Feb. 20, 1934. C. E. GISH 1,947,844

BOWL SEPARATOR

Filed March 23, 1931 3 Sheets-Sheet 1

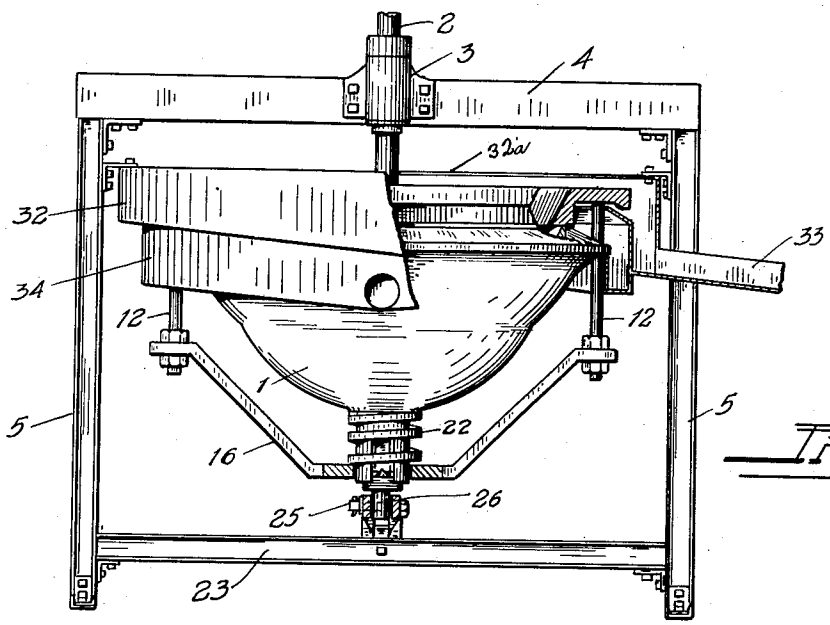


Fig. 1.

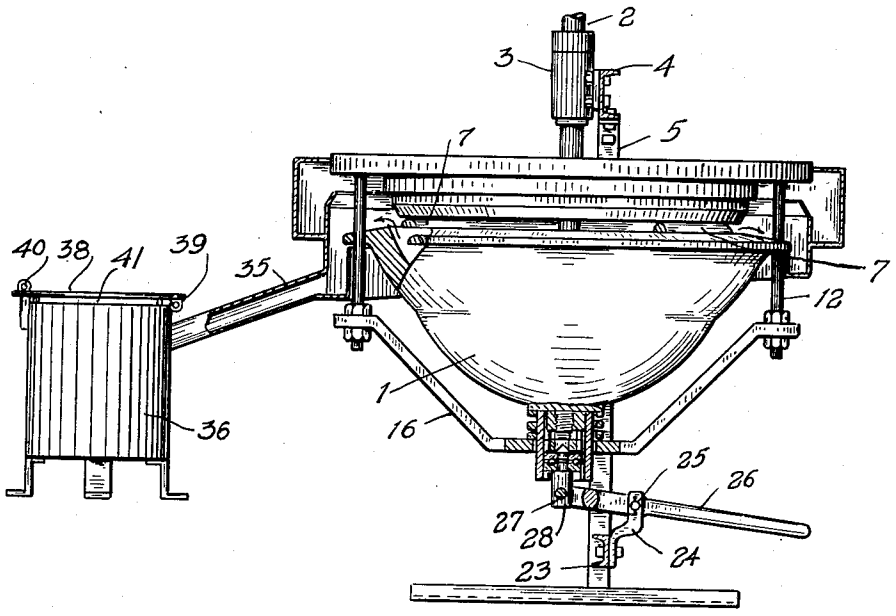


Fig. 2.

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BOWL SEPARATOR

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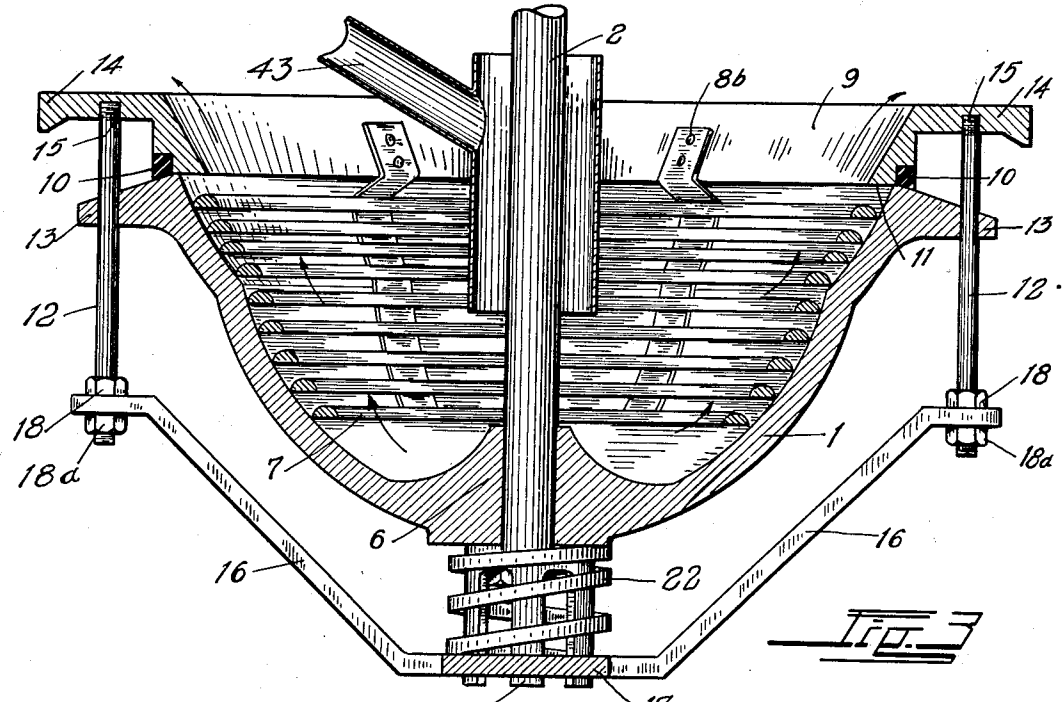


Fig. 3

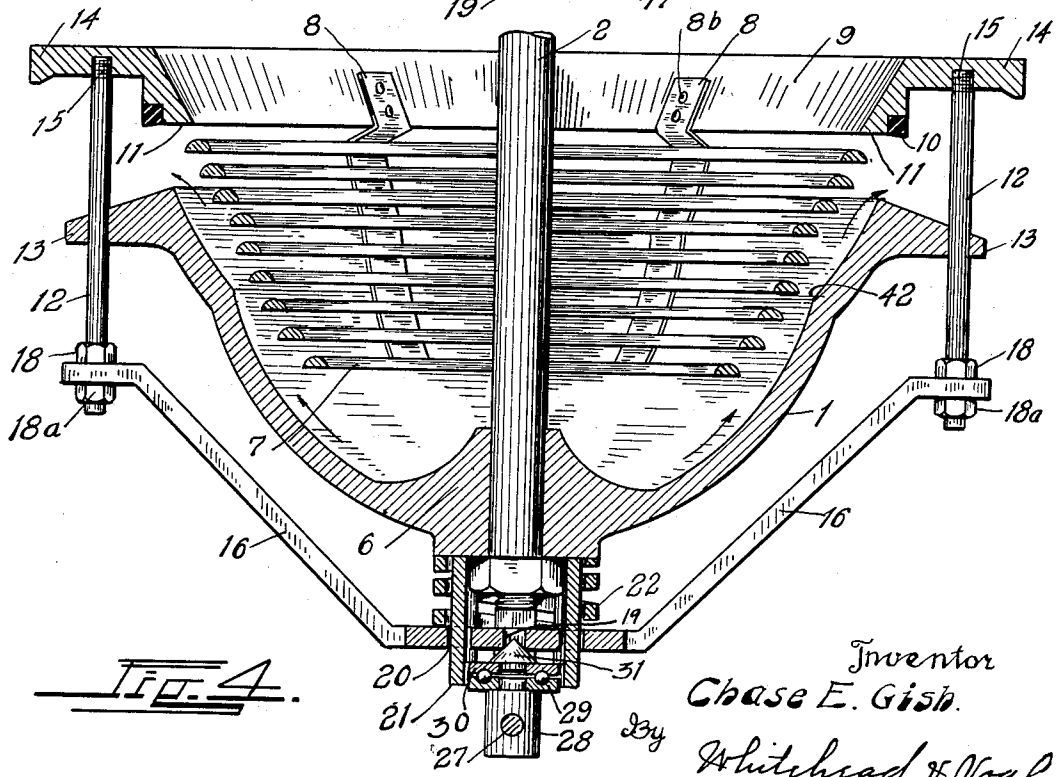


Fig. 4.

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BOWL SEPARATOR

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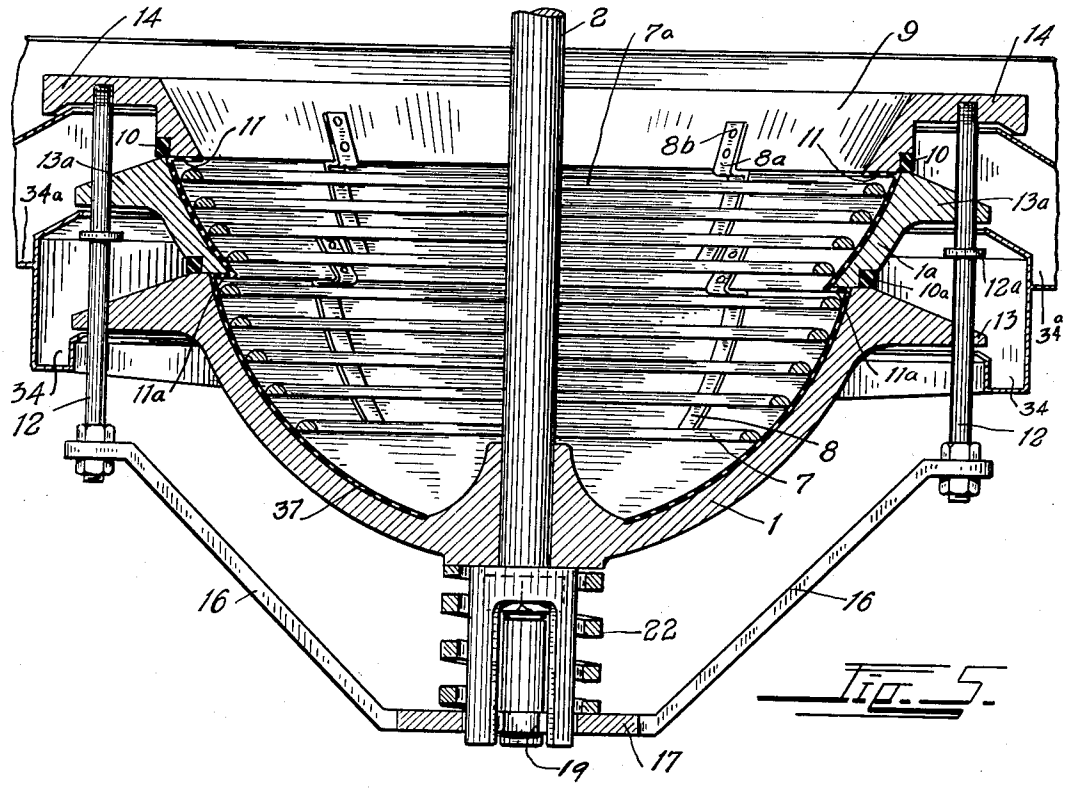


Fig. 5.

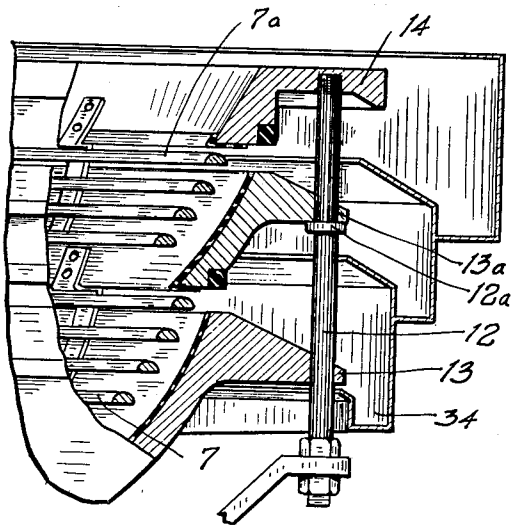


Fig. 7.

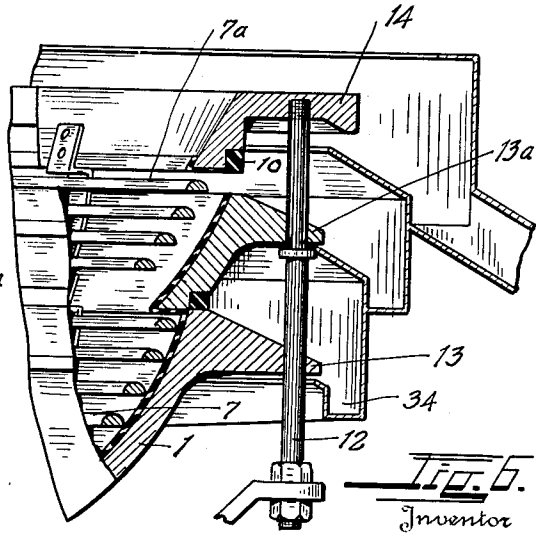


Fig. 6.

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UNITED STATES PATENT OFFICE

1,947,844

BOWL SEPARATOR

Chase E. Gish, Denver, Colo.

Application March 23, 1931. Serial No. 524,541

19 Claims. (Cl. 233—27)

This invention relates to bowl separators and has for an object the provision of improved means for recovering or making a "clean-up" of the material caught by the riffles in the operation of such an apparatus.

A further object of the invention is to provide an improvement in bowl separators whereby the riffles are separable from the bowl.

A further object is to provide improvement in the contour of the interior of the bowl whereby to render the same more efficient in the recovery of various classes of material and values.

A further object is to provide improvements in such a separator whereby the various grades of material recovered thereby may be substantially separated and classified and further improvements whereby such substantially separated classes of material may be separately recovered.

A further object is to provide improvements in the structure of such an apparatus whereby the riffles may be more easily and cheaply constructed and whereby they may be readily renewed or replaced when worn or damaged.

A further object is to provide in such an apparatus an improved construction and arrangement of launders and associated means for receiving and disposing of the waste material and for receiving, retaining and safeguarding the values coming from the machine in the clean-up.

A further object is to provide a bowl separator which shall be of great efficiency in operation and shall be durable and cheap as to manufacture, operation, maintenance and repair.

The foregoing objects will be amplified and other objects will appear in the following specification, taken in connection with the accompanying drawings, in which like characters of reference indicate corresponding parts throughout and in which

Figure I is a rear elevation of the apparatus, portions being broken away and portions being shown in section, exclusive of the settling tank.

Figure II is a side elevation, portions being broken away and portions shown in section, including the settling tank.

Figure III is a sectional view showing the parts of the bowl and riffles in operative position for separation of materials.

Figure IV is a view the same as Fig. 3 but showing the riffle basket raised for the clean-up operation.

Figure V is a sectional view of a modified construction wherein the riffles and bowl are arranged in a plurality of separate sets and sections.

Figure VI is a fragmentary view of the embodiment shown in Fig. 5, illustrating the position of the parts when one of the sets or sections of riffles is in raised position for a clean-up of the upper portion of the apparatus.

Figure VII is a view the same as Figure 6 but illustrating the position of the parts when all sections of the riffles are raised for a clean-up of all portions of the bowl.

In the operation of bowl separators certain objections and difficulties have been encountered, among which are the difficulties and expense incident to the cutting of riffles in the inner surface of the bowl; the necessity of stopping the bowl and washing out the riffles in order to accomplish a clean-up; the difficulty and expense of making repairs or replacement when the riffles become worn or damaged; the difficulties of making complete or efficient recovery of the values from the materials treated; the difficulty of separating or classifying the different values where the material treated contains different kinds of values and the difficulty of separately recovering in the clean-up, the different classes of values caught and retained in the riffles at different sections of the bowl.

The present invention is designed to eliminate, remedy and/or lessen the difficulties and objections encountered in the operation of bowl separators now and heretofore in use, including those above mentioned.

In providing an apparatus according to this invention, many variations in the details of construction may be made and I do not wish to be limited to the details of the structure as herein described or as shown in the accompanying drawings, which are for the purpose of illustration and not intended as a definition of the invention, the scope of which is defined in the appended claims.

The apparatus as illustrated in the accompanying drawings, comprises a bowl 1 mounted upon and for revolution with a shaft 2, which shaft is revolubly supported by any suitable means, as bearing 3 mounted upon a beam 4 supported by standards 5. The shaft may be revolved by any suitable means not shown. The bottom of the bowl is preferably raised, as illustrated at 6, in order to keep contained material from settling at the center of the bowl around the shaft.

The interior surface of the bowl is preferably smooth but for the purpose of catching and retaining the values from the material treated within the bowl, I provide a basketlike structure having an external contour corresponding to the internal contour of the bowl and comprising a series of rings 7 attached to straps 8, supported

by ring 9, which ring is mounted for vertical movement and may seat upon the upper rim of the bowl as illustrated in Fig. 3 or be raised thereabove as illustrated in Fig. 4.

The straps 8, below the ring 9, conform to the contour of the inner surface of the bowl, so that when the ring 9 is lowered to the position shown in Fig. 3 the straps 8 will fit snugly against the inner surface of the bowl. The straps 8 may be mortised into the outer edges of the rings 7 and secured thereto by any suitable means, as by welding, and the outer edges of the rings 7 are formed so as to snugly fit against the inner surface of the bowl when lowered to the position shown in Fig. 3, in which position the rings, which preferably have a flat, horizontal under surface, will form a series of riffles on the inner surface of the bowl.

The ring 9, in lowered position is designed to fit tightly upon the top edge of the bowl, as clearly illustrated at Fig. 3, and at the joint thus formed there is preferably provided a gasket 10 of any suitable material for cushioning the ring 9 as it is lowered onto the bowl and for tightly closing the joint therebetween, so that, in said lowered position, ring 9 in effect forms an extension of the bowl and becomes the rim thereof.

The lower inner edge of the ring 9 is preferably of less diameter than the top or rim of the bowl 1 whereby to form a flange 11, which flange both serves as a riffle to catch and retain values from the material being treated when the bowl is operated in the position shown in Fig. 3 and provides suitable means for the support of the riffle basket above described, and upper ends of the straps 8 being bent over the edge of, and engaging, the said flange as clearly illustrated at Figs. 3 and 4, whereby the said riffle basket conveniently engages and is carried by the ring 9. Straps 8 may be fastened to ring 9 by any suitable means as by rivets 8b.

The means for raising and lowering the ring 9 and therewith the riffle basket comprises rods 12 slidable through the circular apron 13 of the bowl 1 and having their upper ends threaded into the apron 14 of the ring 9 as at 15, or otherwise suitably secured to said apron 14. The rods 12 are supported by the arms 16 of a bracket, the central portion of which is designated as 17, said arms being attached to the rods 12 by any suitable means, as by locknuts 18 and 18a.

The central portion 17 of the bracket is provided with a central orifice 19 and a plurality of orifices 20 which may be separated from said central orifice. Legs 21 depend from the bottom of the bowl and project through the orifices 20, whereby, acting in cooperation with the apron 13, which slidably engages the rods 12, the whole structure, including the bracket, the rods 12, the ring 9 and associated parts, will be steadied and braced so as to revolve in substantially rigid relation with the bowl. It will be understood, however, that the legs 21 are slidable within the orifices 20, so that the central portion of the bracket 17 may slide up and down upon or in relation to the legs 21.

Resilient means, as coil spring 22, may be interposed between the bottom of the bowl and the central portion 17 of the bracket whereby the bracket is normally forced downward and the ring 9 is normally held tightly against the upper rim of the bowl 1.

On a suitable support, as crossbeam 23, carried by standards 5, I mount a bracket 24 and therein pivotally mount, as at 25, a lever 26, upon the inner end of which lever I pivotally mount, as at 27, a block 28 carrying, on its upper side, the lower half 29 of a ballbearing, the upper half of which bearing, being designated as 30, rests upon the balls in said bearing and carries a cone 31 adapted to project into the central orifice 19 and to engage the lower edges of the said orifice when the lever 26 is depressed. It will be apparent that on further depression of the lever 26, the bracket 17—16, the rods 12, ring 9 and riffle basket will all be raised to the position shown in Fig. 4, thus raising the rings 7 away from the inner surface of the bowl 1 and leaving a space along the inner surface of the bowl for the free passage of material, as indicated at the arrows in Fig. 4. The cone 31 entering the orifice 19 centers the bearing assembly relative to the bowl so that the upper half 30 of the bearing, being engaged with the revolving bracket by means of the cone 31 pressed into orifice 19, will revolve upon the balls without vibration.

Beneath the apron 14, I provide a launder 32, with cover 32a and spout 33 for conducting the overflow from the apron 14 to any desired point, not shown.

Within and below the launder 32 and beneath the apron 13, I provide a second launder 34 having a spout 35, said launder being adapted to catch the overflow escaping over the apron 13 during the "clean-up" and to deliver the same to the spout 35, whence it is conveyed to the settling tank 36, hereinafter more specifically described.

The modification illustrated in Figs. 5, 6 and 7 may be generally described as the same as the structure hereinabove described, except that the bowl and riffle basket are formed in separable sections so that one or more annular sections of the bowl and basket may be provided between the bottom or main portion of the bowl below and the ring 9 above.

Each of said annular sections of the bowl being vertically separable from the portion of the bowl immediately therebelow and the section of basket within said section of bowl being raisable out of contact therewith in substantially the same manner as ring 9 and the basket are raised as hereinabove described and a separate launder is provided for each such interposed section.

More specifically and referring to the illustrative drawings Figs. 5, 6 and 7, the bowl 1, rings 7, straps 8, ring 9, aprons 13 and 14, rods 12 and bracket 16—17 are the same as in the above described embodiment. Between bowl 1 and ring 9 I provide an annular section 1a adapted to normally seat upon the rim of bowl in a manner similar to the seating of ring 9 on the rim of bowl 1 in Fig. 3 and provided with a gasket 10a corresponding in structure, relative position and purpose with the gasket 10 of the ring 9. The bottom of section 1a preferably has a smaller diameter than the upper rim of the bowl, normally adjoining the section 1a, whereby a rim or riffle 11a is formed in the same manner as hereinabove described with regard to the rim or riffle 11, formed by the ring 9. The section 1a is likewise provided with an apron 13a, similar in structure and purpose to the apron 13 of bowl 1. A launder 34a is provided for catching the material flowing out over the apron 13a in the same manner that launder 34 catches the material flowing over the apron 13, said launder 34a being positioned intermediate the launders 32 and 34, as clearly illustrated at Fig. 5. The launder 34a may have a spout and settling tank corresponding to the spout 35 and settling tank 36 provided in con-

nection with launder 34 and in view of the disclosure of such spout and tank in Fig. 2 the corresponding spout and tank for launder 34*a* are not shown, as the illustration would be the same as that of spout and tank 35 and 36.

Over the edge of section 1*a* the upper ends of the straps 8 are bent so as to engage the section 1*a* and be lifted therewith in the same manner that the straps 8, shown in Figs. 3 and 4, engage and are lifted with the ring 9. Accordingly, when section 1*a* is lifted, the riffle basket within the bowl 1, will be lifted out of contact with the bowl in the same manner as illustrated in Fig. 4 and as also specifically illustrated in Fig. 7.

Within section 1*a* is another riffle basket, composed of a series of rings 7*a* attached to straps 8*a*, engaging the ring 9, in the same manner as the straps 8 engage the ring 9 in Figs. 3 and 4.

The rods 12 slide through the aprons 13 and 13*a* and are suitably attached to the apron 14, the same as in the construction heretofore described with one exception, namely, that a collar 12*a* is positioned upon the rod 12 at a suitable distance below the apron 13*a* so that the rod 12 may be raised some distance without bringing the collar 12*a* into engagement with the apron 13*a* but when the rod 12 is further raised, the collar 12*a* will engage the underside of the apron 13*a* and lift section 1*a* away from the bowl 1 and therewith will lift the riffle basket away from the walls of bowl 1. It will, therefore, be evident that by the structure illustrated in Figs. 5, 6 and 7, upward movement of the rods 12 will first lift the ring 9 away from section 1*a* and therewith will lift the riffle basket in section 1*a* and that thereafter if the upward movement of the rods 12 be continued, section 1*a* will be lifted away from bowl 1 and the riffle basket in bowl 1 will likewise be lifted. The two last described operations illustrated respectively at Figs. 6 and 7.

In Figs. 5, 6 and 7 I have indicated a lining 37, which may be used for the bowl 1 and likewise for the section 1*a*, which lining may be of rubber or other suitable material and which may be replaced readily in case of wear or damage. This lining may be used in any embodiment.

The settling tank 36 may be of any suitable shape for receiving material from the launder 34 and permitting the solids to settle therein, but the tank is provided with a cover 38 which may be hinged to the tank, as at 39, and provided with a suitable lock 40, whereby the same may be locked to prevent tampering with the contents of the tank. This is an important feature because the theft of values recovered in concentrating apparatus of various kinds is quite common and is difficult to provide against. With the structure here shown it will be noted that there is no opportunity whatsoever to tamper with the values because the bowl continues in the rotation from the time the material is fed into it until after the basket is lifted and the concentrated material is thrown out over the apron into the launder and thence into tank 36, which is locked.

It will be obvious that there is no opportunity to tamper with the concentrated material either in the bowl, along the launder 34 or spout 35, both of which are closed, or in the tank 36 which is locked. It will be noted that the cover 38 is spaced away from the tank as at 41, a sufficient distance to permit water to overflow so that the capacity of the tank is limited only by the amount of settlings therein and not by the total amount of material received from the launder.

In Figs. 1 to 4 it will be noted that I have provided a break in the contour of the inner surface of the bowl as indicated at 42 and it will be noted that the contour of the inner face of the bowl immediately above the point 42, corresponds to the contour of the bowl at the lower section of the riffles and diverges quite materially from the contour of the bowl immediately below the point 42. The contour of the lower part of the bowl is found advantageous in the recovery of certain values, but at the lower part of the bowl the centrifugal force is less than at the point 42. In the recovery of certain values, while the contour of the lower portion of the bowl is advantageous, the centrifugal force is not sufficient and, therefore, I provide, above the point 42, a substantial duplicate of the contour of the lower portion of the bowl but I provide this at a point where the centrifugal force is much greater, with the result that different classes of material may be recovered above the point 42 than can be recovered either at the bottom of the bowl, which has the same contour as the portion of the bowl above the point 42, or at the portion of the bowl just below point 42 which has substantialy the same centrifugal force as the portion immediately above point 42, but which has a different contour. Similarly in the embodiment shown in Figs. 5 to 7, I substantially duplicate in section 1*a* the contour of the lower portion of the bowl 1, but at a point where the centrifugal force exerted upon the material is much greater.

It will be understood that in larger sizes of the apparatus, it may be found desirable to provide suitable means for steadying the bowl at the bottom against vibration. Any suitable means for that purpose may be provided as many bowls have been disclosed heretofore having such means and as such steadying means form no part of the present invention they are not here shown but will readily occur to those skilled in the art, as will likewise readily occur such changes as are necessary in the construction here disclosed in order to accommodate such steadying means.

Having described the embodiments of my invention illustrated in the accompanying drawings, I shall now briefly describe the operation thereof.

Referring to Fig. 3, when operation is commenced the ring 9 is seated upon the bowl and this ring and the riffle basket are in position shown in Fig. 3, in which position the bowl, with its associated mechanism shown in this figure, is revolved and thereupon the material to be treated, consisting of placer material or ground ore and water, is fed to the lower central part of the bowl through any suitable supply means, as conduit 43. It will be understood that the placer material or ground ore and the water, are separately fed into some point in said conduit and that means for regulating the respective quantities thereof are provided. Any suitable structure well known and in common use may be provided for this purpose and as such structures are in common use the same are not disclosed here.

As the material enters the bottom of the bowl the raised central portion 6 deflects the material away from the center and the centrifugal force of the revolving bowl throws the material up along the sides of the bowl and the values are concentrated in the riffles, according to common practice in the use of centrifugal bowl separators. Different grades or classes of material will be collected in the riffles at different points along

the side of the bowl according to the values contained in the material and the varying contour of the bowl and the increase in the centrifugal force applied to the material as it approaches the rim of the bowl.

The waste material or gangue, passes over the top of the ring 9 and out over the apron 14 into the launder 32. It will be understood that any suitable settling means in common use may be provided outside of the launder 32 in any case where values may be left in the gangue or waste material. A tank 36 may be used.

After the above operation has been continued for the desired length of time or until the riffles are sufficiently filled, the revolution of the bowl is continued but the lever 26 is depressed, resulting in raising the ring 9 and opening the space between the rim of the bowl proper and the ring 9 and also in raising the riffle basket from the bowl, whereupon it is obvious that the material gathered under the riffles or rings 7 and against the wall of the bowl will, by centrifugal force, be thrown upwardly along the smooth sides of the bowl to the rim of the bowl and thence will flow out over apron 13 into the launder 34, thence through spout 35 and into the settling tank 36. It will be understood that when the clean-up operation starts, water alone will be supplied through the conduit 43, the supply of solid material being cut off during the clean-up operation. It is obvious, however, that the clean-up operation will be almost instantaneous and that the centrifugal force of the bowl will almost immediately throw all of the material theretofore held by the riffles, up the sides of the bowl and out over apron 13, so that the period during which the supply of solid material to the machine is cut off will be exceedingly brief and, therefore, there will be no substantial interruption of the concentrating operation of the apparatus in order to make a clean-up.

It will be obvious that recoveries will be of different kinds or classes at the different sections or zones of the bowl, according to the variations in the contour of the bowl and the centrifugal force and that these again will vary with the nature of the material treated. Whatever the differences in any given case between the recoveries at different sections or zones of the bowl, the same differences may be maintained in the clean-up or final recovery of the concentrated material by reason of the division of the bowl into separable sections, as illustrated in Figs. 5, 6 and 7 and as described hereinabove. The values recovered in the bowl below the first point of division will be separately recovered over the apron 13 in the launder 34. The values concentrated in the section 1*a* will be recovered and kept separate by means of the launder 34*a* and it will be obvious that the division of the bowl and the corresponding riffles into separable sections may be multiplied as desired, thereby increasing the refinement of classification in the recovery and final clean-up.

It will also be obvious that the rings 7 may be formed in any desired shape and that the riffle basket, whatever the form of the riffles, may be produced more economically than riffles of similar shape can be cut in the inner surface of the bowl and it will also be obvious that wear and damage to the riffle basket can be repaired or the parts replaced with much less expense than in the case of riffles formed directly in the inner surface of the bowl. Moreover, in case of wear and damage to the riffles, the use of the bowl itself would not be suspended, because a new riffle basket could be immediately placed within the bowl while the damaged or worn riffle basket is being repaired, whereas in the case of riffles formed in the bowl itself any repair or replacement would require suspension of operation of the whole machine during the making of such repair or replacement.

I state again that changes in detail, which will readily occur to those skilled in the art, may be made without departing from the spirit of the invention or scope of the appended claims.

I claim:

1. In a centrifugal separator, a rotatable flare-sided bowl, rings normally contacting with the inner surface of the bowl and forming riffles thereon and means for breaking said contact and leaving a space between said rings and the inner surface of the bowl.

2. In apparatus of the class described a flare-sided bowl and means for rotating the same to cause material in the bowl to be moved by centrifugal force outward and upward over the inner surface of the bowl, a rim-ring rotatable with the bowl and normally seated upon the rim of the bowl to prevent the escape of material over said rim, means for separating said ring and said rim, means forming riffles on the inner surface of the bowl when said ring is seated upon said rim and means for separating said riffle-forming means from the inner surface of the bowl when said ring and said rim are separated whereby to remove obstruction to the movement of contained material over the inner surface of the bowl and over said rim.

3. In a centrifugal separator, a rotatable flare-sided bowl having a rim-ring normally seated upon the bowl and normally constituting the material-discharge-rim thereof but separable therefrom to permit material to discharge from said bowl below said ring, means normally forming riffles on the inner surface of said bowl to retain material therein and means for separating the ring and the riffle-forming means from the bowl, to permit unobstructed passage of the contained material over the inner surface of the bowl and outwardly therefrom beneath said ring.

4. In a centrifugal separator, a rotatable flare-sided bowl, a rim-ring normally seated upon the rim thereof, means carried by the ring adapted to normally contact with the inner surface of the bowl and form riffles thereon and means, operable regardless of the rotation of the bowl, for separating said ring and riffle-forming means from contact with the bowl.

5. In a centrifugal separator, a flare-sided bowl, rings normally contacting with the inner surface of the bowl and forming riffles thereon rotatable therewith, straps attached to and holding said rings in fixed inter-relative position and means, operable regardless of the rotation, for separating said rings from the inner surface of the bowl.

6. In a centrifugal separator, a rotatable flare-sided bowl, a rim-ring normally seated upon the rim thereof and extending inwardly from said rim, means carried by the ring adapted to normally contact with the inner surface of the bowl and form riffles thereon and means, operable regardless of the rotation of the bowl, for separating said ring and therewith the riffle-forming means from contact with the bowl.

7. In a centrifugal separator, in combination, a rotatable bowl having a rim-ring normally seated upon the bowl and normally constituting the material-discharge-rim thereof, means for separat-

ing the rim-ring from the bowl during the rotation of the bowl to permit material to discharge from said bowl below said ring, a launder to catch the material flowing over said ring when in normal position and a separate launder for catching material escaping from the bowl below the ring when the ring is raised.

8. In a centrifugal separator, in combination, a rotatable bowl having a rim-ring normally seated upon the bowl and normally constituting the material-discharge-rim thereof, means for separating the rim-ring from the bowl during rotation of the bowl to permit material to discharge from said bowl below said ring, a launder to catch the material flowing over said ring when in normal position, a separate launder for catching material escaping from the bowl below the ring when the ring is raised and a settling tank to receive material from said second launder, said settling tank having a cover spaced from the walls of the tank to permit the overflow of liquid, but lockable to prevent access to the settlings in said tank.

9. In a centrifugal separator a rotatable flare-sided bowl having the upper portion of its sides divided into annular sections, a rim-ring, normally seated upon the top of said sections, said rim-ring sections and body of bowl normally being in closed interrelation and constituting a single bowl with the top of said ring constituting the discharge rim of the bowl, means normally forming riffles on the inner surfaces of the bowl and of each of said sections thereof to retain material therein, means operable during rotation of the bowl for separating said rim-ring and its associated riffle-forming means from the top annular section of the bowl and means for separating each of said annular sections with its associated riffle-forming means from the next lower portion of the bowl.

10. In a centrifugal separator a rotatable flare-sided bowl having the upper portion of its sides divided into annular sections, a rim-ring normally seated upon the top of said sections, said rim-ring, sections and body of bowl normally being in closed interrelation and constituting a single bowl with the top of said ring constituting the discharge rim of the bowl, means carried by the ring adapted to form riffles on the inner surface of the uppermost of said annular sections when the ring is seated thereon, means carried by each of such annular sections adapted to normally form riffles on the inner surface of the next lower section of the bowl and means for separating the ring and each section, together with the riffle-forming means carried thereby, from the next lower portion of the bowl.

11. In a centrifugal separator, a rotatable flare-sided bowl having the upper portion of its sides divided into annular sections, a rim-ring normally seated upon the top of said sections, said rim-ring, sections and body of bowl normally being in closed interrelation and constituting a single bowl with the top of said ring constituting the discharge rim of the bowl, means normally forming riffles on the inner surfaces of the bowl and of each of said sections thereof to retain material therein, means for separating said rim-ring and its associated riffle-forming means from the top annular section of the bowl and means for separating each of said annular sections with its associated riffle-forming means from the next lower portion of the bowl, the inner lower edge of such annular section being of smaller radius than the portion of the bowl normally adjoining such section therebelow.

12. In a centrifugal separator, a rotatable bowl having the upper portion of its sides divided into annular sections, a rim-ring normally seated upon the top of said sections, said rim-ring, sections and body of bowl normally being in closed interrelation and constituting a single bowl with the top of said ring constituting the discharge rim of the bowl, means normally forming riffles on the inner surfaces of the bowl and of each of said sections thereof to retain material therein, means for separating said rim-ring and said riffle forming means from the top annular section of the bowl and means for separating from the portion of the bowl immediately therebelow, each of said annular sections and the means normally forming the riffles in said next lower portion of the bowl, the inner lower edge of each such annular section being of smaller radius than the portion of the bowl normally adjoining such section therebelow, and the contour of the inner surface of each such annular section being upon a larger radius than but otherwise a substantial duplicate of the contour of the lowest riffled portion of the bowl.

13. In a centrifugal separator, a rotatable bowl having its upper portion composed of annular members normally seated one upon another and upon the bottom portion of the bowl to form a complete bowl, said members being vertically separable from each other and from the body of the bowl and means for separating said members from each other and from the body of the bowl, said means comprising a frame rotatable with said bowl and adapted to liftingly engage said annular members when said frame is lifted and means for lifting said frame.

14. In a centrifugal separator, a rotatable bowl having an annular apron surrounding its rim, an annular member normally seated upon said rim and means for lifting said annular member out of engagement with the rim of said bowl, said means being rotatable with said bowl and comprising rods engaging said annular member, and slidably engaging the apron on the rim of the bowl, a bracket connecting said rods, a bearing beneath said bracket and means for lifting said bearing into engagement with and thereafter to raise said bracket and thereby to raise said rods and annular member, the top portion of said bearing forming a contact with said bracket and being adapted to rotate when in engagement therewith.

15. In a centrifugal separator, a rotatable bowl having an annular apron surrounding its rim, an annular member normally seated upon said rim and means for lifting said annular member out of engagement with the rim of said bowl, said means being rotatable with said bowl and comprising rods engaging said annular member and slidably engaging the apron on the rim of the bowl, a bracket connecting said rods, means, fixed against rotation with the bracket, for raising the bracket whereby to raise said annular member, and resilient means normally depressing said bracket whereby to hold said resilient member tightly against the rim of the bowl.

16. In a centrifugal separator a rotatable bowl having an annular apron surrounding its rim, an annular member normally seated upon said rim and having an apron surrounding its upper edge, a second annular member normally seated upon said first annular member, said annular members forming a continuation of said bowl and means for separating said annular members from

each other and from the lower portion of said bowl, said means being rotatable with said bowl and comprising rods engaging the uppermost annular member and slidably engaging the said aprons, collars upon said rods for liftingly engaging the apron of the lower annular member and means for raising said rods to lift said annular members while in rotation.

17. In a centrifugal separator, a rotatable flare-sided bowl, means insertable in said bowl and normally contacting with the inner surface thereof to form riffles thereon, said riffle-forming means being carried by a member rotatable with said bowl, said riffle forming means being separable from said bowl.

18. In a centrifugal separator, a flare-sided bowl, rings normally contacting with the inner surface of the bowl and forming riffles thereon and means for breaking said contact and leaving a space between said rings and the inner surface of the bowl while the bowl is rotating.

19. In a centrifugal bowl separator, rings normally contacting with the inner surface of the bowl and forming riffles thereon and means for separating the riffles and the inner surface of the bowl by a movement of one of said elements at an acute angle to the contour of the inner surface of the bowl.

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