May 29, 1945. H. LEHRECKE 2,377,252

FILTERING APPARATUS

Filed July 28, 1942

Fig. 1.

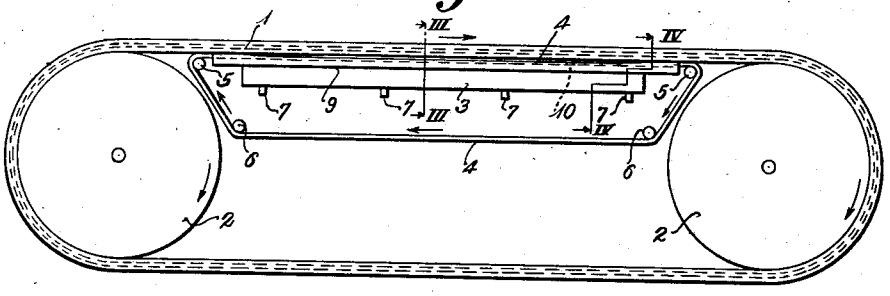


Fig. 2.

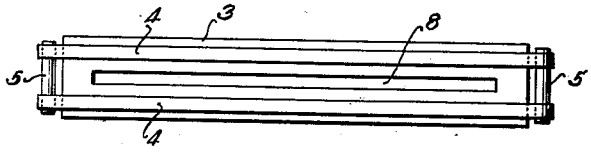


Fig. 3.

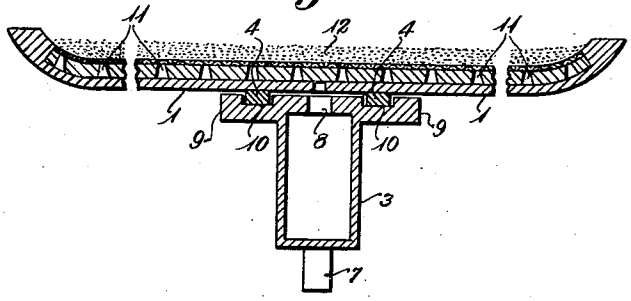


Fig. 4.

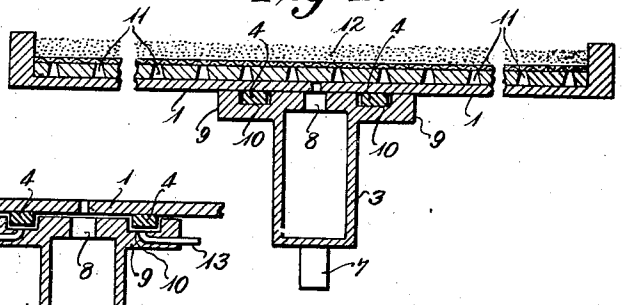
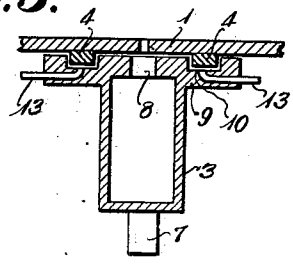


Fig. 5.



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Patented May 29, 1945 2,377,252

UNITED STATES PATENT OFFICE

2,377,252

FILTERING APPARATUS

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Application July 28, 1942, Serial No. 452,647

7 Claims. (Cl. 210—197)

This invention relates to an improved apparatus for filtering mixtures of solid and liquid substances.

For filtering mixtures of solid and liquid substances and for washing the filter cake it is known to employ apparatus in which an endless horizontal carrier band of an elastic material such as rubber is carried by means of guide rollers over one or more suction boxes which are narrower than the band, and are open to the lower surface of the carrier band, the length of the suction box or boxes coinciding with the direction in which the band is travelling. The elastic carrier band is provided with openings and it is guided in such a way that said openings pass over the upper openings of the suction box or boxes, an air-tight seal being effected by the smooth and even edges of said box or boxes contacting with the lower surface of the band. The upper surface of the carrier band may be provided with ribs, bars or knobs or other projections in order to form cells or cavities between the carrier and the filter medium and thereby uniformly to distribute the vacuum over the lower surface of the filtering medium. According to a further form of construction there is arranged between the carrier band and the filtering medium a separate endless band which is also elastic and is porous or perforated or otherwise made permeable in a vertical direction. This intermediate band may be provided on its lower surface with ribs, bars or knobs or other projections, the upper side of the carrier band being plane in this case. The carrier bands are provided with upstanding edges of different height between which the filter medium or the intermediate band or both are positioned.

Such band filters possess in many respects great advantages over filters of other types such as drum filters, disc filters, etc., as it is possible in using them to avoid any formation of cracks in the filter-cake, to vary the thickness of the filter cake as desired, to effect the filtering operation and to wash the cake as formed in horizontal position on one single machine only and to remove the washed filter cake automatically from the filtering medium without the aid of compressed air or like means.

I have found, however, that difficulties will arise in such band filters if the speed at which the band is driven exceeds certain limits. Such may be the case if it is desired to use a very long band or if the material on the filter is such the liquid is apt to pass very easily through it. If in such a case the velocity of the moving band exceeds a certain value the friction between the elastic carrier belt and the upper edges of the suction box will be so high that an undue consumption of energy, a rise in temperature, undue wear of the elastic material and other difficulties will arise. Such difficulties will also arise if the liquid to be filtered has a very low viscosity and, therefore, can not act as a lubricant between the elastic belt and the suction box.

The object of the present invention is to remove all such difficulties as have hitherto limited the use of band filters of the said type. The improvement consists in the provision between the carrier belt and the edges of the suction box of narrow auxiliary belts of a flexible textile material or of an elastic material and textile cloth which both effect a sealing between the lower surface of the carrier belt and the upper surface (viz. the edges) of the suction box and eliminate the friction due to the direct contact between the carrier belt and the suction box.

These auxiliary belts are likewise endless. Their upper surface is smooth so as to adhere strongly to the lower surface of the elastic supporting filtering band whereas their lower surface is adapted to slide easily over the edges of the suction box.

The auxiliary belts move in grooves in the upper longitudinal edges of the suction box on both sides of the upper opening of said box and at their bottoms the said grooves are well polished and they may even be provided with a lining of some special material having a very low friction. The depth of the grooves 10 at the ends of the suction box is the same as the thickness of the belts 4. However, between the ends of the box, the grooves are shallower so that the belts 4 project above the top of the box. With this relationship, the upper surface of the auxiliary belts will be level with the surface of the suction box at the ends of the suction box so that at these points there will be a sealing action between the suction box and the elastic belt so that suction will be maintained at these points. Between the ends of the suction box, the elastic belt will ride higher than the surface of the suction box so that frictional wear will not occur and suction is maintained in this location by the auxiliary belts.

After passing over the suction box the endless auxiliary belts return below the box to its other end. During their passage they can be passed over rolls administering a predetermined tension to the belts.

The effect of the provision of the auxiliary belts is that the friction between the edges of the

stationary suction box and the moving carrier band will be reduced to a minimum. Said carrier band which is much more expensive than the auxiliary belts will be spared and can be used during a considerable time. The auxiliary belts when worn can easily be exchanged at low costs.

The auxiliary belts will as already mentioned be positioned on both sides of the upper opening of the suction box. According to the invention they are either made of alone textile material or an elastic material such as rubber which on their lower surface and on their upstanding edges, i. e., on all surfaces which are not in contact with the carrier band have textile inlay. The bands may also be made from an elastic material having no inlay or an inlay only on its under side.

The invention will be further explained by reference to the accompanying drawing showing a preferred embodiment thereof.

Fig. 1 is a vertical longitudinal section of the apparatus.

Fig. 2 is a top plan view of the suction box showing also the auxiliary belts.

Fig. 3 is a vertical transverse section through the apparatus on a larger scale along the lines III—III in Fig. 1.

Fig. 4 is a vertical transverse section through the apparatus on a larger scale along the lines IV—IV in Fig. 1, illustrating a different form of the carrier band at its margins.

Fig. 5 is also a transverse section through a portion of the apparatus showing a detail.

As best seen from Fig. 1 the elastic endless carrier band 1 travels over the suction box 3 and the drums 2 in the direction indicated by the arrows. Between the upper longitudinal edges of the suction box and the filter carrier band there are provided two endless auxiliary belts one of which only is shown in Fig. 1. These auxiliary belts travel in the direction indicated by the arrows horizontally over the rolls 5 and the suction box 3 and return over the tensioning rolls 6 to the left side of the suction box. The filtrate leaves the suction box through the draining tubes 7.

Fig. 2 shows that the two auxiliary belts are positioned on both sides of the opening 8 in the suction box.

Fig. 3 shows the position of the carrier band in relation to the upper edges of the suction box at the middle of the suction box when lifted by the auxiliary belts.

Fig. 4 shows the position at the ends of suction box where the carrier band makes close contact with the edges of the suction box.

As shown grooves 10 are provided in the upper edges 9 of the suction box 3 in which the auxiliary belts 4 can slide. Superposed on these belts 4 are the means 11 for evenly distributing the vacuum created by suction and drawing off the filtrates and superimposed thereon the filtering medium.

A different form of the carrier band at its margins is shown in Figure 4. The invention will have the same utility in all band-filters which use elastic bands and wherein a vacuum is created in the suction box.

In order that the auxiliary belts should not slide on the surface of the carrier belt it should be made smooth and even and preferably of an elastic material such as rubber and a rubber composition.

As shown in Fig. 5 there may be means as indicated by the duct 13 in Fig. 5 for forcing a lubricant to the grooves 10 below the belts 4.

Having thus described my invention I declare that what I claim is:

1. A filtering apparatus of the band-filter type for separating liquids or solutions from solid substances and washing the latter, comprising a suction box open at the top, a drum at opposite ends of the suction box, an endless carrier band of an elastic material passing over the suction box and around the drums, a perforated elastic belt immediately inside of and traveling with said carrier band for distributing the suction, said suction box having grooves in the top thereof on opposite sides of the opening in the top and extending longitudinally in the direction of travel of said carrier, an auxiliary endless belt of flexible textile material running in each of said grooves and contacting the elastic belt, and means for guiding the auxiliary belts around the suction box.

2. A filtering apparatus as claimed in claim 1 wherein the auxiliary belts have a plane and smooth upper surface.

3. A filtering apparatus as claimed in claim 1 wherein the auxiliary belts are made of elastic material and provided with textile inlay on all sides which do not contact with the carrier band.

4. A filtering apparatus as claimed in claim 1 wherein the auxiliary belts are made of elastic material and provided with textile inlay on their lower surface only.

5. A filtering apparatus as claimed in claim 1 wherein the auxiliary belts are composed solely of elastic material.

6. A filtering apparatus, as defined in claim 1, wherein the depth of the grooves adjacent the ends of the suction box is equal to the thickness of the auxiliary belts so that the elastic band will be in sealing contact with the suction box at these points, and the depth of the grooves between the ends of the suction box is less than the thickness of the auxiliary belts so that at this location the elastic belt will not frictionally contact the suction box.

7. A filtering apparatus as claimed in claim 1 wherein means are provided for tensioning the auxiliary bands during their return passage below the suction box.

HANS LEHRECKE.

CERTIFICATE OF CORRECTION.

Patent No. 2,377,252. May 29, 1945.

HANS LEHRECKE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, second column, line 20, claim 1, after the word "endless" insert --perforated--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of September, A. D. 1945.

Leslie Frazer

First Assistant Commissioner of Patents.

(Seal)