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Cookstove Construction by the Terra-CETA Method

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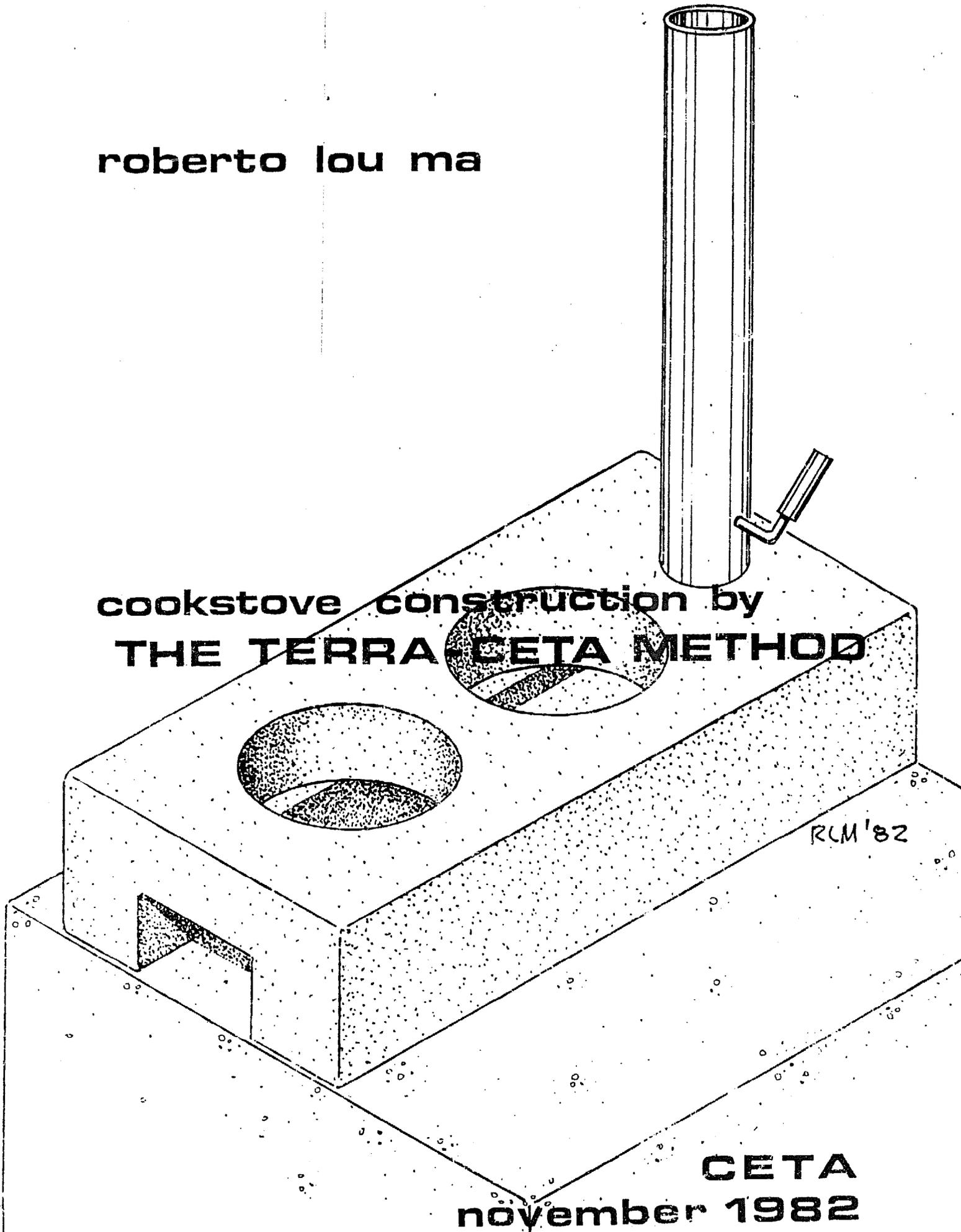
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roberto lou ma

**cookstove construction by
THE TERRA CETA METHOD**



RCM '82

**CETA
november 1982**

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15 AVENIDA 14-61, ZONA 10

GUATEMALA, CENTRAL AMERICA

CENTRO DE EXPERIMENTACION EN TECNOLOGIA APROPIADA **CETA**
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I.- INTRODUCTION

To be effective, a fuel conservation program must promote, among other matters, the generalized adoption of improved cookstoves by people for which fuelwood is the main domestic energetic source. One severe limitation of most existing cookstove designs is that they cannot be readily and cheaply produced in quantities suitable for ample dissemination.

As a possible solution to this problem, a simplified system of stove construction, using mass produced, low cost prefabricated components, designed for self assembly by the potential users, has been proposed elsewhere (Lou Ma, 1982).

As a result of the continued efforts of the Centro de Experimentación en Tecnología Apropriada, CETA, a novel quick and simple procedure for the "in situ" construction of monolithic earthen cookstoves has also been developed, which shall be followingly presented with the name of *TERRA-CETA* as an alternative solution to the referred problem.

II.- THE TERRA-CETA METHOD

The key element to the proposed method is the use of a special dismountable mold, fabricated from metal or lumber. The mold consists of a rectangular frame, to which a number of cavity forming inserts are fastened. With reference to the enclosed drawings:

- A Frame Sides
- B Frame Ends
- C Duct Forming Insert
- D Pothole Forming Insert
- E Chimneyhole Forming Insert

Drawing 1 depicts the dismantled wooden mold. The mold is assembled as shown in Drawing 2, by means of bolts with wingnuts (in a simpler version, the frame is held together with four tie rods, instead of the four steel corner brackets shown in the drawings).

The stove can be built at floor level, or over an elevated base made of rammed earth, adobe, masonry or other material. To form the stove body, the assembled

mold is filled with successive layers of damp earth (clayey soil), each layer thoroughly compacted with a ramming tool. Because the compaction is performed at low moisture contents, very high densities can be attained. Consequently, earth materials with high clay content can be used without the danger of cracks appearing on drying, and producing a very strong and durable mass.

Upon completion of the filling, the cavity forming inserts are extracted. Insert C is pulled straight out as indicated by an arrow in Drawing 3, and inserts D and E are removed by combined rotating and pulling actions. To facilitate their removal, the inserts are covered with paper prior to filling the mold. Lastly, the frame is dismantled.

The stove is completed by placing a baffle block (F) beneath the second pothole, in a manner to step up the duct floor to within 2 or 3 centimeters of the pot-bottom. The baffle block can be a prefabricated piece, or can be molded in place from the same material used for the stove body. In the former case, the position of the baffle may be adjusted along the duct for best performance.

According to the described procedure, a stove can be built in less than one hour, not counting the time needed to prepare the earthen material.

III. - ADVANTAGES

Advantages gained with the *TERRA-CETA* method are:

- Only cheap and simple materials and equipment are involved.
- Simple labor required.
- Short construction time.
- Mass production is possible.
- Production can be standardized.
- Stronger and more durable high clay content materials can be used.
- Great flexibility in regard with design.
- Stoves are visually appealing, harmonizing well with most rural households.

IV. - OTHER CONSTRUCTION MATERIALS

Other possibilities relating construction materials are soil-cement, concrete,

lime-pozzolan mixtures, etc.

V.- PROTOTYPES

The first *TERRA-CETA* stove prototypes were built in August 1982, with the following characteristics (dimensions in centimeters).

- Building material	Sandy clay
- Body dimensions	24 H 40 W 85 L
- Duct cross section	12 H 16 W
- Number of potholes	Two
- Diameter of potholes	22
- Chimney	10 D 300 L
- Damper	Butterfly valve at the chimney base
- Baffle block	Soil-cement prefab 10 H 18 W 30 L
- Finish	Lime whitewash
- Remarks	The pots sink deeply into the stove body, their bottoms bearing on the side walls of the duct. Laboratory tests have shown good efficiency in water boiling and in actual cooking.

VI.- DESIGNING STOVES

The above given specifications are only illustrative, and may be varied to suit any specific application. In doing so, however, care should be taken in keeping the design within the framework of requirements considered to be essential for high fuel efficiency, as have been experimentally identified by CETA (Lou Ma, 1982). For a more rational and scientific approach to stove design, see De Lepeleire et al., 1981.

In any event, it is recommended that the designs are finally verified and refined on the basis of performance observation and measurements, both in the laboratory as in actual use in the field, before intending any large scale promotion.

VII.- OTHER EXPERIENCES

The *TERRA-CETA* method has been successfully applied to building the basic earth block for the Lorena design, including the pilot openings for the duct, potholes and chimney, with great economy in time. Some experimental shielded fires have been as well constructed for efficiency and usefulness studies (See Drawing 6).

The *TERRA-CETA* method is being at the present tried by the Proyecto de Estufas Rurales, Representación General en Puebla de la Secretaría de Agricultura y Recursos Hidráulicos de México, to which the author is consultant.

VIII.- FURTHER DEVELOPMENT

Further development is being carried on by CETA, and a manual describing mold fabrication and use, earth material selection, stove construction procedures, etc., will be eventually produced.

A latest version of the *TERRA-CETA* mold, does without the cross members by which means the pothole inserts (D) are fastened to the frame. Instead, the referred inserts are mounted directly on the duct insert (C) with bolts, as indicated in Drawing 5. This design renders unobstructed working space, expediting filling and compaction operations, and thus reducing construction time.

On completion of the stove body, the inserts are unbolted and removed by pulling them with a special jacking device, first insert (C), then (D) and (E). To ease removal, a strip of light gauge galvanized sheet iron is wrapped to form a cylinder around each pothole insert, and bound in place with a loop of light wire before construction. Thus, when pulled, the insert slides out without difficulty, leaving the sheet metal lining inside the pothole. This lining is in turn also removed. For the same given reason, duct insert (C) may have slightly tapering sides.

In addition to the cylindrical configuration, pothole forming inserts of other shapes can be used, such as tapered, rounded, flared or belled, to suit needs.

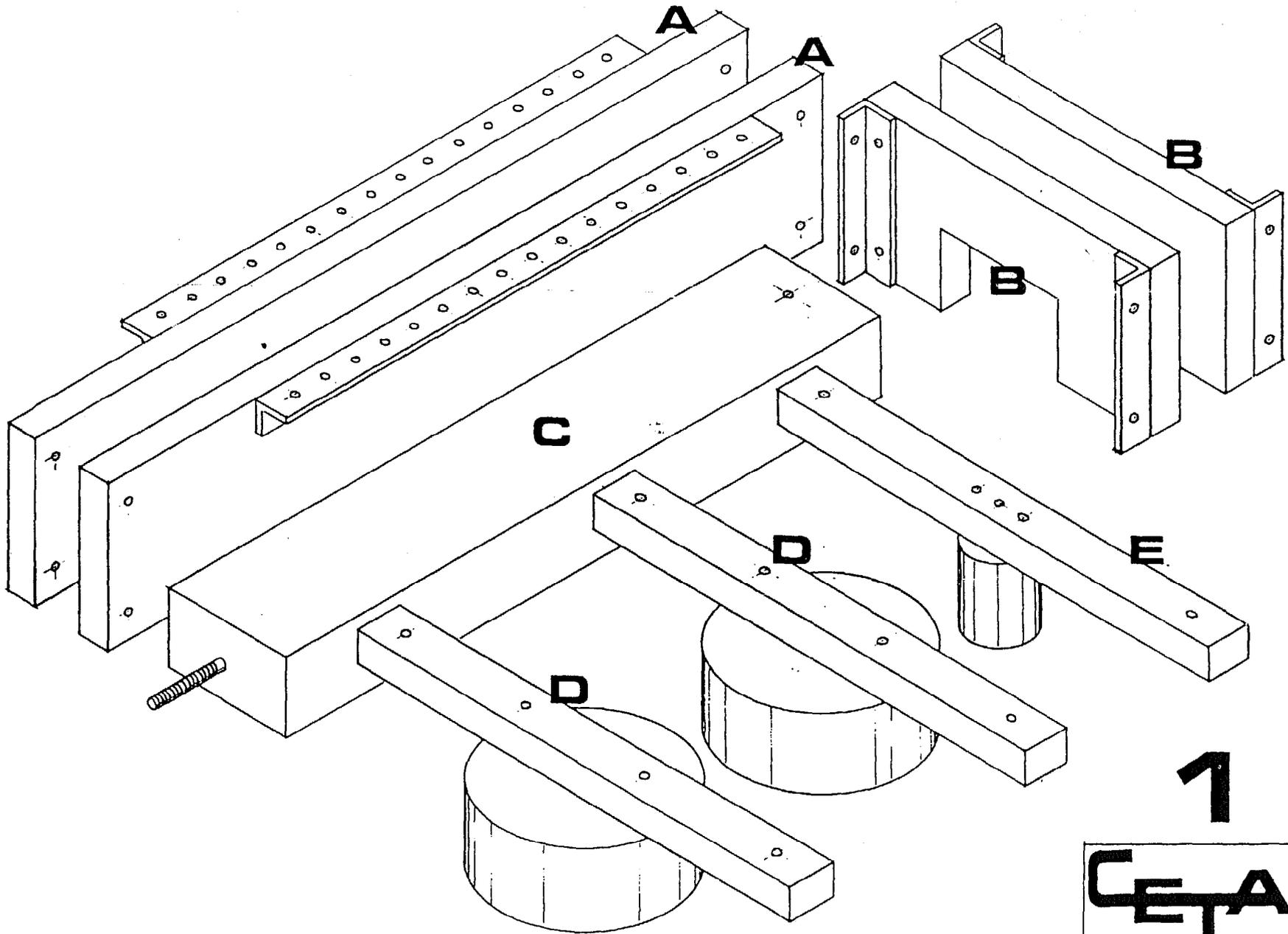
An all metal mold has been designed, and is now being built.

A photographic account on CETA's work is being prepared as a complement to this and other publications by CETA.

IX. - REFERENCES

- Roberto Lou Ma (1982).
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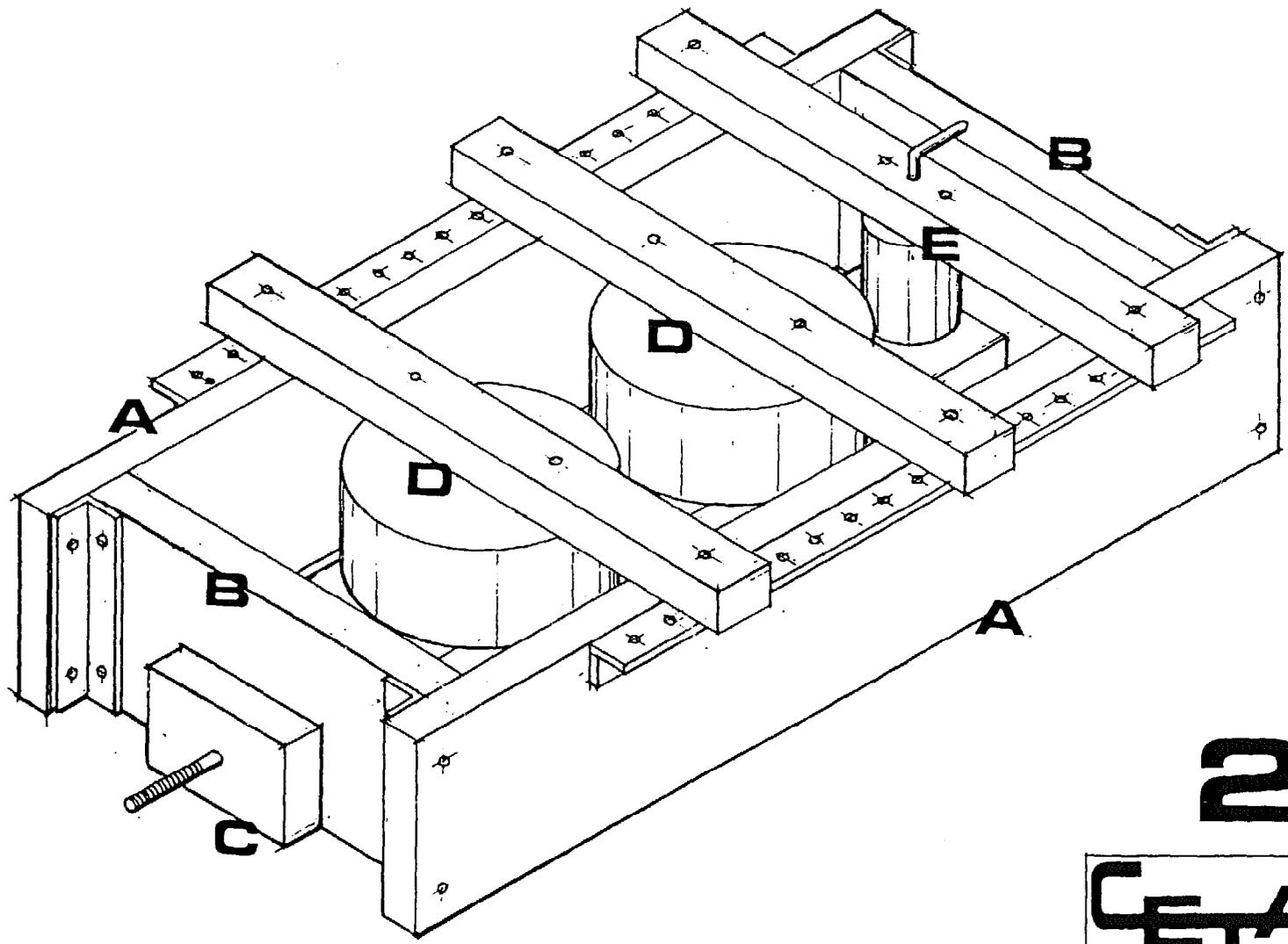
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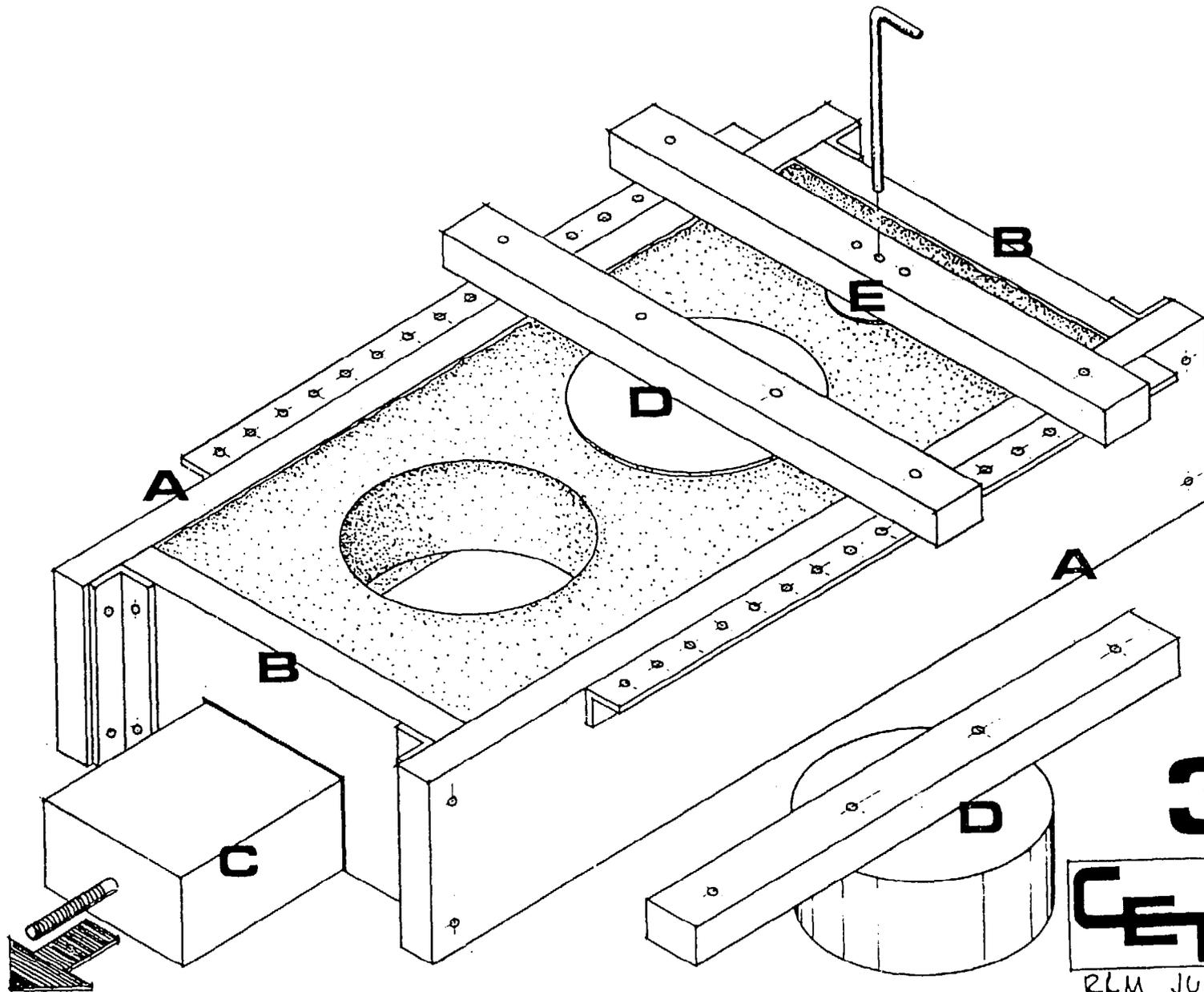
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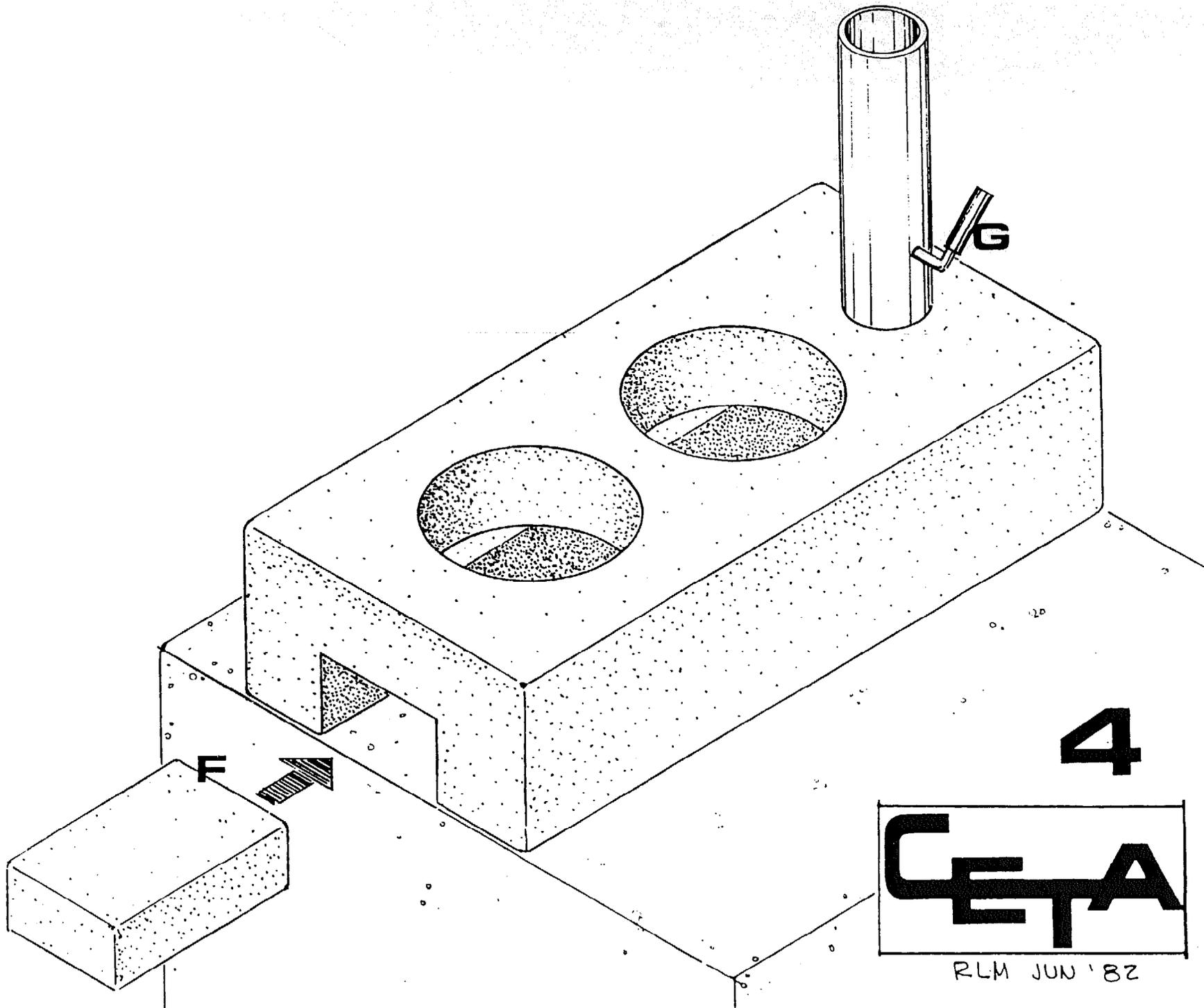
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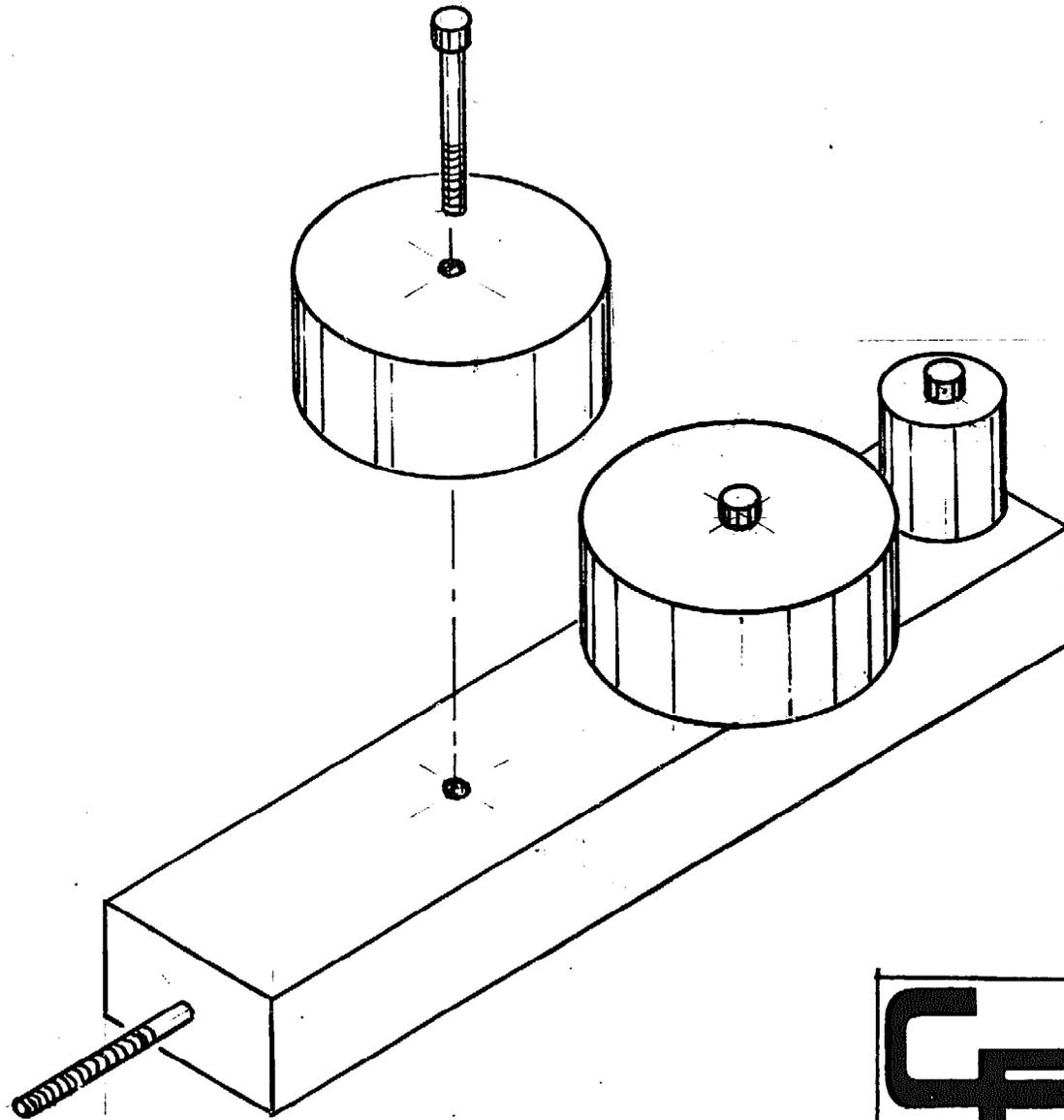
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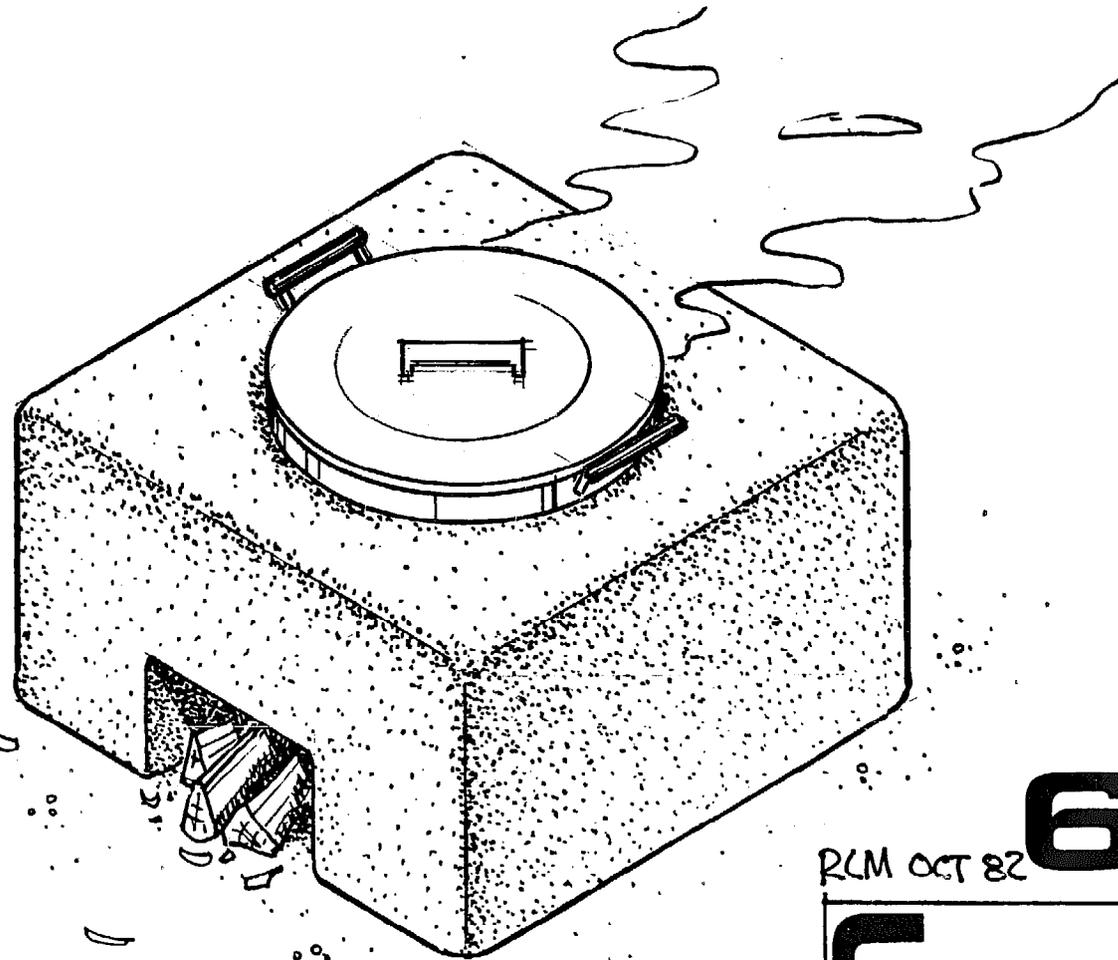
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