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Operated By
UNION CARBIDE NUCLEAR COMPANY

UCC

POST OFFICE BOX P
OAK RIDGE, TENNESSEE

DATE: June 15, 1956

SUBJECT: FEED MATERIALS PROCESSING STATUS REPORT
            FOR JUNE, 1956

TO: F. L. Culler

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ABSTRACT

Metallex Process. Methanol and petroleum ether from which dissolved oxygen has been removed have less oxidative effect upon thorium amalgam than water with or without dissolved oxygen.

A rough correlation between the free voidage of sintered thorium metal and its oxide content, and therefore the metal quality, is indicated. A procedure was developed for determining the total voidage and the atmosphere-connected voidage in sintered thorium metal.

Fluorox Process. The specific surface area of UF_4 appears to be constant over the temperature range 25-600°C. Above 600°C the specific surface area decreases as sintering begins. The major impurities found in UF_6 produced from African ore concentrate were Al, Ca, Cu, and Fe.

The 4-in.-i.d. reduction-hydrofluorination and oxidation reactors were modified to improve their operability, and two runs were made with the improved oxidation reactor. Low-carbon UF_4, suitable for fluorination to UF_6 or reduction to metal, was prepared by burning the carbon in the UF_4 with oxygen.

Excer Process. Results of runs in the 2-in.-dia Higgins continuous ion-exchange contactor indicate that UO_2Cl_2 product may be withdrawn at concentrations as high as 140 g of uranium per liter and containing as low as 0.05 $\underline{M}$ NaCl. Conductivity instruments provided excellent process control, which in turn allowed efficient usage of 5 $\underline{M}$ NaCl eluant. This eliminated the need for recycle of the NaCl.

The presence of sodium or calcium did not affect the density of the electrolytic $UF_4 \cdot 3/4H_2O$ product. An electrolytic cell with 64 in.^{2} inside area was operated 5 hr to produce $UF_4 \cdot 3/4H_2O$. The resulting slurry of $UF_4 \cdot 3/4H_2O$ appears acceptable as far as physical characteristics are concerned for making specification grade UF_4 after filtration and dehydration.

A nickel ribbon flite dehydrator is being constructed.

1.0 METALLEX PROCESS

Reduction of ThCl$_4$ with sodium amalgam and recovery of the thorium from the resulting thorium amalgam by filtration and retorting is a promising method of preparing thorium metal.

1.1 Laboratory-scale Studies (O. C. Dean)

Amalgam Washing Tests. Five tests on liquids that might be used in washing thorium quasi amalgam indicated that removal of dissolved oxygen from the wash liquid considerably reduces the oxidation of the amalgam during the washing process.

Wash Liquid	Thorium Dissolved from Quasi Amalgam (%)
Distilled water, no treatment	0.62
Argon-sparged distilled water	0.26
Distilled water, distilled from potassium pyrogallate under argon	0.42
Methanol, distilled from potassium pyrogallate under argon	0.07
Petroleum ether, sodium-treated	0.08

Methanol distilled from potassium pyrogallate in an inert atmosphere had the least oxidative effect on the amalgam; deoxygenated petroleum ether was nearly as inert. Reduction of the oxygen content of water reduced its oxidative effect but did not eliminate it. Evidently water itself has a corrosive effect.

For the tests 135-g amalgam samples containing 4 g of thorium were washed in 1 M HCl and distilled water and were then agitated in an argon atmosphere for 4 hr under 10 ml of the wash liquid.

1.2 Relation between Voidage and Quality of Metal

A procedure for determination of pinholes and voids which are connected with the surface of the sinter is under study in an effort to find a quantitatively measurable property that will indicate the quality of the sintered metal. It is reasoned that the quality of the extruded metal prepared from the sintered will be dependent on how well the metal

around a void "heals" to sound metal under pressure, and this in turn is
dependent on how "clean" or free from oxide this surface remains through
sintering and pickling. A void connected to the atmosphere by a pinhole
would be oxide-coated, and there is evidence that oxide-coated surfaces
do not weld well under pressure. In addition, an atmosphere-connected
void would fill with molten salt in the preheating operation prior to
extrusion. The percentage of "free" or atmosphere-connected voidage was
determined from the relation

$$\% \text{ voidage} = \frac{100 \times (\text{apparent density - bulk density})}{\text{theoretical density}}$$

The apparent density was determined by a carbon tetrachloride--immersion
technic, using the evacuated metal sample. The bulk density was
determined by a water-immersion technic, after the free voids had been
sealed by a coating of acrylate plastic film. In three determinations
on the same porous sample, results were reproducible.

The following tabulation shows how free voidage determinations may
be related to some variables:

Sample	Reduction Temp (°C)	Treatment after Washing with 1 M HCl and H_2O	Atmosphere-connected Voidage (%) after Pressing at 1000 psi and Sintering
TAS-12-2	130	Rinsed with argon-sparged H_2O	13.2
3		Rinsed with oxygen-free methanol	11.7
1		Vacuum-dried	7.47
TAS-13-2	200	Rinsed with argon-sparged H_2O	35.4
1		Rinsed with oxygen-free methanol	38.1
3		Vacuum-dried	30.2

It is known that thorium amalgams produced at higher temperatures are
reactive to water and oxygen, and this is reflected in increased free
voidage. The voidage test shows that water removal by vacuum-drying is
more effective than by methanol rinsing.

In a series of seven tests there was a rough correlation between
atmosphere-connected voidage in sintered thorium metal and the ThO_2
content. With voidages ranging from 23 to 48%, the ThO_2 contents were
2.07 to 3.48%, while those with voidages of 7.7 to 14.8% had ThO_2 con-
tents of 1.15 to 1.67%.

1.2 Larger-scale Studies (J. C. Suddath)

Storage of Thorium Quasi Amalgam. Washed thorium quasi amalgam from a 4-liter stoichiometric reduction was divided into 25 equal portions, and each portion was stored in a closed container with 1.0 M HCl solution as a blanket, the acid volume being half the amalgam volume. Five portions were examined every 7 days, five were allowed to stand 14 days, five for 21 days, five for 28 days, and the remaining five for a total of 35 days without agitation during the standing. Caking was observed at each examination, but mild agitation broke up the cake, and the amalgam returned to a fluid state. After 24 hr there was a small amount of white precipitate (probably ThO_2) in the acid of each bottle, but this increased only slightly during the next 34 days. Gas bubbles were released at the glass-amalgam interface at a very slow rate, but the amalgam volume did not increase. The amalgam that was stored for 35 days without agitation appeared to have properties identical with those of the material stored only 7 days. The test will be continued for another 35 day period.

Reduction Step Studies. In three dry-reduction runs in a 1.5-gal Dispersal unit, thorium recovery ranged from 61 to 88%:

Run No.	Na Remaining (% of initial)	Thorium			
		Recovered (g)	(%)	Reduced (%)	Material Balance (%)
35	3.5	657.0	74	79	98.6
36	---	783.6	88	71	116.5
37	5.0	541.7	61	75	86.4

The feed for each run was 1450 g of Fernald $ThCl_4$ (thorium, 922 g total, 890 g methanol-soluble); 4 liters of 3.3 M Na(Hg) was used for each reduction. The agitator speed was 1410 rpm, with 5 min contact time at 90-155°C. With 15 min contact time, recovery was 75%. At 110-185°C with 5 min contact time, recovery was 86%. It was necessary to remove heat during the contacting period to keep the temperature down.

2.0 FLUOROX PROCESS

Oxidation of UF_4 to UF_6 and UO_2F_2 with air or O_2 is a potentially economical method of producing UF_6. Among the variables likely to be important in the oxidation reaction are surface area, temperature, and partial pressure of oxygen. Since the UF_4 is produced by reducing UO_3 with starch and then hydrofluorinating, residual carbon removal is also an important practical problem.

2.1 Laboratory-scale Studies (R. G. Wymer, L. M. Ferris)

Surface Area Measurements. The variation of the specific surface area of UF_4 with temperature and time is being investigated, since it is felt that the rate of oxidation of UF_4 is at least partially controlled by the UF_4 surface area available. If this proves to be the case, knowledge of surface areas will be essential in comparing oxidation reactivities of various UF_4 samples. Studies to date have been performed by heating 98% UF_4(2% UO_2F_2) in dry helium for 1 hr at various temperatures. The apparent specific surface is essentially constant up to 600°C, at which temperature sintering begins to occur. For one type of UF_4 the specific surface area remained at ∼ 0.3 m^2/g over the temperature range 25-600°C and then fell to ∼ 0.1 m^2/g at 800°C. Since this UF_4 contains some UO_2F_2 initially, and will be coated with increasing amounts as the oxidation proceeds, work is under way to evaluate the effect of varying amounts of UO_2F_2.

Ore Concentrate Studies. In CF 56-5-100 purity data were given for UF_4 and UO_2F_2 produced from African ore concentrate by the Fluorox process. Data are now available on the purity of the UF_6 formed simultaneously with the UO_2F_2. After the UF_6 gas had been passed through a sintered nickel filter, the impurities, in grams per gram of uranium, were:

Al	0.0074	Fe	0.0023
Ca	0.0275	Mg	0.0005
Cu	0.0052		

Particles with diameters greater than 20 μ were collected on the nickel filter. The appearance of the relatively large amount of impurities in the UF_6 is thus due to entrainment of very small particles and/or to the existence of volatile compounds of the various impurities.

2.2 Larger-scale Studies (J. E. Moore)

Reduction-Hydrofluorination Step. The 4-in.-i.d. reduction-hydrofluorination reactor was modified (Figs. 1 and 2) to make it more dependable. In the original design the reactant gases were introduced through annuli surrounding the reactor shell. The unused annuli occasionally split, as a result of thermal stresses, which allowed the gases to escape. In the new design the reaction zone is a straight section of 4-in.-i.d. inconel pipe containing a suitable number of gas inlet tubes and thermowells for wall and bed temperature measurements. The gases are injected through 1/4-in.-dia tubes, directly into the center of the bed.

Oxidation of UF_4 to UF_6. The 4-in.-i.d. oxidation reactor was modified (Figs. 3 and 4) to improve its flexibility and operability. Increasing the heated length of the solids feed pipe eliminated the
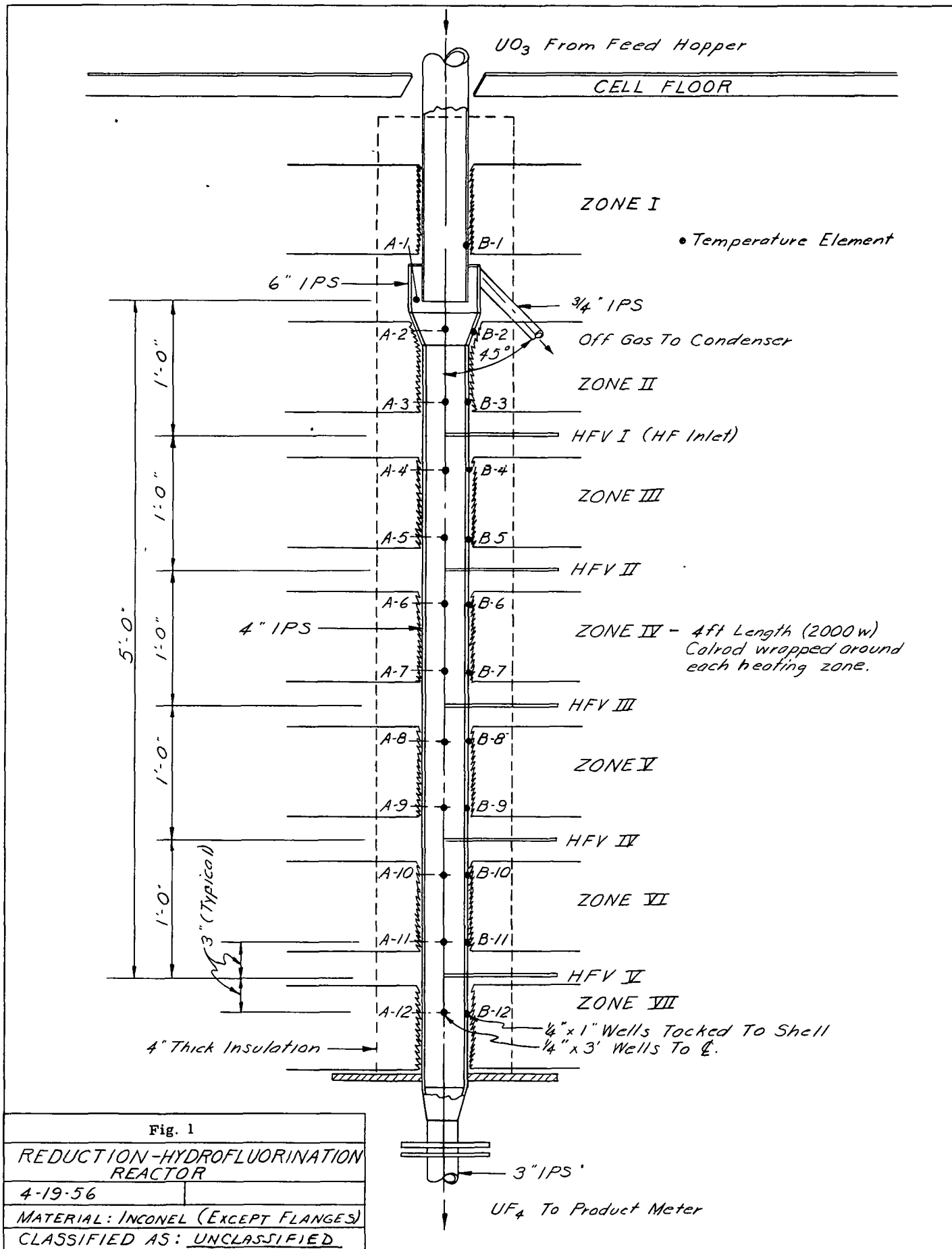
Fig. 1
REDUCTION-HYDROFLUORINATION REACTOR

4-19-56	
MATERIAL: INCONEL (EXCEPT FLANGES)	
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HF Flow Indicator

U'O₃ Feed Hopper

N₂

Flexible Valve

HF Flow Indicator

4' Gloss Pipe

N₂

Vent

Manometer

Air Hammer

Floor

4" ID x 5' Long Reaction Section

HFV I

HFV II

HFV III

HFV IV

HFV V

Water

Condenser

Steam Heater

Electric Heater

Steam

Water

N₂

Product Meter

Condensate

UF₄
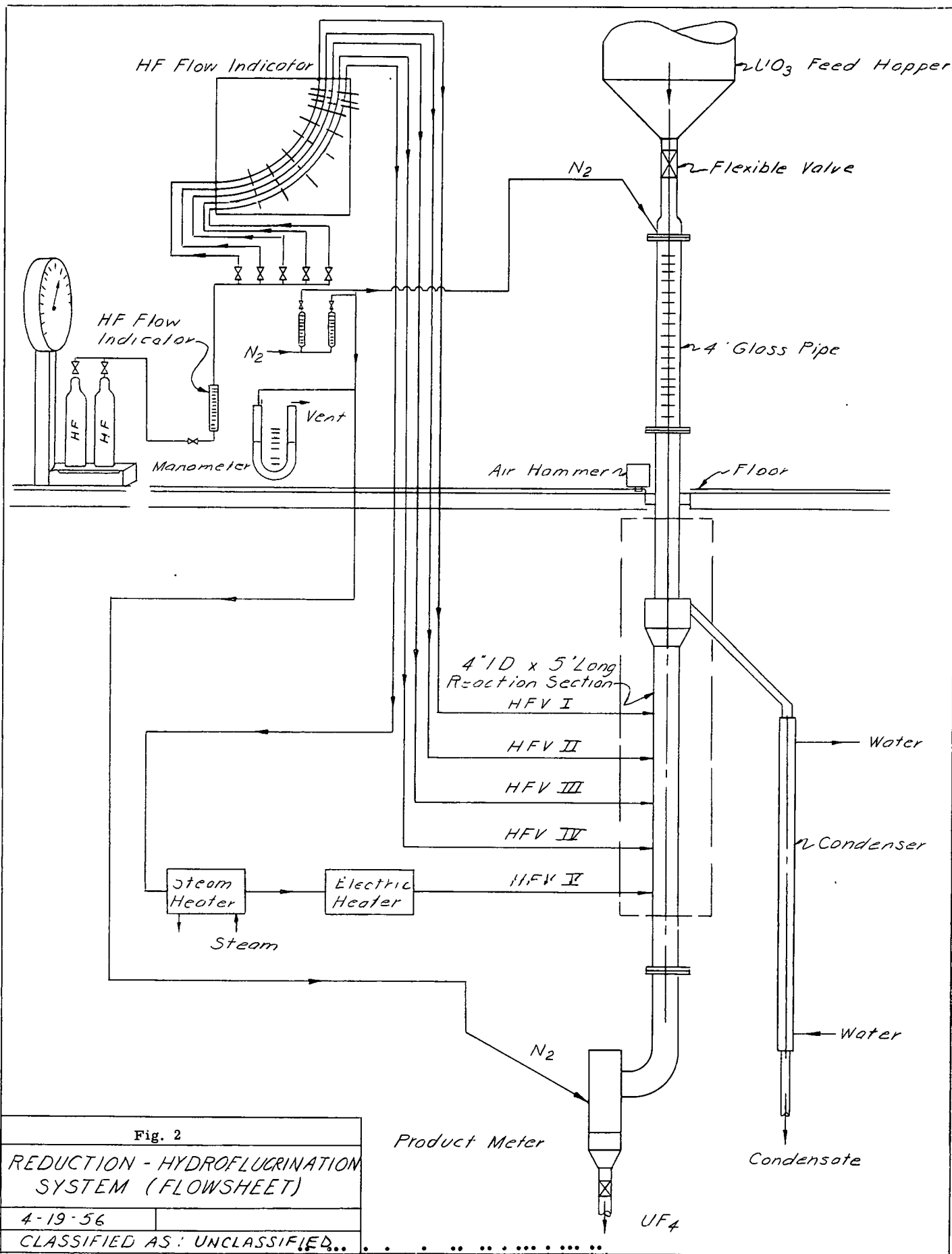
Fig. 2
REDUCTION - HYDROFLUCRINATION SYSTEM (FLOWSHEET)
4-19-56
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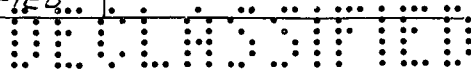
Fig. 3

OXIDATION REACTOR

4-16-56

MATERIAL : INCONEL

CLASSIFIED AS: UNCLASSIFIED

1 • Temperature Elements

UF$_4$ From Feed Hopper

N$_2$

Zone I Heaters

4" Insulation

Solids Heater
3" Dia. Pipe

12"

Zone II Heaters
Zone III Heaters

48"

1" Dia. Screw Feeder

Sight Glass

9"

1" Dia. Opening

O$_2$ Inlet

2" Insulation

U$_3$O$_8$ Lining

Air Hammer

Screw Drive

6"

4" Dia. x 22" Long Opening In Core Of U$_3$O$_8$ For Reaction Zone

45°

UF$_6$ Outlet To Filter And Cold Trap

Gas-Solid Separator

6" Dia. Tapered To 3" Dia.

UO$_2$F$_2$ To Product Meter

Fig 4

OXIDATION SYSTEM

4-16-56

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need for using the reduction-hydrofluorination reactor as a solids pre-heater. A heated screw feeder was installed to meter the pellets into the reactor in order to prevent surges of excess UF_4 into the reaction zone. The solids outlet was constricted by a funnel-shaped baffle to reduce surges of UO_2F_2 pellets from the reaction zone. The proposed method of operation was also changed so that the reactor would be kept slightly less than, instead of completely, filled, and that the oxygen would be fed to the bed from above instead of being injected directly into the bed.

As a result of these changes, heat losses have been greater, probably because of heat radiation from the now exposed reaction zone. Consequently, the reaction was only partially complete in two runs, even with 1% carbon in the UF_4 and a solids preheating temperature of 700°C. In future runs the reaction zone temperature will be raised to the level required for efficient conversion by preheating the oxygen, increasing the carbon content of the UF_4, and possibly by increasing the feed rate.

With the old design, 90% conversion was obtained with UF_4 containing 0.4% carbon, preheating of the solids to 625°C, and oxygen preheated to 400°C and injected directly into the bed.

Removal of Carbon from UF_4. When the UF_4 is to be reduced to metal, the carbon must be removed. In a moving-bed test at 680°C, the carbon content of UF_4 pellets was decreased from 0.3% to 0.012% with very little oxidation of U(IV) to U(VI). However, portions of the bed that were overheated were partially oxidized to UO_2F_2 and UF_6.

For the run (see Table 1) the reactor was filled with carbon-free UF_4 and was preheated to 400°C at the top, with the temperature increasing to 600°C at the bottom. It was planned to move the UF_4 pellets containing carbon into the 400°C zone countercurrently to a stream of oxygen; however, some of the pellets reached the 600°C zone before the oxygen feed was started, and, as a result, the bed temperature exceeded 800°C during the initial part of the run and appreciable amounts of UF_4 were oxidized (P-1). As the feed continued to move into the reaction zone, the maximum temperature dropped to the 660-685°C range, and little of the UF_4 was oxidized (P-2 and 3). The small amounts of partially oxidized pellets in samples P-2 and 3 probably had been delayed in transit out of the initial 800°C zone. After the initially high temperatures were reduced, the wall heater temperatures were again increased in an effort to force the bed temperature to 700°C. As a result, the pellets adjacent to the wall were overheated during the last part of the run and some of the UF_4 pellets (P-4) were again oxidized. A weight balance indicated that approximately 20 lb, or about 20% of the UF_4 feed, was lost, presumably as UF_6, which was visible in the off-gas.

Table 1. Removal of Carbon from UF$_4$ by Combustion with Oxygen in a 4-in.-i.d. by 60-in.-long Moving-bed Reactor (Run CO-3)

Time	Max Bed Temp (°C)	O$_2$ Fed (ft^3)	Sample[b] No.	Weight (lb) Incr.	Weight (lb) Cum.	Total U	U(IV)	AOI	F⁻	C
					Feed[a]					
			Precharge	133	133					
			SRH-4-P-6	34	167	76.89	73.36	2.08	23.92	0.317
			SRH-4-P-9	30	197	75.72	71.80	2.22	24.00	0.279
			SRH-4-P-17	13	210	75.48	72.45	0.75	24.00	0.256
			SRH-4-P-18	17	227	76.26	75.36	1.79	24.01	0.265
					Product					
0845	615	0	PR-1 thru 6	66.5	66.5					
0945	660	1	PR-7	20.9	87.4					
1045	840	9	PR-8	19.2	106.6					
1145	800	18	P-1	22.8	129.4					
			P-1G			75.70	69.64	0.19	23.3	0.025
			(G = 66% of P-1, W = 2%, M = 32%)							
1245	660	18	P-2	20.2	149.6					
			P-2G			75.43	70.13	0.04	23.7	0.034
			(G = 95% of P-2, W = 1%, M = 4%)							
1345	685	15	P-3	19.1	168.7					
			P-3G			76.08	72.34	0.04	24.0	0.012
			(G = 97% of P-3, W = 1%, M = 2%)							
1445	680	8	P-4	21.8	190.5					
			P-4G			75.31	72.71	0.01	23.9	0.016
			(G = 87% of P-4, W = 5%, M = 13%)							
1545	575	0	P-5	0.8	191.3					
			R-1	14.4	205.7					
			R-2	1.3	207.0					
			P-W-C (Composite W's)			77.00			12.8	
			P-M-C (Composite M's)			76.36	47.89	5.40	19.1	0.027

[a]The reactor was precharged with UF$_4$ product from an earlier carbon removal run. Remainder of feed was that produced in a reduction-hydrofluorination run.

[b]Code: PR = pre-run material; P = product removed during operation; R = residue in reactor at end of run; G = green; W = white; M = mixture of green and white. The W and M samples were composited for analysis.

Comparison of the U(IV) content of the UF$_4$ before and after oxidation at 680°C (SRH-4-P-6 and 9 with P-3G and 4G) showed that the U(IV) content of material that was not overheated decreased only slightly or not at all. Approximately 95% of the carbon content of this material was removed.

A 10-lb batch of the P-36 product was ground to pass an 80-mesh screen and will be forwarded to the Mallinckrodt Chemical Works for reduction to metal. The tap density of the pulverized material is 2.75 g/cc, the UF$_4$ content is 95%, and the carbon content is 0.014%.

3.0 EXCER PROCESS

3.1 Laboratory-scale Studies (I. R. Higgins)

Ion-exchange Step. Synthetic ore leach liquor is being processed by the 5 M NaCl--water elution flowsheet in the 2-in.-dia continuous contactor. Because of limitations on height, Permutit SK, 20-40 mesh, was used instead of 10-20 mesh. The gain in efficiency is noticeable, but the conditions have not smoothed out enough for a final analysis. One product sample contained 92 g of uranium per liter.

Excellent process control was obtained with conductivity instruments. Because of the good flow-rate control, the amount of NaCl required to convert the uranium from the sulfate to the chloride form was decreased to 2.5 lb per pound of uranium. The cost of fresh NaCl is thus less than the cost of CaCl$_2$ to remove sulfate from used NaCl, and NaCl recycle is not necessary. The Na$_2$SO$_4$-NaCl waste, containing 3-15% of the uranium, is recycled as feed. The concentration of the chloride thus introduced into the feed is less than 0.1 M, which is not high enough to interfere with loading. The uranium recovery was greater than 99% on 3 ft of resin with a uranium loading of 50 g/liter. Product concentrations varied with the uranium loading, but for 1 hr a product solution containing 98.1 g of uranium, as UO$_2$Cl$_2$, per liter was obtained. The final product composite was 0.5 M in NaCl, but the NaCl content is determined by the control of the rate of product removal. A product containing 53 g of uranium per liter was withdrawn which was only 0.05 M in NaCl. A portion with a peak uranium concentration of 140.6 g/liter was obtained.

The UO$_2$Cl$_2$ product of one run contained 45 g of uranium per liter. Because of experimentation with instrument controls, it was high in sodium, 1.4 M. When batch-converted to UO$_2$F$_2$ on a Dowex 50 column, the product contained 84 g of uranium, 3.5 g of sodium, and 0.25 g of calcium per liter. The sodium and calcium were further reduced to 0.007 and 0.12 g/liter, respectively, by treatment again with H-form Dowex 50.

Product $UF_4 \cdot 3/4H_2O$ Density Studies. Calcium and sodium do not appear to affect the density of the electrolytic reduction product. $UF_4 \cdot 3/4H_2O$ prepared from the UO_2F_2 product of the ion exchange column, which contains calcium and sodium, has a density of 2.4 g/cc. When the feed to the ion exchange column was a pure UO_2F_2 solution prepared by reaction of UO_3 and HF, the electrolytic reduction product $UF_4 \cdot 3/4H_2O$ had a tap density of 1.5 g/cc. However, when 0.16 g of calcium or 2 g of sodium per liter was added to the UO_2F_2, about the amounts in the ion exchange product UO_2F_2, the tap density of the $UF_4 \cdot 3/4H_2O$ was 1.6 g/cc. The effect of variations in current density and feed concentrations are now being studied.

3.2 Larger-scale Studies (C. W. Hancher)

Electrolytic Reduction Step. The Boltaron (polyvinyl chloride) Excer electrolytic cell (Figs. 5 and 6) was operated to produce a dense slurry of $UF_4 \cdot 3/4H_2O$, with a density estimated as 2-2.5 g/cc. The cell has an 8- by 8-in. cathode, anode, and membrane area. The operating conditions were:

Temperature	90-100°C in cathode compartment
Feed	HF, stoichiometric for U conc. + 10% excess; H_2SO_4, 0.25-0.5 M
Anolyte	H_2SO_4, 0.25-0.5 M
Feed rate	At 100% efficiency, 1 mole of U per 53.6 amp-hr
Anolyte rate	F concentration less than 2 g/liter
Voltage	12.4 volts d.c.
Theoretical current density	2 amp/in.^{2} per cathode side
Usual current efficiency	85-90%

Laboratory analyses are not yet available.

In a 4-hr preliminary run, chemical, hydraulic, and heating tests indicated satisfactory operation.

Dehydration Step. A nickel ribbon-flite dehydrator (Figs. 7-9) has been constructed and is being installed. It is 3 in. dia by 6 ft long. The estimated feed rate to this dehydrator is 50 g of $UF_4 \cdot 3/4H_2O$ per minute. The UF_4 will be swept countercurrently with dry N_2 during dehydration at a maximum of 350°C.
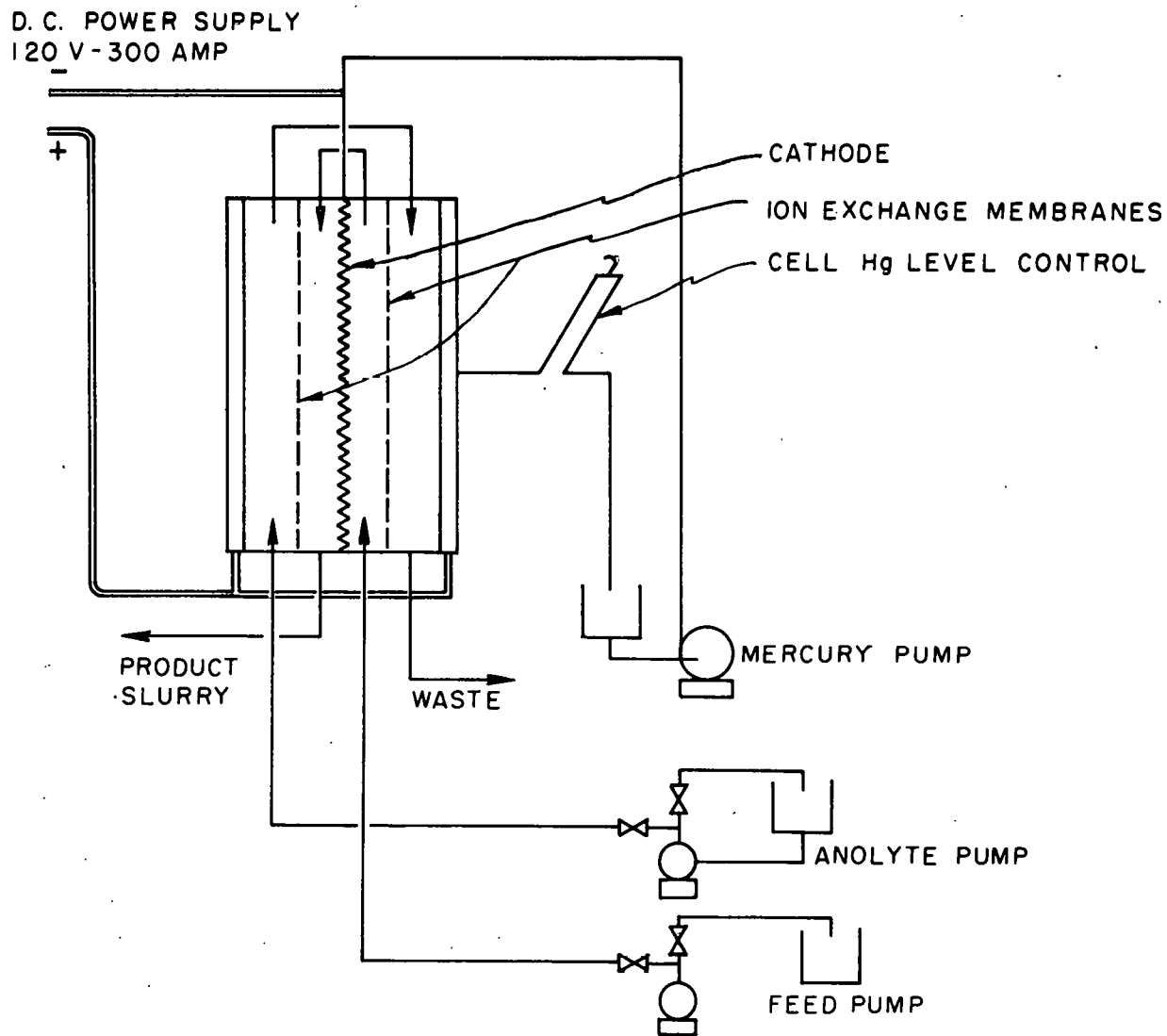
CELL-TOP VIEW

Fig. 5

FLOW SYSTEM FOR EXPERIMENTAL EXCER CELL #1

GAS OUTLET

Hg INPUT

GAS OUTLET

GAS OUTLET

ION EXCHANGE
MEMBRANE

CATHODE SCREEN

CATHODE SPACE

ANODE SPACE

LEAD ANODE

LEAD ANODE

Hg DISCHARGE
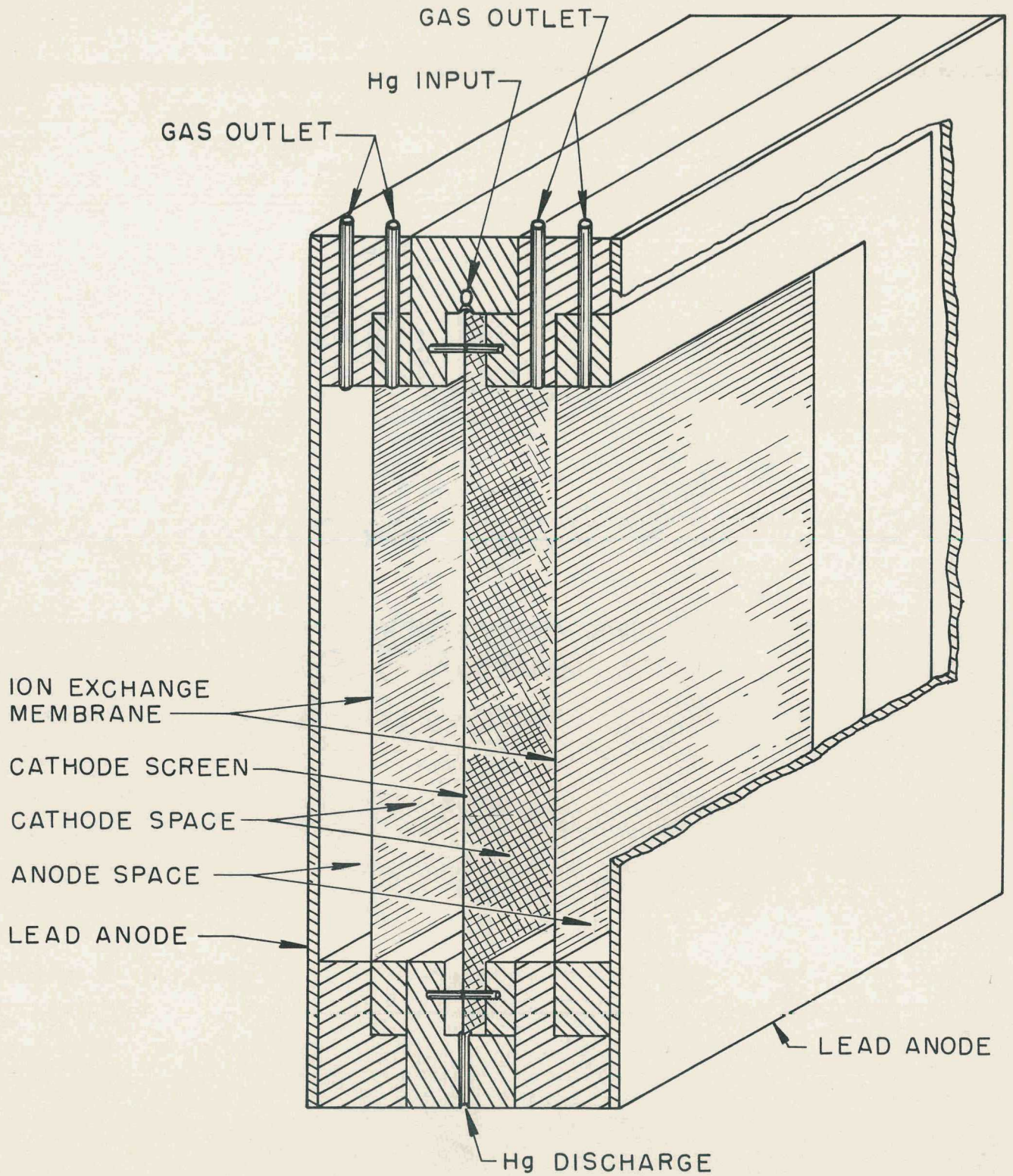
CUT-AWAY OF EXER CELL #1

Fig. 6

18   Fig-7

Fig. 7

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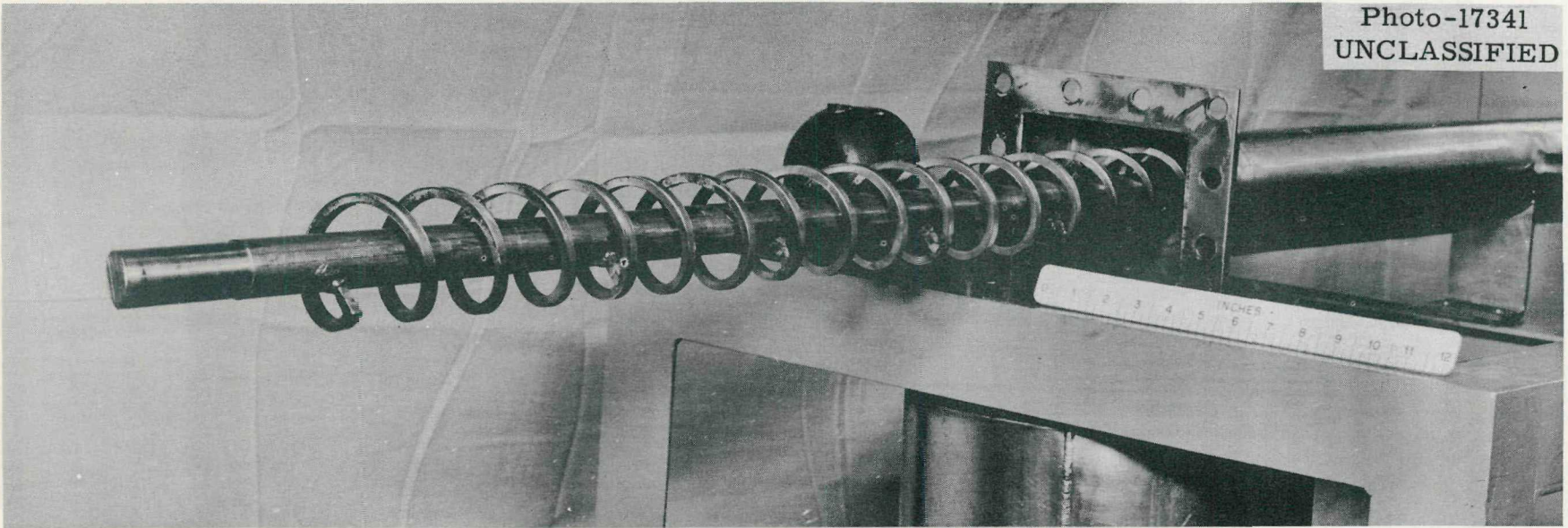
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Fig. 8

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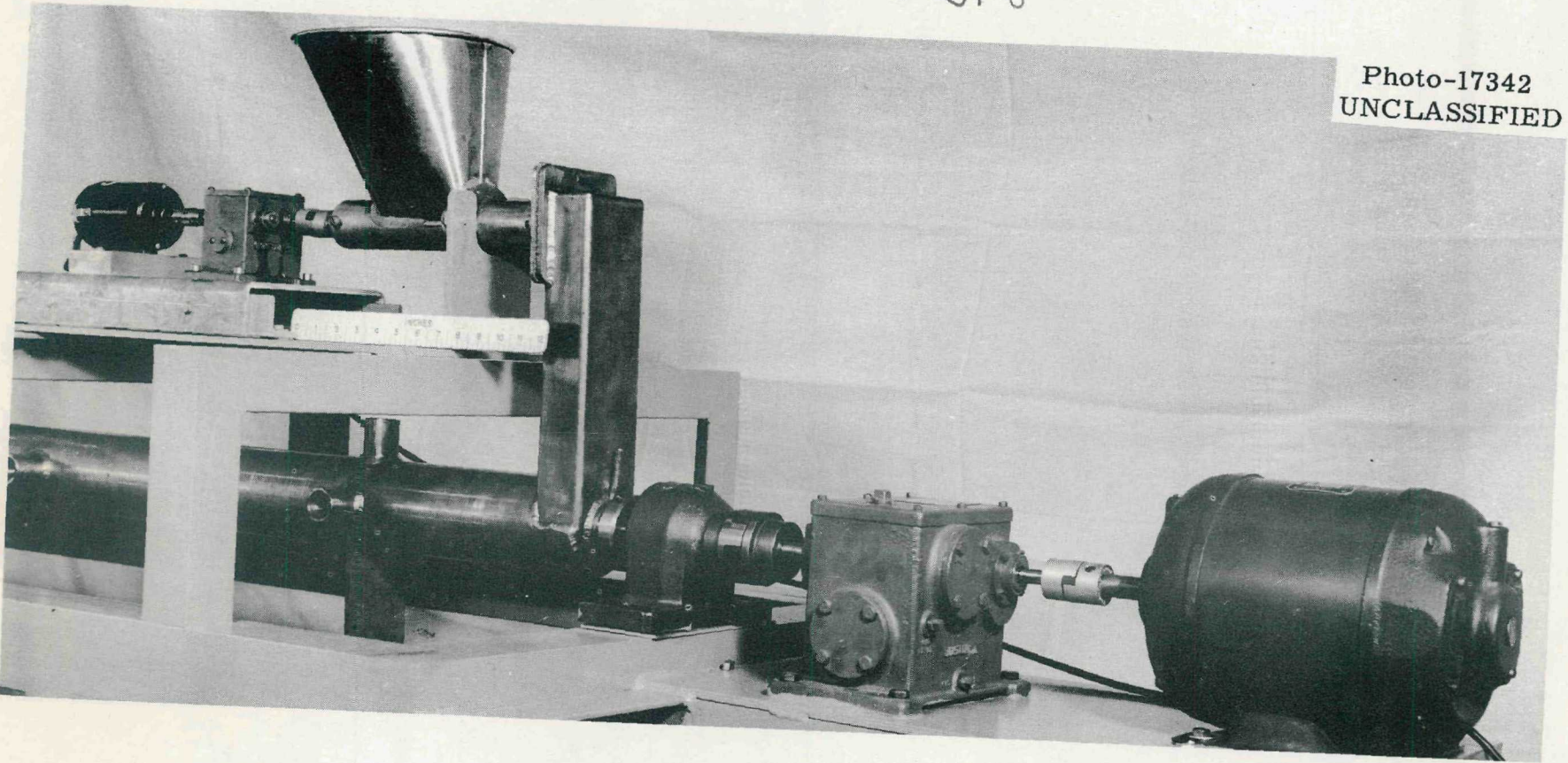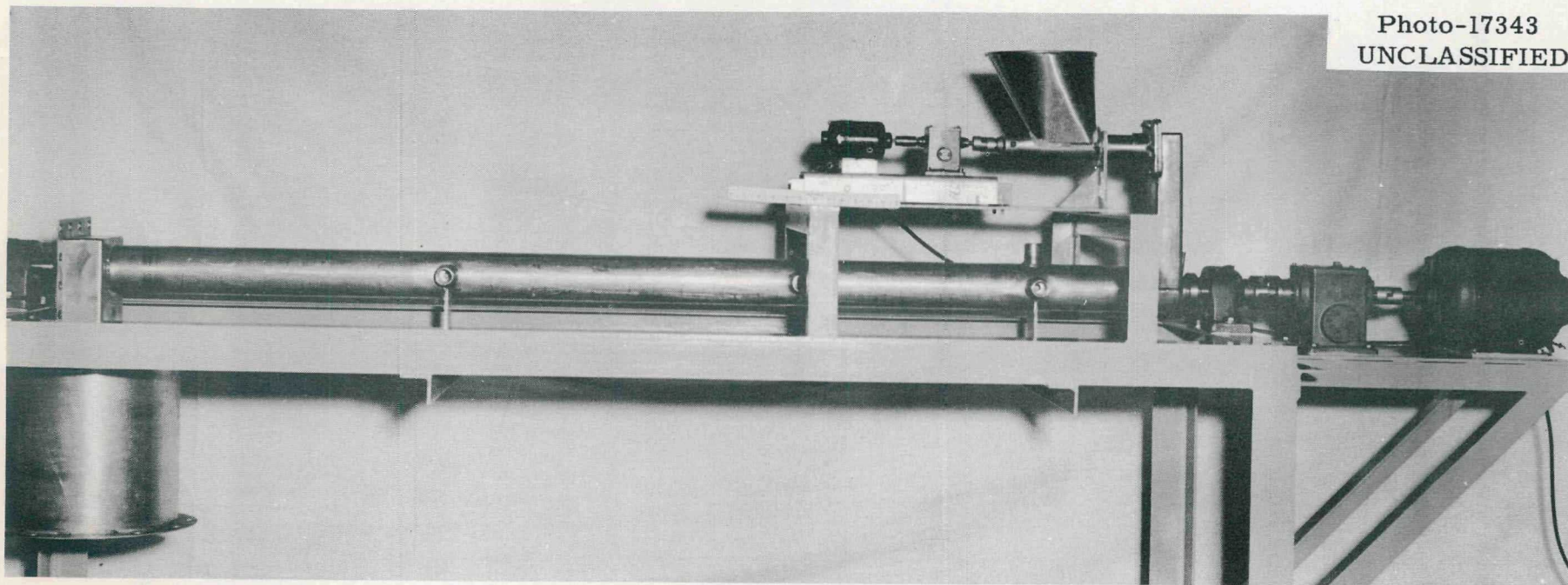
Fig-9

Fig. 9

4.0 ION-EXCHANGE ORE PROCESSING

C. W. Hancher

One of the problems that must be studied in operation of large-diameter (36 to 60 in.) continuous ion-exchange contactors is the method of resin movement. This will be investigated in a 36-in.-dia resin test loop. Construction drawings for such a loop have been completed (Fig. 10) and fabrication and installation have been started. This loop is part of a contactor with a capacity for processing 100 or 200 tons of ore per day, depending on which part of the fuel contactor it is used for.

MWG:jgh

The previous report in this series was ORNL CF No. 56-5-100, for May (30¢). The next, ORNL CF No. 56-7-100 (30¢), will be published about the end of July.

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MATERIALS LIST

ITEM NO.	DWG. NO.	QTY.	NAME	SIZE	MATERIAL
1	THIS DWG	1	36" O.D. pipe	½ wall x 9'-0" lg.	steel
2		1	Cone	¼ R - see det.	steel
3		1	Cone	¼ R - see det.	steel
4		1	24" O.D. pipe	sch 10 x 6'-8½ lg.	steel
5		1	Cone	¼ R - see det. K	steel
6		1	Cone	¼ R - see det. K	steel
7		1	18" O.D. pipe	sch 10 x 3'-9½ lg.	steel
8		1	Cone	¼ R - see det.	steel
9		1	18" O.D. pipe	sch 10 x 8'-3½ lg.	steel
10		2	Pipe	12"sch 20 x 5½ lg	steel
11	D-22845	1	180° L.R. weld return	12" sch 20	steel
12	THIS DWG	1	Pipe	8"sch 20 x 6'-8 lg.	steel
13		1	Pipe	8"sch 20	steel
14		2	Pipe	8"sch 20 x 5½ lg.	steel
15		4	10" pipe sch 20	10½ lg.	steel
16		4	12" pipe sch 20	See sect. A-A	steel
17		⅖	Pipe	1"sch 40	steel
18		⅖ F.	Pipe - threaded end	sch 40	steel
19		1	8"pipe sch 20	See det.	steel
20		1	16" O.D. pipe	½ R see det.	steel
21		1	Weld cap	18" sch 10	steel
22		⅗ F.	pipe	2" sch. 40	steel
23		2	Slip-On flange	36"150# R.F.	steel
24		4	90° L.R. weld elbow	1" std. wt.	steel
25		3	Slip-on flange	18"-150# R.F.	steel
26		1	Blind flange	18"-150# R.F.	steel
27		4	Slip-on flange	12"-150# R.F.	steel
28		4	Blind flange	12"-150# R.F.	steel
29		4	Slip-on flange	8"-150# R.F.	steel
30		7	Slip-on flange	2"-150# R.F.	steel
31		9	Slip-on flange	1"-150# R.F.	steel
32	D-22845	15	Support (H)	1" R. (see det.)	steel
33	THIS DWG	3	Slip-on flange	8"150# F.F	steel
34		3	Gasket	17½ x 21½ x ½	teflon
35		6	Gasket	12 x 16½ x ½	teflon
36		6	Gasket	8 x 11" x ½	teflon
37		16	Bolt stud with 2 hex nut ea.	1½ x 6"	steel
38		16	Bolt stud with 2 hex nut ea.	¾ x 7"	steel
39		72	Bolt stud with 2 hex nut ea.	½ x 4¾	steel
40		8	Bolt stud with 2 hex nut ea.	½ x 5½	steel
41		32	Bolt stud with 2 hex nut ea.	½ x 4½	steel
42			Screen	100 mesh x .005	S. Stl.
43			Screen	4 mesh x .041	S. Stl.
44		1	6" pipe sch. 40	3'-5⅞ lg	steel
45		1	Plate	13½ O.D. x 1"	steel
46		1	pipe	36"O.D. x ½ wall x 15 Lg	steel
47		1	plate	25"O.D. x 1" R	steel
48		1	90° L.R. weld elbow	2" std. wt.	steel
49		1	90° L.R. weld elbow	3" std. wt.	steel
50		⅖ F.	Pipe	3 sch 40	steel
51		3	Slip-on flange	3"-150# R.F.	steel
52	D-26135	1	Valve Operator Ass'y.	AS DETAILED	STEEL
53	D-26135	1	Valve Operator Ass'y.	AS DETAILED	STEEL
54	THIS DWG	1	3 way plug valve	8" 0.5#	steel
55		1	Plug valve	12" 125#	steel
56		2	Gate valve	½-125# scrd.	Brass
57					
58					
59		2	Slip-On flange	12"150# F.F	STEEL
60		1	Gasket	36" std flg	teflon
61		1	Upper support ring	2¼ x ¼ bar-roll 18½ O.D.	347 P. Stl.
62		1	Lower support ring	35"O.D. x 3"I.D. x ¼ R	steel
63		4	Ring Spacer bar	1 x 1½ x 4½ Lg	steel
64		24	Bolts w/lock wash	½"-20NC-2 Hex Hd	steel
65			collar	35½ A.D. x 35 I.D. x 1	

PC. MK. "F"

PC. MK. "H"
SCALE: 3" = 1'-0"

PC. MK. "G"
SCALE: 1" = 1'-0"

PC. MK. "K"
SCALE: 1" = 1'-0"

PC. MK. "J"
SCALE: 1" = 1'-0"

DETAIL "X"
SCALE: ½" = 1"

DETAIL "Y"
SCALE: ½" = 1"

Cut hole to accomodate sight glass. Dwg. D-22844 (far Side)

Drill 8-⅞ dia holes. Locate to match holes of 8"-150# flange.

Tack weld 100 mesh screen all around edge of 1" pipe, inside 180° bend

100 mesh screen. Tack weld all around edge of pipe

SEE DWG. D-22857 PRESSURE PROBES

SECTION C-C
SCALE: ¾" = 1'-0"

COLUMN ASSEMBLY
SCALE: ¾" = 1'-0"

SCREEN SUPPORT
SCALE: 3" = 1'-0"

ASSEMBLY of PC's 'A' & 'B'
SCALE: ¾" = 1'-0"

SECTION B-B
SCALE: 1½" = 1'-0"
NOTE: ITEM 15 TO BE WELDED TO ITEM 28

SECTION A-A
SCALE: ¾" = 1'-0"

Fig. 10

FLOW SHEET	D-22846
REFERENCE DRAWINGS	DWG. NO.

ION EXCHANGE CONTACTOR 100 T/DAY 3203

HYDRAULIC TEST LOOP
ASSEMBLY & DETAILS

NO.	REVISIONS	DATE	APPR.	APPR.

DRAWING NO. D-26130

DRAWN	DATE	CHECKED	DATE	APPROVED	DATE
C. STANLEY		J. OKEEFE	5/9/56	CRISTY	6/7/56
BUSH	5/8/56				

HEALTH PHYSICS	MEDICAL	OPERATIONS	SAFETY
FIRE PROTECTION	RESEARCH SHOP	MAINTENANCE	

SCALE: AS NOTED

D-26130