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MAIN NUMERICAL RESULTS ON THE SEPARATION OF UF_6 BY CENTRIFUGES*

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Table I gives the theoretical total length of spinning rotors necessary to produce 1 kilogram per day of $U^{235}F_6$, contained in 10 kilograms of ($U^{235}F_6$ + $U^{238}F_6$) mixture. It is assumed that the UF_6 discarded at the base of the apparatus has an abundance ratio of the source material. The table also gives the gaseous flow within each machine, per unit length of rotor.

The required length of counter-current (fractional distilling) centrifuges, and the flow per machine depends on the manner in which they are operated. If one chooses very low over-all fractionation factors per individual machine, one obtains the minimum total length of rotors, but the flow required is large. If one chooses higher over-all fractionations per machine, one has to use a slightly greater length of spinning rotors, but one finds that the required flow is greatly reduced.

The flow-through centrifuge is less flexible than the counter-current centrifuges. The value given in Table I when the over-all fractionation factor is 1.0116 represents

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* Taken from the papers: "Concentration of Isotopes by Fractional Distillation in an Ultracentrifuge" (formerly called "Conc. of Isotopes by Counter-Current Flow in an U-C.); "Influence of Baffles on a Counter-Current Centrifuge (extended and corrected); "Theory of the Simple-Process Flow-Through Centrifuge."

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operation under conditions such that the required total length of rotors is a minimum. For this type of centrifuge it is not possible to cut down the flow appreciably without augmenting the total length enormously, as is shown by the figures when the over-all fractionation = 1.0232.

Table I, therefore, gives the lengths and flows as functions of the over-all fractionation factor of a single machine (column 1). The 2nd and 3rd columns give the corresponding values of total required length and flow per machine for a fractional distilling column without any baffles or other internal structure. The 4th and 5th columns give the same quantities for a fractional distilling centrifuge containing annular baffles which immobilize the gas between the periphery and a circle whose diameter is 0.77 the internal diameter of the centrifuge. The 6th and 7th columns refer to the flow-through simple-process centrifuge. When the over-all fractionation is 1.0116, there is supposed to be a core within the flow-through centrifuge blocking off the flow from a region about the axis whose diameter is 53% of the internal diameter of the rotor. When the over-all fractionation is 1.0232, the flow-through centrifuge has no such structure.

In all cases, the peripheral velocity (at the inner face of the centrifuge wall) is taken as $3.07 \times 10^4 \frac{\text{cm.}}{\text{sec.}}$. Other significant data are listed beneath the table.

For the counter-current centrifuges there is naturally a condition on the minimum length of the individual

machines. Table II gives, for the two fractional distilling centrifuges, the minimum ratios of length to internal radius necessary to produce the given over-all fractionation factors at the calculated efficiencies. It should be remarked that only through this limitation does the radius of the rotor, as distinct from the peripheral velocity, influence the calculations.

TABLE I

CONFIDENTIAL

1	2	3	4
Overall Fractionation Factor of Single Machines	Fractional Centrifuge Total Length (Meters)	Distilling Empty Flow per machine (Grams/Sec/Meter)	Fractional Centrifuge Total length (Meters)
4	23,900	.010	16,600
3	22,000	.012	15,300
2	19,300	.019	13,400
1.5	17,400	.033	12,100
1.2	16,000	.072	11,100
1.0232	15,010	0.563	10,380
1.0116	14,950	1.13	10,340
1+δ	14,900	.013/δ	10,300

5	6	7
Distilling With Baffles	Flow-Through Simple-Process Centrifuge	
Flow per machine Grams/Sec/Meter	Total Length (Meters)	Flow per Machine (Grams/Sec/Meter)
.0048		
.0059		
.0092		
.016		
.034		
.268	104,000	.057
.535	28,100	0.77
.0062/δ		

SECRET

Peripheral Velocity = 3.07×10^4 $\frac{cm.}{sec.}$

Viscosity = 215×10^{-6} poise (estimated)

Temperature = 375^{o} Absolute

Table gives

Total length of centrifuges required to give I kilogram/day of $U^{235}F_6$ diluted by 9 kilograms of $U^{238}F_6$

TABLE II

Over-All Fractionation Factor of Single Machines	Fractional Distilling Centrifuge Empty Minimum Ratio: Length/Radius	With Baffles Length/Radius
4	138	115
3	111	42
2	71	59
1.5	42	35
1.2	19	16
1.1	105	88