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L. E. Bruns

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AIR PULSER FOR THE H-1 COLUMN

By:

L. E. Bruns

FINISHED PRODUCTS TECHNOLOGY
RESEARCH AND ENGINEERING
CHEMICAL PROCESSING DEPARTMENT

March 1, 1961

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AIR PULSER FOR THE H-1 COLUMN

Recently, V. Hammond of Hanford Laboratories Operation and D. E. Braden of Chemical Processing Department visited Arco for the purpose of studying prototype and production air pulsing units. Their findings led to the decision to use the air pulser in the Plutonium Reclamation Facility (PRF), Project CAC-880. Installation of a prototype air pulser in the H-1 Recuplex solvent extraction column is recommended for two reasons:

1. Eliminate frequent H-1 teflon bellows replacements.
2. Obtain technical and operating information applicable to Project CAC-880.

Summary

The air pulser system recommended for Recuplex is sketched in Figures I, II, and III. Figure I shows a new hood required in the duct level. The new hood will contain equipment which could possibly become contaminated, namely an air reservoir and a motor and cam assembly for operating the air inlet and exhaust valves. Figure II is a sketch of the essential piping required in the duct level between the new hood and the SE Hood and in the SE Hood itself. Figure III shows the SE Hood piping and a possible arrangement of the panel board at the Recuplex operating level.

Discussion

The air pulser which has given excellent performance at the Arco Plant has advantages over the originally planned piston type bellows for Project CAC-880 or the existing teflon bellows now in Recuplex. Some advantages are lower cost, more easily accessible equipment (almost all parts can be in a relatively "cold" zone), no piston leakage or bellows failure problem, more simplified equipment, smaller diameter pulse leg, and less column down-time required for any equipment change.

The main disadvantage of the air pulser may be the control instrumentation necessary. The Arco pulser does not have and does not require an automatic amplitude stabilization control system. They have good column efficiency and no loss in capacity. The question is, will a solvent extraction system such as in Recuplex or specified for CAC-880 require a differential type amplitude control, a delta type control, or a manual amplitude adjustment?

The two solvent extraction systems, Arco and Recuplex, are compared as follows:

	<u>Arco</u>	<u>Recuplex</u>
Continuous phase	Organic	Organic
Organic	3 $\frac{1}{4}$ % TBP in kerosene	23% TBP in CCl ₄
Organic Sp. Gr.	Less than 1.0	1.44
Aqueous feed	Similar concentration and sp. gr. from batch to batch	Variable concentration and sp. gr. from batch to batch
Column plates	23% free area, standard plates, 2-inch spacing	10% free area, nozzle plates, 4-inch spacing

Continuous heavy phase organic may pose an amplitude stabilization problem in Recuplex. When H-1 begins to flood, the effective column density decreases, hence the amplitude may increase, magnifying the incipient flooding conditions. Compensating factors in the complex acceleration pressure-velocity pressure system tend to minimize the effect.

The nozzle plates may also initiate new problems. The variable density of the aqueous feed, and the fact that CCl₄ evaporates, lowering the organic density, are other factors to consider.

The course of action recommended concerning instrumentation is summarized below:

1. Initially install manually controlled instrumentation except for a pressure-recorder-controller.
2. Initially install interlocks to prevent overflowing H-1 or the pulse leg (conductivity meters might be used).
3. If testing in Recuplex indicates that amplitude control is necessary, develop a column ΔP type control that will automatically reduce the amplitude at incipient flooding conditions.
4. If a differential type controller economically improves the operation, a development program should be initiated in this direction.

Figures I, II, and III sketch the recommended layout for the H-1 air pulser assembly. Detailed design and construction drawings will be made by Facilities Engineering Operation.

Figure I is a sketch of the pulser equipment required in the new hood recommended for the duct level. The lucite-stainless steel hood should be two feet deep, four feet wide, and six feet high. No gloves should be necessary; however, a door in the vicinity of the motor would be advantageous for cam adjustments. The equipment in the hood consists of a 6-inch ID stainless steel air reservoir tank with a drain, an air inlet, and an air outlet line. Also in the hood is the motor and cam assembly with air exhaust and inlet valve actuators attached to the cam.

Figure II is the overall duct level piping sketch. Not shown, but required, is a hood exhaust line from the new hood to the SE Hood or directly to the E-4 exhaust system. The pulse leg is topped with a 4 x 6-inch surge chamber. A conductivity meter should be added to the top of the surge chamber. This conductivity meter can either sound an alarm or can be tied into an interlock valve (not shown on the sketch) that isolates the pulse leg from the new hood. The magnetic flowmeter should be placed in the pulse leg at the position shown, for convenience and to insure that aqueous solution is present.

The pulse leg will contain silver nitrate or bismuth subnitrate. Both of these liquids are heavier than 23% TBP in CCl_4 , and the lack of duct level height requires a heavy liquid in order to prevent back-up into the air exhaust system. An aqueous system must be used in order to obtain sufficient conductivity for a magnetic flowmeter. A funnel is shown on the pulse leg for adding the heavy aqueous solution.

Figure III shows the H-1 column hook-up and a possible Recuplex panel board arrangement.

The cost of the project is estimated at \$10,000 and will be under Research and Engineering prototype funds, 6350-668.21.

FIG. I
NEW HOOD PROCESS SKETCH

FIG. II

DUCT LEVEL OVERALL SKETCH

FIG. III

RECUPLEX LEVEL H-I COLUMN HOOK-UP AND PANEL

H-I COLUMN HOOK-UP

RECUPLEX PANEL BOARD