Recent Developments and Improvements in Pressure Leaf Filters

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Abstract

This paper deals with new and different filter designs which have been offered to the oil industry. It also covers design changes on existing filters which have been made to correct the problems that have developed in operation. The paper also discusses the potential and practice of automating filters used in the oil industry.

Introduction

THERE IS A CONTINUAL demand for improvement of pressure leaf filters. Improved clarity is constantly sought, as are automatic dry cake discharge (preferably from a closed filter), drier cakes, simplified operation, maintenance-free operation, and new designs and ideas.

Some of these goals have already been achieved with the filters on the market, and others are being worked on with excellent results.

Clarity

Clarity on leaf filters dressed with wire mesh, precoated or not, has consistently proved to be better than the clarity obtained on cloth-dressed plate and frames. Superior flow distribution on tank filters has shown a more uniform precoat than plate and frame or Sweetland filters. Better leaf design has also improved clarity, as well as improving support design in the leaf. Welding leaves on the outer closure instead of riveting them has solved many clarity problems. Outlet nozzle design has also been improved, which has helped to improve clarity.

Automatic Dry Cake Discharge

Automation of pressure leaf filters for dry cake discharge is the greatest challenge to our industry. The industry now has several pressure leaf filters in service that discharge their filter cakes dry and automatically; however, these stations are not without some problems.

The cases listed below are examples of the type of filters that have complete automatic operations:

1) Pull-out type of filter operating on bleaching clay removal.
2) Horizontal tank vertical-horizontal rotating leaf filter-catalyst.
3) Rotating leaf-sluicing filter being used on miscella and catalyst.
4) Rotating leaf-wire or blade scraper bleaching clays.

The pull-out type of tank filter is used to a great extent in this industry; however, most of the installations are operated and cleaned manually. This type of filter can be cleaned enclosed with two additions: 1) cake vibrators, and 2) a trough tank with a screw conveyor. With these two features we clean this type of filter enclosed and automatically. Certain limits exist with this type of filter. Vibration is a problem if the leaves are cloth-covered or if the cake is very sticky. Most bleaching clay operations look quite favorable for automatic discharge. If the cake is thixotropic and cannot be conveyed, this type of filter cannot be used.

The horizontal tank vertical-leaf filter has a very definite place in this field. It lends itself to intermittent operation and also to operations where cake washing and drying is a problem, especially if the cakes are not stable.

The rotating-sluicing filter has found its place in miscella and catalyst filtration. The catalyst service is limited to those installations where the clay or catalyst is returned as a slurry for re-use. Automation on this type of filter is very easy.

Rotating leaf-wire or blade scraper discharge filters are currently being used on several bleach filtrations. This filter has had several mechanical problems in the past; however, these problems have been solved and the current design is sound.

The biggest problem facing our industry regarding the possibility of complete automation is handling the dry or semidry cake in an *enclosed* vessel. If the filter is opened, the purpose of automation is defeated. Opening means cooling and cooling takes time, and time is one thing we want to save with automation. Once the filter is open we introduce labor into the operation.

Between vibration and scraping, most of the cake is removed from the leaves and is discharged into the trough. As long as the cake is not thixotropic we can handle it and discharge it from the filters. Moving the dry cake out of the filter is currently being handled in one of three tank designs:

"V" Shape Trough With Sloping Bottom. (The trough should have a 30° slope.) A screw conveyor is mounted in this trough and the speed of the conveyor is dependent upon the application. This tank can be used in filters up to 2000 sq ft of area. Vibrators are sometimes mounted on the sides of the trough to help cake discharge. The tank discharge can be in the center or at one end. Cake breakers can also be installed in this type of tank.

Square Bottom Hopper Tanks. In this design the screw conveyor in the bottom of the tank has been eliminated. An open bottom which changes to a small hopper on the bottom of the filter is substituted for the screw. This type of tank is excellent for cakes which are impossible to convey; however, it is limited to small filters.

The Cone Bottom Tank. The comments made on the second type of tank also apply to the cone bottom tank. The cone is used when a vertical cylindrical tank is used.

Drier Cakes

While the goal of all filter manufacturers is complete cake dryness, complete dryness is not possible; however, there is a chance of getting down to possibly 10–15% on clay oil cakes.

A recent development in horizontal tank leaf filter has shown some very encouraging results with regard to drier cakes. The use of these segmented outlets have in some applications dropped the residual oil in a bleaching clay cake better than 10% below previous figures. This added dryness is attributed to a more efficient use of the available air or gas pressure. Instead of blowing all the leaves with a low CFM/sq ft, one section at a time is blown with a very high CFM/sq ft. The high CFM takes care of any unevenness in the cakes or any cracks which may appear while purging. Drier cakes are obtained with less air or gas.

With the sightglass in the line the operator can see when all the oil from that section has been purged. The sightglass also aids in observing the clarity of each section. If clarity is lost during a cycle, that section could be shut off until the cycle is completed.

The segmented outlet, as offered by many filter manufacturers, is a money-saving feature that should be on all oil filters.

Simplified Operation

Simplified operation on pressure filters is the most difficult challenge filter manufacturers face. Unless the filter can be fully automated the operator may damage the performance of the operation and the equipment itself; however, much has been done to try to minimize the "damage" that can be done by poor operation.

Customers can be shown by proper layout how to eliminate operational damage. With valves and pumps properly placed, operation efficiency can be improved considerably.

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Clarity, cycle lengths, and cake dryness are all improved on a well-laid-out station.

Physical damage to the filters has also been minimized by keeping the filter closed and performing the cleaning duties with vibrators, cutting wires, or scraper blades. Eighty-five per cent of our maintenance problems could be traced to operators' abuse of the filters.

Proper sizing of the filter with components, automated or not, will show a much better performance from the filters and operators. If the filter station is easy to operate, then maintenance will be minimized.

Maintenance-Free Operation

Besides automation, maintenance costs have been further decreased by improving on the design of the various weak points in the filter. Some of these are as follows:

1) Leaf design has been improved. With the use of expanded plate, heavy multiple wire mesh leaves and perforated plate, the industry has increased the strength of the leaves considerably. This change has reduced the bending, curling and warpage of filter leaves; however, if the leaves are bridged with cake, nothing will prevent leaf damage. This heavier leaf has also shown less failure when it is vibrated.

2) Outer closure on the leaf has also been improved with the welded closure versus the riveted or bolted.

3) Improved vibrator design has also cut down on maintenance. The type of vibrator, as well as the vibrator linkage, has been improved.

4) The use of a bellows seal on the vibrator has cut down on the shaft seal packing problems with older vibrators. The bellows offers a good seal without a deadening effect as is obtained with a standard packing seal.

5) A heavier connection between vibrator and leaves has also helped to reduce maintenance. Everything is vibrated simultaneously instead of being shaken apart, as was the problem in the past.

New Designs and Ideas

Antibridging bars have been installed. From the beginning of filtration, bridging the leaves with cake has always been greatly feared. To prevent this, many stations are operated at 50% of their capacity so the leaves are not overloaded.

Many attempts at cake-thickness detectors have been tried, but none until now have been foolproof.

With the antibridging bar design, the leaf is rotated continuously with a heavy rod mounted between each leaf. One or more rods are connected to a limit switch. When the cake builds up to this rod it causes the rod to lift. The moving rod triggers the limit switch and stops the cycle. Where more than one switch is installed, the cycle is stopped when *all* rods lift. With a rod between each leaf we are assured of a uniform cake on each leaf.

This design offers a great potential with regard to using a filter as a thickener.

Conclusion

The filter industry still has a long way to go before it can offer a filter that meets all the requirements outlined at the beginning of this paper. True, we have made progress, but our progress is too slow; we need more cooperation if we are to speed up. When you next filter project arises, discuss the application in detail with your filter vendors and inform them of all the various abnormal properties of the application. Do not let them think that what you are using is the best product available if it really does not work properly.

We in the filtration industry can be of great service to you if we are allowed to correctly engineer the job and not just price it to meet a hardware specification.

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NRS Elects Officers

At their recent annual convention in New Orleans, La., more than 400 delegate-members of the National Renderers Association elected W. R. Malloy as President; Nelson Morris II, first Vice-President; Stanley Frank, second Vice-President; and D. A. Specht, Executive Director.

Mr. Malloy has served the Association in many capacities, representing the NRA in Europe on several occasions. He is Secretary-Treasurer of Lynchburg Rendering Company, Lynchburg, Va.

New officers of the NRA. Left to right: D. A. Specht, Stanley Frank, W. R. Malloy, and Nelson Morris II.

• *Industry Items*

TEXACO TRINIDAD, INC., has under construction a multimillion dollar petrochemical plant at its refinery at Pointe-a-Pierre, Trinidad. The plant will manufacture more than 150 million lb per year of normal paraffins for use in biodegradable detergents and for other chemical uses. Since 1956, capacity has been enlarged from 135,000 barrels a day to its present level, and facilities for manufacturing benzene, toluene, xylene, cyclohexane, and lubricating oils have been added.

F & M SCIENTIFIC CORPORATION, Avondale, Pa., has announced the formation of a Commercial Analytical Services Group to provide consultant and analytical services on a fee basis, utilizing gas chromatography, infrared, atomic absorption, and ultraviolet spectrophotometry as well as the more common laboratory techniques.

NOPCO CHEMICAL COMPANY, Newark, N. J., has approved plans for the expansion of ethoxylation facilities at Cedartown, Ga. The expansion includes new facilities for the manufacture of products involving propylene oxide. Nopco has supplementary manufacturing sources of ethylene oxide adducts in the New York Metropolitan and Chicago areas.

THE CUDAHY PACKING COMPANY is considering the construction of a fresh sausage processing plant at Clay Center, Kan. Approximately 750,000 lb of fresh sausage could be manufactured there weekly.

FOOD TECHNOLOGY, INC., Chicago, Ill., has completed installation of a New-Aire Regulator, Series 400 Constant Temperature Humidity Cabinets for the Moffett Technical Center of Corn Products Company, Argo, Ill. It enables running of tests of three different conditions simultaneously.

FOSTER D. SNELL, INC., a 45-year-old independent company of chemists, engineers, and biologists, has been acquired by Booz, Allen Applied Research, Inc. The firm will continue to operate under its present name, and will retain both its current staff and services.