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H. SOMMERMEYER
ROTARY MAGNETIC SEPARATOR
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FIG. 1

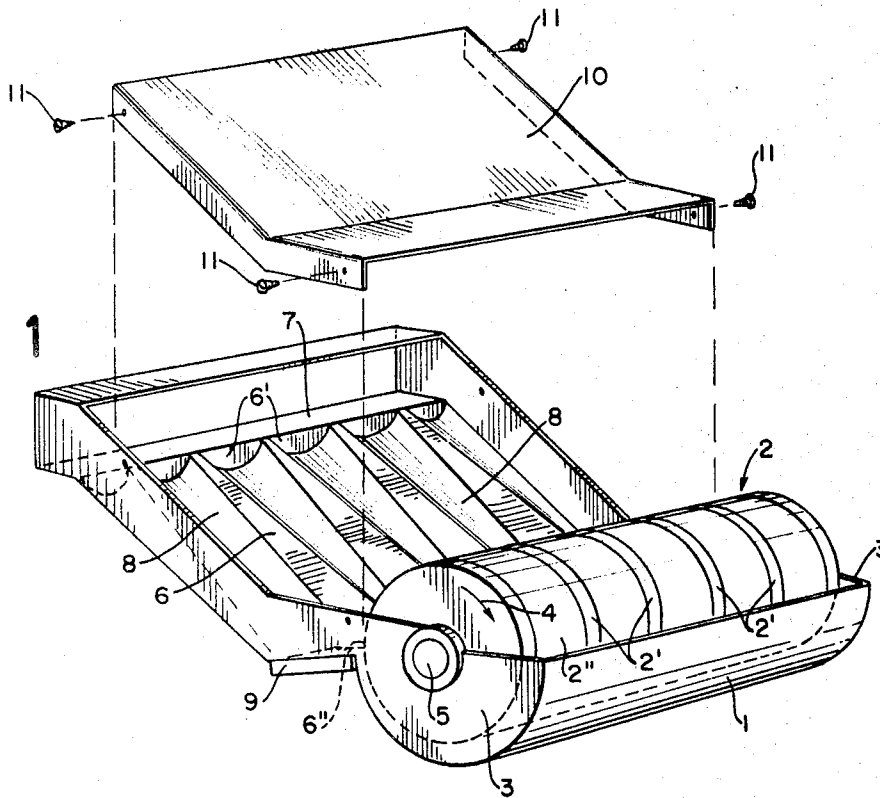


FIG. 2

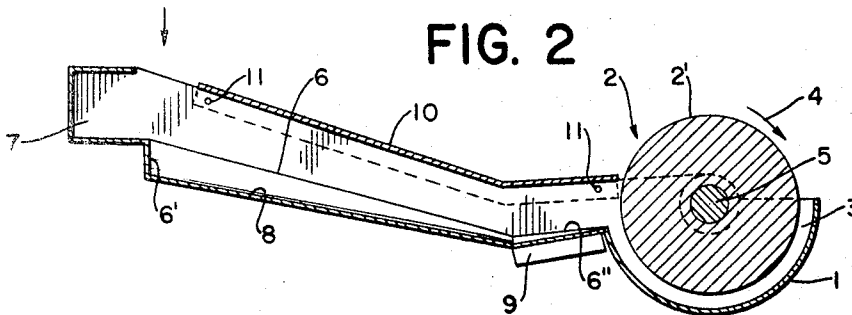
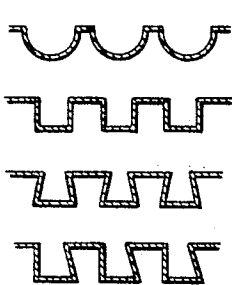


FIG. 3



INVENTOR
HEINRICH SOMMERMEYER

BY

Nolte and Nolte
ATTORNEYS

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3,439,808

ROTARY MAGNETIC SEPARATOR

Heinrich Sommermeyer, Ronneburger Strasse 13,

Gera, Thuringia, Germany

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9 Claims

ABSTRACT OF THE DISCLOSURE

A device for filtering from a liquid particles which are attracted to a magnet. A chute is provided for directing the liquid with the particles therein downwardly toward a rotary magnetic roller means which has a plurality of poles distributed longitudinally therealong. This chute has side walls, between which the liquid is confined, and a bottom wall down which the liquid flows, and this bottom wall is formed with a plurality of grooves gradually tapering in the direction of liquid flow. These grooves are respectively aligned with the poles of the rotary magnetic roller means. Thus, as the liquid flows along the grooves, liquid will be displaced out of the grooves, due to their taper, while the heavier particles will be maintained in the grooves, and relatively small amounts of liquid with large amounts of particles therein will be directed toward the poles so that the greatest part of the particles concentrates at the poles while liquid which is substantially free of the particles flows around the magnetic roller means in a trough in which the lower half of the roller means is situated.

The present invention relates in general to a filter, and in particular to an automatic filter which comprises a driven magnetic roller with a skimmer and a squeeze roller resting against the magnetic roller and of a trough-type housing or casing which surrounds the lower half of the magnetic roller, extending approximately upwardly to half of the axis thereof. The magnetic roller is provided with means for the purpose of guiding a liquid medium into the pole zones thereof.

Automatic filters as described above are known, wherein a feeding chute is provided, consisting of a plate which is slightly tilted toward the magnetic roller, and wherein the edges of the feeding chute are raised. Due to this design, the liquid medium will be distributed almost simultaneously over the entire width of the magnetic roller. Hence, impurities contained in the liquid medium will also arrive uniformly distributed at the magnetic roller. Depending on the duration and on the distance from the magnetic roller and their points of deposit, these impurities are separated to a lower or higher extent. Since the duration is a function of the velocity of flow and of the length of the path during the time period when the magnetic roller exerts its influence, an improvement of the degree of filtering can only be achieved to a rather low extent. By reducing the velocity of flow, the quantity which is to be processed through the filter is reduced. This, however, is not desirable in view of the size of the filter. The Coulomb's law thus defines or establishes a

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clear limit with respect to the small size of the filter which is generally desirable.

A considerable improvement of the degree of filtration cannot be achieved in this manner.

It is also known to design the feeding chute in form of a corrugated plate, and to arrange the obtained grooves in an inclined position toward the magnetic roller. Thus, the liquid medium will be divided into single streams or flows which engage the magnetic roller in this fashion. It can be assumed that the impurities are uniformly distributed in the liquid with this flow control arrangement. The impurities thus arrive with the full liquid quantity of the part flow at the magnetic roller, and are then prevented from depositing at the pole zones of the magnetic roller, to a considerable degree due to the turbulence of the liquid substances. Again, no improvement of the degree of filtration can be achieved with this afore-described method.

It is therefore an object of the present invention to achieve a considerable improvement of the degree of filtration.

It is another object of the present invention to provide an automatic filter comprising a driven magnetic roller with a skimmer and a squeeze roller which engage the magnetic roller, and a trough-type casing or housing which surrounds the lower half of the magnetic roller. The housing is provided with means for guiding the liquid into the pole zones of the magnetic roller, whereby the impurities are separated already within the range of the feeding chute, and are pre-oriented in the direction of their depositing points in the inhomogenous magnetic system.

These objects are achieved according to the present invention by arranging the feeding chute in such a way, that the grooves which extend in flow direction of the liquid are arranged parallel to each other and are tapered in their width and/or depth in the direction of the magnetic roller, and that the grooves are directed toward the pole zones on the circumference of the magnetic roller.

The invention will be more clearly understood from the following description of specific embodiments of the invention together with the accompanying drawings, in which:

FIG. 1 is a perspective view of the filter device with the feeding chute and the cover plate shown in an exploded view;

FIG. 2 shows the angular arrangement of the grooves in the feeding chute, and

FIG. 3 shows a plurality of advantageous groove forms in a sectional view.

With respect to the drawings, and in particular with respect to FIG. 1, it can be seen that a trough-type housing 1 surrounds approximately the lower half of a rotary magnetic roller means 2, extending upwardly to the axis of the magnetic roller means. Magnetic roller means 2 extends longitudinally along the interior of housing 1, and is supported by the end walls 3 of housing 1. Magnetic roller means 2 is continuously driven in the direction of arrow 4 in known manner; the drive means is not shown. The magnetic roller means consists of soft-iron discs 2' and permanent magnet discs 2'' which are concentrically arranged next to each other. The magnet discs 2'' are magnetized in known manner, and engage, with correspondent

poles, a common soft-iron disc 2'. Thus, the permanent magnets 2'' are arranged with like poles directed toward each other so that the soft-iron discs 2' are arranged with one of these discs engaged at its end faces by a pair of north poles, the next disc engaged by a pair of south poles, etc. In this way, the magnetic roller means 2 will have sharply defined pole zones distributed therealong where the discs 2' are located.

Above the shaft or axis 5 of magnetic roller means 2, and outside of the liquid level, a feeding chute 6 is disposed on a side-wall of trough-type housing 1. This feeding chute is arranged in a position inclined downwardly toward magnetic roller means 2, and is provided with opposed side walls and a bottom wall formed with a feeding box 7 mounted on the upper end 6' thereof. Feeding chute 6 is provided with grooves 8 which are directed toward magnetic roller 2 in flow direction of the liquid medium. Grooves 8 are so arranged that they taper off toward the magnetic roller 2, thereby gradually reducing their width or depth. At the chute end 6'', which is arranged adjacent the trough, the grooves 8 terminate with their small ends respectively directed toward and aligned with the pole zones (soft-iron discs 2') of magnetic roller means 2, and may be designed more or less ascending, so that at the region of their small ends the grooves 8 are slightly inclined upwardly toward the magnetic roller means 2. The cross section of grooves 8 may be selected according to the liquid medium which is to be purified, and also to the quantity and type of impurities. Cross sections of grooves 8 which are especially advantageous are illustrated in FIG. 3.

A magnetic system 9 is mounted below feeding chute 6 in the range of magnetic roller means 2, whereby a weak magnetic field occurs in grooves 8 at the region of the end 6'' of chute 6. In this case, feeding chute 6 must be composed of a non-magnetic material. According to the conditions prevailing in the factory or plant, and if so desired, feeding box 7 may be covered to keep foreign matter from entering the liquid medium. This will be done by a cover plate 10 which may be removably mounted onto feeding box 7 by means of screws 11. The cover plate is so arranged on the feeding box that a sufficient filling slit remains open on the upper portion of feeding box 7. The opposite end of cover plate 10 extends as close as possible to magnetic roller means 2.

The mode of operation of this automatic filter is described as follows:

The liquid medium which is to be purified is fed into feeding box 7, and distributes itself above edges 6' into the grooves of feeding chute 6. Due to the inclined position of the chute toward magnetic roller means 2, the liquid medium flows through grooves 8 to magnetic roller means 2. The tapered cross section of grooves 8 causes the liquid medium to overflow out of grooves 8 while flowing downwardly toward magnetic roller means 2, or to housing 1 respectively. Due to their weight, and retarded because of the weak magnetic field and the design of grooves 8 which ascend at 6'', the impurities will remain at the feeding side in grooves 8, and will be guided on account of and together with the remaining small amount of liquid substance onto the pole zones of magnetic roller means 2. The liquid which overflows the grooves 8 is substantially free of the impurities and simply flows into the trough 1 around the magnetic roller means 2. Magnetic roller means 2 is thus released from the hitherto unavoidable duty that it must attract the impurities against the turbulence, against the resistance of the liquid medium and against its own force of gravity. The degree of separation or filtration is thus increased considerably. The main quantity of impurities, which may consist of a mixture of grinding chips and corundum, is immediately separated and removed from the liquid medium by the rotating magnetic roller means 2. A further filtering is also apparent in that the liquid medium passes through the trough-type housing 1 around magnetic roller means 2. The degree of separation or

filtration can be further improved by arranging the grooves in a sloped position in the direction of flow.

It is therefore advantageous if feeding chute 6 ends slightly ascending in the range of magnetic roller means 2 and slightly above the axis thereof. Furthermore, the weak magnetic field which is arranged below the chute adjacent magnetic roller 2 facilitates the filtering operation also. In this case, the feeding chute must be made of a so-called non-magnetic material such as, for example, brass or aluminum.

On account of such a design and arrangement, the liquid medium will concentrate and mix the impurities in the grooves. The liquid medium will then be discharged from the grooves with their reduced cross sections in flow directions, and flow between them toward the magnetic roller. Since grooves 8 are directed toward the pole zones, the main quantity of the impurities, with only a small share of liquid medium, will be guided onto the pole zones on the circumference of the magnetic roller, and will be directly applied thereon. The impurities will be retained, and removed from the range of the liquid medium on the magnetic roller on account of the rotary movement of the magnetic disc. The liquid medium which overflows between the grooves is subjected to the magnetic field after entering into trough-type housing 1, and, while travelling around the magnetic roller, is thus purified from the small amount of impurities still contained in the liquid medium at this time.

It is within the scope of this invention to arrange the grooves in an angular position with respect to the magnetic roller if a large amount of impurities is encountered. Preferably, the grooves should be arranged in an angle of 80-85° with respect to the axis of magnetic roller 2.

The embodiment of the invention particularly described is presented merely as an example of how the invention may be applied. Other embodiments, forms and modifications of the invention, coming within the proper scope of the appended claims, will, of course, readily suggest themselves to those skilled in the art.

What is claimed is:

1. In a filter for separating from a liquid particles which are attracted to a magnet, a rotary magnetic roller means having a substantially horizontal axis and a plurality of pole zones spaced from each other and distributed therealong, and a feed chute inclined downwardly toward said roller means and having opposed side walls and a bottom wall for confining the liquid with the particles therein, said bottom wall being formed with a plurality of grooves extending in the direction of liquid flow and tapering toward said magnetic roller means with said grooves terminating at their small ends adjacent to and respectively in alignment with said pole zones, so that as the liquid flows down said chute, it overflows said grooves leaving particles therein to be directed with the smaller amount of liquid which remains in said grooves directly to said zones.

2. The combination of claim 1 wherein a trough houses approximately the lower half of said magnetic roller means and is connected with said chute to receive from the latter the liquid which overflows said grooves as well as the small amount of liquid which flows from said grooves to said zones, while most of the particles are retained at said zones of said magnetic roller means.

3. The combination of claim 1 and wherein said chute is inclined slightly in an upward direction at the region of the small ends of said grooves for retarding the flow of the particles with the liquid.

4. The combination of claim 1 and wherein said chute is made of a non-magnetic material, and means situated adjacent said chute at the region of the small ends of said grooves for providing a relatively weak magnetic field to retard the flow of particles with the liquid.

5. The combination of claim 3 and wherein said chute is inclined slightly in an upward direction at the region of the small ends of said grooves for further retarding the flow of the particles with the liquid.

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6. The combination of claim 1 and wherein a cover is provided over said feed chute.

7. The combination of claim 1 and wherein said magnetic roller means is made up of a plurality of permanent coaxial magnets spaced from each other and having like poles directed toward each other and a plurality of soft-iron discs situated between and engaging said magnets.

8. The combination of claim 1 and wherein said grooves at least have a gradually diminishing width in the direction of the liquid flow toward the magnetic roller means.

9. The combination of claim 1 and wherein said grooves at least have a gradually diminishing depth in the direction of the liquid flow toward said magnetic roller means.

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REUBEN FRIEDMAN, *Primary Examiner*.

THEODORE A. GRANGER, *Assistant Examiner*.

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209—219, 232; 55—3, 100