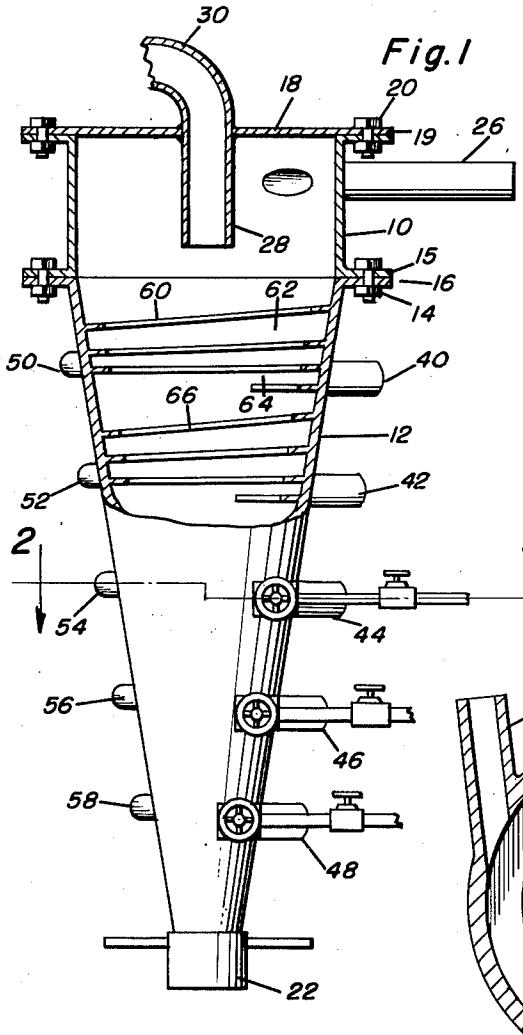
Oct. 30, 1956 F. E. ALBERTSON 2,768,745

MULTI-STAGE CONCENTRATOR

Filed Oct. 12, 1953

Fig. 1



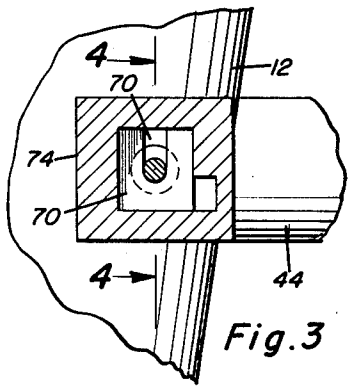


Fig. 3

Fig. 2

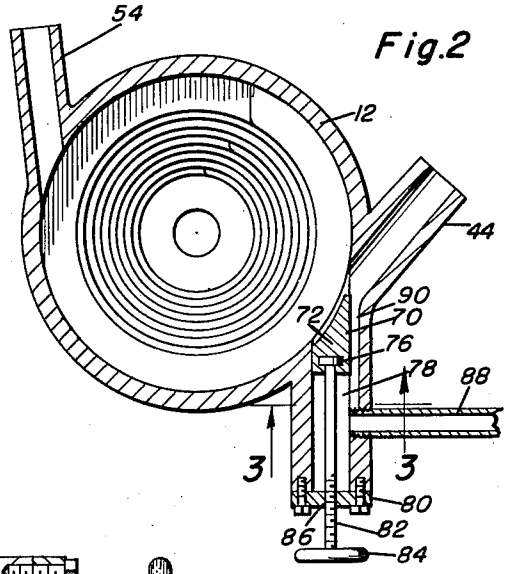
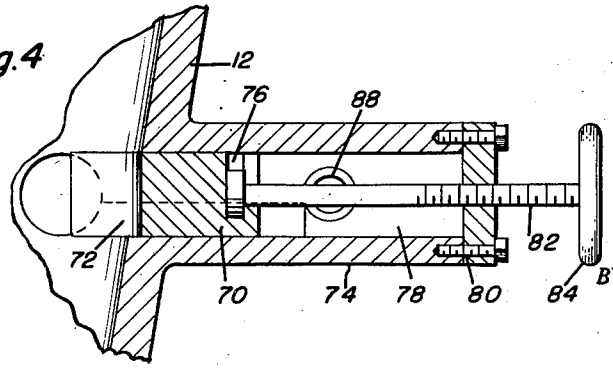


Fig. 4



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MULTI-STAGE CONCENTRATOR

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8 Claims. (Cl. 209—211)

This invention relates to a multi-stage concentrator and particularly to a concentrator of the cyclone type having means for withdrawing concentrates at various portions in the cyclone and for replenishing the fluid to maintain the velocity and quantity of fluid in the cyclone.

In the concentration of certain types of ores and metals, it has been customary to grind the ores into relatively fine particles and to mix the ore with suitable liquids, either water or other liqiuds or combinations thereof and to introduce the mixture into a cylinder normally called a cyclone in which the fluids are rapidly rotated so that the heavy materials are concentrated to the outside of the cylinder and the lighter materials are concentrated on the interior thereof and discharged upwardly through the axis while the heavier materials are concentrated and delivered from a spigot outlet.

According to the present invention these heretofore known cyclones are improved by providing a plurality of mixture inlet and outlet ports longitudinally along the cyclone chamber and further providing a multiplicity of concentrators, these concentrators being associated with the various outlet ports and having baffles of progressively decreasing area so that the heavier materials are concentrated into a relatively small area to be tapped off and further liquid may be introduced in the direction of the flow of material in the cyclone to maintain the quantity and add to the velocity of the material in the cyclone to further maintain its action. In order to prevent the impacting of the discharge gates and to assist in removing the material discharged through the ports, additional fluid is introduced behind the gate blocks and further along the gate blocks so as to wash out any material which attempts to enter the gate slide and at the same time be discharged into the outlet so as to carry away the concentrated material passing through the outlet port.

It is accordingly an object of the invention to provide a cyclone having a plurality of stages.

It is a further object of the invention to provide a cyclone concentrator having outlet ports at various stages.

It is a further object of the invention to provide an improved outlet gate for a concentrator.

It is a further object of the invention to provide means for preventing impacting of outlet gates and to wash away material discharged through the gate.

Other objects and many of the attendant advantages of the present invention will be apparent from the following detailed description taken in conjunction with the accompanying drawing in which:

Figure 1 is a vertical, elevational view of a cyclone with parts broken away and in section to show the inner construction;

Figure 2 is a cross section through the cyclone taken substantially on the plane indicated by the section line 2—2 of Figure 1;

Figure 3 is a cross section through the gate slide showing the gate in place and taken substantially on the plane indicated by the section line 3—3 of Figure 2; and

Figure 4 is a longitudinal section through the gate slide showing the construction arrangement thereof and taken substantially on the plane indicated by the section line 4—4 of Figure 3.

In describing the exemplary embodiment according to the invention, it is to be understood that in accordance with common terminology in this art the cyclone chamber or casing is called a cylinder even though it may be of various formations such as a straight cylinder, a conically tapered casing, or a combination of straight and tapered portions. In the exemplary embodiment the cylinder constitutes a substantially straight upper portion 10 and a conical lower portion 12 secured together by means of bolts 14 operating in flanges 15 and 16.

A cover 18 is provided for engagement with a flange 19 secured by means of bolts 20 to provide a substantial rigid construction and the usual spigot outlet 22 is provided adjacent the bottom of the cylinder. An inlet conduit 26 is provided in the top portion of the cylinder and is arranged to introduce the fluid including the material to be concentrated in a tangential direction to the interior of the upper surface of the cylinder. Axially extending conduit 28 extends down from the top 18 and is connected to a discharge conduit 30. The above-noted construction is standard and forms the environment in which applicant's construction is to be placed.

In order to operate the above-noted construction as a multi-stage concentrator, a plurality of outlet ports 40, 42, 44, 46, and 48 or any other desired number of outlet ports is provided along the longitudinal section of the cyclone and inlet ports 50, 52, 54, 56, and 58 or any other desired number of inlet ports are provided on the longitudinal section of the cyclone and are preferably arranged to enter the cyclone chamber in tangential relation thereto to introduce the fluid immediately after the material is discharged through the ports 40 to 48.

In order to provide a plurality of concentration stages, a plurality of groups of baffles are provided on the interior of the cyclone corresponding to the various outlet ports or gates. Each of these groups of baffles constitutes a series of turns either of one or a multiplicity of barriers herein shown as a single baffle 60 arranged in spiral formation with the pitch of the spiral constantly decreasing so that the space 62 at the top end of the baffle is materially larger than the space 64 at the bottom end of the baffle. As shown herein the outlet port 40 communicates with the spiral baffle 60 adjacent the narrowest portion thereof so that the concentrated material will be discharged through the port 40. The spiral member 66 is constructed identically to the spiral member 60 and will have its narrowest portion communicating with the outlet port 42. Similar spiral sections will be provided for the outlet ports 44, 46, and 48. As more clearly shown in Figure 2 the outlet ports 40 to 48 are arranged tangential to the interior surface of the cyclone chamber 12 and are controlled by means of sliding gates 70 having a curved surface 72 conforming substantially to the inner surface of the cyclone 12. The inlet port 54 is also provided tangentially to the flow of material therein so that the flow of material through the inlet port 54 will not only make up for the quantity of material drawn off through the port 44, but will add velocity to the material so as to maintain its speed or to add to its speed as may be desired.

The sliding gate 70 is maintained in a gate guide 74 and the rear edge of the block 70 will be provided with a T-slot 76, a guide channel 78 and the guide member 74 is of such size that the block 70 fits rather loosely therein and a cover plate 80 seals the rear end of the slide channel 78 in which the block 70 slides and a screw rod 82 provided with a manual handle 84 is in threaded connection with an aperture 86 in the plate 80 so that the block 70 may be slid in the channel 78 by turning the rod 82.

In order to prevent impacting of the slide **70** by means of the concentrated material being packed around the interstices between the block **70** and the channel **78** the conduit **88** is connected into the channel behind the block **70** and a suitable fluid such as water is introduced therein. The channel **90** is also preferably along the back surface of the block **72** or in the surface of the guide member **74** so that an additional quantity of fluid will be discharged into the discharge port **44** to wash out any concentrate delivered through the port. In the operation of the cyclone according to the invention the sludge will be introduced through the conduit **26** and given the usual cyclone or whirling motion therein so that the heavier metals will concentrate around the exterior of the cylinder while the lighter materials such as the fluids will be discharged through the axial conduit **30**. Because of the baffles **60**, **66**, etc. arranged in the series of groups on the interior of the cyclone cylinder, various portions of the concentrate will be selected at various stages and discharged through the ports **40** to **48** while remake or refill fluid will be introduced through the ports **50** to **58** to maintain the quantity and velocity of the fluid within the cyclone. The gates **70** will be opened the various amounts to discharge the proper quantity of concentrate from the various stages and fluid will be introduced through the conduit **88** to prevent the concentrates from impacting the slide block **70** and also to wash the concentrate drawn off down through the conduits **40** to **48** respectively.

It will thus be seen that the present cyclone provides means for pouring off concentrate at various stages and for applying make-up or refill fluid to maintain the quantity of velocity within the cyclone while for the purpose of exemplification a particular embodiment of the cyclone and the construction therewith has been shown and described.

However, it will be apparent to those skilled in the art that many changes and modifications in the construction of any of the parts thereof may be resorted to without departing from the true spirit and scope of the invention.

What is claimed as new is as follows:

1. A cyclone concentrator comprising a frustroconical casing having a wall, a tangential inlet adjacent the top of said casing, an axially disposed outlet adjacent the top of said casing, a plurality of groups of spiral baffles mounted on the wall of said casing, said baffles progressively converging in the direction of flow, a tangential outlet passage at the narrow end of each of said groups of baffles, and an outlet passage in the apex of said casing.

2. A cyclone concentrator comprising a frustroconical casing having a wall, a tangential inlet adjacent the top of said casing, an axially disposed outlet adjacent the top of said casing, a plurality of groups of spiral baffles mounted on the wall of said casing, said baffles progressively converging in the direction of flow, a tangential outlet passage at the narrow end of each of said groups of baffles, a tangential inlet following each of said outlets, and an outlet passage in the apex of said casing.

3. A cyclone concentrator comprising a frustroconical casing having a wall, a tangential inlet adjacent the top of said casing, an axially disposed outlet adjacent the top of said casing, a plurality of groups of spiral baffles mounted on the wall of said casing, said baffles mounted progressively converging in the direction of flow, a tangential outlet passage at the narrow end of each of said groups of baffles, a gate block slidable into closing relation in each of said outlets, the front face of said block being curved to match the curvature of the casing, and an outlet passage in the apex of said casing.

4. A cyclone concentrator comprising a frustroconical casing having a wall, a tangential inlet adjacent the top of said casing, an axially disposed outlet adjacent the top of said casing, a plurality of groups of spiral baffles mounted on the wall of said casing, said baffles progressively converging in the direction of flow, a tangential outlet passage at the narrow end of each of said groups of baffles, a gate block slidable into closing relation in each of said outlets, the front face of said block being curved to match the curvature of the casing, a fluid channel adjacent the rear face of said block and means for applying fluid under pressure through said channel, and an outlet passage in the apex of said casing.

5. A cyclone concentrator comprising a casing generally circular in cross section, a tangential inlet adjacent the top of said casing, an axial outlet adjacent the top of said casing, a plurality of baffles arranged in axially spaced relation in said casing and secured to the inner surface thereof, each of said baffles having a plurality of substantially spiral turns, the space between turns progressively decreasing in the direction of flow, and an outlet port communicating with each baffle adjacent the narrowest portion between the turns, said casing having a discharge outlet in the bottom thereof.

6. A cyclone concentrator comprising a casing generally circular in cross section, a tangential inlet adjacent the top of said casing, an axial outlet adjacent the top of said casing, a plurality of groups of baffles arranged in axially spaced relation in said casing and secured to the inner surface thereof, each of said baffles having a plurality of substantially spiral turns, the space between turns progressively decreasing in the direction of flow, an outlet port communicating with each baffle adjacent the narrowest portion between the turns, and fluid inlet ports intermediate said baffles, said inlet ports being tangential to the direction of flow in said casing, said casing having a discharge outlet in the bottom thereof.

7. A cyclone concentrator comprising a casing generally circular in cross section, a tangential inlet adjacent the top of said casing, an axial outlet adjacent the top of said casing, a plurality of groups of baffles arranged in axially spaced relation in said casing and secured to the inner surface thereof, each of said baffles having a plurality of substantially spiral turns, the space between turns progressively decreasing in the direction of flow, an outlet port communicating with each baffle adjacent the narrowest portion between the turns, fluid inlet ports intermediate said baffles, said inlet ports being tangential to the direction of flow in said casing, a central gate for said outlet port, and there being a fluid channel about said gate and means for producing fluid flow along said gates.

8. In a cyclone separator an outlet port comprising a channel tangential to the inner surface of said cyclone, a gate guide transverse to said channel, a gate block freely slidable in said guide, a closure for said guide, means operatively connected to said gate block for adjusting said block with respect to said channel, said guide having a fluid passage adjacent the rear surface of said block, and a conduit connected to said guide behind said block for producing fluid flow through said guide along said block.

References Cited in the file of this patent

UNITED STATES PATENTS

458,147	Kimble	Aug. 18, 1891

FOREIGN PATENTS

29,186	Great Britain	1910
661,050	Great Britain	Nov. 14, 1951
1,039,869	France	Oct. 12, 1953