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2,570,697

FILTERING APPARATUS

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Fig. 1.

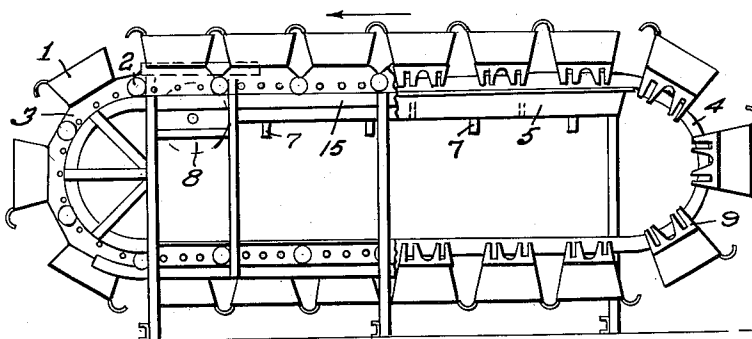


Fig. 2.

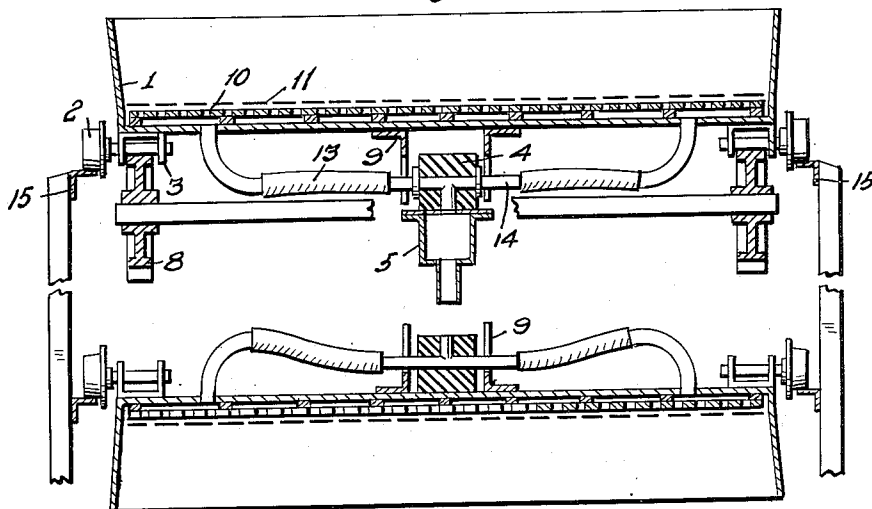


Fig. 3.

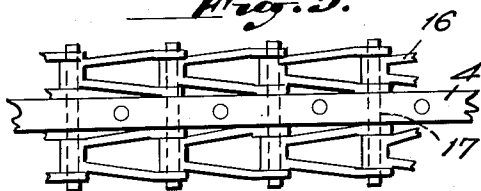


Fig. 4.

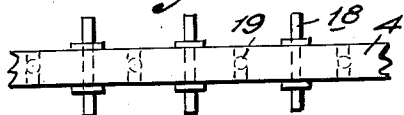


Fig. 5.

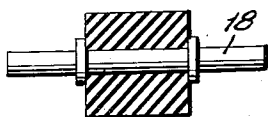
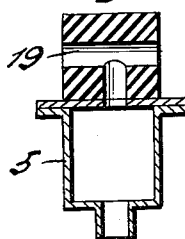


Fig. 6.



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FILTERING APPARATUS

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4 Claims. (Cl. 210—197)

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The present invention relates to an improved apparatus of the vessel-belt type for filtering and washing mixtures of solid and liquid substances.

In so-called belt-filters, the main parts of which consist of a rubber belt with upstanding or upturned sides sliding over a suction box, an auxiliary belt of an elastic material is sometimes introduced between the main belt and the suction box in order to spare the main belt from wearing effects. By means of channels in this so-called suction belt those parts of the main belt which are to be set under vacuum communicate with the suction box. It is of no consequence which of the two belts is driving the other since the driven belt firmly adheres to the driving one on account of the vacuum which is set up when both belts, closely pressed together, are driven over the suction box.

In filters of the so-called vessel-belt type, for example travelling traybelt filters, the continuous main rubber belt has been changed to a belt made up of a series of vessels. These vessels are suitably provided with perforated false inner bottoms over which the filter cloth is fastened. The space between the two bottoms of each tray can be placed under vacuum by being connected with channels in the suction belt, which channels in turn are connected to the suction box. It is, however, impossible to cause the two belts to cooperate in such a way that they will adhere to each other as an effect of the vacuum. This is prevented by the different way in which the two belts behave at their turning points, where the trays or vessels will follow a different path than the elastic suction belt. Another difficulty is caused by the fact that in larger sized filters the individual filtering boxes of the vessel belt have to be supported by wheels, and consequently cannot be pressed by gravity against the suction belt which would be necessary in order to establish a vacuum connection by direct contact between the two belts.

The object of the present invention is to provide means for obtaining a suitable cooperation between the vessel belt and the suction belt. According to the invention the vessel belt is mounted to revolve on an endless trackway and is connected to the suction belt in such a manner that the movement of one controls the movement of the other so that the two move simultaneously and retain the same relative positions. Various means may be used for connecting the two belts such as a rigid connection by use of interlocking pins or they may be connected by the cogs of

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an endless chain with the cogs interconnected to produce synchronization between the movement of the belts so that a complete revolution of one will result in a complete revolution of the other.

The vessel belt is preferably built in such a way that a number of trays or boxes of the same size are united to an endless belt. Between the trays are suitably mounted shafts connected with the trays by bendable joints. On said shafts are mounted wheels which support the trays and roll on the framework. In this way each link of the belt containing one tray or box will be given a length equal to the distance between the centre lines of two adjacent shafts. One way of driving the vessel belt is to equip each link with a row of cogs on each side and driven by a pair of cog-wheels. With this construction no drums are needed at the turning ends of the belt since the framework may be given such a form that the travelling course of the belt is fixed by the wheels running on the framework. If the trays are all made of equal size, which construction is recommended, the number of cogs in the vessel belt will be an even multiple of the number of vessels.

A suitable construction of the means for moving the flexible suction belt is to let these means be constituted of cogs or projecting parts of the belt itself cooperating with parts on the vessel belt. Another possible construction is to place a link-chain on one or both sides of the suction belt and to lengthen the bolts of the link chains so that they can be put through holes in the suction belt, which in this case should be given a square or rectangular section with a relatively large height compared with the width.

It is also possible to arrange the driving of the two belts in such a way that one belt is driven by the other. If this is to be performed in a direct way the outer circumference of the suction belt must be equal to the inner circumference of the vessel belt, i. e. the effective lengths of the two belts must be the same. This is a consequence of the fact that if the velocities of the belts are equal and the revolutions per minute the same, the respective routes must also be equal. This fact can also be explained in the following way. When the suction belt is sliding over the suction box and at the same time is driving the vessel belt or is being driven by the same, each link of the vessel belt must correspond to a part of the suction belt of exactly the same length. Consequently the total effective length of both belts must be equal.

If this condition is fulfilled one belt can drive

the other in a direct way. If, for instance, chains are mounted on both sides of the suction belt this belt can be driven by a pair of cog-wheels. It is then possible to mount tractive means on the chains and to let those means act on corresponding means mounted on the vessel belt so that the latter belt will be driven with the same speed as the suction belt. It is also possible to mount tractive means on the vessel belt which act on corresponding means mounted on the suction belt, for instance in the form of bolts or pipes put through the said belt. This has in fact proved to be the best construction in practice. It is, however, to be observed that if both belts have the same effective length the position of each belt will be completely fixed in a vertical section as soon as the number of links at the turning points of the vessel belt has been fixed. The vessel belt is generally built in such a way that it is bent at its turning ends in a hexagonal or octagonal form. In a vertical and radial projection the distance between the two belts will be varying and the communicating means between them must therefore be constructed in such a way that the suction belt can move freely in a vertical plane through its centre line. The consequence of this is that the vacuum connections between the bottoms of the vessels and the suction belt must be made of a flexible material, for instance of rubber to allow of such a movement.

It is recommended to give the channels in the suction belt a T-form permitting the filtrate from the vessels to enter from both sides horizontally and to pass to the suction box through a vertical channel. Such T-formed channels should be arranged between the above mentioned connecting means mounted for the driving of the suction belt. It is also possible to let the pipes, which are placed horizontally in the T-formed channels, serve as means to be acted upon by the driving means mounted on the vessel belt. If the size of the filter is comparatively large two or more T-formed channels should be used for each vessel.

In the following are described suitable embodiments of the invention by way of example having reference to the accompanying drawing in which—

Fig. 1 is a diagrammatical side elevation of a tray-belt filter;

Fig. 2 is a vertical cross-section through the filter in Fig. 1 on a larger scale;

Fig. 3 shows an arrangement of the suction belt;

Fig. 4 shows a suitable arrangement of means on the suction belt for cooperating with corresponding driving means on the tray belt.

Figs. 5 and 6 show cross-sectional details of the arrangement in Fig. 4.

Similar parts are denoted by same numerals in all figures.

Fig. 1 is a diagrammatical side elevation of a tray-belt filter. An endless belt of trays 1 is rolling on wheels 2 on the frame-work 15. Inside this belt a suction belt 4 slides over a suction box 5. The suction box is provided with partition walls 6 for collecting different filtrates and with outlets 7 connected to recipients under vacuum. Each tray is on both sides provided with cogs 3 on which act a couple of cog-wheels 8, one on each side. In this way the belt is driven. By means of suitable connecting means or prongs 9, fastened to the bottom of the trays the tray belt drives the suction belt 4 with the same

velocity as its own and also with the same number of rotations per hour, the two belts being of the same length. These connecting means 9 which have the form of prongs engage with pins 18 fastened to the suction belt, as shown in Figure 4. In the right hand side of Figure 1 is seen how the rubber suction belt at the turning ends approaches the bottoms of the trays as previously described. Figure 1 as well as Figure 2 shows the form of the prongs 9 which permit the suction belt to move in a vertical plane through the centre line of the belt in accordance with this approach at the turning points.

Figure 2 is a cross section through the filter shown in Figure 1 on an enlarged scale taken through one of the trays in a horizontal position. The tray 1 is moving on wheels 2 rolling on the frame-work 15 of the apparatus. The wheel shafts form part of the cogs 3 which are operated on by the cog-wheels 8. The filtering trays are provided with perforated false inner bottoms 10 which are kept at some distance from the outer bottom. Over this inner bottom the filter cloth 11 is placed. From the outer bottoms of the trays metal pipes 12 and rubber pipes 13 are provided for leading the filtrates to the suction belt 4. Through T-formed channels in said belt are stuck metal pipes 14 which have openings communicating with the vertical channels leading to the suction box 5. The elements 12, 13 and 14 constitute flexible tubes connecting the suction conduit with the filter trays. The suction belt 4 slides over the suction box 5 and is pressed by the atmospheric pressure against its upper part. The suction belt is driven by the prongs 9 which either can cooperate with the pipes 14 or with bolts or pipes 18 as shown in Figure 4.

Figure 3 shows an arrangement of the suction belt when it is desired to have this belt driven separately. On each side of the suction belt 4 are placed link chains 16, both chains having lengthened bolts 17 placed through holes in the suction belt. The means driving these chains should be connected to the cog-wheels 8 driving the tray-belt in such a way that the number of revolutions of each belt during a certain time will be the same.

Figure 4 shows the arrangement of the pins or bolts 18 which are acted upon by the cooperating means mounted on the tray belt as already described. Figure 4 also shows the T-formed channels 19 into which are stuck the pipes 14 shown in Fig. 2. Figures 5 and 6 are cross-sectional details of the belt arrangement shown in Fig. 4.

I claim:

1. A filtering device of the endless vessel-belt type comprising a frame, an endless trackway mounted on said frame, an elongated stationary suction box mounted at the top of said frame having a longitudinal channel connected with suction means, an endless vessel-belt supported by and movable along said trackway comprising a plurality of filtering trays mounted in series and adapted to move around said trackway, the bottoms of said trays serving as filters, an endless suction belt having the same effective length and mounted concentrically with said vessel-belt to move along said trackway in contact with said suction box to close the channel thereof, conduit means in said suction-belt communicating with said channel in an airtight manner, a plurality of flexible conduits connecting said conduit means with each of the filter trays to produce suction at the bottoms thereof, means for driving said vessel-belt around said trackway and a plurality

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of connections between said vessel-belt and said suction-belt permitting relative movement in a radial direction between said belts for driving the latter at the same velocity and revolutions per minute as the former.

2. A filtering device of the endless vessel-belt type comprising a frame, an endless trackway mounted on said frame, an elongated stationary suction box mounted horizontally at the top of said frame having a longitudinal channel provided with a conduit for connection to a suction means, an endless vessel-belt supported by and movable along said trackway comprising a plurality of separate filtering trays mounted in series and adapted to move around said trackway, the bottoms of said trays serving as filters, a separate endless suction-belt having the same effective length as said vessel-belt and mounted concentrically with said vessel-belt to move along said trackway in contact with said suction box to close the channel thereof, conduit means in said suction-belt communicating with the suction box channel in an air-tight manner, flexible tubes connecting said conduit means with each of the filter trays individually to produce suction at the bottoms thereof and providing for relative radial movement between said belts as they pass around said trackway, and means permitting relative radial movement between said belts for driving said vessel-belt and said suction-belt in synchronism at the same velocity and revolutions

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per minute so that they move simultaneously and retain the same relative positions as they pass around the endless trackway.

3. The filtering device of claim 2 in which only one of said endless belts is positively driven and connecting means are provided between the two belts to drive the second belt whereby their movements are synchronized to retain them in the same relative positions as they revolve around the endless trackway.

4. The filtering device of claim 2 in which the conduit means in the suction belt is T-shaped, one branch of the T communicating with the channel of the suction box and the other branches extending transversely from the belt and being connected to said flexible tubes.

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