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UNION CARBIDE

INTERNAL C RRESPONDEN E

UNION CARBIDE CHEMICALS COMPANY SOUTH CHARLESTON 3, WEST VIRGINIA

To (Name) Mr. A. A. Boehm
Company
Location NEW YORK OFFICE

Date May 11, 1961

Originating Dept.

Answering letter date

RECEIVED
JAN 31 1967
R. N Wheeler

Copy to Mr. J. A. Bruton
Mr. D. L. Engle
Mr. J. F. Erdmann
Mr. G. J. Hanks, Jr.
Mr. W. W. TenEyck
Mr. W. R. Wheeler

Subject Summary Report -
Suspension Vinyl Resins Plant
of the Pantasote Company at
Passaic, New Jersey

Dear Mr. Boehm:

In compliance with Mr. Bruton's request I have summarized the pertinent facts, according to his suggested format, concerning the Pantasote Company's suspension resins plant at Passaic, New Jersey. This is a summary report of three reports which were written on this general subject by Jack Erdmann and me following our visit to this plant last October. I have checked with several other of our people who visited Pantasote subsequent to our visit to see if they had anything to add to the information which had been reported in these reports. There were no comments from these people p rtinent to the information desired in this summary report although there were observations and ideas concerning Pantasote's polymerization difficulties arising from the use of our vinyl chloride monomer. These latter facts have been or will be reported by the Development Department.

Very truly yours,

M. E. Sutherland

M. E. Sutherland

MES/bcm
Attachment

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M E M O R A N D U M

TO: Mr. A. A. Boehm (3)
Mr. J. A. Bruton
Mr. D. L. Engle
Mr. G. J. Hanks, Jr.
Mr. W. W. TenEyck
Mr. W. R. Wheeler

BY: Mr. M. E. Sutherland

DATE: May 10, 1961

SUBJECT: Suspension Vinyl Resins Plant of the Pantasote Company at Passaic, New Jersey

I. GENERAL DESCRIPTION OF FACILITIES

The suspension vinyl resins plant of the Pantasote Company at Passaic, New Jersey is a clean, attractive, compact plant designed and built by the Scientific Design Company. It is an adjunct to their calendering plant which has been in operation for a number of years. The first increment of production was installed and put into operation in 1956. This first unit consisted of only four autoclaves and was operated at about 11 MM pounds per year, but in 1959 two more autoclaves were added t this unit which brought the capacity up to 15 MM pounds. In August 1960, an expansion was completed which trebled the capacity of the modified original unit to a total annual capacity for PVC suspension resins of 45 MM pounds. This new unit, consisting of 12 autoclaves, was put into operation in September 1960, and the old unit was shut down. There are three complete and independent polymerization and resin recovery lines, each having a capacity of 15 MM pounds per year of PVC resins, and two monomer de-inhibiting and recovery systems.

A block flow diagram of the process is shown in the attached Figure I. Because the monomer de-inhibiting and recovery system is the most complex portion of th process and is a step which is foreign to our own suspension resin operation, a detailed flow diagram of this system is shown in Figure II attached.

II. AUTOCLAVE DESIGN

The reaction system consists of eighteen - 2,200 gallon glass-lined Pfaudler autoclaves - six in the old unit and twelve in the new unit. The piping on the autoclaves is very simple, with only four process lines connecting to a manifold on a 3-inch nozzle on each autoclave. The heat of polymerization is removed with river water flowing through a completely filled overflow jacket. The water is circulated through the autoclave jackets, to forced-draft cooling towers, and back to the autoclaves. A two-stage vacuum jet is provided for evacuating the autoclaves during charging. Only one recording instrument, a combined temperature controller-pressure recorder, plus a pressure gauge are provided on each autoclave. Each vessel is equipped with one combinod rupture disc - safety valve assembly attached to a 3-inch nozzle on the top dome.

The high productivity of the 2,200 gallon autoclaves was quite impressive. With the 33 per cent larger ratio of wall cooling surface area to charge volume in these small autoclaves as compared with our 4,600 gallon autoclaves, they may use water at atmospheric temperatures to effectively remove the heat of reaction, whereas w must use -20°C brine for equivalent productivity. Another more important advantage of the small autoclaves may be that this is the secret of their producing an excellent dry-blending resin. It is possible that the critical agitation required for this resin cannot be scaled up to a larger vessel. A sketch of one of these 2,200 gallon autoclaves is shown in Figure III attached.

III. RECIPES AND PRODUCTS

Pantasote produces four types of PVC resins which are marketed under the trade name Kohinor. A brief description of each is as follows:

Kohinor 652 - This is their dry-blend resin and, according to evaluations f our own Development Department, is by far the best dry-blend resin on the market. Prior to their expansion the demand for this resin exceeded their production capacity. In order to protect their market position, they produced all the dry-blend resin they could for sale and purchased calendering resin for their compounding plant. This resin has a specific viscosity of approximately 0.220 and is produced with a polyvinyl alc hol recipe.

Kohinor 650 - This is a special calendering resin having a specific viscosity somewhat lower than that of 652. We know nothing of the recipe for this resin.

Kohinor 648 - This is their main calendering resin and next to 652 in importance. Since the plant expansion went on stream, sufficient quantity of this resin has been produced to supply the compounding plant adequately as well as to provide some excess for sale. This is a medium viscosity resin probably similar to our QYSM-5 (0.170 specific viscosity). We believe it is produced with a methyl cellulose r cip .

Kohinor 635 - This is a low viscosity resin used for rigid sheeting. It is probably similar to our QYSA-5 (0.115) or QYSJ-5 (0.145) in specific viscosity. This resin is probably produced with a methyl cellulose recipe along with trichlorethylene molecular weight degrader.

They are working on the development of a vinyl chloride-vinyl acetate copolymer, presumably for the flooring and record molding market, and have successfully accomplished initial production trials.

Since the dry-blending resin (Kohinor 652) was the particular material which Pantasote was having the most difficulty in producing at the time of the visit of J. F. Erdmann and the writer, we were permitted to observe their charges for several autoclaves. None of the amounts of materials was related to us, but our observations and knowledge of this type of operation permitted certain relationships and conclusions to be drawn as to the recipe used for this type of resin. This recipe is approximately as follows:

A.	Vinyl chloride/water ratio	40/60
B.	Vinyl chloride charged, lbs.	5,800
C.	H_2O charged, lbs.	8,700
D.	Suspending agent, polyvinyl alcohol (probably E88H), per cent of vinyl chloride	0.035 (approx. 2 lbs.)
E.	Catalyst, dilauroyl peroxide, per cent of vinyl chloride	0.185 (approx. 10.7 lbs.)
F.	Total charge volume @ 50°C, gals.	1,980
G.	Conversion, approximate	90%
H.	Resin produced per run, lbs.	5,250

Several comments seem justified. The vinyl chloride/water ratio is a guess, but their resin plant supervisor, spoke several times of producing about 5,250 pounds of resin per run. On other occasions he said their conversion was approximately 90 per cent - this was in turn confirmed by the approximate 10 per cent recycle of recovered vinyl chloride. Although we commonly call this size of Pfaudler autoclave a 2,200 gallon vessel, the Pfaudler people refer to them as 2,000 gallon vessels on the basis of operating them filled just to the level of the top manhead gasket. This was the approximate level of operation noted for these charges, taking into account the deep vortex produced by the agitator. Thus, the figures for the total charge and ratio were derived.

The type and concentration of suspending agent was not directly disclosed. Others have reported seeing bags of duPont Elvanol in this plant on previous occasions. The amount of suspending agent was determined from a charge sheet and observation of an actual charging operation. In contrast to our practice of making an aqueous solution of the suspending agent prior to charging, the dry suspending agent was poured through the open manhead directly into the warm water in the autoclave just ahead of the granular dilauroyl peroxide. The use of dilauroyl peroxide as their catalyst was freely discussed.

As best we could determine, no other ingredients were used in this recipe, although notations of "glycerine added" were seen in several log sheets. The scattered timing of these additions suggests that glycerine may be used as the seal fluid for the mechanical seals and the additions were made to the seal fluid reservoirs on the autoclaves.

IV. MANPOWER AND MANUFACTURING COSTS

The entire suspension resin plant operation is under the direction of a production manager who reports to a works manager of the combined operations of the calendering plant and the resin plant. The production manager has reporting to him two production engineers, one development engineer, three laboratory technicians, a clerk and all of the hourly personnel.

There are a total of 35 people on the hourly payroll. Each of four shifts has seven operators, and there are four day operators and three day maintenance men. There are no relief men since each shift group works six straight shifts and then is off two days. Vacations are covered by men from the off-shift.

The shift operating assignments and general duties are as follows:

A. Lead Operator - Supervises entire plant operation on shift. Assists in operation wherever needed.

B. Monomer Purifying Operator - Unloads tank car and operates ground level functions of the monomer de-inhibiting system.

C. Reaction Operator - Assembles, charges, reacts, and strips autoclaves. Removes autoclave manhead after charge is transferred. Controls feed flow to monomer de-inhibiting system; controls reflux flow to monomer refining still.

D. Utility Operator - Transfers charges to slurry tanks. Washes or cleans autoclaves after transfers. Operates water demineralizing system.

E. Recovery Operators (Two - One for each Line) - Switches slurry feed tanks. Operates centrifuge, rotary dryer, baghouse, and screen. Packages resin in bags or "Pillar-Paks".

F. Fork Truck Operator - Helps recovery operators stack bags of resin into pallets and transports to storage area.

For time worked in excess of 40 hours in one week and 8 hours in one day a 50 per cent premium is paid. Double-time is paid for Sundays worked, and I believe this same rate is paid for holidays worked. Each operator gets paid, on the average, an equivalent of 51-1/2 straight time hours for each 40-hour week.

The lead operators receive the top hourly pay rate of $2.54 per hour. The pay rates of the other six operators vary from about 15 cents per hour below this top rate down to a minimum of $1.84 per hour according to the job classification. The pay rate for the three maintenance men is probably equivalent to or slightly under that of a lead operator.

As mentioned earlier, the old 15 MM lbs./yr. unit is now shut down and only the new 30 MM lbs./yr. expansion is being operated. When sales require it, the old plant will be reactivated requiring the addition of 16 hourly men. No additional salaried employees should be necessary.

The following tabulation shows the estimated costs for manufacturing PVC suspension resins in the Pantasote Company Plant at 30 MM lbs./yr. and 45 MM lbs./yr. production rates. The current monomer selling price of 9.6 cents/lb. delivered and a monomer efficiency of 95 per cent were assumed. Operating costs were based upon estimates derived from consideration of the number of people which they utilized in various segments of the plant and upon other bits of information picked up from their personnel. The various elements of these costs are not accurate because of so many unknown factors, but I believe the overall operating costs are fairly reliable but, at the same time, optimistic estimates.

Estimated Costs for Manufacturing Suspension Resins in the Pantasote Company Plant:

	30 MM lbs./Yr.		45 MM Lbs./Yr.	
	Total M$	Unit ¢/Lb.	Total M$	Unit ¢/Lb.
Operating Cost:				
Operating Labor	123	0.41	197	0.44
Supervision	51	0.17	51	0.11
Maintenance	100	0.33	140	0.31
Misc. Labor	20	0.07	29	0.07
Laboratory	26	0.09	35	0.08
Utilities	62	0.20	94	0.21
Allocated Expense	206	0.69	301	0.67
Total Op. Cost	588	1.96	847	1.89
Raw Materials Cost:				
Vinyl Chloride	3040	10.13	4550	10.13
Other R. M.	120	0.40	180	0.40
Total R. M. Cost	3160	10.53	4730	10.53
Packaging Cost:				
Labor	43	0.14	54	0.12
Materials	60	0.20	90	0.20
Total Pack. Cost	103	0.34	149	0.32
Total Mfg. Cost	3851	12.83	5726	12.74

V. INVESTMENT

A Prospectus on Cary Chemical Company revealed that an 11 MM lbs./yr. package Scientific Design Plant cost approximately $1,200,000 in 1956 - the year that Pantasote's original unit was built. The expansion of this unit to 15 MM lbs./yr. in 1959 by the addition of two autoclaves (increase from four to six) is estimated to hav cost about $200,000, bringing the total investment in the old unit to $1,400,000. The 30 MM lbs./yr. expansion completed last year is estimated to have cost $2,300,000. This would bring the total investment in the entire plant to $3,700,000 which represents, at capacity, an investment of $0.082 per annual pound.

FIGURE 1

BLOCK FLOW DIAGRAM OF SUSPENSION RESIN PROCESS
OF THE PANTASOTE COMPANY
PASSAIC, N. J.

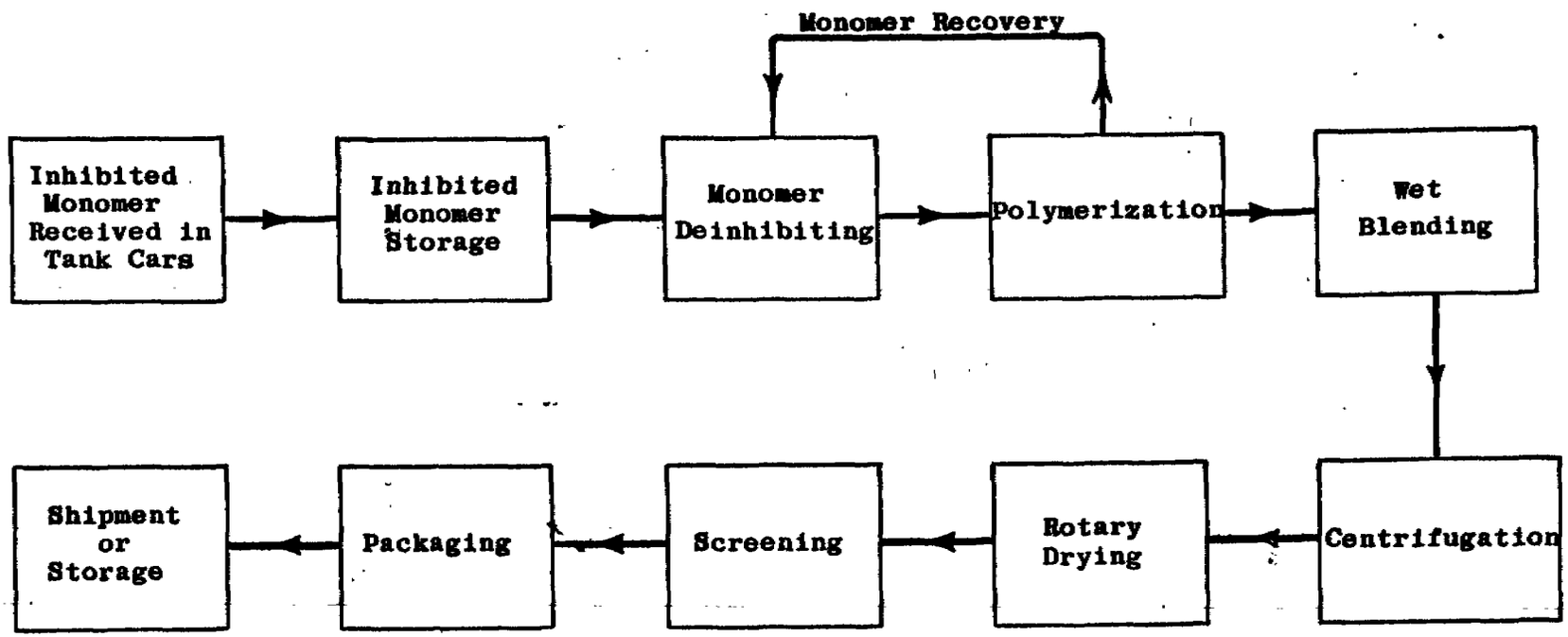

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FIGURE 2

FLOW SHEET OF VINYL CHLORIDE DEINHIBITING SYSTEM - SUSPENSION RESIN PLANT OF THE PANTASOTE COMPANY PASSAIC, N. J.

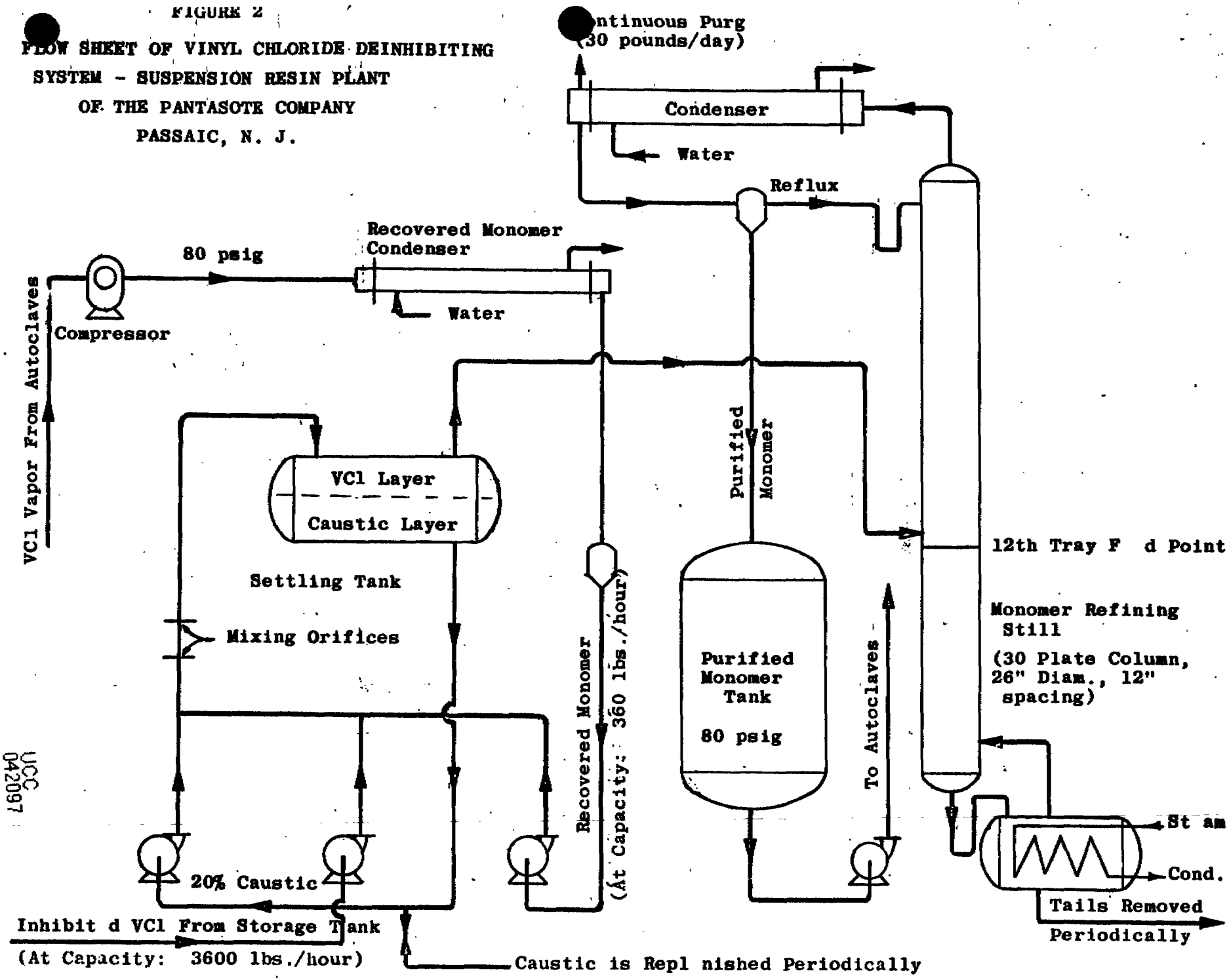
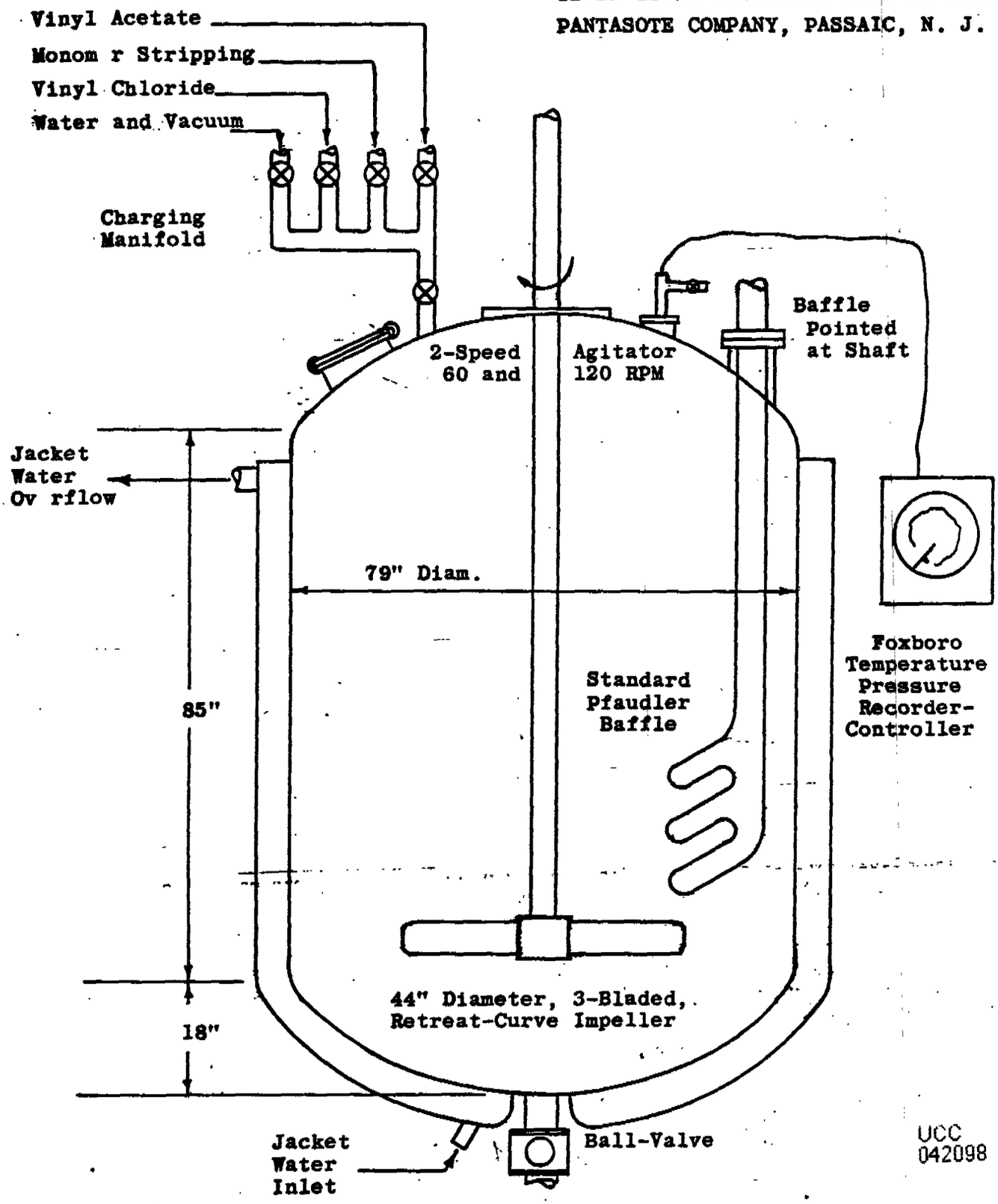


FIGURE 3

PFAUDLER STANDARD 2200-GALLON GLASS-LINED AUTOCLAVE USED BY THE PANTASOTE COMPANY, PASSAIC, N. J.



NOTE: All int rior surfac s glass-coat d.
Dim nsions ar approximate.
V ssel pressure rating 200 psig.