KN 77-6

ISSUED - 10/24/77

COPY No. 2

NEWARK PLANT

PIGMENT COLORS RESEARCH AND DEVELOPMENT REPORT

TITLE EVALUATION OF ENCLOSED DISCHARGE FILTER PRESS TO REDUCE AREA FOGGING

FINAL REPORT

Work Done By John N. Birmingham

Report Written by John N. Birmingham John N Birmingham

Project Code 4656-700

Period Covered: January 1976 - February 1977, part time

KN-77-6

ABSTRACT

During periods of cold weather, warm press effluent in the batch processing area causes excessive steam generation. This results in a hazardous work environment and inefficient use of the area. A filter press was installed which by means of valves on the plates and a third eye in the plates and frames provided enclosed discharge of the effluent. It was planned that by use of enclosed effluent discharge, steam generation would be markedly reduced.

This type of filter press was not suitable for Newark plant operation. Difficulties included filter cloth alignment, effluent line pluggage and inadequately designed valves. Although solutions to most of the problems appear possible, the effort required would not be justified. Furthermore, sustained operation of the press would still be difficult for Manufacturing.

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Batch manufacturing at Newark includes dewatering and washing of pigment slurries using plate and frame filter presses. Many of these slurries are warm when filtered, in some cases having temperatures as high as 190°F. The filter presses have individual effluent lines from the plates, all of which discharge to the floor drains. During periods of cold weather, roughly October through March, the warm press effluent causes excessive steam generation in the work areas. This creates a hazardous condition due to limited visability and prevents optimum utilization of other equipment in the area.

Study of the problem has shown that most of the steam is caused by the hot effluent flowing over the cold floors in the work areas. Steam is formed due to the low temperature of the floor and the immediate air. The amount of steam is increased due to the wide floor area over which the effluent is allowed to flow.

OBJECTIVE:

Evaluate the operability of a filter press capable of both open and enclosed discharge of effluent. Using the enclosed discharge process, determine the impact of efficient effluent removal on steam generation.

SUMMARY AND CONCLUSIONS:

A filter press was installed which combined three-way valves on the plates with a third eye in the plates and frames. This enabled the press to be operated either as a standard open discharge press or as an enclosed effluent discharge press.

This type of filter press was not suitable for Newark plant operation. Major problems occurred in the following areas:

- Filter cloth alignment. Misalignment of the filter cloths frequently resulted in pigment being forced into the effluent eye of the press. This resulted in yield loss and pluggages.

- Effluent line pluggage. The small diameter effluent lines in the plates often plugged. This reduced the filling and washing efficiencies of the press and required periodic service outages for cleaning.

- Plate valve design. Both valve designs tested presented operating and maintenance difficulties.

Although solutions to most of these problems appear possible, the technical effort required would be excessive. Furthermore, sustained operation of the press would still be difficult for Manufacturing. Therefore, the press is to be reworked to operate as a standard open discharge filter press.

Due to the poor operability of the press, the effect of closed discharge effluent removal was not evaluated.

PROGRAM:

This report will serve to close out R & D work on a filter press capable of both open and enclosed discharge of effluent. It was agreed with Manufacturing that the press would be reworked to standard open discharge service. Recommendations and information have been supplied to Manufacturing on the work required for conversion (ltr. JNB - TRB, 2/17/77 - Appendix 7).

R & D will reactivate the trough project originally studied. Work on troughs was deferred during testing of the enclosed discharge press. The trough project is also based on achieving efficient removal of the warm effluent to reduce steam generation.

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During January 1976, press 25 was modified to be capable of both open and enclosed discharge of effluent. To do this, polypropylene plates and frames incorporating a third eye for

effluent removal were installed. A special four inch thick adapter slab was fabricated with a side discharge fitting. This enabled three-eye operation in a press originally constructed for two-eye service. The element arrangement is shown in Appendix 1. The plates were ported and equipped with three-way valves to provide both open and enclosed discharge. The porting and method of valve operation are shown in Appendices 2 and 3. All required polypropylene material was purchased from Lenser America, Inc., Whippany, N. J. as per Appendix 4.

Use of polypropylene plates and frames required alteration of the press closure device. The press is closed and sealed by means of a hydraulic ram. When used with the previous iron elements, the press was sealed by the hydraulic ram to 1200 psig hydraulic pressure. At that point, a lock nut on the ram was secured and the hydraulic system was turned off. During operation, the ram was locked in a stationary position and the hydraulic system was not energized. Due to the relatively high thermal expansion of polypropylene, this system was not usable. When filling with hot slurry, the press length would expand and increase the stress on the press skeleton. This could result in permanent damage to the skeleton. Upon switching to cold water washing, the press length would contract and lower the clamping pressure. This could result in leakage throughout the press.

The ram hydraulic system designed for the polypropylene filter press is illustrated in Appendix 5. The lock nut was removed to prevent securing the ram in a fixed position. Valves and a pressure switch were installed in the hydraulic lines. During operation, the control switch is left on and the pressure switch controls the pump. The low (1050 psig) limit on the switch restarts the pump, thereby preventing underpressurizing the press. When hydraulic pressure reaches 1200 psig, the switch shuts off the pump. If pressure continues to increase due to thermal expansion, the relief valve limits the maximum pressure at 1300 psig. This prevents dangers due to over-pressurizing the press. The system worked well during the year of operation and is being used on all other polypropylene press conversions.

During operation, three main areas of difficulty were encountered: filter cloth alignment, port pluggage and valve design.

Filter cloths were misaligned primarily because of inaccurately cut filter cloths and poor accessibility of the effluent eye. Filter cloths are cut from bulk material on the plant. Due to the limited facilities available for this work, location of cut eyes on the cloths is erratic. This type of error is marginally acceptable with the two eye presses now used. However, with a third eye in the lower corner of the press, alignment of the upper two eyes often results in the third eye being off center. The problem is compounded by the location of the third eye. These eyes are on a level with the platform upon which the operators are standing. Therefore, in aligning the upper two eyes, the misalignment of the lower eye can pass unnoticed.

The result of filter cloth misalignment is illustrated in Appendix 6. The error in the cloth eye position was always above and normally toward the center of the desired spot. This reduced the gasket area of the cloth which separates the frame chamber from the effluent eye. As the slurry pressure increased during the fill cycle, pigment could be forced past the reduced gasket area into the effluent line. This resulted in product loss and pluggage of effluent lines. Pigment could also be forced through to the plate filter area, resulting in bleeds throughout the press. An attempt was made to correct this problem by gluing the filter cloths to the press. A mastic produced by 3M was used to secure the two layers of filter cloth together and to the polypropylene plate. The mastic performed well and prevented misalignment. However, several difficulties exist. The gluing operation is time and labor intensive. Based on the time required by R & D during the test, 24 hours by two men would be required to secure an entire press. This would be required approximately once every two months. During regular operation, individual defective cloths are replaced during the unloading of the press between batches. This would be difficult using the gluing procedure. Further, the problem of miscut filter cloths would still exist.

A possible solution which was not evaluated is the use of precut cloths supplied by an outside vendor. Use of ties on the outside edges would prevent cloth misalignment. This was not pursued due to Manufacturing concern over increasing tramp material into the product.

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Due to the causes discussed, all valves on the press gradually plugged, in some cases completely stopping flow through a particular plate. This lengthened the fill time and reduced press washing efficiency by limiting the maximum flow through the press. To correct the pluggage, the press had to be taken out of service periodically, its valves removed and the lines cleared with a high pressure water jet.

A possible solution to this problem would be to enlarge the diameter of the ports and to machine a cavity where the 105 degree turn occurs. The cavity would modify the effect of the sharp turn between the two port lines. However, this solution would require extensive reworking of the plates. Also, enlarged line diameter would weaken the plate.

The final area of difficulty was the three-way valve used on the plates. The original valve tested was black phenolic model supplied by Lenser America with the plates. The valves were labelled: Continental Model 1094. These valves broke easily, had small ports which plugged and were difficult to operate. These

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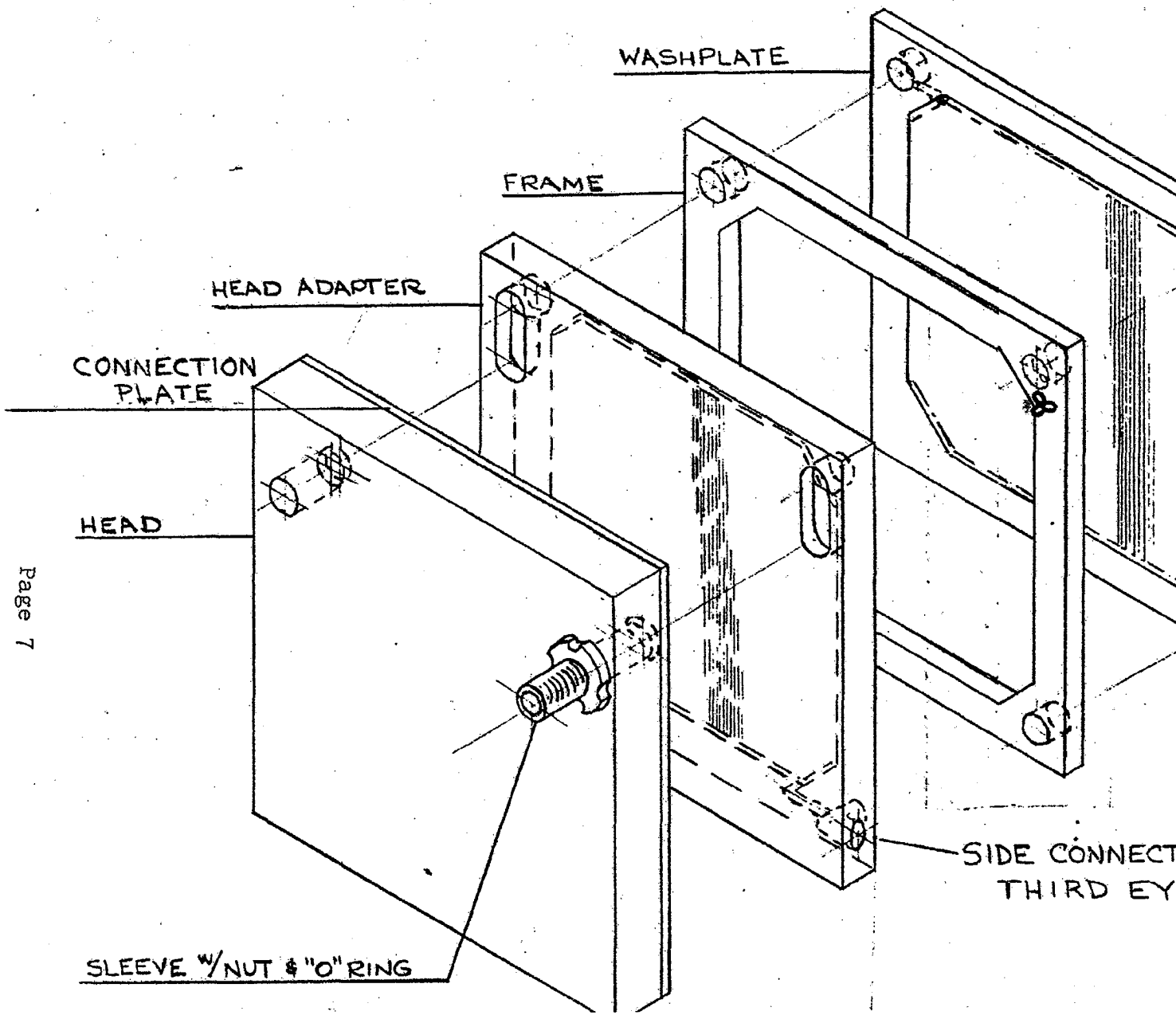
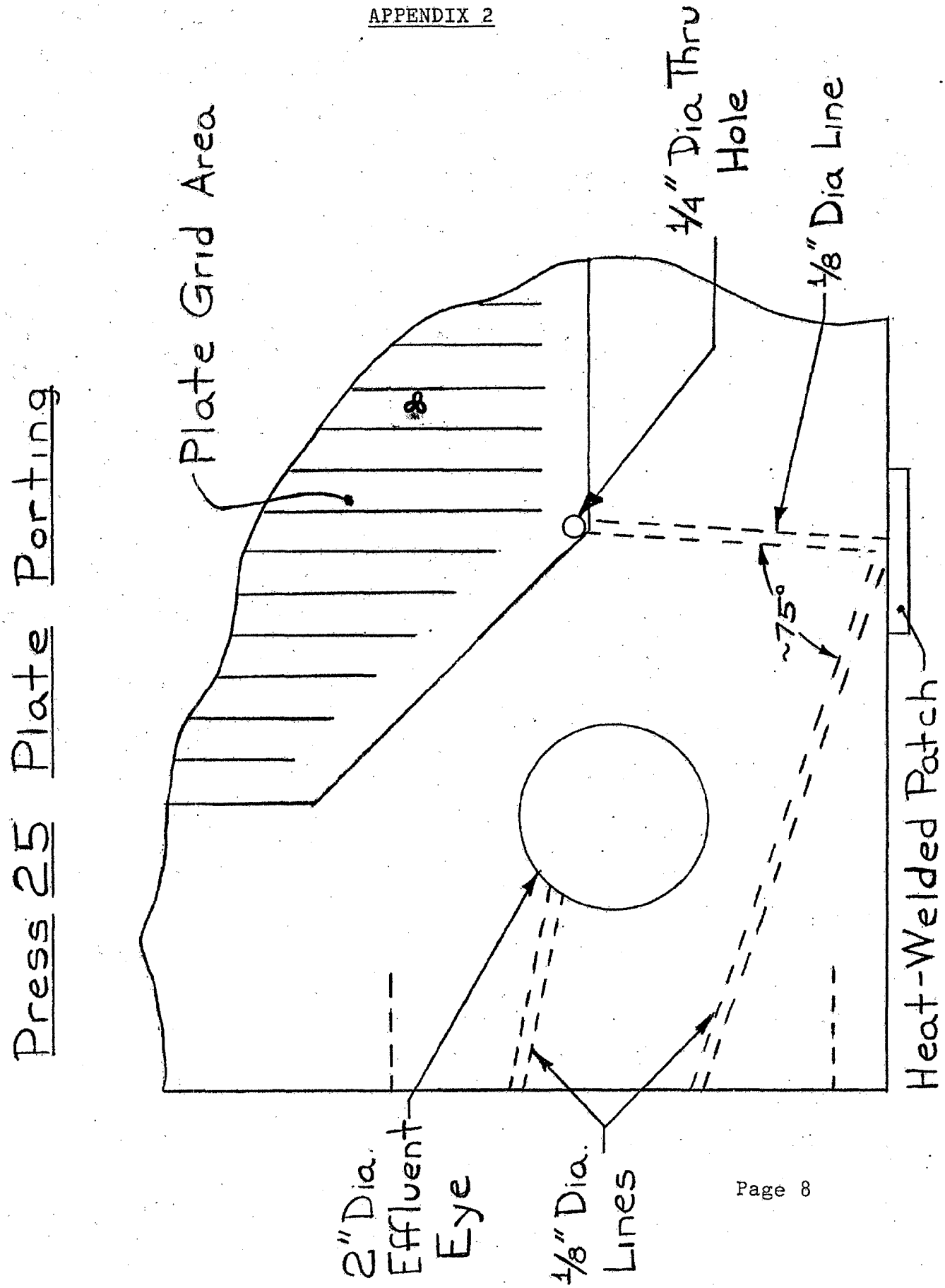
The problems with port pluggage and valve design were intensified by misalignment of the filter cloths. However, it is unlikely that providing proper cloth alignment would eliminate the other two problems. Small amounts of pigment would still enter the ports due to occasional defective cloths and the high-pressure hosing procedure between batches. Therefore, solutions would have to be found for all three areas to improve the reliability of the press.

JNB:mnm

atc.

Filter Press Element Arrangement





APPENDIX 3

Three Way Valve Operation

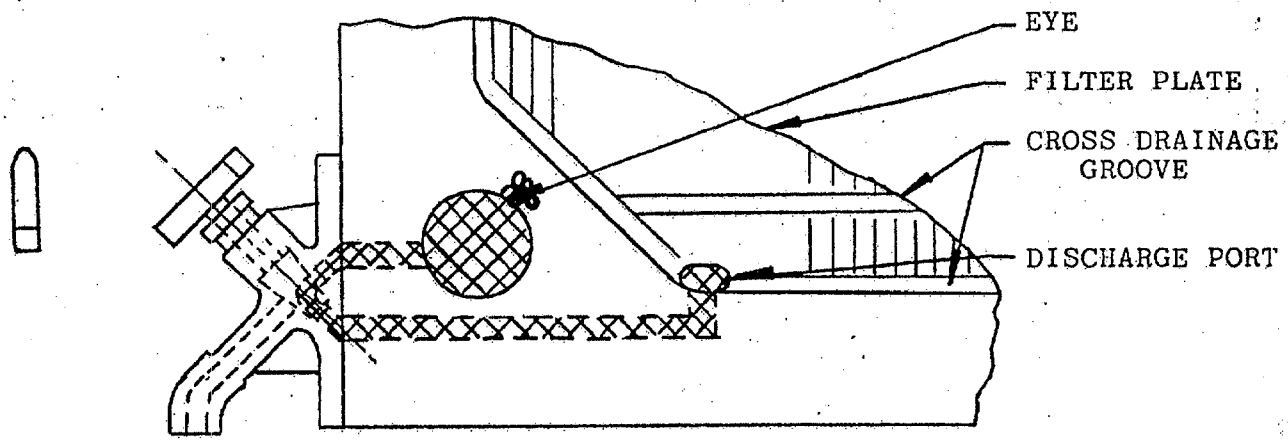


FIGURE 1. CLOSED DELIVERY

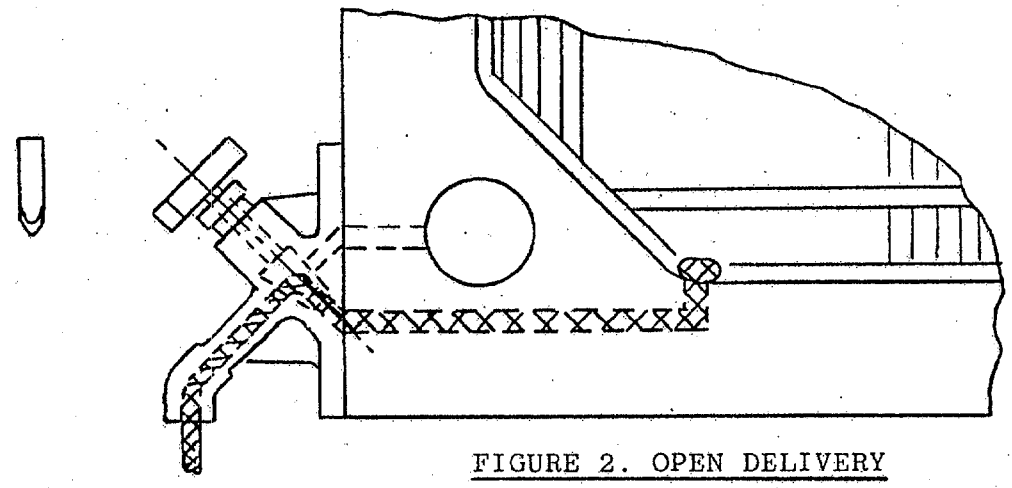


FIGURE 2. OPEN DELIVERY

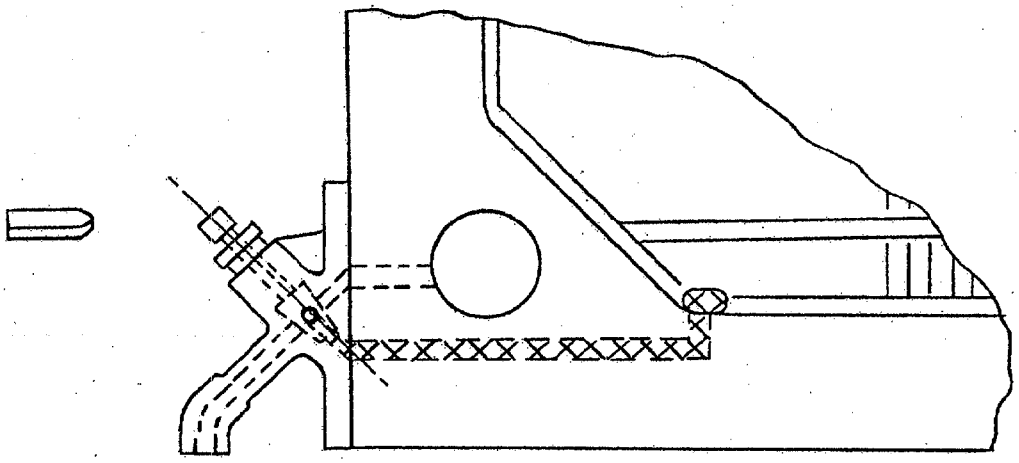


FIGURE 3. PLATE SHUT-OFF

APPENDIX 4

Polypropylene Elements supplied for Press 25:

1 - 42" sq. connection plate, 1-3/16" thick, drilled and counterbored to match existing eyes in head casting.

2 - 2" LPS x 12" lg. liner pipes complete with locknuts.

1 - 42" sq. special adapter, 4" thick for conversion of two eyed to three eyed design

1 - 42" sq. head liner plate, 1-3/16" thick

1 - 42" sq. follower liner plate, 1-3/16" thick

26 - 42" sq. #1 button plates, 1-3/16" thick

27 - 42" aq. #3 button plates, 1-3/16" thick

54 - 42" sq. frames, 2" thick

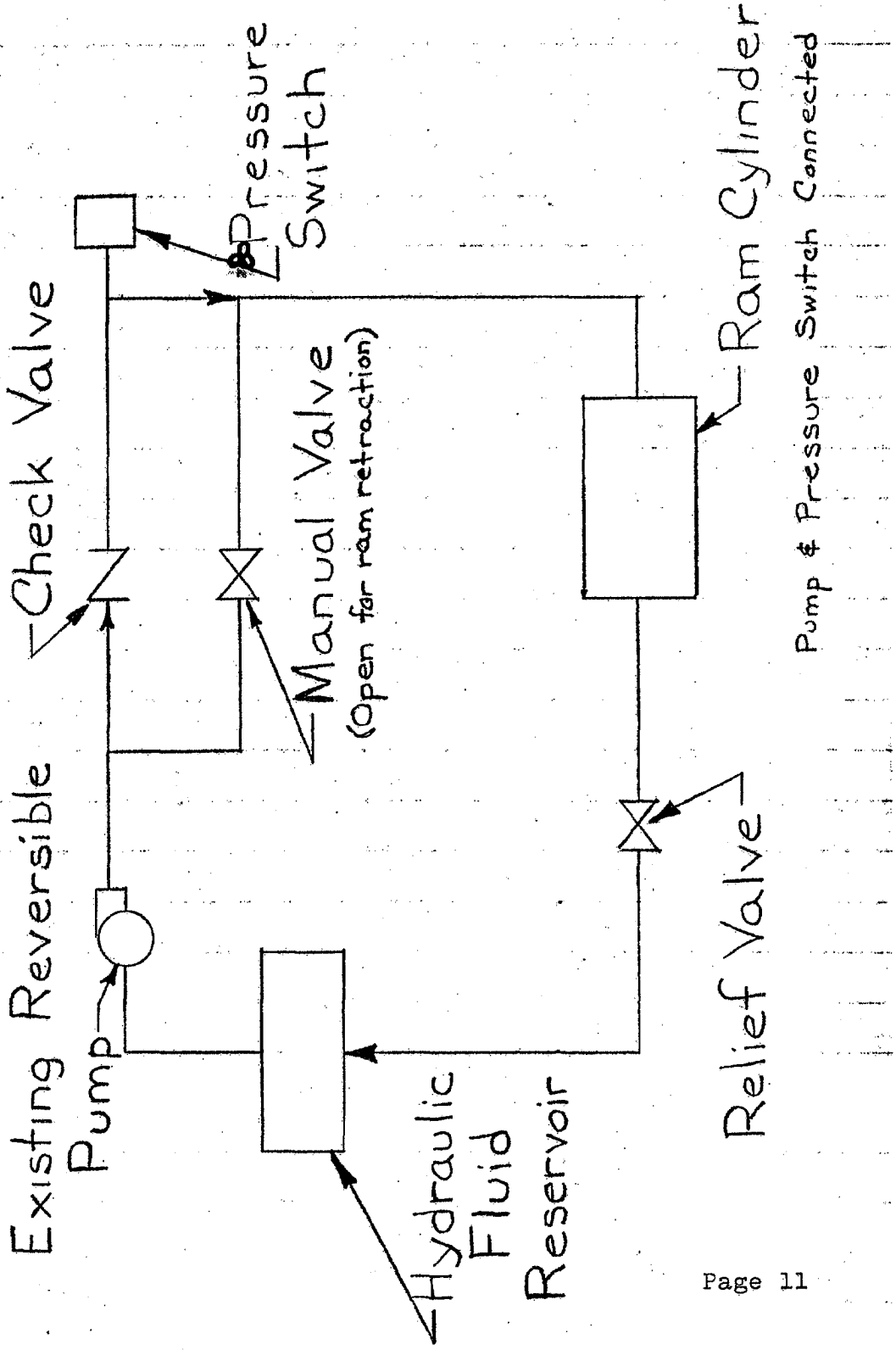
55- phenolic three way valves mounted to plates furnished with stainless steel lag screws and gaskets.

All parts except the valres were RAL 7032 gray polypropylene.

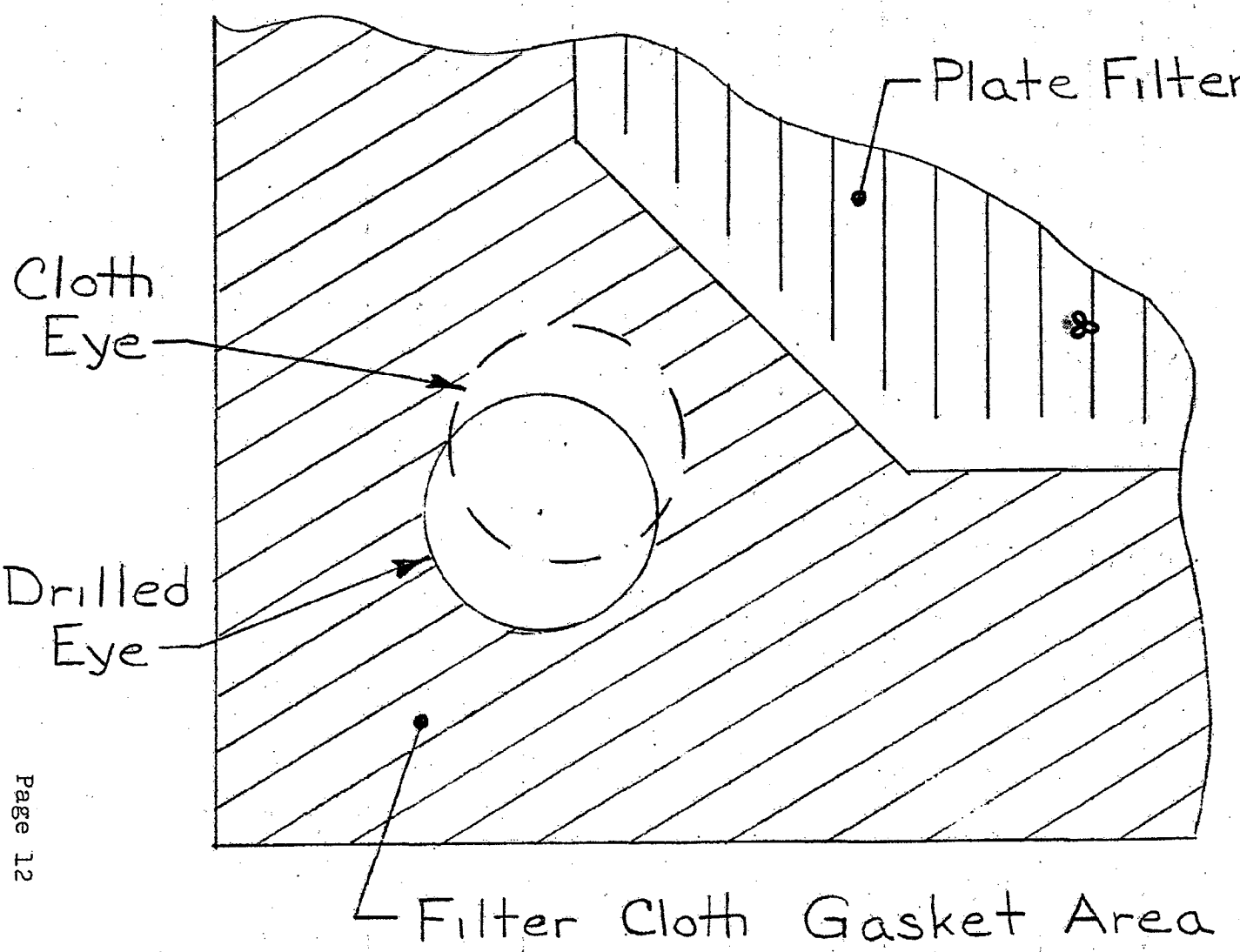
Parts supplied per quotation, Lenser America August 4, 1975.

APPENDIX 5

Ram Hydraulic System For Polypropylene Filter Press



Filter Cloth Misalignment
Effluent Eye



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Pressing

NEWARK, NEW JERSEY
FEBRUARY 17, 1977

T. R. BECKER
Pigments - NEWARK

PRESS 25
CONVERSION TO OPEN DISCHARGE

At our January 24, 1977 meeting, it was agreed that Press 25 would be converted to standard open discharge service. Discussions were held with A.Whitlock, the Lenser America representative, to determine the steps required. The attached Quotation B, February 9, 1977 covers their work for the conversion. The procedure calls for reversing the plate, plugging the current three-way valve and redrilling the plate as required. The new head and tail plates listed in the quotation are not required since after further discussion it was agreed that the existing head and tail plates could be reworked. Therefore the cost for the reworking and the required new parts would be approximately $1450.

Also listed in the quotation is the cost for replacing the current welded-on handles with bolt-on handles. Although this would convert the press to what is now the standard handle design and make future handle repairs easier, the cost would be $2086. Since the existing handles are satisfactory, I would recommend having our Mechanical Department gradually replace the handles as they break rather than including this in the conversion work. The method of doing this will be covered in a later letter on the existing open discharge polypropylene presses.

Possible use of the four inch thick adapter head was also discussed with the Lenser representative. This piece is of no foreseeable use at the Newark plant but could possibly be returned to Lenser America for some amount of credit. This option would have to be pursued by H. Ricardo with Lenser America.

The following steps would need to be done for the conversion:

- Order new connection plate and liner pipes. These should be on hand before converting the press so that the necessary repiping can be done while the polypropylene is being reworked.

- Remove all existing polypropylene from the press.
- Clean the polypropylene elements well prior to shipping to Lenser America.
- Ship the polypropylene to Lenser in Whippany, N. J.
- While the polypropylene is off the plant for reworking, remove excess piping from the press. A diagram of the recommended piping is attached. This should include a pressure gauge on the feed line to prevent problems from overpressurizing the press.

To do the work listed, the press will need to be out of service for a period of two to three weeks. Any costs due to this conversion should be charged to X0902, the S.O. authorized for testing closed discharge filtration. I would recommend that X0902 then be closed out and a new S.O. authorized for future open discharge press replacements.

A final Research KN report is being written for Closed Discharge Filter Press Testing. This will serve to summarize and close out this work as an R&D project. A copy of the report will be circulated to those receiving a copy of this letter.

John N Birmingham

JOHN N. BIRMINGHAM
R & D DIVISION

JNB:mmm

atc.

E. I. DuPont de Nemours & Co.
Newark, NJ

Attention: Mr. H. Ricardo

QUOTATION B: TO COVER CONVERSION OF EXISTING 42" SQUARE PRESSLOAD OF POLYPROPYLENE PLATES AND FRAMES FROM THREE WAY VALVE OPEN AND CLOSED DELIVERY SYSTEM TO OPEN DELIVERY BY USING LEVER HANDLE SPIGOT.

1 - NEW head plate, 1-3/16" thick, #1 button, complete with lever handle spigot	$ 112.50
1 - NEW tail plate, 1-3/16" thick, #1 button, complete with lover handle spigot	112.50
26 - #1 button pressure plates - reworked.	
Operations required - reverse plate:	
A. Spin weld plug in existing port in existing three-way valve port.	
B. Drill new discharge port in bottom blank pad.	
C. Drill pilot holes for spigot and assemble spigot.	
Labor ..... $12.00 each	312.00
New lever handle spigot, $5.50 each	143.00
27 - #3 button wash plates - reworked.	
Operations required - reverse plate:	
A. Spin weld plug in existing port in existing three-way valve port.	
B. Drill new discharge port in bottom blank pad.	
C. Drill pilot holes for spigot and assemble spigot.	
D. Spin weld plug in existing wash port and drill new wash port in opposite.	
Labor ..... $21.00 each	567.00
New lever handle spigot, $5.50 each	148.50
54 - frames - no labor required	---
Replace existing 4" thick adapter currently being used for three way system.	
1 - new 42" square connection plate, 1" thick, drilled and counterbored for two 2" dia. pull thru liner pipes.	146.00
2 - new 2" x 12" long liner pipes complete with O-rings and locknuts, $45 each	90.00
Total Sales Price	$1631.50

Additional if installation of bolt-on handles is desired on all of the above:

26 - #1 button plates	
27 - #3 button plates	
54 - #2 button frames	
107 pieces - labor $12.00 each	$1284.00

E. I. DuPont de Nemours & Co.
Newark, NJ

Attention: Mr. H. Ricardo

214 molded polypropylene universal handles (2-bolt design as furnished on 36" pressload) complete with stainless steel lag screws and washers, $3.75 each ----------	802.50
Total Sales Price ----------	$2086.50

Terms: net 30 days
f.o.b Whippany, NJ

Delivery: one week after receipt of goods from you.

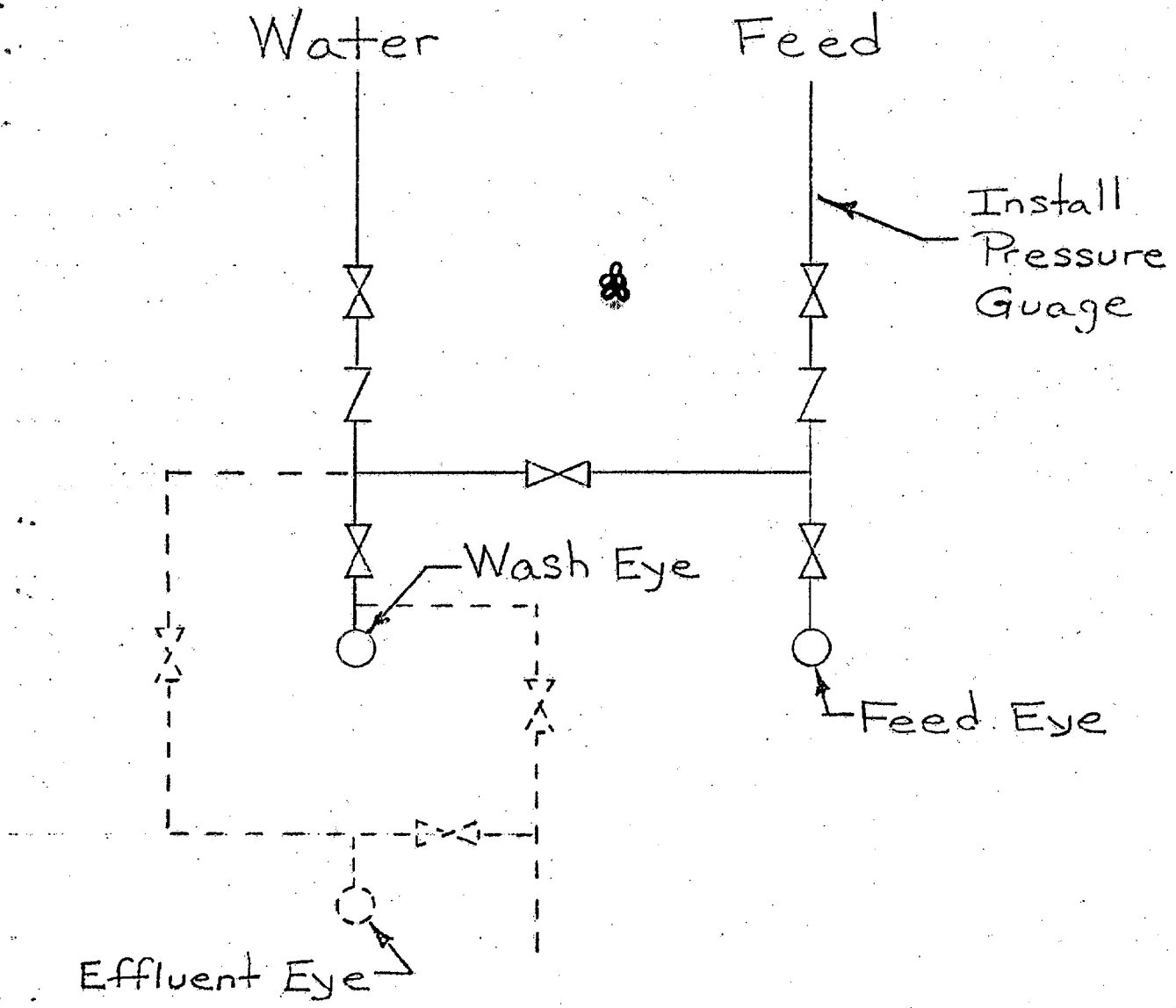
Very truly yours,

LENSER AMERICA INC.

Allan L. Whitlock

ALW:rsb

Press 25 - Fixed Head Piping



Solid : Existing Piping, to be retained.

Dotted : Existing Piping, to be removed.

SNB 2/16/77

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Pigments Department

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ISSUED - 10/24/77

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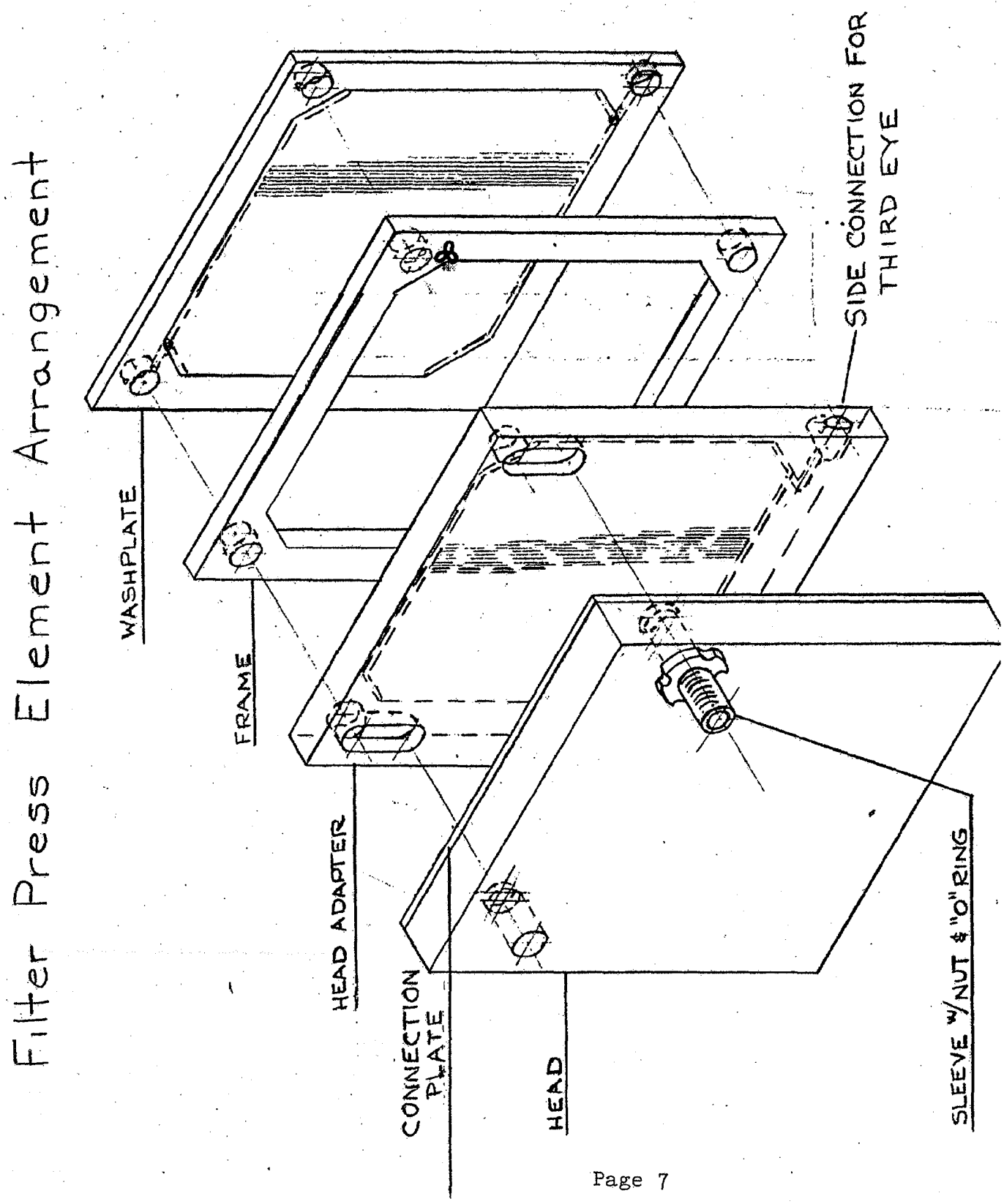
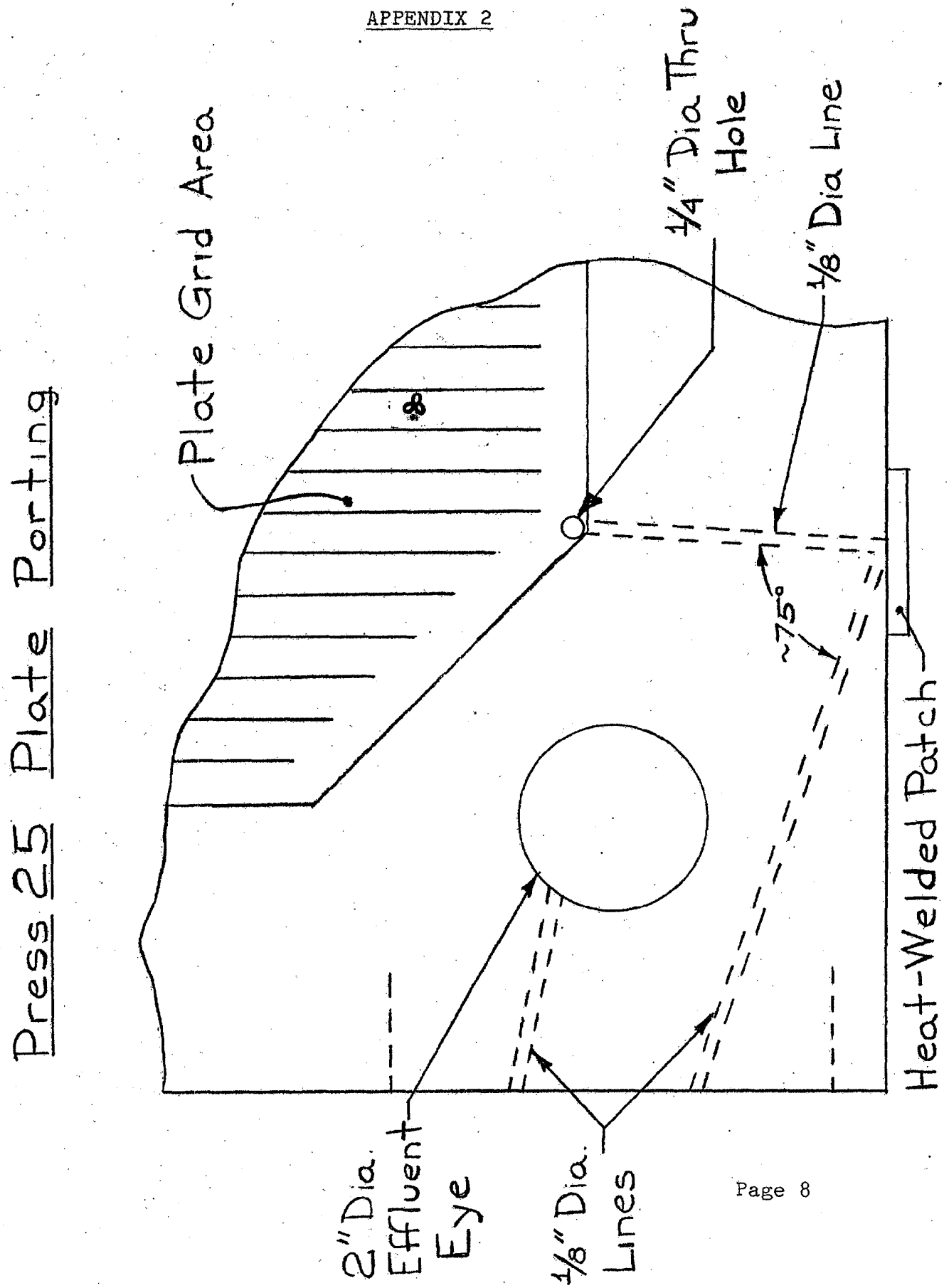
atc.

APPENDIX 1





APPENDIX 3

Three Way Valve Operation

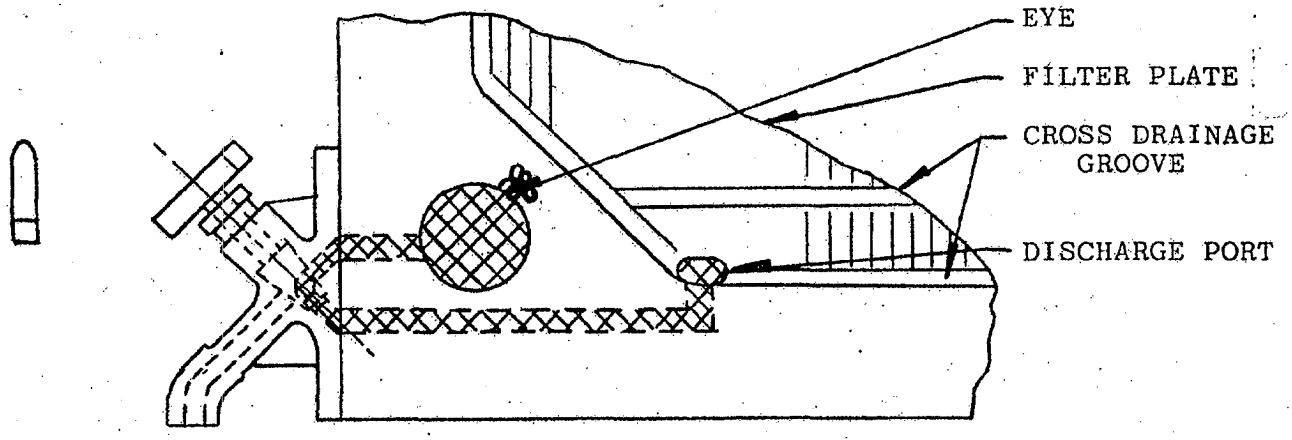


FIGURE 1. CLOSED DELIVERY

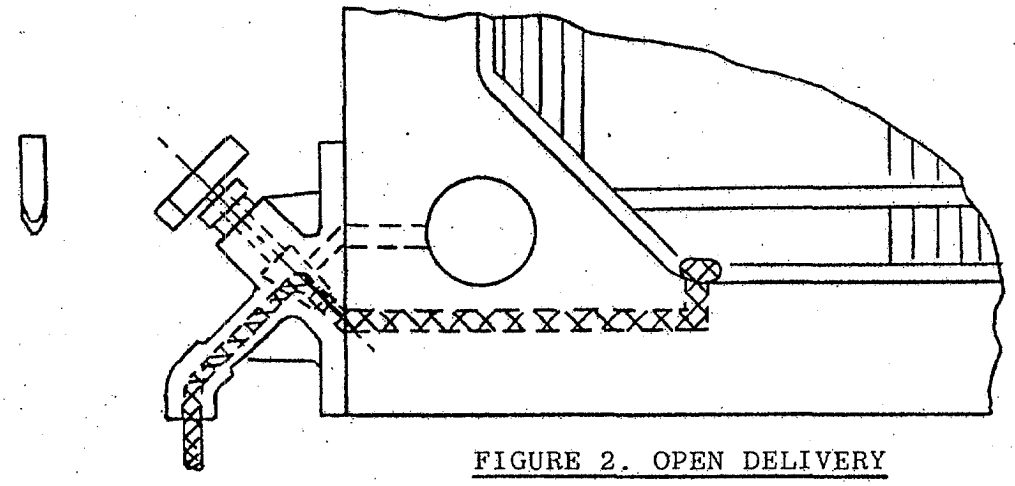


FIGURE 2. OPEN DELIVERY

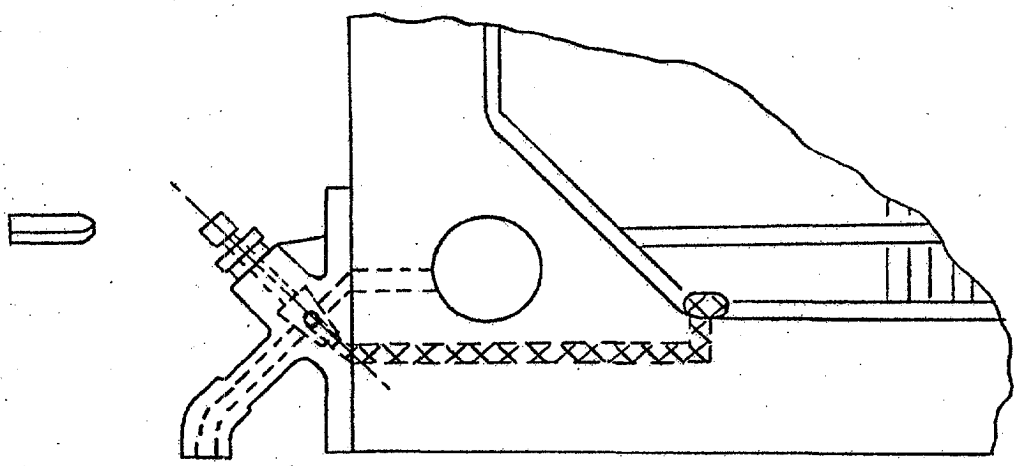


FIGURE 3. PLATE SHUT-OFF

APPENDIX 4

Polypropylene Elements supplied for Press 25:

1 - 42" sq. connection plate, 1-3/16" thick, drilled and counterbored to match existing eyes in head casting.

2 - 2" LPS x 12" lg. liner pipes complete with locknuts.

1 - 42" sq. special adapter, 4" thick for conversion of two eyed to three eyed design

1 - 42" sq. head liner plate, 1-3/16" thick

1 - 42" sq. follower liner plate, 1-3/16" thick

26 - 42" sq. #1 button plates, 1-3/16" thick

27 - 42" aq. #3 button plates, 1-3/16" thick

54 - 42" sq. frames, 2" thick

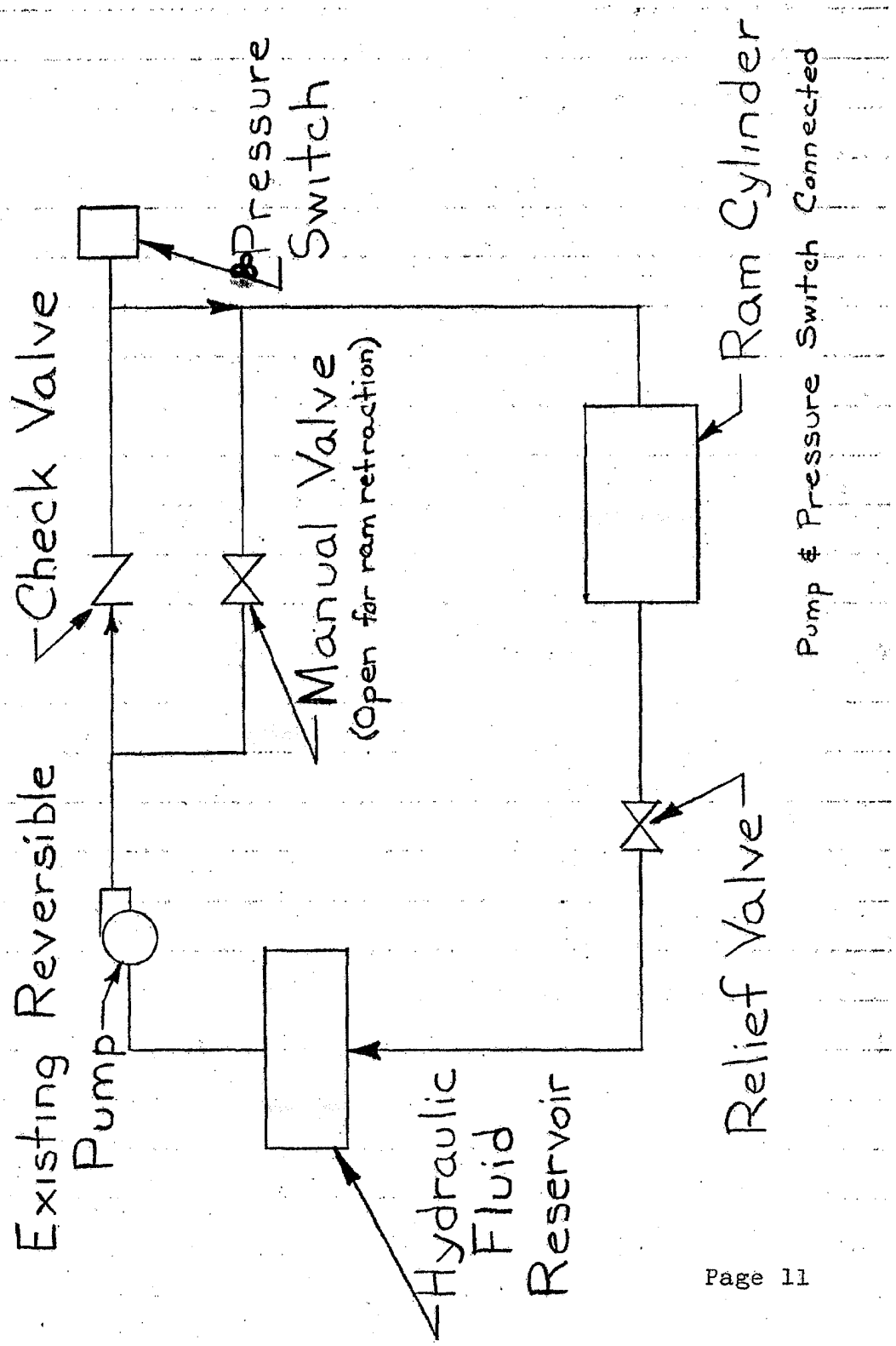
55- phenolic three way valves mounted to plates furnished with stainless steel lag screws and gaskets.

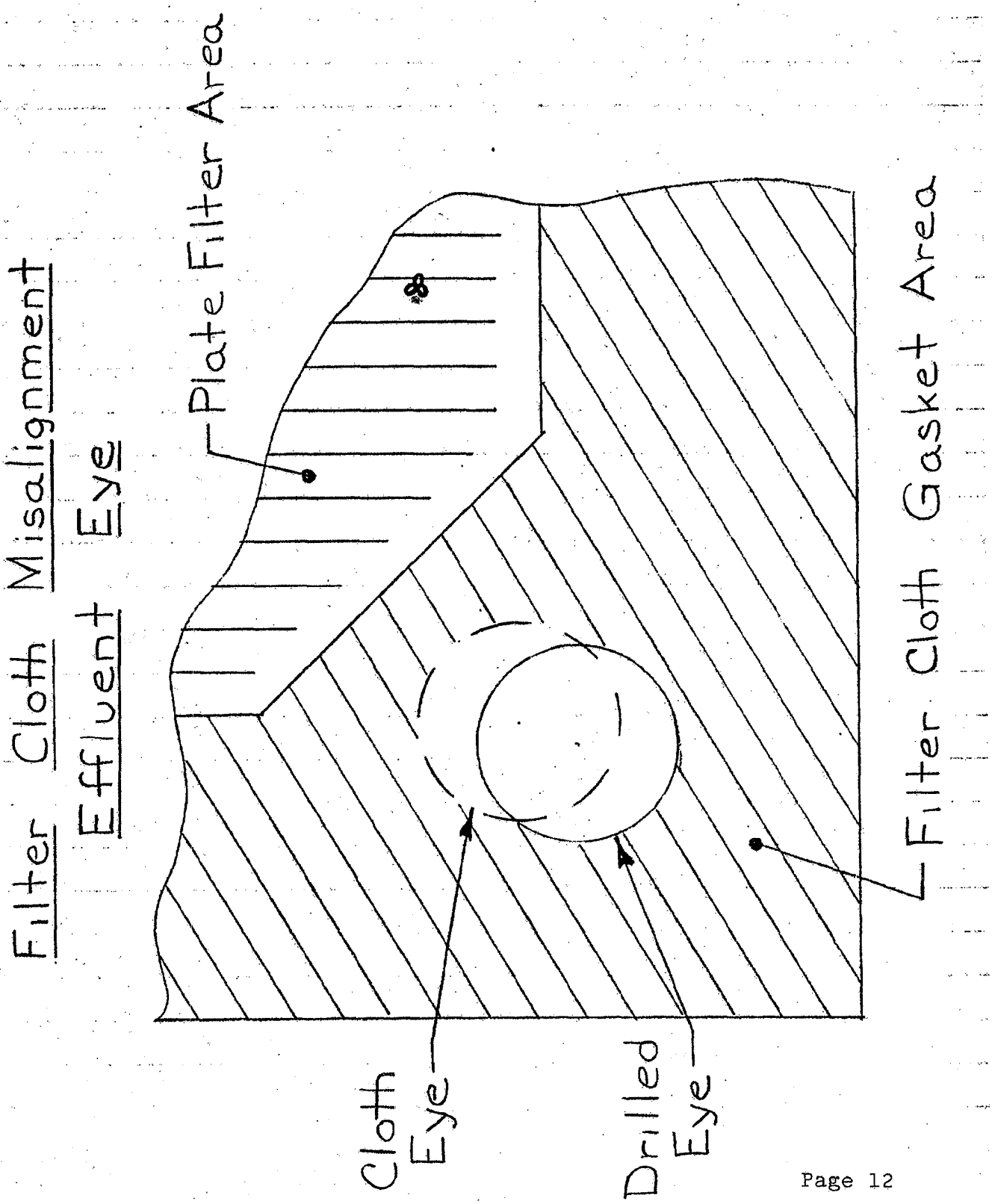
All parts except the valres were RAL 7032 gray polypropylene.

Parts supplied per quotation, Lenser America August 4, 1975.

APPENDIX 5

Ram Hydraulic System For Polypropylene Filter Press





E. I. DU PONT DE NEMOURS AND CO.
Pigments Department

cc: I.H.Dunn
D.C.Gero
J.R.Goughnour
W.T.Harrington
J.A.Johnson
R.F.Mitchell
H.G.Ricardo
F.Scalice
A.P.Smith
W.S.Struve
R & D File Plt Ass't
Pressing

NEWARK, NEW JERSEY
FEBRUARY 17, 1977

T. R. BECKER
Pigments - NEWARK

PRESS 25
CONVERSION TO OPEN DISCHARGE

At our January 24, 1977 meeting, it was agreed that Press 25 would be converted to standard open discharge service. Discussions were held with A.Whitlock, the Lenser America representative, to determine the steps required. The attached Quotation B, February 9, 1977 covers their work for the conversion. The procedure calls for reversing the plate, plugging the current three-way valve and redrilling the plate as required. The new head and tail plates listed in the quotation are not required since after further discussion it was agreed that the existing head and tail plates could be reworked. Therefore the cost for the reworking and the required new parts would be approximately $1450.

Also listed in the quotation is the cost for replacing the current welded-on handles with bolt-on handles. Although this would convert the press to what is now the standard handle design and make future handle repairs easier, the cost would be $2086. Since the existing handles are satisfactory, I would recommend having our Mechanical Department gradually replace the handles as they break rather than including this in the conversion work. The method of doing this will be covered in a later letter on the existing open discharge polypropylene presses.

Possible use of the four inch thick adapter head was also discussed with the Lenser representative. This piece is of no foreseeable use at the Newark plant but could possibly be returned to Lenser America for some amount of credit. This option would have to be pursued by H. Ricardo with Lenser America.

The following steps would need to be done for the conversion:

- Order new connection plate and liner pipes. These should be on hand before converting the press so that the necessary repiping can be done while the polypropylene is being reworked.

- Remove all existing polypropylene from the press.
- Clean the polypropylene elements well prior to shipping to Lenser America.
- Ship the polypropylene to Lenser in Whippany, N. J.
- While the polypropylene is off the plant for reworking, remove excess piping from the press. A diagram of the recommended piping is attached. This should include a pressure gauge on the feed line to prevent problems from overpressurizing the press.

To do the work listed, the press will need to be out of service for a period of two to three weeks. Any costs due to this conversion should be charged to X0902, the S.O. authorized for testing closed discharge filtration. I would recommend that X0902 then be closed out and a new S.O. authorized for future open discharge press replacements.

A final Research KN report is being written for Closed Discharge Filter Press Testing. This will serve to summarize and close out this work as an R&D project. A copy of the report will be circulated to those receiving a copy of this letter.

John N Birmingham

JOHN N. BIRMINGHAM
R & D DIVISION

JNB:mnm

atc.