United States Patent Office 3,474,911 Patented Oct. 28, 1969

3,474,911

FILTERS

Edward W. Olsen, Port Sulphur, La., assignor to Freeport Sulphur Company, New York, N.Y., a corporation of Delaware

Continuation-in-part of application Ser. No. 396,342, Sept. 14, 1964. This application Dec. 11, 1967, Ser. No. 691,114

Int. Cl. B01d 29/04

U.S. Cl. 210—318 2 Claims

ABSTRACT OF THE DISCLOSURE

A filter for filtering liquid comprising a housing with a plurality of filter elements in the housing connected, in parallel, at their outlets to an outlet manifold and a guard screen in the outlet having openings not substantially smaller than 1.2 times and not substantially greater than 2.5 times the size of the openings in the filter element, the guard screen permitting liquid filtered by the filter element to pass into the outlet manifold and preventing liquid which has not been filtered from passing into the outlet manifold.

This is a continuation-in-part of U.S. Application Ser. No. 396,342, filed Sept. 14, 1964, now abandoned, and relates to improvements in filters for use in cleaning or clarifying liquids.

The cleaning and clarification of liquids by filtration is an old and widely-used process. It is applied for clarifying widely diverse materials, such as, water, wine, beer, syrup, oil, varnish, sulfur, and similar materials. Clarification of these and other liquid is necessary, or at least desirable, to improve their salability through improved appearance, and to remove solid contaminants that would be harmful in the use to which the liquid is put. For example, it is essential that lubricating oil be free of solid particles which would be abrasive in bearings, or which would clog small conduits through which the oil is pumped to the bearings. Another example of the need for filtration occurs in the production of sulfur. Sulfur of commerce is an extremely pure material, containing less than 0.5% total impurities. The presence of solid particles of rock or of salt, derived from the deposit from which the sulfur is mined or otherwise, would make the sulfur unacceptable for many purposes. To insure freedom from these contaminants, sulfur produced by the Frasch process is frequently filtered while molten.

Filters are designed in a wide variety of styles and configurations. Generally, they include a container or housing through which the liquid is pumped under pressure. A filter element is contained in the housing. The liquid, as it is pumped through the housing, is passed through the filter element. As the liquid passes through the filter element, the particles to be removed are filtered from the liquid. In some instances the filter element is built into and is an integral part of the container or housing. More frequently, however, the filter element is a separate unit, constructed to fit into the container or housing, and can be removed for cleaning, servicing or replacement.

The filtering portion of the filter element may be fabricated from a wide variety of materials depending to a great extent, on the material to be filtered, the particles to be removed, the pressures to be employed, and other factors. Such material may be a metal screen, cloth, paper, ceramic, sintered powder metal, and a wide variety of other porous materials containing numerous, substantially uniformly sized, small openings. Where the filter element is removable, such porous material is usually fixed to a support frame. In the filtering operation the

particles removed, or filtered out, deposit on the inlet side of the filter element forming a porous coating or cake. Some of the particles of this initial cake may be smaller than the size of the openings of the filter element since the smaller particles coagulate or bridge over in clusters over the openings. A small percentage of the smaller particles pass through the filter element and are recycled with the liquid to the filter element until a continuous coating of the filter element results.

These particles, both large and small, that form the initial cake may be present in the liquid as contamination to be removed in the filtering operations. The nature of these solid particles may be such that a cake or coat of desirable characteristics is obtained and the resultant cake is porous and with continued buildup in the filtering operation does not cause excessive pressure drop increases.

In many cases the particles present in the liquid as contaminates will not form a cake of desirable porosity and filtering characteristics and therefore solid materials may be added to the liquid prior to filtering or may be added to liquid already filtered and such filtered liquid, with the solid material added, may be pumped through the filter before the filter is used. These solid materials are conveniently referred to as "filter aids" and the preliminary operation places a "precoat" of filter aid on the screen and improves subsequent filtering action.

The particles of solid material used as filter aids to precoat the filter element may be of a size smaller than the openings in the filter screen. As with the initial coating action when no filter aids are added, the smaller particles coagulate or bridge over in clusters over the openings. A small percentage of the smaller particles pass through the filter element and are recirculated with the liquid to the filter elements until a continuous coating referred to as precoat results in subsequent removal of all of the smaller particles.

The purpose of recycling the liquid during precoating is obvious. Because the solid particles of the precoat material are smaller than the filter openings, some of these particles pass through the filter during the initial stages of precoating. As precoating continues, these particles collect on the filter element and form bridges or arches across the openings. As precoating continues, these bridges or arches reduce the effective size of the openings, cause the precoat particles in the recycled liquid to be retained and the pre-coat cake to form. Once the cake is formed, however, the particles are not passed. The proper formation of the cake may be determined by examining the liquid discharged from the filter but, usually, is accomplished by recycling the liquid for a predetermined period of time after the filter is installed. Recycling is then stopped and the filtered liquid is discharged from the filter to storage or to the process for use.

After the initial coating of the filter elements is completed by recirculating liquid with or without the addition of filter aids, the filtration operation or cycle is started by pumping the liquid to be clarified or filtered through the filter. The solids are deposited as a cake on the inlet side of the filtering elements and the operation is continued until a thickness of the cake reaches a limit and/or the flow through the cake is sufficiently decreased because of increased pressure drop to result in uneconomical operation. The filter is then opened and the cake or deposit removed from the surface of a filter element or elements. After the deposit is removed, the filter is closed and filtration cycle, starting with the coating operation, is resumed.

One of the major difficulties with many filters is that the filter portions are fragile and develop tears and holes