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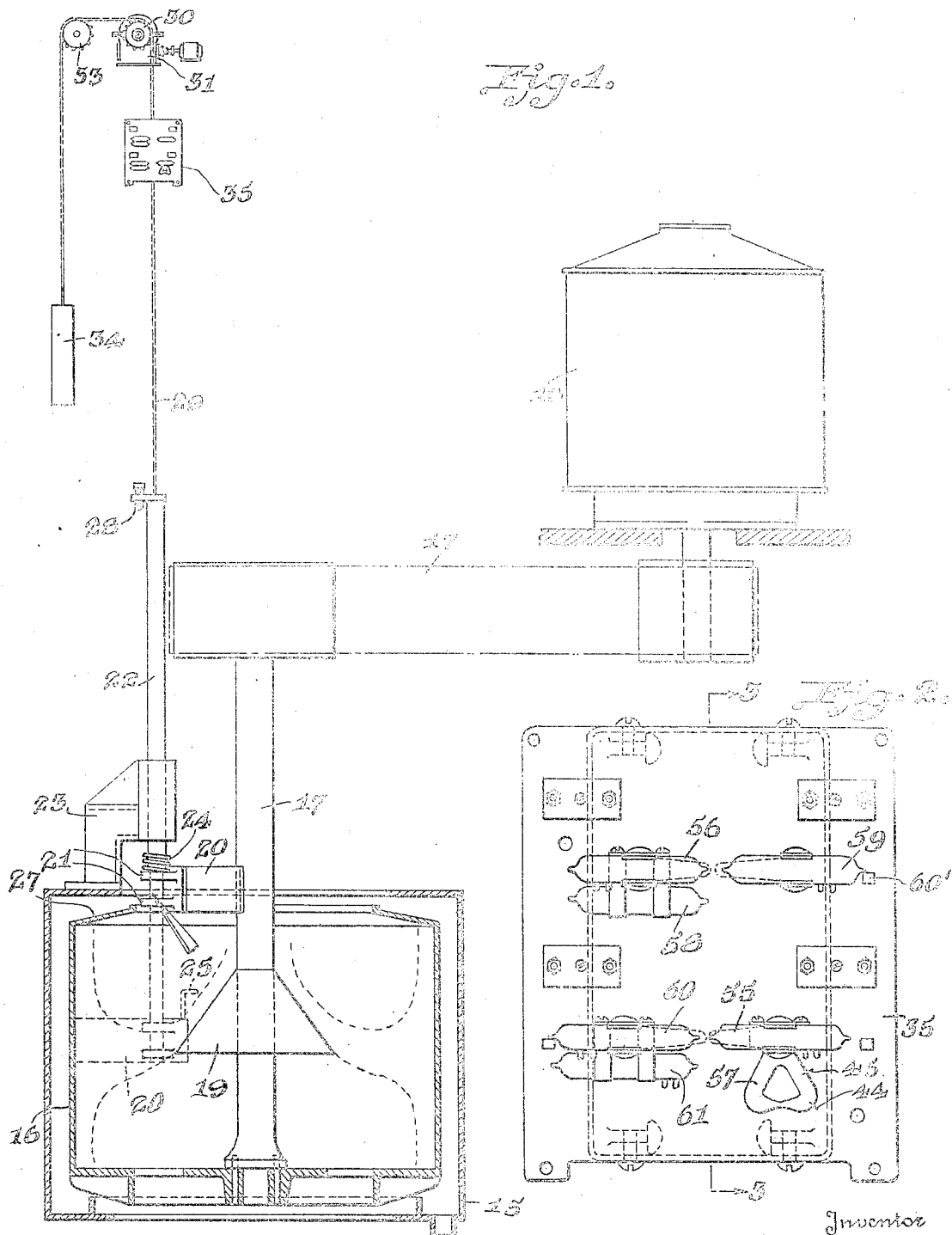
J. J. NEUMAN

2,077,053

CENTRIFUGAL EXTRACTOR MACHINE

Filed Oct. 10, 1935

2 Sheets-Sheet 1



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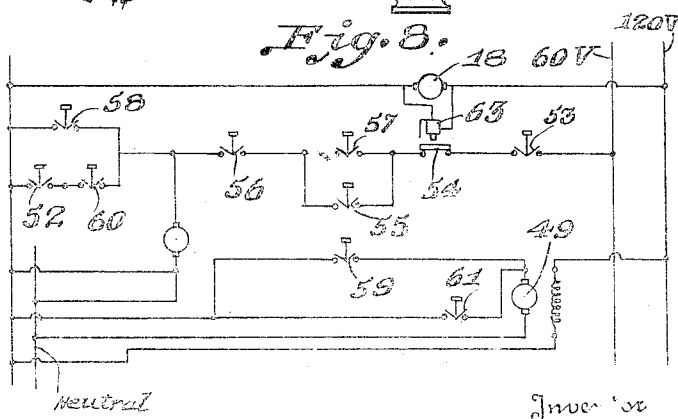
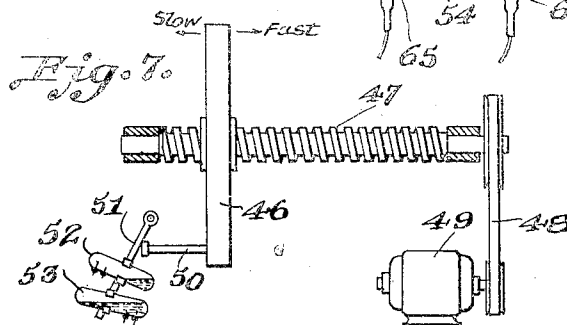
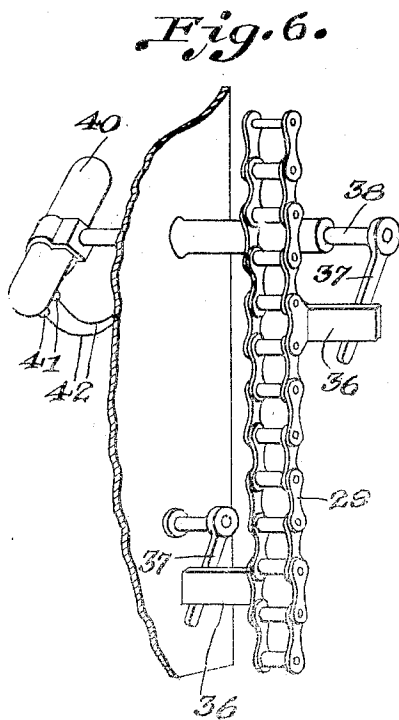
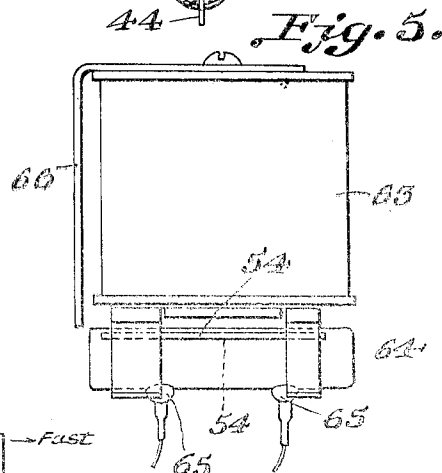
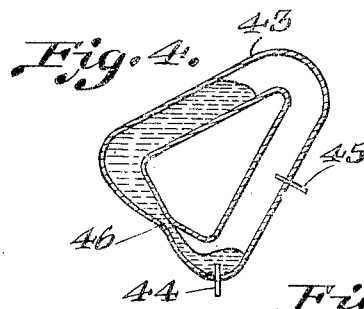
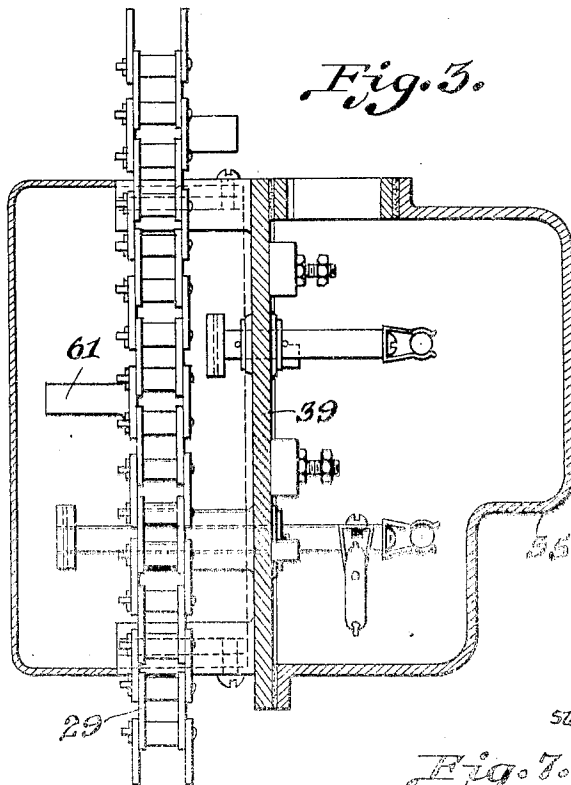
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CENTRIFUGAL EXTRACTOR MACHINE

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,077,053

## CENTRIFUGAL EXTRACTOR MACHINE

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11 Claims. (Cl. 210—70)

The present invention relates to centrifugal extractor machines, and more particularly to the plow or discharger used in connection with the machine.

It is well known that during the processing of sugar it is necessary at different stages of the process to separate the solid crystals from the liquor. This is usually accomplished by means of a centrifugal extractor machine. After the crystals have been separated from the liquor it is necessary to plow, scrape and discharge the crystals from the extractor machine, and this is usually accomplished by a conventional plow manually operated.

The present invention has for an object to eliminate the necessity of having the operator plow out the accumulations from the machine, and to provide means for automatically accomplishing this result and in a more satisfactory manner.

Another object of the present invention is to provide an automatic plow operating device which is electrically controlled for automatically removing the crystals from the inner wall of the basket of the centrifugal machine and for bringing the plow into operation periodically depending upon the operation of the machine so that the removal of the crystals will be uniform and the operation of the plow will not depend upon the hand operation now considered essential.

The invention has for another object to provide the shaft of the centrifugal machine, within the basket, with a novel type of deflector so as to insure the direction of travel of the liquor as it enters the basket. Heretofore, a deflector disc has been used, and during plowing out, the sugar is plowed toward the center of the machine and some falls on the disc with the result that all of the sugar is not removed from the basket.

A further object of the invention therefore is to provide a deflector upon which the sugar removed from the wall of the basket cannot collect incident to the cone shape of the deflector with steeply pitched sides, and this type of cone deflector effects the more even and uniform distribution of the sugar against the wall of the basket throughout substantially its height.

The invention also contemplates certain novel structural features of the electrical means employed for carrying out the various automatic operations and safety guards in the operation of the plow.

With the foregoing and other objects in view,

the invention will be more fully described hereinafter, and will be more particularly pointed out in the claims appended hereto.

In the drawings, wherein like symbols refer to like or corresponding parts throughout the several views,

Figure 1 is a sectional elevation, partly diagrammatic, of a centrifugal extractor machine equipped with an automatic plow operating means.

Figure 2 is a detail enlarged front elevation of the plow switch box employed.

Figure 3 is a vertical section taken through the same substantially on the line 3—3 of Figure 2.

Figure 4 is a detail sectional view taken through one of the delayed action switches used.

Figure 5 is a detail elevation of a magnetic switch by-passed in the extractor driving motor circuit.

Figure 6 is a fragmentary perspective view of a rear portion of the plow switch box, showing the plow supporting chain in its relation to the circuit closers.

Figure 7 is a detail view partly in section of the controller bridge of the extractor driving motor, showing the circuit closers operated by the bridge, and

Figure 8 is a diagram of the electrical circuits and instrumentalities used.

Referring now to the drawings, and first to Figure 1, 15 designates the casing or jacket of a centrifugal extracting machine within which is mounted a basket 16 of conventional form and which is connected to and rotated by an extractor shaft 17 which extends upwardly through the casing 15 and is connected by a belt 17 with its respective pulleys to an extractor driving motor 18. The extractor shaft 17 is provided with a deflector 19 disposed within the basket 16 intermediate the upper and lower ends thereof. The deflector 17 has its larger end lowermost and provides steeply sloping lateral surfaces over which sugar entering from above the cone is adapted to slide and to be deflected toward the inner wall of the basket 16, as shown in dotted lines in Figure 1.

The centrifugal machine is provided with the usual plow 20 which is of arcuate form and adapted at one edge to engage against the inner wall of the basket 16 and which has a hinge bracket 21 near one end, opposite the scraper end, and which is mounted to turn upon the lower end of a plow shaft 22 supported in

a guide 23 mounted on the upper end of the casing 15.

The shaft 22 is adapted to slide down through the guide 23 and carry the plow 20 into the basket, and a coil spring 24 is carried by the shaft 22 and engages the bracket 21 for normally urging the plow 20 to swing with its free end against the inner wall of the basket. This conventional structure is shown in Patent No. 1,922,629, granted August 15, 1933.

The heel end of the plow 20 is provided with an upstanding finger 25 which is disposed in the path of the cam plate 26 fixedly mounted in the upper end of the casing 15 and which projects into the upper end of the basket 16. The cam plate is inclined upwardly and outwardly so as to engage and move the finger 25 outwardly as the plow is raised out of the basket. The finger 25 operates against the tension of the spring 24 to swing the plow toward the center of the basket and to thus escape the upper inverted rim 27 of the basket 16.

The plow shaft 22 is provided with an adjustable stop 28 at one side of its upper end and which is adapted, when the shaft is lowered, to engage the upper end of the guide 23 for limiting the downward movement of the plow 20 and its shaft 22.

The shaft 22 is raised and lowered by means of a chain 29 which extends upwardly and passes over a sprocket wheel 30, the shaft of which is connected through a suitable reduction gear 31 to a plow motor 32. The motor 32 is reversible so as to drive the chain over the sprocket 30 first in one direction and then in the other as will be later brought out. The chain 29 may pass over the sprocket 30 to the idler pulley 33 and may be directed downwardly. The lower end of the chain is provided with a counter-weight 34 so that the plow and its shaft will be counter-balanced over the pulley and thus reduce the drag through the reduction gear 31.

The automatic control of the plow 20 is obtained by electrical devices and circuits and as part of this structure a plow switch box 35 is mounted in position adjacent the chain 29 so that the chain will pass through or adjacent to the switch box for operating certain circuit closers or switches during the rise and fall of the chain.

With reference now to the diagram shown in Figure 8, and the various other detail views as will be particularly pointed out, the plow motor 32 is controlled by mercury switches mounted in the plow switch box 35 and on the extractor driving motor control panel, as shown in Figure 7.

Referring particularly to Figures 3, 4, and 6, the plow chain 29 is provided with a number of laterally extending clips 36 extending from the opposite edges of the chain 29 and suitably spaced apart for contact with and swinging arms 37 which have shafts 38 mounted in the plow switch box 35 for opening and closing the mercury switches in proper sequence. It will be noted from Figures 2 and 3 particularly, that the shafts 38 extend through the wall 39 of the switch box 35 and carry on their inner ends tubes 40 with mercury therein.

Each shaft 38 may be provided with one or two mercury tubes 40 as will subsequently appear, and each tube 40 is provided near one end with spaced contacts 41 adapted to be connected to circuit wires 42 for closing the circuit when the mercury in the tube covers the contacts 41 by

tilting the tube in the direction of the contacts.

Normally the tubes 40 are disposed in substantially horizontal position but inclined sufficiently to maintain certain of the contacts 41 closed, and certain other of the contacts 41 open. One of the shafts 38 is provided with not only a tube 40, as shown in Figures 2, 3, and 4, but also with a delay contact tube 43 which may be of hollow triangular leg construction with a body of mercury therein and with one contact 44 in one lower corner of the tube and a second contact 45 spaced upwardly in one of the lateral legs of the tube.

The bottom leg of the tube is contracted as shown at 46 to provide a narrow passage between the adjacent side legs of the tube, and the tube is adapted to be tilted as shown in Figure 4 when the shaft 38 is turned out of a normal position so that the body of mercury may flow from one leg into the other but through the restricted passage 46. This restricted passage is adapted to provide a time interval of several seconds during the seeking of a common surface level of the mercury in the opposite portions of the tube and to thus bridge the contacts 44 and 45 and close the circuit. This delay in the circuit closing will be further explained in the operation.

The extractor driving motor is operated through a controller bridge 46 which is mounted on a threaded shaft 47 adapted to be turned for moving the bridge 46 in one direction for slow speed, and in an opposite direction for fast speed of the driving motor, as shown in Figure 7. The shaft 47 is connected by a belt 48 with its pulleys to a pilot motor 49 as shown in Figure 8. The controller bridge is provided with a tilting finger 50 disposed in the path of a hinged arm 51 upon the lower portion of which are mounted a pair of mercury switch tubes 52 and 53 having their contacts oppositely disposed so that when in one position the switch 52 is open while the lower switch is closed, as shown in Figure 7.

As soon as the controller bridge 46 moves away from the switches, the finger 50 is moved away from the arm 51 and the latter is permitted to swing down, under any suitable action desired, so as to reverse the relation between the switches.

When the extractor machine has reached a safe speed for plowing out or removing the accumulations against the inner side of the basket, the lower switch 53, shown in Figure 7, is tilted to the closed position shown. This completes the circuit from the 60 volt line through a magnetic switch 54, shown in detail in Figure 5, through switch 55 and switch 56 which are normally closed at this part of the cycle, and through the plow motor 32 to neutral. This operates the motor 32 in a direction which lowers the chain 29, plow shaft 22 and the plow 20, the latter entering the basket 16, and this operation is relatively slow due to the fact that the motor 32 is connected in the 60 volt line. The plow 20 of course swings over into contact with the basket 16, or the accumulations thereon, when the finger 25 is freed from the cam plate 26.

The plow motor 32 continues to rotate in the same direction until a clip 36 on the chain 29 strikes an adjacent arm 37 of a pair of the mercury switches, such as shown at 55 and 57 in the diagram in Figure 8, and having respectively the mercury tubes 40 and 43.

Thus, the switch 57 is a time delay switch, such as shown in Figure 4. The operation of these switches 55 and 57 by the chain 29 opens the circuit through the switch 55 and consequently through the plow motor 32 so that the down-

ward movement of the chain is stopped to support the plow 20 directly at the top of the basket 16. The time delay switch 57 is sufficient only to give the plow 20 sufficient time to clear away all of the sugar from the top of the basket, and when the switch 57 is finally closed the plow 20 is again started in its downward travel into the basket, the circuit being now closed through the switch 57 instead of the switch 55. When the plow 20 has been lowered so that its lower edge is flush with the bottom of the basket 16, the plow is supported by the adjustable stop 28 carried upon the upper end of the plow shaft 22. However, the plow motor 32 is allowed to run sufficiently for making a desired slack in the chain 29, such as about one foot lengthwise of the chain. At this time one of the clips 36 on the chain 29 engages another arm 37 of the plow switch box and operates mercury switches 56 and 58 which are preferably on the same shaft 30 as that of the arm 37 actuated.

The switch 56 opens the circuit and stops the plow motor 32. At the same time the switch 58 closes and completes the plow motor circuit from the side of the line of opposite polarity through the plow motor 32 to neutral. The current through the armature of the motor is thus reversed and the motor 32 driven in an opposite direction to raise the plow 20. The motor 32 at this time is operated at the 120 volts, and as soon as the slack is taken up out of the chain 29, the plow 20 is quickly raised out of the basket 16. The purpose in providing the slack in the plow chain 29 is to give a time delay leaving the plow 20 at the bottom of the basket 16 for several seconds or until the sugar is entirely discharged. When the plow 20 has been raised a short distance from the bottom of the basket, for instance six inches, the switch 59 is tilted to a closed position for a few seconds and is then permitted to open. This is accomplished by providing a spring 60 for the switch, as shown in Figure 2, biasing the valve to open position and providing the chain 29 with a longer clip 61 than the other clips 36 for holding the switch closed for a desired time interval.

The switch 59 is in the circuit of the pilot motor 49 and closes the circuit long enough to move the extractor driving motor controller bridge 46 away from the slow speed position, a distance of a few inches. This allows the mercury switch 53, which was previously swung or tipped to closed position as the bridge 46 arrived at a plowing speed, to swing back to its former open position. When the plow 20 is all the way out of the basket 16, the switches 56 and 58 are tilted to their former positions. The switch 58 opens, thus breaking the circuit through the plow motor 32 and the motor stops. The switch 56, which is in circuit with the plow motor 32 for slow speed, is tilted to its closed position.

However, the plow 20 is not lowered because the switch 53, which is also in the circuit for lowering the plow, has been opened by the controller bridge 46 moving slightly away from the slow speed as above described. At the same time as the switches 56 and 58 tilt, the switches 60 and 61 also tilt. The switch 60 opens and the switch 61 closes. The switch 61 is in the circuit of the pilot motor 49 and starts the pilot motor to move the extractor driving motor controller bridge 46 to charging position.

The plow 20 is now raised and all of the switches are in their original positions ready to repeat the

cycle of operation. The magnetic relay switch 54, and the switches 52 and 60 are in the nature of safety switches or devices. The magnetic relay switch 54, as shown particularly in Figure 5, has an electro-magnet 63 beneath which is mounted in suitable clips a glass tube 64 provided in its bottom with spaced apart contacts 65 covered with pools of mercury. The tube 64 carries the contact wire or strip 54, and an angle iron bracket 66 completes the magnetic circuit and also serves as a support for the switch as a whole. The electro-magnet 63, as shown in Figure 8, is connected across the armature of the extractor driving motor 18.

While the extractor or basket 16 is rotating at greater than safe plowing speed, the electro-magnet 63 is energized by the counter electro-motive force generated by the extractor driving motor 18. This holds the iron wire or contact bar 54 in raised position at the top of the tube as shown in Figure 5. The contacts 65, having the mercury pools, are connected in series in the circuit for the plow motor 32, as shown in Figure 8.

The plow motor 32 cannot lower the plow 20 until the extractor driving motor 18 has been decelerated sufficiently to deenergize the magnet 63, thus allowing the bar 54 to drop and close the plow motor circuit. Switch 52, which is on the extractor motor controller panel and under control of the bridge 46, is mounted on the same arm 51 which carries the switch 53, and closes the circuit through the plow motor 32 for raising the plow 20 out of the extractor basket 16. If for any reason the controller bridge 46 should move to speed up the driving motor 18 while the plow 20 is still in the basket the plow is thus raised out of the extractor basket before the latter has attained a dangerous speed. The switch 60, which is in the plow motor switch box 35, is on the same shaft 30 with the switch 32 and closes as soon as the plow 20 starts down, thus making it possible for switch 52 to close the circuit for raising the plow if the machine speeds up. Switch 60 is necessary in order to keep the plow motor circuit open while the plow is out of the extractor basket 16 since the switch 52 is normally closed when the extractor driving motor controller bridge 46 is not at plowing speed, and if it were not for the break in the circuit at the switch 60 the plow motor 32 would thus be energized.

It is apparent therefore that the switches 52 and 60, operating together, act as a safety device to cause the removal of the plow 20 from the basket 16 at such times as the driving motor controller bridge 46 moves to speed up the driving motor 18.

What is claimed is:—

1. In a centrifugal extractor machine having a motor driven basket, a plow for removing accumulations from the inner wall of the basket, an electric motor for raising and lowering the plow out of and into the basket, and electrical control devices connected to said plow motor and to the basket motor for automatically controlling the operation of the plow relatively to the speed of rotation of the basket.

2. In a centrifugal extractor machine having a motor driven basket, a plow for operation against the inner wall of the basket, an electric motor for raising and lowering the plow out of and into the basket, and electrical control devices connected between the plow and basket motors for automatically controlling the operation of the plow relatively to the operation of the basket.

3. In a centrifugal extractor machine having a

motor driven basket, a plow for operation on the inner wall of the basket, an electric motor for raising and lowering the plow out of and into the basket, and electrical connections between the plow and basket motors and including plow actuated control switches for controlling the reverse and intermittent operations of the plow relatively to the operation of the basket.

4. In a centrifugal extractor machine having a rotary basket and a motor for driving the basket, a vertically movable plow, a chain supporting the plow, a reversible motor connected to the chain for driving the same in one direction to lower the plow into the basket and in the opposite direction to raise the plow out of the basket, electrical connections between the plow chain motor and the basket motor for raising and lowering the plow relatively to the operation of the basket, and plow actuated reverse and stop switches interposed in said electrical connections for automatically regulating the movement of the plow into and out of the basket.

5. In a centrifugal extractor machine, a motor driven basket, a motor operated plow movable vertically into and out of the basket, electrical connections between the basket and plow motors for regulating the operation of the plow relatively to the rotation of the basket, a plow operated delay switch interposed in said connections and operable by the downward movement of the plow to arrest the movement thereof at the top of the basket and for subsequently causing the plow to move down into the basket, and reversing switches in said connections and operable by the plow to change the direction of operation of the plow motor to raise and lower the plow at the limits of its movements into and out of the basket.

6. In a centrifugal extractor machine having a motor driven basket, a motor driven plow for movement into and out of the basket, electrical connections between the basket and plow motors, a basket motor control bridge, a plow switch panel having switches for operation by the plow in moving into and out of the basket, and control switches in said connections between the motors and operable by said control bridge for cooperation with the switches of the plow panel for controlling the raising and lowering of the plow into and out of the basket relatively to the rotation of the basket.

7. In a centrifugal extractor machine having a motor driven basket, a vertically movable plow shaft overhanging the basket and having a plow on its lower end, a chain connected to the plow shaft for supporting the same and having a counterweight for counter-balancing the plow and its shaft, motor drive means connected to the chain for moving the same in one direction to raise the plow out of the basket and in a reverse direction to lower the plow into the basket, electrical connections between the chain motor and the basket motor, and control devices interposed in said connection and disposed in operative relation to the chain and to the control bridge of the basket driving motor for regulating the raising and lowering of the plow out of and into the basket relatively to the rotation of the latter.

8. In a centrifugal extractor machine which includes a motor operated basket, a control circuit for the motor, and means for decelerating the motor, in combination with a plow and its supporting mechanism for vertically adjusting the plow into the basket, a motor operatively connected to the supporting mechanism and adapted upon operation thereof to lower the plow into or withdraw the plow from the basket and a circuit for such motor, interconnections between the two motor circuits for controlling the same and including oscillatable mercury switches at least one of which is movable to position to close the circuit through the plow motor for adjusting the plow into the basket, and means operable upon deceleration of the basket motor a predetermined amount to effect the closing movement of the mercury switch which closes the circuit through the plow motor.

9. In a centrifugal extractor machine which includes a motor operated basket, a second motor, means connecting the second motor to a plow for vertical adjustment of the plow into and out of the basket, circuits for operating the motors, control interconnections between the circuits for rendering the two motors operative in relative relation, including mercury switches at least one of which is movable to position to close the circuit through the plow motor for adjusting the plow into the basket, a separate switch interposed in the plow motor circuit to close the plow motor circuit, and a time delay switch interposed in the plow motor circuit for first interrupting the closed plow motor circuit and subsequently closing the same through the said separate switch.

10. In a centrifugal extractor machine which includes a motor operated basket and a second motor, means connecting the second motor to a plow for vertical adjustment of the plow into and out of the basket, whereby to remove accumulations from the inner wall of the basket, circuits for operating the motors, control interconnections between the circuits for rendering them operative in relative relation including oscillating mercury switches at least one of which is movable to position to close a circuit through the plow motor for adjusting the plow into the basket, and means on the supporting mechanism for engaging and moving said one switch at a definite predetermined position of movement of the supporting mechanism.

11. In a centrifugal extractor machine having a rotatable basket, a plow for removing accumulations from the inner wall of the basket, operating means for said basket, means for supporting said plow for vertical movement into and out of the basket, operating means for said supporting means, automatic control means connected to each of said operating means for automatically controlling the vertical movement of the plow relatively to the speed of rotation of the basket, and automatic means including a chain cooperating with the plow and striking a clip connected to said control means for arresting the movement of the plow for a predetermined period at the end of one movement of the plow.

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