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APPARATUS FOR WASHING POROUS MATERIALS

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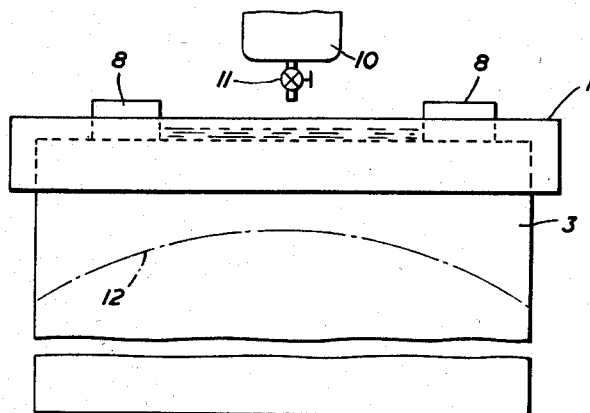


FIG. 1.

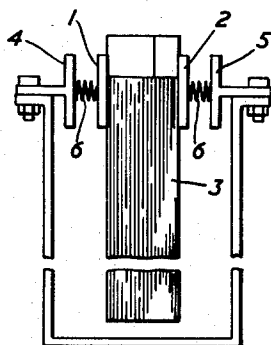


FIG. 2.

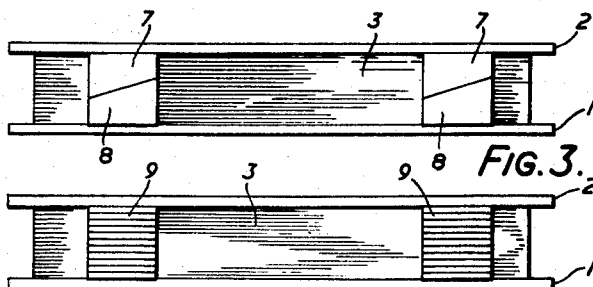


FIG. 3.



FIG. 4.

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APPARATUS FOR WASHING POROUS MATERIALS

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6 Claims. (Cl. 134-156)

This invention relates to apparatus for washing or otherwise treating porous material with liquids, and is particularly though not exclusively applicable to the washing of sheets of paper such as filter paper used in analytical chromatography.

In finely porous material such as filter paper any impurities present will normally be distributed throughout the material in the component fibres or particles and to remove the impurities by washing in a conventional manner is low and inefficient unless currents can be set up within the pores of the material. In many cases, and filter paper for chromatography is a particular instance, it is impossible to set up currents by mechanical agitation or thermal convection in view of the danger of weakening or destroying the material. It has been found that the best method of washing porous material in such cases is to allow the washing liquid to percolate through the material primarily by capillary forces. To obtain satisfactory reproducible results the rate of percolation must be equal in every part of the cross section of the material and furthermore a considerable volume of liquid must percolate.

In a previous proposal for washing filter paper in bulk, that is to say washing a considerable number of sheets of paper simultaneously, it has been proposed to clamp the upper ends of a "block" of sheets and to insert the upper end of the block into a slot in the bottom of a trough containing the washing liquid. This proposal suffers from the main disadvantage that it is difficult to prevent leakage around the edges of the block where it is inserted into a trough. The trough must be made very accurately and even then slight variations in thickness and width of the sheets create gaps which must be filled with a paste of pulp or similar material. This creates further difficulties due to the dirt introduced by manipulating paste into the gaps and moreover the apparatus is not adjustable to different numbers of sheets or different sizes of sheets.

It is an object of the invention to provide an improved apparatus for the purpose of washing porous material such as blocks of filter paper and apparatus according to the invention comprises a pair of side plates of a length not less than the width of the material, means for urging the plates towards one another to grip the upper part of the material with the upper parts of the plates lying above the material, a pair of expandable filler elements capable of substantially filling the gap between the plates, without necessarily making an absolute liquid tight seal therewith, at two spaced points in the length of the plates, thus forming a trough above the central part of the material, and means for supplying a washing liquid to the trough so formed.

It will be appreciated that no attempt need be made to provide a liquid tight seal at the ends of the material, which in fact do not lie within the trough. On the contrary the filler elements are placed short of the ends of the porous material and the leakage past these filler elements is used deliberately to supply liquid to the parts of the material outside the filler elements. It is relatively

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simple to ensure a tight contact between the side plates and the side surfaces of the material and thus there is no necessity to provide any special liquid seal. Furthermore the gap between the plates can be varied considerably with great ease and any desired width of material or number of sheets can therefore be washed at one time. Moreover the length of the sheets is not critical to the functioning of the apparatus since the position of the filler elements can be easily adjusted.

Preferably the side plates are urged inwards towards one another by resilient means capable of applying a substantially constant force on the plates over an appreciable range of distances between the plates.

The side plates and filler elements are conveniently made of glass, which is chemically inert to most liquids. In apparatus according to the invention no special shaping or dimensioning of these parts is required.

In one preferred form of the invention the filler elements each comprise a pair of wedges to permit adjustment of the thickness of the filler elements. Alternatively each filler element may be built up from a series of thin plates.

The invention may be performed in various different ways but one specific embodiment and a modification thereof will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a front elevation of the apparatus with the supporting framework removed for clarity,

Figure 2 is an end elevation of the apparatus showing the framework,

Figure 3 is a plan view of the parts shown in Figure 1, and

Figure 4 is a similar plan view of a modification of the invention.

In this example the apparatus comprises a pair of side plates 1, 2, formed of plate glass, of a length somewhat greater than the maximum width of the filter papers 3, these plates being supported from a frame including two parallel abutments 4, 5, spaced apart by a distance somewhat greater than the expected maximum spacing between the two glass side plates 1, 2. A series of horizontally spaced compression springs 6 are provided between each of these abutments and the adjacent glass side plate, so urging the plates towards one another to grip the upper part of a block comprising a number of sheets of filter paper 3. The side plates 1, 2 are positioned in relation to the paper block so that their upper edges are somewhat above the level of the upper part of the block of paper and a pair of filler elements are then positioned between the side plates and resting on the upper surface of the paper at points adjacent to but spaced somewhat from the opposite ends of the paper sheets. The filler elements are also of glass and each comprises either a pair of opposed wedges 7, 8 as in Figure 3, which thus permit the width of the filler elements to be adjusted to suit the corresponding width of the block of filter paper, or alternatively they may comprise a number of thin glass slides 9, as shown in Figure 4, in which case the overall thickness will be adjusted by inserting or removing some of these slides. In any case it is unnecessary for the filler elements to make an absolutely liquid tight seal with the inner faces of the glass side plates 1, 2 and in fact some leakage or seepage past the filler elements is desirable to the working of the invention.

The apparatus also includes means for admitting a washing liquid to the trough formed between the two side plates and the filler elements, such means in a laboratory usually comprising a gravity tank 10 with an adjustable feed cock 11.

In use, with the block of filter paper sheets 3 positioned between the glass side plates as referred to above the washing liquid is supplied into the trough to fill the trough

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to a suitable depth. The liquid percolates downwards through the filter paper and also percolates around the filler elements to wet the upper parts of the filter paper outside the filler elements. It will be appreciated that the positioning of the filler elements determines the proportion of the filter paper at the opposite ends of the block which is supplied with washing liquid by seepage round the elements. When the washing process begins therefore the downward moving wet "front" of the percolating liquid is watched and noted. If this "front" is concave downwards as shown by the chain line 12 in Figure 1, the filler elements are too close to the ends of the block, which are receiving too much liquid. If the "front" is convex downwards the filler elements are too close to one another. The position of the filler elements is therefore adjusted till the "front" is straight and horizontal.

What I claim as my invention and desire to secure by Letters Patent is:

1. Apparatus for supporting sheets of porous material for treating the material with liquid comprising a pair of parallel side plates spaced apart from one another and of a length not less than the width of the material, means for urging the plates towards one another to grip the upper part of the material with the upper parts of the plates lying above the material, and a pair of expandable filler elements capable of substantially filling the gap between the plates at two spaced points along the length of the plates while allowing limited leakage past said elements, thus forming a distributing trough above the central part of the material.

2. Apparatus as claimed in claim 1 in which the side plates are urged inwards towards one another by resilient means capable of applying a substantially constant force

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on the plates over an appreciable range of distances between the plates.

3. Apparatus as claimed in claim 1 in which the side plates and the filler elements are formed of glass.

4. Apparatus as claimed in claim 1 in which each filler element comprises a pair of opposed wedges to permit adjustment of the thickness of the filler elements.

5. Apparatus as claimed in claim 1 in which each filler element is built up from a series of thin plates.

6. Apparatus for supporting sheets of porous material for treating the material with a washing liquid, comprising a pair of parallel side plates spaced apart from one another and of a length not less than the width of said material, means for urging said plates toward one another to grip the upper part of said material with the upper portions of said plates extending above the said material, and means forming a washing liquid distributing trough to distribute washing liquid over a selected portion of said material including a pair of expandable filler elements spaced apart in the direction of the length of said plates and selectively located between said plate portions to form a liquid distributing trough over a selected portion of said material.

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