Jan. 9, 1934. G. TER MEER 1,943,098

CENTRIFUGAL SEPARATOR

Filed April 14, 1932 2 Sheets-Sheet 1

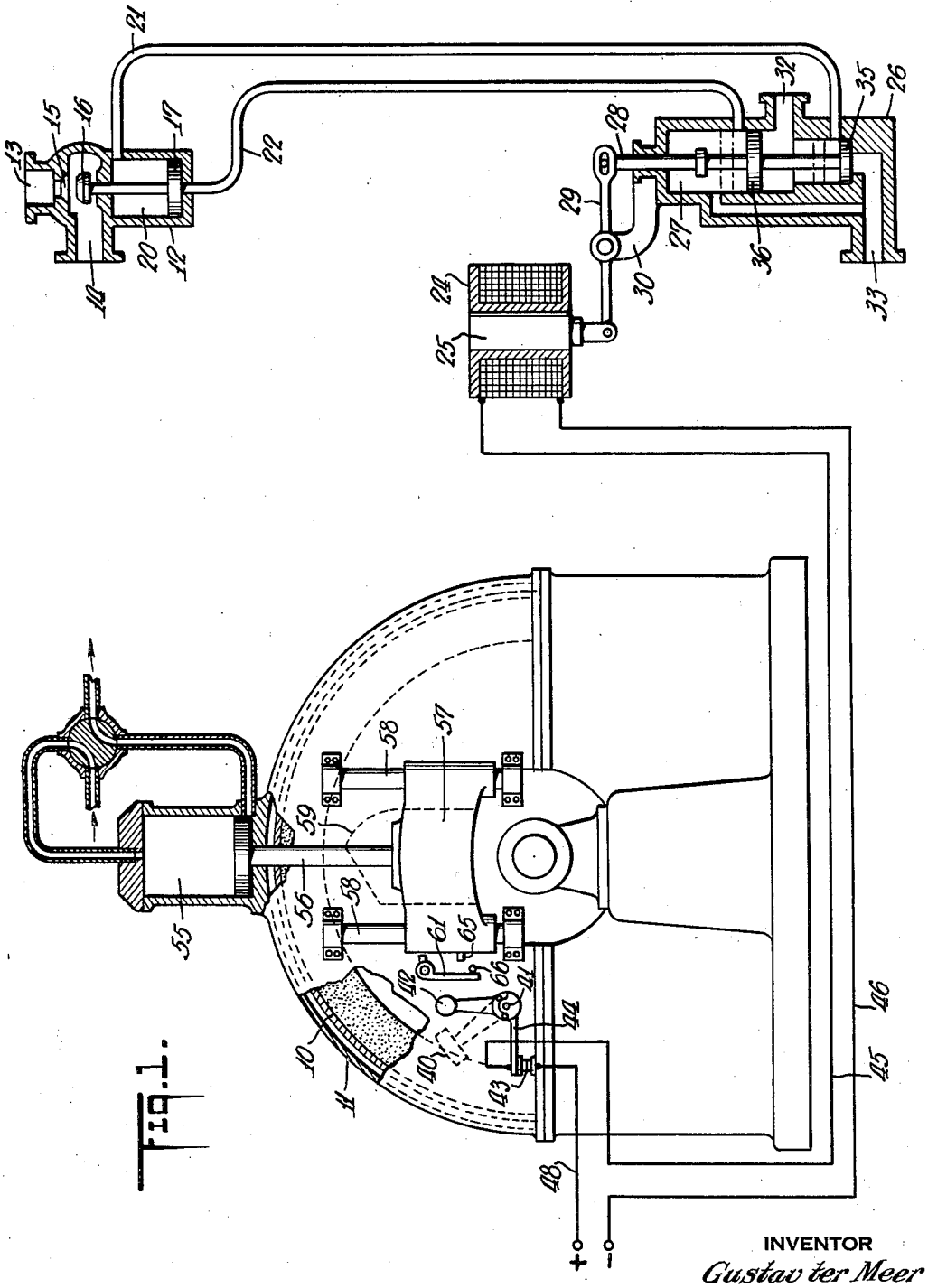

Fig. 1.

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Fig. 4.

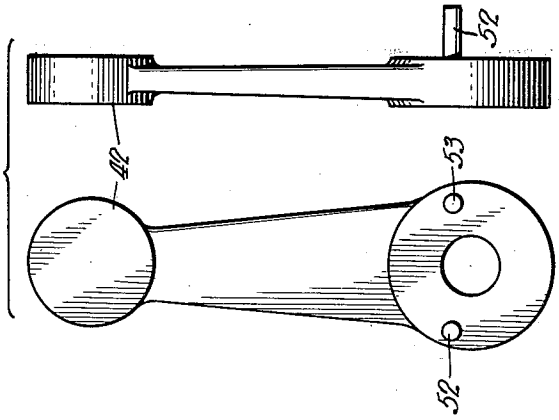


Fig. 5.

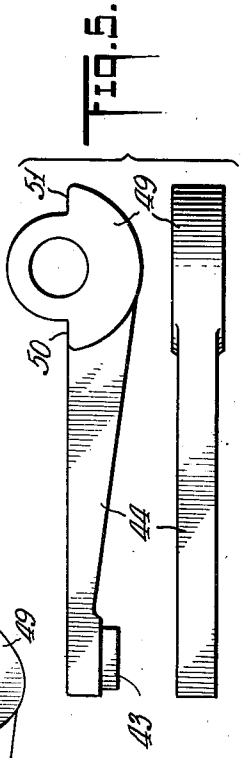


Fig. 2.

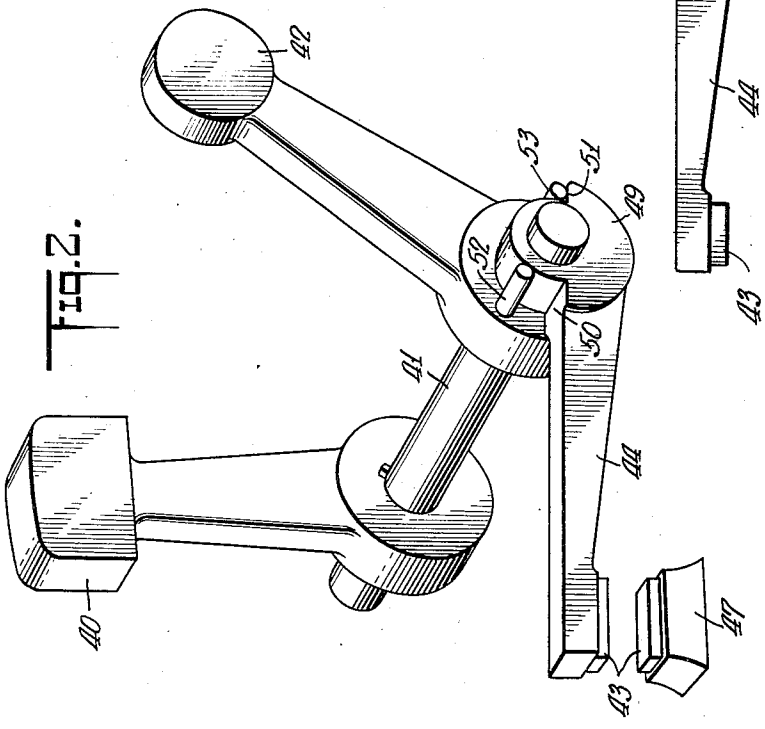
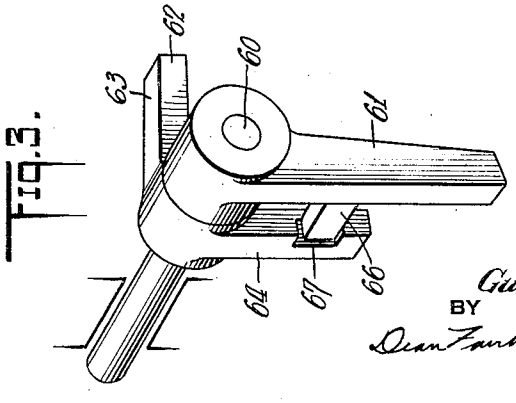


Fig. 3.



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CENTRIFUGAL SEPARATOR

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7 Claims. (Cl. 210—70)

The invention relates to a centrifugal machine in which the feeding of material to the machine is automatically controlled in accordance with predetermined conditions associated with the operation of the machine.

It has been proposed to provide centrifugal machines, such as separators, with shut-off devices or inlet valves which are automatically controlled in accordance with the performance of certain functions in the operation of these separators. It has been proposed, for instance, to open and close the inlet valve in accordance with the condition and pressure of the material in the separator, and in corelation to the cross-section of the material and the definite sequence of the other operations. However, I have found that such automatic control is impractical due principally to the fluctuations in pressure of the material within the inlet pipe. The result is that the shut-off device does not operate to secure uniform filling of the bowl.

It has been proposed to meet these imperfections by providing a measuring container between the inlet valve and the centrifuging drum, the capacity of the container corresponding to that of the drum. This has the disadvantage that deposit will accumulate in the container when the feeding of the material is interrupted, as for instance when centrifuging, scraping and other operations are taking place, thereby leading to the gradual clogging of the inlet valve.

One object of the present invention is to provide a new and improvided mechanism whereby the automatic closing of the inlet valve to the separator does not take place until a definite predetermined amount of material has been collected within said separator.

As an important feature of the present invention, there is provided a float which operates in accordance with the amount of material in the machine, to control the operation of the inlet valve device.

As another important feature of the present invention, an electromagnet is provided for controlling the operation of the inlet valve, this magnet being operated in accordance with certain predetermined conditions in the operation of the separator, as for instance when a definite amount of material has collected in the centrifugal drum, or when the scraper has terminated its function of removing the separated material from the interior of the separator.

In the accompanying drawings, there is shown for purposes of illustration, one embodiment of the present invention. In these drawings

Fig. 1 is a front elevation, partly in section, and partly diagrammatically, of a portion of a centrifugal machine and its associated control devices.

Figs. 2 is a perspective view showing a portion of the control device shown in Fig. 1.

Fig. 3 is a perspective view showing another portion of the control device shown in Fig. 1, and

Figs. 4 and 5 are different views of the counterweight lever and contact arm.

The present invention is illustrated in connection with a centrifugal separator including a drum or bowl 10 rotated by any suitable power means and enclosed in a casing 11. The drum 10 may have the periphery thereof perforated to permit the separated liquid to escape therethrough under centrifugal action, or the liquid may be made to escape by any other suitable means. The inflow of material into the separator is controlled by an inlet valve 12 which, in the specific form shown, has an inlet port 13 and an outlet port 14, separated by a valve seat 15 cooperating with a valve member 16. This valve member 16 is fluid actuated, and for that purpose is connected to a piston 17 adapted to reciprocate in a cylinder 20. This cylinder 20 communicates at the ends thereof with pipes 21 and 22. Fluid under pressure is delivered from a suitable source of fluid pressure through said pipes alternately to control the movement of the piston 17, so as to correspondingly close or open the valve.

The pipes 21 and 22 are controlled by an electromagnet 24 shown in the form of a solenoid, and having an armature plunger 25, the movement of this plunger controlling the operation of the valve 12. Means are provided for operating this valve 12 in accordance with the movement of the plunger 25, said means, in the specific form shown, including a control valve 26 operable to control the passage of fluid under pressure from the source of fluid pressure to either of the pipes 21 and 22. The control valve 26 comprises a valve chamber 27 in which reciprocates a valve stem 28, one end of which has a pivotal connection with one end of the lever 29, the other end of which is pivotally connected to the plunger 25. This lever 29 is fulcrumed intermediate its ends to a bracket 30 connected to the valve 26.

The pipes 21 and 22 lead into the valve chamber 27 adjacent to but spaced from opposite ends of the latter, the fluid under pressure being admitted either through the pipe 21 or the pipe 22 in accordance with the position of the valve stem 28. For that purpose, the valve 26 is provided with

an inlet port 32 intermediate of the ends, and leading from a suitable source of fluid pressure, for instance a pump, an outlet 33 communicating with opposite ends of the chamber 27. Connected to the valve stem 28 are a pair of plungers or slide valves 35 and 36 so spaced and positioned that the lower valve 35 may move above the port of the pipe 21 to connect said pipe with the outlet 33, or may move below said port to cut off communication between said port and the outlet and establish communication between said port and the inlet 32. The upper valve 36 likewise connects the pipe 22 with either the inlet or outlet, and the two valves operate substantially simultaneously to perform alternate functions.

In the position shown in Fig. 1, the electromagnet 24 is energized so that the plunger 25 is in its uppermost position. The plungers 35 and 36 are in the position with the valve stem 28 in its lower position so that the fluid under pressure enters the valve chamber 27 between the plungers 35 and 36 and passes through the pipe 21 into the cylinder 20 to maintain the valve 12 in open position as shown. When the electromagnet 24 is deenergized, the armature plunger 25 will fall into its lowermost position, thereby causing the plungers 35 and 36 to move into the dotted position shown. In this position, the pipe 22 will receive the fluid under pressure to move said piston upwardly and close the valve 12. The fluid on the other side of the piston 17, under these conditions, will be in communication with the low pressure side of the valve 26 or outlet 33, and may escape through the pipe 21 and the port 33 of the valve 26. Thus the electromagnet controls the supply of material to the bowl. It will be understood that the valve 12 is connected to the interior of the bowl by a suitable pipe, not shown.

The electromagnet 24 is operated in accordance with predetermined operating conditions in the centrifugal drum 10. In the specific form shown, the electromagnet is operated when a predetermined amount of material is collected on the inner periphery of the drum 10, and is also made to operate following a sequence of operation of a scraper mechanism. The operation of this electromagnet 24 is preferably controlled in accordance with the amount of material collected on the periphery of the centrifugal drum 10. For that purpose, the interior of the drum 10 is provided with a float 40 connected to the shaft 41 which extends to the outside of the casing 11. Fixed to this shaft 41 on the outside of the casing 11 is a counterweight 42. The float 40 is supported by the material being separated so that the angular position of this float is determined in accordance with the amount of material collected on the internal surface of the centrifugal drum 10. The movement of this float 40 is transmitted to a switch 43 which is in the electric circuit of the electromagnet, and which is made to open or close this circuit in accordance with the angular position of the float 40. This switch 43 includes a contactor arm 44 loosely mounted on the shaft 41 and connected to a current line 45 leading to one terminal of the electromagnet 24, the other terminal being connected to one side of the source of current by a lead line 46. The contactor arm 44 is adapted to engage a contact member 47 constituting the other pole of the switch 43, and connected through the lead line 48 to the other side of the current source.

To operate the switch 43 in accordance with the position of the float 40, the contactor arm 44 has lost motion connections with the shaft 41. As shown, it has a hub 49 presenting spaced shoulders 50 and 51. Means are provided for moving the contactor arm 44 when the counterweight 42 has reached its limiting positions. For that purpose, the hub of the counterweight 42 has extending therefrom two pins 52 and 53 adapted to alternately contact with the shoulders 50 and 51 respectively. As the material collects on the inner periphery of the centrifugal drum 10, the float 40 will be moved in the clockwise direction shown in Fig. 1, thereby causing the corresponding clockwise movement of the counterweight 42 until the catch pin 53 engages the shoulder 51 of the contactor arm 44. After the counterweight has moved a certain distance past its vertical position, it will move out of its position of equilibrium in a clockwise direction, under the action of gravity, and move the float 40 into an inoperative position. The clockwise movement of the counterweight 42 causes the corresponding clockwise movement of the contactor arm 44, the outer end of said arm, under these conditions, being moved away from the contact member 47, thereby opening the circuit of the electromagnet 24. This causes the plunger 25 to fall, thereby closing the valve 12, as already discussed, to shut off any further feeding of the material to the centrifugal drum 10.

The electromagnet 24 is automatically reenergized following a subsequent sequence of operation of the centrifugal machine. For instance, after the valve 12 has been shut, as already described, the material from the inside of the drum is scraped off and discharged. Thereafter the valve 12 is automatically opened. The means for scraping the material from the internal surface of the drum 10 forms no part of the present invention, and in the form shown is operated by fluid pressure from a cylinder 55 in which reciprocates a rod 56 mounted on the outside of the casing 11, and guided vertically by means of a crosshead 57 engaging a pair of guide rods 58. Connected to the crosshead 57 in the inside of the drum 10 is a scraper or peeling knife 59 movable into and out of scraping relationship with the material to be scraped. The crosshead 57, as shown in Fig. 1, is in its inactive lowermost position with the knife 59 away from the material.

After the valve 12 has been shut by the operation of the float 40, the scraper may be operated to move the crosshead 57 so as to cause the corresponding movement of the knife 59 into peeling or scraping relationship with the material. In order to automatically open the valve 12 after the process of scraping the material has been finished, there is mounted on the outside of the casing 11 a spindle 60 upon which is loosely mounted an arm 61 and a crank lever 62 comprising arms 63 and 64. The arm 63 is disposed in the path of movement of a lug 65 connected to the crosshead 57.

As the float 40 is moved upwardly and in a clockwise direction by accumulating material, the counterweight 42 will come in contact with the arm 61 and move it in a counterclockwise direction. However, the counterclockwise movement of this arm 61 is limited by a pin 66 connected to the casing 11.

During the operation of moving the crosshead 57 to effect the movement of the knives into scraping relationship with the material being scraped, the lug 65 in its upward movement will engage the arm 63 and move said arm in a coun-

terclockwise direction until it clears said arm. The arm 61 has a lug 66 extending therefrom, and adapted to engage a recess 67 in the arm 64. After the lug 65 on the crosshead 57 has passed the arm 63 during its upward movement, the arm 63 will fall back into substantially horizontal position, but will be prevented from moving downwardly any further by the engagement of the recess 67 with the lug 66 on the arm 61, the arm 61 being held in position by the engagement of the counterweight 42 therewith. After the termination of the scraping operation, the crosshead 57, in its downward movement, will cause the lug 65 to engage the arm 63 and move the crank lever 62 in a clockwise direction. This movement of the crank lever is transmitted to the arm 61, which causes the counterweight 42 to move in a counterclockwise direction until it passes dead center, and the catch pin 52 engages the shoulder 50 and causes the contactor arm 44 to move into engagement with the contact member 47 to close the circuit of the electromagnet 24. This movement of the counterweight 42 is transmitted through the shaft 41 to the float 40 so that said float is restored into position to be effected by the level of the material collected in the drum 10.

The energization of the electromagnet 24 causes the valve 12 to be opened so that the material is permitted to again be fed into the centrifugal drum 10.

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

1. A centrifugal machine having an inlet valve, an electromagnet for controlling the operation of said valve, a float pivotally mounted in the interior of said machine, a counterweight movable with said float and adapted to move said float away from the material being treated and into inactive position when said float has reached a predetermined position, and a switch operated by said counterweight, and in the electric circuit of said electromagnet.

2. A centrifugal machine having an inlet valve, a float in said machine, a counterweight movable with said float and adapted to move said float into inoperative position with respect to the material when said float has been moved by said material to a predetermined position, means for closing said valve when said float has been moved to inactive position, a scraper in said machine adapted to be moved into and out of scraping relationship with the material in said machine, and means for automatically restoring said float to operative position when said scraper has been moved into inoperative position.

3. A centrifugal machine having an inlet valve, a float in said machine, a counterweight movable with said float and adapted to move said float into inoperative position with respect to the material being centrifuged when said float has been moved by said material to a predetermined position, means for closing said valve when said float has been moved into inoperative position, a scraper in said machine movable into and out of scraping relationship with the separated material in said machine, and means for automatically restoring said float into operative position and for automatically opening said inlet valve when said scraper has been moved out of scraping position.

4. In a centrifugal machine, the combination of an inlet valve, an electromagnet for controlling the opening and closing of said valve, means for operating said electromagnet to close said valve when a predetermined amount of material has been collected in said machine, a scraper adapted to be moved into and out of position to remove the separated material collected in said machine, and means for operating said electromagnet when said scraper has been moved into inoperative position and to automatically open said inlet valve.

5. In a centrifugal machine, the combination of an inlet valve for controlling the inflow of material to be treated, an electromagnet for controlling the opening and closing of said valve, means for operating said electromagnet to close said valve when a predetermined amount of material has been collected in said machine, and including a float movable in accordance with the level of material collected in said machine, and means for moving said float into inoperative position with respect to the material, when said float has been moved by said material to predetermined position, a scraper in said machine adapted to be moved into position to remove the separated material collected in said machine, and means for automatically restoring said float to operative position and for automatically opening said inlet valve when said scraper has been moved into inoperative position.

6. A centrifugal machine having a rotary separating chamber, an inlet valve, an electromagnet for controlling the operation of said valve, a member mounted within said chamber, a counterweight operatively connected to said member and adapted to move the member away from the material being treated and into inactive position when said member reaches a predetermined position, and a switch controlled by said counterweight and in the electric circuit of said electromagnet.

7. A centrifugal machine having a rotary chamber adapted to receive the material to be treated, an inlet valve outside of said chamber, a member mounted within said chamber and adapted to be directly engaged and actuated by the fill mass within said chamber, a counterweight adapted to move said member away from the material being treated and into inactive position when said member reaches a predetermined position, and means operated by said counterweight and adapted to control said inlet valve.

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