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Reactor spec Design

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DESCRIPTION OF ACCOMPANYING PRELIMINARY

DESIGN DRAWINGS FOR A CONVERTER PILE

PRODUCING 23 AND UTILIZING 49

L. A. Ohlinger

Obviously, there are innumerable possible designs for a converter and its component parts to produce 23 by bombarding 02 with neutrons, even when it has been specified that the neutron source shall be a 49 consuming reactor. The accompanying drawings present just a few of the design potentialities and combinations.

HETEROGENEOUS TYPE PILES:

Page 1 shows a typical heterogeneous type pile (or reactor) with two alternative methods of unloading the active elements in the pile or in the reflector. The pile sections proper would be a multiplicity of individual elements having 49 in the central section and 02 in the ends to form the reflector. Surrounding this would be individual elements of 02 to form the reflector. Surrounding this would be individual elements of 02 to form a lateral reflector. These would all be so disposed in a pressure tank as to form a pile and reflector through which a cooling liquid such as water or P-9 could flow. These elements could be supported at the bottom and have bales at the top for engaging the removable hoisting mechanism which would handle the elements, or they could be suspended from above on cables which would be used for the removal or replacement of elements.

The cooling water flow might be either up or down and it might be necessary to end the cooling water in the tank above the pile just above the water outlet, with a hydrocarbon floating on the surface to complete the full tank of liquid which serves as a shield and reservoir. The coffin for handling the sections could be operated either upside down or right side up as indicated in the alternate sketches.

Due to its comparatively small size, the reservoir and shield tank has been shown with a pressure cover for operation of the entire cooling system under pressure. For removing and replacing units, covering and handling the coffin, etc., the pressure cover would be removed and auxiliary hoisting and handling equipment operated through the water from above. The lateral shielding has been neglected in the sketches but may be any of the conventional designs. As an alternate, the unit could be operated without a pressure cover by increasing the depth of the r[redacted]or so, but this would ren[redacted]t.

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Control would be obtained by moving one of the central elements in or out of the pile as indicated and would be arranged to drop out of the pile in an emergency. The actual details of an element are not fixed but are subject to many variations. One proposal is to dispose the 49 as an alloying element in say 2S aluminum formed into a sheet and then to clad or electroplate the faces and edges with aluminum or other material as indicated on Page 3. This so-called "sandwich" might be of any size or shape and might have end reflectors of O2 incorporated right in the unit as shown although it will probably be better to have thicker elements of O2 than indicated at the ends.

These sandwiches might be set together in groups of any cross section and size a few of which are indicated on Pages 4, 6 and 7, where hexagonal boxed units (these could be square or rectangular or any shape), accordion pleated sections, and corrugated square tubes full of sandwich wafers show a few possible arrangements. Another way of disposing the 49 might be as a coating on an aluminum tube over which another tube would be drawn to encase the 49 in a tubular sandwich. These tubes could be hexagonal or octagonal in shape grouped together geometrically as indicated on Page 4 to leave water passages between as well as through tubes and tack welded to form units say 4" x 4" in section.

By going to a more complicated setup (Page 5), it is also possible to arrange for a bottom discharging and charging into a submerged coffin which is removed through a pressure lock. Here the elements are supported from cables or rods. Page 6 shows another top discharge arrangement utilizing a transport coffin from the reactor to a water-cooled coffin which is not submerged.

The choice of reflector is also open to much variation and several forms of reflector are shown on the piles on Pages 1, 5, 6 and 8. Page 1 shows the lateral reflector as typical elements formed of groups of O2 plates much as the pile elements would be formed. Page 5 indicates the lateral reflector as O2 balls or shot, dropped in from above and removed through a retractable gate to a submerged coffin similar to the element coffin. Page 6 shows a lateral reflector of an O2 slurry which is circulated through the reflector tank and cooled by pumping through an exchanger. This method requires means for gas disposal and handling and introduces the typical slurry problems. Page 8 indicates a novel O2 ball or shot reflector in which the shot is not replaced continuously but only when fully exposed. Here the shot is constantly tumbled in the reflector by a revolving tank with internal blades, and is withdrawn at intervals at the bottom.

Instead of this, the shot could be dropped into the top and fall out the bottom of the reflector continuously with a submerged or pressure type Redler conveyor to move it from the bottom to the top. This arrangement is not shown in the sketches.

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HOMOGENEOUS TYPE PILES:

Page 2 shows the simplest form of homogeneous type converter. The 49 would be dissolved in, say, water or P-9 and circulated through the pile tank, while the 02 would be suspended in a slurry in, say, water or P-9 and circulated through the reflector tank.

In the sketch, the 49 solution is forced through the pile tank by an axial flow pump (centrifugal pumps could be adapted if necessary). From there, the stream spreads to the annular shaped tubular heat exchanger surrounding the reflector tank. After passing through the exchanger tubes, it collects in the distributing annulus and then is forced through spray nozzles into the vapor and storage tank above, on which the axial flow pump takes suction. This spraying and pressure reduction gives the gases a chance to be released while cooling coils in the tank condense all condensable vapors. The gases of decomposition and fission gases passing the coils would be diluted with helium and the decomposition gases burned back to liquid to avoid explosions. The 02 slurry would be circulated through the reflector tank and exchangers with means for gas removal, etc.

Another form of homogeneous pile which eliminates the pumps is the Wigner "pulsating" pile shown on Page 8 in which the solution is forced from the pile through an exchanger to tanks and back by gas pressure.

CONCLUSIONS:

Obviously, there are many combinations of pile and reflector types even among the few shown here but the ones which appear most promising are the heterogeneous pile and reflector shown on the right of Page 1 and the homogeneous pile and reflector shown on Page 2.

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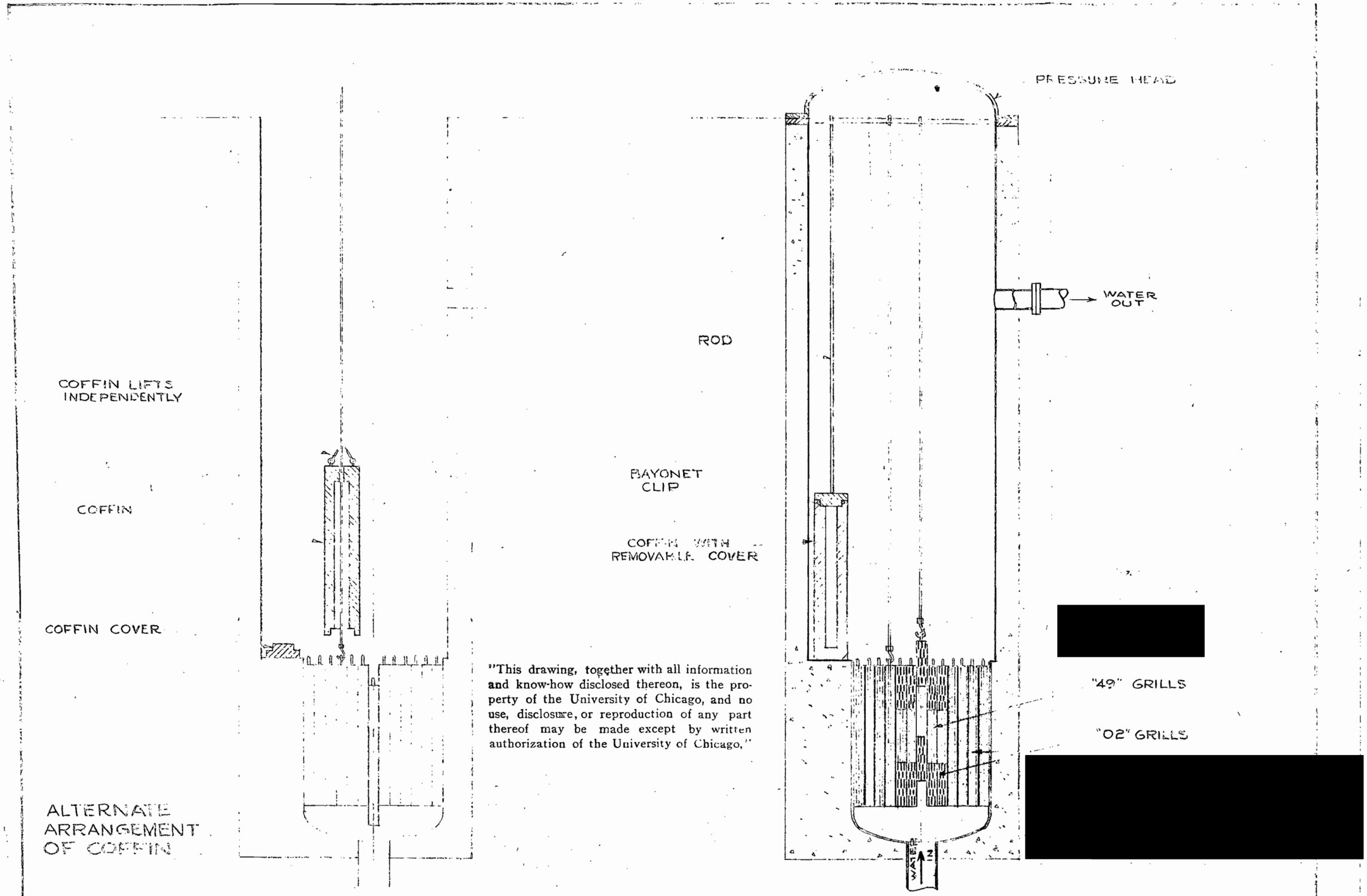

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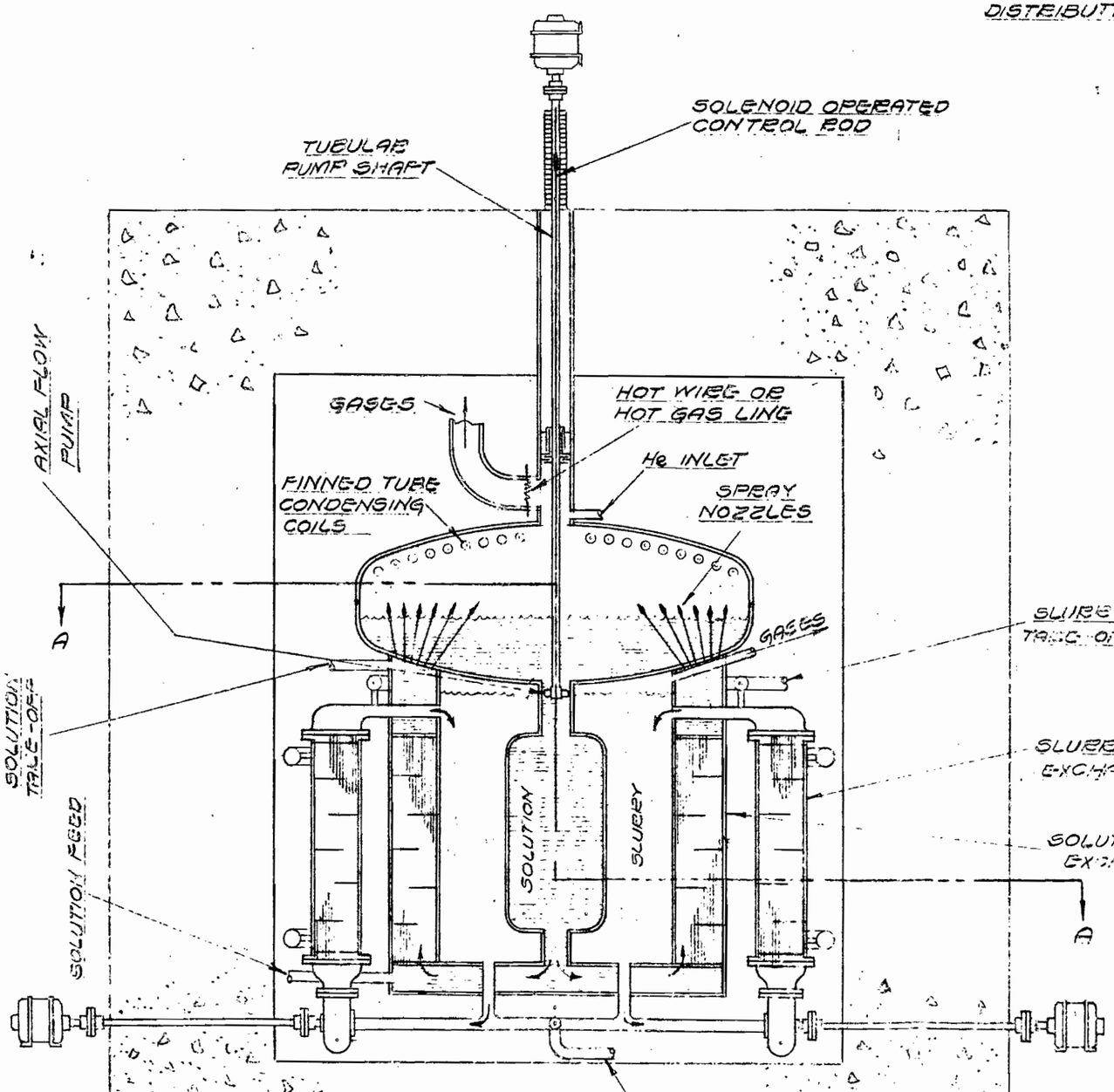
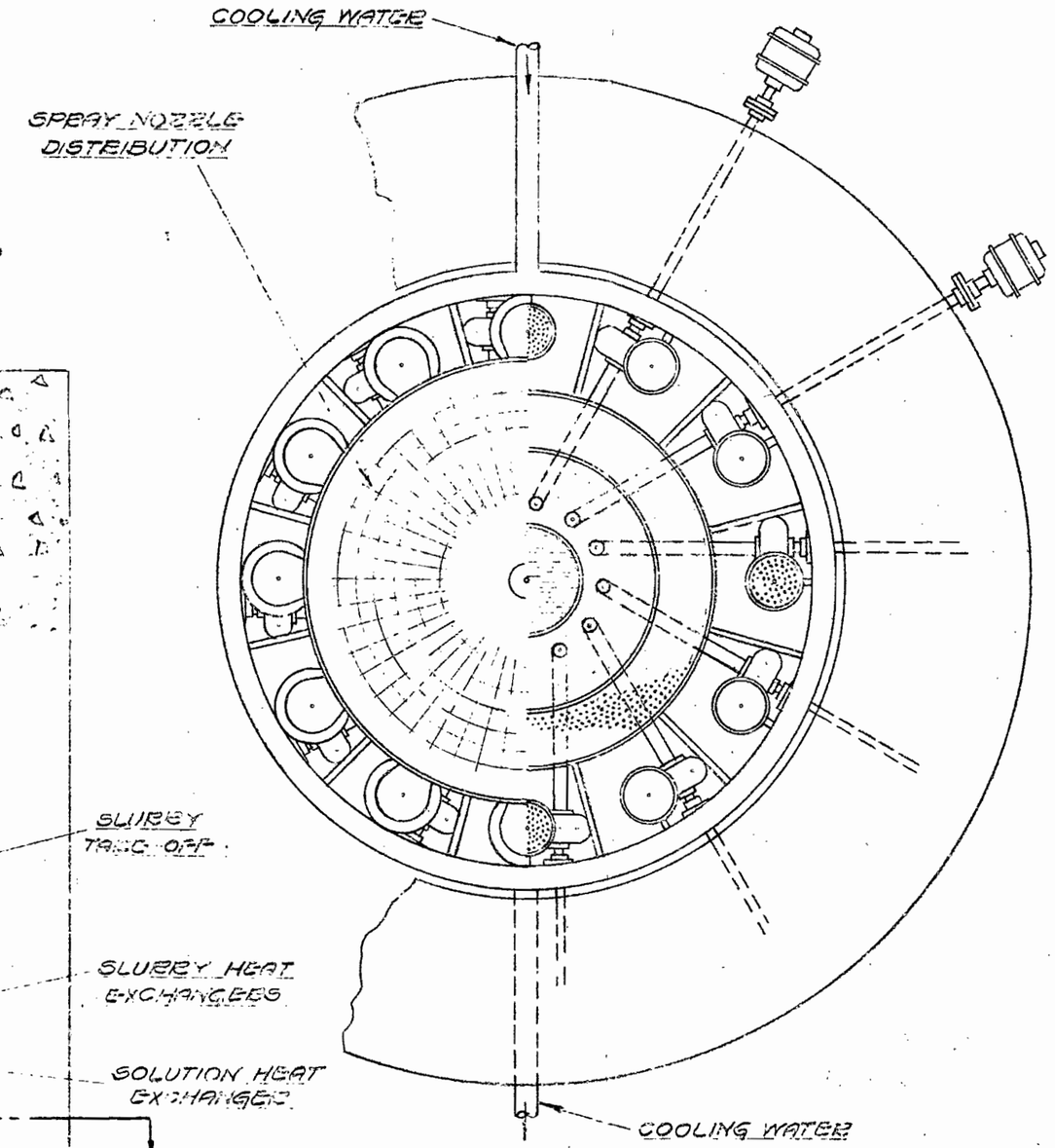
HETEROGENEOUS PILE ARRANGEMENT.

SCALE $\frac{1}{4}$"=1'-0"

BY S.W.K. FOR OHLINGER 1-5-45





SECTION AA

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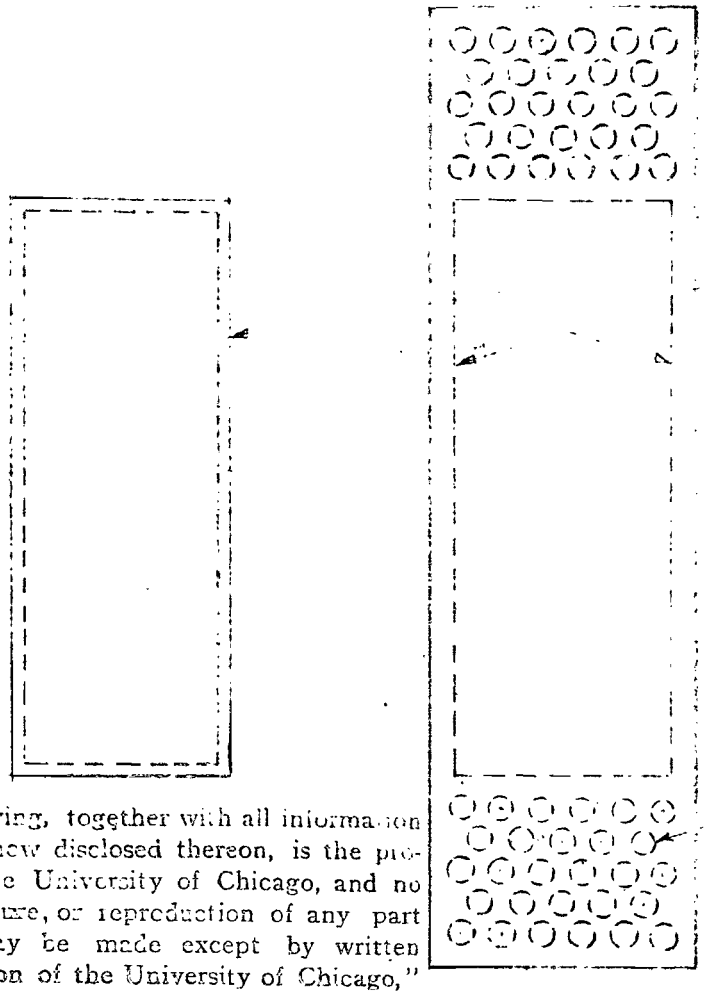

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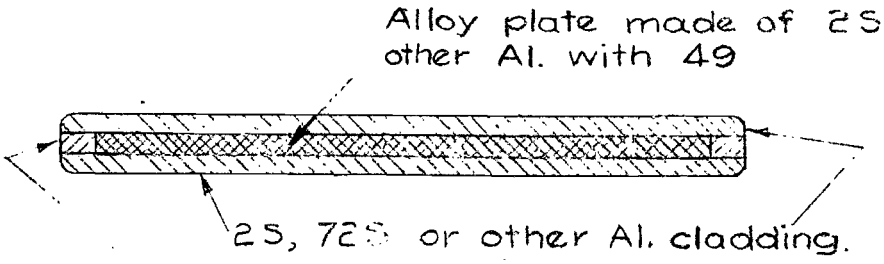

Center frame of same alloy, cut from single sheet with center cut or punched out so edge is continuous around four sides.

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May also be accomplished by electroplating alloyed plate of 2S-49, etc.

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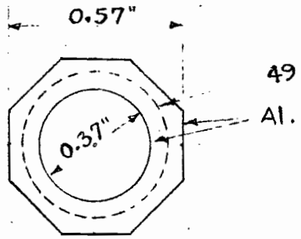
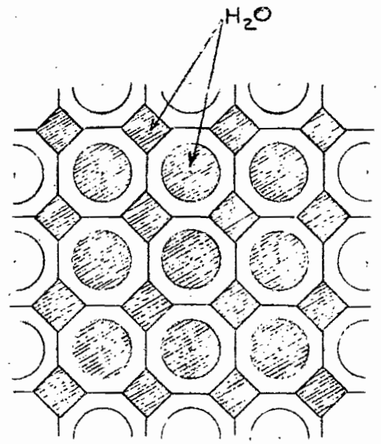
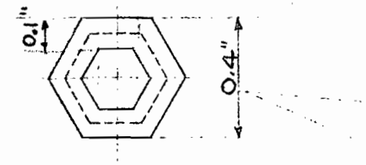
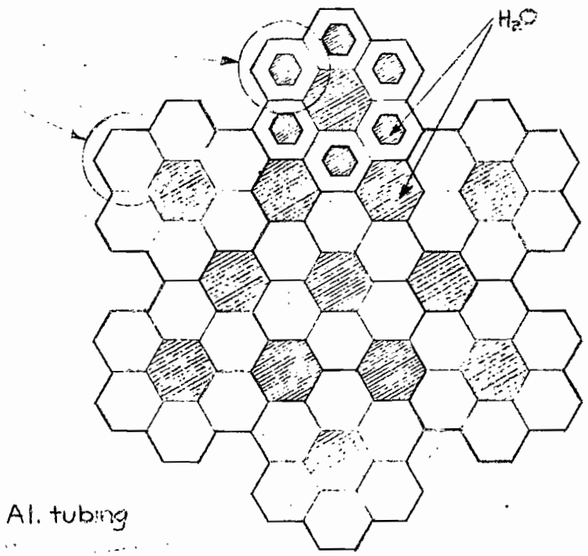
By SML, for OHLINGER









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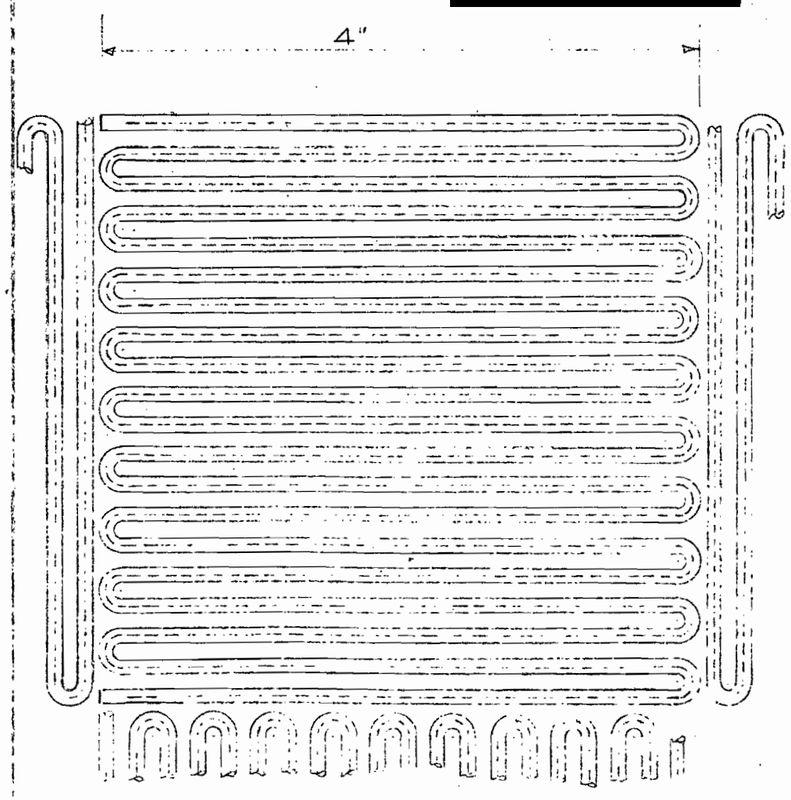
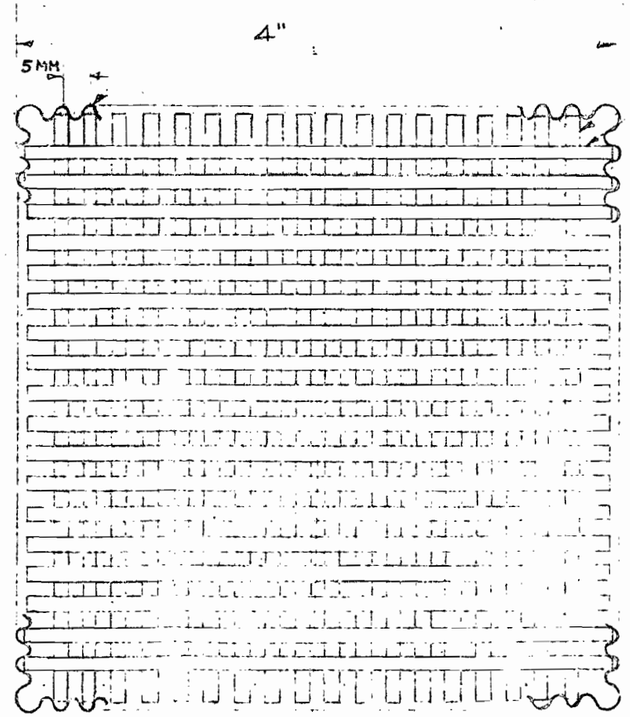
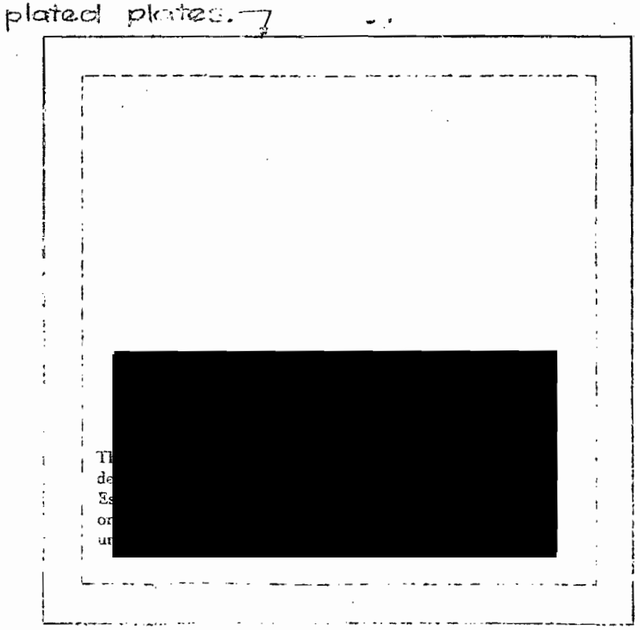
Corrugated Al. tubing





Small sandwich blocks or plated plates.



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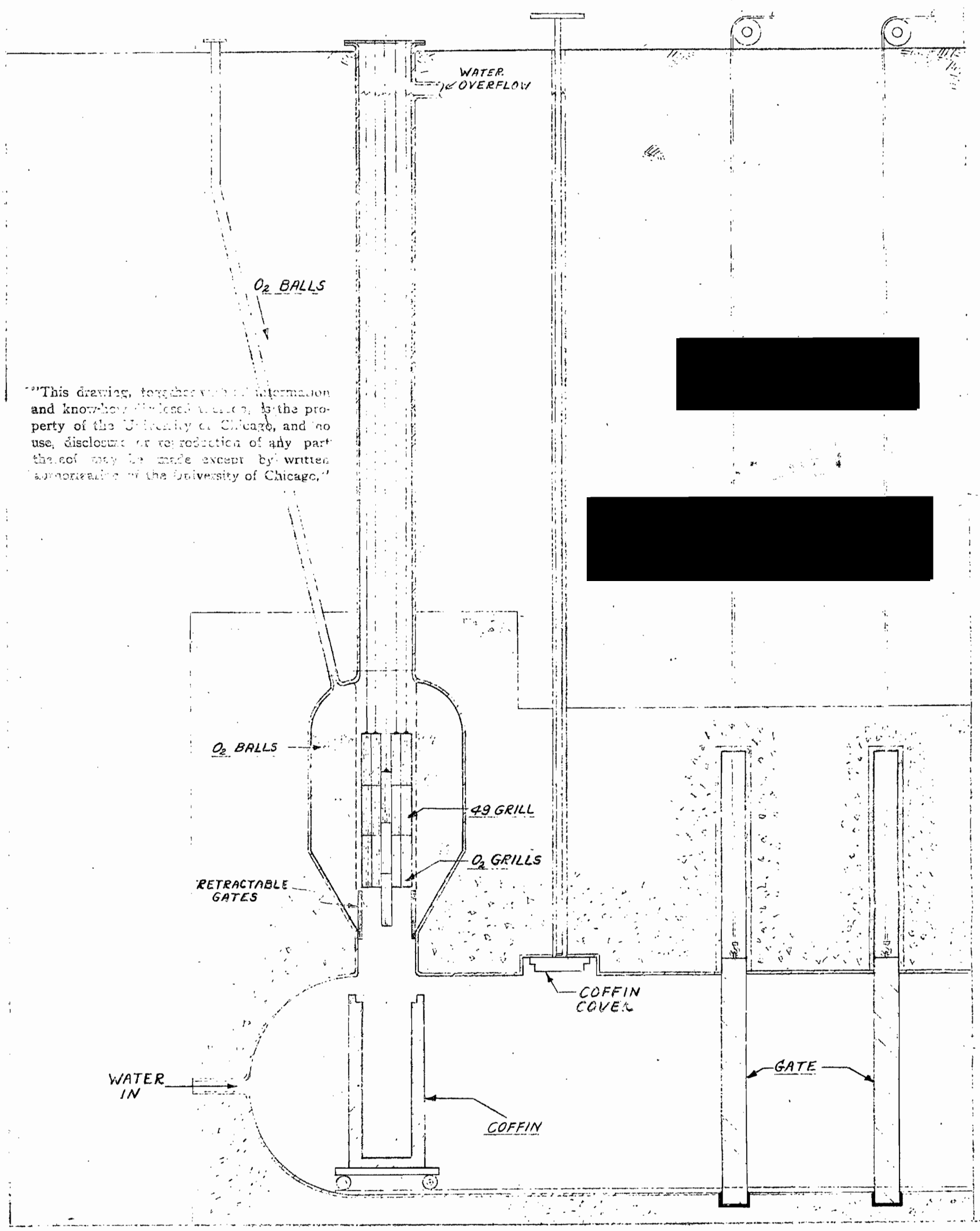
DRAWN BY J.A. FOX PLINGER 1-8-15

HETEROGENEOUS PILE ARRANGEMENT



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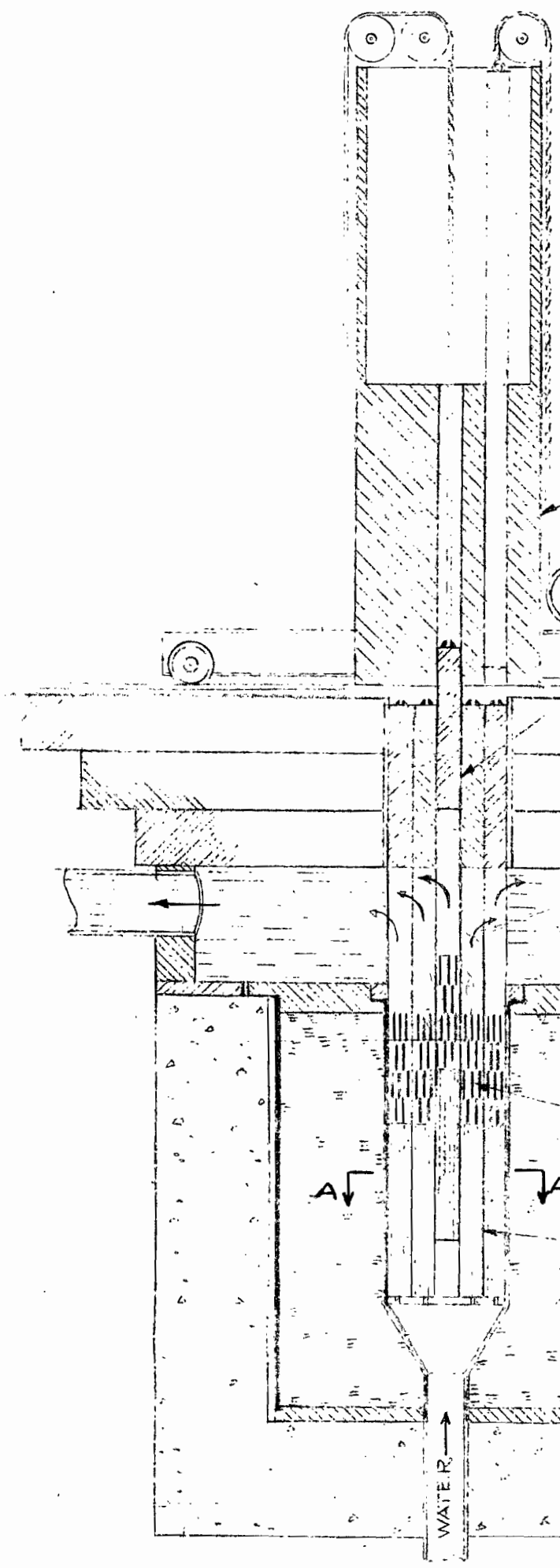
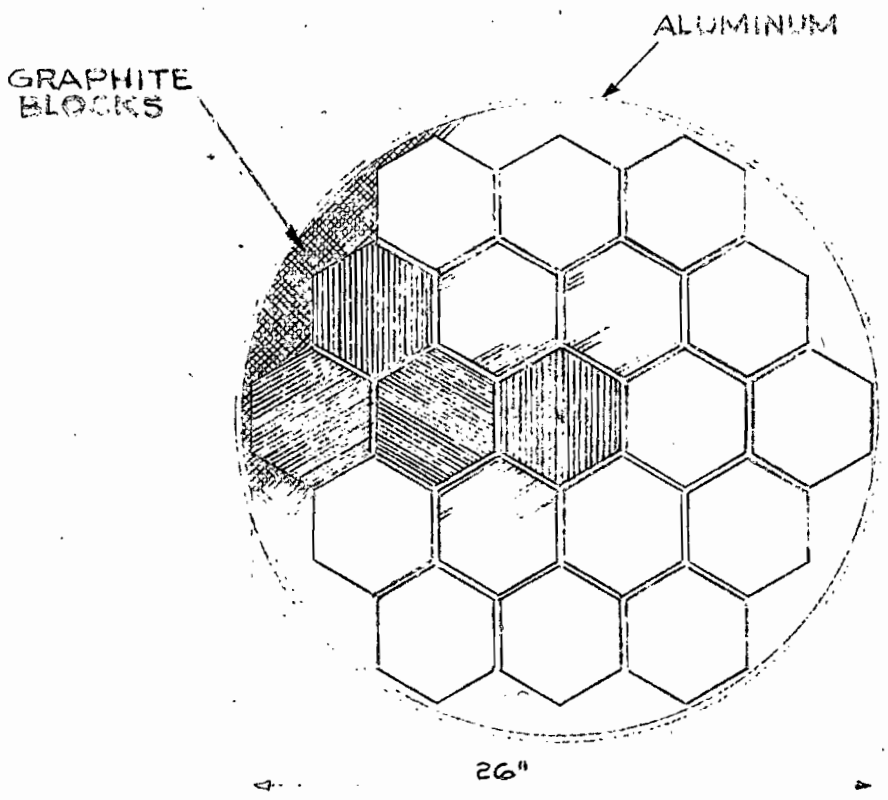
BY J.L.A. — FOR OHLINGER — 1-5-44





SECTION A-A
(SHOWING CARTRIDGE BUNDLE AT "49" GRILLS)
SCALE $1\frac{1}{2}$" = 1'-0"

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HEAT EXCHANGER

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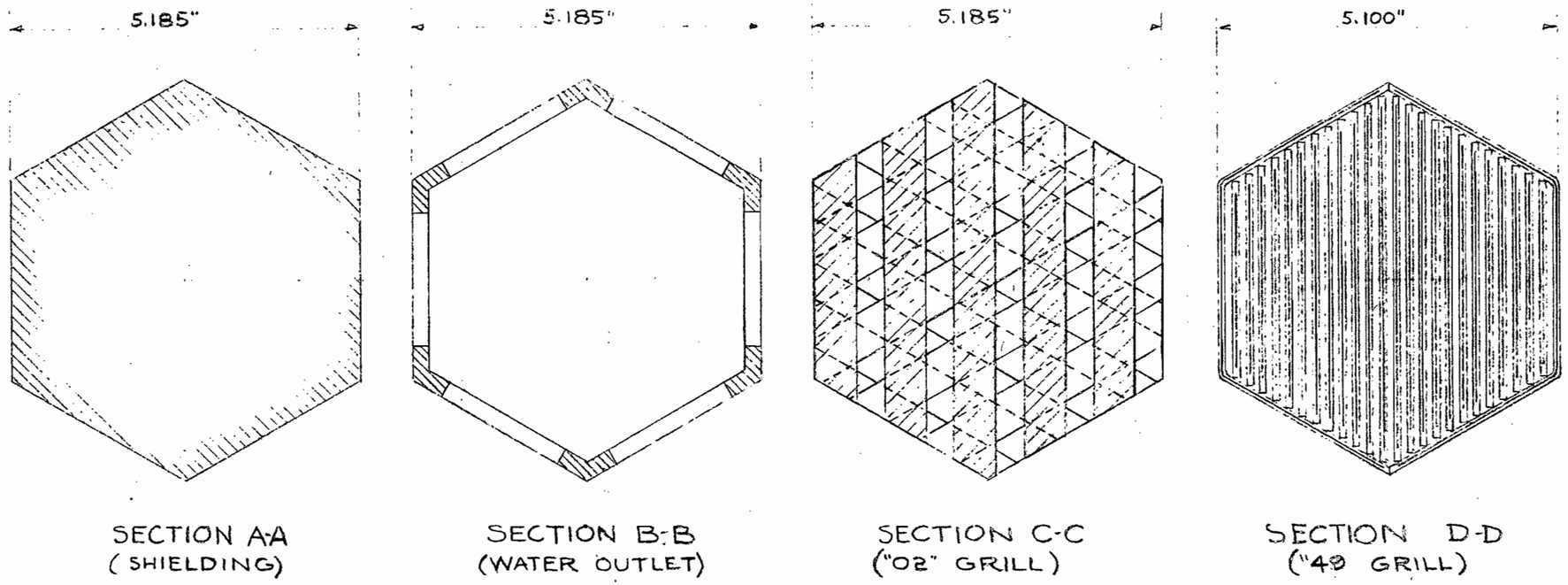
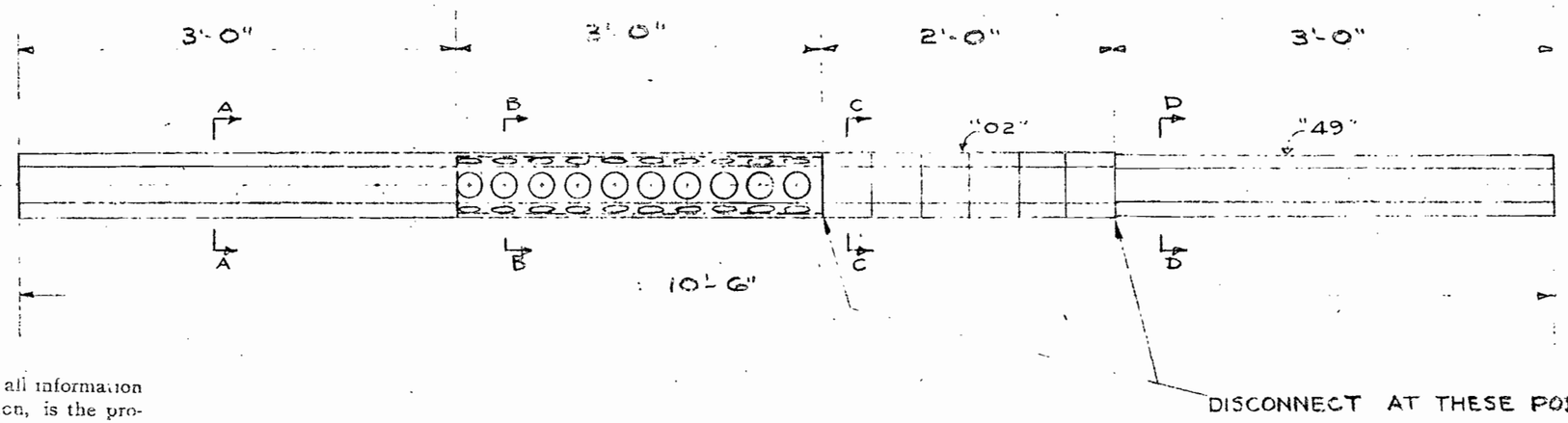
HETEROGENEOUS PILE ARRANGEMENT
SCALE $\frac{3}{8}$" = 1'-0"

BY Linzell FOR OHLINGER
1-5-45





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CARTRIDGE FOR HETEROGENEOUS PILE

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BY Lingell FOR OHLINGER
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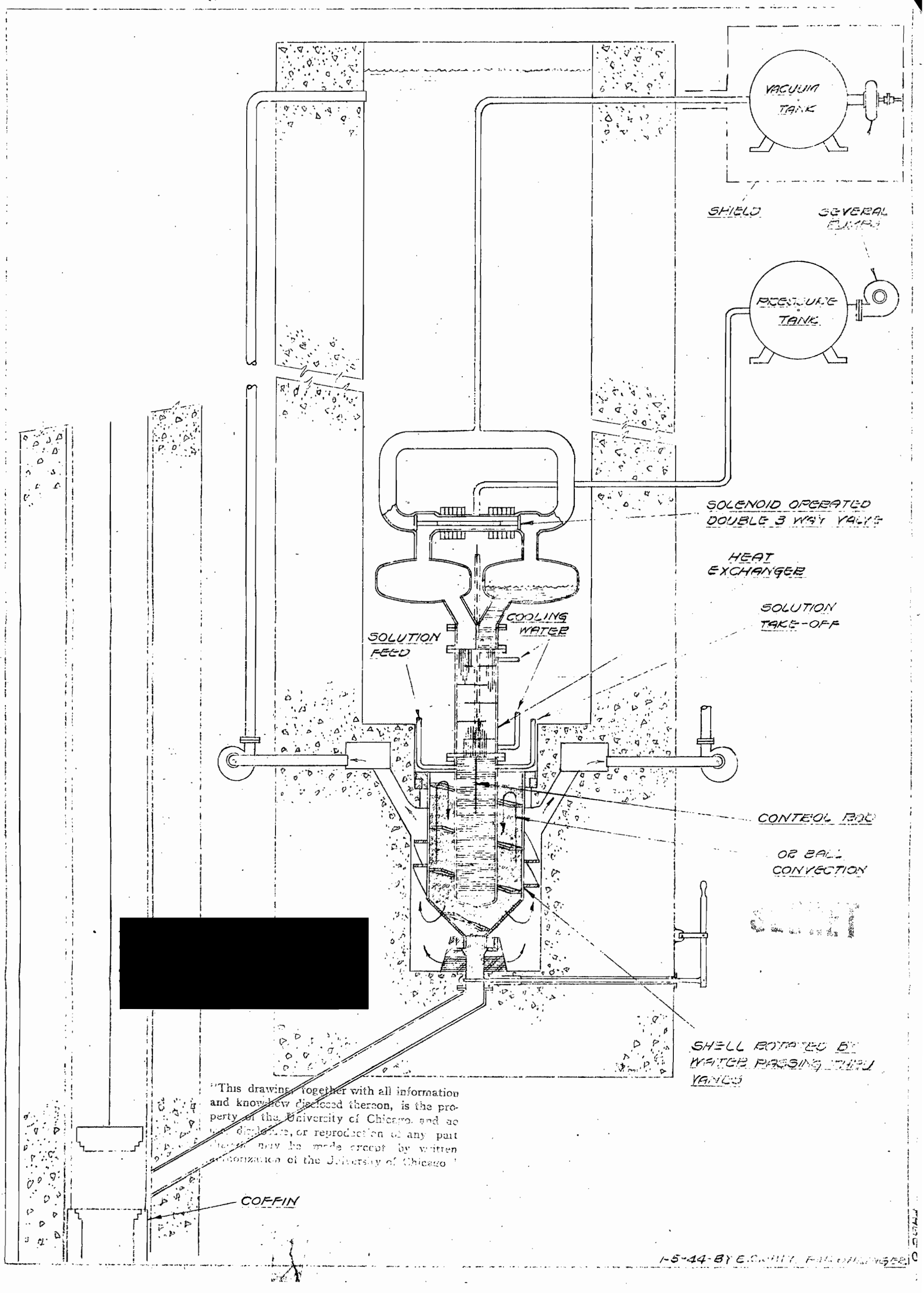

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