Serial No. KN-67-12

Copy No. 1

E. I. DU PONT DE NEMOURS & COMPANY
256 VANDERPOOL STREET
NEWARK, NEW JERSEY

KN-67-12

NEWARK PLANT
PIGMENT COLOR RESEARCH REPORT

PRELIMINARY EVALUATION OF THE FUNDA FILTER

Period Covered November 1966 to February 1967

FILE: 114

DATE: 6/7/67

N33703

KN-67-12
Copy No. 1

1. Numerical File
2. Research Office File (114)
3. Library File (114)
4. M. Hunt/ E. Gonick, Pigments-Wilm.
5. W.S.Struve/A.A.Brizzolara
6. H.R.Linton/F.F.Ehrich/B.H.Perkins/Library
7. P.J.Monahan (Vital Records)
8. R.H.Wetzel/J.W.Minnich, Newport
9. N.G.Fisher, Central Res. Dept., Wilm.
10. G.P.Lewis - Newark
11. W.J.McClure/R.A.Hageman, Newark
12. E.W.Andrews/J.F.Little, Newark
13. J.E.Flood/ F.W.Rennie-Louviers, Wilm.
14. Extra
15. "
16. "
17. "
18. "

NEWARK PLANT
PIGMENT COLOR RESEARCH REPORT

SUBJECT: PRELIMINARY EVALUATION OF THE FUNDA FILTER

PERIOD COVERED: November 1966 to February 1967

SUBMITTED BY: G. P. LEWIS — Date Submitted: 6/1/67

APPROVED BY: H. R. LINTON — Date Released: 6/7/67

ABSTRACT

Evaluation of a small Funda filter has shown filtration rates 15 to 20 times those obtained in a plate and frame filter press. A test using a 20 ft^2 filter is recommended.

TABLE OF CONTENTS

INTRODUCTION

Filtration of pigment from synthesis and extraction slurries at the Newark plant is usually carried out with plate and frame filter presses. The only exceptions are the inorganic lead and zinc based colors which are isolated by continuous centrifuge. Batch pressing is followed by tray drying, and the combined operation requires a considerable amount of manual labor. As a possible labor savings device, the methods and standards department suggested that research evaluate a new automatic discharging filter. Preliminary evaluation at the vendor's facility resulted in inconclusive data. A small scale pilot plant filter was rented from the vendor and evaluated in the Newark Semi-Works.

SUMMARY AND CONCLUSIONS

The Funda filter has been tested on quinacridone, CPC blue and molybdate orange vat control slurries. The filtration and washing rates were up to 20 times that presently obtained in our plate and frame filter presses. The drying cycles for the cake to obtain discharge from the filter was not conclusively established during the test. Drying cycles in the test were longer than necessary due to limiting dimensions of the pilot plant unit tested, which had a filtration area of .5 feet^2.

The data indicates a significant improvement in throughput (lb/hr/ft^2), and a potential cost savings. It is recommended that further testing on a 20 ft^2 filter equipped with a Rootes Blower be carried out to establish the operating cycles for several pigments.

PATENT STATUS

No patentable items will result from this work.

DESCRIPTION OF FILTER

The filter tested is called a Funda filter and it is manufactured by Chemap A. G. of Switzerland. Sales in the United States are carried out by the De Laval Separator Company, and an affiliate of Chemap; Chemapec Inc. located in Hoboken, N. J. The work reported on in this memorandum was carried out using Chemapac equipment.

The Funda filter is a horizontal multi-leaf pressure filter. It is similar to a Nutsche filter with the exception that several leaves can be accommodated within the filter vessel. Automatic discharge of the cake is another feature of the filter. These innovations lead to a compact unit with a relatively high filter area per unit volume.

Figure 1 is a schematic of the filter. The vessel is cylindrical with a conical bottom. Several disc shaped filter leaves are mounted on a hollow central shaft and any type of filter cloth can be used with these leaves. The shaft is connected to a motor mounted on top of the vessel. Figure 2 shows the detail of the filter nest. The slurry passes over the top of the cloth, and filtration takes place when the appropriate pressure differential is applied. The filtrate passes through the cloth and down the filter disc toward the central shaft. Openings on the shaft at specified locations permit the filtrate to pass down the hollow center of the shaft. The cake is collected on the top surface of the cloth and a cake thickness essentially equal to the distance between two adjacent filter discs can be obtained.

Auxiliary equipment includes a slurry and wash water pump, and a source of pressurized (10-15 psig) heated air. In operation, the slurry is pumped to the vessel as shown in Figure 2. It is desirable to operate the filter with a recycle stream, as shown by the slurry overflow line at the top of the vessel. This overflow returns to the synthesis or extraction vat. A valve in this line may be used to control the filtration pressure by varying the overflow rate. The filtrate runs down the shaft and out the bottom of the vessel as shown. The filtration is carried out for a predetermined time until the desired cake thickness is reached. This thickness is typically one inch. Following this a heel filtration is carried out to filter the slurring remaining in the filter vessel.

Washing is now carried out using the same pump as for the feed slurry. Overflow washing as before is preferred for the operation. At a given conductivity, the washing is terminated, and the remaining wash water can be heel filtered or drained.

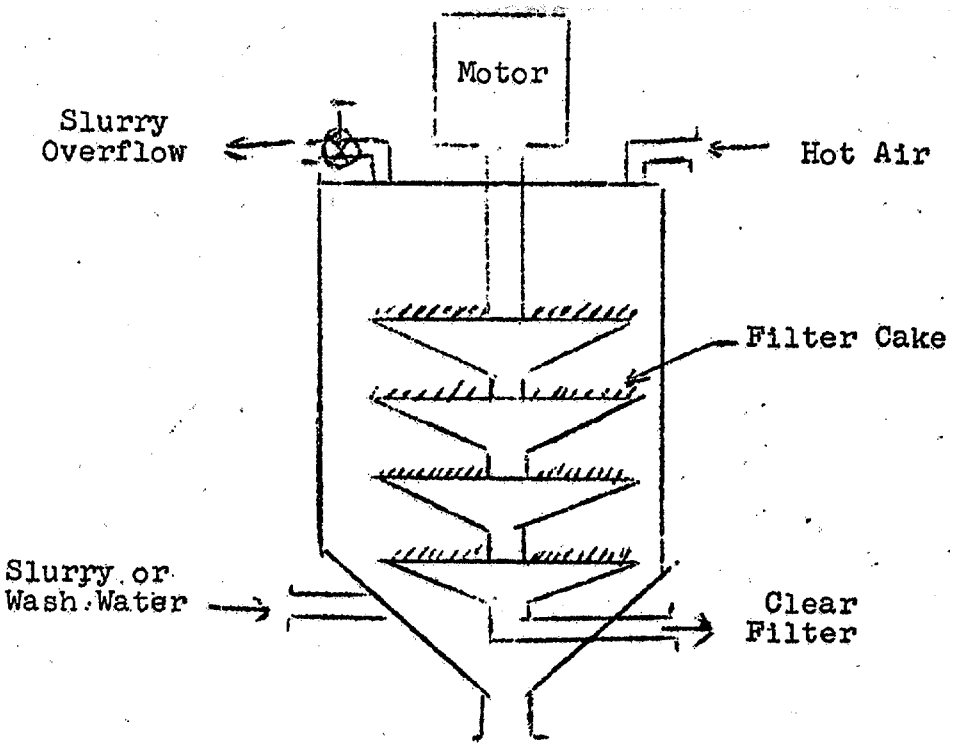

Fig. 1 FUNDA FILTER

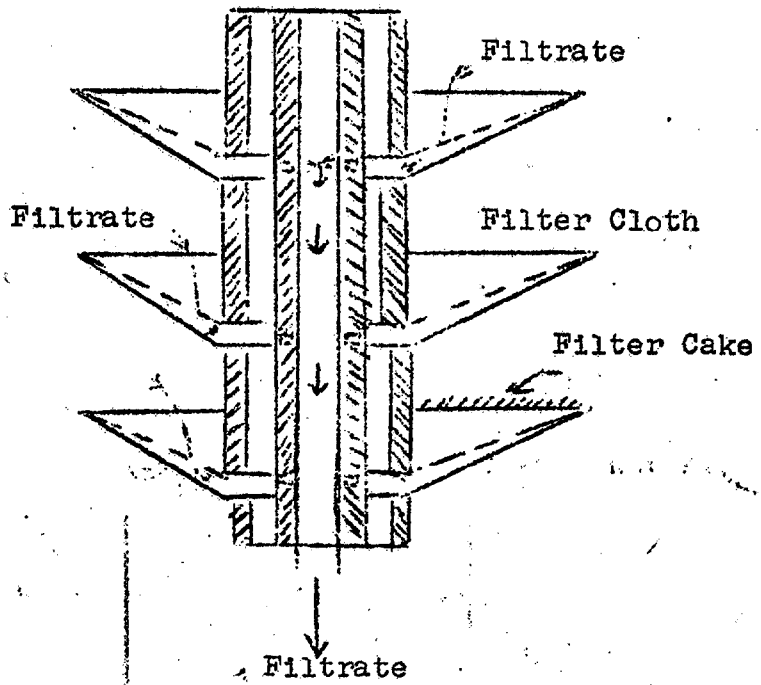

Fig. 2 FILTER NEST

Description of Filter (Cont'd)

A unique feature of the Funda filter is automatic cake discharge obtained by rotating the center shaft and filter leaves. In order for the pigment to leave the filter cloth and discharge through the bottom of the filter, the pigment generally must be partly dewatered. This is accomplished by the use of hot pressurized air to displace the water from the cake and to dry it. The air pressure would be 10-15 psig with an inlet temperature of up to 300°F - 350°F. Drying is carried out only up to the point where the pigment can discharge easily. This will be in the range of 35% - 50% solids depending on the material. The drying time which is determined experimentally, can be as long as the filtering or washing times, but again depends on the pigment filtered.

Following the drying, the motor on the filter vessel is activated, and the entire filter nest rotates, discharging pigment by centrifugal force. After pigment discharge, the vessel is ready for another filtration cycle.

Changeover between codes is normally made by replacing the filter nest assembly and scrubbing the equipment. This changeover should be accomplished in 4 - 6 hours.

The entire process can be automatically controlled requiring a minimum of manual labor.

EXPERIMENTAL DETAILS

The pilot plant filter rented from Chemapec had a .5 ft^2 filter area, a total volume of about 13 liters and was constructed of stainless steel. The unit is identical to production models with two exceptions. The heel filtration lines were not present and air jets to help discharge cake was not available.

Each filter disc was .1 ft^2 in area and 5 discs were placed in the unit at a spacing of 1-1/4". Feutron cloths were sewn together to completely surround the disc and a single cloth was used for the majority of the runs.

The pigment slurry was fed from a 30 gallon steel tank by a gear pump capable of delivering a 75 psig head. Washing was accomplished using city water directly off the line at 40 psig, which was throttled to vary the pressure in the filter. Plant compressed air was used for heating and drying of the filter cake. Steam tracing around the air line provided inlet air temperatures up to 170°F maximum.

Preliminary runs to establish rates and pigment loading on the filter disc were made using a pressure Nutsche filter with a single filter disc of 0.1 ft^2 in area. The volume of the pressure filter was 95 ml. Nitrogen gas from cylinders was used to pressurize the vessel.

TEST RESULTS

QUINACRIDONE PIGMENTS

The samples tested in the quinacridone group were RT-796-D, RT-839-D and RT-849-D. The first two materials are the extraction vat slurries obtained by charging mill powder into a sulfuric acid solution. The main soluble salt is the aluminum sulfate. The weight percent pigment is 4 — 6% in these slurries. The RT-849-D has a 10% calcium staybelite extension of the pigment. The soluble salts contain mainly sodium chloride, with the solution being alkaline. Pigment content is about 6% by weight.

Initial testing with the pressure nutsche using RT-839-D gave a total filtration time of one hour for a quart of slurry. The filtration rate was 2.5 gal/hr/ft^2 with a final pressure of 60 psig. Washing was carried out at pressures of 40-50-psig. The filtration rate was 2.5 gal/hr/ft^2 for the first quart of wash water and this rate increased to 4.3 gal/hr/ft^2 for the second wash. The cake thickness was 5/16 to 3/8 inch for a quart of feed slurry. Based on a desired cake thickness of one inch in the .5 ft^2 pilot plant filter, about four gallons of the quinacridone slurry (.3 - .4 lb/gal) had to be filtered.

Testing in the pilot plant unit was carried out as follows:

> Fifteen gallons of the slurry were added to the feed tank and agitated. The slurry was then pumped into the filter unit. Approximately four gallons were required to fill the unit. After the unit was filled as indicated by the overflow at the top of the filter, the overflow valve was closed to obtain pressure within the filter. At this point filtration commenced. The pressure within the filter was regulated by the overflow valve. Most runs were carried out with an overflow. That is, the feed rate exceeded the filtration rate. In some cases the pump did not deliver the rated flow and the runs were carried out with a closed overflow valve. Maximum pressure developed was 30 - 35 psig because of leakage in the pump packing. When the required amount of filtrate was collected, the pump was shut off and the contents of the filter drained to the feed tank. This was done carefully to avoid disturbing the cake. Washing was carried out by applying hot water at city line pressure directly to the filter and controlling by the inlet and the overflow valve. Conductivity readings were taken to indicate degree of washing. When the desired conductivity was reached, the wash water was turned off and the filter drained as before. Hot air (170°F) at essentially zero pressure was used to blow the water out of the cake.

Quinacridone Pigments (Cont'd)

This required about 3 - 5 minutes. Following this, 12 SCFM of air at 170°F was passed through the cake for varying times. The jacket of the filter was chased with steam to maintain temperature. After the drying was complete the air was shut off and the filter nest rotated for up to one minute. The cake was collected at the bottom of the filter and a solids analysis was carried out.

Several runs were made to familiarize the personnel with the unit. The data sheets indicate the pertinent information obtained from typical runs on quinacridone slurries.

Phtalocyanine Blue Pigments

The same procedure was followed for BT-417-D slurry. Pressure Nutsche tests showed that one liter of slurry filtered with a cake thickness of 1/4" on the .1 ft^2 unit. The average rate was 2 to 2.5 gal/hr/ft^2 at a 60 psig maximum pressure. Two typical runs are given for the pilot plant .5 ft^2 Funda.

Molybdate Orange Pigments

This pigment filtered very rapidly using the pressure Nutsche. Average filtration rates of 14 gal/hr/ft^2 were obtained for a total of 1.4 gallons of slurry. The cake thickness was one inch at a maximum of 60 pound pressure. Four runs were made as shown on the data sheets.

DISCUSSION OF RESULTS

Filtration and Washing

Operation of the unit generally was satisfactory regarding filtration and drying. In some of the runs, the final vat control slurry to be filtered had a 50% higher solids content than expected. This was caused by sampling at the bottom of the vat after settling had taken place. The higher solids level meant that for the calculated quantity of slurry to be filtered, too much pigment was collected. For these runs the plates were filled and filtering occurred at the outer periphery with cake extending to the wall. This resulted in lower average filtration rates, as in run 1. Solids were then taken before each run and the unit performed satisfactorily.

The data indicated average filtration rates of 8 — 10 gal/hr/ft^2 for the dispersion milled vat control .QA slurries. This is the average for the one inch of cake to form. Rates of up to 16 gal/hr/ft^2 were observed at cake thicknesses up to one half inch. The washing rates were not reproducible for all the

RUN: 1

Filtration	Cotton Cloth
Pigment Slurry:	RT-796-D
Solids Content:	4%
Gal. Filtered:	3.5
Time:	2 hr.20 min.
Avg. Filtration Rate:	3 gal/hr/ft^2
Maximum Pressure:	14 psig
Washing	
Gallons Wash Water:	10
Time:	1 hour 15 minutes
Average Wash Rate:	16 gal/hr/ft^2
Maximum Pressure:	14 psig
Initial Ohms Wash Water:	3200
Final Ohms of Filtrate:	2000
Drying	
Drying Time:	2 hours
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	52%

RUN: 2

Filtration	Cotton Cloth
Pigment Slurry:	RT-839-P
Solids Content:	Approx. 5%
Gal. Filtered:	4
Time:	1 hour
Avg. Filtration Rate:	8 gal/hr/ft^2
Maximum Pressure:	60 psig
Washing	
Gallons Wash Water:	20
Time:	1 hour 30 minutes
Avg. Filtration Rate:	27 gal/hr/ft^2
Maximum Pressure:	25
Initial Ohms Wash Water:	3500
Final Ohms of Filtrate:	3000
Drying	
Drying Time:	1 hour 30 minutes
Air Temp:	170°F
Air Flowrate:	125 CFM
% Solids of Cake:	43%

RUN: 3

Filtration	Feutron Cloth
Pigment Slurry:	RT-796-D
Solids Content:	4%
Gal. Filtered:	5.1
Time:	1 hour 25 minutes
Avg. Filtration Rate:	7.7 gal/hr/ft^2
Maximum Pressure:	25 psig
Washing	
Gallons Wash Water:	50
Time:	50 minutes
Avg. Filtration Rate:	84 gal/hr/ft^2
Maximum Pressure:	27 psig
Initial Ohms Wash Water:	2900
Final Ohms of Filtrate:	2900
Drying	
Drying Time:	1 hour
Air Temp:	160°F
Air Flowrate:	12 SCFM
% Solids of Cake:	35.1%

RUN: 4

<u>Filtration</u>	Feutron Cloth
Pigment Slurry:	RT-849-D
Solids Content:	6%
Gal. Filtered:	5
Time:	1 hour
Avg. Filtration Rate:	10 gal/hr/ft^2
Maximum Pressure:	16 psig
<u>Washing</u>	
Gallons Wash Water:	25
Time:	1 hour 20 minutes
Avg. Filtration Rate:	38 gal/hr/ft^2
Maximum Pressure:	34 psig
Initial Ohms Wash Water:	4000 ohms
Final Ohms of Filtrate:	3600
<u>Drying</u>	
Drying Time:	40
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	* 23.8%

*Did not spin off.

RUN: 5

Filtration	Feutron Cloth
Pigment Slurry:	RT-849-D
Solids Content:	4%
Gal. Filtered:	2-1/2
Time:	24 minutes
Avg. Filtration Rate:	13.4 gal/hr/ft^2
Maximum Pressure:	16 psig

Washing	
Gallons Wash Water:	25
Time:	1 hour
Avg. Filtration Rate:	25 gal/hr/ft^2
Maximum Pressure:	30 psig
Initial Ohms Wash Water:	3300 ohms
Final Ohms of Filtrate:	3100 ohms

Drying	
Drying Time:	40 minutes
Air Temp:	160°F
Air Flowrate:	12 SCFM
% Solids of Cake:	* 26.4%

*Did not all spin off.

RUN: 6

Filtration	Feutron Cloth
Pigment Slurry:	RT-796-D
Solids Content:	4%
Gal. Filtered:	3
Time:	30 minutes
Avg. Filtration rate:	12 gal/hr/ft^2
Maximum Pressure:	32 psig

Washing	
Gallons Wash Water:	15 gallons
Time:	1 hour 15 minutes
Avg. Filtration Rate:	24 gal/ hr/ft^2
Maximum Pressure:	20 psig
Initial Ohms Wash Water:	5000
Final Ohms of Filtrate:	5000

Drying	
Drying Time:	1 hour 30 minutes
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	34.5%

RUN: 7

Filtration	Feutron Cloth
Pigment Slurry:	RT-796-D
Solids Content:	4%
Gal. Filtered:	4 gallons
Time:	35 minutes
Avg. Filtration Rate:	13.8 gal/hr/ft^2
Maximum Pressure:	28 psig

Washing	
Gallons Wash Water:	16
Time:	1 hour
Avg. Filtration Rate:	32 gal/hr/ft^2
Maximum Pressure:	24 psig
Initial Ohms Wash Water:	4200
Final Ohms of Filtrate:	4000

Drying	
Drying Time:	1 hour 30 minutes
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	34.1%

RUN: 8

<u>Filtration</u>	Feutron Cloth
Pigment Slurry:	BT-417-D
Solids Content:	4%
Gal. Filtered:	4
Time:	3 hours
Avg. Filtration Rate:	2.7 gal/hr/ft^2
Maximum Pressure:	22 psig
<u>Washing</u>	
Gallons Wash Water:	50
Time:	7 hours 40 minutes
Avg. Filtration Rate:	13 gal/hr/ft^2
Maximum Pressure:	28 psig
Initial Ohms Wash Water:	3800
Final Ohms of Filtrate:	3000
<u>Drying</u>	
Drying Time:	2.5 hr
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	40.3%

RUN: 9

Filtration	Feutron Cloth
Pigment Slurry:	BT-417-D
Solids Content:	4%
Gal. Filtered:	5
Time:	1 hour 45 minutes
Avg. Filtration Rate:	5.8 gal/hr/ft^2
Maximum Pressure:	20 psig

Washing

Gallons Wash Water:	60
Time:	3.5 hours
Avg. Filtration Rate:	34 gal/hr/ft^2
Maximum Pressure:	35 psig
Initial Ohms Wash Water:	3000
Final Ohms of Filtrate:	3400

Drying

Drying Time:	2 hours
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	*26.4%

*Did not spin off.

RUN: 10

<u>Filtration</u>	Cotton Duck Cloth
Pigment Slurry:	YE-698-D
Solids Content:	4%
Gal. Filtered:	10
Time:	30 minutes
Avg. Filtration Rate:	40 gal/hr
Maximum Pressure:	20 psig
<u>Washing</u>	
Gallons Wash Water:	16
Time:	25 minutes
Avg. Filtration Rate:	75 gal/hr/ft^2
Maximum Pressure:	20 psig
Initial Ohms Wash Water:	4000
Final Ohms of Filtrate:	3200
<u>Drying</u>	
Drying Time:	6
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	99%

RUN: 11

Filtration	Cotton Duck Cloth
Pigment Slurry:	YE-698-D
Solids Content:	5%
Gal. Filtered:	7
Time:	20 minutes
Avg. Filtration Rate:	44 gal/hr/ft^2
Maximum Pressure:	20 psig
Washing	
Gallons Wash Water:	50
Time:	1 hour
Avg. Filtration Rate:	100 gal/hr/ft^2
Maximum Pressure:	25 psig
Initial Ohms Wash Water:	2700
Final Ohms of Filtrate:	2500
Drying	
Drying Time:	3-1/2 hours
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	84%

RUN: 12

Filtration	Cotton Duck Cloth
Pigment Slurry:	YE-698-D
Solids Content:	5%
Gal. Filtered:	7
Time:	20 minutes
Avg. Filtration Rate:	42 gal/hr/ft^2
Maximum Pressure:	20 psig
Washing	
Gallons Wash Water:	30
Time:	45 minutes
Avg. Filtration Rate:	80 gal/hr/ft^2
Maximum Pressure:	20 psig
Initial Ohms Wash Water:	3000
Final Ohms of Filtrate:	3000
Drying	
Drying Time:	1 hour 30 minutes
Air TempP	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	68%

RUN: 13

Filtration	Cotton Duck Cloth
Pigment Slurry:	YE-698-D
Solids Content:	5%
Gal. Filtered:	7
Time:	20 minutes
Avg. Filtration Rate:	44 gal/hr/ft^2
Maximum Pressure:	20 psig

Washing

GA Gallons Wash Water:	)
Time:	) DID
Avg. Filtration Rate:	) NOT
Maximum Pressure:	)
Initial Ohms Wash Water:	) WASH
Final Ohms of Filtrate:	)

Drying

Drying Time:	1 hour
Air Temp:	170°F
Air Flowrate:	12 SCFM
% Solids of Cake:	* 60%

*Some Sticking to Wall.

Filtration and Washing (Cont'd)

runs, but generally were between 20 and 30 gal/hr/ft^2. About 3 - 4 gallons of wash water per gallon of filtrate were required, to reach the acceptable ohms level. In most cases the washed cake was reslurried in water to check on the uniformity of washes. No changes in conductivity were observed, indicating a uniform wash with no channeling or leakage.

The CPC blue BT-417-D filtered at rates from 3 to 5 gal/hr/ft^2 and washed at rates exceeding 20 gal/hr/ft^2. Approximately 8 - 10 gallons of wash water were required per gallon of slurry filtered.

The inorganic molybdate orange YE-698-D filtered exceedingly well at rates up to 45 gal/hr/ft^2, and washed at rates up to 80 gal/hr/ft^2. This is of course due to the density of the pigment.

The data indicates that the loading of the blue and red pigments is 3 - 4 lb dry pigment per ft^2 of filtering area at a one inch cake thickness. For the molybdate orange pigments the loading is about 6 lb. dry pigment per ft^2 at a one inch cake thickness.

Drying

The drying portion of the test did not yield valid data for several reasons. The low air temperature (170°F) attainable resulted in long drying cycles. In addition there was only about a half inch clearance between the plate and the wall in the pilot plant unit. The bottom of the vessel, where the pigment discharges also had a small clearance due to the piping necessary to take the filtrate out. This meant that when the cake was spun off the plate, chunks of pigment were caught between the plate and the wall, and in the bottom of the filter. Since the pigment did not discharge properly, we had to dry longer than necessary in order to get discharge of the pigment. Therefore drying cycles can only be estimated.

It was determined that the quinacridone pigments will discharge at about 35% solids, the CPC blue discharged only after the 40% solids level was reached, and the molybdate orange did not discharge below 60% solids.

SCALEUP AND COST DATA
COMPARISON WITH PRESENT FILTERS

Using the data obtained with maximum pump pressures of 30-35 psig we can extrapolate to somewhat higher rates if the pump could reach 70-90 psig, as is common in our present filtering operation. We can also extrapolate the drying data for assumed air temperatures of 275°F - 290°F to arrive at overall cycle times.

Quinacridone Pigments

Extrapolation of the data as indicated above results in a filtration rate of 10 gal/hr/ft^2, a wash rate of 25 gal/hr/ft^2 and a drying time of one hour at a rate of 8 SCFM/ft^2 of air at 275°F. Our present filter press operation on RT-796 takes 12 hours to fill the press, 32 hours to wash and two hours to drop the press for a total of 46 hours.

The press has an area of 1550 ft^2 and a batch has about 8000 gallons. The filtration rate is 8000/1550 x 12 = .43 gal/hr/ft^2, while the Funda rate is 20-25 times this rate. At a one inch cake loading a sq. ft. of filter area requires 10 gallons of filtrate giving a pigment loading of 3 - 3.5 lb/ft^2. This is achieved in one hour. About 35 gallons are required to wash this amount of pigment and this requires 1.4 hours, while the drying time to discharge is one hour. The throughput of the Funda is therefore 3 - 3.5 lb/ft^2/3.4 hr = .88 - 1.04 lb/hr/ft^2. The comparable number for the plate and frame is 2600/1550 x 46 = .036 lb/hr/ft^2. An improved press, the ALP Shriver, has been installed at Newport for QA crude. Its service is not the same as our filter presses, but its capacity is only .057 lb/hr/ft^2.

The number and size of the filters required for a given hourly throughput of pigment can be calculated as follows:

> Assume a desired 500 lb/hr throughput. Using an average loading of 3.25 lb/hr/ft^2 the filter area required is 154 ft^2. The nearest production unit is a 15 m^2 or 162 ft^2. Our cycle time is 3.4 hours and therefore four filters would be selected to produce a rate of 500 lb/hr. The cost for each filter would be about $20,000. With automatic controls, Rootes blower, etc., the unit should cost $40,000. Installation might double this price leading to $80,000 per filter. This compares to an uninstalled capital costs of $69,000 for the aforementioned ALP Shriver press. On a square foot basis the Funda costs $240/$ft^2$ uninstalled, the ALP Shriver cost $70/$ft^2$ and a plate and frame of iron construction of 1500 ft^2 cost about $20/$ft^2$. The Funda throughput per ft^2 is 15-20 times the ALP and 25-30 times a plate and frame press.

CPC Blue Pigments

As above, the extrapolated filtration rate for a BT-417 type slurry is about 7 gal/hr/ft^2. The wash rate is 25/ gal/hr/ft^2 and a drying time is 1.5 hours. The pigment loading is also 3 - 3.5 lb/ft^2 requiring 10 gallons filtered in 1.4 hours. About 100 gallons of wash water were required, to reach the proper conductivity level. This requires four hours and 1-1/2 hours are necessary to dry. The cycle is 6.9 hours and the throughput is 3.25/6.9 = .47 lb/hr/ft^2. The rate through our plate and frame presses is .038 lb/hr/ft^2.

Calculating the filter size requirements as before, assume a desired production rate of 300 lb/hr. The pigment loading is 3.25 lb/ft^2 as before, which results from the filtration of 10 gallons of slurry. At the conservative rate of 7 gal/hr/ft^2 for filtration, the above loading requires 1.42 hours and filtration throughput is 3.25/1.42 = 2.3 lb/hr/ft^2. The filter area required is therefore 300 lb/hr/2.3 lb/hr/ft^2. This is a 12 m^2 production size unit. The cycle is 6.9 hours as before, requiring seven filters for this job. Each filter equipped with blower and controls would cost about $32,000.

The number of filters is quite large due to the necessity to wash with 10 volumes of water per volume of slurry filtered; as compared to 3 volumes for quinacridones. The plant data indicates that the washing times are the same for QA and CPC and this paradox should be explored by further testing.

Molybdate Orange Pigments

While the throughput for the molybdate orange slurries were very rapid, it is necessary to dry to 60% solids before adequate discharge is obtained. This means that the largest portion of the cycle is spent in drying and the unit does not appear attractive. This is particularly true when centrifuges do an adequate job in a continuous production facility for inorganic pigments.