April 14, 1936. E. ROBERTS 2,037,655

CONTROL APPARATUS FOR CENTRIFUGALS

Filed April 15, 1931 2 Sheets-Sheet 1

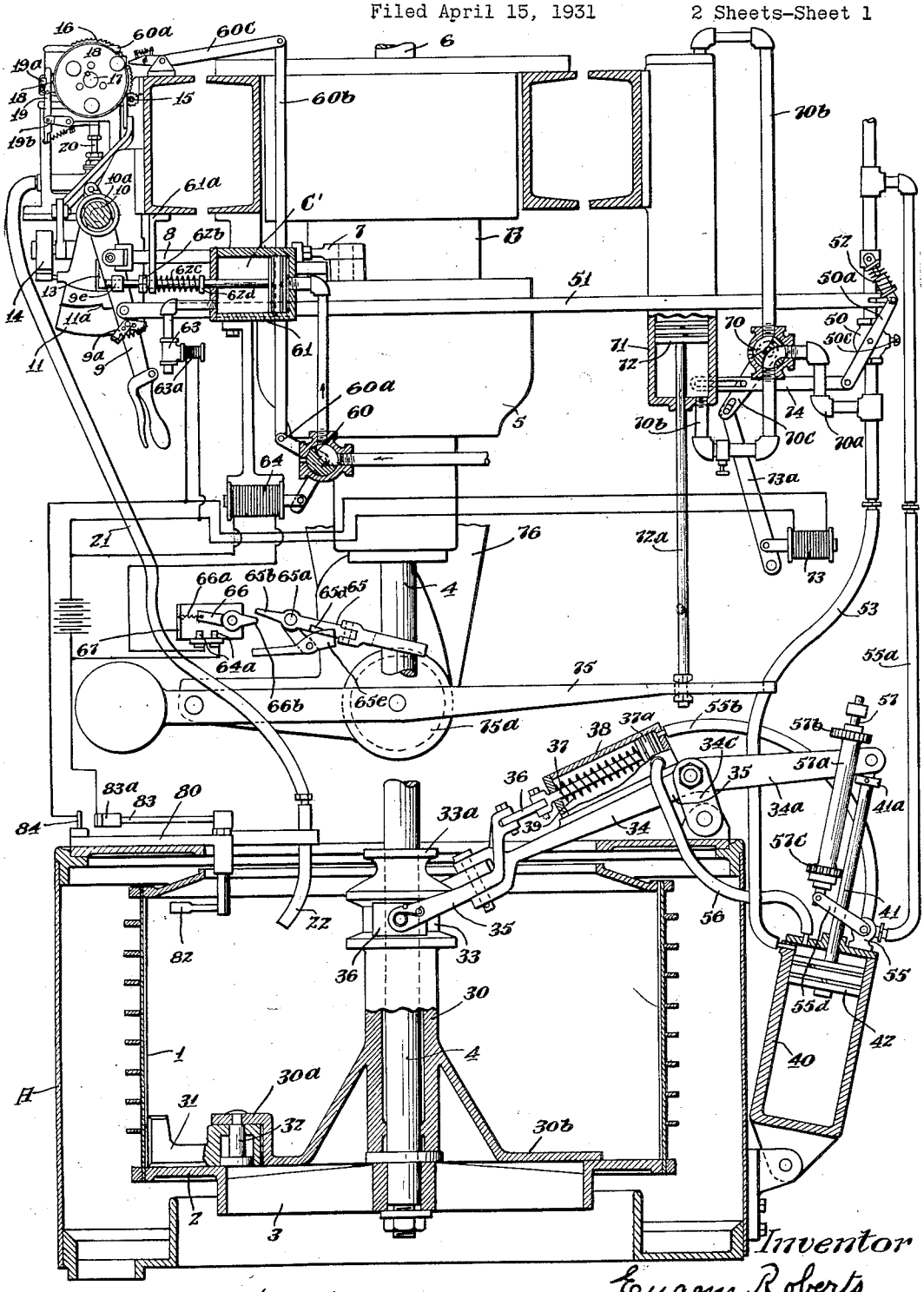


Fig. 1.

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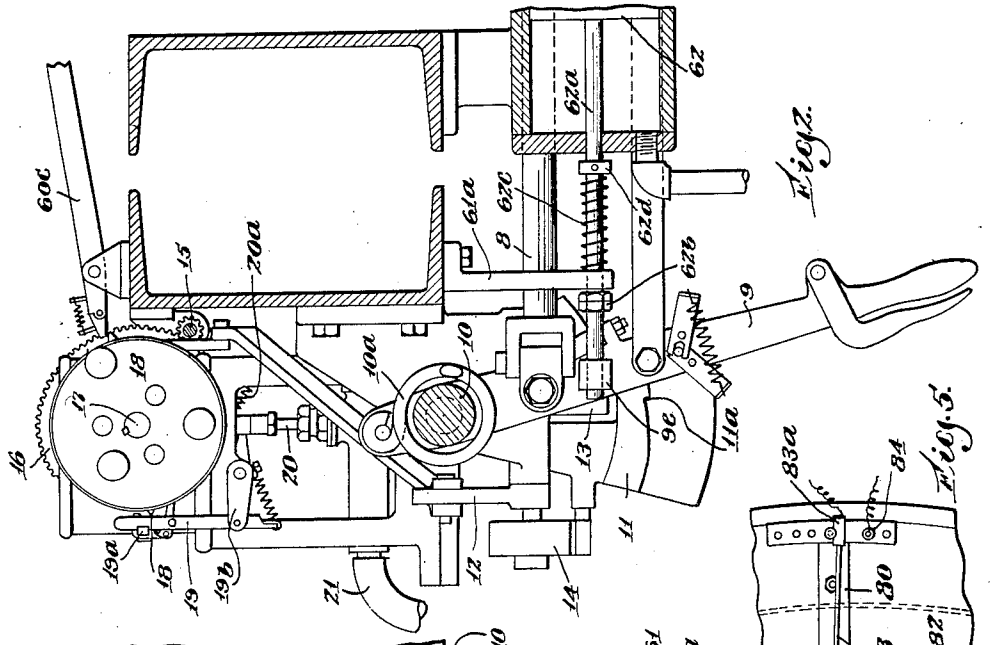


Fig. 2.

Fig. 5.

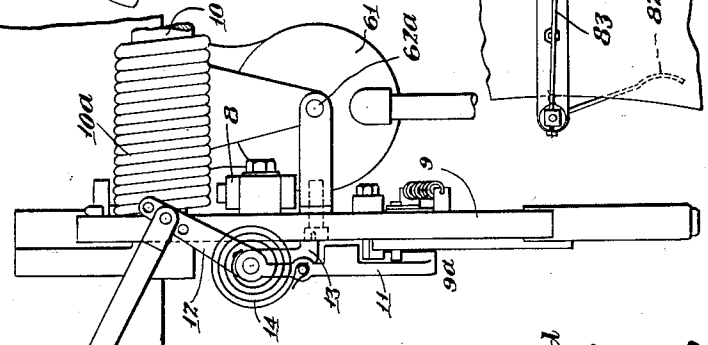


Fig. 3.

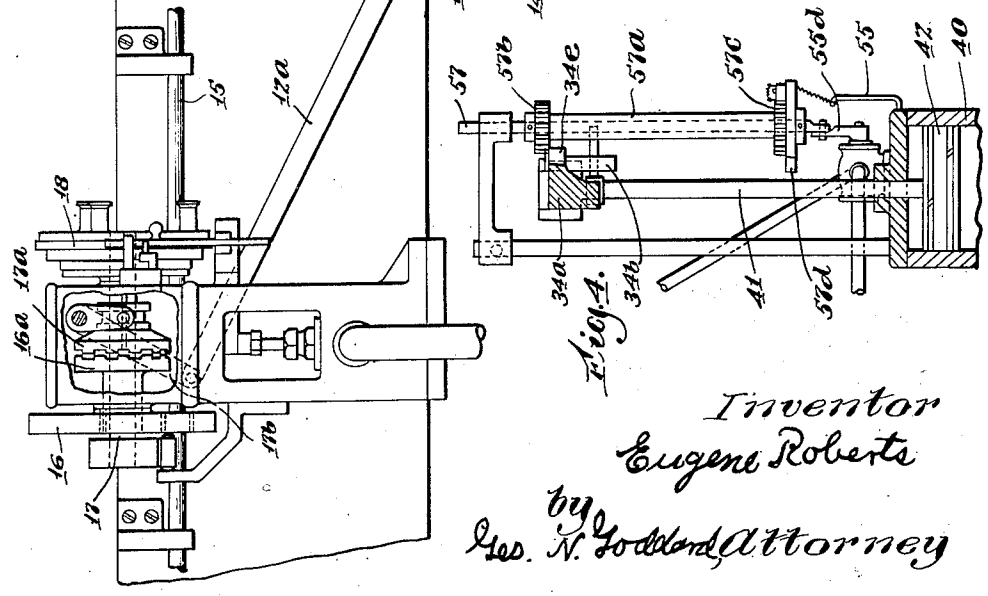


Fig. 4.

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UNITED STATES PATENT OFFICE

2,037,655

CONTROL APPARATUS FOR CENTRIFUGALS

Eugene Roberts, Hastings, N. Y., assignor to The Western States Machine Company, Salt Lake City, Utah, a corporation of Utah

Application April 15, 1931, Serial No. 530,225

12 Claims. (Cl. 210—72)

This invention relates to centrifugal apparatus and more particularly to that type of centrifugal apparatus such as is commonly used for the centrifuging of sugar in order to separate the syrup or liquor centrifugally through a perforated basket in which the solid crystals or grains are retained which grains, after washing and drying, are subsequently discharged through a discharge opening in the bottom of the basket.

In Letters Patent No. 1,719,132 granted me July 2, 1929 there was disclosed a centrifugal apparatus of this type equipped with a sprayer and with a timer control that made it possible for the operator, after loading and starting the centrifugal at normal operative speed, to give his attention to other machines until the successive operations of purging, washing and drying, and finally the braking of the machine, had been performed at proper predetermined intervals, each operation being controlled by the timer. Then the operator returns to the machine for the purpose of discharging the load, after which he reloads the machine and starts it again on its predetermined cycle of operation, thereby securing a uniformity of duration for the successive steps appropriate to the requirements of the sugar being treated that was not attained by the old method of hand control, which depended on the judgment of the operator.

The present invention is intended to provide a complete control of all steps involved in a complete cycle of operations for one or more centrifugal machines, including the starting and loading at the beginning of the cycle and the discharging of the centrifugal load at the end of the cycle, the complete cycle being repeated over and over again without requiring interference or manipulation by an attendant.

Heretofore, suggestions have been made looking to the continuous operation of a centrifugal running continuously at full speed, but such suggestions were of no practical value, because it is not practicable to load and unload a centrifugal of this type when it is running at normal speed. My present invention while providing a discharging means that may be started in action at relatively high speed as compared with previous practice, nevertheless makes adequate provision for starting full speed operation of the centrifugal as soon as the basket has been loaded at relatively low speed and also makes practical provision for slowing down the centrifugal and discharging the load, after which discharge the machine is automatically started and reloaded and then accelerated to high speed. In consequence, the centrifugal after having once been started continues to perform its alloted functions over and over again in an ordered sequence of steps having predetermined but variable duration without interference on the part of the operator. I believe that I am the first in the history of the art to devise centrifugal apparatus operating on this principle, which is wholly novel and which makes possible for the first time the successful and repeated operation of centrifugals without requiring an attendant to perform at least some of the steps in the complete cycle, thereby making it practicable for a single expert supervisor to oversee the normal operation of a large number of machines without the aid of attendants or workmen.

In the accompanying drawings I have illustrated a control apparatus by which the operation of a centrifugal through a complete cycle, including both the loading and the unloading, may be effected and may also be repeated as long as may be desired.

In the form of the invention illustrated in the accompanying drawings I have utilized for the most part the construction and arrangement of centrifugal control apparatus shown and described in my aforesaid Letters Patent and with this are associated other control mechanism, the construction of which separately is shown in other copending applications, this application dealing with the features of automatic control by which the entire cycle of operations is controlled from beginning to end and is repeated indefinitely.

In order to give a clear understanding of the present invention I will first describe that part of the apparatus for controlling and varying the duration of the purging, washing and drying operations of the centrifugal, which is disclosed in fuller detail in my aforesaid Letters Patent.

In the drawings

Fig. 1 is an assembled view somewhat diagrammatic in arrangement in order to show all the control apparatus and their operative interrelation, although the physical arrangement and location of the parts in practice would be changed as a matter of convenience, since the most convenient and effective arrangement of the different parts of the apparatus would be such that they could not very well be shown completely in a single view.

Fig. 2 is an enlarged detail view, principally in end elevation, showing the timer mechanism in relation to the starting and brake setting lever and in relation to the means for automatically

causing the starting of the centrifugal and its acceleration after loading, the timer control mechanism in this case being mounted overhead instead of on the casing of the machine, as in my aforesaid Letters Patent.

Fig. 3 is a front elevation of the timer and starting mechanism arrangement shown in Fig. 2.

Fig. 4 is a detail view showing in vertical elevation, at right angles to the plane of Fig. 1, the mechanism for controlling the admission of air into the piston cylinders for controlling the unloader.

Fig. 5 is a detail plan view showing the control device for shutting off the supply of sugar to the centrifugal.

The centrifugal basket comprises the usual perforated peripheral wall 1 with a centrally apertured flanged bottom 2, in which is carried the open spider 3 which secures the basket to the gyratory suspension shaft 4, to the upper end of which is secured the brake pulley 5 and the driving connection with the overhead motor shaft 6, all of well known construction.

The brake-setting and switch-energizing lever 7 is connected by the link 8 with the starting lever 9 secured to the rock shaft 10 and normally actuated to throw the lever into its rearmost position by means of a heavy coiled spring 10a, which sets the brake when the control lever 9 is released by the timer, all as shown and described in my aforesaid Letters Patent, the first part af the return cutting off the drive.

The rock shaft 10 has one end mounted in a supporting bracket 11 having an intermediate stop shoulder 11a adapted to be engaged by a spring bolt when moved to first speed position to hold the lever in that position against the retracting action of the coiled spring, until the loading has been effected, when the operator moves the shipper arm or lever 9 forward to high speed position allowing the latch 12, 13 under the tension of spiral spring 14 on the latch shaft to spring behind the lever 9, thereby holding it in high speed position until the latch is released by the timer head, as fully explained in detail in my aforesaid patent.

In the present case the timer, instead of being mounted on the curb or casing A which surrounds the centrifugal basket, as shown in said patent, is mounted above the machine and is driven by means of a continuously running drive shaft 15 which has a pinion meshing with the gear 16 secured to, and compounded with, a clutch member 16a loosely mounted on the timer shaft 17. Splined to the timer shaft 17 is a companion clutch member 17a, which is normally out of clutch engagement with the continuously rotating clutch member 16a but which is thrown into clutch engagement with its driving member 16a by means of a shipper fork lever 17b connected by a link 12a with the latch arm 12, so that when the starting lever is thrown forward to high speed position and the latch 13 is rotated by its spring 14 into engagement with the rear face of said starting lever, the clutch is simultaneously thrown into mesh to drive the timer shaft 17 and with it the timer head 18 carrying the swells or projections by which the timer acts, after a predetermined period, as explained in my aforesaid patent, first to open the valve 20 to admit the wash water to the tube 21 leading to the spray nozzle or head 22 and later, after a predetermined period of rotation, the timer releases the valve lifting mechanism and allows the valve to close and cut off the supply of water to the spray nozzle. As explained in said patent, the further rotation of the timer for a predetermined period acts to disengage the latch 12, 13 from its detaining position behind the starting lever 9, thus allowing the actuating spring 10a to return the starting lever to initial position, thereby setting the brake into braking engagement with the brake pulley. Thus it will be seen that after the release of the brake and the shifting of the starting lever to high speed position, the attendant has no further work to do until the machine has slowed down or stopped to permit discharging of its load through the opening in the bottom of the basket. It will also be seen that the starting lever is held at first speed position by means of the hand controlled bolt 9a having the construction and operation described in my aforesaid patent, which bolt as therein explained is thrown to idle position when the starting lever is moved to high speed position and is restored to active position on the rearward swing of the lever 9 to brake setting position.

The power actuated mechanism for discharging the load through the bottom of the basket is described in detail and forms the subject of a companion application for patent filed by me and therefore only so much of the construction and operation thereof, as is necessary to understand its relation to the present invention, will be described herein.

On the centrifugal shaft 4 is slidably mounted a sleeve or head 30, which serves as a carrier for discharging plows 31 each mounted to have a slightly vertical play or lost motion on a headed pin 32 secured in a hollow boss 30a projecting from the head 30. In the case of a flat bottom basket, such as illustrated in the present drawings, this head may be provided with a circular flange 30b to act as a closure or valve for closing the centrifugal discharge opening in the bottom of the basket. At its upper end the sleeve is provided with a spool-like member 33, which also has an upward extension 33a. A lifting arm 34 is fulcrumed in a pair of short supporting pivotal links 34c mounted on the top of the curb or casing and said lifting arm has an outward extension 34a connected with the stem 41 of a piston 42 mounted in an air cylinder 40 that is pivotally supported outside of the curb. At its inner end the lifting lever is provided with a lifting head embracing pivotal arms 35 carrying at their free ends clutch blocks 36 adapted to engage opposite sides of the spool 33 to form a strong clutching or braking engagement therewith. The arms 35 are forced inwardly into strong frictional engagement with the spool by means of toggle links 36 connected to the outer ends of said arms 35 at one end and at the other end to a piston rod or stem 37 of the piston head 37a in a compressed air cylinder 38. A helical spring 39 acts to return the piston head to outermost position when the air pressure behind it is relieved.

When the lifting head, comprising the arms and clutch members 35, 36, is moved into engagement with the spool 33 by the inward movement of the piston head 37a under air pressure admitted behind it and air is admitted above the piston head 42 in the cylinder 40, the outer end of the lifting lever is pushed down so that the plow carrying head, or sleeve, which normally rotates with the centrifugal is frictionally retarded and is also raised or lifted toward the top

of the basket so that the plows 31 act to cut away and discharge the walled up solid through the bottom of the basket, the plow being given the upward traverse to disrupt and deflect the walled up sugar through the bottom opening.

This action of the discharging apparatus is effected in the following manner. The air supply pipe B leads through a rock valve 50, which in the position shown in Fig. 1 is in closed position to allow venting of the upper end of the cylinder 40. The lever 50a secured to the rock valve is moved beyond the dead center by a link 51 connected with the starting lever 9 and having a pin and slot engagement with the lever 50a, which is pivotally connected with an over the center spring actuated arm 52, hence when starting the centrifugal by moving the starting lever or control lever 9 forward to first speed position the valve 50 is opened to admit compressed air through the pipe 53 to the cylinder 40 above the piston. At this stage the return spring 37 has released the lifting head from engagement with the spool 33, so that the lifting head is raised from the basket without lifting the sleeve 30 by means of the descending piston 42, the object being to get the lifting head out of the way during the loading and normal operation of the centrifugal. The slot in the rear end of the link 51 permits the further movement of the control lever 9 to high speed position after the valve actuating arm 50a has been moved to open position.

When, however, the brake-setting movement of the lever 9 occurs, the valve arm 50a is thrown to cut-off or closed position, while affording a small vent 50a to the upper end of the cylinder through the pipe 53 to allow the air to escape from the upper end of the cylinder 40, thus allowing the lifting head and lever of its own weight to drop into the basket somewhat cushioned by the partly confined air that is escaping through the vent. In this position the clutch blocks 36 are at the level of the spool 33 ready to be engaged therewith. This dropping of the lifting head, causing the raising of the outer arm 34a, is employed to open a valve 55 to which leads an air supply pipe 55a and from which leads a pipe 55b communicating with the outer end of the cylinder 38. Air is thus admitted behind the piston 37a to move said piston inward and thereby engage the clutch blocks 36 with the spool 33. After the piston 37 has moved inward a short distance it uncovers a port communicating through pipe 56 with the upper end of the cylinder 40, so that the piston 42 is forced downward thereby lifting the plow carrying head upward toward the top of the basket. The combined braking and lifting action performed by the air pressure in the respective cylinders 38 and 40 serves to retard the plow and at the same time cause it to travel upwardly. The valve 55 is opened by the upward movement of its outer arm 34a when the lifting head drops into the basket after the machine has been braked. This is effected by means of a valve actuating rod 57 connected with a valve arm 55d, which is raised on each alternate upward stroke of the arm 34a of the lifting lever, said arm having a laterally projecting finger 34c arranged to engage a projecting tooth of a star wheel 57b secured to a rotatable sleeve 57a, whose lower end is provided with a ratchet 57c which is actuated one tooth of the ratchet by a cam finger 34g also carried by said arm 34a from which it extends downward so as to engage a pawl arm 57d and turn the ratchet wheel, secured to the lower end of the sleeve, on each downward stroke of the arm 34a. As there are twice as many teeth or projections to the star wheel as there are to the ratchet wheel, every alternate movement of the ratchet wheel brings alternately a tooth or a space of the star wheel into alignment with the projecting finger on the arm 34a. The mechanism is set so that on the initial raising of the lifting head out of the basket, when the machine has started, the star wheel is rotated to bring a tooth into alignment or registry with the pin on the arm 34a, so that when the lifting head drops into the basket preparatory to engaging and lifting the plow carrying head the valve-actuating rod 57 is lifted by the upwardly swinging arm 34a to energize the discharging apparatus. During the upward discharging traverse of the lifting head, the arm 34a drops with the downwardly moving piston, said piston being provided with a laterally projecting pin at 41a for engaging the valve actuating arm 55d to depress said arm and thereby close the valve 55. Not only is the valve 55 closed by the down stroke of the arm 34a when the discharging operation is taking place, but at the same time the cam finger attached to said arm turns the ratchet wheel 57c one tooth so as to bring a notch instead of a tooth in registry with the valve opening pin on the arm 34a, so that when the lifting head and the plow carrying head drop into the basket the upward stroke of the arm 34a has no effect in opening the valve. Again, when the arm 34a is depressed through the opening of the valve 50, when the centrifugal is started, to raise the head out of the basket, the cam finger turns the ratchet another tooth, thus bringing the next finger of the star wheel into alignment with the lifting pin carried by the arm 34a, so that the dropping of the head into the basket preparatory to beginning the discharging operation opens the valve 55 to energize the discharger.

After the setting of the brake and the completion of the discharging or unloading operation, the machine is again started at slow speed and is automatically loaded to the desired thickness of sugar wall inside the basket. In the present case, the starting of the machine on low speed is effected through automatic operation of the starting lever or shipper 9, which is moved to first speed position by the automatically controlled admission of compressed air through the valve 60 to the cylinder 61 behind the piston 62, whose stem 62a preferably has a lost motion actuating engagement with a transversely perforated swivel member 9e carried by the lever 9. The piston rod 62a is passed loosely through the perforation in said swivel 9e and is provided with an adjustable thrust nut 62b arranged to allow the piston to complete say one-half, or more, of its forward traverse before the thrust nut engages and pushes forward the lever 9 to its first speed position. As it is desired that a brief interval to complete the loading shall intervene before shifting the lever 9 to high speed position, the forward end of the cylinder 61 is closed in order to form an air pocket in which compressed air resistance is built up by the forward movement of the piston to resist the pressure behind the piston and stop the forward traverse after the lever 9 reaches its first speed position. This resistance may be increased by a compression spring 62 engaging a fixed stop 61a through which the rod 62a slides and its rear end engaging a stop nut 62d adjustably secured to the piston rod 62a.

When the loading has been completed the pressure resistance in front of the piston is relieved by opening a vent or poppet valve at 63 by means of any convenient instrumentality, such as a solenoid 63a.

Any suitable arrangement of mechanism may be used to open the valve 60 after the discharging operation, in order to start the centrifugal and later open the vent 63 to obtain full speed operation of the centrifugal. In the present case, I prefer to control the starting of the centrifugal by means associated with the discharger head. As illustrated in Fig. 1, I provide a control lever 65 loosely fulcrumed on a horizontal shaft 65a extending longitudinally of the battery of centrifugals, the longer inner end of said control lever substantially overbalancing the shorter outer end and being normally permitted to drop to a point somewhat below the upper limit of travel of the spool extension 33a which forms the upper end portion of the sleeve 30 constituting the discharger head or plow carrying head. On the upward traverse of the sleeve 30 during the discharge operation, the member 33a engages and lifts the inner end of the lever 65, while on the downward or return stroke of the discharger head the lever 65 drops to its lowermost position.

The lever 65 is so positioned that it is not actuated or moved by the upward movement of the lifting head alone when it is not carrying the discharger head, of which the member 33a forms an upward extension. Furthermore, the inner, heavier end of the lever 65 is slotted from its outer end inward to embrace the centrifugal shaft and is pivotally jointed, as shown at 65b, to follow the lateral oscillations of the suspended centrifugal shaft. This lever 65 is therefore raised when engaged and lifted by the upper end 33a of the spool on the discharger head and, when the discharger head drops after completing the discharging operation, the lever drops also. It is on this latter descending movement of the lever 65, after the completion of the discharging, that means are energized to open the valve 60 and start the machine by pushing forward the shipper 9, which releases the brake and energizes the driving mechanism in the manner described in my aforesaid Letters Patent, or any other suitable manner.

In the present case, the valve opening solenoid 64 is energized from switch terminals 64a by means of a circuit closer or switch member 66, which is pivoted intermediate of its ends adjacent to the travel of the outer short arm of the lever 65. This circuit-closing switch member 66 is mounted on a fulcrum arranged on the same level as that of the shaft 65a which supports the lever 65 and is held yieldingly in alignment with the horizontal plane intersecting the pivotal centers of the lever 65 and of the switch 66 by means of a spring 66a anchored to a suitable fixed support 67. The adjacent ends of the switch arm 66 and of the actuating lever 65 are dimensioned so that on the upward movement of the inner end of lever 65, the short arm 65b thereof wipes across the adjacent arm 66b moving the switch 66 away from the terminals 64a. At the top of its upward traverse the short arm 65b has passed by the adjacent end of the arm 66b, so that when the lever 65 has reached its uppermost position its short arm 65b is beneath the adjacent arm 66b of the pivoted switch, which is held in intermediate position by the spring 66a. When, however, the discharger head and the lever 65 drop, the short arm 65b wipes against arm 66b from the underside, thus depressing the switch 66 into engagement with the terminals 64a, thereby closing the circuit and energizing the solenoid 64 to open the valve A through the pull exerted by the solenoid upon the valve actuating arm 60a.

Since the venting of the forward end of the cylinder 61 should be accomplished immediately after the loading of the basket has been effected, the venting is associated with the loading mechanism, which will now be described.

The loading of the machine is commonly effected by throwing up a counterbalance lever 75, which carries a valve or cut-off plate 75a normally in its lowermost position closing the discharge opening of the sugar spout 76, which is led down from the overhead mixer containing the supply of wet sugar to be treated. It is desired that this sugar spout gate shall be opened as soon as the machine has started at low speed and I provide for this purpose a compressed air cylinder 71 containing a piston 72, whose actuation in opposite directions is controlled by a three-way valve 70 that is associated, in this case, with the valve 50 through which air is admitted to the cylinder 40 to actuate the lifting head to raise and hold it out of the basket during the normal operation of the centrifugal.

As explained above, the valve arm 50a is thrown to valve-closing position by the brake-setting movement of the shipper 9 and the connecting link 51. A branch pipe 70a leads from the pipe 53 on the delivery side of valve 50, so that when valve 50 is open air is admitted to the valve 70. As shown in Fig. 1, the valve 70 when the machine is started is in open position to allow compressed air to enter through the valve into the lower end of the cylinder by means of the connecting pipe 70b.

Now, since valve 70 is in open position but valve 60 is in closed position when the brake is applied, no compressed air can operate on the piston 72 until valve 60 has been opend to throw the shipper 9 to first speed position. This first stage forward movement of the shipper 9, therefore, opens valve 50 and allows the air to flow through valve 70 to the lower end of the cylinder 71, thereby pushing the piston upward and therefore, through connection of the piston rod 72a with the gate, control lever 75, raising that lever and opening the gate to allow the sugar to flow through the discharge spout into the basket, precisely in the same way that the loading would take place when the spout gate is lifted by hand.

It will, of course, be understood that when the basket has been charged with a sufficient load of sugar or material the spout should be closed to prevent overloading. Since this spout-closing mechanism of itself forms the subject of a copending application, I will very briefly describe its arrangement and operation as part of the present automatic control apparatus.

Mounted in a bracket 80 on the curb or casing A is a vertical oscillatory spindle 81 projecting downwardly into the top of the basket and having a laterally projecting finger or blade 82 adapted to be engaged by the wall of sugar built up inside of the basket. It will be understood that when the basket is loaded by admitting the sugar from the supply spout, the wet sugar tends to build up in an annular wall inside of the basket, the thickness of which depends upon the amount of sugar supplied. Usually the wall is allowed to build up to a thickness of perhaps five or six inches, when the operator closes the gate and throws the shipper

to full speed. This blade 82 on the rotatable spindle 81 is normally pressed inwardly to within, say, four inches more or less of the basket wall by means of a light torsion spring. When the sugar wall is built out that distance, it begins to form contact with the blade or gauge and, as the wall of sugar continues to build out, it rotates the gauge toward the inner or central portion of the basket against the tension of its spring. Secured to the upper end of the spindle is an arm 83, which is provided with an electric terminal or contact 83a and which moves over an arcuate track on which is set an adjustable contact pin 84, whose position of adjustment depends upon the thickness of sugar wall that it is desired to build up inside the basket. If the sugar wall builds, say, to a thickness of six inches, assuming that to be the desired thickness for illustration, the contact member or terminal 83a on the arm 83 will engage the terminal pin 84, thus closing an electric circuit. This electric circuit includes a solenoid 73 which, when energized actuates a lever 73a operatively connected with a valve arm 70c secured to the valve 70, causing the valve arm 70c to be moved counterclockwise (shown in Fig. 1) to cut off communication between the air supply branch 70a and the lower end of the cylinder and establishing communication between the supply pipe branch 70a and the branch delivery pipe 70d which leads to the upper end of the cylinder 71. This reversed position of the valve 70 results in forcing the piston 72 downward and closing the spout gate 75a.

In this position of course no air can flow into the lower end of the piston to open the gate, but the valve 70 must be returned to such position before the centrifugal is started again. This return of the valve 70 to initial position is effected at the same time that the valve 50 is closed by the rearward or brake-setting movement of the shipper 9. This may be effected in a simple manner by providing the valve arm 50a with a link 74, which has a pin and slot engagement with the valve arm 70c so dimensioned that when the valve arm 50a is moved to its valve-closing position by the setting of the brake it will cause the valve arm 70c to move to initial position for opening the spout gate. The slot in the link 74 allows the opening movement of valve arm 50a without disturbing the existing position of the valve 70. It will therefore be seen that the brake setting movement of the link 51 closes valve 50 to venting position and at the same time returns valve 70 to a position where it is ready to cause the opening of the sugar spout gate after a short pause following the opening of valve 50 by the starting lever or shipper. To give a somewhat longer pause the piston rod 72a is so adjustably connected with the lever 75 that when the gate is closed the piston 72 is some distance above the lower end of the cylinder giving the compressed air an opportunity to build up pressure for a brief interval before actually opening the gate.

To summarize the various operations performed by the control mechanism I will now explain the entire sequence of such operations.

Assuming each centrifugal of the battery to be at rest or idle, it is started by the forward movement of the shipper 9 to first speed position, in the first instance by manual manipulation either through pulling forward the shipper 9 or by releasing a trip latch to allow the lever 65 to drop, as will presently be explained.

After the first starting of the centrifugal at low speed, the spout gate 75a is opened to load the machine by means of the piston 72, which is moved by air through the valve 70 to gate-opening position very shortly after the shipper moves to first speed position. Thirdly, the gate is closed by reverse movement of piston 72 which is effected by reversing the position of valve 70 through the loading gauge controlled circuit energizing the solenoid 73. Next, occurs the moving of the shipper to high speed position through venting of the air in front of piston 62 by solenoid 63a, which is energized also through loading gauge control circuit. Fifth, at the same time, the forward movement of the shipper to high speed effects the starting of the timer through operation of the clutch arm 17b. Sixth, after a proper interval the timer starts the sprayer. Seventh, after another interval the timer cuts off the spray. Eighth, about the same time the timer head shifts valve 60 to cut-off and venting position to permit return of piston 62 to initial position. Ninth, after sufficient centrifugal drying, the timer through release of the latch 13 allows the return movement of the shipper to cut-off the drive and set the brake. Tenth, the same rearward movement of the shipper closes valve 50 to venting position, allowing the plow lifting head to drop to the level of the spool 33. Eleventh, the final part of the down stroke of the lifting head acts, through arm 34a, to open valve 55 by raising valve stem 57. Twelfth, the air passing through valve 55 operates piston 37a to set clutch 36 into braking engagement with spool 33. Thirteenth, air passing to cylinder 41 through pipe 56 lifts the discharger head 30 while maintaining braking action on the discharger head. Fourteenth, the lever 65 for closing valve 60 is lifted by 33a so as to wipe arm 65b beneath arm 66b and then on the downward movement of the lever 65 the valve 60 is opened through the closing of the switch 66, which energizes the solenoid 64 and results in once more moving the shipper 9 from braking to first speed position.

This cycle of operations is repeated automatically as long as may be desired. When, however, it is desired to stop the operation of any machine of the battery, the opening of the starting valve 60 is prevented by suitable means.

In the drawings I have shown a latch 65e carried on a bracket supported by the shaft 65a which supports the lever 65, this latch being heavier at its inner end normally assumes a horizontal position where it is inactive, but before the discharging operation is completed on any machine that it is desired to stop the latch 65e is swung to vertical position to engage a stop pin 65d on the lever 65 and thus lift the lever 65 out of reach of the spool extension 33a. Accordingly there is no dropping of the lever 65 when the discharger head descends into the basket and consequently the valve 60 is not opened to throw the shipper to starting position. In practice the operator should start the machine by releasing or tripping the latch 65e manually, thereby causing the valve 60 to open and start the machine on its continuous cycle of operations, since the starting by tripping the latch avoids leaving the latch in its active position in case the shipper 9 is pulled forward by hand.

It will be understood that it is preferable to operate each machine of the battery under its own individual control for several reasons. In the first place, starting all the machines simultaneously puts a very heavy initial load on the

power generator in case the machines are electrically driven by individual motors, and in case the machines are driven from a line shaft, either through belting or gearing connections, it puts a very heavy starting load on the line shaft drive. Again, it is desirable, after a battery of machines have been shut down and they are started up again, that the supervisor should inspect the first operation of each machine of the battery in order to assure himself that everything is running properly. There are also other practical advantages which render the individual control of each machine desirable, although it will be understood that I do not confine the application of this invention to such individual control, since it is applicable to a simultaneous or interconnected control, if for any reason such control should be desired in particular cases, since it is obvious that the switch levers 66, through which the centrifugals are started, could be actuated simultaneously by securing them to a common supporting shaft, instead of mounting them loosely thereon, so that the operation or actuation of any one of the switch levers 66 would actuate the whole series correspondingly.

It will be observed that while the rotating timer controls the duration of certain operations, such as the purging, the spraying and the drying that is terminated by the slowing down or stopping of the machine after the brake is set, the other steps in the cycle of operations of the apparatus are performed in an interdependent sequence. That is to say, the setting of the driving mechanism to low speed position depends upon the completion of the unloading evidenced by the dropping of the unloader or discharger head; the opening of the spout gate depends on the starting of the driving operation through the opening of valve 50 admitting air through valve 70; the cutting off of the sugar supply is dependent upon the thickness of sugar wall in the basket, that is, upon a predetermined loading of the basket through the action of the loading gauge; the termination of the loading also results in the venting of the drive control cylinder 61. After the drive has been cut off and the brake set, the unloading or discharging device is set in action through the venting of the cylinder 40 by the movement of valve 50 to cut-off and venting position which, by permitting the lifting head to drop into the basket, opens valve 55 to energize the discharging or unloading apparatus. Therefore, those operations requiring a definite and precise duration are controlled by the timer and the operation of the rest of the mechanism is in an established sequence dependent upon the completion of the next preceding action to effect the next succeeding action. While there are practical advantages in this principle of arrangement, it will be understood that the principles of this invention are not limited to that particular system of control.

While I have illustrated and described the invention as applied to an electrically driven centrifugal, it will be understood that the principle of control and operation is equally applicable to centrifugals driven from a line shaft, either by a clutch controlled belt pulley, or by clutch controlled gearing. Obviously, such a clutch may be set into light driving engagement or heavy driving engagement by its shipper to effect the low speed, or the high or normal speed, driving of the centrifugal.

What I claim is:

1. The combination with an intermittently rotated gyratory foraminous-basket centrifugal provided with alternately acting driving and braking mechanism for alternately driving and stopping the centrifugal, timer means for controlling the starting and the stopping of the centrifugal at predetermined times, an unloader device loosely mounted on the centrifugal shaft, and actuating means for the unloading device, said actuating means being rendered active by the setting of the brake to stop the centrifugal.

2. The combination with a gyratory centrifugal provided with driving, braking and unloading mechanism, each operating in predetermined timed sequence under the control of a timer device that is started when the centrifugal is started to cut off the drive, set the brake and unload the centrifugal, and means energized by the traverse of the unloading mechanism for restarting the centrifugal driving mechanism.

3. The combination with a gyratory centrifugal provided with driving, braking and unloading mechanism operated under controlling means acting in a predetermined sequence to cut off the drive, set the brake and unload the centrifugal, means energized by the unloading mechanism for starting the centrifugal at low speed to permit its being loaded, and means dependent on cutting off the loading supply for establishing the operation of the driving mechanism at high speed.

4. The combination with a gyratory centrifugal provided with a bottom discharge opening and with a gate controlling the loading of the centrifugal and provided also with driving, braking and unloading means, of means for starting the centrifugal in action, gate opening means associated with the starting means to admit material to be treated into the centrifugal basket, means controlled by the magnitude of the load in the basket for closing said gate, means acting in coordination with the gate closing means to accelerate the speed of the centrifugal, means for cutting off the drive and setting the brake, and unloading mechanism for discharging the material through the bottom of the basket, said unloading mechanism being dependent upon the setting of the brake.

5. A loading control mechanism for a sugar centrifugal embracing, a delivery conduit, a cut-off gate, means energized through the starting of the centrifugal to open said gate for the delivery of material, and means controlled according to the amount of material delivered by said spout to close said gate.

6. In a loading control mechanism for a sugar centrifugal the combination with a delivery conduit and its cut-off gate, of a pressure actuated piston for controlling said gate, means rendered active by the starting of the centrifugal for admitting air pressure to one side of said piston to open the gate, and means dependent on the supply of sugar delivered through said conduit to close said gate.

7. A loading control mechanism for a sugar centrifugal embracing, a delivery conduit, a cut-off gate, means energized through the starting of the centrifugal for opening said gate, and means controlled according to the amount of material delivered by said conduit to close said gate, and means coordinated with the gate closing control for effecting the setting of the centrifugal driving means to high speed position.

8. In a sugar centrifugal, the combination with a gyratory centrifugal having driving and braking mechanism, of unloading mechanism set in operation after the cutting off of the drive and

the setting of the brake, of a shipper combined with the driving and braking mechanism for effecting the starting and the stopping of the centrifugal, means energized through the action of the unloading mechanism acting to move the shipper to low speed drive position to start the centrifugal, and means acting after the loading of the centrifugal to effect the movement of the shipper to high speed position.

9. In a sugar centrifugal apparatus, the combination with drive control and braking mechanism, a pressure-actuated piston for releasing the brake and shifting the driving mechanism to low speed position, means for preventing movement of the drive control mechanism to high speed position, and means acting after the loading of the centrifugal to effect movement of the drive control mechanism to high speed position.

10. A drive control and braking mechanism for a sugar centrifugal embracing in combination, a shipper cooperatively associated with braking and driving mechanism, a pneumatic cylinder, a pressure-actuated piston therein connected with said shipper, means for admitting compressed air behind the piston, means for releasably opposing resistance to the movement of the piston and shipper beyond low speed position, and means acting after the loading of the centrifugal to release such resistance and permit the piston under pressure of the air behind it to move the shipper to high speed position.

11. In a sugar centrifugal apparatus, the combination with driving and braking mechanism and an associated shipper, a pressure cylinder, a piston therein connected with said shipper, means for admitting air behind the piston, means for confining the body of air in front of the piston to limit forward movement of the piston beyond first speed position of the shipper, means arranged to act after the loading of the centrifugal to vent the confined body of air in front of the piston and allow the piston to move the shipper to high speed position.

12. In a sugar centrifugal apparatus, the combination with a loading mechanism comprising a delivery spout gate, a pressure-actuated piston for opening said gate to load the centrifugal and to close the gate after the delivery of a predetermined mass of material into the centrifugal, a control valve rendered active by the starting of the centrifugal to admit air pressure to one side of the piston to open the gate, means for shifting the valve to admit air to the other side of the piston to close the gate, and means for restoring said valve to initial position.

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