Jan. 19, 1943. F. W. WINKLER 2,308,559

SOLID BOWL TYPE OF CENTRIFUGING APPARATUS

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FIG. 1.

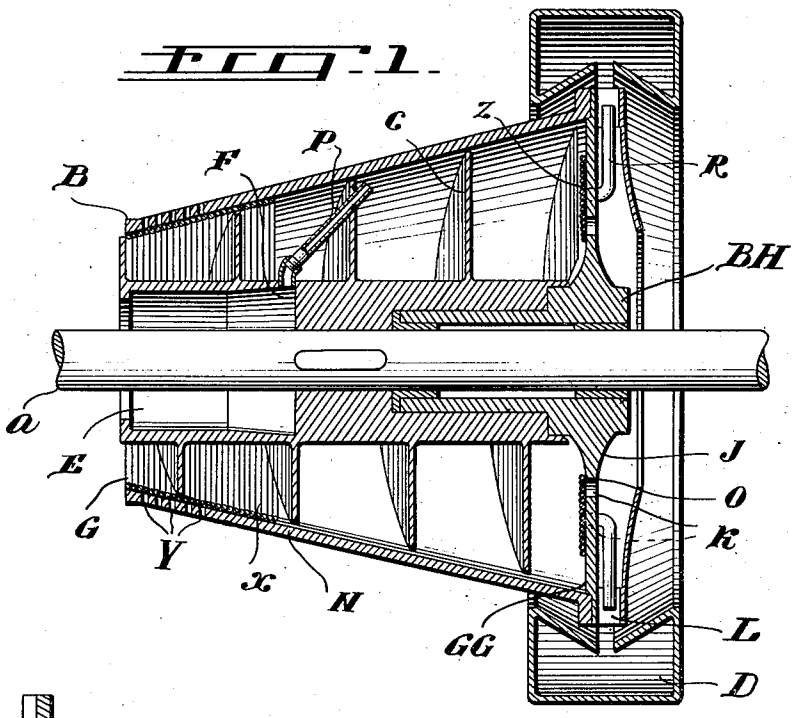


FIG. 2.

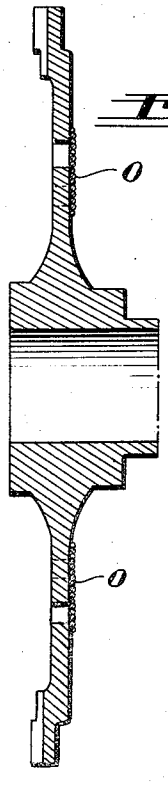
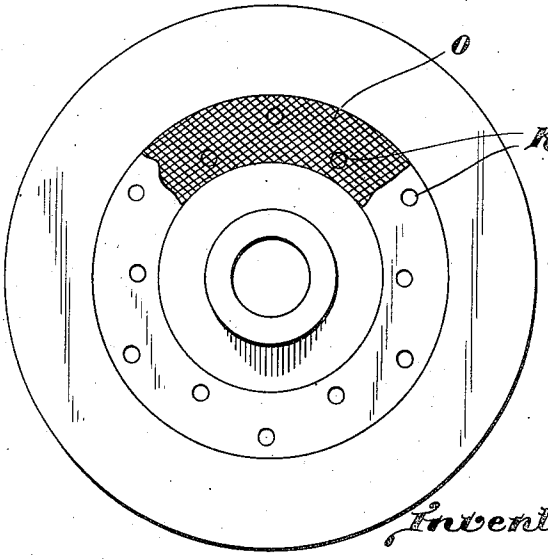


FIG. 3.



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SOLID BOWL TYPE OF CENTRIFUGING APPARATUS

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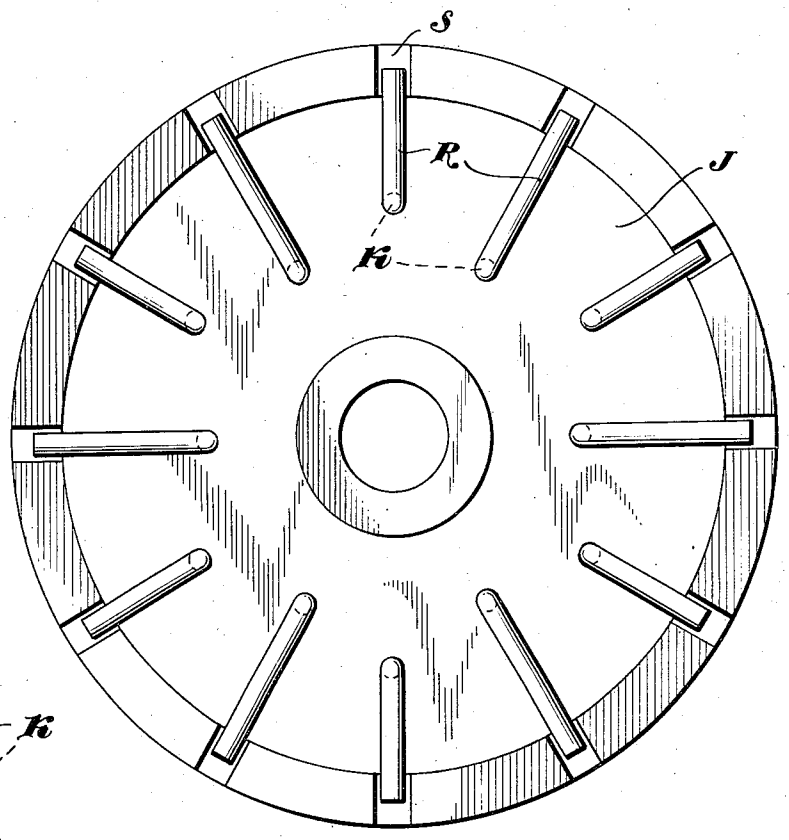
FIG. 5.



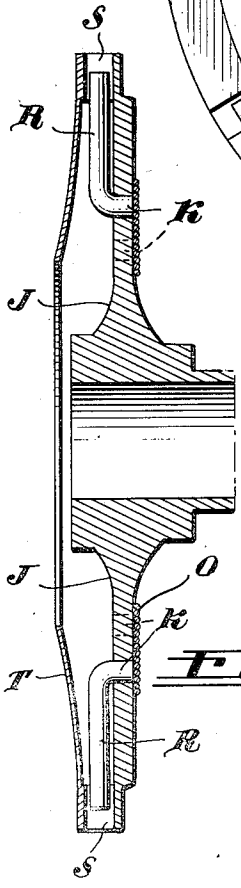
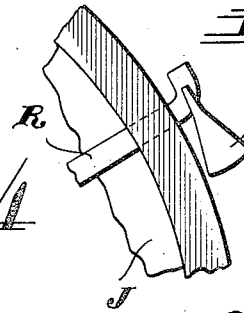


FIG. 4.

FIG. 6.



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Patented Jan. 19, 1943 2,308,559

UNITED STATES PATENT OFFICE

2,308,559

SOLID BOWL TYPE OF CENTRIFUGING APPARATUS

Frederick W. Winkler, Newark, N. J.

Application March 12, 1940, Serial No. 323,508

1 Claim. (Cl. 233—2)

This invention has to do with centrifuges operating on mixtures of liquids and solids, where it is desired to separate such solids and liquids as nearly as possible, perfectly from each other.

This invention relates to improvements which will make possible the separating of the solids in a greater degree of dryness than hitherto possible with this type of apparatus and the liquids to a better clarity than up to now possible.

For the purpose of illustration, a standard horizontal bowl type of continuous centrifuge has been used, but the invention is not restricted solely to this particular type as the improvements are applicable to the vertical bowl continuous centrifuge, in the same degree.

It is well known that the more general use of continuous centrifuges of the solid bowl type has been restricted for industrial purposes by certain inherent limiting factors, which have made these continuous centrifuges in many cases less effective than a class known as batch centrifuges. Thus, while it would be expected that the principle of continuity of operation would be a decisive factor in the choice of continuous machines over those known as the batch type, this expectation has not been fully realized, because of the limiting factors referred to. The inventor by certain improvements hereinafter described has overcome these limiting factors and has thereby considerably widened the scope of the application of this apparatus.

In the accompanying drawings are shown a horizontal solid bowl continuous centrifuge apparatus, together with a full description and explanation of the operation thereof. These same improvements with minor re-arrangement of the respective parts thereof are applicable to the vertical bowl type of continuous centrifuge to exactly the same degree, without in any respect departing from the principles involved.

Figure 1 is a longitudinal sectional view of a centrifuge involving my invention,

Figures 2 and 3 are sectional and end views respectively, of the end plate U of the centrifuge shown in Fig. 1,

Figure 4 is a sectional view of the discharge means of the centrifuge shown in Fig. 1,

Figure 5 is an end view of the structure shown in Fig. 4 with the cover plate T removed for clarity.

Figure 6 is a detail view showing a modified form of discharge means.

As the improvements concern only the vital centrifuge parts, such as the bowl and conveyor screw, these features of the centrifuge only, are shown in illustration. Such other parts of a complete continuous centrifuge as, differential gears, driving equipment and supporting structure have been omitted for the sake of simplification.

In Fig. 1, the bowl B is arranged to revolve on the shaft A but is not fastened thereto. It depends for its motion on gears fastened to its hub BH. Attached to the shaft and revolving with it, is the helical screw C. Thus, through the use of a differential gear arrangement the bowl and screw are caused to revolve on the same shaft in the same direction but at slightly different speeds so as to give a conveyor effect to the helical screw. The procedure of operation is as follows: The material to be centrifuged is fed into the receiving chamber E from which it flows into the bowl through a series of holes around the periphery of this chamber indicated and located by F. This is done while the bowl and screw are revolving. Thereupon through the agency of centrifugal force a separation takes place, the solids collecting on the periphery of the bowl while the liquid takes a position nearer the shaft of the bowl. Due to the conveyor effect of the helical screw, the solids collecting on the periphery are carried continually to the bowl edge or opening at G and are here thrown off and out of the bowl. The liquid meanwhile runs off through a series of holes K in the backplate J. Due to the arrangement of the holes in the backplate J the liquid level in the bowl can be regulated at any depth required, but is most generally arranged so that a portion of the periphery of the bowl near G of the space GG to G is exposed and not within the liquid level of the bowl. This dry space is for the purpose of draining the solids as nearly dry as possible before ejecting them from the bowl. This section is known as the dry area of the centrifuge bowl and is thus referred to, in the following description: The liquid flowing through the holes K is ejected through holes L and is caught and conveyed from the machine by the collector chamber D. Thus a continuous addition of material into the receiving chamber E, while the bowl and screw are revolving results in a continuous separation of solids and liquid from each other and their continuous ejection from the centrifuge as such.

The operation of this type of equipment is substantially as described and it has found application in many industries despite certain limitations previously referred to. These limitations consist of a relatively high liquid content in the solids ejected as well as a lack of clarity in the liquid leaving the discharge nozzles. These limitations have been corrected by the following inventions and the field of usefulness of this type of apparatus thereby considerably broadened. Some of these correcting devices are shown on Figure 1 and are fully described and explained in the following paragraphs. One of these inventions consists of that part of the periphery of the bowl, referred to as the dry area, being fluted with grooves indicated by the dotted line MN Figure 1 and this fluted surface being covered

with a metal screen X or a covering of other suitable filtering material or a combination thereof. The object of this arrangement is to allow the wet paste, traversing this dry area, under the influence of the conveyor screw, a more ready means of discharging its liquid content. The periphery of this dry area is further improved with holes Y Figure 1 to provide for a more rapid elimination of the liquid discharged from the paste of solids. In addition, to prevent wetting of the material in this drying area by incoming wet material from the entrance chamber E, Figure 1 the holes, indicated by F, have been equipped with conductors or pipes P Figure 1 of sufficient length to conduct the incoming wet material beneath the liquid level of the bowl. These inventions just described make possible the ejection of much dryer solids than has hitherto been possible with this type of machine.

Thus as a better dryness of solids was accomplished by the use of a metal screen or some suitable filtering material, a better clarity of the liquid, leaving the machine was likewise accomplished. This was achieved by covering the holes K in the back plate J Figure 1 with a covering of wire screen or other suitable filtering material as shown at O Figure 1. This is also shown on Figures 2 and 3. where the position of wire cloth or filtering material O is again shown. By the use of this filtering material any finely divided material not readily carried to the periphery of the bowl, is prevented from leaving the centrifuge by way of the discharge nozzles K Figure 4. This precipitation collects on the filtering medium and when its mass reaches sufficient proportions to be acted upon by centrifuge force, is thrown to the periphery of the bowl where it is conveyed out of the machine by the helical screw. This prevents the liquid leaving the centrifuge through its ejecting nozzles, from doing so in a turbid condition. This application of a filtering medium to the nozzles K Figure 2 would normally result in a considerable hindrance to the free flow of liquid through these nozzles and thereby considerably restrict the capacity of such machines. Therefore these nozzles have been provided with aids for overcoming such resistance. This is accomplished by use of vacuum creating syphons of the ejector type. This is better shown and described on Figure 5. Here are shown each of the holes K in back plate J provided with an extension pipe or tube R. The holes K which are commonly referred to as nozzles are thereby extended to the periphery of the backplate for a two fold purpose. One of the reasons therefore is to take advantage of the effect of centrifugal force on a tube full of liquid and the other is to use this tube as one of the elements of an ejector type vacuum pump. This is shown on Figure 5 where the nozzle R is extended into the orifice S. This combination of nozzle and orifice constitutes a simple form of ejector type vacuum pump when the rush of air or liquid between apron T and backplate J Figure 4 forces itself through the orifices S and out at the periphery. The action of this combination of orifice and tube is that of a vacuum pump and its function is to keep the tubes R constantly filled with a column of liquid which is as constantly ejected by centrifugal force. Thus the impeding action of any filtering medium to the free flow of liquids of the centrifuge nozzles is counteracted with this combination of vacuum pump and centrifugal syphon. While the flow of air from between the apron T Figure 4 and the backplate J through the orifices S is sufficient in many cases to maintain a column of liquid in the nozzle tubes R a constant supply of liquid into this space made by apron cover T and backplate J is much better for some purposes. This liquid flowing through orifices S past the openings of the tubes R creates a more powerful vacuum than air and for most purposes is a better arrangement. The supply of liquid for this purpose, after providing a start with some priming liquid, can come from a recirculation of part of the liquid separated by the centrifuge and ejected therefrom. While this combination of orifice S and nozzle R constitute the most simple form of vacuum ejector pump, the inventor reserves the right to alter the size, shape and arrangement of the vital parts thereof and to otherwise arrange the form of this syphon, without departing from the principle thereof.

On Figure 6 another form of such syphon instrument is shown in illustration. Here the syphon is constructed by extending the nozzle R beyond the periphery of the backplate J and at a right angle tangentially to the circumference of this back plate. The funnel shaped portion V when the bowl is rotated in the direction of the arrow causes a vacuum in nozzle R when used with either air or a liquid.

The column of liquid resulting in the nozzles R is thrown off by centrifugal force and constantly reformed by this vacuum in the event of an interruption in its continuity. When a liquid is to be used as the energizing medium in the ejector pump Figure 4 the funnel shaped portion V is arranged so as to scoop this liquid out of a trough (not shown in illustration). This syphon effect shown in Figure 4 while possible of use with the horizontal solid bowl machine is more particularly made for the vertical solid bowl centrifuge.

Reference is herewith made again to Figure 1 where attention is directed to screen O. While this screen will in most cases be kept clean by centrifugal force it receives in addition a mechanical cleaning from the knifelike edge Z of the revolving helical screw C.

While I have illustrated and described my invention with some degree of particularity, I realize that in practice some alterations may be made. I, therefore, reserve the right and privilege of changing the form and the details of construction and of otherwise altering the arrangement of the correlated parts, without departing from the spirit or scope of the appended claim.

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

An imperforate bowl continuous centrifuge, provided with a filtering device on the liquid ejecting side of the centrifuge, in which the centrifugal pressure, on the side of the filter within the bowl, is aided by a syphon device, consisting of ejector tubes constructed on the opposite side of the filter, in which tubes a column of liquid is established and maintained from the filtrate, by lowering the atmospheric pressure within the ejector tubes, thus creating a vacuum therein, said vacuum being created by passing a stream of liquid or air over the peripheral end of the ejector tubes through means of an apron constructed and arranged to accomplish this purpose, this apron or directing element likewise being arranged so that the liquid required for this purpose can be supplied at the beginning from some outside source and thereafter continued with the filtrate supplied by the centrifuge.

FREDERICK W. WINKLER.