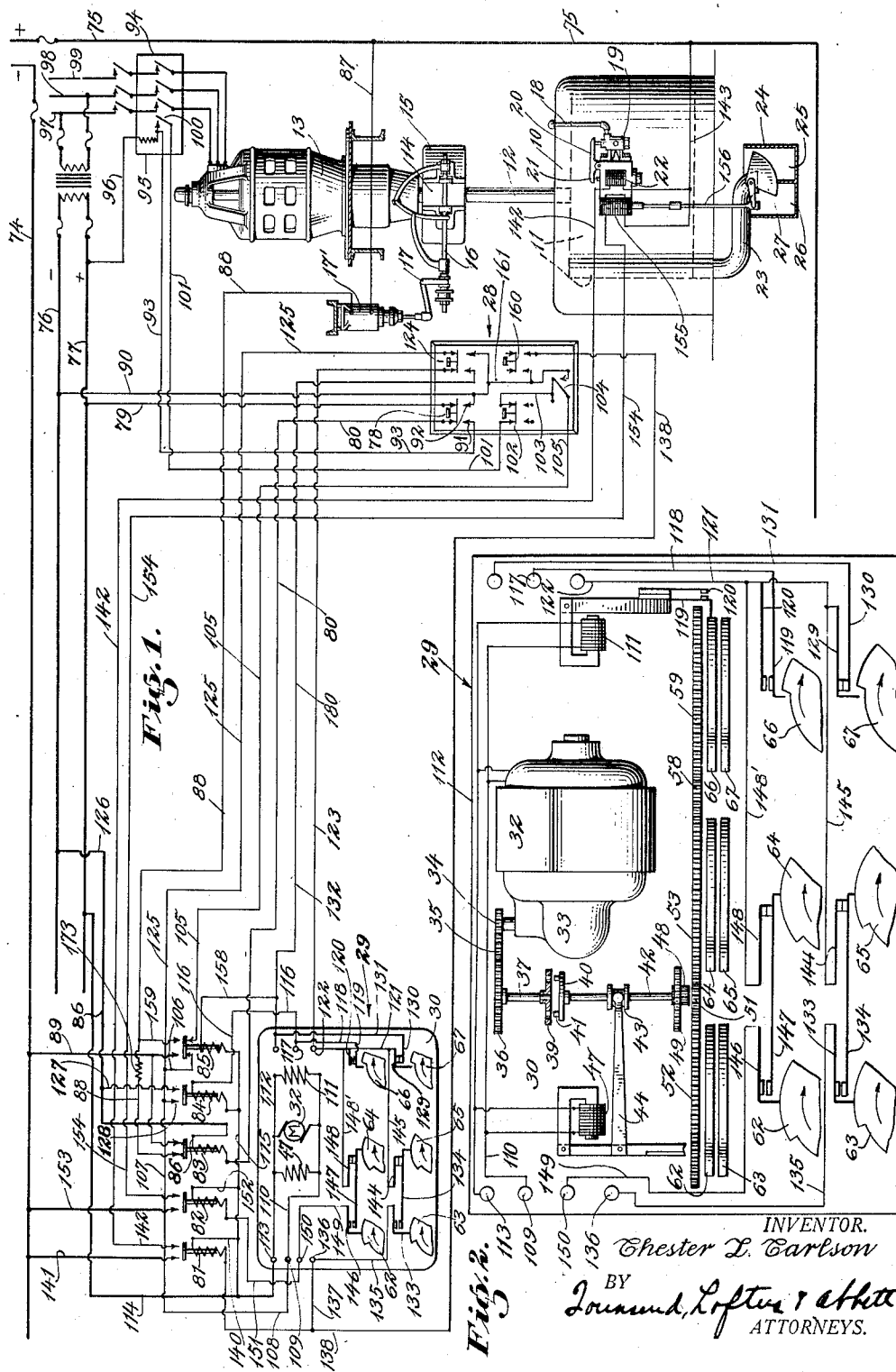


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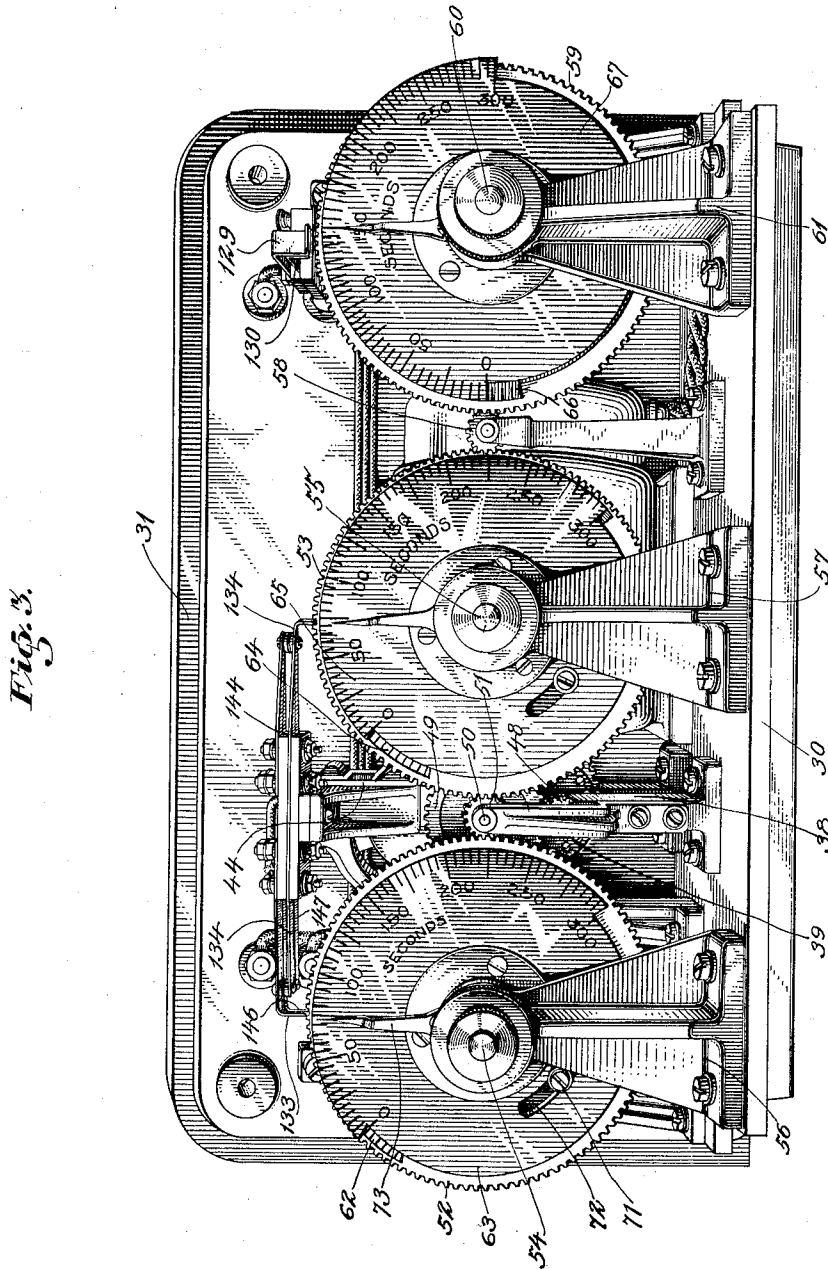
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1,820,374

CONTROL DEVICE FOR AFFINATION CENTRIFUGALS

Filed June 15, 1927

4 Sheets-Sheet 2



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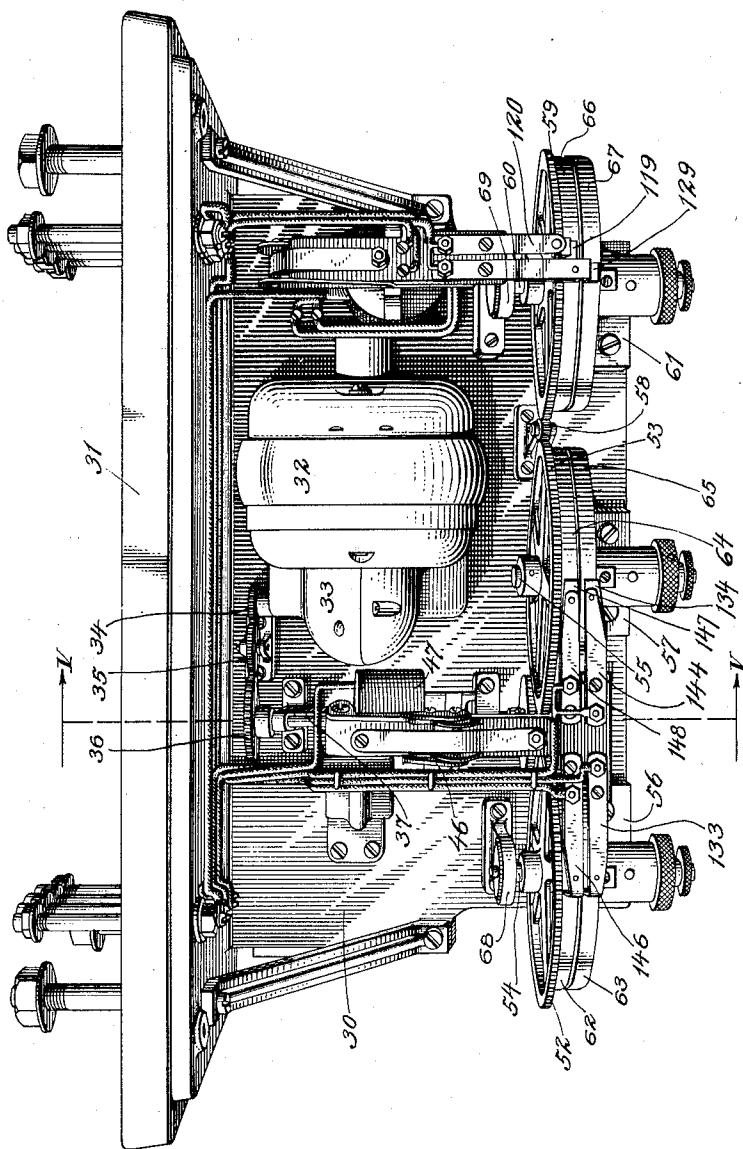
1,820,374

CONTROL DEVICE FOR AFFINATION CENTRIFUGALS

Filed June 15, 1927

4 Sheets-Sheet 3

Fig. 4.



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CONTROL DEVICE FOR AFFINATION CENTRIFUGALS

Filed June 15, 1927

4 Sheets-Sheet 4

Fig. 5.

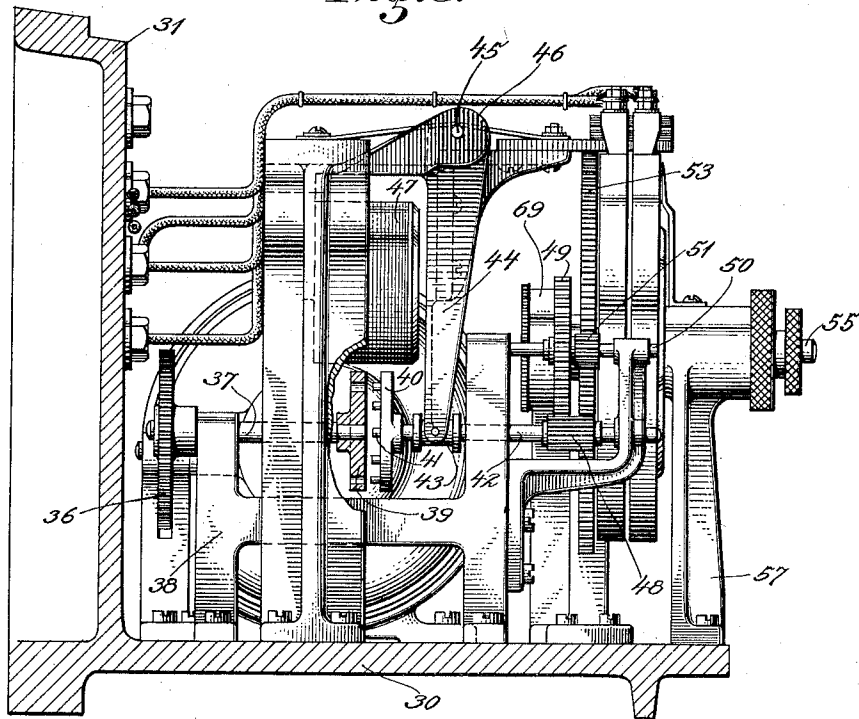
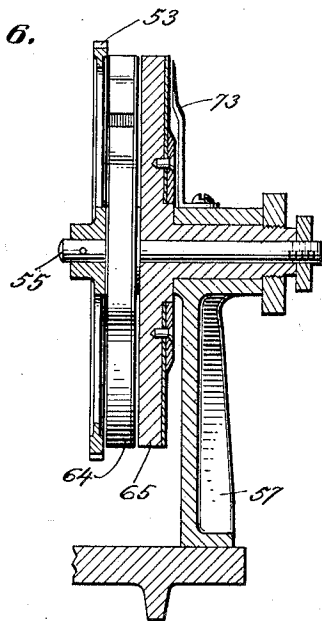


Fig. 6.



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CONTROL DEVICE FOR AFFINATION CENTRIFUGALS

Application filed June 15, 1927. Serial No. 198,947.

This invention relates to automatic controls for centrifugal machines and particularly pertains to means for automatically controlling the operation of affination centrifugals used in the manufacture of sugar.

In the making of sugar it is desirable that that batches of sugar shall be treated in a uniform manner, thereby insuring that the final product will maintain a predetermined standard of uniformity both as to sugar color and the size of crystals, and that this shall be accompanied by a minimum loss of sugar. At the present time it is common practice to wash the sugar in centrifugal machines during which time the machines are under manual control both as to the rotation of the centrifugals and as to the beginning, length and termination of the washing operation with relation to the centrifugal operation and as to the separation of the impure green syrup from the purer syrups obtained in washing.

Such manual control does not make it possible to uniformly wash the sugar and it is the object of the present invention therefore to provide means for automatically setting in motion, controlling the period of rotation and the period of washing of the sugar.

The present invention contemplates the use of a centrifugal sugar washing device and means for controlling the same whereby it will be set into driving motion at a predetermined time and at a predetermined time thereafter a washing operation will be started, which shall continue for a predetermined period and will then be automatically interrupted; such device being further fitted with automatic means for separating green and purer wash syrup coming from the centrifugal.

The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a view in plan showing a schematic arrangement of the various elements with which the present invention is concerned, and particularly disclosing a wiring diagram therefor.

Fig. 2 is a diagrammatical view in plan showing the contact disks for the supervising relay and the mechanical means for controlling the same.

Fig. 3 is an enlarged view in front elevation showing the supervising relay timer.

Fig. 4 is a view in plan showing the timer disclosed in Fig. 3.

Fig. 5 is a view in transverse vertical section through the supervising relay timer as seen on the line V—V of Fig. 4.

Fig. 6 is a view in transverse vertical section through a pair of the timing disks and their bearing.

Referring more particularly to the drawings, 10 indicates the curb of a centrifugal machine within which is disposed a basket 11 having a foraminous side wall. A vertical spindle 12 extends from the curb and connects with a driving motor 13 by which motor the basket is rotated. A brake drum 14 is secured upon the shaft 12 and is surrounded by suitable brake bands or shoes 15. These shoes are provided with a shaft 16 which may be actuated by a shifting lever 17 to set the brake and thus bring the rotating basket to rest in a relatively short period of time. The shifting lever is suitably actuated by a brake magnet 17', the circuit of which will be hereinafter described.

A water supply pipe 18 extends over the lip of the curb and projects into the basket where it is fitted with a suitable spray nozzle and strainer adapted to project a stream of water against the sugar contained in the basket. A valve 19 controls the flow of water to the nozzle. This valve is here shown as fitted with a lever 20 adapted to be actuated by the plunger 21 of a solenoid 22 in a manner which will be hereinafter described.

A spout 23 leads from the centrifugal and is intended to direct the washed and green syrup into a divided syrup trough 24. This trough 24 is divided into two compartments 25 and 26 and a movable hood member 27 is pivotally mounted on the spout so that when it is in either of its extreme positions it will cause the material from the centrifugal to pass into one or the other of the troughs.

In addition to the mechanism here disclosed there are two units forming part of the control. They are the control station switch 28 and the supervising relay timer 29.

The operation of the timer is generally in-

dictated in Fig. 2 of the drawings while the details of its construction are more clearly shown in Figs. 3 to 6 inclusive. Referring more particularly to these figures, 30 indicates a base plate having a suitably disposed back plate 31. The base plate carries a motor 32 fitted at one end with a worm gear structure 33. This structure drives a gear 34 in mesh with a gear 35 which gear drives a gear 36 in turn. The gear 36 is mounted on the end of a shaft 37 extending through a bearing 38 and carries a perforated clutch plate 39 at its opposite end. This clutch plate is adapted to be engaged by pins 41 on a complementary clutch plate 40 to connect the shaft 37 with a secondary drive shaft 42 which is in longitudinal alignment therewith.

This shaft 42 is provided with a collar 43 by which the clutch disk 40 may be shifted into and out of engagement with the disk 39. The collar is engaged by a clutch lever 44 mounted on a pivot 45 and carried on a bearing 46. A magnet coil 47 is disposed adjacent the clutch lever 44 and in such a position as to exert an influence on the lever when the coil is energized whereby the pins on the disk 40 will project into the perforations in the disk 39 and will thus cause the two disks to lock together.

The shaft 42 is provided with a pinion 48 in constant mesh with a gear 49 which is carried on a jack shaft 50. This jack shaft also carries a pinion 51 which is in mesh with large timing gears 52 and 53. The timing gears are carried on timing shafts 54 and 55 which are disposed in parallel relation to each other and are mounted in bearings 56 and 57. The gear 53 is in mesh with a pinion 58, which in turn meshes with the timing gear 59 carried upon shaft 60 supported in a bearing 61.

It is intended that when the magnet 47 is energized it will establish a driving connection between the timing gears 52, 53 and 59 and the motor so that these gears will be simultaneously driven in synchronism with each other, and will thus control the supervising relays. This is done in the following manner.

The shaft 54 carries timing cams 62 and 63. The shaft 55 carries timing cams 64 and 65, while the shaft 60 carries timing cams 66 and 67. These cams, as particularly shown in Fig. 2 of the drawings, each have a "rise" in their circumferential face which acts to close certain switches, as will be hereinafter described. The cam 62 is provided to close the syrup divider magnet control circuit. The cam 64 is provided to open the same circuit. The cam 63 is provided to close the circuit through the magnet of the spray water valve. The cam 65 is provided to open the same circuit. The cam 66 is provided to completely shut down the supervising relay and cam 67

closes the brake magnet circuit to apply the brake to the centrifugal.

Suitable spring units 68 and 69 restore the various cams to their original starting position after a cycle of operation has taken place. Dial faces are formed on each of the timer cams. The cams of each set are adjustably secured in relation to each other by set screws 71 passing through slotted openings 72 in the front cam of each set and engaging threaded openings in the rear cams. The dials operate in conjunction with fixed pointers 73 and indicate the period of time elapsed between the starting operation of a particular cam and the operation of the cam associated therewith.

The switch elements affected by the various timing cams 62 to 67 inclusive will be described during the description of the wiring diagram so that the various conductors and switch members may be described and numbered in sequence.

Starting operation

The wiring arrangement and the operation of the apparatus will now be described. 74 and 75 are the feed wires of a 110 volt direct current circuit, while 76 and 77 are feed wires of a 110 volt alternating current circuit. A starting button 78 on the control station switch 28 normally closes a circuit along a conductor 79. The conductor 79 connects the A. C. feed wire 77 with one pole of the switch 78. This switch in its normal position closes a circuit from the conductor 79 through the switch 78, thence to a conductor 80 to one side of a magnet in a set of relay magnet contactors. These contactor magnets are here indicated by numbers 81, 82, 83, 84 and 85 and it will be seen that the wire 80 connects with one side of the normally closed contactor magnet 83 and that the circuit is then completed along the wire 86 to the A. C. feed wire 76.

This will energize the magnet 83 and act to break the circuit which includes the brake magnet 17'. The circuit is traced from the direct current feed wire 75 to conductor 87 which connects with one side of the coil or brake magnet 17' and thence along conductor 88 to one point on the contactor relay switch 83. The other point of the switch connects with a wire 89 secured to the D. C. feed wire 74. It will be evident that the brake magnet under normal braking conditions is energized by direct current and that when the starting switch is depressed the contactor relay 83 will interrupt the brake magnet circuit and permit the brake to be automatically released.

When the starting switch 78 is depressed it will establish a circuit from A. C. feed wire 76 and wire 90 which connects with point 92 of the starting switch, through the switch blade then to switch point 91 to which is secured

conductor 93, along this conductor to the magnetic switch 94 where it connects to one side of the switch operating coil 95. This circuit is then completed along wire 96 to the A. C. feed wire 77. It will be understood that when the magnetic switch is closed a circuit will be completed from a high voltage line indicated at 97, 98 and 99 and which circuit includes the motor 13 of the centrifugal machine.

When the switch blade 100 of the magnetic switch is closed it will establish contact with the feed wire 93 and establish a second circuit in parallel with the circuit just described. This second circuit is then traced to conductor 101 leading through the normally closed stop switch 102, where it then passes to a conductor 103 normally passing through an emergency switch 104. A conductor 105 is secured to this switch and leads to a contact of the contactor relay switch 85. A conductor 106 is connected with the other contact of this relay switch and is secured to a buss wire 107. The current then proceeds along the buss wire 107 to conductor 108 which is secured to the binding post 109 of the supervisory relay unit. A distributing wire 110 is also secured to this binding post and connects to one side of the clutch magnet 47, one side of the timing motor 32 and one side of a contact magnet 111. The opposite sides of these members are connected to a return wire 112 which is secured to a binding post 113 and to a wire 114, leading to A. C. wire 77 and thus the actuation of the push button 78 will control the energization of both the line switch 94 and the supervising relay 29.

At the same time a circuit will be completed to conductor 114 along buss wire 115 to contactor relay magnet 85, then proceeding from the magnet 85 to the conductor 158 which is connected to the upper binding post of the supervisory relay unit. A conductor 158 is connected with the wire 116 and leads to one contact finger 130 bearing against the face of the timing cam 67. The end of this finger is down-turned to engage the cam and since the cam is in rotation due to the fact that the motor 32, the clutch magnet 47 and the contacting magnet 111 have been previously energized. This causes a circuit to be completed to the contacting finger 129 and thence to conductor 121 secured to binding post 122. This post leads to a conductor 123 secured to one side of the brake control switch 124. This places the brake control switch in an operative condition.

The circuit then continues along conductor 125 to wire 106, thence through the lower contacts of contactor relay 85 along wire 105 to one side of the emergency switch 104 and then along wire 103 through the stop switch 102 to conductor 101. After which the circuit flows along wire 93 to contact point 91 of

the starting switch 78 and then from contact point 92 along wire 90 to the opposite A. C. lead wire 76.

Sustained operation

The magnet of contactor relay 84 was energized by the circuit previously described when the switch 78 was depressed. A circuit was completed from lead wire 76 through wire 126 to a wire 127 connected with one side of the relay switch 84. The circuit then continues along wire 128 to the buss wire 108 and thence through the supervisory relay unit to return wire 114. It will thus be seen that by this means the timing motor 32 is maintained with a closed circuit and it will thus be seen that the circuits are now in such a condition as to cause the motor 13 of the centrifugal to be driven and the timing motor 32 to be driven. At the same time the brake magnet 17' is not energized while the magnets 47 and 111 of the supervisory relays are energized.

The motor 32 is now driving the gears 52, 53 and 59 and these gears are in turn simultaneously rotating the timing cams 62 to 67 inclusive. The initial rotation has closed the supervisory relay circuit controlled by the cam 66 and the contact fingers 119 and 120.

At the same time the brake control circuit is broken, due to the fact that the cam 67 has acted to separate contact fingers 129 and 130. The contact finger 129 is secured to conductor 121 leading to binding post 122 and to which binding post a conductor 123 is secured and extends to one side of the brake switch 124. The contact finger 130 is secured to conductor 131 which is in turn fastened to a wire 132 leading to a normally open contact of the brake switch 124, which circuit may be completed when the brake switch 124 is depressed and the fingers 129 and 130 are in contact. This is done by the circuit travelling along wire 90 leading to the A. C. lead wire 76.

When the supervisory relay is energized the clutch magnet 47, timing motor 32 and contact magnet switch 111 will be simultaneously energized. The magnet 111 will move the normally opened contact fingers 119—120 into engagement with the periphery of cam 66 to bring them into electrical contact and will move the normally closed contact fingers 129—130 against the periphery of cam 67 to separate the fingers and break any electrical connection there between. When the fingers 119 and 120 contact a circuit will be established from wire 77 along wire 114 to buss 115 and thence through contactor magnet 84 to wire 116 which connects with binding post 117. The circuit continues along wire 118 to spring finger 119 and then to finger 120 through wire 121 and binding post 122, thereafter passing along wire 123 to the upper contacts of switch 124 and

then returning along wire 125 to 128 and 127 to the feed wire 76. This causes contactor switch 84 to take the place of the momentarily closed starting switch 78 and to maintain the supervisory circuits closed.

Spraying operation

It will be understood that the basket of the centrifugal machine is driven by the motor 13 for a predetermined period of time prior to the beginning of the washing or spraying operation. It is desirable that this predetermined time shall be accurately set, due to the fact that as the basket rotates the sugar therein arranging itself against the side wall of the basket and if prolonged rotation of the basket continues before the wash water is applied the centrifugal action will cause it to become excessively packed so that it will not be thoroughly washed. It is also desirable that an initial predetermined time shall be established during which the green or impure syrup will be separated from the washed or pure syrup which is a result of the wash operation mentioned above, and the centrifuging action. On the other hand, if the washing operation begins before the sugar has assumed a desired condition against the side wall of the basket, the wash water will have easy access through the sugar and will tend to waste it by washing it away.

In order to insure that the spraying operation takes place after a predetermined operating time of the basket has elapsed, the timing cams 63 and 65 have been provided. The cam 63 has a raised portion on its circumferential face which is engaged by the downturned end of the spring finger 133, which is normally held out of contact with a finger 134. The finger 133 connects with a conductor 135 which is secured to a binding post 136. A wire 137 is also secured to this binding post and leads to a wire 138.

The wire 138 connects with one side of the contact magnet 81. The opposite side of this magnet is provided with a wire 140 connecting with the buss wire 115 which in turn is secured to the wire 114 leading to A. C. lead wire 77. The other side of this contact relay circuit is completed through the contact finger 134, through contact finger 144, along wire 145 to binding post 122, along wire 123, through upper contacts of brake switch 124, along wire 125 to 128, through contact switch 84, and then along wire 127 to 126 and the A. C. feed wire 76.

When the contactor magnet 81 is energized, it will complete a circuit from the D. C. lead wire 74 to a wire 141, thence through the relay switch 81 to a wire 142. The wire 142 leads directly to one side of the water valve magnet 22 by which the water valve 19 is opened. The other side of this magnet is

provided with a wire 143 leading to the D. C. lead wire 75.

Automatic spray cut-off

It will be seen that when the circuit is traced through contact fingers 133 and 134, the circuit will be completed through the opposite end of contact finger 134 which normally bears against the circumferential face of the timing cam 65, and the raised portion of which cam acts to keep the finger 134 in contact with the spring finger 144. This spring finger is provided with a conductor 145 secured to the wire 121 and along which the circuit is completed through control switch 124 and contactor switch 84.

It is to be understood that the cams 63 and 65 have such a relation to each other as to make a circuit through the spring fingers 133, 134 and 144 for a predetermined period of time. This period is begun when the finger 133 passes the rise on the cam 63 and makes contact with the finger 134. The spraying operation is discontinued when the downwardly projecting portion of the opposite end of spring finger 134 passes the rise on the cam 65 and breaks electrical contact between the finger 134 and the finger 144, at which time spraying water valve 19 will be automatically cut off.

Syrup dividing operation

Prior to and for a predetermined initial period of the spraying operation it is desirable to separate the green and washed syrups, and it is for this reason that the spout 23 with its moving gate 27 has been provided to alternately direct the syrup into compartments 25 and 26 of the trough 24. The gate 27 is operated in such relation to the washing operation as to insure that the green syrup spun off prior to the beginning of the spraying operation and until a predetermined purity has been reached during the spraying shall be directed into one compartment of the trough, and that the purer syrup shall subsequently be directed into the other compartment of the trough. This may be accurately timed and automatically controlled by the timing cams 62 and 64.

The cam 62 is provided with a finger 146 which rests upon the edge of the cam and moves toward and away from it as determined by irregularities on the circumferential face of the cam. A complementary spring contact finger 147 is provided, and is adapted to contact with finger 146 at one end and with the edge of timing cam 64 at its opposite end. The contact 148 normally contacts with the movable end of the member 147, and since these two contacts are in series it is necessary for the cam 62 to move to a point where the spring finger 146 will not be supported and at which time this finger will

contact with member 147. A circuit will then be completed from finger 146 to conductor 149, which is secured to binding post 150 of the supervisory relay unit. A wire 151 then leads to one side of contactor relay magnet 82. This circuit is completed through a wire 152 to the buss wire 115, and the circuit will then continue along wire 114 to the A. C. feed wire 77. The other side of this circuit will continue from contactor 146 to contactor 147, and thence along contactor 148 to conductor 148' which leads to binding post 122. The circuit will then continue in the manner previously traced through the normally closed brake switch 124, along conductors 125 and 128 through contactor switch 84 along wire 127 through 126 to A. C. lead wire 76.

When the free end of the contact member 147 passes the raised portion on the edge of the timing disk 64, it will move out of electrical contact with the member 148 and will break the circuit.

When the contactor magnet 82 was energized, it closed the circuit from the D. C. feed wire 74 along a conductor 153 to the contactor relay switch 82; and thence along conductor 154 to the syrup divider magnet 155, thereafter continuing to the D. C. feed wire 75 along conductor 143. This magnet acts upon a pull rod 156 to shift the gate 27.

Braking operation

At the conclusion of and after a predetermined period of operation, it is desired to cut off the motor and apply the brake. This is controlled by the timing cam 67, which moves to a point where it will relieve its support from contact finger 129 and cause the finger 129 to contact with finger 130. This acts to complete a circuit along the wire 131 to wire 132, and thence along the wire 158 to the contactor relay magnet 85, thereafter passing along the buss wire 115 to the wire 114 and the A. C. lead wire 77. The other side of this circuit leads through the control station switch and to the A. C. lead wire 76.

When this operation takes place the contactor magnet 85 will be energized to break the contact from wires 105 and 106, thus automatically breaking the timing motor circuits, and at the same time it de-energizes the operating coil 95 of the magnetic switch 94. This will actuate the magnetic switch to interrupt the supply of current to the motor 13 of the centrifugal. It is then desirable to brake the motor. This is done by the contactor relay switch 85, which establishes contact from the wire 89 to a wire 159, which wire connects with the wire 88 leading to one side of the brake magnet 17'. The wire 87 connects the opposite side of this magnet with the D. C. lead wire 75, thus completing

the magnet circuit and causing a pull to be exerted upon the lever mechanism 17 to set the brakes.

Supervisory relay shut-down

Before the braking operation has been completed it is desirable to shut-down the supervisory relays for various reasons, particularly to prevent the heating of the magnets. This is done when the circuit through contact fingers 119 and 120 is broken by the timing cam 66, for at this time contactor magnet 84 will be de-energized, breaking the circuit supplying the supervisory relay, and will then act to relieve the pressure of spring fingers 119 and 120 from engagement with the cam 66, thus permitting the circuit to be broken between these fingers and the supervisory relay rendered disconnected from the feed current. The brake circuit through contact switch 83 and because of the resistance 173 will continue at a reduced voltage until such time as the starting button is again actuated.

By an examination of the wiring diagram it will be understood that the control station is provided with various switches whereby results may be instantly obtained out of sequence, as would not be the case in their automatic operation. For example, the button 102 may be depressed at any time, breaking the circuit from conductor 101 and 103 and interrupting the operation. Button 124 may be depressed to instantly apply the brake. In some instances it is desirable to wash the machine with the spray, and for such purpose a spray button 160 is provided which establishes a circuit from wire 138 to wire 161, which is connected with wire 90. This completes a circuit through the contactor relay magnet 81 controlling the spray, and places the magnet in series with A. C. lead wires 76 and 77. Emergency switch 104 may be operated to break contact between wires 103 and 105 and to establish contact between wires 103 and 161. This will act to completely disconnect the supervisory relay from the circuit and permit of the operation of the centrifugal motor independent of same.

It will thus be seen that the control apparatus here confided for initiating and concluding the operation of a sugar washing centrifugal and for definitely fixing the interval of the washing operation, and for separating wash waters, will act in a semi-automatic manner to bring about the various operations with exact uniformity and in predetermined sequence and time periods.

While I have shown the preferred form of my invention, it is to be understood that various changes may be made in its construction by those skilled in the art without departing from the spirit of the invention, as defined in the appended claims.

Having thus described my invention, what

I claim and desire to secure by Letters Patent is:—

1. A sugar refining apparatus comprising means to separate liquid material from solid material mixed therewith, means to wash said solid material, several means to convey away the liquid separated from said material, controlling means for initiating operation of said separating means and for stopping said operation at a predetermined fixed time after initiation thereof, for initiating operation of said washing means at a predetermined fixed time with respect to said separating operation and for stopping said washing operation at a predetermined fixed time after initiation thereof, and for deflecting said separated liquid from one of said conveying means to another at a predetermined fixed time with respect to said other operations, a means for initiating operation of said controlling means, and means for separately indicating the duration of each operation.

2. A sugar refining apparatus comprising means to separate liquid material from solid material mixed therewith, means to wash said solid material, several means to convey away the liquid separated from said material, controlling means for initiating operation of said separating means and for stopping said operation at a predetermined fixed time after initiation thereof, for initiating operation of said washing means at a predetermined fixed time with respect to said separating operation and for stopping said washing operation at a predetermined fixed time after initiation thereof, and for deflecting said separated liquid from one of said conveying means to another at a predetermined fixed time with respect to said other operations, a means for initiating operation of said controlling means, and means for independently varying the duration of each operation.

3. A sugar refining apparatus comprising a centrifugal separator, means to spray water upon the inner side of said separator, several means to convey away the liquid flowing from said centrifugal separator, controlling means for initiating rotation of said centrifugal separator and for stopping said rotation at a predetermined fixed time after initiation thereof, for initiating operation of said spraying means at a predetermined fixed time after initiation of said rotation and for stopping said spraying operation at a predetermined fixed time after initiation thereof and for deflecting the liquid flowing from said centrifugal separator from one of said conveying means to another at a predetermined fixed time with respect to said other operations, a manually operable means for initiating operation of said controlling means, means for separately indicating the duration of each operation, and means for separately varying the duration of each operation.

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