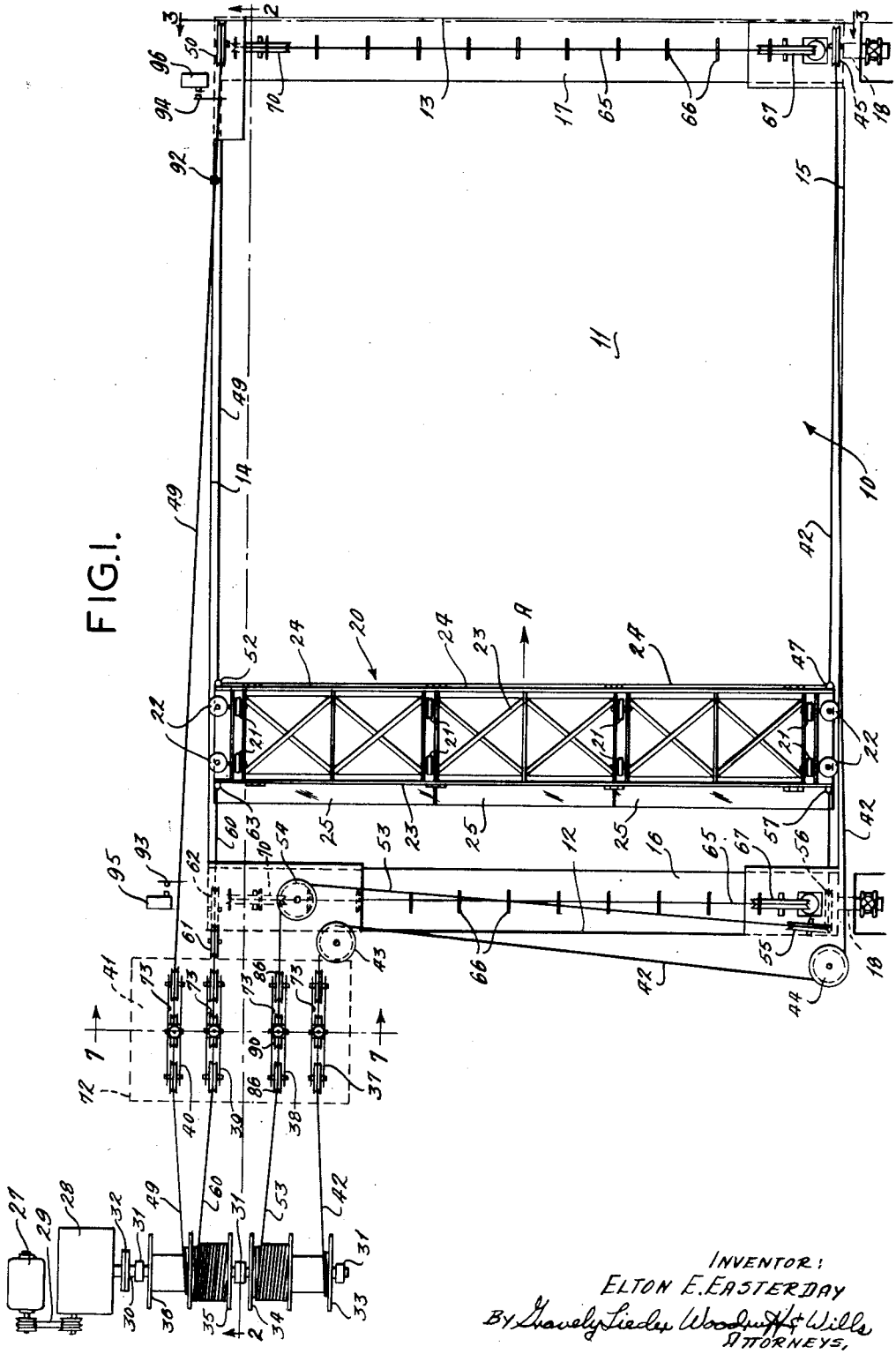
Oct. 30, 1956 E. E. EASTERDAY 2,768,749

SEDIMENTATION BASIN CLEANING APPARATUS

Filed Dec. 14, 1953 5 Sheets-Sheet 1

FIG. 1.



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SEDIMENTATION BASIN CLEANING APPARATUS

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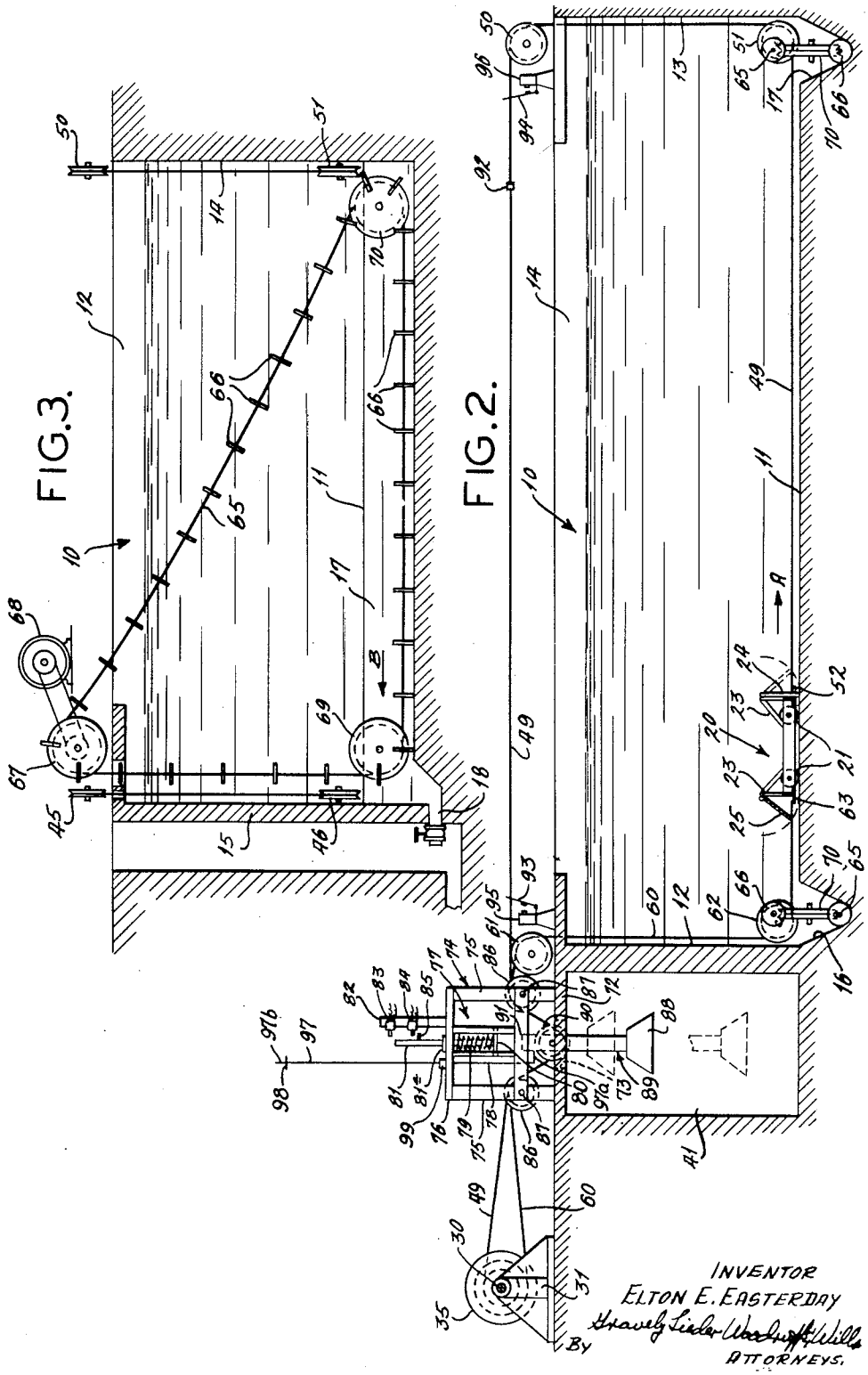


FIG. 3.

FIG. 2.

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SEDIMENTATION BASIN CLEANING APPARATUS

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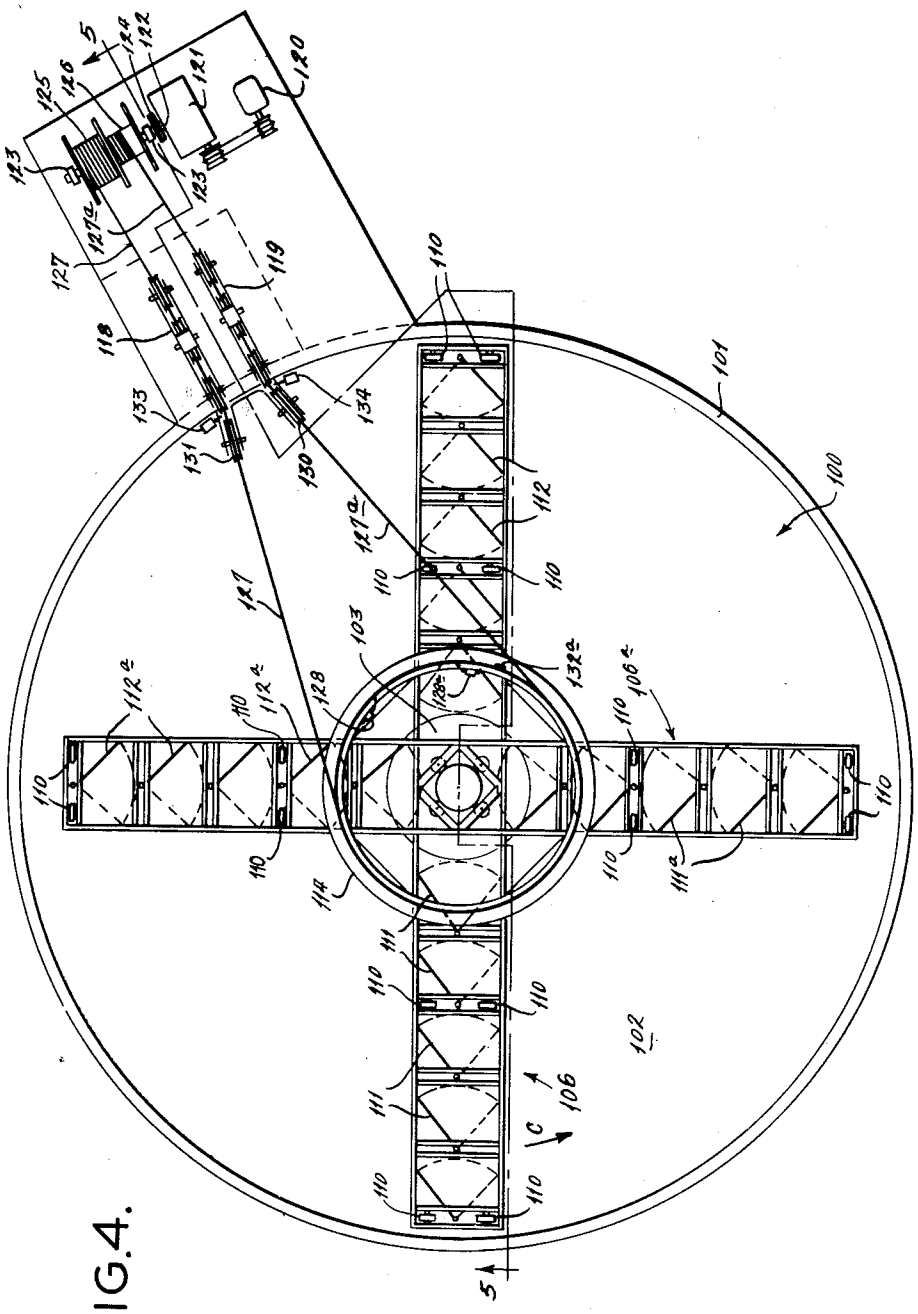


FIG.4.

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SEDIMENTATION BASIN CLEANING APPARATUS

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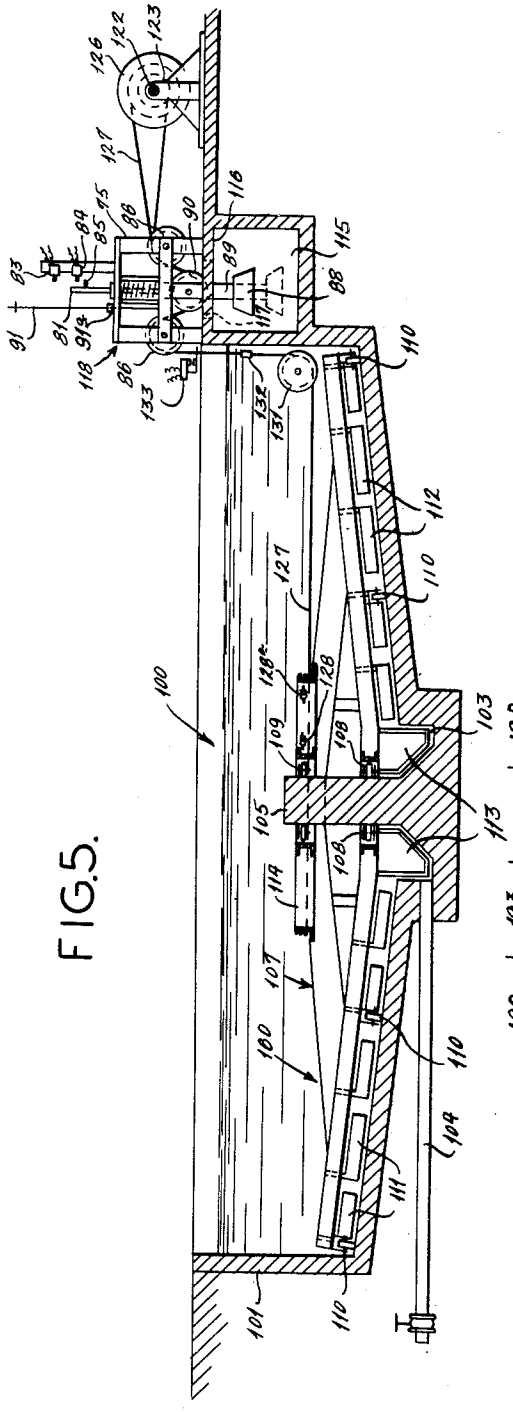


FIG. 5.

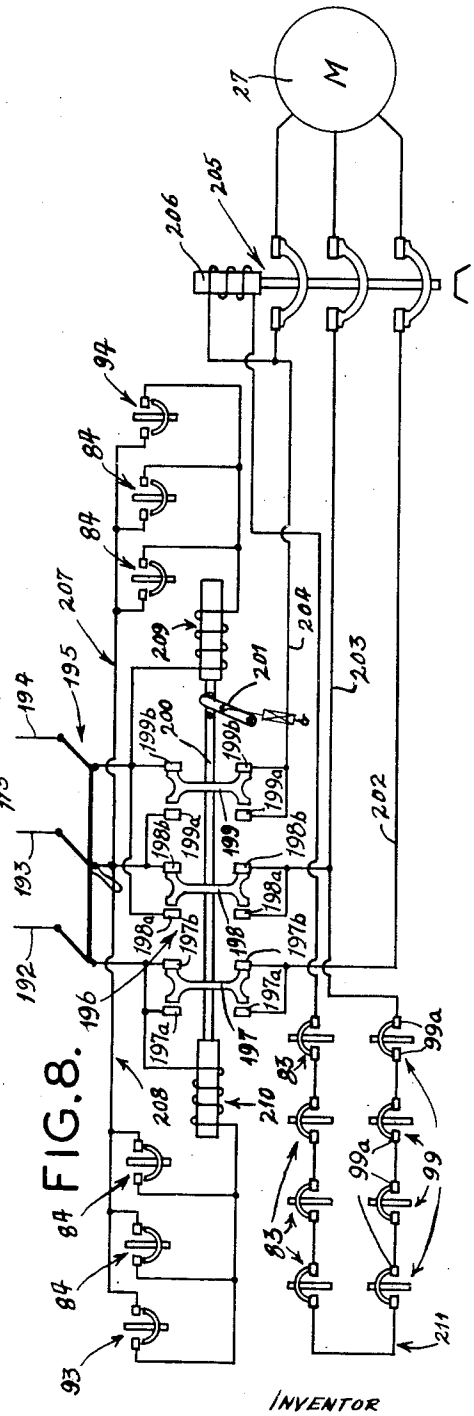


FIG. 8.

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SEDIMENTATION BASIN CLEANING APPARATUS

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FIG.6.

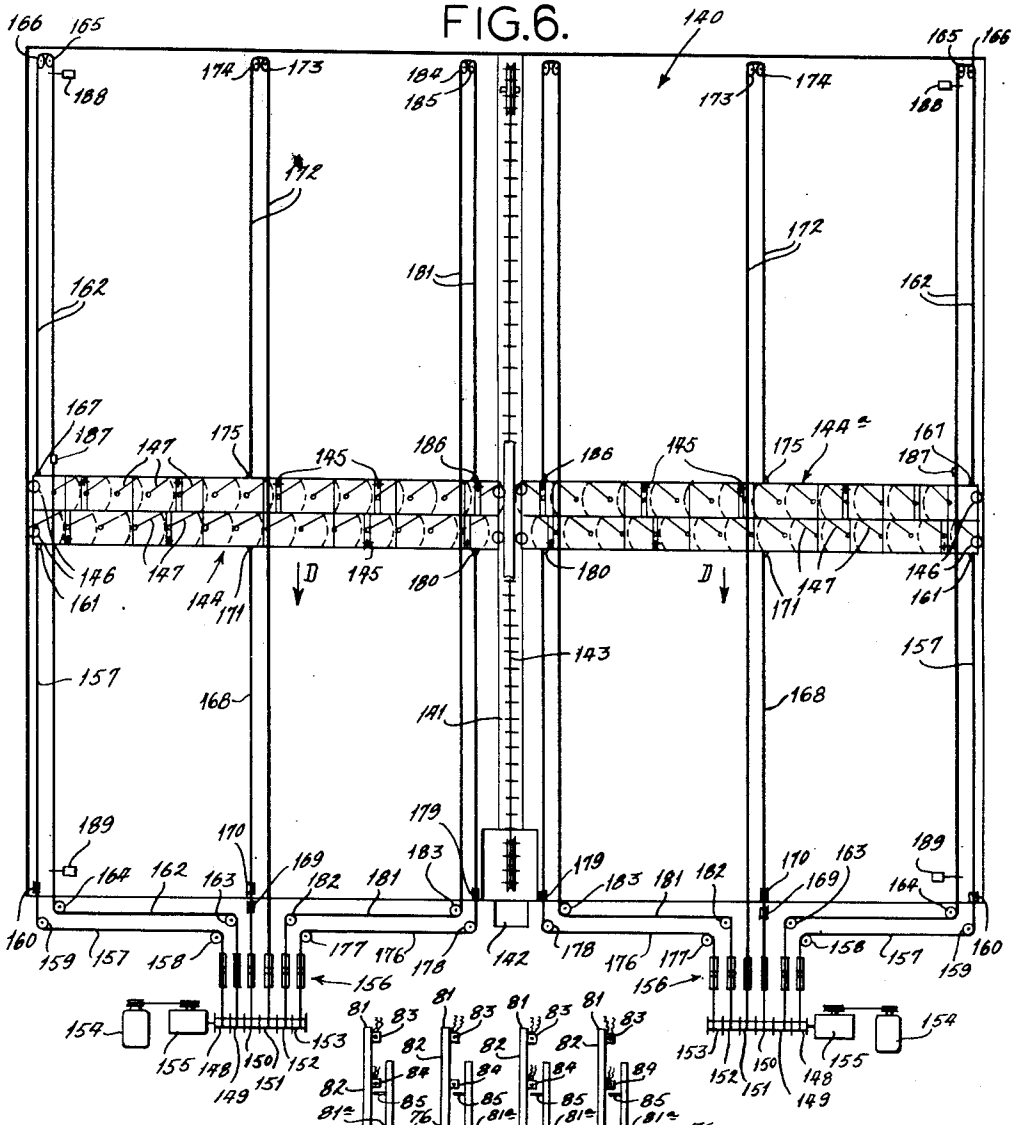
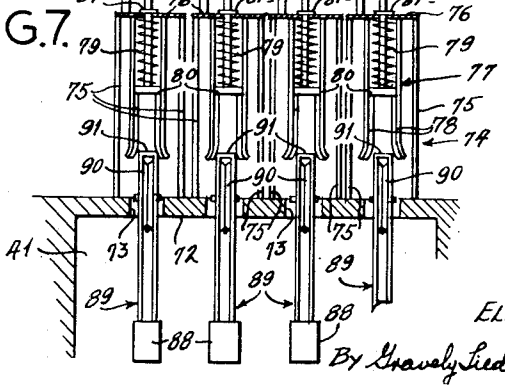


FIG.7.



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2,768,749

SEDIMENTATION BASIN CLEANING APPARATUS

Elton E. Easterday, St. Louis, Mo.

Application December 14, 1953, Serial No. 398,029

5 Claims. (Cl. 210—55)

This invention relates to improvements in apparatus for sediment or sludge removal from sedimentation basins of the types provided for water treatment plants, sewage, industrial waste treatment, mining sedimentation and the like.

This invention is objectively directed toward obtaining more efficient use of existing installations by keeping the sedimentation basins at or close to the designed capacity without prohibitive expense, thereby restoring the overall efficiency to a level in keeping with the design or rated efficiency.

The usual installation may have one or more primary sedimentation basins and one or more secondary basins connected in series or parallel flow relation so that certain basins can be shut off for cleaning without taking the entire installation out of service. If the primary basins, as well as the secondary basins, can be effectively cleaned without being taken out of service the overall efficiency can be kept at or near the design figure, therefore the present invention has as one of its objects the provision of apparatus which can effectively be used for removal of sediment without requiring shutdown.

Another object is to provide basin cleaning apparatus with automatic control means for insuring safe operation of the cleaning apparatus by limiting the load placed on the operating components thereof, especially upon the propelling means. A further object is to provide improved cleaning apparatus which will be automatically operated in reverse directions throughout the full length or over the full area of sedimentation basins to remove sediment, whether it be a heavy or relatively light deposit.

Still another object is to provide improved basin cleaning apparatus which may be adapted for use in rectangular or circular basins and which may be adapted to direct the sediment toward one or a plurality of sediment discharges.

The improved apparatus consists in the provision of reciprocating or oscillating sediment removing means operated by propelling cables or chains from a common power operated unit, in the provision of automatically operating control and safety means for sensing excessive loads and for effecting the reciprocating or oscillating movement in short strokes for heavy deposits or in full length strokes for light deposits, and in the provision of automatically operating scraper elements on the sediment removing means for relieving the build-up of excessive loads.

The invention further consists in control means for the propelling cables and sediment cleaning means, such control including cable slack take-up and yieldable load weighing devices for preventing cable entanglement and for safe guarding the cable against strains exceeding a predetermined safe value and for automatically reversing the operation of the apparatus so that under exceptional load strain conditions the usual long periods of reciprocation or oscillation of the cleaning means may be altered to produce short periods of relatively rapid reversals of

the applied power for propelling the cleaning means. In conjunction with the control means of the general character indicated, the invention consists in the provision of simple structures for the cleaning means movably supported on the floor of the basin so that the same may when encountering heavy sediment deposits assume elevated positions to aid in keeping the loads within safe values.

Other objects will appear from the following description of certain preferred embodiments of the present apparatus, but no limitation is to be inferred therefrom.

In the drawing:

Fig. 1 is a diagrammatic plan view of a sedimentation basin of rectangular shape showing the improved cleaning apparatus therefor;

Fig. 2 is a longitudinal sectional elevation of the basin taken at line 2—2 in Fig. 1 and showing the apparatus in greater detail;

Fig. 3 is a transverse sectional elevation of the basin taken at line 3—3 in Fig. 1;

Fig. 4 is a diagrammatic plan view of a circular sedimentation basin with the improved apparatus adapted therefor;

Fig. 5 is a sectional elevational view of the circular basin as seen at line 5—5 in Fig. 4;

Fig. 6 is a digrammatic plan view of a rectangular basin having central sediment disposal provisions for which the present apparatus is adapted;

Fig. 7 is a sectional elevational view of the control means shown in Figs. 1 and 2, this view being taken at line 7—7 in Fig. 1; and

Fig. 8 is an electrical circuit for the apparatus of Fig. 1, but which may be also adapted for the apparatus of Figs. 4 and 6.

In Figs. 1, 2 and 3, the sedimentation basin indicated at **10** is constructed with a floor **11**, opposite end walls **12** and **13**, and opposite side walls **14** and **15**. The basin floor **11** is generally level and horizontal throughout, except for sediment collecting gutters **16** and **17** across its opposite ends, the gutters being connected with valve controlled discharge conduits of any suitable construction, such as that shown at **18** in Fig. 3. Inlet and outlet provisions for basin **10** are not shown as the same may be constructed in accordance with prevailing practice, and such means are not necessary to an understanding of the present invention.

The basin sediment removing means consists in an open work frame or carriage **20** having a plurality of pairs of rollers or wheels **21** spaced along its length to support the frame in rolling contact with the basin floor **11**. Each end of the frame **20** is provided with guide rollers **22** arranged in pairs to engage the walls **14** and **15**. A braced superstructure **23** extends along each longitudinal side of the frame **20**, and groups of scraper blade elements **24** and **25** are pivoted near the upper margins of the superstructure **23** and extend in hanging relation to near the basin floor **11** with just sufficient clearance at the floor to prevent contact therewith. In the example shown, each group has three elements. In Fig. 2, the right hand group of blade elements **24** is shown in full line in working position against the frame **20** and the left hand group of blade elements **25** is shown in full line in an open or trailing angular position relative to the frame **20** as would occur due to the flow of fluid over and around the frame during movement thereof to the right in the direction of the arrow A. The dotted line positions of blade elements **24** in Fig. 2 illustrate the positions assumed for reversed movement of frame **20**. Obviously, frame **20** may be constructed of suitable structural members to form a rigid member of sufficient weight to tend to

hold itself in rolling contact on the basin floor 11 for effective pushing action on sediment collecting in front of the closed blade elements. As sediment accumulates in front of the closed blades, it may rise and flow over the top to pass out through the open trailing blades, or the frame 20 may lift and ride over the same. Thus, several passes back and forth over the basin floor 11 are usually necessary to effect maximum cleaning action. The speed of movement of the frame 20 may also be regulated to avoid stirring up the sediment and to avoid exceeding the safe load on the propelling cables or chains.

The frame 20 is cable or chain propelled by means now to be described. At a drum station adjacent basin 10, a motor 27 is connected to a speed reducer unit 28 by belt 29, and the output shaft 30 from the unit 28 is supported in bearing stands 31, a suitable shaft coupling 32 being disposed at the unit 28. The shaft 30 carries cable drums 33, 34, 35 and 36, all of which rotate together at the same speed. A control station adjacent the drums is provided with a plurality of control units 37, 38, 39 and 40, all of similar construction and performing similar control functions to be described later. The control station may be located over a pit 41 near basin 10, as shown in Figs. 1 and 2, or the same may be located over one end of the basin to utilize the basin depth for means to be described. Since the views are somewhat diagrammatic, the following description will omit details of structure deemed unnecessary to a full and complete understanding of the invention.

Drum 33 carries a cable 42 which leads through control unit 37 to a cornering pulley 43 and about a second cornering pulley 44 at the basin side wall 15, thence along the basin side 15 to a distant cornering pulley 45 set on a horizontal axis, thence downwardly in the basin along end wall 13 to a similar cornering pulley 46, and then along the basin floor 11 to a point of connection at 47 with the frame 20. Drum 36 carries a cable 49 which leads through control unit 40 and extends to a distant cornering pulley 50 at end wall 13, thence downwardly in the basin to a similar cornering pulley 51, and thence along the basin floor 11 to a point of connection at 52 with frame 20. The drum 34 carries a cable 53 leading through the control unit 38 to a cornering pulley 54, thence across the basin end wall 12 to a cornering pulley 55 and downwardly in the basin to a cornering pulley 56, and thence to a point of connection 57 with frame 20. In a similar manner, drum 35 carries a cable 60 leading through the control unit 39 to a cornering pulley 61 and downwardly in the basin about a cornering pulley 62 and to a point of connection 63 with frame 20.

Since all of the cable drums rotate together, the drums 33 and 36 have their cables 42 and 49 respectively connected to wind or unwind in the same direction, and drums 34 and 35 have their respective cables 53 and 60 connected to wind or unwind in the same direction, but just opposite to the cables on drums 33 and 36. Thus the drums for cables 42 and 49 alternate with the drums for cables 53 and 60 in winding up or paying out cable length for moving the frame 20 in opposite directions. Assuming that frame 20 is moving in the direction of arrow A, cables 42 and 49 are under pulling tension and are being taken onto drums 33 and 36 respectively. Cables 53 and 60 are now trailing and will be paid out from the respective drums 34 and 35. In this manner frame 20 can be reciprocated back and forth over the basin floor 11 to move the sediment alternately toward the respective collecting gutters 17 and 16.

Each gutter is provided with a clean out drag cable, a description of one being exemplary of each thereof. In Figs. 1 and 3, the drag cable 65 is provided with a plurality of space flights 66 which move through the bottom zone of the gutter 17 and propel the sediment delivered thereto by frame 20 toward the outlet 18 in the direction of arrow B. This cable is driven by pulley 67 from any convenient source of motive power 68 and extends about spaced cornering pulleys 69 and 70 adjacent the floor 11 of the basin at side walls 14 and 15. Opposite gutter 16 is similarly provided with a cleanout drag cable as shown in Fig. 1.

The upper corners of the basin 10 may be provided with suitable platforms or overhanging shelves to carry the pulleys for the frame towing cables as well as the drag chain power pulleys. These structures are shown as overhanging shelves, but are not specifically designated, as any convenient structure may be used.

Referring now to Figs. 1, 2 and 7, the control units 37 to 40, each being similar, will now be described in more detail in connection with the provision of pit 41 separate from the basin 10. Pit 41 is provided with a covering platform 72 having slot like apertures 73 therein. Over each such aperture 73 is placed a frame 74 having four vertical legs 75 and a head plate 76. A guideway 77 consisting of suitable angle elements 78 is placed within the frame 74 in depending relation from head plate 76. A spring 79 is placed within the guideway 77 and abuts the head plate 76. Spring 79 is held in unstressed position by a bumper plate 80 attached to a slide rod 81 extending through head plate 76. A cross pin 81*a* retains the rod 81 and plate 80 against dropping downwardly. Near the slide rod 81 and on top of head plate 76 is a fixed support 82 for a stop switch 83 and a reversing control switch 84 spaced below switch 83. A trip arm 85 is carried by the slide rod 81 in position to strike the switch 84 upon upward movement of the rod 81.

The frame 74 is provided with cable pulleys 86 (Fig. 2) carried on horizontal shafts 87 extending between adjacent legs 75. Pulleys 86 are in alignment so that, for example, the cable 42 from drum 33 may be passed over each thereof leaving a span of the cable free therebetween and in alignment with the lower curved opening of the vertical guideway 77. The free span of cable 42 between pulleys 86 is utilized to support a slack take up device comprising a pendent drop weight 88 affixed to the lower end portion of a hanger 89. The upper end portion of hanger 89 carries a pulley 90 which rides upon the cable 42 between pulleys 86. Hanger 89 has its upper end provided with a striker plate 91 in alignment with the guideway 77. The striker plate 91 is located above pulley 90 a suitable distance so that it may strike the bumper 80 and compress spring 79 at certain times in the operation of the unit. Since all of the control units 37, 38, 39 and 40 are constructed in like manner it has been deemed sufficient to designate the parts of each thereof by similar reference numerals in accordance with the above description. The pit 41 is adapted to receive the drop weights 88 and hangers 89 during operation of these control units.

Since the cable drums 33 and 36 reel in and pay out cables 42 and 49 at different rates, depending on the diameter attained by such cables at any given time, from the rates at which cables 53 and 60 are payed out and reeled in, it is necessary to take up the slack in the trailing set of cables being payed out during the time the pulling set of cables are being reeled in. The weights 88 perform this function and prevent cable piling up at the drums. In other words, for long runs two of the drums may contain several layers of cable when the frame 20 reaches one end of the basin 10; therefore, when the frame 20 is reversed the empty drums begin winding in cable and the full drums concurrently pay out cable faster than the empty drums can reel in cable due to the difference in effective drum diameter.

In the example of Fig. 1, drums 33 and 36 are empty and are reeling in cables 42 and 49, while drums 34 and 35 are filled and pay out cables 53 and 60. Under these conditions it happens that the drop weights 88 for control units 37 and 40 elevate and the drop weights 88 for control units 38 and 39 descend in order to take up the cable slack. These latter drop weights 88 will descend during

the time when the drums 34 and 35 have a larger diameter of cable than drums 33 and 36 and, as the diameter changes during the latter portion of the unwinding action, these drop weights will rise until they are again at about the same elevation with the drop weights for control units 37 and 40. Since the drop weights 88 for the pulling set of drums 33 and 36 are held up due to tension in the cable span between pulleys 86 for control units 37 and 40, the hanger striker plates 91 will bear upwardly upon bumpers 80 and compress the springs 79 to the extent dictated by the cable tension. The springs 79 thus act continuously to weigh the cable tension in the pulling set of cables 42 and 49 so that undue cable strain may be continuously detected if the cable strain becomes too great, as when a heavy load of sediment is piled up on the blade elements, the slide rod 81 will rise until the arm 85 trips the reversing switch 84 and reverses the motor 27 so that the direction of movement of the frame 20 will be reversed in the basin, as will be described more fully hereinafter. Thus, the frame 20 may be automatically oscillated in short strokes to overcome a heavy sediment deposit which places a strain on the propelling set of cables, and this oscillation of the frame 20 will cause it to effectively and progressively push into the heavy sediment deposit until it becomes fluid enough to allow the frame progressively longer strokes and finally break up the deposit. The control units are effective to protect the cables against strains of any predetermined value, and the trip arm 85 on slide rod 81 may be adjustable to any position desired, or the reversing switch 84 may be adjustable on support 82 if desired, or both means may be adjustably mounted. If the trip arm 85 should be caused to rise beyond switch 84 by unusual conditions, stop switch 83 will be actuated to stop the motor 27 and the action of the apparatus.

In certain cases, the sediment may be unevenly deposited so that the frame 20 can ride over the heavy or thick zones without exceeding the predetermined cable strain and in this manner progressively reduce the same on successive passes along the basin floor 11.

Automatic reversal of movement of frame 20 at the ends of its full stroke along the basin floor 11 is provided for by utilizing one of the cables in conjunction with a pair of spaced reversing control switches. In the present embodiment of Figs. 1 and 2, cable 49 may be selected to carry a lug 92 which alternately trips reversing switches 93 and 94 positioned on suitable supports 95 and 96 respectively. These reversing switches 93 and 94 are located near opposite ends of basin 10 in line with the cable 49, and are employed during normal full length reciprocation of the frame 20 in the basin when light loads of sediment are being moved.

Referring specifically to Fig. 2 it will be seen that a safety device is associated with each of the hangers 89 of the control units 37, 38, 39 and 40. Each of the safety devices includes a vertical rod 97 having its lower end 97*a* attached to the hanger 89 and a trip bar 98 carried by its upper end 97*b*. The safety rod 97 is slidably mounted adjacent to a normally closed safety shut-off switch 99 having contacts 99*a*. The safety rod 97 is vertically movable with the hanger 89 and weights 88, and the trip bar 98 is secured to the safety rod 97 in position to be out of contact with the switch 99 during normal operation of the apparatus. However, if a cable should break, the fall of the weight 88 would operate the safety rod 97 connected to the hanger 89 to open the contacts 99*a* of the switch 99. These switches 99 are connected to the motor 27 so that it will be stopped in the event any of the cables should break, as will become apparent hereinafter.

Referring to Figs. 4 and 5, a circular sedimentation basin 100 has a vertical wall 101 and a sloping floor 102 provided with a central circular gutter 103 communicating with a discharge conduit 104 for sediment. The gutter 103 surrounds a central upstanding column 105 which acts as a pivot for a sediment propelling and removing means. The latter means comprises combined carriage frame 106 and 106*a* formed of suitable structural members in an open work assembly. A suitable bracing superstructure 107 (Fig. 5) is connected to the frames 106 and 106*a* and the whole assembly extends diametrally across the basin 100 in two directions at right angles with the radial portions of the frames 106 and 106*a* sloping upwardly to be substantially parallel with the floor 102 so as to sweep the floor area outwardly of the central gutter 103. The frames carry a plurality of rollers 108 engaging the central column 105 to provide a pivot assembly, and similar rollers 109 carried by the superstructure 107 pivot about the column 105. Also the frames are provided with spaced sets of supporting rollers 110 engaging floor 102 so that the same may oscillate smoothly about the column 105. The radial portions of the frames carry a plurality of pivoted scraper elements, the elements 111 being set oppositely to the elements 112 in frame 106 and the elements 111*a* being set oppositely to elements 112*a* in frame 106*a*, and all of the scraper elements being effective to propel the sediment toward the central gutter 103 during oscillation. With the frames 106 and 106*a* moving in the direction of arrow C, the elements 111, 111*a* and 112 and 112*a* assume the full line positions, and reverse movement is accompanied by pivoting action of these scrappers into the dotted line positions. As between frames 106 and 106*a*, elements 111*a* are relatively off-set to elements 111, and elements 112*a* are off-set to elements 112 so that the whole area of the basin floor 102 may be swept by all of the elements and no sediment be left unmoved thereby. Sediment being collected in the central gutter 103 is moved toward the discharge conduit 104 by blades 113 carried at the central zone of the frames 106 and 106*a* below the pivot rollers 108. Moreover, the superstructure 107 carries a bull wheel or pulley 114 by which the assembly may be oscillated about the pivot column 105.

Adjacent the basin wall 101, a pit 115 is provided and a platform 116 covers this pit except for slot-like openings 117 therein. A pair of control units 118 and 119 are mounted over the platform openings 117. The units 118 and 119 are similar to the units 37 to 40 shown in Fig. 1, and the parts thereof as described in connection with Figs. 1, 2 and 7 are designated by similar reference numerals. It is not believed necessary to repeat the description heretofore given in referring to units 118 and 119. Drive motor 120 is belt connected to a speed reducer unit 121 and a shaft 122 carried in bearing stands 123 is connected to the unit 121 by a suitable coupling 124. Shaft 122 carries a pair of drums 125 and 126 to which the ends of cables 127 and 127*a* are connected for simultaneous but alternate winding and unwinding action. Drum 125 is filled with several layers of cables 127 and drum 126 is relatively empty of cable 127*a* since it is acting to wind up cable 127*a* as drum 125 pays out cable 127 in order to oscillate the frame 106 and 106*a* in the direction of arrow C.

The cable 127*a* from drum 126 passes through control unit 119 by being run over the pulleys 86 and under the slack take-up pulley 90 therein. From unit 119, cable 127*a* passes downwardly into basin 100 and about cornering pulley 130 to and substantially more than one turn about the pulley 114 to a connection at 123*a* oscillating the frames. Cable 127 is connected to the bull wheel 114 at 123 and leads to a second cornering pulley 131, thence upwardly and over pulleys 86 and under pulley 90 in control unit 118 to the drum 125. The function of control units 118 and 119 is similar to control unit 37 described in the preceding example, except that the control switches 83 and 84 are connected in circuit with the motor 120 for stopping or reversing the latter, as the case may be. So long as switches 83 and 84 are unaffected, automatic reversing action of frame 106 at the ends of its travel is under the control of lug 132 on cable 127,

which lug actuates the reversing limit switch **133**, and lug **132***a* on cable **127***a* which actuates a reversing limit switch **134**. Switch **133** is mounted on a leg **75** of control unit **118** and switch **134** is similarly mounted on a leg **75** of unit **119**, as shown in Fig. 4.

In Fig. 6, a rectangular sedimentation basin **140** is diagrammatically shown with a central sediment collecting gutter **141** connected to a discharge pit **142** at one end thereof. The sediment may be moved to pit **142** by a drag cable device **143** similar to the device **65** described in Figs. 1 and 3. In this arrangement, a sediment removing frame **144** having bottom rollers **145** and end rollers **146** moves along one side of gutter **141** and a second similar frame **144***a* having the same arrangement of bottom rollers **145** and end rollers **146** moves along the opposite side of the gutter **141**. The action of each frame is to propel the sediment in the direction toward the central gutter **141** as will be presently described.

This arrangement may be modified by eliminating one portion of the basin **140** and one frame, as frame **144***a*, so that the sediment collecting gutter **141** may be located at one side of the modified basin. Other modifications will be suggested after the principles of this invention are more fully appreciated.

Since frames **144** and **144***a* are similar, a description of one will suffice for both, keeping in mind that frame **144***a* may be operated oppositely to frame **144** in respect of its sediment propelling action toward gutter **141**. Frame **144**, for example, consists in a suitable open frame work of structural members in which a plurality of pairs of pivoted scraper elements **147** are mounted in off-set relation so as to sweep the whole area of the basin floor. In either direction of movement of the frames **144** and **144***a*, the scraper elements **147** are angularly positioned relative to the gutter **141** so that sediment contacted by the elements **147** will be moved angularly across the floor of the basin **140** to the gutter **141**. This frame is reciprocated upon its rollers **145** and **146** by a system of cables or chains now to be described.

A plurality of drums **148** to **153** inclusive are driven together by motor **154** through a suitable speed reducer unit **155** in a manner similar to that heretofore pointed out. Each drum is associated with a control unit of the type corresponding to those described in Figs. 1, 2 and 7. These control units are indicated as a group at **156**. Winding drum **148** has its cable **157** extending through unit **156** and passing around cornering pulleys **158**, **159**, and **160** to a connection **161** on frame **144**. Unwinding drum **149** paired with drum **148** has its cable **162** extending through control unit **156** and passing about cornering pulleys **163**, **164**, **165** and **166** to a connection **167** on frame **144** opposite the connection **161** for cable **157**. Winding drum **150** has its cable **168** extending through control unit **156** and passing about cornering pulleys **169** and **170** to a connection **171** near the center of frame **144**. Unwinding drum **151**, paired with drum **150**, has its cable **172** extending through control unit **156** and passing about cornering pulleys **173** and **174** to a connection **175** on frame **144** opposite connection **171** for cable **168**. Likewise, winding drum **153** has its cable **176** extending through control unit **156** and passing about cornering pulleys **177**, **178** and **179** to a connection **180** at the end of frame **144**. Unwinding drum **152**, paired with drum **153**, has its cable **181** extending through control unit **156** and passing about cornering pulleys **182**, **183**, **184** and **185** to a connection **186** on frame **144** opposite connection **180** for cable **176**. Thus winding drums **148**, **150** and **153** propel the frame **144** in the direction of arrow D and scraper elements **147** assume the full line positions shown. Reversal of movement of the frame **144** causes these elements **147** to pivot in the direction of the dotted lines shown. Automatic reversal of movement for frames **144** and **144***a* at the ends of the stroke in basin **140** is achieved by the provision of lugs **187** on cables **162** alternately actuating the reversing switches **188** and **189** located near the ends of the basin and in line with the span of cables **162**. The action of frame **144***a* may be in unison with frame **144** or it may be activated in an opposite sense, as desired.

Referring now to Fig. 8, it will be seen that the electrical circuit for operating the sedimentation basin cleaning apparatus includes power source or main leads **192**, **193** and **194** for the three phase motor **27**. The main leads **192**, **193** and **194** are connected to a motor armature reversing switch **196** through a master switch **195**. The reversing switch **196** includes a switch element **197** movable between contacts **197***a* and contacts **197***b* to connect the main lead **192** to a lead **202** to one phase winding (not shown) of the motor **27**. A second switch element **198** of the reversing switch **196** is movable between contacts **198***a* and contacts **198***b*. One of the contacts **198***a* is connected to a lead **203** to a second phase winding (not shown) of the motor **27**, and the other contact **198***a* is connected to the main lead **194**. One of the contacts **198***b* is connected to the lead **203** to the second phase winding of the motor **27**, and the other contact **198***b* is connected to the main lead **193**. Accordingly, movement of the switch element **198** between the contacts **198***a* and **198***b* reverses the connection of the second phase winding of the motor **27** between the main leads **193** and **194**. Similarly, a third switch element **199** is provided with contacts **199***a* for connecting the main lead **193** to a lead **204** to a third phase winding (not shown) of the motor **27**, and contacts **199***b* for connecting the lead **204** to the main lead **194**. Therefore, when the switch elements **197**, **198** and **199** are moved simultaneously between their respective sets of contacts, the connection of the main leads **193** and **194** to the second and third phase windings of the motor **27** are reversed and the direction of rotation of the motor **27** and belt **29** are reversed. As discussed hereinbefore, the reversal of the motor **27** is effective to reverse the rotation of the drums **33**, **34**, **35** and **36** so that the cables will be payed out from or wound thereon, and the direction of movement of the frame **20** in the basin **10** will be reversed.

The switch elements **197**, **198** and **199** are connected to a reversing contactor **200** having right and left-hand solenoids **209** and **210** adapted to be alternately energized to move the contactor **200** and reverse the position of the switch elements with their respective sets of contacts. The solenoid **209** is connected in series with the reversing switch **94** by a lead **207** between main lead **193** and main lead **194**. The solenoid **210** is connected in series with reversing switch **93** by a lead **208** between main lead **192** and main lead **193**. Therefore, when the frame **20** is moved to the right in Fig. 1 and the switch **94** is contacted by the lug **92** on the cable **49**, the solenoid **209** is energized and the contactor **200** is moved to the right in Fig. 8 so that the main leads **192**, **193** and **194** will be connected to the motor winding leads as shown. The motor **27** is reversed and the frame **20** is moved to the left in Fig. 1. When the lug **92** contacts the switch **93** and the solenoid **210** is energized, the contactor **200** moves the switch elements to the left in Fig. 8 thereby reversing the main leads to the motor windings. The contactor **200** is maintained in either leftward or rightward position by a toggle **201**. When the cleaning apparatus is operating under a light load, full basin length reciprocation will continue as long as desired. However, as previously discussed, when the cleaning apparatus is operative on heavy sediment loads, the cable strain will be increased and the safety means or control units **37** to **40** will be effective to provide short stroke reciprocation of the frame **20**.

Referring again to Fig. 8 it will be seen that a pair of the reversing switches **84** are connected in parallel with the reversing switches **94** and **93** for the solenoids **209** and **210**, respectively. The cables **42** and **49** cooperate in moving the cleaning means to the right in the basin, and it is desired to prevent an overload on these cables. Therefore, the switches **84** associated with the cables **42**

and **49** are connected in the circuit of the solenoid **209** so that whenever either of the cables **42** or **49** become taut enough to raise the rod **81** into contact with the switch **84**, the solenoid **209** will be energized and the direction of movement of the frame **20** is reversed in the basin. Similarly, the switches **84** associated with the cables **53** and **60** are connected in the circuit of the solenoid **210**. Regardless of which direction the frame is moving in the basin, a load above a predetermined value will cause one of the reversing switches **84** to close to energize a solenoid and reverse the direction of movement of the frame in the basin whereby the cables under load will be relieved and the other cables will be actuated into pulling condition.

The leads **202**, **203** and **204** to the motor windings are provided with a circuit breaker arrangement **205** including a solenoid **206**, the deenergization of which is effective for stopping the motor **27**. The solenoid **206** is connected in a lead **211** between leads **203** and **204**, and all of the switches **83** and **99** are connected in series therewith. Accordingly, if the trip arm **85** of any of the control units for the cables should move above the switch **84** without reversing the motor **27**, a switch **83** will be contacted and opened whereby the solenoid **206** will be deenergized and the motor **27** will stop. Similarly, if any of the cables should break, weight **88** will drop below a predetermined level and the safety rod **97** will carry the bar **98** into contact with the safety switch **99** so that the contacts **99***a* will be opened and the solenoid **206** will be deenergized. The electrical circuit for the other basins **100** and **140** operate in a similar manner as the circuit just described for the basin **10**.

It should now be apparent that in each embodiment herein disclosed the control units associated with the cable drums which are functioning to wind up the cable act continuously to weigh the cable tension and prevent loads building up in the sediment cleaning frames or carriages beyond a predetermined value, and should such excessive loads occur, the control units act first to reverse the motion of the frames and second to stop the driving motor. In like manner, cable elongation beyond a safe point or cable breakage will result in stopping the driving motors.

What I claim is:

1. In sediment cleaning apparatus for sedimentation basins having a collecting gutter, a frame movable in said basin in reverse directions, pivoted scraper elements carried by said frame to swing into opposite sediment moving positions upon reverse movements of said frame, cable means connected to said frame to propel the latter in opposite directions, said cable means extending to a control station adjacent the basin, cable winding drums at the control station to which said cable means is connected, and reversible motor means driving said drums together, said drums alternately winding in cable and unwinding cable; the improvement of control units adjacent said drums, said cable means extending through said control units, and cable tension weighing means in said control units, each cable tension weighing means including yieldable means movable toward and from a position corresponding to a predetermined maximum cable tension value, a weighted device connected to said cable means to move in response to cable tension reaction and move said yieldable means toward said predetermined position, said weighted device also acting alternately to absorb slack in said cable means coming from the unwinding drum, and control means at said maximum tension position operable by said yieldable means to reverse said motor means.

2. In sediment cleaning apparatus for sedimentation basins having a collecting gutter, a frame movable in the basin in reverse directions, scrapers carried by said frame to propel the sediment toward the collecting gutter in both directions of frame movement, a cable system connected to said frame for reversely moving the frame, and motor driven drums connected to said cable system for

alternately winding in and paying out cable to reverse frame movement; the improvement of control units operatively connected wtih said cable system to respond to tension loads in said cable system to absorb slack in said cable system, said control units including means connected to said motor driven drums to reverse the latter, weighted means riding on said cable system to move in response to tension and slack in the cable system, and yieldable means actuated by said weighted means in response to tension in said cable system to actuate said reversing means.

3. In sediment cleaning apparatus for sedimentation basins having a collecting gutter: the combination with a frame movable in opposite directions in the basin, scraper elements movably mounted in said frame to assume sediment propelling positions in accordance with the direction of frame movement in the basin, a cable system connected to said frame, cable drums, reversible motor means connected to said cable drums to rotate the latter together, said cable system being connected to said cable drums in opposite winding directions so that said cable system is simultaneously wound onto and payed out from said cable drums to effect reversal of frame movement in the basin, and means actuated by said cable system to reverse said motor means to limit the travel of said frame in its opposite directions of movement in the basin; of means responsive to tension in said cable system to additionally reverse said motor means and limit the tension therein to a predetermined value, said last means including weighted means riding on portions of said cable system to move in response to cable tension, reversing controls connected to said reversible motor means and spring means engaged by said weighted means to be compressed thereby and move in response to the weight of the tension loads in said cable system, said spring means acting to actuate said reversing controls to reverse said motor means upon tension loads exceeding a predetermined value.

4. In sediment cleaning apparatus for sedimentation basins having a collecting gutter, a frame movable in opposite directions in the basin; scraper elements movably mounted in said frame to assume alternate positions to propel sediment toward the gutter for opposite directions of frame movement, reversibly rotatable drums, and a cable system connected to said drums and to said frame and acting alternately upon reversals of drum rotation to wind up a portion of said cable system and to pay out another portion of said cable system; the improvement of control units for each portion of said cable system each including a weighted device riding upon and movable to take up slack in the portions of said cable system being payed out from said drums, yieldable means adapted to be engaged by said weighted device to continuously weigh the tension load in the portion of said cable system being wound up by said drums, said yieldable means being movable by said weighted device toward a position indicative of a predetermined tension load in said cable system, and means in said position operably connected to said reversible rotatable drums to be actuated by said yieldable means for effecting reversal of rotation of said drums.

5. In sediment cleaning apparatus for sedimentation basins having a collecting gutter, a frame reversibly movable in the basin, scraper elements pivoted in said frame to move into alternate positions upon reversals of frame movement to propel sediment to the gutter, reversibly rotatable drums, and a cable system connected to said drums and to said frame and acting alternately upon reversals of said drum rotation to wind up a portion of said cable system and to pay out another portion of said cable system; the improvement of control units for each portion of said cable system each including a weighted

device carried by said cable system, yieldable means engageable by said weighted device and movable in a direction to weigh the tension load in said cable system, means actuated by said yieldable means upon a predetermined movement of the latter means in response to excessive tension loads to reverse rotation of said drums, other means actuatable to stop drum rotation upon breakage of said cable system, and a member carried by said weighted device to actuate said other means in response to fall of said weighted device due to cable breakage.

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