Dec. 30, 1969 N. A. L. WIKDAHL 3,486,618

MULTIPLE-CYCLONE SEPARATOR INSTALLATION

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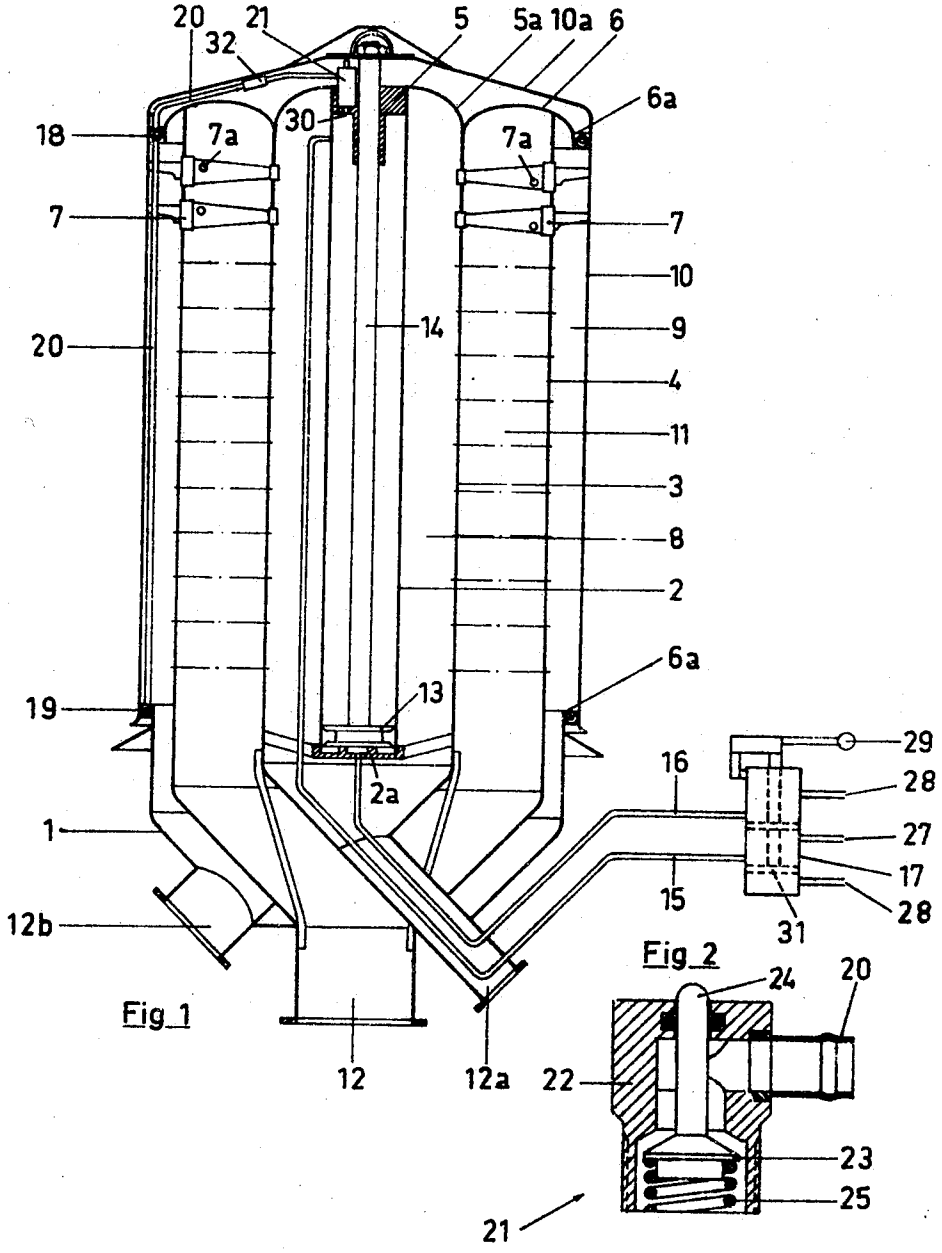


Fig 1

Fig 2

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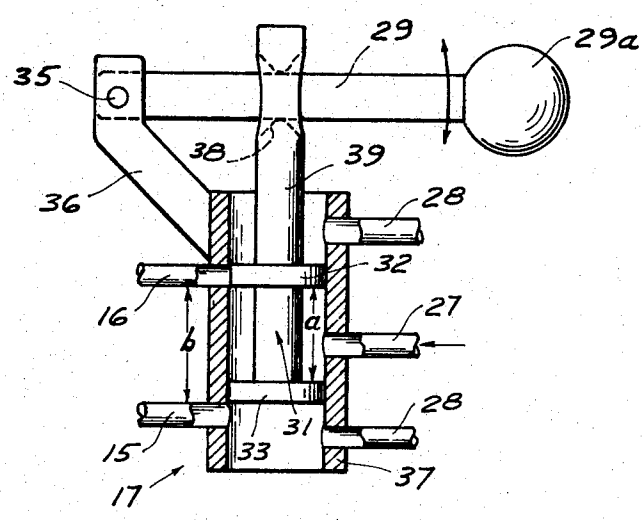


FIG. 3

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MULTIPLE-CYCLONE SEPARATOR INSTALLATION

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ABSTRACT OF THE DISCLOSURE

A multiple-cyclone separator installation the hood of which can be lifted to uncover the separator assembly for servicing. The hood in its lowered or operational position is tightly sealed to a mantle supporting the separators at one end thereof and defines in conjunction with this mantle a collecting chamber for the discharged light fraction or accepts. The lifting means for the hood and the sealing means for sealing the hood to the mantle are controllable by common control means so that the sealing means are released when lifting of the hood is initiated and restored when the hood is lowered into its operational position.

The present application relates to a multiple-cyclone separator installation, and more particularly to an installation in which a stationary separator assembly is enclosed by a liftable hood.

There are known installations of this kind in which the separators are supported at one discharge end, generally the discharge end for the accepts, by a mantle which in conjunction with the hood defines a collecting chamber for the discharge at said supported separator ends. Obviously, the hood must be tightly sealed against the mantle when the installation is in operation to prevent the escape of collected material from the chamber and the seal between the hood and the mantle must be released when and while the hood is lifted for servicing of the separators and other structural components associated with the separators.

The known practice is to provide separate means for lifting and lowering the hood and for releasing and restoring the sealing means. Such separate means require a rather complex equipment. Moreover, there is the danger that the two means are not properly and timely operated. For instance, a failure to restore the sealing means not at all or not at the correct time, would result in an escape of material from the aforesaid collecting chamber when operation of the separators is started.

It is an object of the invention to provide a novel and improved multiple-cyclone separator installation of the general kind above referred to in which the hood lifting means and the sealing control means are so coupled that operation of the lifting means for lifting of the hood initiates release of the sealing means, and similarly, operation of the lifting means for lowering of the hood initiates restoration of the sealing means. Such an arrangement has the advantage that it virtually precludes operational mistakes and it also simplifies the required control equipment or the hood and the sealing means.

A more specific object of the invention is to provide a novel and improved multiple-cyclone separator installation of the general kind above referred to in which both the lifting means and the sealing means are controllable by operation of a common control means.

Other and further objects, features and advantages of the invention will be pointed out hereinafter, and set forth in the appended claims constituting part of the application.

In the accompanying drawing, a preferred embodiment of the invention is shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a diagrammatic elevatioanl view of a multiple-cyclone separator installation according to the invention;

FIG. 2 is a fragmentary sectional view of one of the control means of the installation on an enlarged scale; and

FIG. 3 is a detail view of part of the control means on an enlarged scale.

Referring now to the figures more in detail, the exemplified installation comprises a stationarily mounted base part **1** on which are supported three coaxially disposed mantles or sleeves **2**, **3** and **4**. The mantles are secured at their lower ends to base part **1** and are closed at their upper end by cover members **5**, **5***a* and **6**, the cover member **5** also constituting a support and guide member for a purpose which will be more fully explained hereinafter. Mantles **3** and **4** support by means of suitable openings a plurality of generally conically shaped cyclone separators **7** of conventional design. Several superimposed layers of preferably radially disposed separators should be visualized; as a matter of convenience, only four separators located in the two top layers are shown. The cyclones are so arranged that the narrow ends thereof, that is, the discharge ends for the heavy fraction or rejects face inwardly to discharge into a generally annular collecting chamber **8** defined by mantles **2** and **3**. The accepts are discharged at the wide ends of the separators into an annular collecting chamber **9** defined by the outermost mantle **4** and a hood **10** for enclosing the separator assembly and the structural components associated therewith. The hood **10** has a generally cylindrical sidewall and is closed at its top by a roof **10***a*.

Suspension is fed into the separation chamber of separators **7** through preferably tangentially directed ducts **7***a* from an annular supply chamber **11** formed between mantles **3** and **4**. The supply chamber **11** in turn is supplied with suspension via a feed duct **12**. Similarly, collected heavy fraction is discharged from chamber **8** and the collected light fraction from chamber **9** through ducts **12***a* and **12***b*, respectively. All three ducts communicate with the separator assembly through the base part **1** thereof.

Hood **10** is up and down movable to uncover the separators and the associated structural components for overhaul, repair, cleaning or exchange. Lifting or lowering of the hood is effected by lifting means which comprise a piston **13** which is slidable in a cylinder defined by innermost mantle **2**. The cylinder is closed at its lower end by a closure member **2***a* and its upper end by cover member **5**. The piston is secured to a piston rod **14** which extends through a suitable bore of cover member **5** and abuts against the roof **10***a* of hood **10** suitably anchored thereto.

The cylinder space above piston **13** is connected by a pipe **15** to a port of a four-way valve **17**. Similarly, the cylinder space below the piston is connected by a pipe **16** to a second port of valve **17**. Valve **17** should be visualized as a conventional multiple-way valve. As is diagrammatically shown, its housing includes a slide **31** by means of which pipes **15** and **16** can be selectively connected either to a pipe **27** leading to a supply of pressure fluid such as water or air, or to one of two pipes **28** each connected to the atmosphere. The position of slide **31** is controllable by a simple conventional control linkage. Such linkage as shown by way of example comprises a lever **29** having on one end a grip **29***a* and hinged on the other end to a pivot pin **35** of a bracket **36** secured to a valve housing **37**. The lever is extended through an opening in a rod **39** mounting slide **31** and is guided in

the rod by bearing wedges **38**. The slide comprises two piston disks **32** and **33** mounted axially spaced on rod **39**. As is evident, up and down movement of lever **29** will connect one or the other of pipes **15** and **16** with pressure pipe **27**. Control valves of this kind are well known in the art and widely available in the market; the construction thereof as such does not constitute part of the invention, and hence is not described and illustrated in detail.

As is evident, hood **10** must be tightly sealed to mantle **4** or cover **6** and base part **1** when the hood is in the lowered or operational position shown in FIG. 1 to prevent the escape of material accumulating in chamber **9**. As is also evident, the sealing means must permit free lifting of the hood out of its lowered or operational position and return of the hood into this position. There are shown as sealing means two inflatable tubular sealing rings **18** and **19** made of elastic material, for instance rubber, and fitted into peripherally open channelled members **6***a* extending from cover member **6** and base part **1**. The sealing rings such as O-rings are so dimensioned that when they are deflated hood **10** can be readily moved past the rings, but that they will tightly engage the hood wall when they are inflated.

Pressure fluid is supplied to and discharged from the sealing rings through a pipe **20** which through a valve **21** and a bore **30** connects with the cylinder space above piston **13**. As is shown in greater detail in FIG. 2, valve **21** comprises a valve housing **22** mounted on cover member **5** in alignment with a bore **30** therethrough. A valve member **23** is pressed upwardly by a loaded coil spring **25**, that is, into a position in which it is engaged with its seat thereby closing the connection between pipe **20** and the interior of the cylnder space above piston **13**. The valve member is upwardly extended by a pin **24**, the protruding tip of which abuts against the lower side of the wall top or roof **10***a* of hood **10**. The length of the pin is such that when the hood is in the operational position of FIG. 1, the top of the hood presses valve member **23** into the open position shown in FIG. 2. Accordingly, pressure fluid present in the cylinder space above piston **13** will flow through bore **30**, valve **21** and pipe **20** into sealing rings **18** and **19** so that the same are inflated and thus in the sealing condition.

The operation of the installation as hereinbefore described is as follows:

Let it be assumed that the hood is in the position of FIG. 1 and slide **31** in the position in which pressure fluid is fed via pipe **27**, valve **17** and pipe **15** into the cylinder space above piston **13**. As previously described, the pressure build-up in this cylinder space is extended through pipe **20** into sealing rings **18** and **19**, valve **21** being open as also previously described.

Let it now be assumed that it is desired to lift hood **10**. To effect such lifting, control lever **29** on valve **17** is moved into the position in which pipe **15** is connected to the atmosphere via pipe **28** and pipe **16** is connected to the pressure supply via pipe **27**. As a result, the pressure in the cylinder space above piston **13** is released via pipe **15** and the pressure in sealing rings **18** and **19** is also released via pipe **20**, open valve **21** and bore **30**. Pressure fluid is supplied to the cylinder space below piston **13** via pipe **16**, causing piston **13** and its piston rod **14** to rise so that the hood is lifted. As soon as the lifting of the hood begins, pin **24** of valve **21** is freed from the top wall of the hood. Spring **25** now moves valve **21** into its closed position and it remains in this closed position until the hood is returned into the illustrated lower or operational position. Accordingly, the rings are not inflated when pressure fluid is fed into the cylinder space above piston **13** to lower the hood.

It may be desirable to delay the feed of pressure fluid to rings **18** and **19** via pipe **20** until the hood is fully settled in its lowered or operational position. As is evident from FIG. 2, valve **21** begins to open just before the hood reaches its fully lowered position and the resulting beginning inflation of rings **18** and **19** may exert an undesirable braking force upon the final downward movement of the hood.

The desired slight delay in the feeding of pressure fluid to the sealing rings can be obtained by several conventional means well known to experts in the art. There is indicated by way of example, a throttling means **32** included in pipe **20**. Various types of suitable throttling means are well known to workers in the art, and are available in the market. For instance, a conventional adjustable valve, a nozzle or a pipe portion of reduced diameter may be used.

Control valve **17** may be so arranged that when the hood is to be lifted, the discharge of pressure fluid from the cylinder space above piston **13** is initiated just prior to the admission of pressure fluid into the cylinder space below piston **13**. As is evident from the previous description, the sealing rings are connected to the cylinder space above piston **13** through valve **21** now open and bore **30**, so that the deflation of the sealing rings begins as soon as the discharge of pressure fluid from the cylinder space above piston **13** is opened. Such timed operation of valve **17** can be readily and conveniently obtained by an appropriate axial spacing of piston disks **32** and **33**. As it is indicated, the spacing *a* between the piston disks is somewhat larger than the spacing *b* between pipes **15** and **16** thereby causing the desired delay in the feeding of pressure fluid to the sealing rings.

This has the advantage that the sealing pressure upon the hood **10** is released or at least reduced just before the lifting of the hood actually begins, thereby facilitating such lifting.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. A multiple-cyclone separator installation comprising in combination:

a separator assembly including a plurality of cyclone separators, a receiving chamber for the accept discharge of the separators, a receiving chamber for the reject discharge of the separators, conduits communicating with said chambers for discharging the accepts and the rejects respectively therefrom and a stationary mounting member supporting said separators, said chambers and said conduits,

a cover member movable up and down out of and into an operational position in which the cover member encloses said separators and chambers and engages said mounting member, said cover member constituting an outer wall portion of the receiving chamber for the accepts;

hoist means for lifting and lowering said cover member respectively out of and into said operational position;

releasable sealing means for releasably sealing the cover member to said mounting member in the operational position of the cover member; and

common control means for controlling said hoist means for displacing the cover member and said sealing means for activating and releasing the same, said control means when operated for lifting the cover member out of the operational position effecting release of the sealing means just prior to the beginning of the lifting movement and when operated for lowering the cover member into the operational position effecting activation of the sealing means substantially upon completion of said lowering into the operational position.

2. A multiple-cyclone separator installation according to claim 1 wherein said hoist means comprise pressure fluid operated means coupled to said cover member, pressurizing and depressurizing of said pressure means by operation of the control means effecting lifting of the cover member out of its operational position and lowering of the same into its operational position respectively, and wherein said sealing means comprise pressure fluid pressure operated means which when pressurized seal the cover member to said mounting member and when depressurized release the cover member from the mounting member, said common control means being connected to said pressure fluid operated hoist means and said pressure fluid operated sealing means for controlling both said means for the purposes aforesaid.

3. A multiple-cyclone separator installation according to claim 2 wherein said sealing means comprise at least one inflatable tubular member interposed between said cover member and said mounting member, said tubular member when inflated by pressure fluid forming a tight seal between the cover member and the mounting member and when deflated, freeing the cover member for lifting in reference to the mounting member.

4. A multiple-cyclone separator installation according to claim 1 wherein said pressure fluid operated hoist means comprise a cylinder-piston servo means, the piston of said servo means being coupled to said cover member for lifting and lowering the same in accordance with the position of the piston in the cylinder, and wherein said common control means comprise pressure fluid feed and discharge conduits and multiple-way control valve means included in said conduits for selectively feeding pressure fluid into the cylinder space on either side of the piston therein and discharging pressure fluid from the respectively opposite cylinder space to effect displacement of the piston in the cylinder in accordance with the setting of said valve means.

5. A multiple-cyclone separator installation according to claim 4 wherein said common control means comprises further pressure fluid feed and discharge conduits connected to said pressure fluid operated sealing means and to said multiple-way control valve means for controlling the pressurizing and depressuring of both the servo means and the sealing means by the setting of said valve means.

6. A multiple-cyclone separator installation according to claim 5 wherein said common control means further comprise a second control valve means connected to the conduits leading to said sealing means, said second valve means including a valve member and a spring means urging said valve member into a valve closing position, said valve member coacting with said cover member to hold the valve member in a valve opening position against the action of said spring means when the cover member is in its operation position and to release the valve member for movement into its valve closing position when the cover member is being lifted out of its operational position, thereby blocking the flow of pressure to said sealing means until the cover member is lowered into its operation position.

7. A multiple-cyclone separator installation according to claim 6 wherein said common control means further comprise throttling means for delaying the feed of pressure fluid to the sealing means in reference to the feed of pressure fluid to the servo means whereby the conduits for feeding pressure fluid to the sealing means remain throttled when the valve member is in its valve opening position.

8. A multiple-cyclone separator installation according to claim 7 wherein said throttling means are included in the conduits connected to the sealing means.

9. A multiple-cyclone separator installation according to claim 5 wherein said common control means comprise delay means included in said multiple-way control valve means for delaying the beginning of feed of pressurized fluid into the cylinder space on the side of the piston for displacing the cover member out of its operating position in reference to the beginning of discharge of pressurized fluid from the cylinder space on the opposite side of the piston through said conduits.

10. A multiple-cyclone separator installation according to claim 9 wherein said multiple-way control valve means comprise a control slide for opening and closing respectively, the pressure fluid feed and discharge conduits connected to said valve means in accordance with the position of the slide, said slide opening the discharge conduits for discharging pressure fluid from said cylinder space on said opposite side of the piston prior to the opening of the conduits for feeding pressure fluid into the cylinder space on the side of the piston for displacing the cover member out of its operating position thereby relieving the pressure in the cylinder space above on said opposite side of the piston prior to the beginning of the lifting of the cover member.

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U.S. Cl. X.R.

137—625.69; 209—211; 251—172