Developments of First Carbonation Vacuum Filter Details

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Introduction

The evolution of various methods of separating first carbonation sludge is no doubt well known to most of you. Development in the industry has moved through the plate and frame stage, pressure filter stage utilizing Kelley-type filters, and thence into a vacuum filter stage. The vacuum filter stage has included such combinations as Genter or Borden tube type vacuum filters followed by a suitable rotary vacuum filter to desugar the resulting sludge; and the more or less standard combination of utilizing a thickner or clarifier for initial sludge separation, followed by a rotary type vacuum filter. This paper is concerned principally with the recent developments and practices in the use of rotary type vacuum filters for reclaiming the dissolved sugars from this first carbonation sludge.

Procedure

Naturally, most of the initial developments were concentrated in improving the automatic valve head. This phase of development resulted in the present valve head with three separate sections—the filtrate or initial cake section, the wash or cleansing section, and the discharge or blow section. In view of the fact that this development is well established a review will be concentrated on developments for: (1) Protective coatings, (2) types of drainage grids and the adaptation of new type grids to old vacuum filters, and (3) a few methods of dressing the filters.

The problem of protective coatings to lengthen the life of the drums and metal parts of the filter has long been a subject of much controversy and varying methods. Almost everyone has utilized the clean and oil method to lengthen the life of the filters. However, this is a continuing expense and proper cleaning and oiling each season requires considerable labor, and costs about $.045 per square foot per year. This method does not offer complete protection to the drums, and an average steel filter drum so treated will probably require replacement after 25 years of service, involving a drum replacement cost of about $1.40 per square foot per year. Total drum maintenance then becomes about $1.45 per square foot per year.

Recently there has been developed a series of plastic paints which, if properly applied, appear to give a very durable protective coating. Tygon and Plasite are two examples of these protective coatings. The Plasite which has been used on vacuum filter drums is No. 7100 cold set. This is a material composed of thermo-setting phenolic resins modified with a small percentage of Epoxy resin, plasticizers, solvents, inert pigments, and a liquid alkaline catalyst.

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The procedure for applying this type of protective coating is to first sandblast the unit, clean up the sand, apply the initial primer, and then apply multiple coats of Plastie No. 7100. It is recommended that at least two coats be applied to give a thickness of .012 to .015 of an inch. The curing time is four to five days at about 70° F. and, with this type of coating, protection is afforded in corrosive conditions of temperatures up to 400° F. The initial cost for such an application is about $1 per square foot and, assuming a five-year life, this then represents $.20 per square foot per year. The additional drum life by the use of protective coatings is not known, but initially it would appear to be economically sound and certainly is a step in the right direction.

There are several other similar protective coatings that are suitable for varying temperatures and various types and strengths of corrosive elements, but it appears that Plastie No. 7100 will work out very well for use on first carbonation vacuum filters. The coverage for this material is about 40 to 50 square feet per gallon, and it can be applied wih a standard spray gun by the average sugar factory painter.

Figures 1 and 2 are pictures of a rotary vacuum filter to which this protective coating has been applied. This drum is equipped with perforated screen type grids, and has been in operation about 100 days since the application of the protective coating.

Figure 1.—General view of Plasite coated vacuum filter (perforated screen grids).

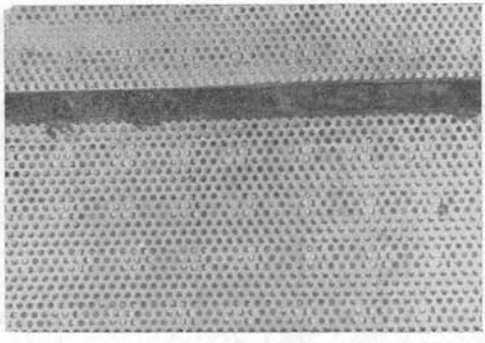

Figure 2.—Close-up view of Plasite coated drum and perforated screen.

The development of drainage grid details has also progressed through various stages, including wooden slats, wire screens, flat perforated screens (held in place by a strap, gasket and countersunk bolts), and snap-in screens, to mention a few. In recent years the perforated screen, either flat or snap-in, has been the most common.

However, the requirement of replacing this type grid periodically has been expensive in both labor and material, approximately $.67 per square foot per year on a six-year life basis. Filter manufacturers have made frequent and continuing revisions toward a more durable and suitable type drainage grid. One of the latest types is the hard rubber drainage grid which is depicted in Figure 3, a sketch projection of one grid section. Figure 4 is a picture of a rotary vacuum filter equipped with rubber grids

Rubber grids are furnished in sections 24 inches long, and in widths from 15 inches and 18 inches to fit the customer's filter. To modify a vacuum filter with screen type drainage grids to accomodate rubber grids, it is necessary first to remove the old screens, marcells, and division bars. When these are removed and the bolt holes, if any, are welded up, all welds and chisel marks are ground smooth and any spatter resulting from the welding is removed. At this stage, the drum should be bare and smooth and the existing drum heads (to which nothing has been done) should project about 1 inch above the drum.

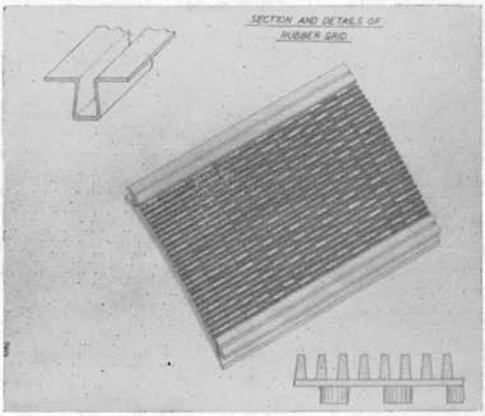

Figure 3. — Sketch projection and details of rubber grid section.

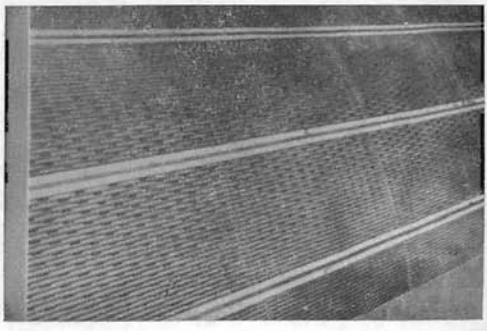

Figure 4.—Old style vacuum filter modified to the use of rubber drainage grids.

Next, the stainless steel grid clips shown in Figure 3, are welded to the drum in the position of the previous division bars. These are welded solid on the trailing edge of the clip and spot welded on the leading edge. This seals between the divisions, and gives strength to both sides of the clip. There is apt to be some warping of old drums from this welding as can be noted in Figure 4. The ends of the clips are seal welded to the drum heads. At this point the drum should be sandblasted and covered with a suitable protective coating as discussed previously.

To insert the grid section in the divisions it is necessary to warm the grids in water at 75° to 80° C. This makes the grid flexible and it can be bent along the long axis and inserted between the grid clips. The section is then pressed in place by hand to form to the contour of the drum. When the rubber grid cools a little, it again becomes rigid and retains the contour.

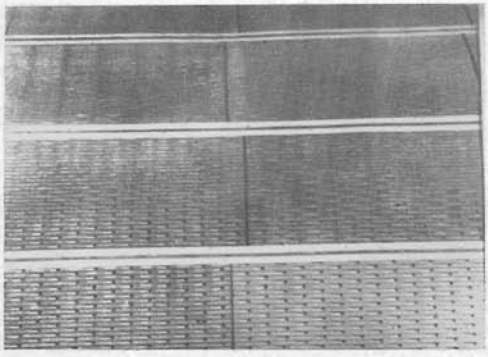

Figure 5. — Close - up of staggered grid sections.

To prevent a continuous joint in the grid sections around the drum (into which a wrapping wire could sink), the sections are staggered between divisions. Figure 5 indicates this staggering which is accomplished by starting every other division with a slightly shorter section on each end. The final result is a good substantial drainage grid which supports the filter medium. This modification complete with grids installed and a suitable protective coating costs about $7.30 per square foot. Allowing $6.30 per square foot for the grid installation alone, the break-even life of the rubber grids as compared to bolted screens would be between 9 and 10 years. It seems reasonable to assume that the rubber grids will last at least this long in carbonation service.

The grid clips are designed to permit either wrap dressing or panel dressing which represents the last phase in this discussion of recent developments. It has long been the custom to attach the filter medium to this type of rotary vacuum filter by means of seal wraps on each end and about 1⅛ inch spaced wire wrap across the face of the drum. In recent years some effort has been placed on eliminating the wire wrapping and utilizing a system of panel dressing across each division.

In panel dressing, the filter medium is attached to the drum by means of rubber or fiber rope which is caulked into grooves in the division strips. The cloth is sealed at the ends of the drum by wire wrap or steel band. No other wrapping is used, except that one or more steel bands may be placed around the drum to control billowing of the cloth during blowoff. In this type of dressing the cloth billows and bears against the discharge apron during blowoff. This action is said to clean the cloth more thoroughly than does the blowoff with conventional wire wrapping. This type of dressing is being used quite successfully in a comparatively difficult magnesium hydroxide operation near Salinas.

Experience has shown that panel dressing offers no marked advantages in carbonation filtration. The cleaning cycle was not markedly effected. On the other hand, the cloth life was shortened and labor requirements for dressing increased as compared to normal wire wrap dressing. It has been found that it takes about 2½ times as many man-hours to panel dress as it does to wire wrap a filter and this represents about $.057 per square foot more in labor alone.

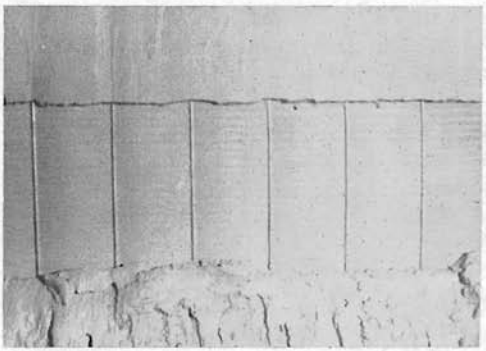

Figure 6. — 4-inch spaced wrap on rubber grid equipped filter.

Figure 7. — 4-inch spaced wrap on perforated screen grid equipped filter.

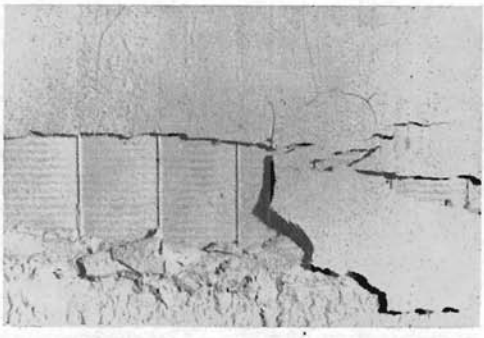

Figure 8. — 4-inch spaced wrap on rubber grid equipped filter.

A recent modification of wire wrapping has been found to be economical and beneficial. This involves the usual seal wraps on both ends but utilizes a four inch spaced wrap across the face of the drum. Figures 6, 7, and 8 show units in operation with four inch spaced wraps on rubber grids and on perforated screens, using cotton style No. 15 mesh cloth. Besides saving labor, his type of dressing reduces shutdown time for dressing by about 50 percent as compared to the normal 1⅛ inch spacing, and lowers the labor cost per dressing by about $.017 per square foot of area covered. The four inch type of wide wrap dressing has several advantages in (1) less wire requirements, (2) more filter media exposed, (3) better filter qualities, and (4) no apparent unsatisfactory "blow-by."

Summary

To summarize, three phases of recent developments in first carbonation vacuum filter details have been covered:

1. Protective coatings to lengthen the life of the filters. In this regard it is noted that there are various plastic-type paints that could be suitably applied at a cost of about $1 per square foot. The benefits are: (1) Longer life of the unit, (2) less maintenance, and (3) no continuing cleaning and oiling costs. The length of life for these protective coatings is still a guess, but certainly a 100-day campaign indicated no major problem.

2. New type drainage grids appear to be a better support for the filter media with improved drainage area. They can be adapted to old style filters at a cost of about $7.30 per square foot including protective coating, and thus far the maintenance requirements for replacement of broken grids, etc., average about ½ of one percent of the screen-covered surface, or about $.017 per square foot per year.

3. The methods of dressing rotary filters which included the normal wire wrap at about 1⅛ inch spacing, panel-type dressing and wide wrap dressing at about 4 inch spacing. For first carbonation filtration the latter method has been found satisfactory and economical.