This invention relates to centrifugal machines and more particularly to the automatic control of the flow of material to such machines during the charging operation thereof.

In one form of centrifugal device, such as is used, for example, in the removal of salt from slurry, the slurry is continuously admitted during the charging period at the top of a perforate centrifugal basket while it is rotating at low speed around a vertical axis. There is a hole in the center of the bottom of the basket for the removal of the solids at the end of the drying period. As the basket is rotated, centrifugal force causes the salt to build up in a wall around the outside of the basket and the liquid to discharge through a suitable screen placed against the inside of the perforate basket wall. It is very desirable to cut off the flow of slurry to the basket when the salt has built up into a wall of predetermined thickness considered appropriate for the particular basket being used, since further charging of slurry will cause an overflow of solids over the upper brim of the basket with resulting loss of solids.

It is an object of this invention to cut off, by improved automatic means, the flow of slurry or other chargeable material to a centrifugal machine at a predetermined time in its charging cycle.

It is another object of this invention to control by means of a probe the stoppage of the flow of such material to a centrifugal in response to the thickness of a wall of solid material accumulated in the basket of the centrifugal.

The above and related objects are attained in accordance with the invention by providing, in an illustrative embodiment thereof, a proximity probe which senses the thickness of the wall of solid material in the centrifugal basket and stops the charging of a centrifugal when the thickness reaches a predetermined point. The probe is placed in the basket generally parallel to the axis of the basket and spaced from the wall thereof. One terminal of the probe is connected in a bridge circuit positioned in the input circuit of a vacuum tube having a relay coil connected across a condenser in its output circuit. There is a variable capacity between the terminal and ground due to the changing wall thickness and when this capacity has built up to a predetermined value, the voltage across the condenser in the output circuit changes sufficiently to operate the relay and shut off a valve admitting the material to the basket. By changing various constants in the bridge circuit, the wall thickness at which the probe operates the control circuit can be varied.

The invention will be more readily understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which:

FIG. 1 is an elevation view showing schematically a centrifugal machine embodying the probe-controlled, material supplying means in accordance with the invention;

FIG. 2 is an enlarged elevation view, with portions broken away, of the basket, probe and control means of the embodiment of FIG. 1;

FIG. 3 is a schematic diagram of a suitable control circuit which can be used with the probe shown in the arrangement of FIG. 2; and

FIG. 4 is an elevation view, with portions broken away, of a probe used in the embodiment of FIG. 1.

Referring more particularly to the drawings, FIG. 1 shows, by way of example for purposes of illustration, a centrifugal assembly 10 embodying novel means in accordance with the invention for controlling the flow of material during the charging operation thereof.

The assembly 10 includes a centrifugal machine 11 provided with a rotating basket 12 for the material to be centrifuged which is mounted with a curb or casing 13, and a spindle 14 attached to the basket. Merely by way of example, the material can be a salt-containing slurry. The basket 12 is driven by any suitable means such as, for example, an electric motor 15. The motor is supported by a superstructure 16 from which the shaft 14 and the basket 12 are suspended so that the centrifugal machine may rotate freely. It will be obvious that the invention is not confined to electrically driven centrifugals.

Surrounding the shaft 14 is a brake assembly 17 supported from the superstructure 16 by any suitable means. A control panel 18 may be located in front of a portion of the superstructure 16.

During the charging operation, while the basket is being driven at slow speed by any suitable means (such as, for example, by the speed control means described and claimed in a copending application of the present inventors, Ser. No. 743,535, filed June 23, 1958), the material to be centrifuged is applied from a suitable receiver by gravity or otherwise as will be described more completely in connection with FIG. 2.

Reference will now be made to FIGS. 2, 3 and 4, which show various elements of the invention in greater detail. Mounted on the top of the casing 13 so as to project down into the basket 12 is a proximity probe 25, a suitable example of which is shown in FIG. 4. The probe 25 comprises an insulated contact 26 mounted in a suitable metallic container 27. Two leads, one the live probe lead 28 and a second lead 29 which is preferably grounded, are brought out from a flexible cable 30. The live lead 28 is connected in a bridge circuit 31 which includes, among other elements, a condenser 32 which can be varied for course control and a condenser 33 which can be varied for a fine or vernier control. The capacity (shown as condenser 34 in FIG. 3) between lead 28 and the vertical wall 35 of solid material on the inner surface of the basket 12 varies as the wall 35 builds up and thus the effect of the bridge circuit 31 on the input circuit of the vacuum tube 36 is varied. When the voltage across a condenser 37 in the output circuit of the tube 36 is varied sufficiently by the change in capacitance of the effective capacity 34 between the probe 25 and the material wall 35, the relay coil 23 is operated to shut off the valve 22 in the pipe 21 feeding material to the basket 12 through feed nozzle 38. Preferably pneumatic means (not shown for simplicity in the drawings) is utilized to operate the valve 22 in response to the operation of the solenoid 23.

The manner of operation of the embodiment shown in FIGS. 1, 2, 3 and 4 will now be described. At first the centrifugal basket 12 and the motor 15 are at rest, the brakes in the assembly 17 are released, the charge valve 22 is closed, and the basket 12 is empty. The operator starts the motor 15 and accelerates it to about 200 r.p.m. when the valve 22 is opened (preferably by pneumatic means not shown) and the material to be centrifuged allowed to flow onto a distributing plate 40 clamped to the spindle at about mid-height of the basket and rotating with the basket so that centrifugal force distributes the material into the basket 12. The basket is charged while running at a controlled speed between about 200 r.p.m. and 400 r.p.m. As the basket is charged at this controlled speed, the solid material wall 35 thickens until it
reaches a suitable thickness to operate the circuit shown in FIG. 3, by the probe 25 in the manner described above, to shut the valve 22 by the solenoid 23. The basket is then operated by suitable and well known timer means (not shown) to accelerate to full speed and run at full speed for an interval set by the timer. During this full speed run the liquid is driven off. After the timer times out, air is admitted to the basket, power is interrupted to the motor and the basket 12 decelerates to full stop. At this point, the basket 12 (which is of a well-known self-discharging type) discharges itself by gravity through the bottom 41. The starting conditions are then restored and the centrifugal has completed a full cycle.

While salt-bearing slurry has been given by way of example as a suitable material for centrifuging, obviously sugar- or other solid-bearing materials can be used instead.

Various changes can be made in the embodiment described above without departing from the spirit of the invention, as indicated in the claims.

What is claimed is:

1. In combination, a centrifugal basket, means for rotating said basket, charging means for applying solid-containing material to be centrifuged to said basket as it is being rotated, a valve for controlling said material applying means, and valve control means, including probe means positioned within the basket so as to be immovable at all times the basket is being rotated during the charging operation and electric circuit means outside the basket connected to said probe means, for controlling the operation of said valve in a direction to cut off the application of said material when the solids therein build up a wall of predetermined thickness on the inside of the basket, said probe means comprising a single insulated metallic member placed generally parallel to the axis of said basket and out of contact at all times with said wall.

2. In combination, a centrifugal basket, means for rotating said basket, charging means for applying solid-containing material to be centrifuged to said basket as it is being rotated, a valve for controlling said material applying means, and valve control means, including probe means positioned within the basket so as to be immovable at all times the basket is being rotated during the charging operation and electric circuit means outside the basket connected to said probe means, for controlling the operation of said valve in a direction to cut off the application of said material when the solids therein build up a wall of predetermined thickness on the inside of said basket, said probe means comprising a single insulated metallic member placed generally parallel to the axis of said basket and out of contact at all times with said wall.

3. The combination of elements as in claim 2 in further combination with a solenoid which is controlled by said circuit means and operates said valve.

4. The combination of elements as in claim 2 in further combination with a solenoid which is controlled by said circuit means and operates said valve and which circuit means includes a circuit element thereof which can be varied to change the sensitivity of operation of said probe means.

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