Feb. 10, 1959 H. F. BRIED 2,873,028

FILTERS

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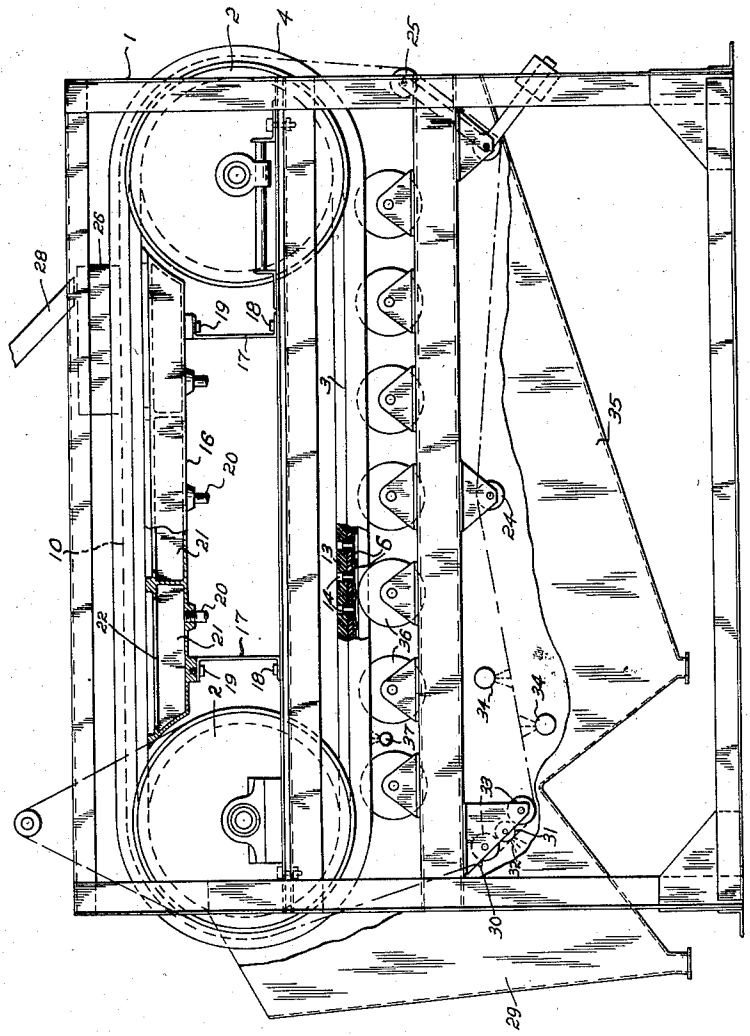


FIG. 1.

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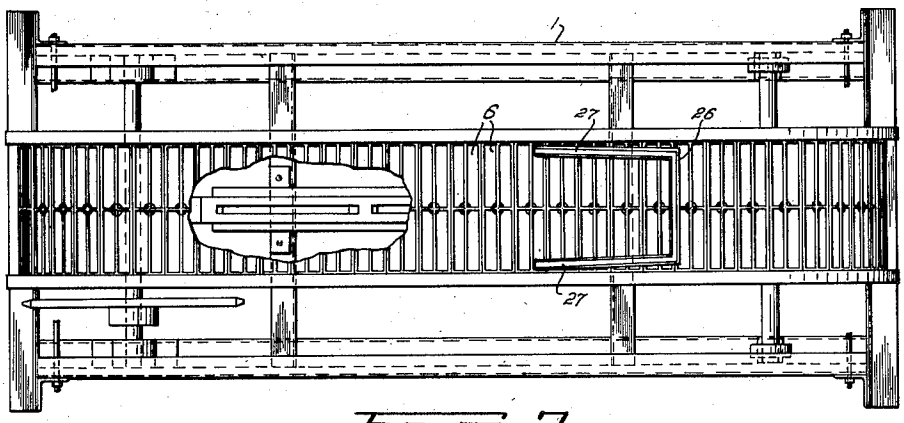


FIG. 3.

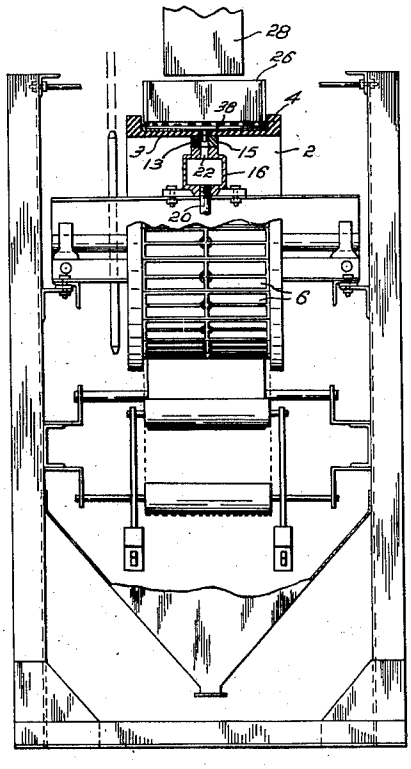


FIG. 2.

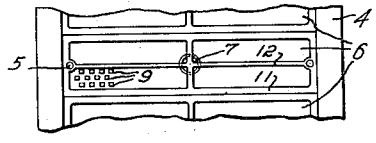


FIG. 4.

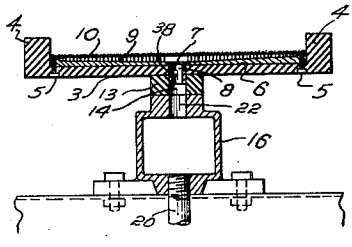


FIG. 5.

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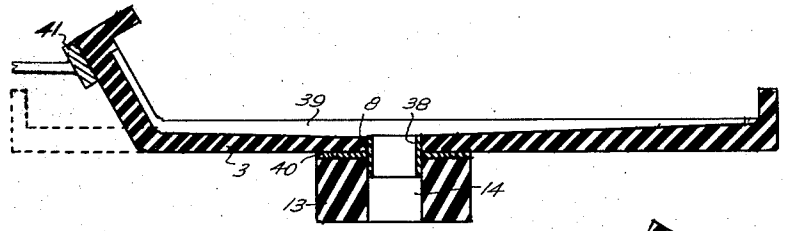


Fig. 6.

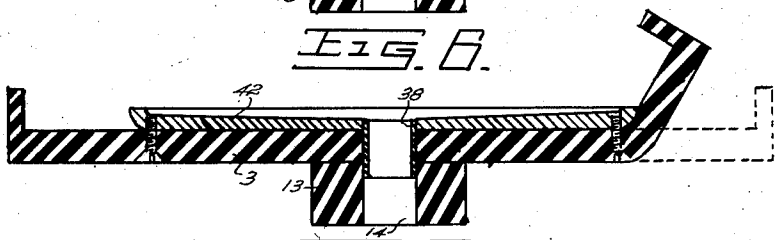


Fig. 7.

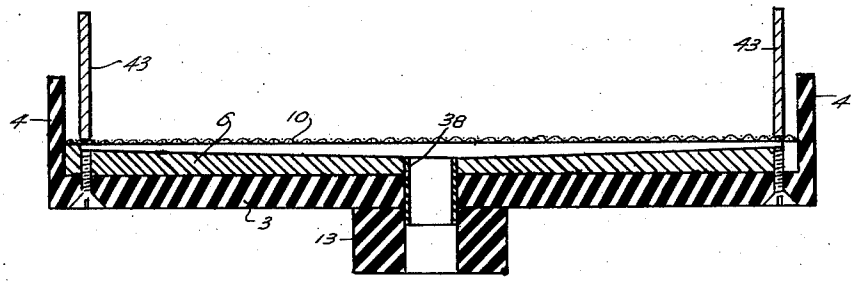


Fig. 8.

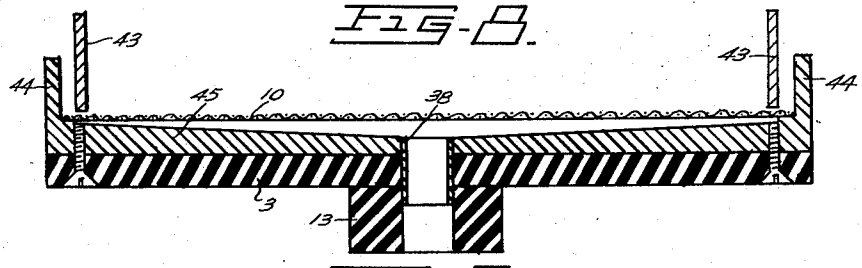


Fig. 9.

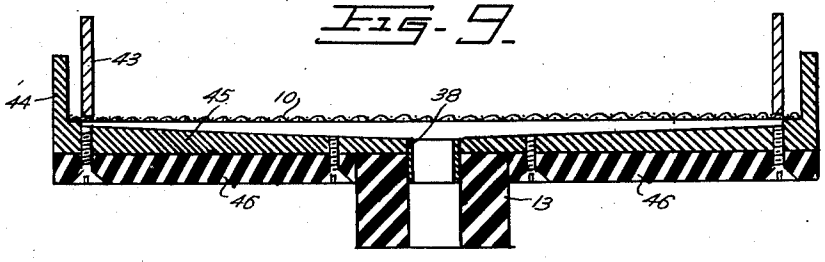


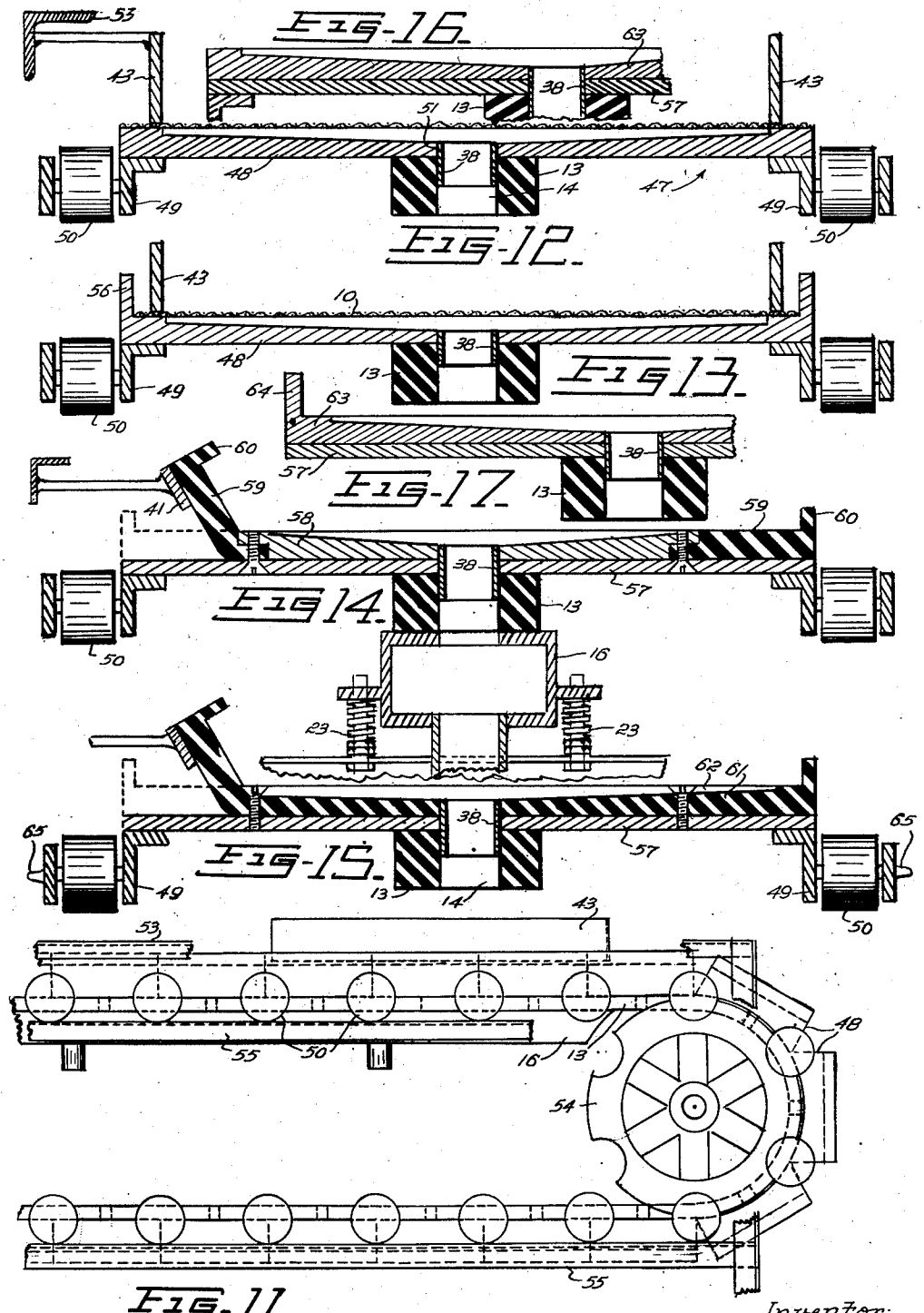
Fig. 10.

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FILTERS

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2,873,028

FILTERS

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Application September 6, 1955, Serial No. 532,525

5 Claims. (Cl. 210—401)

This invention relates to filters of the endless grid carrying type.

An object of the invention is to provide a filter comprising a series of grids and an endless valve member wherein means are provided for aligning passages in the grids and valve member, such aligning means forming a connection between each grid and the valve member for simultaneous travel thereof.

Another object is to provide a filter of the type set forth which includes means for insuring constant alignment of the filter medium in order to prevent lateral wandering with respect to the grids. This lateral wandering has heretofore presented a great problem in respect of machines wherein the filter medium is not attached directly to the machine but operates freely therein.

Another object is to provide means for conveniently mounting the operating portion in the filter machine whereby it may be easily and rapidly removed therefrom to permit ready replacement of the valve and associated elements. In machines heretofore proposed, this step may take as long as seven to ten days, whereas, the present invention makes it possible to perform this step in a matter of a few hours.

Other objects, details and advantages will become apparent from the following description and accompanying drawings, in which

Figure 1 is a side elevation, partly in section, of a filtering machine in accordance with the invention,

Figure 2 is an end elevation, partly in section, of such filtering machine,

Figure 3 is a plan view of the filtering machine,

Figure 4 is an enlarged plan view of a portion of an endless grid carrier belt,

Figure 5 is an enlarged sectional transverse view of the grid carrier belt and associated elements,

Figures 6 to 10 are enlarged sectional transverse views of modified forms of grid carrier belts,

Figure 11 is a side elevation of a modified form of filtering machine, and

Figures 12 to 17 are enlarged sectional transverse views of various forms of grid carrying chains such as may be employed in the machine shown in Figure 11.

Referring to Figures 1 to 5, inclusive, 1 is a supporting frame in which are rotatably mounted a pair of horizontally disposed supporting drums 2. Mounted on the drum 2 is an endless carrier belt 3 of approximately the width of the drums composed of an inherently flexible material such as rubber, rubber fabric, fabric or the like. The carrier belt 3 is provided with marginal side walls 4 extending perpendicularly from the body portion of the carrier belt. Each side wall is of minor height to permit passage of the carrier belt over the drums 2 without undue distortion of the carrier belt. The height of the side walls is dependent on the diameter of the end drums and resulting distortion. This distortion can be relieved by partially slitting the walls at intervals. The walls 4 may

be formed integrally with the carrier belt 3 or they may be separately formed and rigidly fixed to the strip.

Fixed to the outer surface of carrier belt 3 between side walls 4, as by means of rivets or screws 5, are a series of rigid grids 6 formed of stainless steel or other metal, plastic composition, or the like. Each grid 6 is relatively narrow, depending on the diameter of the end drums 2, to permit easy passage over the ends. In the horizontal position of travel of the carrier belt and grids, the side edges of the grids are in close proximity with each other. Each grid 6 has a centrally arranged opening or passage 7 registering with a corresponding opening or passage 8 in the carrier belt 3. The face of the grid 6 is provided with a plurality of raised portions 9 for engagement by and support of an endless filter medium 10. The grid 6 may also have marginal ribs 11 and intermediate ribs 12 extending across the central opening 7 to provide suitable support for the filter medium thereon. The bottom wall of each grid is preferably inclined towards its opening 7 and arranged to provide channels for directing liquid into the opening.

A valve member comprising a relatively narrow endless belt 13 engages the midportion of the under surface of carrier belt 3. Valve member 13 is preferably formed of rubber, rubber fabric or the like. Valve member 13 is provided with a series of openings or passages 14 each in registry with an opening 8 of carrier belt 3 and opening 7 of a grid. As shown, each drum 2 is circumferentially grooved at 15 to permit passage of the valve member 13.

A suction or vacuum box 16 is mounted on supporting beams 17 carried by frame 1. As shown in Figure 1, beams 11 are fixed to the frame by bolts 18 and box 16 is fixed to the beams by bolts 19. Thus, the box may be easily mounted in or removed from the frame 1. Conduits 20, connected to a suitable source of vacuum, are connected to the bottom portion of box 16. As shown, box 16 is elongated in shape and extends throughout substantially the entire upper portion of horizontal travelling movement of the carrier belt 3 and valve member 13. The box illustrated has three longitudinally aligned compartments 21, each of which communicates with a conduit 20. The box may be formed in one piece or may comprise several separate aligned compartments 21. The top wall of the box is in engagement with the valve member 13. Such top wall has one or more longitudinally aligned slots 22 communicating with the interior of the box and arranged for successive registry with passages 8 and 7.

The filter medium 10 comprises a belt of foraminous or porous material such as plastic, cotton or wire cloth or the like. As shown, the filter medium 10 extends over and in engagement with the upper travelling portion of grids 6 and is supported in its return or lower travelling portion by rollers 24 carried by the frame. A pivotally mounted belt tightening roller 25 is preferably included to maintain the filter medium in any required taut condition.

A feed box 26 is provided at the feed end of the machine and may be in U-shaped form with slightly flaring side walls 27 positioned closely adjacent but slightly above the filter medium. A feed spout 28 is arranged to feed fluid material containing solids into the box. It will be apparent that the side walls 27 will retain the material on the filter medium and prevent it from spilling over the sides thereof while such material is in flowable condition. Since the vacuum exerted on the material will quickly remove a substantial portion of the liquid therefrom, the walls 27 need be only of short length such that when the filter medium passes from beneath the box 26

the wet material will be in non-flowable or caked condition and will remain upon the filter medium.

A receptacle **29** is provided at the discharge end of the machine to receive the filter cake. A scraper comprising a wire **30** or similar device, may be provided to scrape off any solids which adhere to the filter medium. Preferably also, a blow-off roll **31** arranged to direct an air or like jet **32** through the medium is provided in order to further remove any other solid material clinging to the filter medium and direct it into receptacle **29**. A pair of rollers **33** may be provided to support the medium for passage across the jet **32**.

Means for cleaning the filter medium may comprise a pair of spray jets **34**, a pan **35** being provided to collect the spraying liquid.

The carrier belt **3** and valve member **13** may be supported during their return or lower portion of travel by means such as a plurality of rollers **36** mounted in the frame and engaging the carrier belt **3** or the grids **6**. A spray jet **37** may be provided to effect a cleaning action on the grids **6**.

A very important feature of the invention resides in the provision of a short piece of tube **38** which extends through each passage **8** in carrier belt **3** into the registering passage **14** in valve member **13**. Tube **38** may be of any suitable cross section, such as round, square, oblong or rectangular, depending upon the cross-sectional shape of the pasages. Tube **38** is fixedly mounted in such relation and constitutes a positive aligning means for such passages as well as a connection between the grids **6** and valve member **13** for simultaneous travel thereof. It will be apparent that it is highly important that the passages **8** and **14** be in positive registry at all times and thus that the grids **6**, carrier belt **3** and member **13** travel together as a unit. Since the valve member is thus firmly attached to the grids by means of the tubes **38**, the frictional resistance of the valve member in travelling over the vacuum box is overcome.

The entire "core" of the machine, including the end drums, is supported in the frame on cross beams **66**. The beams **66** may be mounted in the frame by bolts **67**. Thus, by removal of such bolts, which may be only four in number, the entire core may be withdrawn from the frame for the replacement of parts, such as the valve member.

Figure 6 illustrates a modified form of filter assembly wherein the carrier belt **3** is provided with flexible grids **39** and a metal plate **40** is interposed between the valve member **13** and carrier belt **3**, the tubes **38** being fixed to plates **40** to ensure more rigid mounting thereof. As shown the marginal portions of carrier belt **3** and the grids **39** thereon are bendable upwardly, as by means of a slide **41** or similar means, carried by the frame, to impart a troughlike shape to the carrier belt and in this case, flexible grids during their upper horizontal travelling movement and thus provide a retaining means during its flowable state of the material thereon.

Figure 7 shows a further modified arrangement wherein metal or like rigid grids **42** on carrier belt **3** terminate inwardly of the marginal portions of carrier belt **3** to permit upwardly flexing movement thereof by the slides **41** in order to achieve a troughlike shape.

Figure 8 shows an arrangement wherein side bars **43** carried by the frame have their lower edges in close proximity to the filter medium **10** and adjacent the side edges thereof to provide a material retaining means.

Figure 9 shows a modified arrangement wherein the side walls **4** are omitted from the carrier belt **3** and wherein instead, side walls **44** are provided on rigid grids **45** carried by the carrier belt. Side bars **43** are also shown in respect of this arrangement.

Figure 10 shows a modification which is closely similar to that illustrated in Figure 9 but wherein the carrier belt **3** is replaced by two laterally aligned flexible strips **46** one on each side of the valve member **13** which is in direct engagement with the grid **45**.

Referring to Figures 11 and 12, the endless filter medium conveyor **47** comprises a series of rigid grids **48** carried by side chains **49** provided with rollers **50**. The valve member **13** engages the under surface of the grids and a tube **38** connects each passage **14** of the member **13** with a complementary passage **51** in each grid **48**. Material retaining side bars **43** carried by arms **52** fixed to frame **53** may be provided. The members **47** and **13** are mounted for travelling movement on sprockets **54**, which engage the rollers **50**. The rollers **50** are supported on tracks **55** during their horizontal portions of travel. It will be observed that the side bars **43** are located preferably at the feed end of the machine, except during a washing period, to retain the material on the filter medium while it is in freely flowable condition.

The modification shown in Figure 13 is similar to that of Figure 12 with the exception that each grid **48** is provided with end walls **56** to serve as filter medium guides.

Figure 14 illustrates a modification wherein a plurality of metal plates **57** constitute the supporting means carried by the side chains **49**. Grids **58** are fixed to the plates **57**, such grids terminating inwardly of the side edges of the plates. Fixed to each edge of the grids is a flexible (such as rubber) strip **59** which may have an upturned edge **60**. The flexible edge portions **59** are arranged for engagement by a tilting means **41** to impart a troughlike shape to this portion of the filter assembly during its upper portion of travel.

The modification of Figure 15 is similar to that shown in Figure 14 but includes a single flexible strip **61** mounted on the plates **57**, grids **62** being cast integral with or attached to the strip **61**.

Figure 16 shows a modification wherein rigid grids **63**, in which end walls are omitted, are fixed to the plates **57**.

Figure 17 illustrates a modification which is similar to that shown in Figure 16 but wherein the end walls **64** are provided.

Grease fittings **65** may be provided for internal lubrication of the chains **49**, and to prevent the penetration of dust, grit or the like into the moving parts of the chain.

An alternative resilient type of mounting for the vacuum box is shown in Figure 14, wherein adjustable springs **23** resiliently support the box for snug engagement with the valve member **13**, and to relieve the weight on the vacuum box top.

I claim:

1. Vacuum filtering apparatus of the conveyor type comprising, a frame, a pair of horizontally disposed spaced apart drums mounted on said frame, each of said drums having a similar circumferential groove of substantially less width than said drum, an endless carrier belt mounted on said drums for rotational movement and having upper and lower flights, means for rotating said drums, a plurality of rigid rectilinear grids having a bottom wall and fixedly attached to the outer peripheral surface of said carrier belt, each of said grids extending transversely across said carrier belts, an endless filtering medium carried in superposed relation on the upper flight of said carrier belt, a vacuum box fixedly supported on said frame beneath said upper flight of said carrier belt, said vacuum box having the plane of its top wall spaced from said carrier belt and parallel therewith, said vacuum box having a slot in its top wall in longitudinal alignment with said circumferential grooves in said pair of spaced apart drums, an endless valve member, having a plurality of valve openings spaced along its longitudinal centerline, mounted in said grooves of said drums and having a width substantially equal to the width of said grooves, said valve member bridging the space between said carrier belt and said vacuum box, each of said grids having an opening in its bottom wall, all of said openings in said bottom walls of said plurality of grids

being in longitudinal alignment with the valve openings of said valve member, said carrier belt having a plurality of openings therethrough registering with said openings in the bottom walls of said grids, and a rigid tube fixedly attached in said opening in the bottom wall of said grid and extending therefrom through one of said openings in said carrier belt and into said valve opening in said valve member, whereby said opening in said bottom wall of said grid, said opening in said carrier belt and said valve opening in said valve member are held in registry during rotation of said drums and said valve openings are held in alignment with said slot of said vacuum box as said valve member slidingly traverses said top wall of said vacuum box.

2. Vacuum filtering apparatus of the conveyor type comprising a frame, a pair of horizontally spaced apart lower trac members mounted on said frame, a pair of similarly spaced upper track members in spaced superposed vertical alignment with said lower track members, sprockets vertically mounted at each end of said upper and lower pairs of track members, each of said sprockets mounted in vertical alignment with one member of said pair of upper track members and one member of said pair of lower track members in bridging relation, each of said sprockets having a plurality of spaced arcuate grooves in its periphery, a pair of endless roller chains, each of said roller chains mounted to roll on one of said superposed upper and lower track members and enmesh with said sprockets at each end thereof, a plurality of plates having side edges, each of said plates transversely bridging said pair of roller chains and having one side edge attached to each of said chains, to form upper and lower conveyor flights, each of said plates having an opening similarly spaced from said side edges of said plates, a vacuum box fixedly supported on said frame beneath said upper flight of said conveyor, said vacuum box having the plane of its top wall spaced from said carrier belt and parallel therewith, said vacuum box having a slot in its top wall in longitudinal alignment with side openings

in said plates, an endless valve member, having a plurality of valve openings in spaced registry with said openings in said plates, said valve member bridging the space between said conveyor and said vacuum box, a rigid tube fixedly attached in each of said openings in said plates and extending therefrom into said valve openings in said valve member, whereby said opening in said plate is held in registry with said opening in said valve member and said valve openings are held in alignment with said slot of said vacuum box as said valve member slidingly traverses said top of said vacuum box, and an endless filter medium carried by said upper flight of said conveyor.

3. In a vacuum filtering apparatus of the conveyor type as claimed in claim 2, a grid fixedly attached to said plate intermediate said filter medium and said plate.

4. In a vacuum filtering apparatus of the conveyor type as claimed in claim 2, a pair of material retaining side bars mounted on said frame, each of said side bars extending longitudinally of said upper flight of said conveyor and adjacent one edge thereof, and said side bars being in substantial juxtaposition to said filter medium.

5. In vacuum filtering apparatus of the conveyor type as claimed in claim 1, said rigid grids terminating inwardly of the side edges of said carrier belt, a slide mounted on said frame adjacent said upper flight of said carrier belt to engage the underside of said carrier belt extending outwardly of said grid and raise it out of the plane of said carrier belt underlying said grid.

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