

1,338,232.

Patented Apr. 27, 1920.

3 SHEETS—SHEET 1.

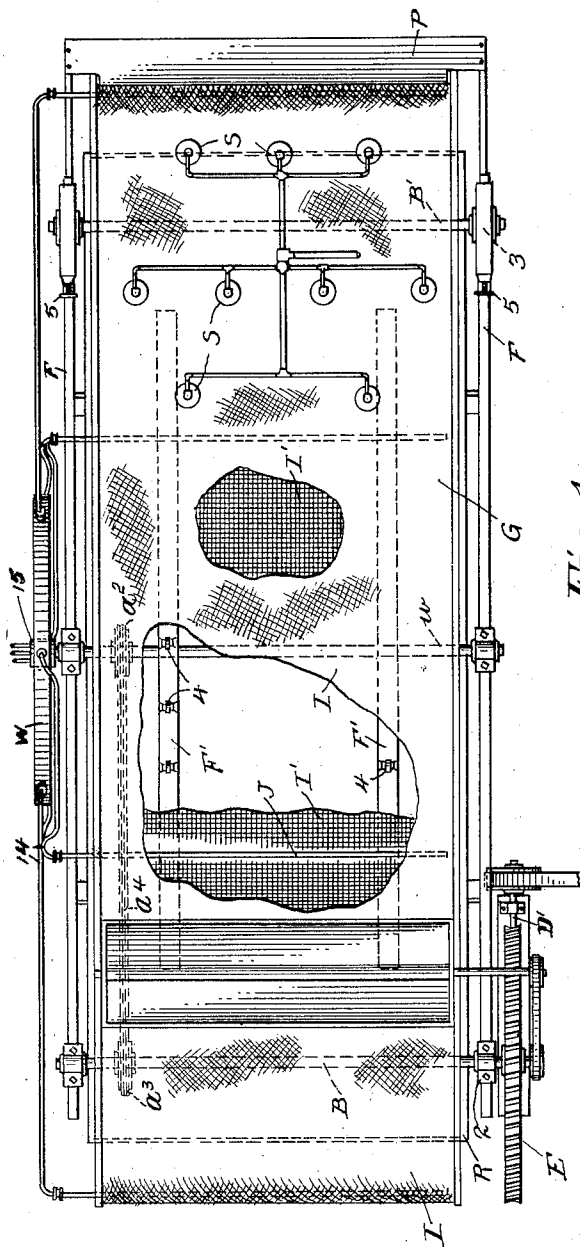


Fig. 1.

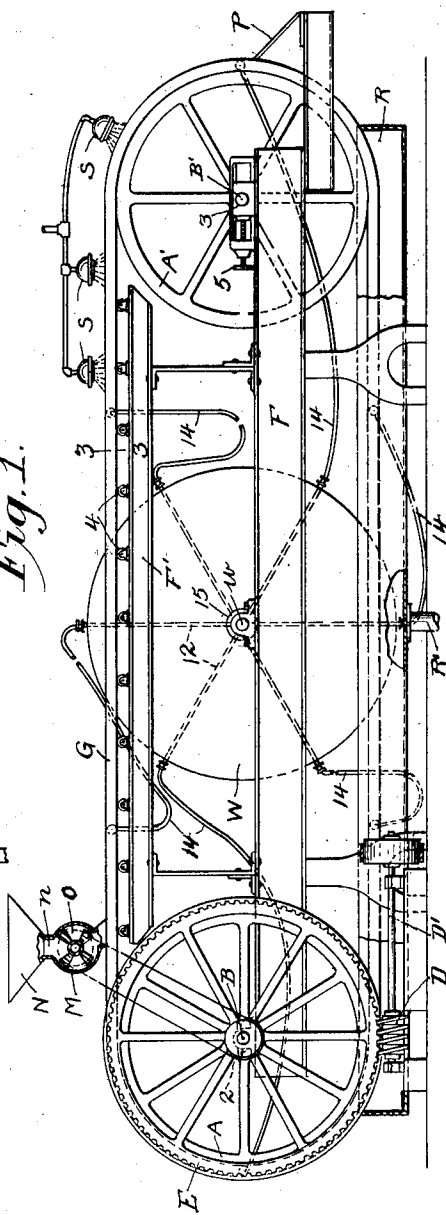


Fig. 2.

Inventor:
 Jasper A. McCaskell.
 By J. Walter Fowler
 atty.

J. A. McCASKELL.
 FILTERING BELT.
 APPLICATION FILED JUNE 21, 1918.

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3 SHEETS—SHEET 2.

Fig. 3.

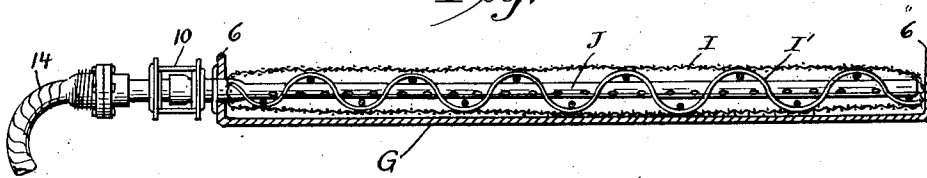


Fig. 4.

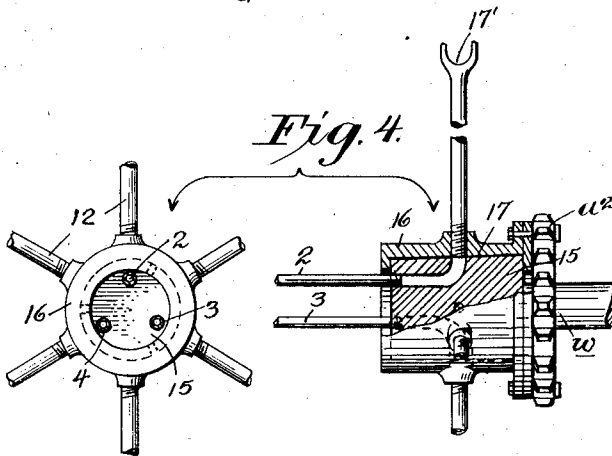
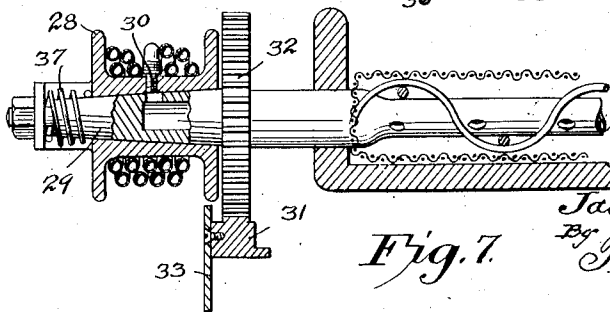
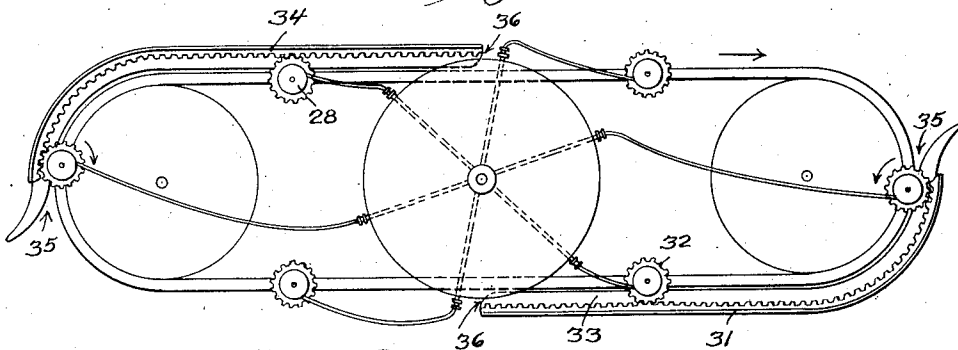


Fig. 8.



Inventor:

Jasper A. McCaskell.

By T. Walter Fowler
 atty.

Fig. 7.

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 3 SHEETS—SHEET 3.

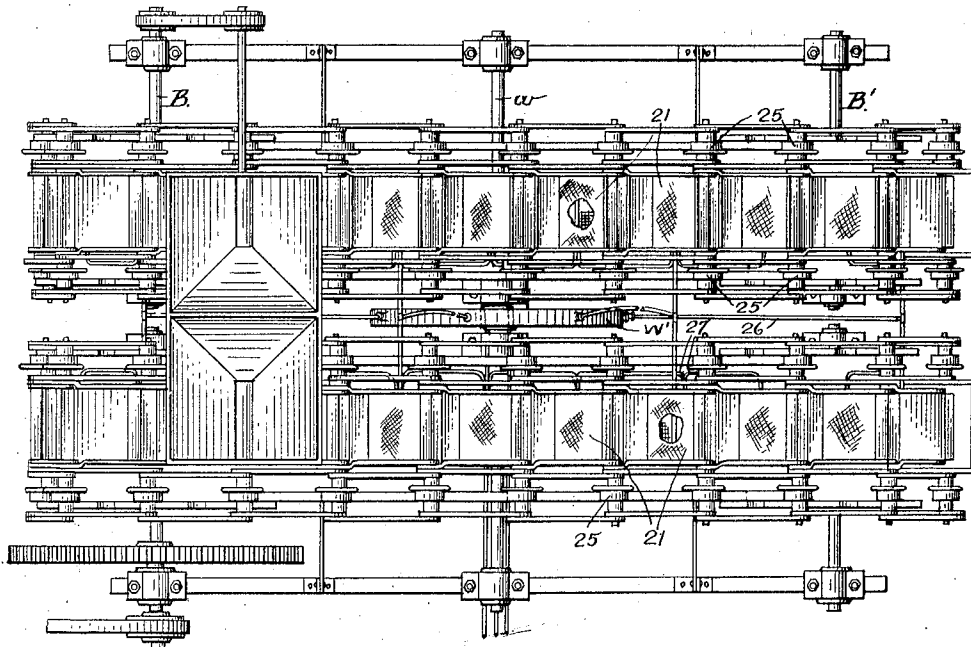


Fig. 6.

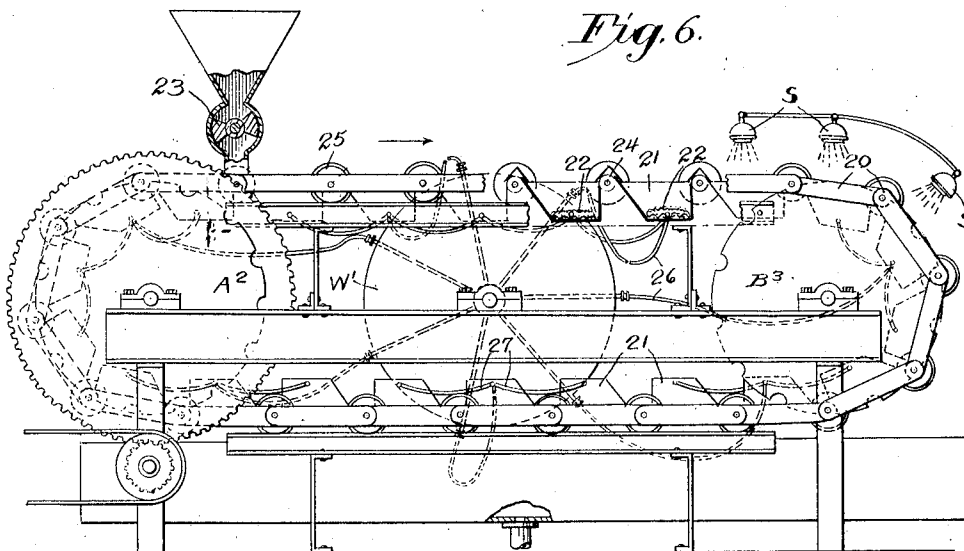


Fig. 5.

Inventor:
 Jasper A. McCaskell.
By T. Walter Fowler
 atty.

UNITED STATES PATENT OFFICE.

JASPER A. McCASKELL, OF SALT LAKE CITY, UTAH.

FILTERING-BELT.

1,338,232.

Specification of Letters Patent.

Patented Apr. 27, 1920.

Application filed June 21, 1918. Serial No. 241,273.

To all whom it may concern:

Be it known that I, JASPER A. McCASKELL, a citizen of the United States, residing at Salt Lake City, in the county of Salt Lake and State of Utah, have invented certain new and useful Improvements in Filtering-Belts, of which the following is a specification.

My invention relates to certain new and useful improvements in continuous belt-filters; that is, a filter in the form of a traveling belt which is constantly supplied with a suction during its travel, the said belt being connected at various points to a disk or wheel, or equivalent member which is supplied with filtrate passages for conducting filtrate from the interior of the belt to a place of final discharge, and said belt being associated with means for removing the deposited solids from its exterior, and for washing the cake-material before it reaches a point of final removal.

One of the leading objects of the present invention is to simplify and render more effective the usual belt filter and to connect a unitary filtrate wheel, disk or member having radial or other passages leading to a central shaft, with the filtrate chamber of the belt at a number of points so as to effect the more ready removal of the filtrate.

With the above and other objects in view my invention consists in the parts and the constructions, arrangements and combinations of parts which I will hereinafter describe and claim.

In the accompanying drawing forming part of this specification, and in which like reference characters indicate similar parts in the several views;

Figure 1 is a side elevation of a belt-filter illustrating one embodiment of my invention.

Fig. 2 is a top plan view of the same.

Fig. 3 is an enlarged transverse sectional view of the belt on the line 3—3 of Fig. 1.

Fig. 4 represents details of a central filtrate-discharge valve.

Fig. 5 is a side elevation of a belt filter of a modified type.

Fig. 6 is a plan view of Fig. 5.

Fig. 7 is an enlarged detail showing one form of swivel and valve, and means for coiling and uncoiling the flexible filtrate conducting tubes.

Fig. 8 is a side elevation of the hose-coiling mechanism.

Referring to Fig. 1, which illustrates the more simple form of my invention, A and A', represent end drums, preferably of steel, which are directly keyed to transverse shafts, B, B' respectively, these shafts being mounted in suitable bearings, 2, 3, supported on longitudinal beams, F, or other rigid supports, and which beams also support other longitudinally extending beams, F', provided with rollers, 4, which form a rolling table for the under side of the top-run of the belt, G.

The end drums, A, A', and the means for mounting the same are substantially similar to the well known belt conveyer construction and around these drums passes the filtering belt. The shaft of one of the drums is also keyed or transversely rigidly connected to a gear or worm wheel, E, which is engaged and driven by a worm or pinion, D, on a main power shaft, D', having a pulley or motor to which power may be applied and the drum rotated to cause the travel of the belt. Also, one of the bearings, say the one for the shaft, B', may be of an adjustable character; that is to say, its bearing-box is slidably mounted in a slotted frame and is adjusted back and forth direct by appropriate screws, 5, to adjust the tension of the belt, substantially in the manner commonly employed in belt-tighteners.

The filtering belt is illustrated in detail in Fig. 3; it is, preferably, formed of rubber or other material may be used and its edges are up-turned to form guards and flanges, 6, along the sides of the belt. The upper portion of the belt is formed of filtering cloth, 1, or other filtering medium and below this and forming a spacing element or backing for the cloth is a sheet of woven wire or other suitable material, I', whereby the cloth is maintained out of contact with the bottom of the belt and a filtrate chamber is formed interior to said belt. In fact, I prefer that the woven wire or screen plate shall be entirely surrounded by filter cloth and which cloth may be either of cotton or other fibrous material, or it may be of some appropriate metal, such as is well known in the filtering art.

At various points in the length of the belt and extending through the up-turned

sides thereof and across the filtrate chamber formed within the belt are perforated pipes, J. These I prefer to flatten somewhat as by so doing I may increase the diameter of the pipes without increasing the depth of the filtrate chamber. However, other designs of pipes may be used without departing from the spirit of my invention. One end of each of these pipes extends through a corresponding side flange of the belt and is provided with a swiveled or coupling or similar part, 10, for the ready coupling and uncoupling of a section of rubber or other flexible hose, 14, which serves as a conductor for the filtrate which has been drawn into the chamber of the belt.

Centrally or otherwise placed intermediate of the end drums and located at one side of the supporting frame-work is a wheel or disk, W, which is mounted upon a central transverse shaft, *w*, appropriately journaled on the supporting frame structure. This wheel or disk which may be of any desired construction, is provided with a series of radial passages or pipes, 12, or like means for the ready coupling and uncoupling of the flexible filtrate conducting tubes, 14. Thus it will be seen that each filtrate passage in the wheel is coupled to one end of a flexible tube whose opposite end is coupled to one of the perforated pipes, J, which extends into and crosses the filtrate chamber of the belt, the length of these flexible tubes being such that the pipes may readily pass around the end drums during the travel of the belt, this operation resulting in the wheel or disk, W, being turned axially in response to the movement of said belt, thereby maintaining the proper relation between the suction features with which the wheel is supplied, and the filtrate chamber of the belt.

The shaft of the wheel is provided with a turning-plug valve, 15, with appropriate ports and passages, the casing, 16, of the valve being, if desired, in the form of a conical hollow hub, 17, fixedly attached to the wheel, W, and adapted to rotate therewith relatively to the shaft, the shaft in the present case being stationary. Instead of the discharge valve, 15, being revolved only by the tension of the hose connections with the wheel, W, I may prefer to positively operate the valve and this may be done by appropriate sprocket wheels a^2 and a^3 on the shafts *w* and B, and a connecting chain, a^4 , or like arrangement, as shown by dotted lines in Fig. 2. In this latter case, the turning plug valve will be geared so as to be driven by the proper revolution to conform with the travel of the belt. If desired, the wheel may be provided with a circumferential groove, 17', as shown in Fig.

4, to receive the flexible hose during the movement of the latter and particularly as the hose is approaching the wheel and is then in a more or less looped or folded condition.

The aforesaid valve construction may follow more or less closely the similar arrangement found in my prior application, Serial Number 165,750, filed May 1, 1917, for continuous pressure filters, this valve having appropriate outlets, 2, 3 and 4', the outlet, 2, being for the filtrate drawn from the filtrate chamber of the belt, the pipe, 3, being for the passage of wash-water which is also drawn through the belt and into the filtrate chamber of the belt, thereby removing any retained values which the cake material might contain, and the pipe, 4', being for the admission of high-pressure air which is delivered through the valve and the radial passages, 12, or pipes of the wheel, W, and through the flexible tubes, 14, and into the filtrate chamber for the purpose of loosening and assisting in removing the cake material after it has been washed and is ready for discharging from the belt. To accomplish these various functions I locate above the belt suitable spray devices, S, for the admission of wash-water or other liquid to the surface of the belt, and I suitably support in proximity to one of the end drums and to the belt passing thereover, an appropriate scraper, P, which serves to remove caked-material which still adheres to the portion of the belt, at this point.

At the head-end of the belt I have arranged a suitable feeder, M, of the rotary pocketed type. This feeder operates in a cylindrical casing which is a continuation of the discharge end of a suitable hopper, N, said casing having a reduced spout or chute, *n*, through which a charge of material which has been received into one of the pockets, *o*, of the feeder is delivered when the pocket registers with the upper end of the chute, said material being then delivered onto the surface of the traveling belt. The feeder, M, is so regulated that the requisite amount of pulp is fed onto the belt during its operation. In other words, the solution to be filtered and containing solids in suspension will be removed in charges as the several pockets of the feeder register with the outlet from the hopper, and these charges of material will in turn be delivered onto the filtering surface of the belt.

In practice, the belt will be subdivided into sections corresponding with the number of filtrate passages in the wheel, K, and the number of flexible hose connections employed; it will be understood, however, that any other subdivision of the belt may be made as desired, but in any event each

section will be directly connected with one of the filtrate passages or tubes in the wheel, W, and with an appropriate and corresponding passage in the central valve, so that as the wheel or disk, W, rotates, each radial passage thereof is first brought into register with the appropriate filtrate passage, 2, and the fluid contents of the pulp will be drawn through the belt and into said passage, and as the belt continues to rotate, and a perforated pipe, J, passes beyond the portion of the belt subjected to the washing fluid, a radial passage, 12, of the wheel will be caused to register with the passage, 3, of the valve, and the wash-water will be delivered therethrough, and as the wheel further rotates, the radial passage, 12, will in turn register with the pipe or passage, 4', through which high-pressure air, derived from any suitable source may be admitted and which will pass back through the radial passage and a rubber or flexible hose, 14, to the interior of the belt beneath the filtering surface thereof and thereby loosen and partially or wholly remove any adhering cake material. In other words, the valve and passages are so constructed that during a certain portion of the travel of the belt, the filtrate is sucked through by means of a vacuum pump (not shown but designed to be suitably connected to the valve), and as said valve revolves the wash-water is in turn sucked through and discharged into its special pipe, and the cake is finally discharged by means of the high-pressure air being blown back through the valve, through the appropriate pipe, 4, while at the same time any material still remaining on the belt will be positively removed by the suitably placed scraper, P.

Referring to Fig. 1, it will be seen that the lower run of the belt operates within a suitable vat, R, from which leads a bottom discharge pipe, R'.

In operation, pulp is fed from the hopper, N, and is automatically delivered to the surface of the traveling belt. The speed at which the belt travels in connection with the feed from the hopper, will regulate the thickness of the cake formed during the filtering function. As the cake forms on the belt, and it passes by the hopper, the filtrate is sucked through the filter cloth and is discharged through the aforesaid central valve. As the belt continues to travel the cake is washed by means of the spraying devices, and the wash-water is drawn through the central valve and is designed to be delivered to a separate tank, and as the belt travels still farther, the continued suction of the air dries the cake until it is finally discharged at some selected point, which may be represented by the scraper, P, by means

of admitting high-pressure air through the valve, and the radial passage and appropriate flexible hose.

Another mode of operation will be substantially as follows: The vat, R, will be filled with pulp and the cake will be formed on the lower side of the lower run of the belt and the suction will be continued as the belt leaves the vat, and until the cake passes the spraying devices, S, where it will be washed and it will be finally discharged at the scraper, P. In this case the automatic feeding device before mentioned will not be required. The position which is selected for the formation of the cake, the position in which the cake is washed, or the position in which the cake is discharged can be varied at will as will be fully understood by those skilled in this art.

In Figs. 5 and 6, I have illustrated a modified form of duplex filtering belt, although the operation of the belt is practically the same as before described. In the modified arrangement the end drums, A² and B³, are notched on their periphery, and the belt is of the link-belt type; that is, the belt is made by a series of side links, 20, and a series of trays or buckets, 21, each of which is provided with a filtering agent, 22, substantially as before described, these pans or buckets passing successively under an automatic feeder, 23, and receiving charges of pulp from an appropriate hopper. The pins or rods, 24, which furnish the pintles of the links are provided with rollers, 25, and these pintles or rods or sleeves thereon are adapted to fit the recesses at the circumference of the drums.

The type of apparatus shown in Fig. 5, is also provided with the intermediate wheel or disk, W', with its radial passages and hose connections, 26, leading from these passages to the several trays or buckets. In the instance shown, the hose are connected to branches, 27, so that two or more of independent trays may be connected directly with a single hose leading to one of the radial passages in the wheel. Otherwise, the belt of Fig. 5 is in all essential respects substantially similar to the type of apparatus illustrated in Fig. 1.

If the belt is of considerable length it may be desirable to provide means for taking up slack in the more or less lengthy hose connections, and accordingly in Figs. 7 and 8, I illustrate a mechanism which will be found very useful for this purpose, and wherein the various connections to the filter-belt or trays are shown. In the type of apparatus shown in Fig. 7, I employ the valve construction shown in Fig. 8, and which construction includes the rotary valve casing, 28, which is in the form of a grooved drum, and a plug, 29, or valve proper which will be supplied with the necessary ports or passages connect-

ing with the flattened tubes, J, which pass across the filtrate chamber of the belt or across the respective trays of the apparatus of Figs. 7 and 8, whereby the fluid extracted from the pulp will pass through respective passages of the plug and which passages communicate with the lateral port, 30, in the grooved valve casing. This port connects with one end of the flexible tube the other end of the tube in turn connecting with the belt in either of the methods before mentioned. In other words, the valve construction of Fig. 4 is made drum-shaped so that it may revolve and wind up the hose that conducts the filtrate. The winding operation may be performed by a gear rack, 31, fixed to the supporting frame, 33, as shown in Fig. 7, engaged by gear wheels, 32, attached to the valve casing whereby during the travel of the belt the said casing will be revolved and the hose-connections will be wound upon the circumference thereof. The outer end of the gear-rack is curved upwardly substantially concentric with the axis of the end drum and the gear-rack is flanged at its sides to form a guard, 33, to prevent entanglement of the hose-connections.

At the opposite end of the belt is a similar but reversely arranged gear-rack, 34, which will be engaged by the gears, 32, on the respective valves as these gears enter into engagement with this rack during the travel of the belt. In other words, when the gear wheels leave the lower rack, 31, they revolve unwinding the hose during the travel of the belt from this point to the end, 35, of the upper rack, 34, the arrangement of the parts being such that the hose connections will be enabled to unwind during the travel of the belt to the point 35, and until substantially a maximum length of hose has been unwound, but when a valve passes the point, 35, its gear wheel will engage with the other rack, 34, which again gives rotation to the valve-drum or casing, 28, and this results in the hose-connection being wound about the circumference of said casing until substantially the entire slack is taken up. When a valve and its gear, 32, reaches the point, 36, the hose begins to unwind in unison with the travel of the belt and this operation continues for every revolution of the main filtering belt.

To insure against leakage at the valve of Fig. 7, I may employ a spring, 37, which operates expansively against the drum or valve casing, 28, the interior of which may be tapered to fit the corresponding plug or valve, whereby the spring acts to hold the casing with a close running fit upon the valve. This and the other details are more or less unimportant and may be modified and added to as desired and within the scope of the appended claims.

The foregoing types of filter belt will be found quite useful for filtering water, oil, sewage, etc., and they can also be used as driers by substituting metallic cloth as a filter medium instead of cotton cloth and a flexible metallic conveyer instead of rubber belting and the application of heat at suitable points along the line of the belt.

Having thus described my invention what I claim as new and desire to secure by Letters Patent is:

1. The combination with a filtering belt and means for supplying material to be filtered thereto, said belt having an interior fluid space, of a filtrate collector associated with the belt having independent fluid passages, flexible conductors connected at a plurality of points along the belt respectively with the fluid space of the belt and to said fluid passages, means for winding and unwinding the flexible conductors during the travel of the belt, and means for controlling the discharge of filtrate.

2. The combination with an endless traveling filtering belt having an internal subdivided fluid space, of a filtrate collector adjacent the belt having fluid conducting passages, flexible conductors each having one end connected to one of said passages and the opposite end connected to one of the divisions of the fluid space of the belt, and means for winding and unwinding the conductors as they successively approach the collector.

3. The combination with an endless traveling filtering belt having an internal subdivided fluid space, of a filtrate collector adjacent the belt having fluid conducting passages, flexible conductors each having one end connected to one of said passages and the opposite end connected to one of the divisions of the fluid space of the belt, means for winding the conductors as they successively approach the collector and means for feeding material to said belt.

4. The combination with an endless traveling filtering belt having an internal fluid space, of a rotary filtrate collector adjacent the belt having fluid conducting passages, a plurality of flexible conductors each having one end connected to one of said passages and the opposite end connected to the filtrate space of the belt, and a winding and unwinding mechanism connected to the conductors.

5. The combination with an endless traveling filtering belt having an internal fluid space, of a rotary filtrate collector adjacent the belt having fluid conducting passages, a plurality of flexible conductors each having one end connected to one of said passages and the opposite end connected to the filtrate space of the belt, means for supplying wash water to the surface of said belt, said flexible connections and collector serving for the

passage of filtrate and wash water, a winding and unwinding mechanism connected to the conductors, and means for controlling the automatic discharge of filtrate and wash water during the operation of the belt.

6. The combination with a filtering belt having an internal fluid space, end drums around which the belt passes, and means for operating the belt, of a rotatable fluid collector having radial passages connecting with its interior, flexible conductors each having one end connected to one of said passages and the opposite end connected to the filtrate space of the belt, a shaft and a rotary-valve thereon controlling said fluid passages and having ports or passages successively registering therewith, and means for winding and unwinding the conductors as they respectively approach and recede from the fluid collector.

7. The combination with a filtering belt having an internal fluid space, end drums around which the belt passes, and means for operating the belt, of a rotatable fluid collector having radial passages connecting with its interior, flexible conductors each having one end connected to one of said passages and the opposite end connected to the filtrate space of the belt, a shaft and a rotary-valve thereon controlling said fluid passages and having ports or passages successively registering therewith, means for winding and unwinding the conductors as they respectively approach and recede from the fluid collector, and means for supplying wash-water to the surface of said belt, said flexible connections and passages serving to conduct wash-water to said valve for final discharge.

8. The combination with a filtering belt having an internal fluid space, end drums around which the belt passes, and means for operating the belt, of a rotatable fluid collector having radial passages connecting with its interior, flexible conductors each having one end connected to one of said passages and the opposite end connected to the filtrate space of the belt, a shaft and a rotary-valve thereon controlling said fluid

passages and having ports or passages successively registering therewith, means for winding and unwinding the conductors as they respectively approach and recede from the fluid collector, means for supplying wash-water to the surface of said belt, said flexible connections and passages serving to conduct wash-water to said valve for final discharge, and means for removing cake-material from the surface of said belt.

9. A filtering belt comprising a link-mechanism and filtering sections carried thereby and each having an internal fluid space, end drums around which the belt passes, a rotatable fluid receiver having radial passages connecting with its center, flexible fluid conductors having one end connected to said passages and having the opposite end connected to the fluid spaces of the filter sections, a winding mechanism connected with the flexible conductors, and means for operating the belt.

10. A filtering belt comprising a link-mechanism and filtering sections carried thereby and each having an internal fluid space, end drums around which the belt passes, a rotatable fluid receiver having radial passages connecting with its center, flexible fluid conductors having one end connected to said passages and having the opposite end connected to the fluid space of the filter sections, means for rotating the belt, and means for coiling and uncoiling the flexible connections during the travel of the belt toward and from said collector.

11. A filtering belt having a filtering surface and internal fluid space, pipes entering said fluid space and communicating with the interior thereof, a rotatable fluid collector having radial passages leading to its interior, flexible fluid conductors having one end connected to said passages and the opposite end connected to the said pipes, an automatic mechanism registering with successive fluid passages and conducting fluid to the exterior, and means for operating said belt.

In testimony whereof I affix my signature.

JASPER A. McCASKELL.