March 13, 1934. J. H. V. FINNEY 1,951,012

STARTING DEVICE FOR SEDIMENTATION APPARATUS

Filed Nov. 1, 1930 2 Sheets-Sheet 1

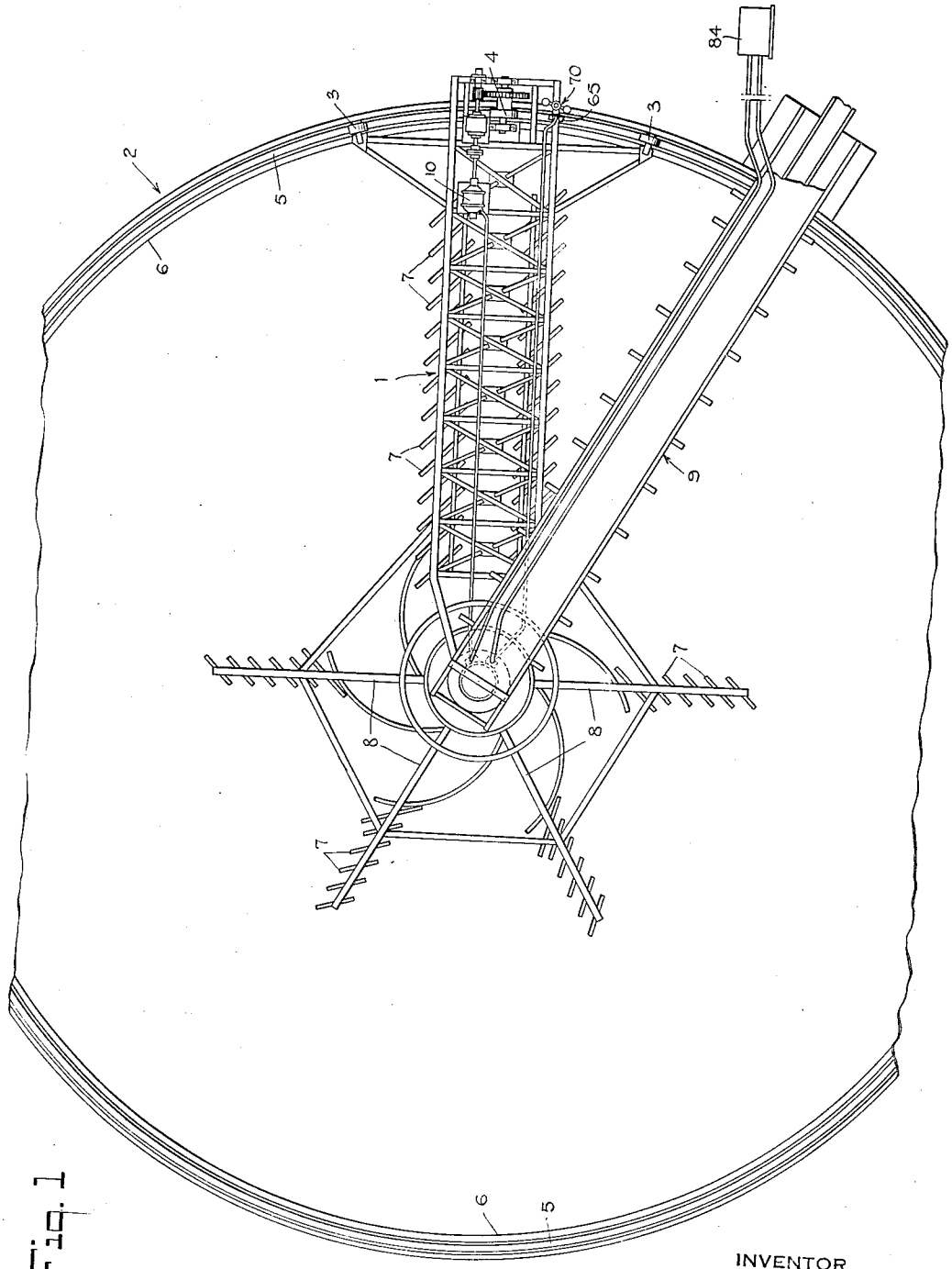


Fig. 1

INVENTOR
JOHN H. V. FINNEY
BY
Arthur Middleton
ATTORNEY

March 13, 1934. J. H. V. FINNEY 1,951,012

STARTING DEVICE FOR SEDIMENTATION APPARATUS

Filed Nov. 1, 1930 2 Sheets-Sheet 2

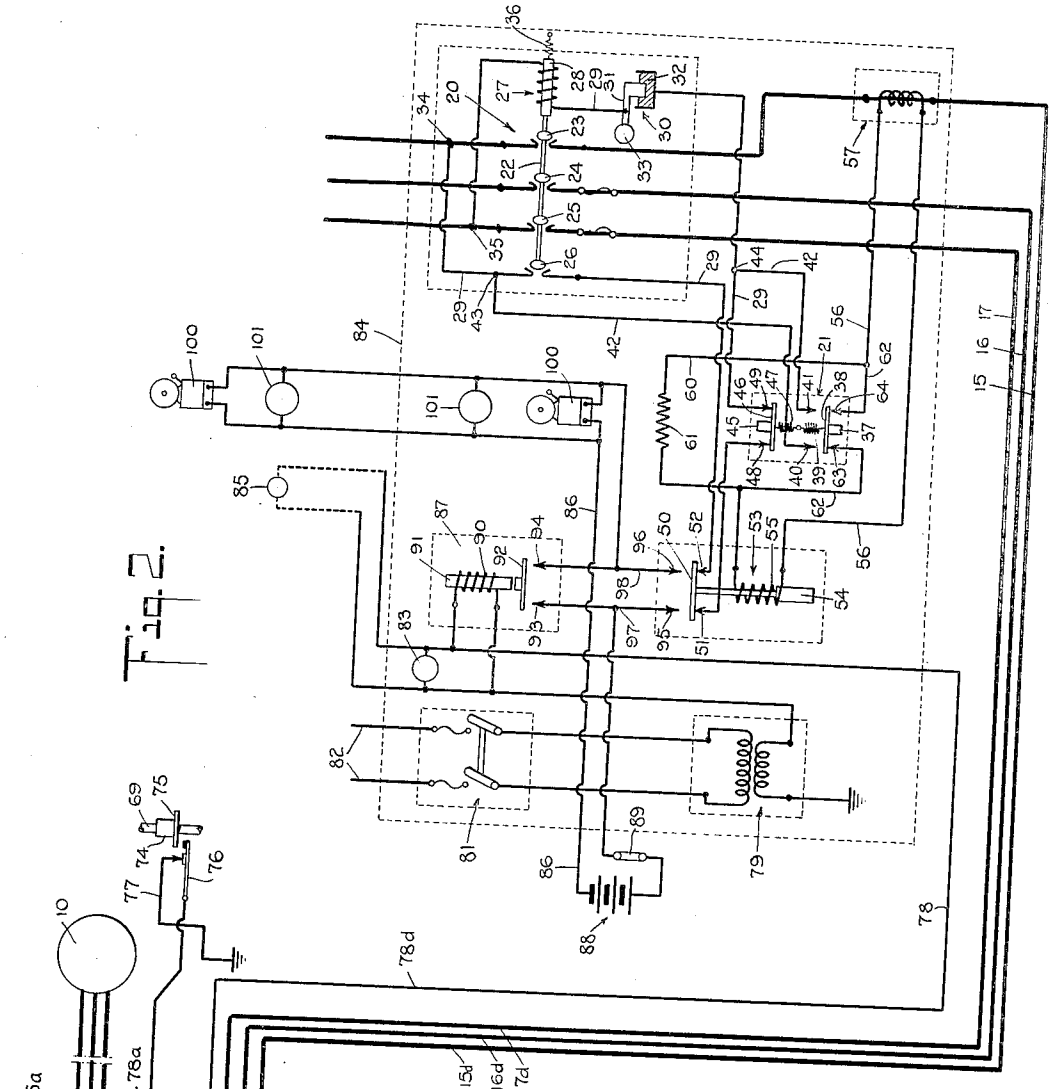


Fig. 2.

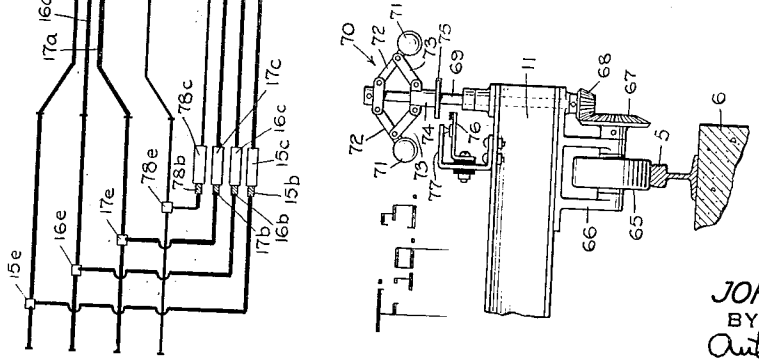


Fig. 3.

INVENTOR
JOHN H. V. FINNEY
BY
Arthur Nissen
ATTORNEY

Patented Mar. 13, 1934 1,951,012

UNITED STATES PATENT OFFICE

1,951,012

STARTING DEVICE FOR SEDIMENTATION APPARATUS

John H. V. Finney, Denver, Colo., assignor, by mesne assignments, to The Dorr Company, Inc., New York, N. Y., a corporation of Delaware

Application November 1, 1930, Serial No. 492,748

1 Claim. (Cl. 172—179)

This invention relates to improvements in liquid treating apparatus especially sedimentation apparatus of the traction type, such, for example, as the apparatus disclosed in United States Letters Patent, No. 1,356,608, and more particularly to means for preventing damage to such apparatus, which preventing means acts to notify an operator that attention to the apparatus is required.

In certain forms of apparatus of the type referred to, the settled solids in a sedimentation tank are moved toward a central outlet by suitable rotatable raking mechanism actuated by a truss or operating member connected with said mechanism to rotate the same and extending to the wall of the tank and actuated in turn by a motor-driven truck including a traction wheel travelling along the top of the tank wall, for example on the top of a rail. This apparatus is designed to overcome only a certain maximum amount of resistance from the settled solids.

Due to certain causes, such as excessive feed changes in the character of the solids, and changes in the proportion of solids in the feed, the settled solids at the bottom of the tank may build up to such a point as to oppose to the raking mechanism resistance above that for which the mechanism was designed, thus tending to warp or break the mechanism. Excessive resistance to operation may also arise from corrosion and the falling of objects, such, for example, as tools, into the tank. This resistance to the operation may stop the rake structure or slow it down, for example, by causing the traction wheel of the truck to slip. Such slipping might also be caused by conditions which reduce below the necessary degree for operation, the friction between the traction wheel and the surface on which it runs. It would also be desirable to operate the alarm system in the event that the resistance to operation of the rake causes an overcurrent in the power lines supplying the motor, which may be of a constant speed type and, in the event that reduced resistance to the operation of the rake structure, due, for example, to the dropping off of parts of the rake structure, causes the current required to operate the motor to drop below a predetermined amount and thereby establishes an undercurrent condition.

The main object of the present invention is to provide apparatus including, in combination, liquid treating mechanism of the traction type provided with an electric motor for driving the same, and a single electrical safety system of which the various parts are closely correlated, said safety system including signals or indicators at desired points and being responsive to substantially every condition of danger, which may arise, to operate said signals. The apparatus of the present invention may include means, independent of the traction drive, for indicating that the liquid treating mechanism is operating at or above a predetermined speed.

The need for having this speed indicating means independent of the traction drive will be apparent when it is considered that, in the event of the slowing down of the liquid treating mechanism due to slipping between the traction wheel and the track, the motor might be acting within the range of normal resistance and there would be nothing to indicate the slow speed of operation. The safety system may also include a single alarm circuit having signals at various points and means operable in response to any one of a plurality of different danger conditions for operating signals.

Other objects and advantages will be apparent upon consideration of the following detailed description and of the drawings in which:

Fig. 1 is a plan view of apparatus embodying the preferred form of the invention;

Fig. 2 is a diagrammatic view illustrating the electrical system and

Fig. 3 is a detail view of means for controlling the underspeed control circuit.

The objects of the invention are, in general, attained by providing, in closely correlated arrangement, in apparatus of the type referred to, an alarm circuit and controlling means therefor, including means responsive to the speed of operation and adapted to indicate certain conditions as to speed and to control the alarm circuit accordingly, and means reflecting changes of conditions in the power lines and adapted to control the alarm circuit and the supply of power through the power lines. The response to speed of operation is obtained by a speed operated device on the traveling device controlling a running signal circuit to maintain a running light lighted when the apparatus is operated at or above a predetermined minimum speed and for breaking the circuit when the speed falls below said minimum and thereby closing the alarm circuit.

According to one form of attaining the objects of the invention, it is applied to a traction type liquid treating device, such as that disclosed in the above mentioned patent the motor of which is driven by power, such as a three phase alternating current supplied through power lines extending to the top of the central column of the sedimentation device in any suitable manner and out along the actuating truss thereof to the motor. In order that normal operation of the device may be indicated and that slowing down of the truss below a predetermined speed at the periphery of the tank may operate a suitable signal, there is provided a signal circuit including a line passing to the top of the central column and outwardly along the truss to the outer end thereof and including therein a circuit closing device controlled

by a wheel, connected with the truss but independent of the drive therefor, running along a path extending around the sedimentation device at the upper part thereof and acting when the speed of operation of the truss is above the predetermined minimum, to cause the circuit closing device to close and upon reduction of speed below said predetermined minimum to cause said circuit closing device to open. This signal circuit is supplied with a suitable device such as an electric lamp to indicate, when the lamp is lighted, that the truss is operating at or above the proper speed, and also includes a device, which, when the aforesaid signal circuit is closed, acts to hold open a circuit closing device in a second or alarm circuit and, upon breaking of the signal circuit, acts to close the alarm circuit and operate one or more signals, such as lamps and bells, at one or more convenient points to notify an operator that the apparatus requires attention. The alarm circuit is also provided with another device for closing and opening the same, which device is operated to close the alarm circuit when either overcurrent or undervoltage conditions are established in said lines.

Referring to the drawings; 1 is a truss rotatably supported on a central pedestal projecting upwardly from the bottom of the circular tank 2 and at its outer end by a truck provided at opposite ends with wheels 3 and at its center with a traction wheel 4, all of which wheels are arranged to run on a rail 5 mounted on the top of the circular wall 6 of the tank.

The truss is provided at its lower side with rakes or scrapers 7 arranged to work the settled solids toward the central outlet in the bottom of the tank when the truss is rotated in a clockwise direction (Fig. 1). The truss is also used to rotate a raking structure including radial arms 8 of much shorter length than the truss and also carrying rakes or scrapers 7. The material to be treated is supplied to the tank at its center through a launder carried by a bridge 9. The traction wheel 4 is driven by a motor 10 located at the outer end of the truss 1 and connected with the traction wheel 4 by suitable means including a speed reducer. The structure thus far described may be substantially the same as that disclosed in said Patent, No. 1,356,308. As illustrated diagrammatically in Fig. 2, the motor 10, which preferably is of a three-phase alternating current constant speed type may be supplied with power through three power lines 15, 16, and 17, of which the generally horizontal portions 15*a*, 16*a* and 17*a* leading from the motor indicate the portions extending from the motor to the portion of the truss adjacent to the central column or pier extending upwardly at the center of the tank and around the axis of which the support for the truss turns.

The portions 15*a*, 16*a* and 17*a* are connected with slip rings 15*b*, 16*b*, and 17*b*, respectively, and these slip rings are engaged by brushes 15*c*, 16*c* and 17*c* connected with portions 15*d*, 16*d* and 17*d* of the power lines, which as shown in Fig. 1 pass along a bridge to points outside of said tank. In forms of apparatus without such bridges, the power lines may pass downwardly through the central column and outwardly at the bottom of the tank. Although the tanks for thickeners are in general round, some forms of traction liquid treating apparatus have tanks of other than round shape, or rectangular shape, for example. In such cases the truss is arranged to slide on its support at the central column and the requirements for maintaining the electrical connections with the motor may be met by providing sliding or trolley connections, such as indicated at 15*e*, 16*e* and 17*e*.

The supply of power to the motor 10 is controlled by a magnetic switch 20 (such, for example, as the magnetic switch with overload and undervoltage protection, Cutler-Hammer Bulletin 9586), which, in turn, is controlled by a suitable start-stop device 21 (such, for example, as that illustrated in Cutler-Hammer Bulletin 10250H28). The switch 20 is illustrated diagrammatically as including a member 22 carrying, in insulated relation with respect to each other, conducting members 23, 24, 25 and 26 adapted upon movement of the member 22 in one direction, by means of a solenoid 27 including a core 28 mounted on the rod or member 22, to close respectively gaps in the power lines 15, 16 and 17 and in a circuit 29 which includes the coil of the solenoid 27 and a thermal device 30, here illustrated as including a switch member 31 in the form of a lever held in circuit closing position by means of a member 32 of fusible material and urged to circuit breaking position by means of a weight 33.

The circuit 29 is connected at one end 34 with the power line 15 and at the other end 35 with the power line 17, and when the member 22 is moved to switch closing position and the member 26 closes the corresponding break in the circuit 29, the solenoid 27 will, unless the circuit 29 is open at some point, be maintained in energized condition and will hold the switch closed against the action of suitable means, such as a spring 36, tending to shift the member 22 to circuit opening position.

The start-start device 21 includes a start button 37 adapted to operate a circuit closing device or member 38 against the action of a spring 39 to engage and connect electrically two contacts 40 and 41 in a branch circuit 42 connected at points 43 and 44 with the circuit 29 on opposite sides of the break controlled by the member 26. If the switch 20 is open, actuation of the start button 37 will close the solenoid circuit 29 through the branch 42 and energize the solenoid to close the breaks in the power lines and also the break in the main solenoid circuit 29. Then, when the start button 37 is released, the branch circuit 42 will be broken but the main solenoid circuit 29 will remain closed through the contact member 26.

The start-stop device also includes a stop button 45 associated with a switch member 46 normally held, by suitable means, such as a spring 47, in engagement with two contacts 48 and 49 at opposite sides of a break in the main circuit 29 for energizing the solenoid. Obviously, upon depressing the stop-button, the solenoid will be de-energized, the switch 20 will be opened, and the circuit 29 will be opened at the break controlled by the member 26 and will remain open when the stop button is released to permit it and the switch member 46 to be returned to their normal positions by the spring 47.

There is also provided a device or relay for opening the solenoid circuit 29 substantially instantaneously when overcurrent conditions arise in the power lines. This device includes a switch member 50 normally closing a gap between two contacts 51 and 52 in the solenoid circuit 29 and suitable means for moving said switch member 50 to open said circuit 29, and which is here illustrated as including a solenoid 53 having a core

54 connected with the switch member 50, and a coil 55 in a circuit 56 connected with a suitable transformer 57 associated with the power line 15 and which may be of the General Electric Type Y-285-D. The relay may be a manual reset relay of the General Electric Type P. Q. 106-Y-2.

The circuit 56 includes, between two points 58 and 59 therein, a branch 60 including a resistor 61 which may be of the 10 ohm General Electric Type CR-9006 Form Q S-K-1924034, and a branch 62 having a break between two contact points 63 and 64, which break is closed by the switch member 38 when the start button 37 is in its normal position. As a result of this arrangement, the depression of the start button 37 will break the branch 62 between contacts 63 and 64 and prevent effective energization of the solenoid 53 to the extent necessary to open the circuit, unless the overcurrent resulting from the greater resistance met in starting the motor becomes great enough to act effectively through the resistor 61. Upon release of the start button 37, the switch member 38 will be returned into engagement with the contacts 63 and 64 and close the branch 62 to enable control of the solenoid by current passing through this branch 62.

A feature lies in the peculiar combination of the starting switch 37 of the push button device 21 with the transformer circuit 56 and the resistance 61 connected across the terminals 63 and 64 of the push button 37. When a motor is accelerating it draws considerably more current than it does after it has reached its normal running speed. Consequently if the relay switch 53 were put in series directly, the rush of current when starting would actuate the switch 53, open the contacts 51 and 52 and stop the motor before it could get started.

According to this invention the difficulty is overcome by using the transformer 57 in parallel with the resistance 61. A current transformer must not be operated with open secondary circuit. When placing the resistance 61 across the terminals of the starting switch 37, the resistance acts to maintain the circuit when the contacts 63 and 64 are temporarily open. This resistance also acts to prevent a surge of current which would operate the relay switch 53.

The electrical system hereinbefore described provides for opening the switch 20 under overcurrent and undervoltage conditions due, for example, to too great or too little resistance to the actuation of the truss. When, however, conditions are such that the traction wheel slips, the resistance to the operation of the truss may be of substantially the normal amount although the speed of the operation may be too slow for effective operation and, for that matter, the truss might be stopped completely.

It is important, therefore, to provide means, independent of the driving mechanism for the truss, for indicating underspeed conditions for the truss. According to one form of carrying out this feature of the invention, a wheel 65, independent of the drive mechanism is so mounted, in a bracket 66 attached to the truss, that it will travel on the rail 4, and this wheel is connected by means including bevel gears 67 and 68 with a vertical shaft 69 of a ball governor 70 which includes balls 71 on the outer ends of arms 72 pivoted at their inner ends to a member fixed on the shaft 69 and, at points intermediate said balls and said inner ends, to the ends of links 73 pivoted at their lower ends to a sleeve 74 having an annular flange 75.

Upon the slowing down of the truss 1, the balls 71 will fall and cause the flange 75 to engage a piece of insulating material on an arm or member 76 and depress the same to break the contact between the same and on arm 77 grounded on the truss 1. The arm 76 is connected with an indication line or running signal circuit 78 which includes a part 78*a* extending inwardly along the truss and connected, by means including a slip ring 78*b* and a brush 78*c*, with a portion 78*d* extending outwardly over the bridge 9 or when there is no bridge, downwardly through the central column and out at the bottom of the tank. It should be understood that the indication line and the power lines are in separate conduits and that in the event that the truss is arranged to slide on its support at the central column the sliding movement is taken care of by a sliding connection 78*e* between the part 78*a* and the slip ring 78*b*.

The indication line 78 is grounded outside of the tank but includes the secondary coil or winding of a transformer 79 of which the primary coil or winding is connected by means of a double pole switch 81 and suitable fuses with power lines 82, which may be in a 110 volt light circuit. The line or circuit 78 also includes a lamp 83, preferably adjacent to the switches 20 and 81 and to the start-stop push button station 21, all of which may be assembled in a single unit 84; and if desired a lamp 85 in parallel with the lamp 83 and located at any desired distant point. These lamps 83 and 85 are lighted continuously during operation of the truss at or above a predetermined speed and, therefore, when so lighted, indicate such a condition.

In the form of the invention here illustrated, the safety system also includes an alarm circuit 86 of which the closing and opening is controlled by the relay device including the solenoid 53 in the overcurrent circuit or line 56 and a relay 87 in the circuit 78 in parallel with the lamps 83 and 85. The alarm circuit 86 is supplied with power from any suitable source, such as a battery 88 and includes a switch 89. It should be understood that, in the event that the lighting circuit is independent of the power lines, it may be desirable to connect the circuit 86 with the conductors 82 rather than with a battery.

The relay 87 includes a coil 90 and a core 91 and normally serves to hold a contact device or member 92 away from two contacts 93 and 94 connected with the circuit 86 at opposite sides of a break therein, against the action of a force, gravity, for example, tending to move the member 92 into engagement with said contacts 93 and 94. This relay may, for example, be a Graybar signal AB—1, or equivalent, 12V coil continuous service, contacts closed when deenergized.

The circuit 86 may also be closed by means of the circuit closing device 50 which, when shifted by the solenoid 53, is moved from engagement with the contacts 51 and 52 into engagement with contacts 95 and 96 connected by lines 97 and 98, respectively with the alarm circuit on opposite sides of the break referred to in connection with the contacts 93 and 94. In the event of the opening of the indication line or circuit 78 due to the slowing down of the truss, the switch or contact member 92 will drop and close the circuit through the contacts 93 and 94 and will tend to remain in this position until the truss is again brought up to said predetermined speed.

On the other hand the shifting of the member 50 from the contacts 51 and 52 to the contacts 95 and 96 closes the alarm circuit 86 but at the

same time opens the circuit 29 and causes the switch 20 to be thrown out of action thereby shutting off the supply of current to the transformer 57 and consequently in the coil or winding. This would release the core 54 and except for the fact that the controlling relay is designed for manual resetting, the member 50 would move back into engagement with the contacts 51 and 52, thus breaking the alarm circuit which should be kept closed until opened by the operator after his attention has been attracted. The member 50 is, however, held in closed position to maintain the alarm circuit 86, due to the design of the relay, until reset manually.

The alarm circuit 86 is preferably provided with a bell 100 and a lamp 101 arranged in parallel in the circuit and located on the panel 84. The alarm circuit may also be provided, at any desired point distant from the panel, with any suitable alarm device which may include a bell 100, or a lamp 101, or both. Preferably lamps with red globes are used in the alarm circuit.

The operation of the apparatus is substantially as follows: The apparatus may be started by depressing the start button 37 to move the circuit closing member 38 into engagement with the contacts 40 and 41 thereby closing the branch circuit 42 and consequently the portion of the circuit 29 including solenoid 27. Upon energization in this manner, the solenoid 27 will act to move member 22 longitudinally, against the action of the spring 36 and to close the gaps in the power lines 15, 16, and 17 as well as the circuit 29 across the gap controlled by the circuit closing member 26. Due to the closing of the circuit 29 by the member 26, the solenoid 27 will remain energized when the start button is released and returned to its normal position, and the main switch 20 will remain closed. The switch 81 may be closed at any convenient time to supply current to the transformer 79 and consequently to the running circuit 78.

The power lines 15, 16 and 17 will therefore remain closed and the motor 10 will be operated to start the truss 1. The truss will be brought up to the required speed, thus causing the ball governor 70 to raise the annular flange 75 and permit the spring contact arm 76 to swing into electrical engagement with contact 77, thereby closing the running circuit 78 and lighting the running lights or lamps 83 and 85 to indicate that the truss is being operated with sufficient speed for economical operation.

Such closing of the running circuit will also energize the relay 87 and shift the member 92 out of engagement with the contacts 93 and 94 in the alarm circuit 86, thereby opening the alarm circuit at this point. The alarm circuit 86 may then be closed at the switch 89, while remaining open between the contacts 93 and 94 and the contacts 95 and 96, the arrangement being such that connection of the contacts 51 and 52 will complete the closing of the circuit 86, thereby sounding the alarms or bells 100 and lighting the lamp 101.

If the truss 1 slows down, due, for example, to slipping of the traction wheel 4, the running circuit 78 will be broken, thereby deenergizing the relay device 87 and closing the alarm circuit 86 and warning the operator that attention is required. Upon resumption of speed the running circuit will be closed, the relay device 87 energized and the alarm circuit opened. Such slowing down of the truss might also arise from excessive resistance or overload on the rotary parts of the apparatus and then the overload guarding devices, will be operated in a manner which will be described hereinafter. In the event that there is an overcurrent due, for example, to too great resistance to the constant speed motor 10, the current, supplied by the transformer 57 to the instantaneous relay containing the solenoid 53, will energize the solenoid to a greater degree and shift the member 50 to close the alarm circuit and open the circuit 29, thereby causing the motor to stop. As hereinbefore described, the relay containing the solenoid 53 must be reset manually before starting the motor by again closing the main switch 20.

The thermal device 30 is also adapted to open the circuit 29, but as a result of continued overcurrent rather than a sudden surge of current, and its only direct effect is to throw off the main switch. This will stop the motor and cause the running light circuit to be opened with consequent closing of the alarm circuit at the contacts 93 and 94.

If there is an undervoltage condition in the power lines, the truss may slow down and cause underspeed control to open the running light circuit and thereby close alarm circuit, or the main switch may be thrown off due to deenergization of the solenoid 27, and the same result be obtained.

The apparatus may be shut off at any time by depressing the stop button 45, thereby breaking the circuit 29 and deenergizing the solenoid 27 to permit the opening of the main switch 20 by means of the spring 36.

It should be understood that various changes may be made in the construction and arrangement of the parts and that certain parts may be used without others without departing from the true spirit and scope of the invention.

Having thus described my invention, I claim,

For use in liquid treating apparatus of the traction type including a rotating operating member, and means for operating the same including a motor on said operating member, a control arrangement comprising a main switch for controlling the supply of power to the motor, of means for normally urging said main switch to open position, means for holding said switch closed including a control circuit containing a second switch connected with the main switch to open and close therewith, and a third switch normally closing a break in the control circuit, means operated in response to predetermined abnormal electrical conditions at the main switch to shift said third switch thereby causing the main switch to open, said means including a transformer energized from the main line, and a solenoid operable by the transformer to shift said third switch when the solenoid is sufficiently energized, a starting device for the main switch arranged in parallel connection with said control circuit and comprising a switch member operable for momentary closing of said control circuit, said last mentioned switch member arranged to normally bridge a gap in the transformer circuit and effective to momentarily open said gap while the switch member is operated to start the main switch, and a resistance connected in parallel with said gap.

JOHN E. V. FINNEY.