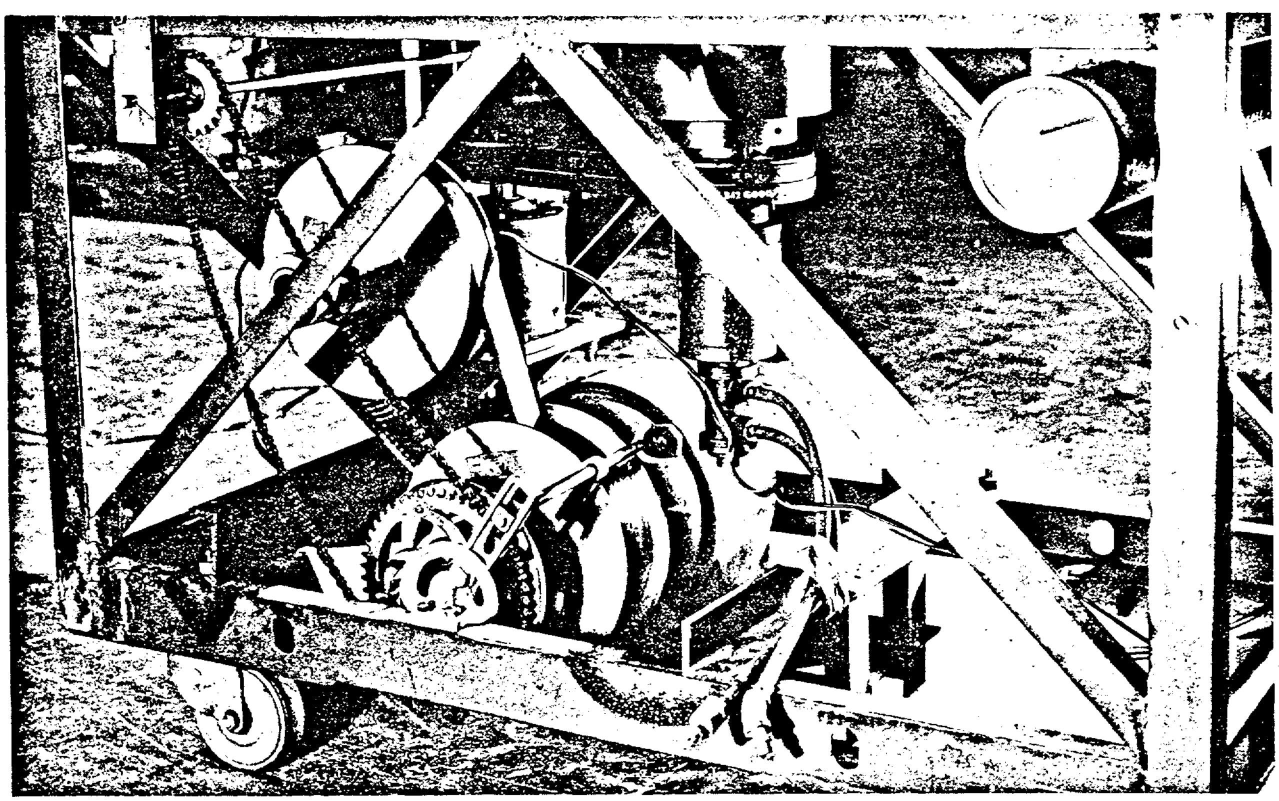


Fig. 9 — Lathe spindle

Fig. 10 — Lathe drive



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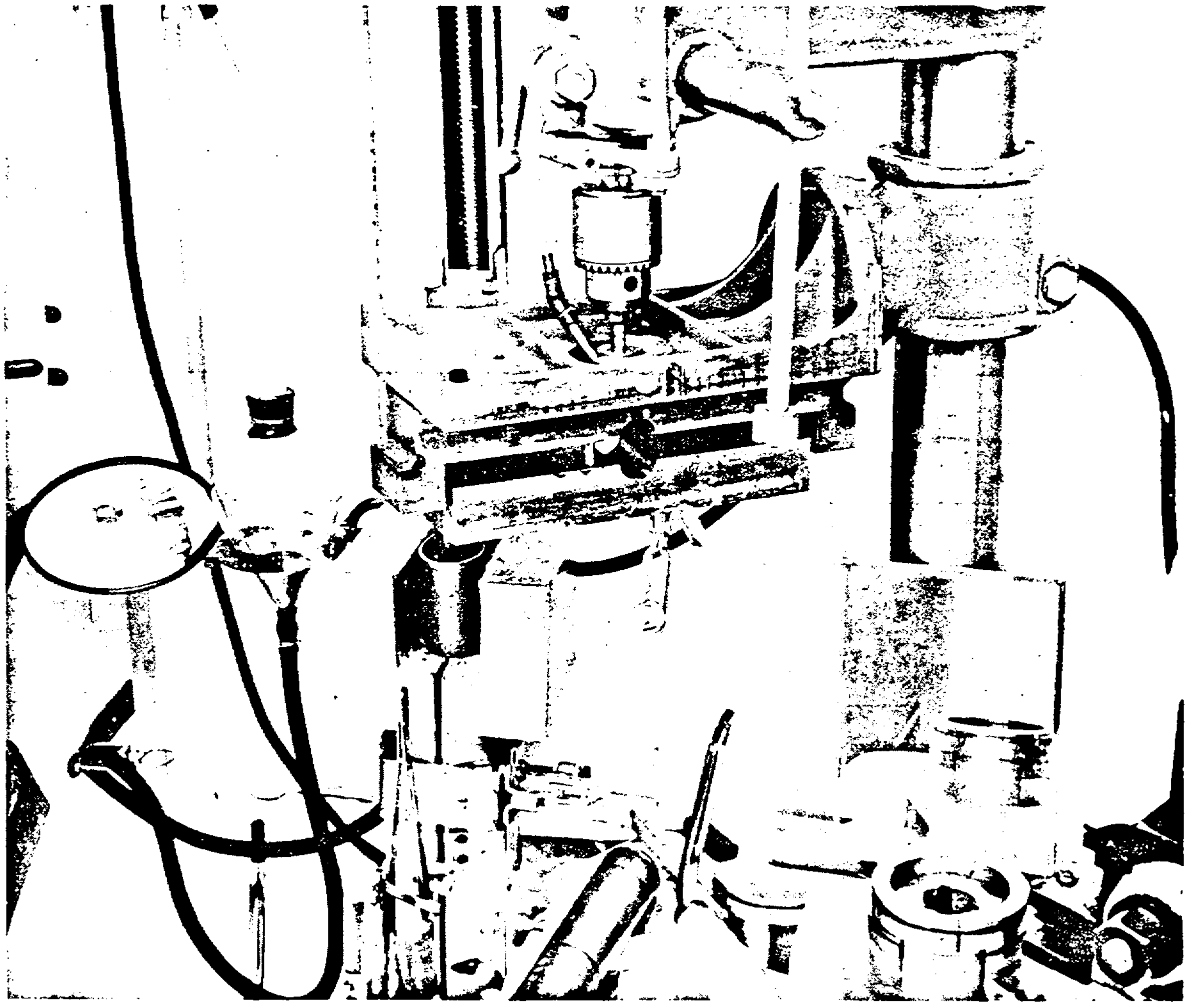

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Fig. 11 — Gas sampling system

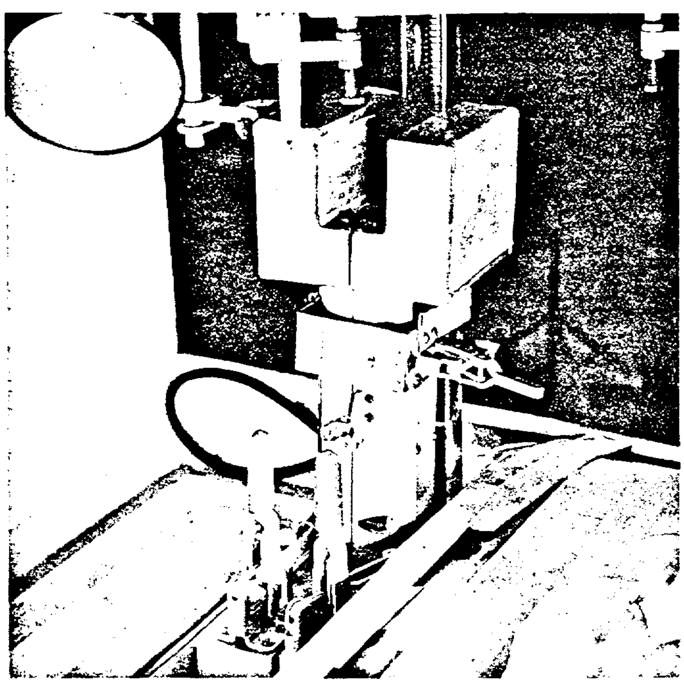

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Fig. 12 — Thawer

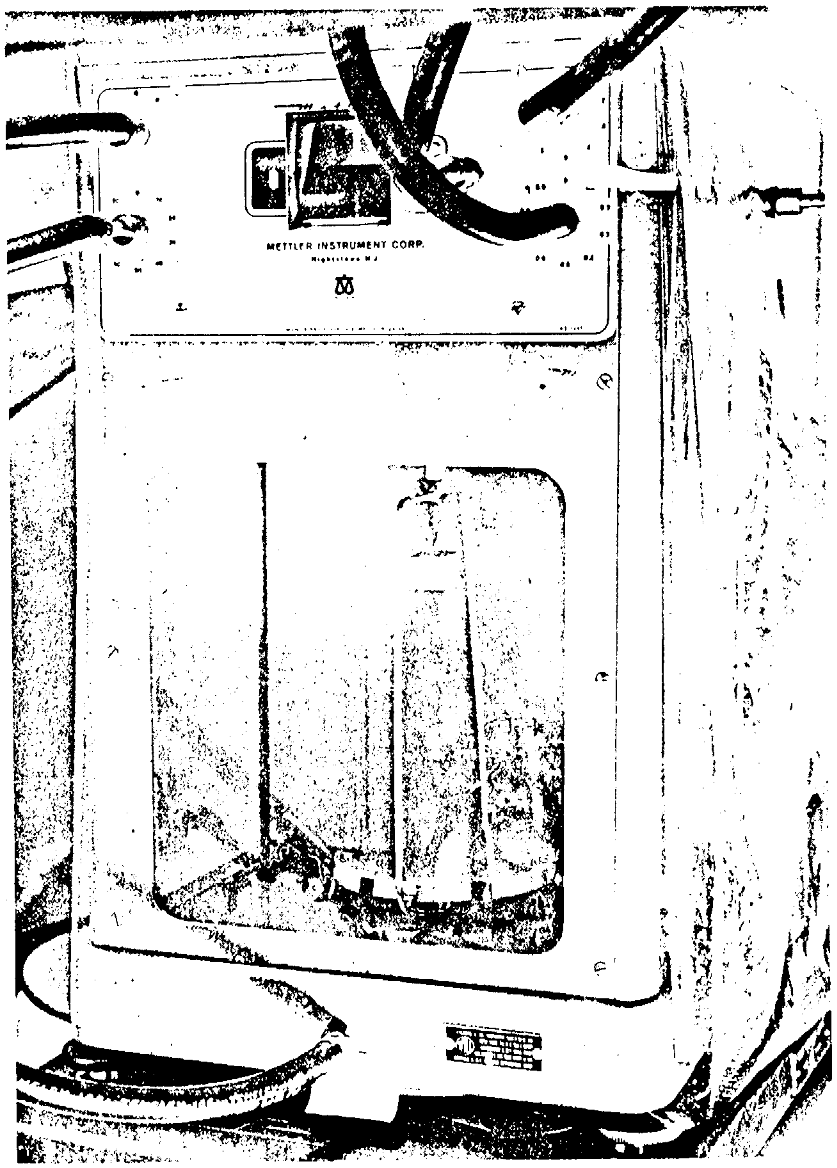

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Fig. 13 — Analytical balance

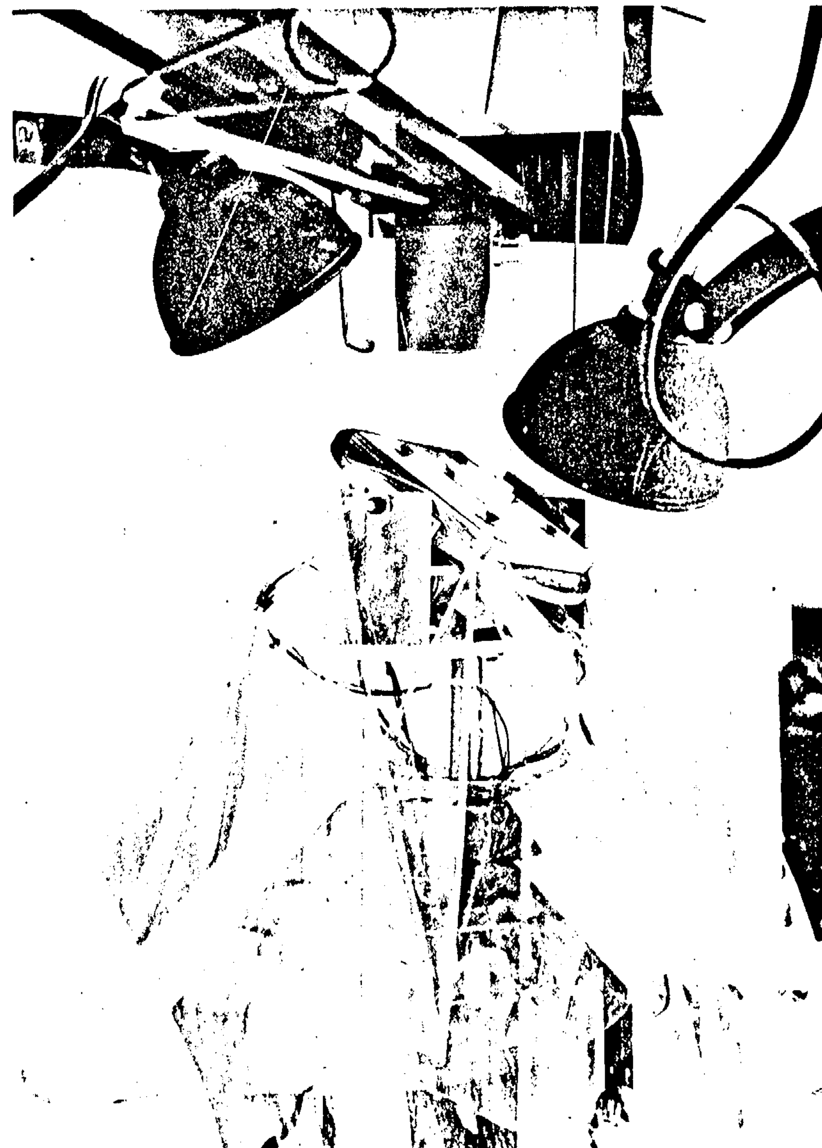

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Fig. 14 — Microscope stage

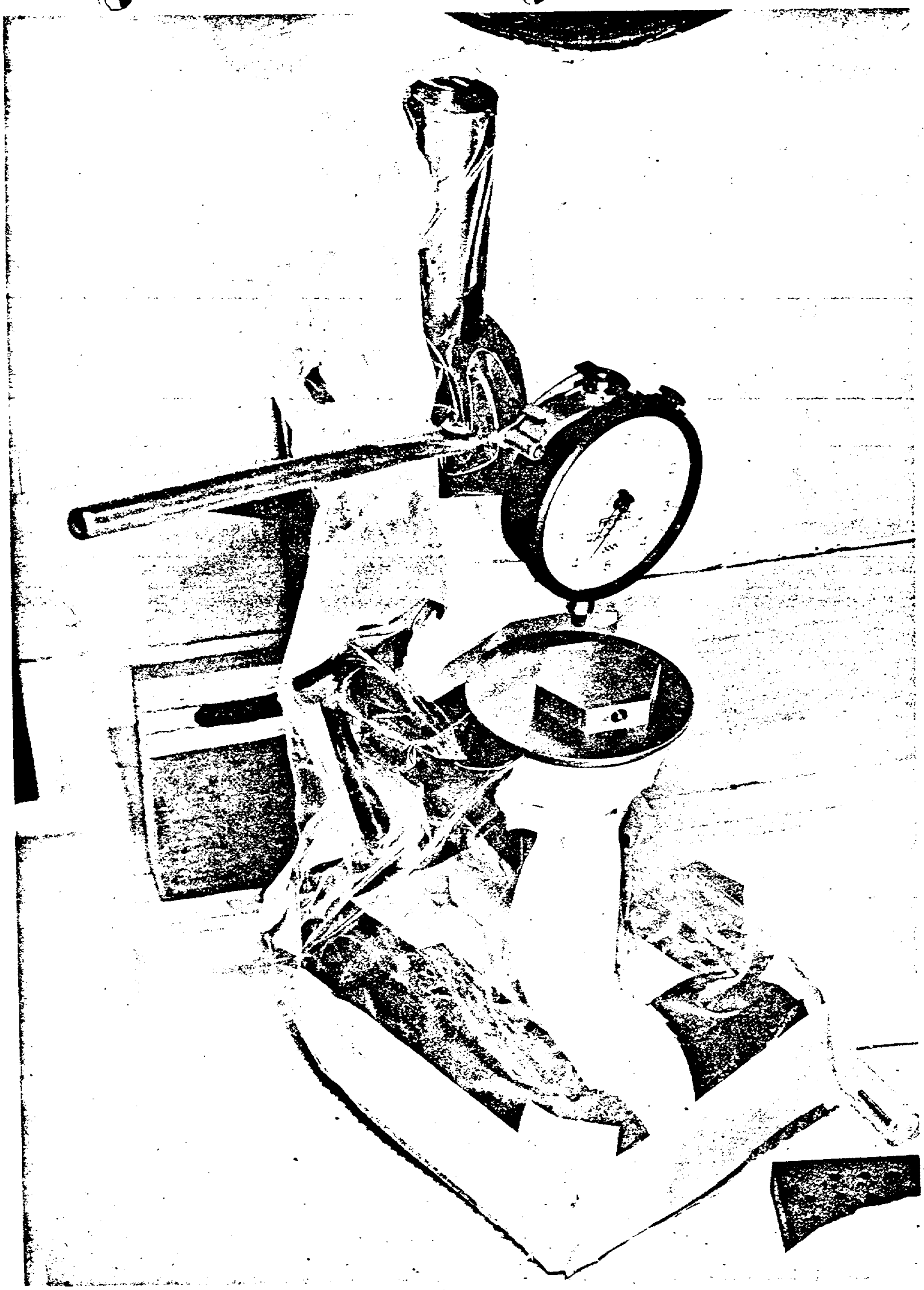
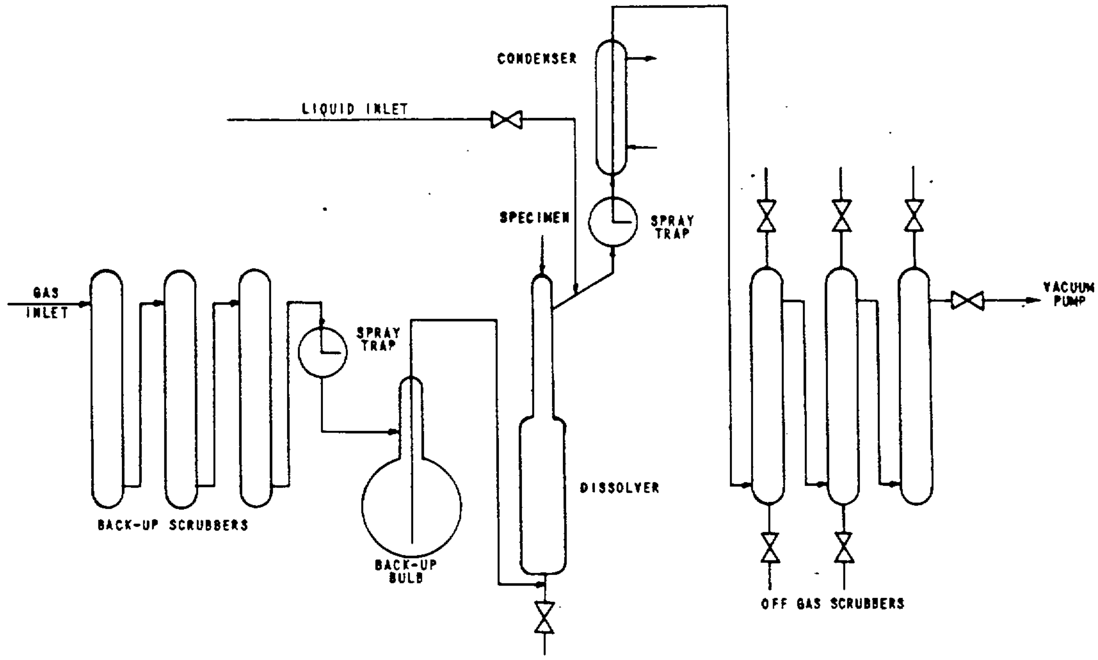


Fig. 15 — Dimensional comparator



Flow diagram of chemical box

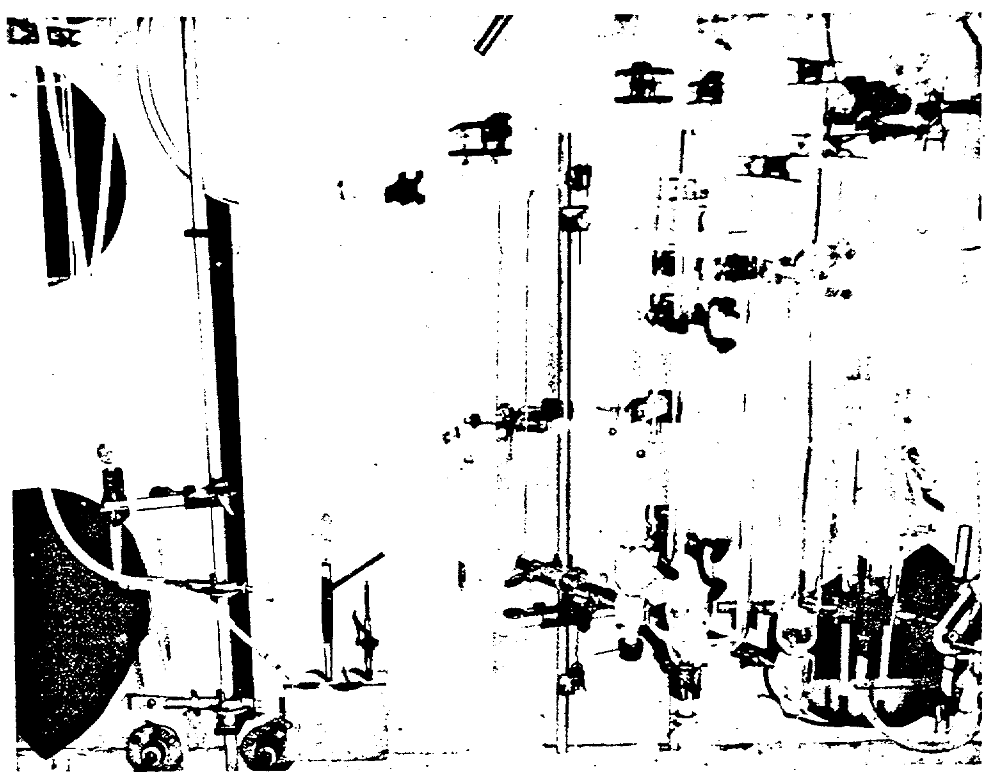


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Fig. 17 — Interior of chemical box