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NEW "47-PROCESS" DESIGNS AND ARRANGEMENTS

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ABSTRACT

Up-to-date "47-Process" design and arrangements are discussed. Design modifications are recommended for the Moberly Plant which are expected to achieve greater flexibility. A number of separate evaluations carried out by F. & F. plants define several ways for improving "47-Process" operations.

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I - SUMMARY

A. Purpose of This Report

To provide an up-to-date summary of work by many locations on improving "47-P" arrangements so that individual areas can adopt those features which may suit their needs.

B. Origin of the Study

Although the sand grinder has become the workhorse of the paint industry, we can still improve its design and set up better manufacturing systems for using it. For instance, a survey of F. & F. experience indicates that maintenance cost for each "47-P" unit runs about $1,500 per year. Largest items in this expense are pumps, feed lines and screens. The survey also shows that F. & F.'s utilization of the "47-P" investment is relatively low. Clean-up difficulties force plants to segregate units according to color and, to some extent, product quality.

New innovations such as closed head sandmills and alternate types of grinding media offer processing advantages but bring with them an assortment of teething pains. Design faults have to be corrected and satisfactory operating procedures established to obtain maximum benefits. In addition, the decision to build the new Moberly Plant and the progressively more complicated product mix that F. & F. must make urgently required that we update "47-P" design and arrangement.

During 1967 and early 1968, several F. & F. plants carried out separate evaluations of "47-P" design modifications. This coordinated effort was aimed at establishing a design and operating system which will achieve: 1) less mechanical wear problems, 2) faster and more thorough clean-up between batches, 3) better process control during grinding and 4) greater flexibility and utilization of the equipment.

C. Objectives

1. Correct design faults found in the Conversion Units sold by the Crossley Equipment Company so that open sandmills can be converted to closed head units without creating new operational problems.

2. Evolve feed control designs for "47-Process" which provide the operator with more positive control of the equipment and fewer recurring mechanical problems.

3. Increase manufacturing capability of sand grinders by establishing an equipment arrangement which permits "bare metal" cleaning of all components in the system.

4. Evaluate new operating concepts so that an up-to-date sandmill design can be specified for the new Moberly Plant.

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D. Results and Conclusions

1. A new design for the Crossley Conversion Units has been evolved.

2. Satisfactory operating procedures for closed head sandmills have been defined.

3. Less screen blinding and resulting high pressure in closed head sandmills has been obtained by using grinding media free of "fines."

4. A standard disc spacing in the screen area of closed head sandmills has been set up to reduce screen blinding.

5. Feasibility of two new, positive control feed arrangements for sandmills is being demonstrated by plant evaluations.

6. More rapid and thorough clean-up of premixers, piping, pumps, vessels, etc. has been demonstrated by a new equipment arrangement using an in-line centrifugal pump for high velocity solvent washing.

7. Greater utilization of "47-Process" investment is possible as a result of better cleaning capability which reduces the need for equipment segregation.

8. Effective "47-Process" installations require that the standard design be carefully modified and adopted to overall manufacturing needs of an individual plant.

9. The bottom stabilizer on sandmill agitators can be replaced by two discs as a result of the better quality disc castings available today.

10. Preliminary results from the Toledo Plant's evaluation of a pump design modification indicates that clean-up is easier and pump life will be prolonged.

E. Action Taken

1. A standard design for Closed Head Conversion Units is established and will be used on the units planned for the Moberly Plant.

2. The Chicago Boiler Company has agreed to install Conversion Units supplied by Du Pont on new sandmills fabricated for us.

3. All F. & F. plants are using either Ceramedia (glass beads) or specially processed sand in closed head sandmills.

4. "47-Process" feed control systems designed to suit local needs are being evaluated by several F. & F. plants.

5. The "47-Process" units for the Moberly Plant will use two discs in place of the bottom stabilizer and a horizontal, tangential feed.

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6. The feed control system in the Moberly Plant's "47-Process" arrangement will be set up with a high/low pressure switch controlling a ball valve at the inlet of the vessel.

7. The Toledo Plant plans to duplicate a "47-Process" installation which utilizes a centrifugal pump to obtain "bare metal" cleaning and a Viking feed pump modified for easier cleaning and longer pump life in facilities for making "Du-Lite" enamels.

F. Continuing Work

1. Fort Madison is evaluating performance of larger size Ceramedia in closed head sandmills.

2. Chicago Plant is evaluating performance of sand especially strained by the Toledo Plant in closed head sandmills.

3. The Parlin Plant is evaluating the effect of varying disc spacing in the screen area on performance when using Ceramedia and also when using coarser sand.

4. The Toledo Plant is evaluating feed control using high/low pressure switch to activate opening and closing of the ball valve.

5. The Fort Madison and Parlin Plants are evaluating feed controls utilizing a flow switch to control action of the ball valve at the bottom of the vessel.

6. The Toledo Plant is evaluating a special feed pump design consisting of a Viking pump with oversize clearances and two small ports in the casing to solvent-flush the area behind the rotor.

7. Individual plants are evaluating various instrument arrangements designed to provide the operator with greater communication with "47-P" equipment.

G. Recommendation

It is recommended that each plant review their sand grinder installations to determine if equipment changes can be made which will: 1) lower maintenance costs, 2) provide less expensive and more effective between-batch cleaning, 3) increase flexibility and 4) foster greater utilization of the equipment investment. Also, individual plants should review operating procedures with closed head units and adjust if necessary. Process Engineering will assist where required.

H. Patent Situation

No action has been initiated.

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I. Acknowledgment

Progress reflected in this report resulted from the earnest cooperation of many people within and outside F. & F. Special note is made on the contributions of G. G. Miller at the Toledo Plant for his guidance and early action, to F. P. Hartz at the Chicago Plant for setting up initial evaluations, and to C. R. Walton at the Chicago Plant for his diligent follow-up.

PREPARED BY: W. B. CALLAHAN

APPROVED BY: W. H. EDWARDS

WBC:IL

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II - DISCUSSION

A. Closed Head Conversion Units

Background: Mr. Dexter Tight first introduced Closed Head Sandmilling (see reference #1) several years ago on the west coast by adding new top sections containing an enclosed screen and a shaft seal to standard Sand Grinders. This patented innovation was taken over by the Morehouse-Cowles Company of Los Angeles who now manufacture and sell the M-C sandmill (see Appendix A) which was evolved with a small batch paint manufacturer in mind as the principal customer.

Conversion Units for converting regular open sandmills to closed head operation is another Tight innovation. These kits are fabricated and sold by the Crossley Equipment Company of East Liverpool, Ohio under license from Morehouse-Cowles Company. The Toledo Plant Report (reference #2) graphically describes steps involved when installing Conversion Units, which can be either welded or bolted onto existing "47-P" vessels.

Most F. & F. plants have converted at least one "47-P" unit to closed head operation with varying success. Their individual experiences defined a number of problems which varied from the usual teething pains with new equipment to major design faults. In addition to requiring altered procedures to avoid operational difficulties, the inconsistent quality of Conversion Kits added to the conversion and alignment problems.

The Conversion Kit design has now evolved to a stage where the major faults are eliminated. Some operating problems can be anticipated. Since the new Moberly Plant will use closed head sandmills and since most other plants are converting existing "47-P" equipment, the contributions of the individual plants to this total evaluation takes on added importance. The present Conversion Unit design reflects the viewpoints of many operating areas and incorporates features which have been evaluated by our plants.

Updated Design of Conversion Units:

1. A sealed design consisting of three rings of graphite impregnated braided asbestos packing.

2. Alemite grease fittings on the packing glands so that the operator can grease the gland at regular intervals.

3. Two 1-1/2" access holes in the top at 45° off the center line and near the outside edge on all unit sizes except the 3-gallon size which will have 1" access holes. These drilled and tapped openings are for adding grinding media, attaching pressure gauges, etc.

4. The screen cover set up with two 1-1/2" discharge openings with half couplings on all unit sizes except the 3-gallon size which will use 1" openings. A 1-1/2" discharge line is provided on the upper opening and a plug is used on the lower. (The Fort Madison Plant interconnects these two openings with suitable valves and piping to facilitate cleaning procedures.)

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5. A wraparound screen design consisting of a formed sheetmetal frame sandwiched between cork gasket and held in position by pressure from the flexible cover. Additional struts are added to the screen to provide greater strength and reduce screen bulging (see Appendix B). The unit is designed to provide interchangeability with existing equipment. Mesh material is the regular electrolytic screen.

6. The electrolytic screen is soldered to the frame with "Eutec Rod 157" which has a low melting temperature making screen repair easier with less distortion problems.

7. Critical welded joints on the conversion unit are revised to reduce stresses and eliminate some leakage problems. A 70 psi hydrostatic test on the water jacket is now used on all units.

8. Tighter design tolerances and higher fabrication standards are now set up to avoid some of the sloppy workmanship encountered earlier and to provide interchangeability of parts when making repairs.

9. Disc spacing in the screen area of Closed Head Conversion Units is set up so that the smaller screen area is swept free of lodged media during operation (see Appendix C).

Purchase of Crossley Conversion Units: The Crossley Equipment Company is prevented by their agreement with the Morehouse-Cowles Company from selling Conversion Units directly to sand grinder fabricators such as the Chicago Boiler Company. However, they can sell units to Du Pont for delivery to Chicago Boiler who have agreed to install Conversion Units on new mills they make for Du Pont. Any contact on such an arrangement should be made directly with Howard Crossley of the Crossley Equipment Company or with Frank Pirok of the Chicago Boiler Company.

Grinding Media: Successful operation of closed head sandmills requires grinding media free of "fines." Since the screen area in these units is about one-third the screen area of regular open units, a small amount of "fines" can lodge in the screen and block flow. This choked flow will result in buildup of high pressures requiring repeated shutdown to clean the screen. Many plants find that when they replace regular "47-P" sand with Ceramedia, performance greatly improves. Type "LL" 20-30 mesh Ceramedia is recommended. (See Appendices E and D.) The Toledo Plant also obtains satisfactory results in closed head units using regular sand especially sieved to remove "fines." Some feedback indicates that screen blinding is also influenced by start-up procedures. Sand can become lodged in the screen area when initial feed rates are too high.

The subject of the preferred grinding media to use with closed head sandmills is still under investigation. Larger particled size medias may offer advantages with certain formulations. Also, the varying density of grinding medias now available may offer new formulating dimensions.

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Operating Procedures: The operating procedures with closed head sandmills are generally defined. They are important. One of our sand grinder licensees had a fire in one of his closed head sandmills. Apparently his procedures resulted in heat buildup at the top area and leaking material at the seal ignited. Luckily the fire was brought under control with no serious damage, but their experience does indicate the need for establishing and adhering to adequate procedures as outlined below.

1. Start units at a low feed rate. When the first premix is pumped into the unit too rapidly, it can force dry media to the top and result in overheating.

2. The normal operating range of the closed head units is below 4-5 psig. Higher pressures usually indicate screen blockage and if the pressure reaches 9 psig, the unit should be shut down to clear the screen blockage.

3. A positive shutoff should be provided between the feed pump and the vessel and should be used when shutting down the pump to eliminate the surgeback inherent in pressurized operation which could cause severe pump wear problems.

4. Avoid screen drying problems by keeping solvent in the unit when shut down and blocking air from getting into the unit through the discharge line.

B. "47-Process" Feed Systems

Background: "47-Process" arrangements vary from plant to plant. Premix tanks are located above the grinding unit at some locations and below at others. Some plants use takeaway pumps to transport processed mill base relatively long distances while others set up operations with no takeaway pump and discharge by gravity. Two big problems common to all "47-Process" installations are: 1) keeping the system clean and 2) retaining sand within the vessel. Feed pumps will pump cleaning solvents when new but rapidly lose efficiency when worn. Check valves at the vessel inlet are fine when they work but a real headache when they do not.

Current Evaluations: Several new feed arrangements are being evaluated to achieve better operator control, easier and more efficient clean-up, and fewer mechanical shutdowns.

Appendix F covers the design concepts evaluated by the Toledo Plant for pressurized solvent cleaning and positive feed control.

Appendices G & H show the feed control planned for the Moberly Plant which uses high and low pressures to operate a ball valve at the vessel inlet.

Appendices I & J cover information on the feed control design planned by the Parlin Plant which will use a flow switch for controlling the ball valve.

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Appendix K shows the design planned by the Philadelphia Plant.

The Fort Madison Plant is evaluating a feed control system which utilizes a flow switch, with a special solvent flushing port, to control an air-actuated ball valve at the bottom of the "47-Process" vessel.

Moberly Feed Design: Sandmills planned for the Moberly Plant will be fed through a tangential, horizontal line with an air-actuated ball valve. The bottom stabilizers have been replaced with two discs. The center opening in the bottom plate normally used as the feed pump will be converted to a solvent drain port by silver-soldering a screen over the opening and adding a petcock. Center placement of this opening is necessary to avoid excessive wear. A sand removal port will also be installed near the bottom of the vessel.

Between-Batch Cleaning: Efficient operation of "47-Process" equipment depends to a large degree on the ability to keep the components completely clean. A pressurized wash solvent system will be used in the Moberly design to flush out the system during the clean-up. Tucker Plant has had good success with a similar system. The Toledo Plant has taken a slightly different approach which appears to give them "bare metal" cleaning capability.* This design also includes a modified Viking feed pump with special cleanout ports which are expected to prolong pump life. Toledo hopes to obtain greater utilization of their sandmill equipment by abandoning the traditional segregation of equipment by color line.

Sand Grinder Arrangements: The specific equipment arrangement to set up with a sand grinder depends on commercial needs and local conditions. Generally, two fixed premix tanks with every unit is the most desirable set-up. Clean-up procedures and pumping arrangements depend on the positioning, above or below the grinding unit, of these premixers. When the tank is below, cleaning problems are more difficult since worn feed pumps will not pump solvent and more planning is needed when designing procedures and equipment.

One of our licensees utilizes a booster pump to pump the premix from a downstairs premixer to the suction side of sandmill feed pump located upstairs. This booster pump is installed in a circulation loop - out of the bottom of the premixer and back in at the top. This arrangement has the advantage of a builtin method for boosting pumping pressure when solvent washing but the disadvantage of an expensive pump. Another licensee has eliminated feed pumps in his sandmill arrangement by pressurizing his premix tank and controlling feed rates by regulating the pressure. This set-up will handle products which normally cannot be pumped because of their rheology. A large number of our licensees simply use portable premix tanks. They make up the premix at a separate location and transport it to the sandmill. Such an arrangement is more suitable for a small batch manufacturer rather than a large volume producer.

(*) See Appendix L for Toledo's "47-Process" piping system involving reduced pipe diameters and a segregated centrifugal pump to pump cleaning solvent at high velocities.

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C. Takeaway Piping Systems

Local conditions and production patterns determine the specific arrangement on how to handle processed mill base coming off the sand grinders. Generally, objectives are to transport the material to point of use or storage and to monitor its quality, rate, temperature, etc. Equipment should be designed to prevent grinding media from coming through and ruining pumps in subsequent processing operations.

Open Mills: The regular standard design calls for an open discharge hopper on the suction side of the takeaway pump with a screen to catch stray media particles. Some users attach a vibrator to this screen to facilitate the flow of "puffy" mill bases. Others eliminate the screen and take their chances with high pump wear that can result from media getting into the moving pump parts. This latter practice is not recommended. The Toledo Plant have set up their "47-Process" units to use direct discharge with no takeaway pumps. (See Reference #3 in Bibliography.) This gravity discharge is also used by many of our licensees.

Basket Strainer: The Parlin and Philadelphia Plants plan to evaluate a basket strainer designed by Chicago Boiler which will be positioned on top of the takeaway pump. (See Appendix M.) The objective is easier straining and clean-up with correspondingly less pump wear. Since Parlin must pump mill bases through long transfer lines to the storage point, an improved takeaway system can result in significant benefits.

In-line Strainer: The Chicago Plant is evaluating another method for straining material coming off the units. They removed the hopper and connected the takeaway pump directly to the discharge pipe of closed head mills. An in-line strainer is installed in this line with a takeoff for cleaning and monitoring flow rates. It is important that the speed of the discharge pump be the same as the feed pump to avoid a condition of insufficient liquid within the vessel which can lead to severe wear. (See Reference #4.)

Moberly Design: The Moberly Plant will be set up to use a closed takeaway system but with a slightly different arrangement. Their takeaway pump will be located below the floor. A basket strainer is used in place of the in-line strainer which, with the relatively long vertical piping leg leading to the pump, serves to adjust for surges within the system. Piping is arranged to permit monitoring effluent product and for pressure cleaning by solvent flushing.

D. Small Size Process Lines

One very important aspect of a successful sandmill feed and takeaway system is the capability for keeping the piping clean. Small diameter lines are recommended (1/2 to 3/4-inch for the feed lines). Satisfactory clean-up of lines with batch or wash solvent requires high velocities to suspend solid material and to clean pipe walls. In addition to promoting higher velocities, minimum pipe sizes also force design and adoption of clean-up procedures which avoid build-up and plugging.

The sand grinder arrangement for the Moberly Plant is designed with improved clean-up between batches in mind. Process lines are kept to minimum size. Feed lines, vessel and takeaway system can be routinely flushed out with pressurized wash solvent. The objective is greater flexibility as a result of better cleaning capability.

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B. Closed Head "47-Process" Instrumentation

Feed System Protection: Strainers in the feed line between the premix tank and the suction side of the feed pump are necessary for troublefree operation of sand mills. These strainers should be set up so that they can be routinely cleaned by the operator.

Manual Temperature Control: Manual temperature control is satisfactory for most "47-Process" installations since the equipment responds slowly to changes in the flow rate of cooling water. However, the temperature must be continuously indicated and it is recommended that calibrated dial thermometers be installed in a tee on the discharge line.

Automatic Temperature Control: Some product qualities may require critical temperature control. An automatic temperature control set-up is covered in Appendix N.

Feed Pump Pressure Readings: Pressure gauges indicating line pressures on both the suction and discharge side of the feed pump will provide the operator with direct control of the equipment and a running indication of its mechanical condition. Changing pressures will indicate pump wear, line plugging, etc.

Pipe Line Pressure Sensors: Results so far from performance in F. & F. plants on a full ported pressure sensor made by the Ronningen-Petter Company are good. These units can be factory-assembled with desired gauges, instruments, capillary lines, etc. The Engineering Department has also had good service from in-line pressure sensors made by the Mansfield & Green Company. Pressure sensors in process line are desirable when installing pressure gauges. The increased cost can be justified by longer gauge life and greater dependability. Some sandmill users find that some metal sponge stuffed into the lines leading to the pressure gauge reduces the amount of plugging. However, the most dependable arrangement is to use a pressure sensor.

Pressure Within Sandmill Vessels: Closed head sandmills are not pressure vessels. They are designed to run under a low pump pressure. The seal is not designed to hold back high pressure nor are the gaskets around the screen and cover. The present design is set up so that leakage will occur at the shaft seal when pressure builds.

A number of closed head sandmill installations are set up with simple pressure gauges connected at the top of the unit. These seem to work all right if they are installed with metal sponge stuffed into the port leading to the vessel and are cleaned out regularly by the operators. However, pressure build-up in closed head units can still be a problem if the screen blinds before the operator can take appropriate action. Several plants are evaluating pressure switches connected at the top of the unit through a diaphragm seal. This diaphragm seal can be equipped with flushing ports to facilitate cleaning between batches.

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Flow Indication: The Chicago Plant is planning to evaluate a flow sensing device in the discharge line which they hope to correlate with screen blockage and pressure build-up. The Photo Products Department reports that they are able to monitor flow in sandmill feed lines by pressure readings at the discharge of the feed pump. The Fort Madison Plant is evaluating a flow switch which responds to conditions of no flow by shutting down the unit. The Moberly Plant will be set up to monitor flow by pressure readings. Moberly will also have a high temperature alarm on the units to indicate a condition of rising temperatures at the bottom of the unit.

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APPENDIX

APPENDIX A

CC: C. F. KALB - WILM. F&F
J. R. CHALMERS - " "
E. T. BREUER - " "
R. E. TUCKER - PHILA.

Philadelphia Plant
March 27, 1967

MEMORANDUM TO FILE

TRIP REPORT
COMMENTS ON M-C SAND MILL DESIGN
MOREHOUSE INDUSTRIES (LOS ANGELES)

SUMMARY

Visit: Morehouse Industries during the week of 3/13/67.

Objective: To discuss sand grinding background and provide assistance to Morehouse during their sales convention.

Conclusions: Morehouse is making careful progress in developing sealed sand mills. Present equipment is marketable and I expect design flaws to be ironed out with time as feedback comes in from the field.

DESIGN SPECIFICS

Morehouse is taking steps to eliminate leakage in screen area. Gasketing holding screens in place is now cork. When the cover is bolted in place, the cork compresses to hold the screen in position. Full compression is obtained. Earlier designs used elastomeric material for holding screen in place which led to leakage when pressure built up forcing the screen out which compressed the elastomeric material and allowed sand leakage. Also, Morehouse is fabricating covers by casting - either aluminum or cast iron. This provides tighter fit and less chance of leakage resulting from warped sheet metal.

Viking pumps are used in the commercial units. A Graham variable speed friction drive is used with the pumps. These drives use a break-in oil which must be changed after the first 30 hours use. Arrangement of drain plug is awkward and oil is now drained by dumping it on the floor. In addition, the mounting arrangement for the pumps will eventually be changed. Present mounting can result in unnecessary strain on pump casings which will lead to excessive wear. Morehouse is conscious of these problems and will eventually correct them.

No bottom check valve is used in the Morehouse mill. A straddle-type ball valve is located in the feed line near the bottom. Trouble-free operation now depends on operator's ability to shut this ball valve before shutting down pumps. If operator does not do this, back-pressure in the sealed unit will blow sand back through the feed line to the pump, resulting in excessive wear, etc.

Four rings of braided asbestos, "Teflon®" filled packing are used as a seal. This seal is somewhat protected by a slinger ring located at the top of the grinding vessel. It is necessary to remove the whole shaft assembly to replace the lower two rings of packing. Top rings can be removed without disassembling the unit but this is recommended only for emergency measures. Morehouse Industries feel all rings should be replaced if new packing is necessary. They have no feedback on expected life of the asbestos packing. Feeling is that it gives a reasonably long wear life.

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OPERATING COMMENTS

Recommended cleaning procedure is no agitation during solvent flushing. Turn agitator off and only jog it once in a while.

Some feedback exists on excessive screen wear particularly when using Zirconium oxide. No correlation as yet between screen wear and a particular formulation. Some customers indicate concern for shell wear. Apparently wear has been observed. Solution has been to reposition discs on agitators. Again, no correlation exists between wear problems and types of formulation.

Morehouse is not selling the sealed sand mill as a pressure unit. They take special care to point this out.

Morehouse does not sell a continuous lab mill of the sealed variety. Their experiments with such a design indicate too much cleanup is required for such a little mill. They recommend a batch-type process using a container about the size of a 2-lb. coffee can and a 3" disc on a Cowles unit. Their preliminary data indicate adequate correlation. It was suggested that they consider Du Pont's batch beaker technique for lab work.

Morehouse claims increased productivity with their sealed mill when overall operation is considered; i.e., wash-up time and grinding time. They do not find that increased shear levels are present in this mill and make no claims about higher productivity as a result of better milling. Any increased productivity is a result of ability to retain sand in the unit.

Formulating parameters for the sealed sand mill are pretty much undefined. They find that it will handle most products now processed by open mills with the possible exception of organosols. It is being readily accepted in the printing inks where the ability to handle higher viscosities is attractive. Most people are using glass beads in the sealed mills rather than sand. This apparently leads to less possible screen blockage due to fines contained in the grinding media.

PLANNED ACTION BY PROCESS ENGINEERING

We will continue to follow design progress with the M-C sand mill and F. & F.'s operating experience with sealed conversion units. When sufficient data to permit valid conclusions are developed, we will summarize the information and distribute it to the operating plants. The Chicago Plant is giving us an assist here by a somewhat controlled evaluation of the sealed conversion units being used at that location. We are keeping in touch with them on their experience.

DIVISIONAL PROCESS ENGINEERING GROUP

W. B. CALLAHAN

WBC:IL

WHE

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APPENDIX B

CC: C. W. KACENA - WILM. F&F

Philadelphia Plant
March 5, 1968.

MEMORANDUM TO FILE

CLOSED HEAD SAND MILLS
BULGED SCREENS
FORT MADISON PLANT

Bob Bell reports that Fort Madison is having screen trouble with their new 16-gallon unit. They notice sand leakage. When the cover was taken off, they found a bulged screen.

Bell states that the operator did not report that he noticed any pressure build-up. The pressure gauge checked out O.K. and is operative. No abnormal leakage was observed at the top seal. The unit had been running for over a week before the trouble occurred. No problems are believed to exist with the particular charge of Ceramedia.

The bulged screen appears to be the result of localized pressure. This means mechanical pressure. The conditions that lead to bulged screens may possibly develop during start-up. If the pump rate is too high on initial start-up, media and some base is forced to the top as a plug. It will be forced into a condition of interpacking and act as a solid. The spinning disc will press on the wedged sand creating a radial pressure - resulting in a bulged screen. Sand under this type of pressure will crush but Ceramedia appears to have greater crushing strength and is able to transmit the radial pressures.

Bell will confer more with the operator to see if such conditions could have existed. He will also check on the particular mill base formula involved and report back to me. Bell indicates that the particular screen involved was of the old style. He feels that the new style screen has more reinforcement and will be stronger. He feels that the new screen will be better because of this advantage. Fort Madison plans to weld a new screen onto the old frame and return the unit to service. They will add additional reinforcement to the frame.

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WBC:IL

W. B. CALLAHAN

P.S. - Bell also reports that the Jamesbury ball valve on this unit had been scored by Ceramedia particles. They replaced it and will follow performance with a new ball valve. This can be a problem with the ball valve in place of a check valve. We will have to follow up on this.

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APPENDIX C

Philadelphia Plant
February 28, 1968.

MEMORANDUM TO FILE

CLOSED HEAD SAND GRINDERS
DISC SPACING
F. & F. DEPARTMENT

SUBJECT

The objective of this memorandum is to summarize findings on how operational performance with closed head sand mills is influenced by disc spacing. Generally, the smaller screen area of closed head units has to be kept free of lodged media to avoid pressure buildup. Situation is less critical with "P" series unit than with the straight unit where larger discs in the screen area give more agitation. Disc spacing in the screen area of straight units is critical for satisfactory agitation of media at the smaller screens.

RECOMMENDED SPACING

Straight Eight: Three discs are to be used in the screen area spaced 2" apart. This gives a total of 11 discs with the stabilizer and 13 discs if the stabilizer is eliminated.

Straight Sixteen: Two discs are to be used in the screen area, giving a total of 10 discs with the stabilizer and 12 discs without a stabilizer. A 3-1/2" disc spacing is to be used between the 10th and 9th disc and also between the 9th and 8th disc.

Straight Thirty: Two discs are to be used in the screen area, giving a total of 10 discs with the stabilizer and 12 discs without the stabilizer. A disc spacing of 4" is to be used between the 10th and 9th disc and also between the 9th and 8th disc.

"P" Series Units: No changes are needed when adapting a "P" series unit to a closed head design. Two large discs are used in the screen area with hubs down. Chicago Boiler's standard spacing of 2-3/8" appears satisfactory.

BACKGROUND

Parlin: Bernie Yenc reports that Parlin has had difficulty with their converted Straight Eight. This unit is set up with two discs in the screen area. They have repeatedly tried to operate with Ceramedia and encountered pressure buildup due to screen plugging. They are able to operate using 16-20 mesh sand but Yenc reports that this may even cause some problems. Another disc in screen area is recommended for this unit.

South San Francisco: Jack Shehi reports that South San Francisco encountered the same type of difficulty that Parlin reports with their converted Straight Eight. They were able to get better performance by installing an additional disc in the screen area. Shehi reports that Dexter Tight suggested this. South San Francisco was careful to change one variable at a time when making the change during alignment of the closed head set-up. Shehi feels that

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performance with and without the disc was assessed under controlled conditions and demonstrates significant advantages with the increased agitation.

Fort Madison: Bob Bell reports that Fort Madison is starting up two new closed head units - a Straight Sixteen and a Straight Thirty. They changed the disc spacing to conform to the above recommendation. (The units as originally shipped by Chicago Boiler had 2-3/8" between the disc with the 16-gallon unit and 2-5/8" between the disc with the 30-gallon unit.) Experience of about three weeks with the 16-gallon unit has been good. Only one batch made in the 30-gallon unit and no problems reported. Other closed head units at Fort Madison are set up with 11 disc spacing.

Flint: Burt Hill reports that Flint has one 30-gallon unit converted with closed head operation. Their experience parallels that of other plants on screen blinding. Now operating satisfactorily with Ceramedia. They will add an extra disc when converting their eights.

Chicago: Bob Walton reports that the new closed head units set up at Chicago are the "P" series design. The older straight units with the conversion heads have 11 discs in the screen area. No significant problems can be reported on the operation of the "P" series units.

Philadelphia: Ralph Smith reports that the 8-gallon unit operating at Philadelphia contains 11 discs or three in the screen area. The new 30-gallon unit on order will be set up to conform with the above recommendations.

Toledo: George Miller reports that Toledo had problems with the Straight Eights as originally set up. The conversion heads on these were smaller than the standard conversion unit - hence, smaller screens. Toledo found that they were able to get better performance using fewer discs in the screen area. They ended up with nine discs. I believe that the different unit design leads to a different solution of the problem and must be considered as an exception to the rule. No problems with the "P" series units which Toledo reports to be working better than the Straight Eights.

ACTION

1. New standards are being set up on disc spacing.

2. Chicago Boiler was contacted on what spacing we want in units in F.& F. and why. Frank Pirok, Chicago Boiler, indicates that there will be no problem in conforming to our requests.

3. The disc spacing on the unit for Philadelphia has been changed to conform to new recommendations.

4. Specific recommendations are being delineated for the Moberly Project.

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5. Parlin will be advised to change the disc spacing on the 16 and 30-gallon units to be installed. Parlin already plans on adding the third disc in the screen area on the present Straight Eight.

6. We will communicate the information to all plants.

DIVISIONAL PROCESS ENGINEERING GROUP

W. B. CALLAHAN

WBC:IL

DUP030002392

APPENDIX D

CC: C. F. KALB - WILM. F&F
J. R. CHALMERS - " "
J. A. HAASE - CHICAGO
F. P. HARTZ - "
C. N. SWINEHART, JR. - PHILA.

Philadelphia Plant
March 9, 1967

R. A. DE WALL
CHICAGO

ATTENTION: E. A. MILLER

SEALED SAND MILL OPERATION
EVALUATION: OTTAWA SAND VERSUS CERAMEDIA
CHICAGO PLANT

Reference phone conversations with F. P. Hartz and my memo of 3/3/67.

A number of questions are unanswered on best ways to operate sealed sand mills. Chicago's action on converting a standard unit to sealed operation and keeping track of the necessary steps and modifications to bring it on-stream helps F. & F. to define processing requirements and develop the know-how.

The object of this letter is to make a request. Can you set up at Chicago an evaluation to provide more information on possible advantages of Ceramedia (glass beads sold by the Quackenbush Company) in sealed sand mills? Fritz Hartz mentioned that Bill Sutton is following your alignment of the sealed sand mill closely and is keeping accurate records of problems, performance, usage, maintenance, etc. The objective is to have a complete log of experience on operating the sealed mill. If a similar history can be delineated when aligning the sealed sand mill with Ceramedia, you can obtain the data for comparing sand to Ceramedia.

Some of my feedback indicates that Ottawa sand in sealed units leads to problems of repeated screen blockage when starting up with a fresh charge. Once conditioned, the sand does not cause screen blockages and seems to give adequate performance in sealed mills. On the other hand, my feedback indicates that Ceramedia, which is more spherical and contains fewer fines, causes fewer problems on start-up. Right now this feedback is not fact but only opinion.

If Chicago develops data substantiating or refuting these opinions, they will make a real contribution at this time. We are particularly interested in comparisons of experience in two areas: a) problems involved in bringing the equipment on-stream and b) problems involved in normal operation after the equipment is on-stream.

Please let me know if you would like me to dig up any information pertinent to an evaluation of Ceramedia. I will be discussing the sealed sand mill next week during a visit to the Morehouse Company. If any more feedback develops, I will get in touch with you.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

WHE

By: W. B. Callahan

WBC:IL

DUP030002393

COPY

APPENDIX E

CC: C. F. Kalb - Wilmington
W. H. Beutel - Philadelphia
F. J. Johnson - Flint
K. E. Ackley - S. San Fran.
F. S. Baker - Tucker
J. F. McGettigan - Parlin
C. W. Stahl - Toledo
C. H. Thompson - Fort Madison
B. F. Whitlock - Chicago
C. N. Swinehart - Philadelphia

CHICAGO PLANT
2100 Elston Avenue

July 12, 1967

MR. W. H. EDWARDS
PHILADELPHIA

ATTENTION: W. B. CALLAHAN

"47 PROCESS" SEALED SAND MILL OPERATION
EVALUATIONS OTTAWA SAND VERSUS CERAMEDIA
CHICAGO

The Chicago Plant converted a 16 gallon "47 Process" Unit to a sealed screen unit with a Crossley Conversion Unit in February, 1967. Some problems were encountered in the installation and the initial production because of the limited experience with the equipment. However, if the recommendations listed in this letter are followed and "Ceramedia" is used as the grinding media, the problems of converting to a sealed unit should be minimized.

Ottawa Sand (14-18 mesh), supplied by the Chicago Boiler Company, was first used in this unit. It was necessary to clean the screen twice to remove the sand fines which were plugging the screen during the grinding of the first batch. Forty more pounds of sand were added to replace what had been lost after grinding approximately 4,000 gallons of base. After this addition, it was necessary to clean the fines from the screen three times. There was some build-up of dried paint around the agitator between the three top discs. Another 1500 gallons of material were ground, but considerable plugging of the screen and high pressure caused leaking at the agitator packing. The agitator was cleaned and 20-30 mesh "Ceramedia" was added. The Unit has been running for three months with "Ceramedia" and the screen was removed only once for observation; the additional cost of "Ceramedia" is justified.

Production rates up to 120 gallons per hour have been obtained with the 16 gallon sealed Unit versus 90 gallons per hour of the same base on a 30 gallon open screen unit.

Some leaking occurs at the agitator packing when the pressure exceeds four pounds. The Chicago Plant plans to purchase other sealed Units which will have a seven ring packing versus the present three ring type. It is hoped the new packing gland will eliminate the leakage.

The following recommendations should help during the installation of a sealed Unit and the initial production. Some of this information has been previously reported.

1. The bronze bushing on the agitator shaft should be sealed to the shaft with epoxy to prevent leakage. The shaft should be aligned and smooth at the bushing area.

2. Braided asbestos with graphite is the best packing.

3. A manual shut-off valve between the feed pump and vessel will help to prevent a surgeback of the grinding material.

4. The screen should be checked to assure that it is properly installed. The larger side of the openings should be on the outside.

5. The Unit should be started slowly until material is coming out of the Unit, then adjusted to the desired grinding rate.

6. Do not operate over four pounds of pressure to prevent leakage.

7. Fill the head with thinner when closing down after grinding a batch to keep the screen wet. This usually require 3 to 4 gallons of thinner.

8. If leakage occurs at the shaft, tighten the packing and replace when needed. Packing replacement for a three ring gland is necessary every five to ten days depending on the use of the equipment.

R. A. DE WALL - Plant Manager

By: W. M. Sutton /s/

cmb
(il)

COPY

APPENDIX F

CC: C. F. KALB - WILM. F&F
C. W. KACENA - " "
C. W. STAHL - TOLEDO
H. R. CARR - "

Philadelphia Plant
July 26, 1967

C. W. STAHL
TOLEDO

ATTENTION: P. R. STORVES

"47-PROCESS" DESIGN
EVALUATION OF IMPROVED FEED ARRANGEMENT
TOLEDO PLANT

Reference our previous phone conversations.

We would like to set up with you a cooperative program at Toledo to evaluate a new feed arrangement for "47-Process." The goals are easier clean-up between batches, better process control during grinding, and less mechanical wear problems. Hopefully, your evaluation will extend F. & F.'s sand milling capabilities and establish a design for new facilities and for upgrading existing operations.

Two of the bigger problems in sand milling are keeping the equipment clean and retaining the sand in the vessel. Both contribute to overall process difficulties of wear, poor efficiency, operational breakdown, reduced capacity, product contamination and subsequent processing troubles, etc. Although various equipment arrangements have been set up to avoid these problems, none proved to be completely adequate and free from breakdown. For instance, new pumps will pump cleaning solvents but worn pumps will not. Also, check valves are fine when working but are a real headache when not operating properly.

The attached sketch covers a design intended to provide easier and better cleaning with less effort and a more foolproof method for keeping sand out of the feed lines. Essential features are:

1. Centrifugal Solvent Pump: An open impeller pump for boosting pressure when pumping low viscosity solvents during the cleaning cycle. It is sized to produce discharge pressures in the range of 60-80 psi.

2. Solvent Pump By-pass: The centrifugal pump is located in a parallel loop off the line leading from the premixer to the positive displacement feed pump. It is isolated during the grinding operation by a manual valve on the pump suction side and check valves on the discharge side.

3. Viking Feed Pump: The Viking pump driven by a variable speed drive and sized to give desired rates at low R.P.M. Clearances can be oversize to minimize effects of wear since the pump will not be used to pump solvents. Special ports installed in the back of the pump will be used for solvent flushing the back cavity during the cleaning cycle.

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4. Pressure Gauges: Operators can monitor flow through feed line with pressure gauges on both the suction and discharge side of the feed pump. Snubbers in the pressure line will dampen pressure fluctuations and insure gauges remain operative. Some metallic sponge stuffed into the port leading to the pressure gauge will prevent paint from plugging the lines and will be cleaned each cleaning cycle.

5. Pressure Switch: A pressure switch on the discharge side of the feed pump will protect the pump from shock loads. It may also serve as a method for automatic pump shut-off at the end of the batch when no flow causes the ball valve at the bottom of the unit to close.

6. Cleaning Loop: A 3-way valve installed in the feed line near the unit with one leg leading to the bottom of the unit and the other leg leading back to the premix tank will afford a loop for cleaning. Premixers, feed pump and feed line are the most difficult items to clean. During the cleaning cycle, the 3-way valve can be set to recirculate back to the premixer and solvent will be cycled by the centrifugal pump.

7. Premixer Cleaning Nozzle: A nozzle designed to spray solvent onto the top portion of the premixer and run down to the bottom is possible using the centrifugal pump for boosting pressure. Flushing premixer surfaces in this manner will prevent build-up.

8. Ball Valve and Electrical Actuator: The check valve is eliminated and a ball valve substituted. This ball valve is opened and closed by a valve actuator running off the feed pump drive (valve open when pump is running) and tied in to a flow switch (valve open when flow indicated).

9. Flow Switch: Objective of the flow switch is to shut the ball valve at the end of the batch when flow stops. It also functions as an additional check valve. It will be set up with an electrical override to cut it out of the circuit during start-up.

10. Feed Line: A length of pipe running from the discharge side of the feed pump and the bottom of the vessel should be as small of diameter as possible consistent with pressure drop. Objective is to keep the velocities up and so, keep it clean.

11. Running Cycle: Once operating conditions are established, the unit should perform more or less automatically. If a line blockage occurs, the pressure switch will shut down the pump and so, close the ball valve. If flow stops for some reason, the flow switch will shut the ball valve. When the flow switch shuts the ball valve at the end of the batch, there should be enough pressure build-up to also shut down the pump.

12. Cleaning Cycle: After recovering as much of the mill base as possible from the system, the operator can set his 3-way valve to recycle back to the premix and add solvent to the premixer. The centrifugal pump is cut into the system and solvent is circulated through the loop. Sufficient pressure will insure that the pump, gauge pressure ports, etc. will be cleaned on each batch. Experience will determine how effective the cleaning nozzle will be in the premixer. Once this part of the system is cleaned out, the operator can then proceed to clean up the unit by switching the 3-way valve. The Viking feed pump will be running during the cleaning cycle so that the bottom ball valve will open when the 3-way valve is switched to the unit.

Please give me a call when you have had a chance to look at the sketch. We are most anxious to begin this evaluation. Since the design is somewhat experimental and since the benefits, if successful, extend beyond Toledo, the equipment cost should be borne by Process Engineering's P-52 project. The final design, of course, must be tailored to Toledo's requirements. We can work out the details in any manner you suggest. I propose that some of the items be ordered here at Philadelphia since special design features are necessary. Your comments or suggestions would be appreciated.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

By: W. B. Callahan /s/

WBC:IL
Att.
(il)

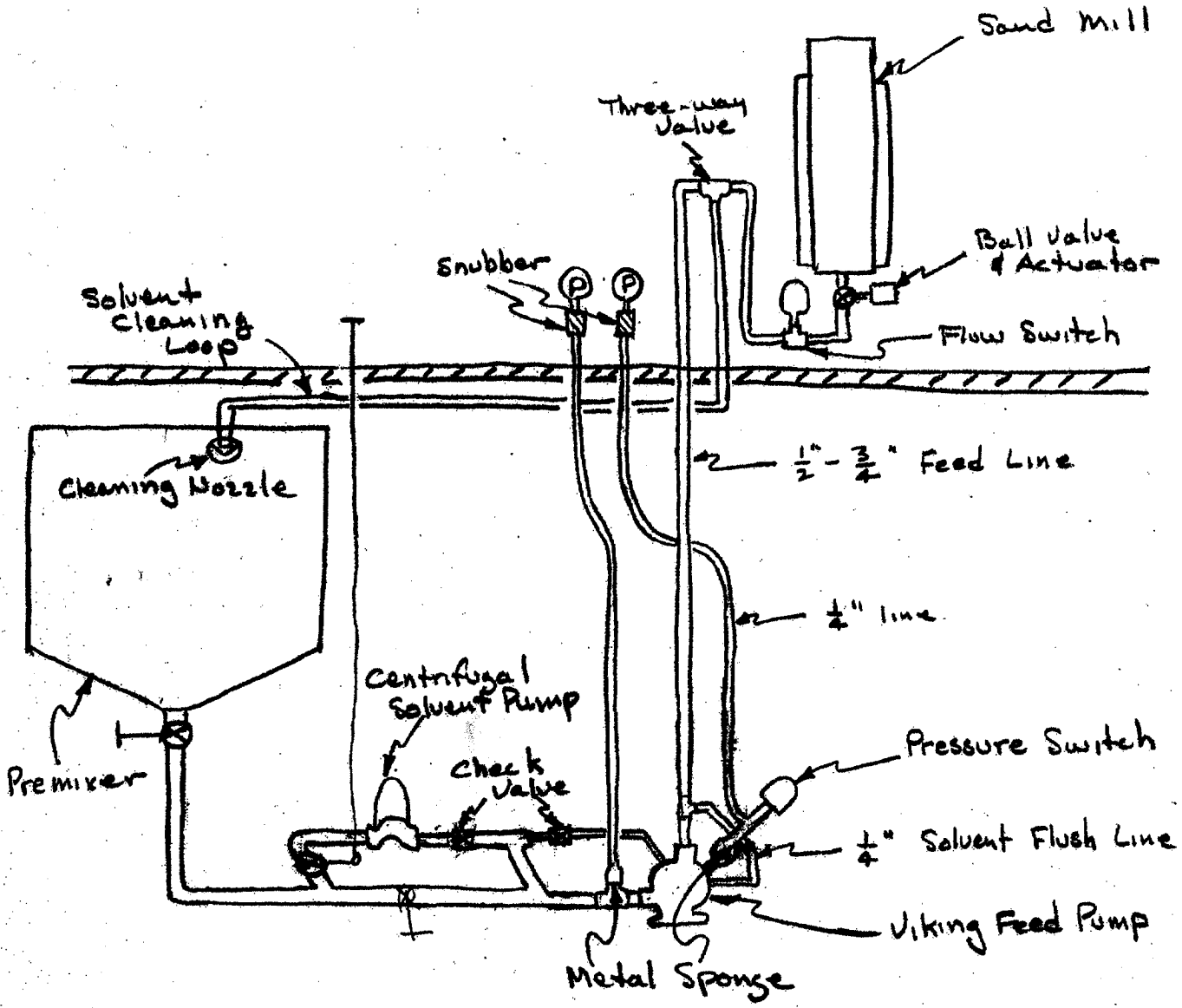
G-46 REV. 11-59

ENGINEERING (DUPONT) COMPUTATION SHEET APPENDIX F (Cont.)

TITLE OF PROJ OR STUDY _____ PROJ OR STUDY NO P-52

SUBJECT SAND MILL FEED ARRANGEMENT (Toledo Plant) WORK PE

W B Callahan 7-17 19 67



Note

Pipe line strainer on suction side of feed pump optional.

APPENDIX G

CC: C. W. KACENA - WIIM. F&P
G. E. TIBBETTS - TOLEDO
G. G. MILLER - TOLEDO

Philadelphia Plant
February 14, 1968.

C. W. STAHL
TOLEDO

ATTENTION: P. R. STORVES

"47-PROCESS" DESIGN
EVALUATION OF FEED CONTROL ARRANGEMENT
TOLEDO PLANT

Reference our phone conversation of 2/13/68.

Toledo's help is needed to pin down final details for the sand mill design in the Moberly Plant. We hope to operate the ball valve at the bottom of sand grinders by controlling with a high/low pressure switch. The valve will open when the feed pump builds pressure to 10 psi and will remain open until the pressure drops to 1 psi. Although this arrangement now appears to be the best one for Moberly, it has not been evaluated under production conditions. Your agreement to carry out the evaluation will provide the feedback on performance that we need.

A pressure switch to be mounted at the factory on a pressure sensor with a suitable gauge has been ordered for delivery to George Miller in Toledo. The attached sketch shows how this pressure switch is to be mounted in the sand grinder feed system. A ball check valve is needed in this design and I have asked George Miller to pick one up locally in Toledo. A rough sketch of the wiring diagram is also included with this letter. I will pass along copies of the purchase orders when available. The supplier assures me that he can make delivery within two weeks.

Please give me a call if there are any problems that come up in this evaluation. I plan to keep in close touch with George Miller on the design and possible alternates for adapting to Toledo's needs. Hopefully, we will be able to give the Engineering Department the go-ahead on the design within four weeks.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

By: W. B. Callahan

WBC:IL
Att.

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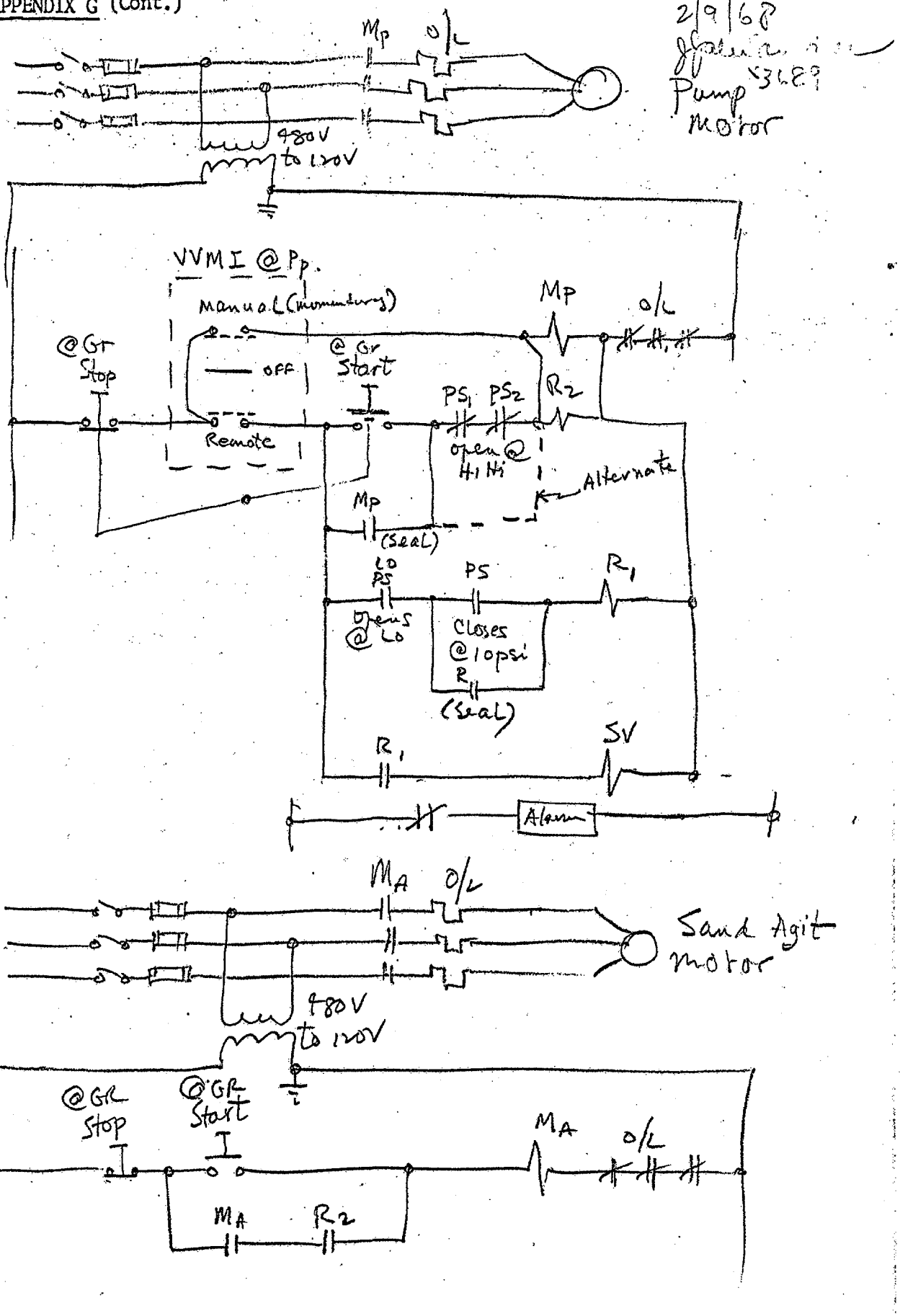
APPENDIX G (Cont.)

2/9/68



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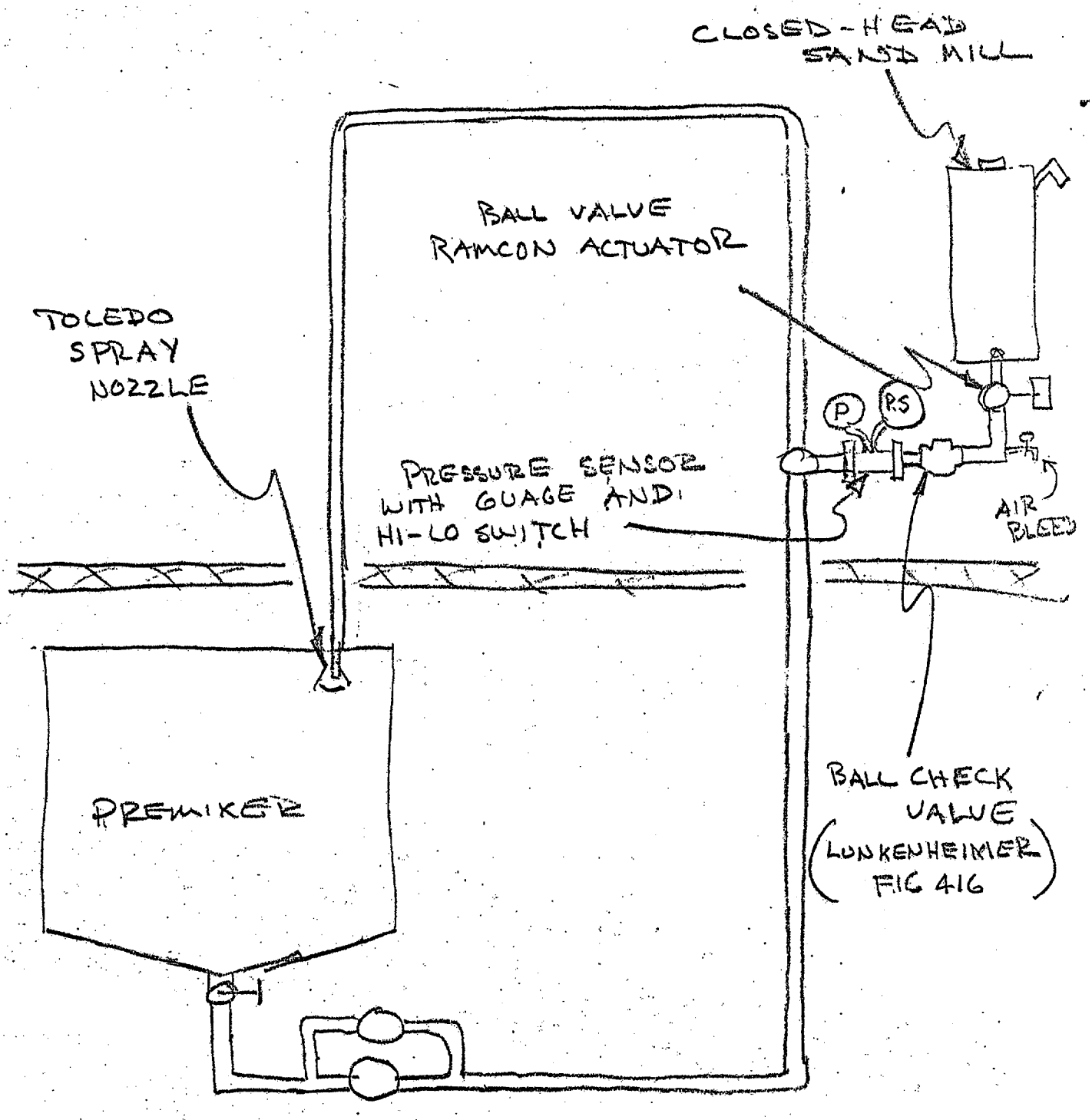
P-100

SAND GRINDING
FEED CONTROL ARRANGEMENT Toledo
WB Callahan 2-12-68



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APPENDIX H

CC: C. W. KACENA - WIIM. F&F
G. E. TIBBETTS - TOLEDO
G. G. MILLER - TOLEDO

Philadelphia Plant
March 15, 1968.

C. W. STAHL
TOLEDO

ATTENTION: P. R. STORVES

"47-PROCESS" DESIGN
FEED CONTROL
TOLEDO PLANT

A short note Paul, to confirm the points we discussed on evaluating the new sand mill feed arrangement.

The high/low pressure control covered in my letter of February 14 appears to be working well. George Miller and I experimented with it using solvent during my visit earlier this week. The ball valve responded to pressure buildup and shut down when the premix became empty and pressure dropped. However, only one batch has been made with this set-up and more experience is needed.

Paper and tramp material in the lines continue to be a problem. A trap installed on the suction side of the feed pump should collect these small bits of material and prevent them from plugging various portions of the feed system. George Miller is looking into the feasibility of installing an easy-to-change basket strainer. If possible, you should have a procedure established which requires the operator to change the strainer in the trap after washing.

Once equipment is set up and procedures are established that will eliminate tramp material in the feed system, a final evaluation of the feed control components can be made. The bottom check valve is still in the unit. It should be removed when sufficient confidence on the control system is gained. You will then be able to have a final evaluation. Resulting information will be applied to the Moberly design. Also, the specific set-up for the two units intended in the "Du-Lite(*)" project will be based on results with the present equipment.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

WBC:IL

By: W. B. Callahan

P.S. - The preliminary results with the Toledo spray nozzle in the dome of mixers appear good. George Miller indicates that the 3/16" adapter on standard spray nozzles appears to work better than other sizes and designs when operating at around 30-35 psi. I suggested to Miller that Toledo issue a device memorandum when all involved are satisfied with performance.

(*) Du Pont Registered Trademark

APPENDIX I

CC: C. F. KALB - WILM. F&F
C. W. KACENA - " "
A. L. DADE - PARLIN
W. S. BROWN, JR. - "
F. P. HARTZ - CHICAGO
S. T. NOTTINGHAM - FORT MADISON
R. L. MC FARLAND - TOLEDO

Philadelphia Plant
September 21, 1967

J. F. MC GETTIGAN
PARLIN

ATTENTION: P. J. PANDOLFI

"47-PROCESS" DESIGN
REVISED ARRANGEMENT
PARLIN PLANT

Reference my visit of 9/1/67 and our subsequent phone conversations.

The objective of this letter is to summarize very generally the points we covered on Parlin's design for the new eight and 30-gallon units being installed. Divisional and licensee experience on sand mill operation indicates several aspects of the standard design that should be improved.

1. Eliminate mechanical check valves in bottom of sand mill vessels and substitute electrically actuated ball valves.

2. Install side entering feed line tangentially near bottom instead of bottom entering feed in center of bottom plate. Agitator rotation must be away from the feed opening.

3. Include flow switch in feed line and tie it in electrically with the feed pump and ball valve actuator. Ball valve will shut down when no flow occurs or when the pump is turned off.

4. Use pressure sensers in line on suction and discharge side of the feed pump so that pressure gauges can be set up to permit operators to monitor performance. Also set up electrical pressure switch to protect feed pump.

5. Reduce feed line piping size so that higher flow rates are obtained. This is particularly important during solvent washing to suspend and carry away solids.

6. Remove bottom stabilizer from the shaft and substitute two discs.

7. Use the inlet opening normally in the bottom plate for the check valve for solvent draining. Cover the opening with a screen and install a petcock.

8. Install a sand discharge port with cock near bottom of the vessel to remove small quantities of sand.

DUP030002404

9. Run a line from the top of the "trombone tube" back to the premixer to achieve a cleaning loop. A 3-way valve is needed to switch flow during the washing cycle.

10. Eliminate open screens in the discharge hoppers and substitute an inline straining device. Objective is more positive suction at the screen and less starving of takeaway pumps. Chicago Boiler has a design which appears to be suitable for this objective.

The Chicago Boiler Company has agreed to assemble the complete package for you; i.e., piping, valves, flow switches, etc. I have contacted Frank Pirok, Chicago Boiler, on the specific hardware you want. Fritz Hartz, Chicago Plant, can provide guidance to Chicago Boiler if needed on conversion units. Experience gained on assembling your units will have direct bearing on the design for the Moberly Plant.

You will want to consider a lead being evaluated by the Toledo Plant. They have covered all their units with a "Teflon*"-coated metallic foil having an adhesive backing. I think this is the same "Tri-foil" that you mentioned. It is easy to clean. Results are good so far but still too early to pass judgment on durability. This skin of "Teflon*" will be cheaper than sand-blasting and polishing and should be considered.

The package unit that Chicago Boiler will be supplying to you will include all piping up to the pumps. One exception will be the pressure gauges on the suction and discharge side of the feed pump which you can supply at Parlin. Suction gauge should be set up with a range of 15 inches to 30 psi and the discharge gauge should be set up with a range of 0-60 psi. The pressure sensers installed in the line will be filled systems which means that you will have to fill the piping to your pressure gauge with a 50/50 mixture of glycol and water.

Specific details on wiring of control circuits, valve design and general arrangement are being finalized. I will continue to keep in touch with you on specific details. Let me know if there are any items that you would like to revise or modify. The overall package that you evolve will serve as a prototype for future sand mill standards.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

By: W. B. Callahan

WBC:IL

WHE

(*) Du Pont Registered Trademark

CC: C. W. KACHMA - WILM. P&P
W. S. BROWN, JR. - PARLIN
S. T. NOTTINGHAM - FORT MADISON

APPENDIX J

Philadelphia Plant
October 10, 1967

J. F. MC GETTIGAN
PARLIN

ATTENTION: P. J. PANDOLFI

"47-PROCESS" DESIGN
DETAILS ON COMPONENTS FOR REVISED FEED
PARLIN PLANT

Reference my letter to you of 9/21/67.

The information on individual components for the feed arrangement you plan on your sand mills is enclosed with this letter. Frank Pirok at Chicago Boiler states that he can have them assembled any way you desire. He suggests that Parlin order them for delivery to Chicago Boiler. You can set up your own communication with Frank on how you want to handle the fabrication.

A few comments on the parts and pieces may be helpful.

Flow Switch: You will need one for each unit. The attached purchase requisition covers the specs. I have been in contact with Mr. Ball of the Ball Manufacturing Company on our applications. He feels that a step plunger should be used rather than a beveled plunger and will supply units to us with this design. Mr. Donnelly of Ramick, Inc. also is familiar with our needs. The flow switch can be adjusted in the field. Until we have been able to build up some experience, you will have to plan on making some adjustments during alignment.

Ball Valve and Actuator: Actuators can be supplied for either electrical or pneumatic operation. Toledo is planning to go with an electrical actuator while Moberly plans to use a pneumatic one. I suggest that you go with the pneumatic actuator using a speed control valve in air supply line. Specs for both types are included with this letter. They can be mounted on any type of ball valve. I recommend Hills McKenna.

Pressure Sensor: You will need two for each unit. I am contacting the vendor to see if these things can be assembled at the factory. At present you will have to assemble and fill the system in the field. It is not too much of a job. Just fill it up with 50/50 mixture of glycol and water. You can use your own pressure gauges. The pressure sensors dampen flocculation and so, eliminate need for snubbers.

Pressure Switch: Use any type of pressure switch you want. United Electric makes a good one. Toledo is ordering the Solon pressure switch. Use one that has a range of 50-150 psi. Set it at around 100-120 psi.

Electrical Controls: Harry Rundgren at Philadelphia has designed a control circuit which I think is pretty good. Although other designs can be evolved which should work, I suggest that you use the circuit design enclosed with this letter. Two time delay relays should be employed. Make and type of individual control components should be consistent with local practice.

DUP030002406

APPENDIX J (Cont.)

The Moberly task force is interested in your final design. Present thinking is to adapt it to the new plant. Please give me a call if you have any questions or if I can be of any further help.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

By: W. B. Callahan

WBC:IL
Encl.

APPENDIX K

CC: C. F. KALB - WILM. F&F
KACENA - WILM. F&F
W. J. GRIFFITHS - PHILA.

Philadelphia Plant
November 2, 1967

W. H. BEUTEL
PHILADELPHIA

ATTENTION: J. R. CHURCH

"47-PROCESS"
RECOMMENDED DESIGN FOR PHILADELPHIA PAINT DEPARTMENT
DIVISIONAL PROCESS ENGINEERING GROUP

It may be helpful to you if I summarize some of the points we discussed on 11/1/67 pertaining to my recommendations on a new sand mill for Philadelphia Paint Department.

You should plan on using a standard Chicago Boiler "Red Head" mill and install a Crossley conversion unit to make a sealed sand mill. You can order the Red Head mill from Chicago Boiler without the screens, fume guards, etc. and order the conversion unit from Crossley for assembly here at Philadelphia. However, there are some political problems which do not affect you but can affect the sand mill licensing program and other construction projects. Please do not let Crossley's local agent (Olin West) know that this conversion unit is to be installed on a new Red Head mill.

There are some design features that you should have included on this new sand mill. These will give you a unit better suited to the specific requirements in the Paint Department. You can work out the fabrication specs by contacting Frank Pirok at Chicago Boiler. Although they are deviations from the standard design, Pirok has indicated that he can handle the changes.

Tangential Feed: Change the feed arrangement at the bottom of the unit so that the inlet comes in horizontally at the side and tangentially to the vessel circumference. However, the drive will have to be hooked up during installation so that the agitator turns away from the opening of this tangential feed.

Plumber's Check Valve: Eliminate the ball check valve and utilize a common flapper check valve similar to the one you now use on your sealed 8-gallon unit. It would be better to purchase the unit without any check valve and install the plumber's check valve locally during installation.

Solvent Drain Port: The bottom opening which normally is used as the feed port should be converted to a solvent drain port. Have Chicago Boiler silver-solder a screen over the opening and install a plug. This will be a help when cleaning, since you can drain solvent out of the unit.

DUP030002408

APPENDIX K (Cont.)

Sand Discharge Port: Have Chicago Boiler install a nipple and valve at the bottom of the unit so that small portions of sand can be removed. Both the tangential feed port and the sand discharge port can be located at any point on the vessel. Consider where you want them and let Chicago Boiler know.

Takeaway Screen: The Parlin Plant is installing two units with a revised takeaway screen. This is a Chicago Boiler development that one of their customers reports gives good service. It is a sealed screen arrangement which results in less attention time and easier housekeeping. You should plan on using this design in the unit for the Paint Department.

Pressure Switch: Your idea of installing a pressure switch to shut the unit down when pressure builds up sounds like a good one. I suggest that if you go with this feature, you use a Mansfield and Green diaphragm seal. They can factory assemble a filled system to your specifications for pressure switch and diaphragm type. You should have a switch with a variable setting which can be pegged at the level indicated by experience.

Bottom Disc: Eliminate the bottom stabilizer and have Chicago Boiler install two extra discs in its place. The quality ofsand mill disc is much better today than it used to be. Chicago Boiler can assemble an agitator sans stabilizer and balance it before installing in the unit.

You indicate that the Paint Department does not use the flexible hose in the feed line. So, buy the unit from Chicago Boiler without feed lines, etc. and install them yourself to suit requirements in the Paint Department. Please let me know what design you decide on or if I can be of any further help. We will be interested in learning how the design works out.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

By: W. B. Callahan

WBC:IL

P.S. - I spoke to John Butler and suggested that he install metal sponge in the fittings leading to the pressure gauges on your present sealed units. This should give a little longer life to these pressure gauges. Feedback from the field indicates that this has eliminated problems in a number of cases.

DUP030002409

APPENDIX L

CC: J. S. ALLEN - WILM. F&F
P. R. STORVES - SO. SAN FRAN.
N. B. SUNCHINE - SO. SAN FRAN.
G. E. TIBBETTS - TOLEDO

Philadelphia Plant
April 10, 1968.

K. E. ACKLEY
SOUTH SAN FRANCISCO

ATTENTION: B. D. LILLY

"47-PROCESS" DESIGN
ARRANGEMENT FOR "BARE METAL" CLEAN-UP
SOUTH SAN FRANCISCO PLANT

A few comments to supplement my letter to you of 3/1/68.

The Toledo Plant is having good early success with their solvent flushing arrangement on a sand mill feed system. This design consists of an open impeller centrifugal in parallel with the Viking gear pump. The Viking pump is installed with oversize clearances and two small ports in the casing to solvent flush out behind the rotor. The centrifugal pump is used for pumping solvent only and is not in the system when the Viking pump is pumping mill base.

Toledo replaced large diameter lines from the pump to the sand grinder with 3/4" pipe. They have operated for two months and the inside of all lines is completely free of any build-up. They plan to duplicate the arrangement with another "47-Process" unit. They hope to be able to make a wide assortment of colors and so, obtain better utilization of the equipment.

You may want to use the same arrangement at South San Francisco. Drawings showing the specific arrangement being evaluated by Toledo are included with this letter. The added cost can be justified by the greater flexibility obtained with the equipment and potentially less mechanical problems with feed pumps. It is too early to predict the extent of possible benefits but results so far have stimulated enthusiasm.

Please let me know if you would like any more information on current evaluation work with sand mill design. A lot of work is in progress. Any comments you may have would help overall considerations of the problems involved.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

By: W. B. Callahan

WBC:IL
Encl.

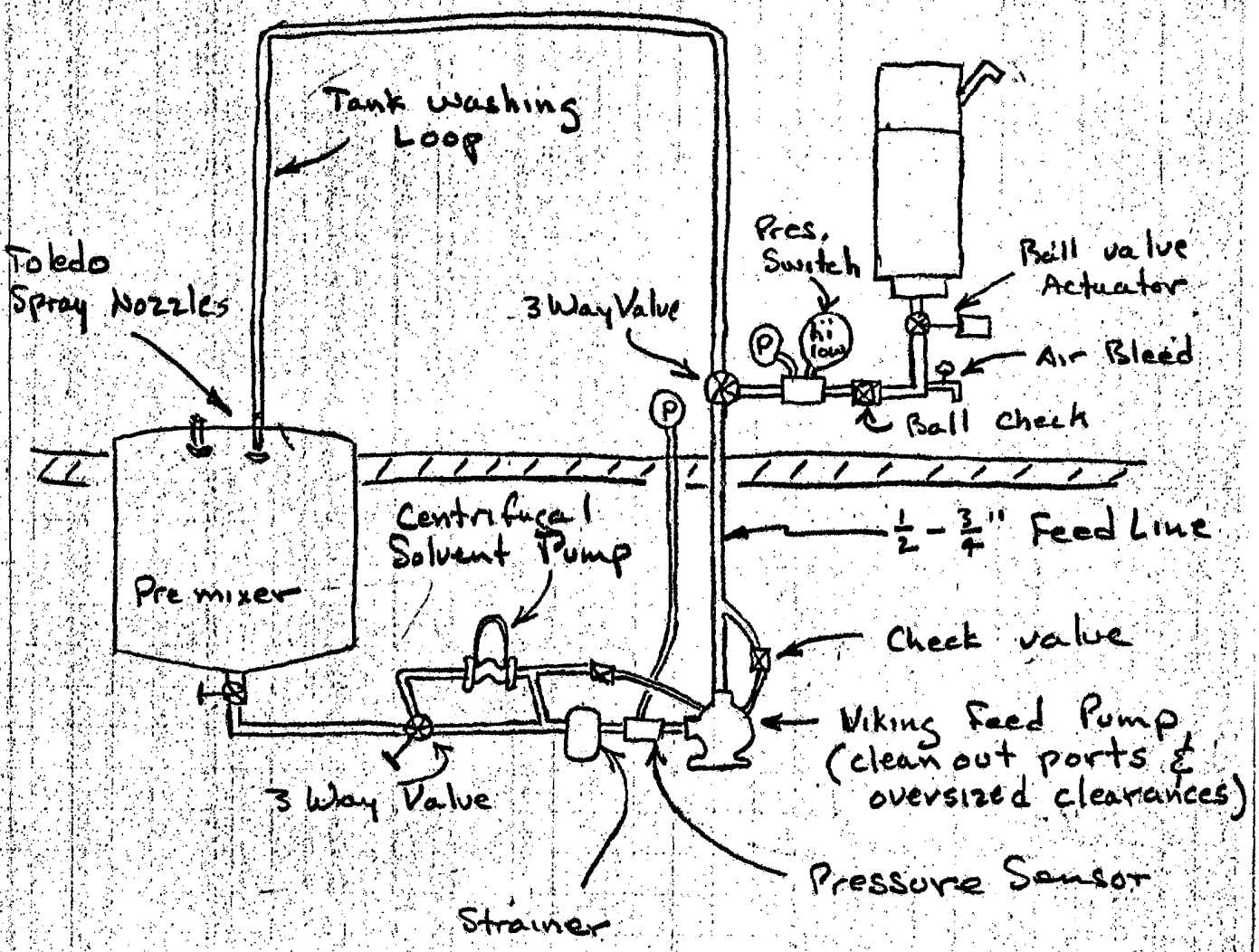
DUP030002410

ENGINEERING COMPUTATION SHEET

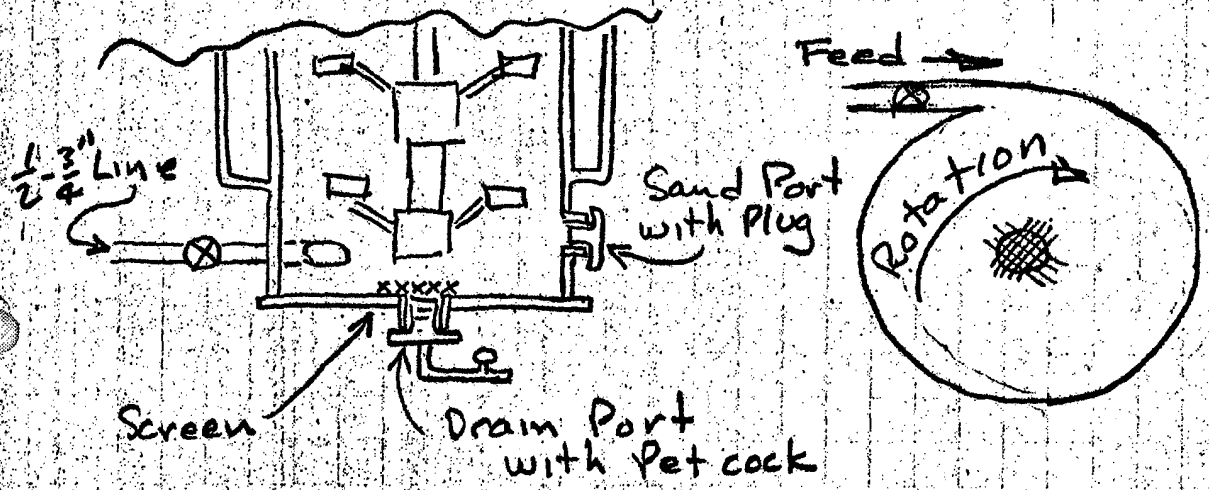
TITLE OR PROJ. OR STUDY _____ PROJ OR STUDY NO. _____

SUBJECT SAND MILL FEED ARRANGEMENT WORK'S _____

COMPUTER WRC DATE 4-5 19 68



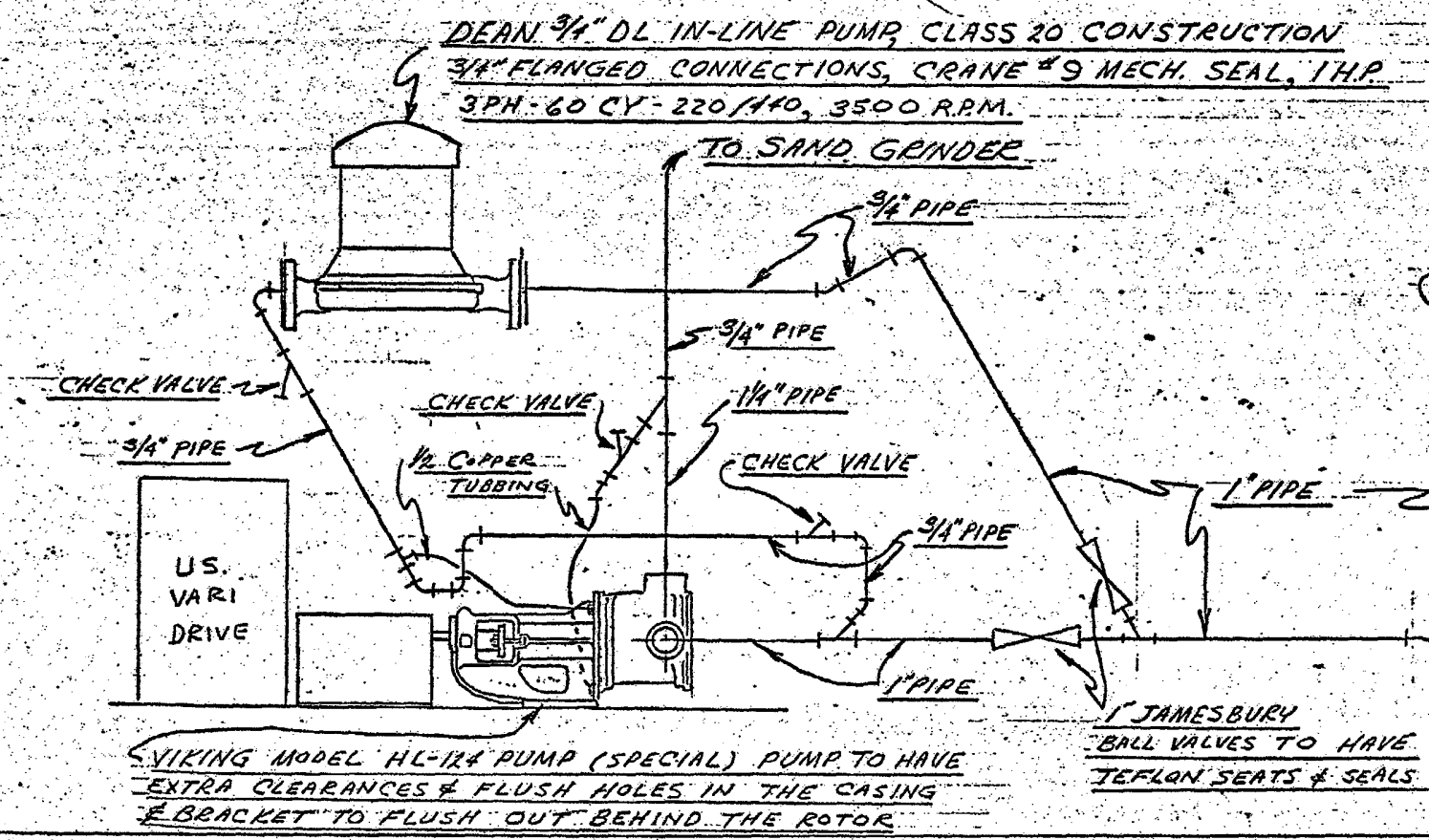
Mobarly's Bottom Feed Arrangement



DUP030002411

47- PROCESS
SOLVENT PUMP

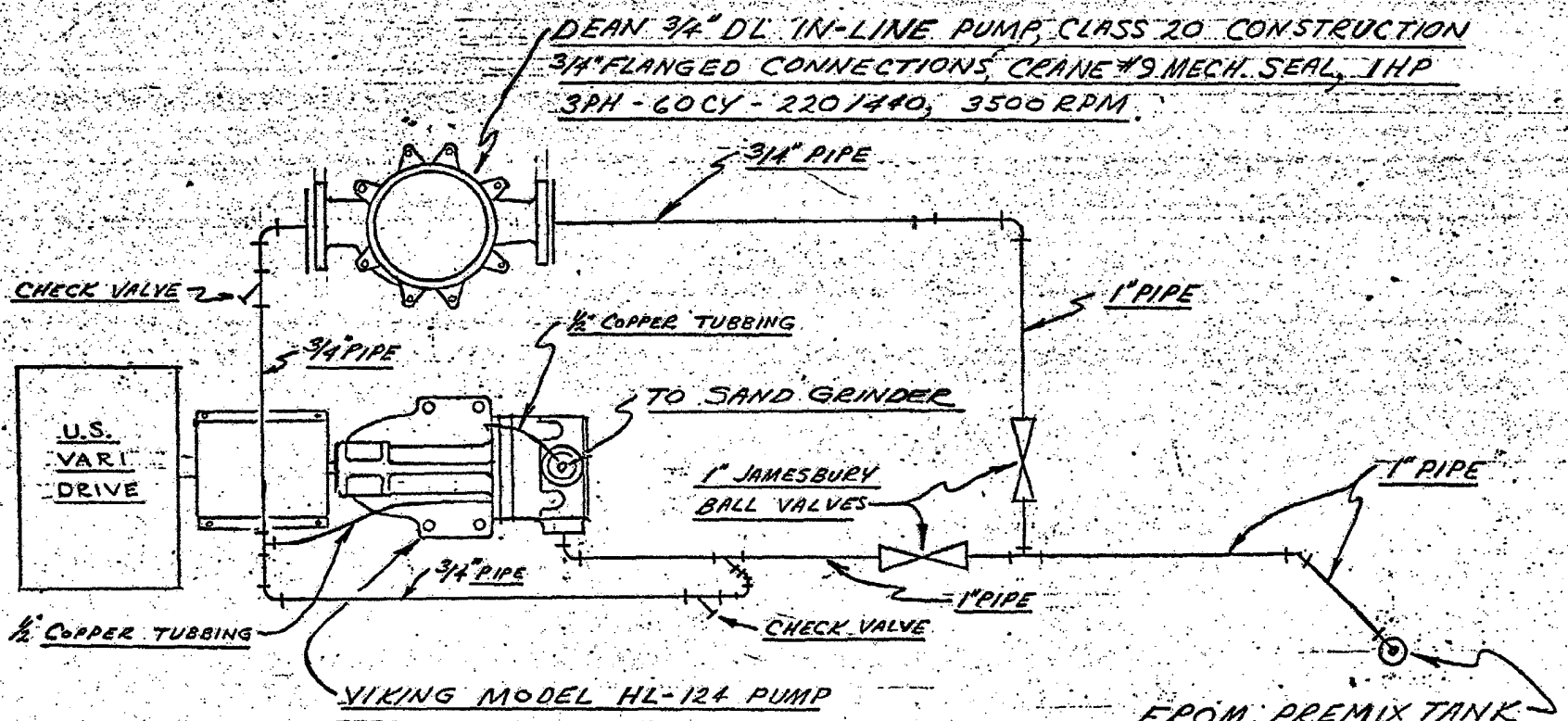
J. HART	3-13



DUP03000412

NOTE:

1" JAMESBURY BALL VALVES TO HAVE TEFLON SEATS & SEALS

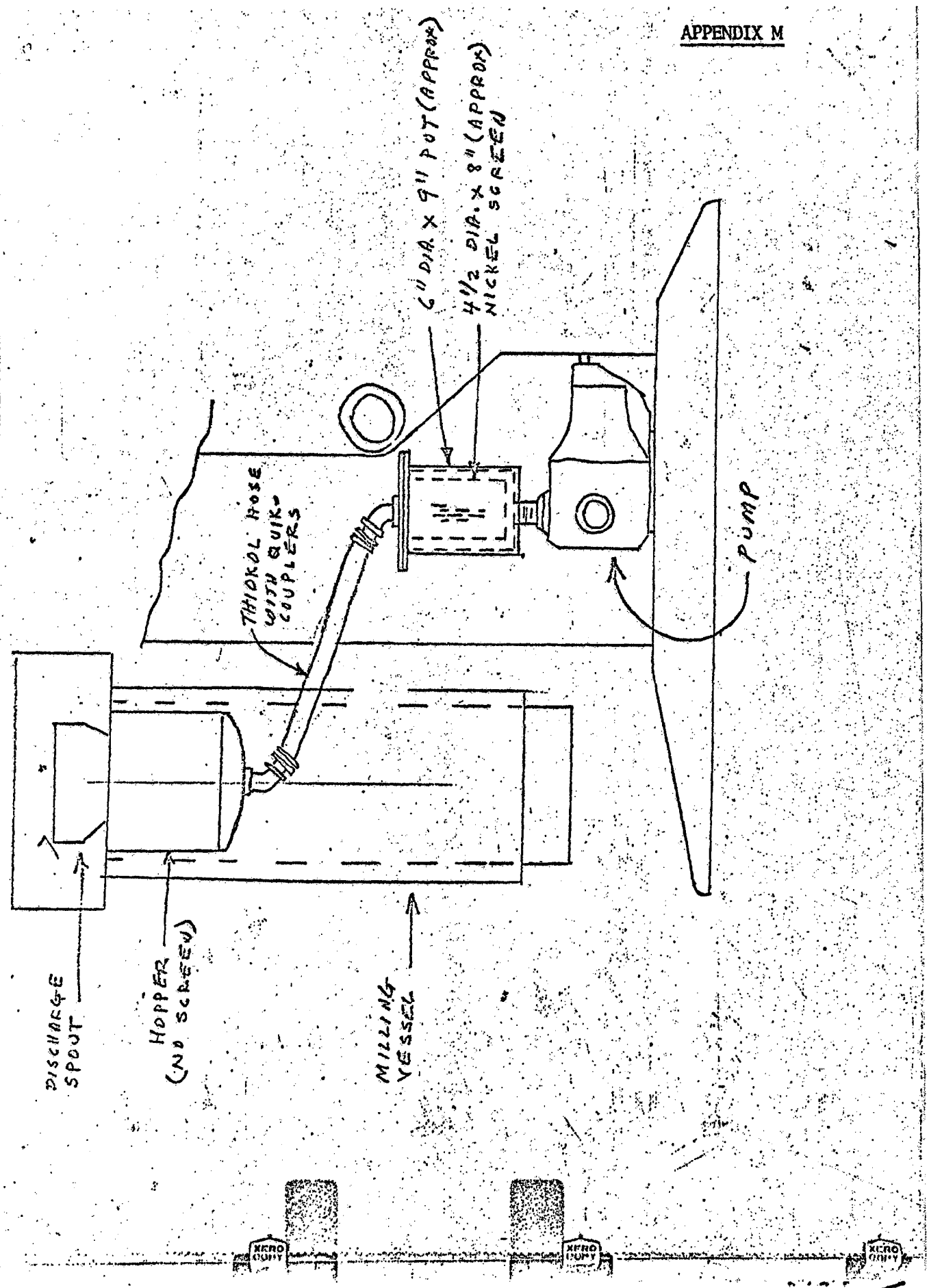


47- PROCESS FEED PUMP SOLVENT PUMP IN PARALLEL		
J. HART	3-13-68	

APPENDIX L (Cont.)

DUP03000413

APPENDIX M



DUP030002414

APPENDIX N

CC: C. P. KALB - WILM. P&P) IN
C. W. KACENA - " ") TURN
G. E. TIBBETTS - TOLEDO
R. F. DUNCAN - TOLEDO

Philadelphia Plant
March 7, 1968.

C. W. STAHL
TOLEDO

ATTENTION: J. J. TEACHEY

"47-PROCESS"
AUTOMATIC TEMPERATURE CONTROL
TOLEDO PLANT

Here is the information on a design for automatically controlling temperature that you requested. My crude sketch shows how to make your set-up with either open units or with closed head units. Quotation on the equipment involved is included with this letter. The vendor supplied engineering data with his quotation which gives you a pretty complete rundown on the equipment involved. Total cost is about $123.

This design for automatic control will provide on-off operation of a solenoid valve in the cooling water feed line. Sensing point is the ground base coming off the unit. The controller is adjustable. Use a small bypass line around the solenoid valve. You may find that it will be desirable to throttle some water through this bypass during operation.

This specific design is probably the least expensive way of controlling temperature in sand mills. I believe it will be more than adequate for your needs.

There are other alternate ways of doing the same job. Self-contained units such as Powers regulators will give you proportional control at a throttling valve but have the drawback of a very large sensing bulb. Temperature controllers are available with indicating dials and proportional controls. These controllers can be either electric or pneumatic. However, their cost is around $3-400 compared with the $123 for the present set-up. It will be cheaper for you to indicate temperature by using an inexpensive dial thermometer.

You will need temperature indication to set up the control circuit. It may be necessary to constantly bypass some water during operation in order to avoid excessive temperature cycling. Dial thermometers are cheap and reliable. However, check calibration before installing. Also, make sure that the thermometer's sensing probe is submerged at least two inches into the liquid.

DUP030002415

Other F. & F. sections are looking for inexpensive, reliable methods for controlling temperature in sand mills. There is interest on how well this particular set-up works out. Toledo Plant can again contribute to improved sand mill capability by providing rapid feedback on performance.

Please let me know if there is anything I can do to help you set up this design or expedite evaluation.

DIVISIONAL PROCESS ENGINEERING GROUP
W. H. EDWARDS, DIVISIONAL SUPERVISOR

WBC

By: W. B. Callahan

WBC:IL
Encl.

DUP030002416

E-48 REV. 11-59 ENGINEERING DUPONT COMPUTATION SHEET SHEET NO. _____

TITLE OF PROJ. OR STUDY SAND MILL DESIGN PROJ. OR STUDY NO. P-52

SUBJECT AUTOMATIC TEMPERATURE CONTROL WORKS P.E.

COMPUTER WRC DATE 3-6 19 68

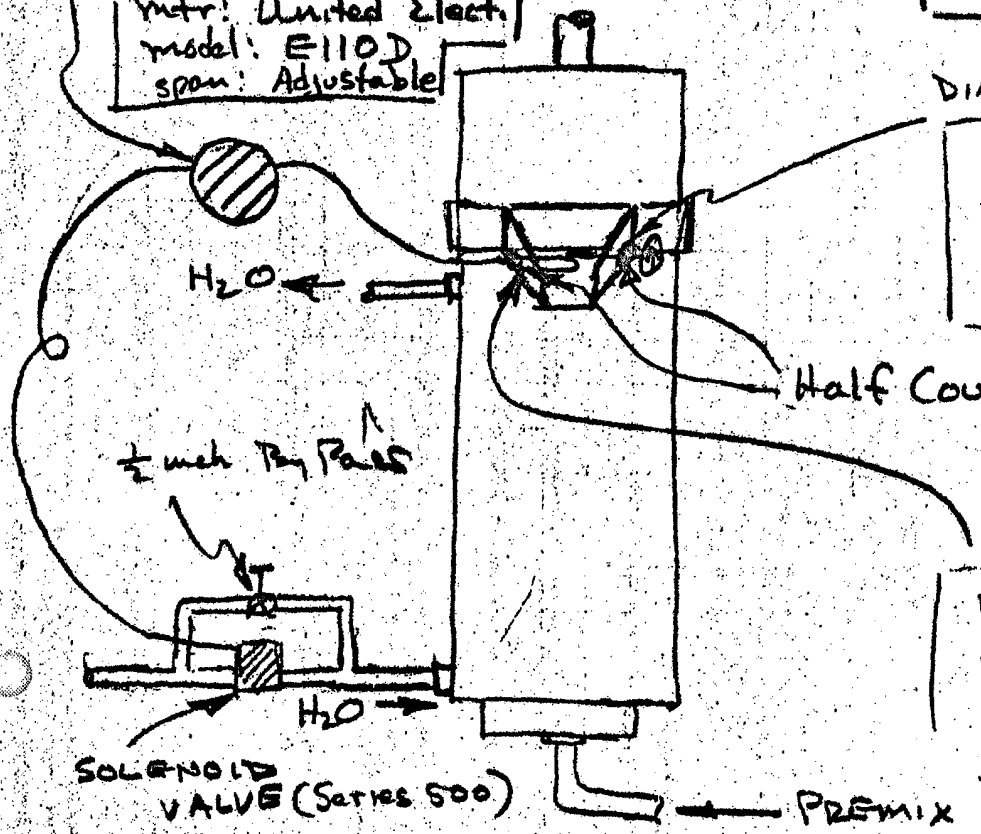
TEMPERATURE CONTROLLER →

mfr: United Electr.
model: E110D
span: Adjustable

ALTERNATE A

DIAL THERMOMETER

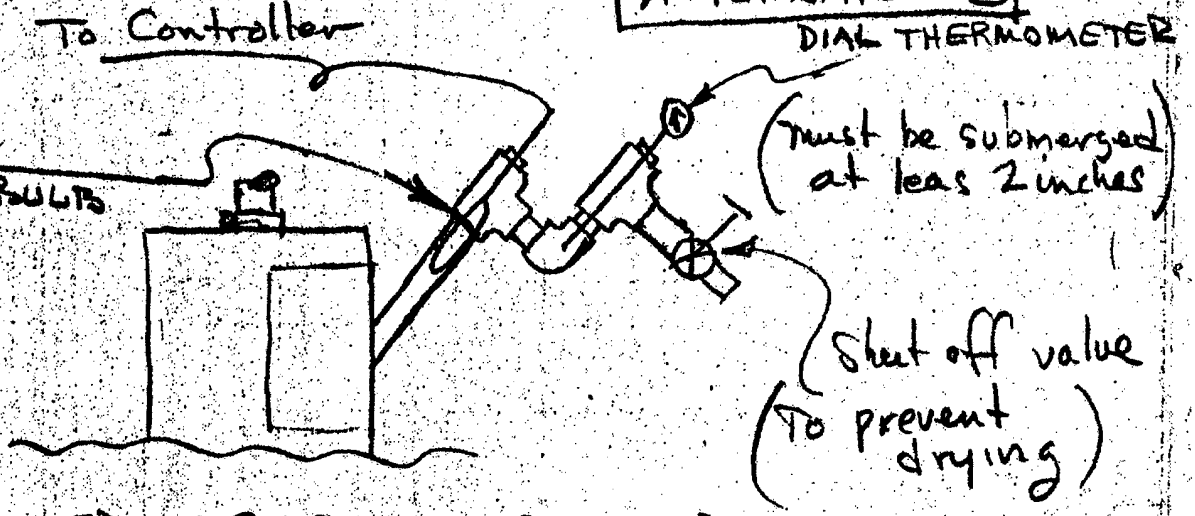
mfr: Weston or Moeller
range: 0-200°F
code: T200FA4



mfr: United Electric
size: 3/8 x 4 15/32
model: 6BS

OPEN SAND MILL SET UP

ALTERNATE B



CLOSED HEAD SET UP

WRC

SAVE TIME—USE THE STANDARDS

DUP030002417

PE-68-5

CC: W. D. LAWSON - WILM. F&F
C. W. THEOBALD - WILM. F&F
J. O. GRAVES - WILM. F&F)
C. F. KALB - " ") IN
R. J. KNAKE - " ")TURN
C. W. STAHL - " ")
E. T. BREUER - WILM. F&F
R. B. DAVIS - WILM. F&F
P. C. OLIN - WILM. F&F
K. E. ACKLEY - SO. SAN FRAN.
F. S. BAKER - MOBERLY
W. H. BEUTEL - PHILADELPHIA

CC: C. E. CORRELL - OLD HICKORY
R. A. DE WALL - CHICAGO
S. L. FINCH - TUCKER
J. W. GKONOS - TOLEDO
A. J. JENNINGS - FAIRFIELD
J. F. MC GETTIGAN - PARLIN
P. O. PEASLEY - EVERETT
H. R. STINE - FLINT
C. H. THOMPSON - FORT MADISON
O. H. BULLITT, JR. - MARSHALL LAB.
P. J. GRAHAM - EXP. STATION
R. W. LAURRELL - MARSHALL LAB.
C. N. SWINEHART, JR. - MARSHALL LAB.
G. I. MULHOLLAND - FLINT DEV. LAB.
P. R. STORVES - SO. SAN FRAN.
A. H. POTTER - WILM. F&F
F. W. TROMBLEY - AJAX

Philadelphia Plant
May 10, 1968.

CONFIDENTIAL

J. S. ALLEN
F. & F. DEPARTMENT
WILMINGTON

NON-TECHNICAL PLANT ASSISTANCE (P-52)
NEW "47-PROCESS" DESIGNS AND ARRANGEMENTS
DIVISIONAL PROCESS ENGINEERING GROUP

The attached report by W. B. Callahan summarizes, for informational purposes, the range of equipment and installation changes which have taken place in the past few years in commercial "47-Process". It should be noted that most of these changes have been installed and evaluated through the cooperation of Production Division plants under the overall guidance of Mr. Callahan. It is also obvious that no single "47-Process" installation represents the optimum for all plants. The specific installation should be carefully adapted to the individual plant requirements. Process Engineering will provide assistance where needed.

DIVISIONAL PROCESS ENGINEERING GROUP

W. H. EDWARDS
DIVISIONAL SUPERVISOR

WHE:IL
Att.

DUP030002418