May 8, 1928. 1,668,557

G. GRÖNDAL

CONTINUOUS FILTERING APPARATUS

Filed June 7, 1923 2 Sheets-Sheet 1

Fig. 2.

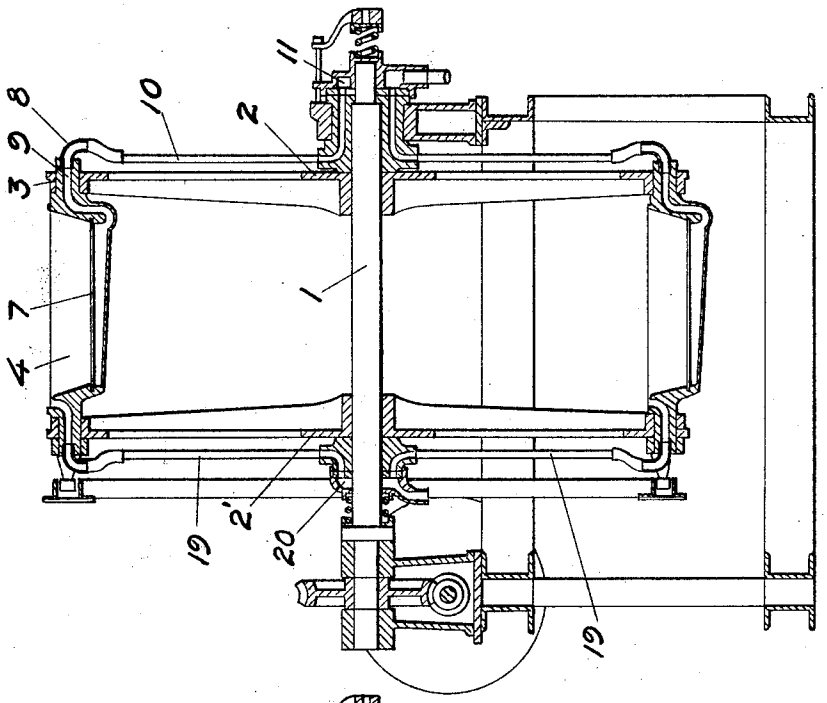
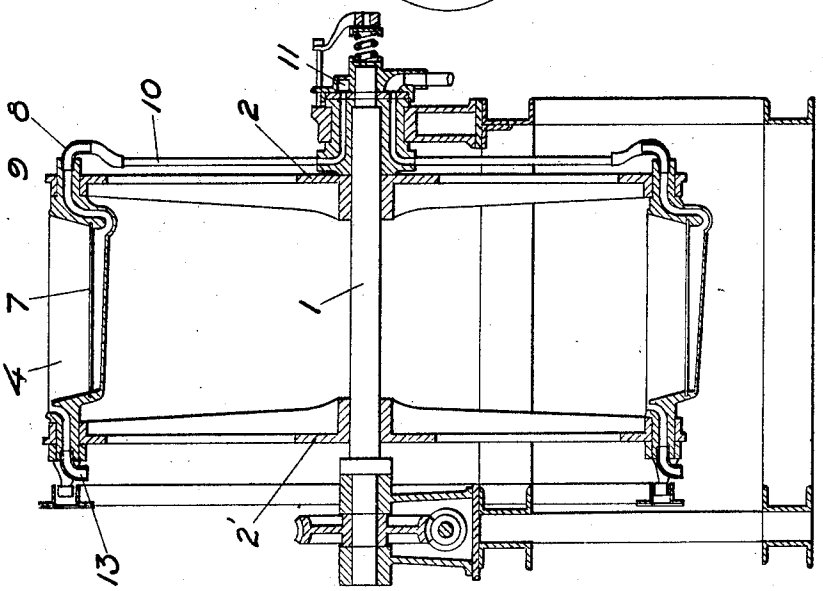


Fig. 1.



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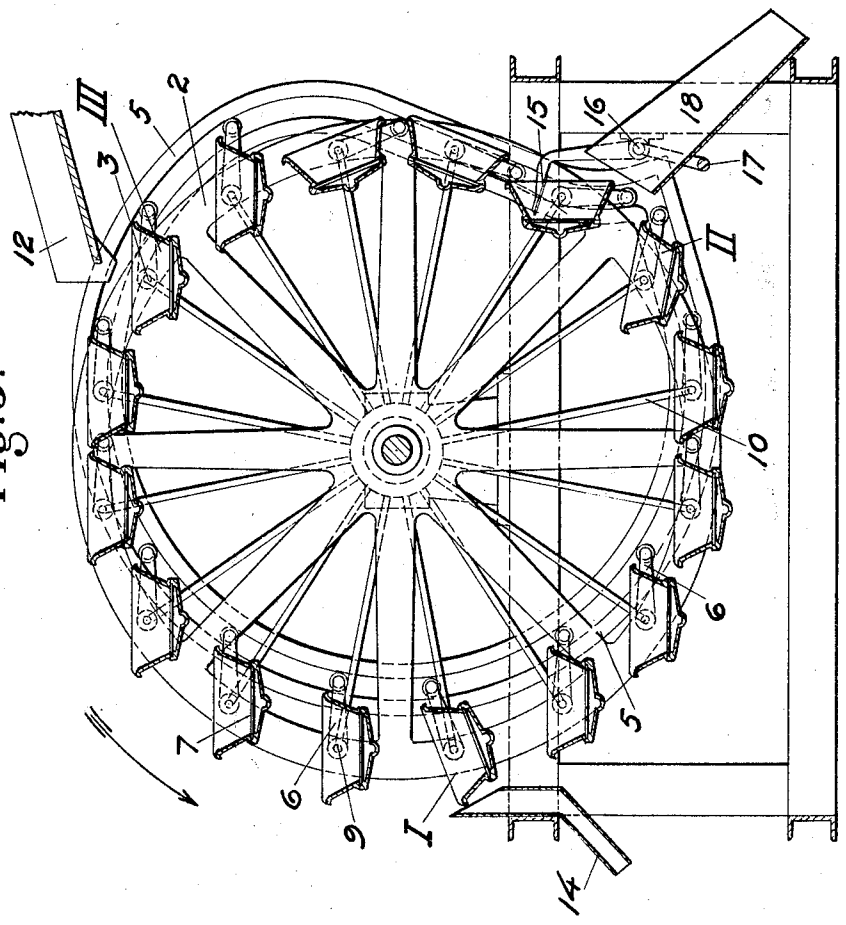


Fig. 3.

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UNITED STATES PATENT OFFICE.

GUSTAF GRÖNDAL, OF DJURSHOLM, SWEDEN.

CONTINUOUS FILTERING APPARATUS.

Application filed June 7, 1923, Serial No. 643,942, and in Sweden April 23, 1921.

The present invention relates to a new method of filtering and to a continuous apparatus for effecting the same.

The invention effects the desideratum of separating by filtering solid particles of any desired specific or absolute weight from the liquid containing them.

One object of the invention is to classify the particles—if they be of different sizes—so that the coarser particles will be the first to settle on the filter.

A further object is to remove part of the liquid without filtering this part of the liquid.

A still further object is to wash the solids with water or other convenient liquid after the original liquid has been removed.

With these general statements of the objects and purposes of my invention I will now proceed to describe the embodiment thereof, and the manner in which my invention is carried out, and it will be understood that while I have described what may be considered as a preferable embodiment of my invention, I do not limit myself to the exact details of construction shown and described as they may be varied by those skilled in the art in accordance with the particular purposes for which they are intended and the conditions under which they are to be utilized.

In the accompanying drawings: Figure 1 is a longitudinal section of the apparatus and Fig. 3 a transverse section thereof. Figure 2 is a longitudinal section of the apparatus in a form as used when it is desired to wash the solid particles by means of water or other suitable fluid, the original liquid having first been removed therefrom.

A shaft 1, conveniently rotated by any known means, as for example by the worm and wheel shown, carries a frame, for example consisting of two wheels 2 and 2^1, keyed thereon. Circumferentially to the frame are fixed a number of bearings, 3. In the bearings 3 are mounted open receptacles 4 which, by means of the guiding plate 5 and tilting levers 6 are forced to occupy different positions, independently of their gravity. These positions are in part horizontal but for the rest such as required at other steps of the filtering process, and they will be further described and explained later on.

In the form preferred by the inventor, the guiding plate 5 and the tilting levers 6 are in continuous engagement, but this is not absolutely necessary as it may in some cases be more convenient to keep the receptacles balanced by means of gravity and apply a guiding plate or like means at those points only where a tilting of the same is desired.

In each receptacle a filter 7 is located, and in the form shown the filters 7 divide the receptacles into two parts; the compartment below the filter by means of a connection bend 8, which is movable in respect of the hollow trunnion 9, and the connection pipe 10 is kept in airtight connection with a valve chamber 11 of known type; the valve chamber 11 being divided into two or more compartments, one or more of these being evacuated and the other being supplied with air under pressure. The receptacles communicating with such parts of the valve chamber as are evacuated will then be exposed to suction, such receptacles again as communicate with a compartment supplied with air under pressure will be exposed to pressure.

The filtering apparatus when being started will be moving in the direction indicated by the arrow. From the feeding channel 12 the material to be filtered flows to the receptacles 4. If more material be fed into the receptacles than those can take, the excess may be discharged through pipes 13 to a hopper in order that it may be brought back in any convenient way to the feeding channel 12. During the feeding of material into the receptacles air is caused to bubble up through the filter, the lower part of the receptacle being brought in connection with a chamber containing compressed air. The rising bubbles will tend to keep the slime and smaller particles of the material suspended in the fluid but allow the coarser material to settle, thus effecting a classification of the material. Of course, the pressure must be kept low enough not to cause the greater particles to rise together with the slime, but not so low that the slime can settle on the filter. The proper pressure will vary according to the kind of material used and will be easily determined in each case by those skilled in the art. After the receptacle has been filled, the chamber below the filter is exposed to suction, and then the smaller particles of the suspended solids will also begin to settle. When the receptacles arrive at the point indicated by the letter I, the levers 6 that are fixed to the receptacles and cooperate with the guiding

plate 5 will cause the receptacles to tilt, as shown in Figure 3, so that the water or other liquid standing over the material that has settled on the filter is decanted off to the channel 14, whereupon the receptacles return to their horizontal position. The rotation is effected at such a rate, that the material is properly dehydrated when the receptacles arrive at the point II. Here by means of the guiding plate 5 and the levers 6 the receptacles are nearly completely tilted over as shown in Figure 3. In this position the receptacles are in communication with that part of the valve chamber in which there reigns a pressure above atmospheric pressure which loosens the cake from the filter.

A scraper 15, which is mounted on the shaft 16 and is kept pressed against the filter by the counterweight 17, scrapes the loosened cake away and causes it to fall into the channel 18. The scraper having departed from the receptacle the receptacle returns to its horizontal position. It still is left in communication for some time with the part of the valve chamber under pressure, so that the filter is thoroughly opened and cleansed by the air passing through it before the receptacles arrive at the point III, where they receive a new charge of material to be filtered.

Though the series of operations and movements of the receptacles as now described have been found by the inventor to constitute a convenient solution when filtering certain kinds of materials, he does not intend to limit himself to the exact details, as in some cases it may be found necessary or convenient to suppress some steps of the process, for example the decanting stage, or even to add others.

So, if chemical precipitates are to be filtered it is often a desideratum also to be able to wash them. In Figure 2 there is shown a means for effecting this by the apparatus. In this case the overflow-pipes 13 are put out of function and exchanged for a system of pipes 19 communicating with a valve chamber 20, through which clear water or other convenient liquid can be fed to the receptacles after the original liquid has been removed.

I claim:

1. Apparatus for continuous filtering comprising a frame, means for rotating said frame, rotatably mounted receptacles circumferentially positioned on said frame, means for feeding the material to be treated into the receptacles, a guiding plate, tilting levers guided by said plate for causing the frame to occupy a filling position and a position wherein the dehydrated solids may be removed, a filter for dividing each receptacle into an upper and a lower part, a valve chamber divided into parts adapted to communicate respectively with a source of compressed air and a suction device, connection pipes between the lower parts of the receptacles and the valve chamber, whereby each pipe and the lower part of the corresponding receptacle may be supplied with a fluid underpressure in the course of filling the receptacle or immediately thereafter, so that the solid material may be classified, and thereafter upon rotation exposed to suction so as to remove the liquid from the material, and in the further course of rotation exposed to pressure so as to remove the dehydrated solids from the receptacles, and means for removing the dehydrated solids from the filtering receptacles.

2. An apparatus for continuous filtering, comprising a frame, means for rotating said frame, receptacles rotatably mounted on said frame, a filter dividing each receptacle, the filter closing the lower part of the receptacle, a valve chamber divided into parts adapted to communicate respectively with a source of compressed air and a suction device, connection pipes between the lower parts of the receptacle and the valve chamber, a guiding plate, tilting levers for operatively associating said plate and said receptacles, a second valve chamber operatively associated with the upper parts of said receptacles whereby washing agents may be supplied thereto, means for feeding the material to be treated into the receptacles, and means for removing the dehydrated solids from the filtering receptacles.

3. Apparatus of the class described comprising a movable frame constituting a support for a plurality of filtering receptacles, a valve chamber divided into parts adapted to communicate respectively with a source of compressed air and a suction device, connection means between said receptacles and said valve chamber, and a second valve chamber operatively associated with said receptacles whereby a desired fluid may be supplied thereto.

In testimony whereof I have signed my name to this specification.

GUSTAF GRÖNDAL.