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Filed Nov. 20, 1928

2 Sheets-Sheet 1

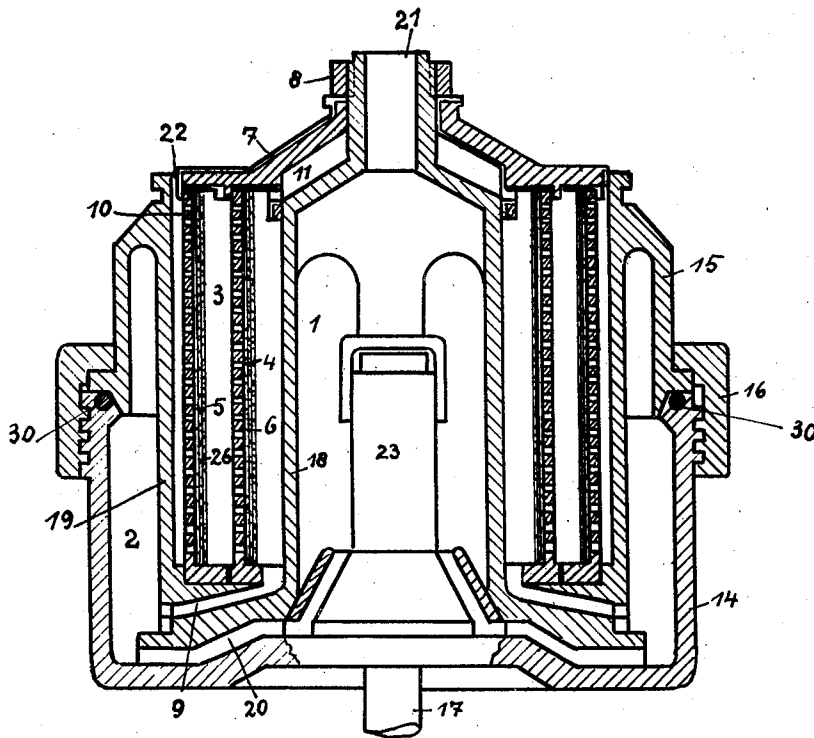


Fig. 1.

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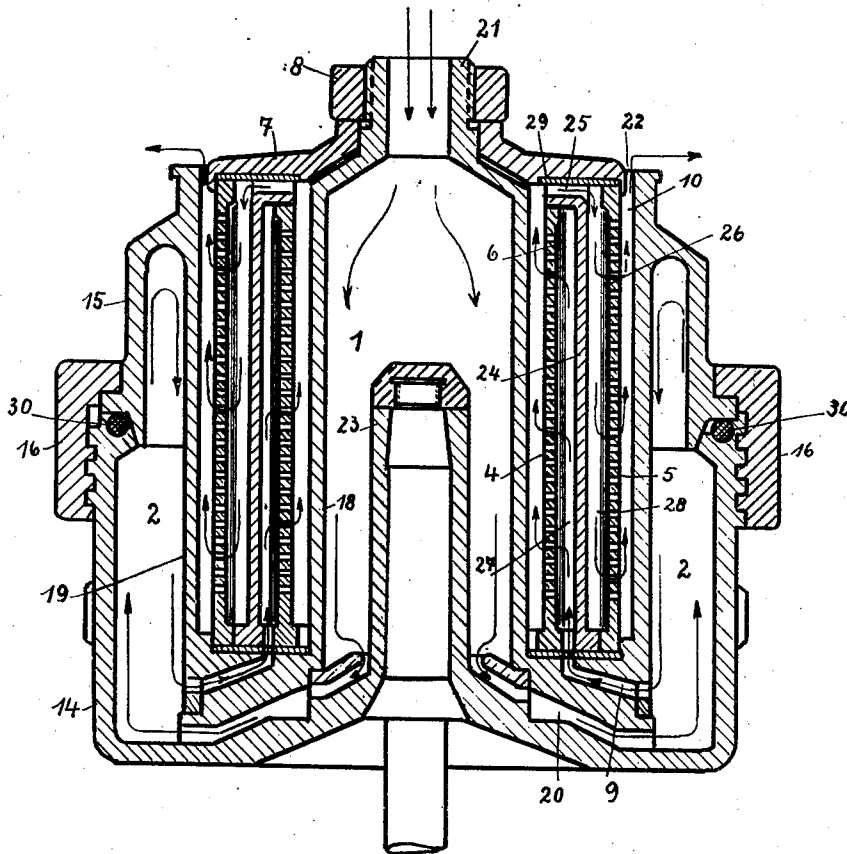


Fig. 2

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UNITED STATES PATENT OFFICE

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CENTRIFUGAL MACHINE FOR CLARIFYING LIQUIDS AND THE LIKE

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The invention relates to a closed centrifugal drum for clarification of liquids and for similar purposes and especially for a closed centrifugal drum provided with preliminary separating chambers and with fine-clearing sieves and filters, and it is intended to improve the arrangement and the function of the sieves and filters in such a centrifugal drum so as to avoid the obstruction of the sieves and filters and to obtain a very efficacious utilization of the centrifugal action and the finest possible clarification. According to the invention this problem is resolved by that, on the one hand, all the clarifying spaces of the drum, inclusively the clearing space comprising the sieves and filters, are formed as closed concentric chambers being in communication with one another at the lower or upper end and that, on the other hand, the space containing the sieves in concentric arrangement is inserted in the form of a middle annular chamber between the inner and the outer preliminary clearing spaces.

In this way an efficacious and intensive preliminary clearing action is obtained by separating the coarsest particles in the inner clearing chamber and the particles of middle heaviness in the outer clearing chamber so that only the finest particles must be separated by means of the sieves and filters which, therefore, are securely protected against obstruction and clogging. At the same time the sieves and filters are arranged in a zone of the drum which is practically not useful for clarifying because there exists only a middle centrifugal force. Furthermore by arranging the sieves and filters in this middle zone, also a favourable utilization of the inner space of the drum is realized and, furthermore, the sieves and filters are enabled to be united to a closed separate body which can be easily inserted into the drum and withdrawn therefrom. Another advantage consists in that by placing the sieves and filters in the zone of middle centrifugal force, a too high pressure on the sieves and filters and the danger of an undesirable passage of impurities through the sieves are avoided with security. Finally,

when lodging the sieves and filters in a closed separate annular chamber, there is the further favourable result that the conditions of flowing in the preliminary clearing spaces are not unfavorably influenced by an irregular passage of liquid through the sieves.

By placing the sieves and filters in a separate closed annular chamber situated between inner and outer preliminary clearing spaces, there is the further advantage that this annular chamber can be provided without constructional difficulties with means causing the liquid to pass through the sieves and the filters from the inside to the outside and also from the outside to the inside, whereby the filters and sieves are automatically cleared of the heavy as well as of the light particles. When conducting the liquid only from the inside to the outside through the filters and sieves, this automatic cleansing of the filters and sieves will take place only as regards the particles being specifically lighter than the liquid as for instance fat and wax particles which when conglomerated sufficiently will overcome the pressure of the liquid current, and swim away from the filters, whilst the heavier particles are held on the filters by the action of the centrifugal force so as to obstruct the filters. On the other hand in the case of conducting the liquid from the outside through the filters and sieves, only the heavier particles, when sufficiently conglomerated, will be removed from the filters by the centrifugal force, but the lighter particles are retained on the filters by the pressure of the liquid current acting in this case in opposition to the centrifugal force, and will obstruct the filters.

However, owing to the various compositions of the liquids to be clarified, heavier as well as lighter particles must be separated from about all these liquids and to this end two centrifugal drums have been hitherto employed, the one having filters and sieves traversed by the liquid in the direction of the centrifugal force and the other having filters and sieves traversed in the opposite direction by the liquid. According to the invention these two opposite directions of

the passage of the liquid through the filters and sieves are obtained both in a single centrifugal drum by that in the annular chamber containing the sieves and filters it is foreseen an intermediate wall conducting the liquid in such a way that it traverses radially the filters and sieves first in the one and then in the opposite direction whereby an automatically cleansing of the filters and sieves of the heavier as well as of the lighter particles is obtained by simple means.

The invention will be more specifically described with reference to the accompanying drawing showing by way of example two forms of embodiment of the principles of the invention. Figure 1 represents in a vertical section a centrifugal drum having sieves and filters arranged in an intermediate annular closed chamber situated between an inner and an outer preliminary clearing space, whilst Figure 2 shows, also in a vertical section, a centrifugal drum in which a middle annular chamber containing filters and sieves and arranged between an outer and an inner preliminary clearing chamber is subdivided by a partition wall guiding the liquid to be clarified in two opposite radial directions through the intermediate annular chamber.

As appears from Figure 1 the centrifugal drum comprises the drum casing 14 and the cover 15 with a screw-threaded ring 16 connecting the two parts 14, 15 with the intermediate of a tightening or packing member 30. The operation of the drum is effected by means of a vertical shaft 17 which is suitably journaled and connected to a driving source, motor or the like. The interior of the centrifugal drum is subdivided by means of two partition walls 18 and 19 concentric to the shaft 17, into three spaces 1, 2, 3 forming closed cylindrical chambers communicating with one another only at their lower ends through the channels 20 and 9 respectively. The inner chamber 1 is connected at its upper end to the inlet pipe 21 and contains a displacement body 23 coaxial to the shaft 17. The partition wall 19 which extends from the cover 15 works as displacement body in the outer chamber 2. The middle annular chamber 3 contains the filtering body 10 which comprises two concentric cylindrical sieves 4 and 5 carrying at their inner surfaces cloth filters 6 and 26 respectively. The cover 15 closes only the outer annular chamber 2, whilst the middle annular chamber 3 is closed by a separate cover 7 which is lodged in the drum cover 15 and pressed tightly on the upper ends of the sieves 4, 5 by means of the ring 8 screwed on the inlet pipe 21. Between the upper end of the middle chamber 3 and the outer wall of the inlet pipe 21 there is foreseen for equalizing the pressures a space 11 communicating with the space between the

partition wall 18 and the sieve 4. The space situated between the sieve 6 and the partition wall 19 is at its upper end in communication with the annular outlet orifice 22 of the centrifugal drum.

The liquid to be clarified is admitted through the inlet pipe 21 to the inner chamber 1 in which, by means of the displacement body 23, the first preliminary clearing of the liquid is effected, the coarse solid particles separated therefrom being collected on the inner surface of the partition wall 18. Then, the liquid flows through the channels 20 into the outer chamber 2 where a second preliminary clarification takes place which is very intensive and efficacious owing to the highest centrifugal force being operative in the chamber 2. The particles separated from the liquid by this second preliminary clarification are deposited on the inner surface of the drum 14. Thereupon the liquid passes through the channels 9 into the middle annular chamber 3 in which it traverses the sieves 4, 5 and filters 6, 26 from the inside to the outside whereby it is liberated from the finest impurities so that it leaves the outlet 22 in a perfectly clarified state. The liquid being dammed up into the space 11 provokes by its centrifugal pressure an equalizing action counteracting to an irregular admission or flowing of liquid.

The centrifugal drum shown in Figure 2 is distinguished from the embodiment of the invention according to Figure 1 by that the middle annular chamber situated between the preliminary clearing spaces 1 and 2 is subdivided by means of a cylindrical intermediate wall 24 in two concentric annular spaces 27 and 28 which contain the sieves 4 and 5 with the filters 6 and 20 respectively. The inner annular space 27 is connected at its lower end to the outer chamber 2 by means of the channels 9 and at its upper end to the outer annular space 28 by means of the channels 25, whilst the outer annular space is in communication with the outlet 22 through the sieve 5. The ring 29 which may contain the channels 25 tightens the spaces 27, 28 at their upper ends. As the arrows indicated in Figure 2 show, the liquid is conducted by the intermediate guiding wall 24 in such a way that it traverses the sieve 4 and the filter 6 from the outside to the inside and then the sieve 5 and the filter 26 from the inside to the outside whereby an automatic clearing of the filters from the heavier as well as from the lighter particles is simultaneously obtained.

The outer annular space 28 of the middle chamber may open, if desired, directly to the outlet 22, the sieve 5 and the filter 26 being omitted in this case. Furthermore the guiding wall 24 may replace the outer sieve 5 so that the annular space 27 includes also the annular space 28. In many cases it may be

advantageous to exchange the inner filtering sieve for a narrower sieve. Instead of conducting as in Figure 2 the liquid first from the outside to the inside and then from the inside to the outside through the chamber containing the sieves and filters, the liquid can be guided also in the reverse way so as to traverse this chamber first in the direction of the centrifugal force and then in the opposite direction. These two currents flowing in opposite directions may be branched off from the outer preliminary chamber 2 either in series or in parallel. Instead of a single intermediate guiding wall 24, two or more conducting and separating walls may be provided in the middle annular filtering chamber which is then subdivided in three or more concentric compartments. Finally, instead of two sieves 4, 5 also a higher number of sieves and filters may be arranged in the middle annular chamber of the drum and more than two preliminary clearing chambers may be contained in the drum. Still further changes and modifications may be made in the construction and arrangement of the parts and details of the invention without deviating from the spirit thereof, except as stated in the claims hereinafter appended.

I claim:

1. In a centrifugal machine for clarifying liquids and the like, in combination a centrifugal drum, admission and eduction means on said drum, concentric partition walls in said drum dividing its interior in at least one inner and at least one outer closed chamber, these chambers communicating at their one end with one another in series connection, means for producing a preliminary clearing in these chambers, a middle chamber situated between the inner and outer clearing chambers and communicating at its one end with the eduction means and at its other end with the outer clearing chamber, filtering means in this middle chamber and means for conducting the liquid to be treated first through the inner and outer clearing chambers and then through the middle filtering chamber to the eduction means.

2. In a centrifugal machine for clarifying liquids and the like, in combination a centrifugal drum, a cover for said drum, admission and eduction means on said drum, concentric partition walls in said drum dividing its interior in at least one inner and at least one outer closed chamber, these chambers communicating at their one end with one another in series connection, means for producing a preliminary clearing in these chambers a middle annular chamber situated between the inner and outer clearing chambers and communicating at its lower end with the outer clearing chamber and open at its upper end, a cover closing the upper end of said middle chamber and being independent of the drum cover, filtering means in said middle

chamber, means for pressing the cover of the filtering chamber on the filtering means so as to tighten their ends and means for conducting the liquid to be treated in series first through the inner and outer clearing chambers and then through the middle filtering chamber to the eduction means.

3. In a centrifugal machine for clarifying liquids and the like, in combination a centrifugal drum, a cover for said drum, admission and eduction means on said drum, concentric partition walls in said drum dividing its interior in at least one inner and at least one outer closed chamber, these chambers communicating at their one end with one another in series connection, means for producing a preliminary clearing in these chambers, a middle annular chamber situated between the inner and outer clearing chambers and communicating at its lower end with the outer clearing chamber and open at its upper end, a cover closing the upper end of said middle chamber and being independent of the drum cover and prolonged up to the admission means of the drum, filtering means in the middle chamber, means for pressing the cover of the filtering chamber on the filtering means so as to tighten their ends and means for conducting the liquid to be treated first through the inner and outer clearing chambers and then through the middle filtering chamber to the eduction means.

4. In a centrifugal machine for clarifying liquids and similar purposes, in combination a centrifugal drum, admission and eduction means on said drum, partition walls in said drum dividing its interior in concentric closed chambers communicating with one another, means for producing a preliminary clearing in at least one of said chambers, filtering means in at least one of said chambers, means for subjecting the liquid to be treated first to the action of said preliminary clearing means and then of said filtering means, and means for conducting the liquid through the filtering means in opposite directions.

5. In a centrifugal machine for clarifying liquids and the like in combination a centrifugal drum, a driving shaft, an admission pipe on said drum, an outlet orifice on said drum, concentric partition walls on said drum subdividing its interior in several concentric chambers, sieves and filters in one of said chambers, means for producing a preliminary clarifying in the other chambers, means for conducting the liquid to be treated first through the preliminary clearing chambers and then to the filtering chamber, an intermediate wall in said filtering chamber subdividing its interior so as to conduct the liquid in the one and then in the opposite radial direction through said filtering chamber.

6. In a centrifugal machine for clarifying liquids and the like, in combination a centrifugal drum, a detachable cover for said

drum, a driving shaft connected to said drum,
an admission pipe and an outlet orifice on said
drum, concentric partition walls on said drum
dividing its interior in several chambers con-
centric to said driving shaft, sieves and filters
5 in one of said chambers, means for prelimi-
nary clearing in the other chambers, means
for connecting the filtering chamber in series
with the preliminary clearing chambers, an
10 intermediate wall in said filtering chamber
subdividing its interior in two compartments
each containing at least one sieve and filter,
means for connecting said two compartments
with one another and with the preliminary
15 clearing chambers so that the liquid is con-
ducted first through the inner compartment
from the outside to the inside and then
through the other compartment in the oppo-
site direction and to the outlet of the drum.

20 In testimony whereof I affix my signature.

CARL SCHMITZ.

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