April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

Filed Feb. 25, 1946 9 Sheets-Sheet 1

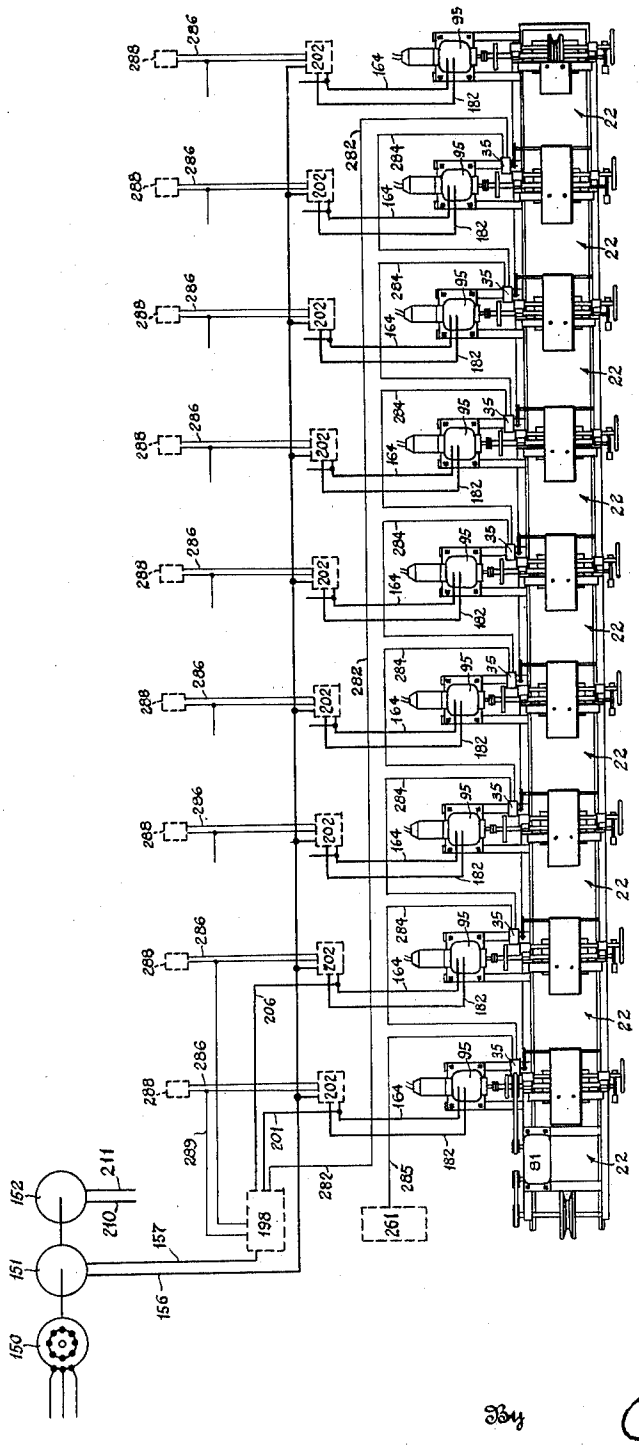


Fig-1

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CLOTH WASHING APPARATUS

Filed Feb. 25, 1946 9 Sheets-Sheet 2

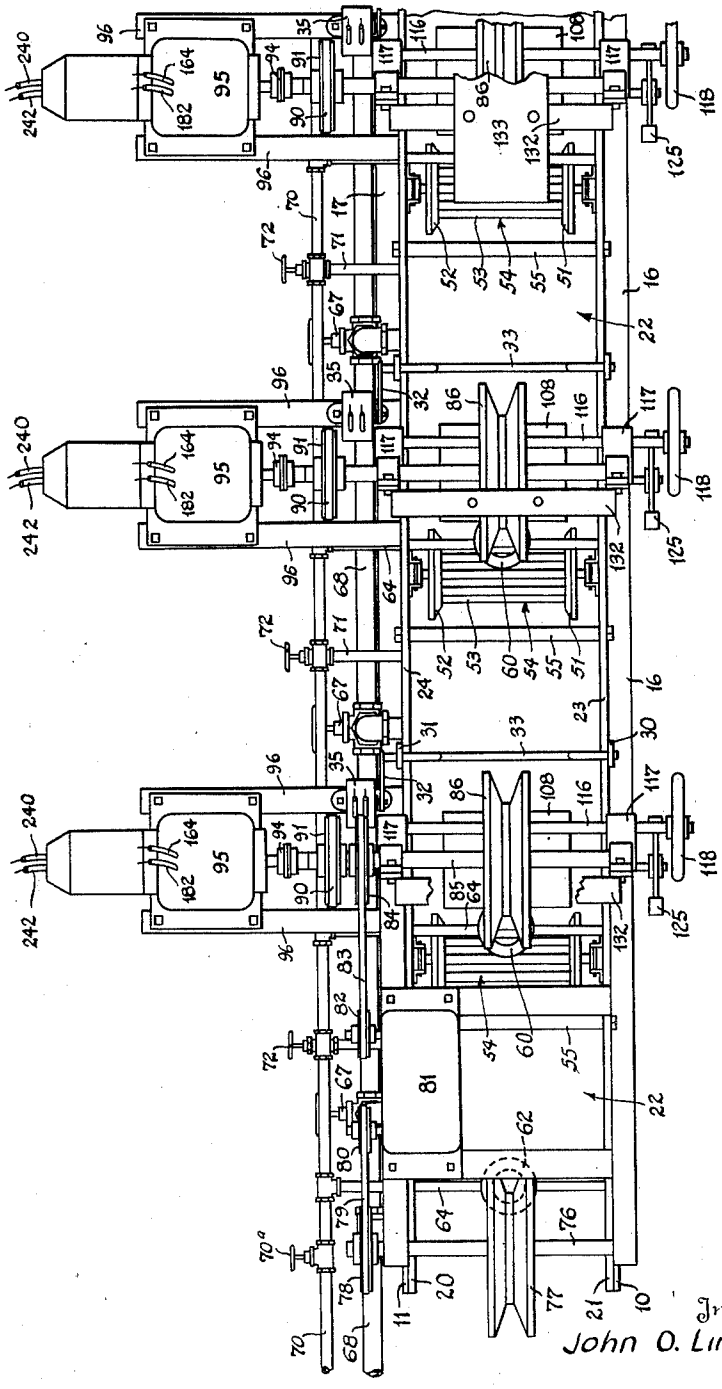


Fig-2

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CLOTH WASHING APPARATUS

Filed Feb. 25, 1946 9 Sheets-Sheet 3

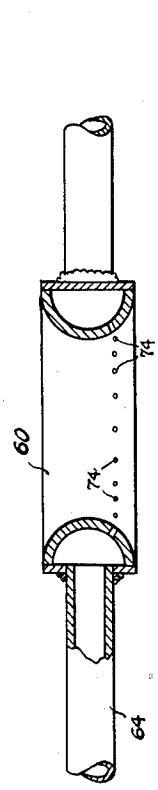


Fig-13

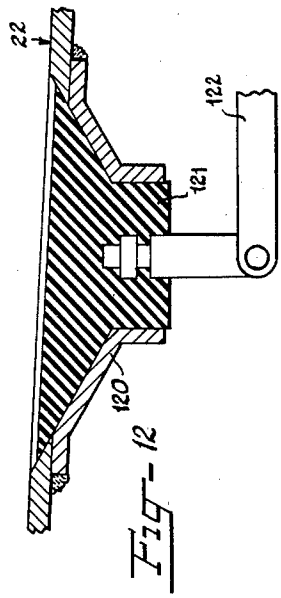


Fig-12

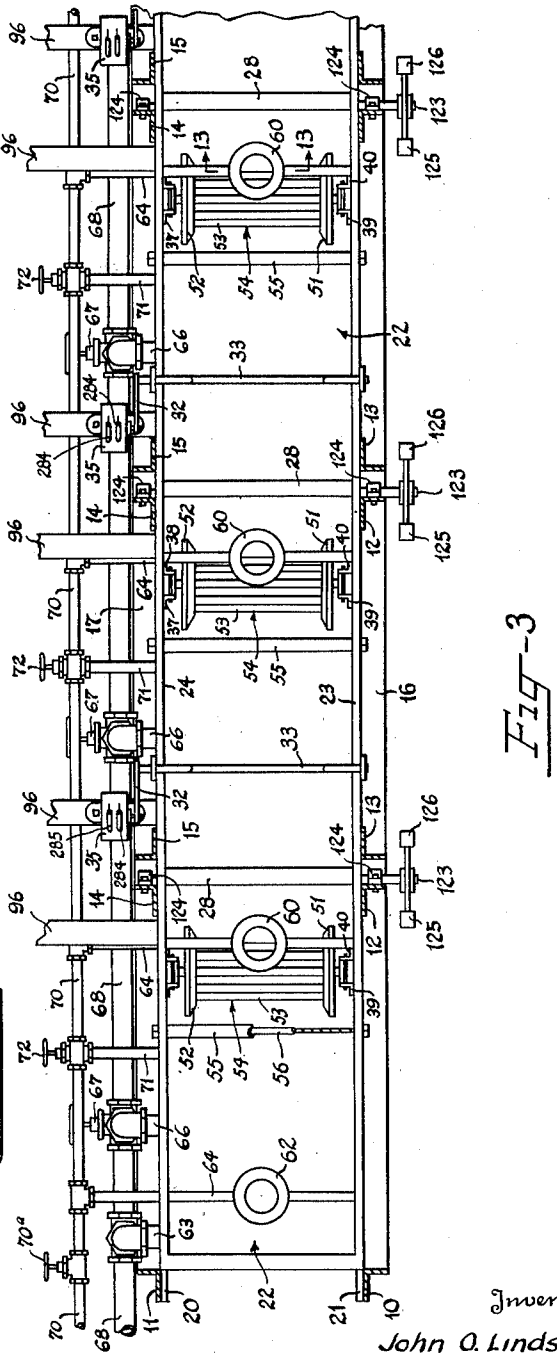


Fig-3

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April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

Filed Feb. 25, 1946 9 Sheets-Sheet 4

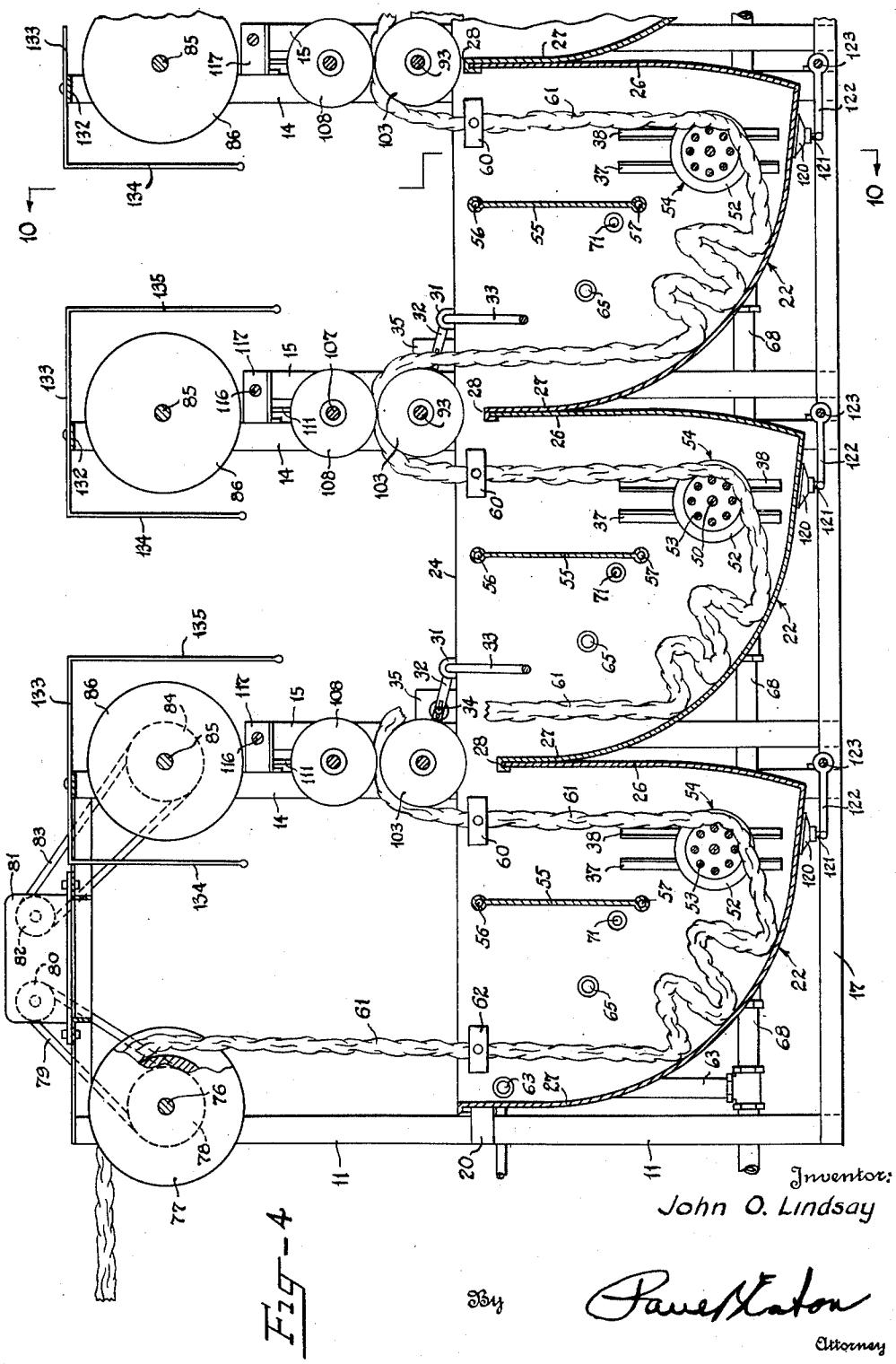


Fig-4

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April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

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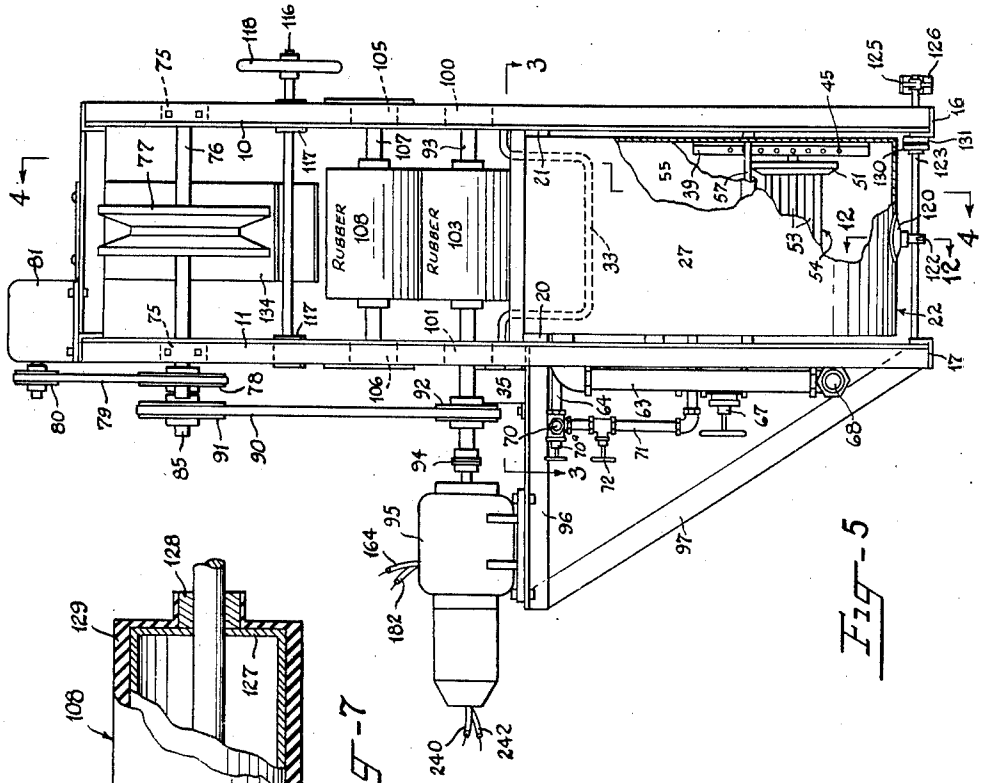


Fig-5

Fig-7

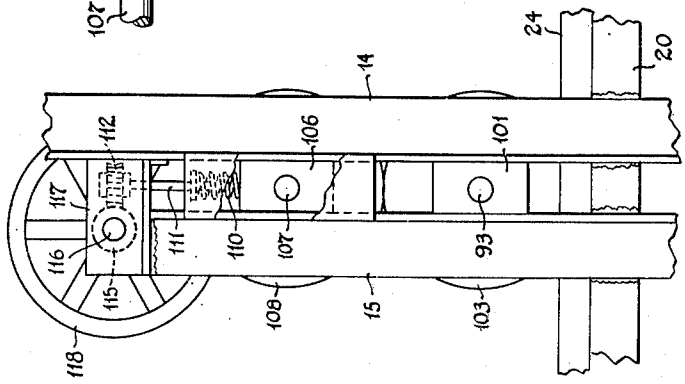


Fig-6

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April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

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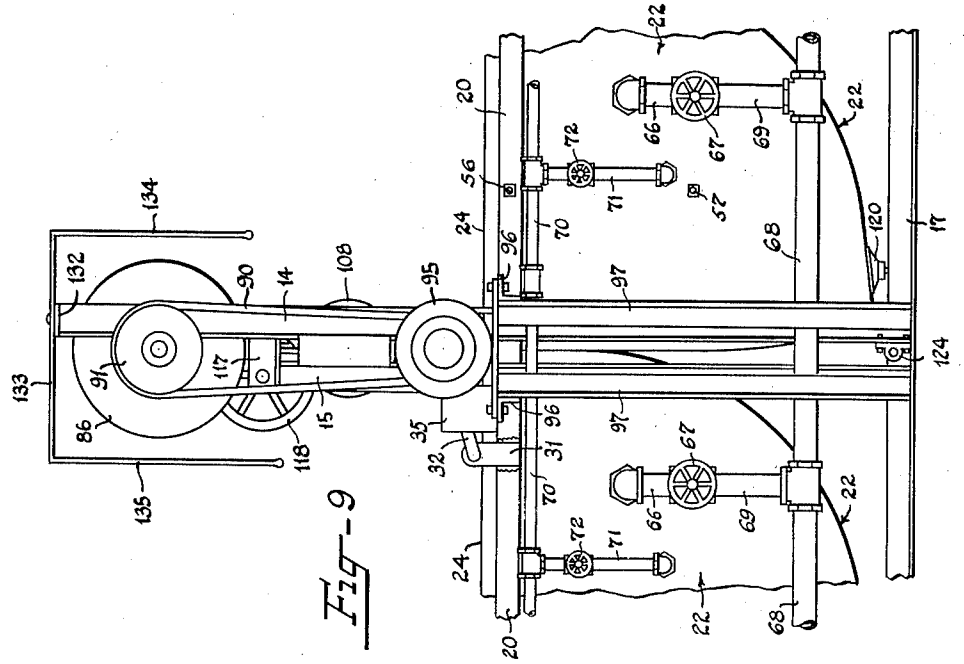


Fig-9

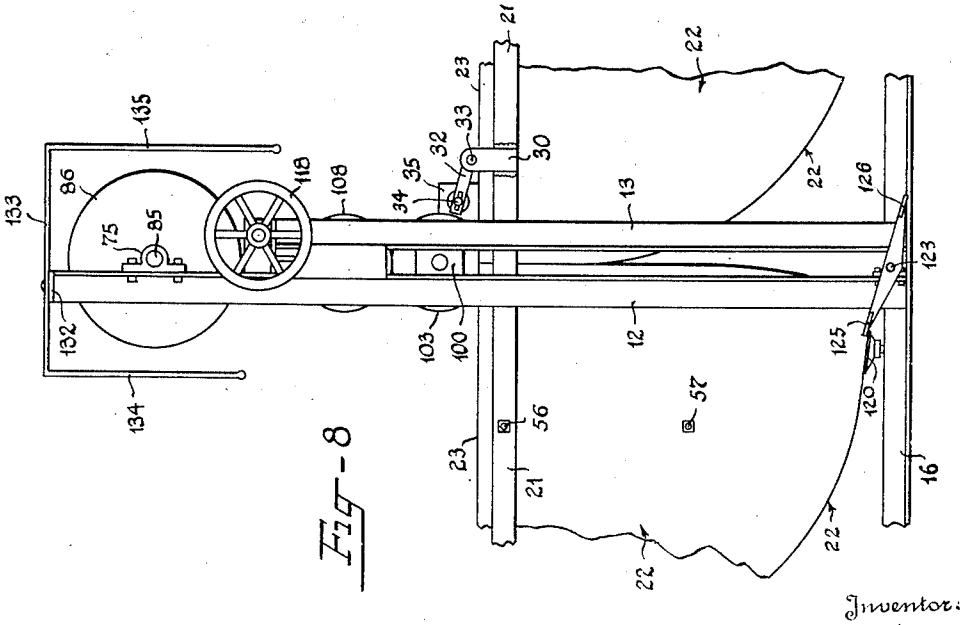


Fig-8

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April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

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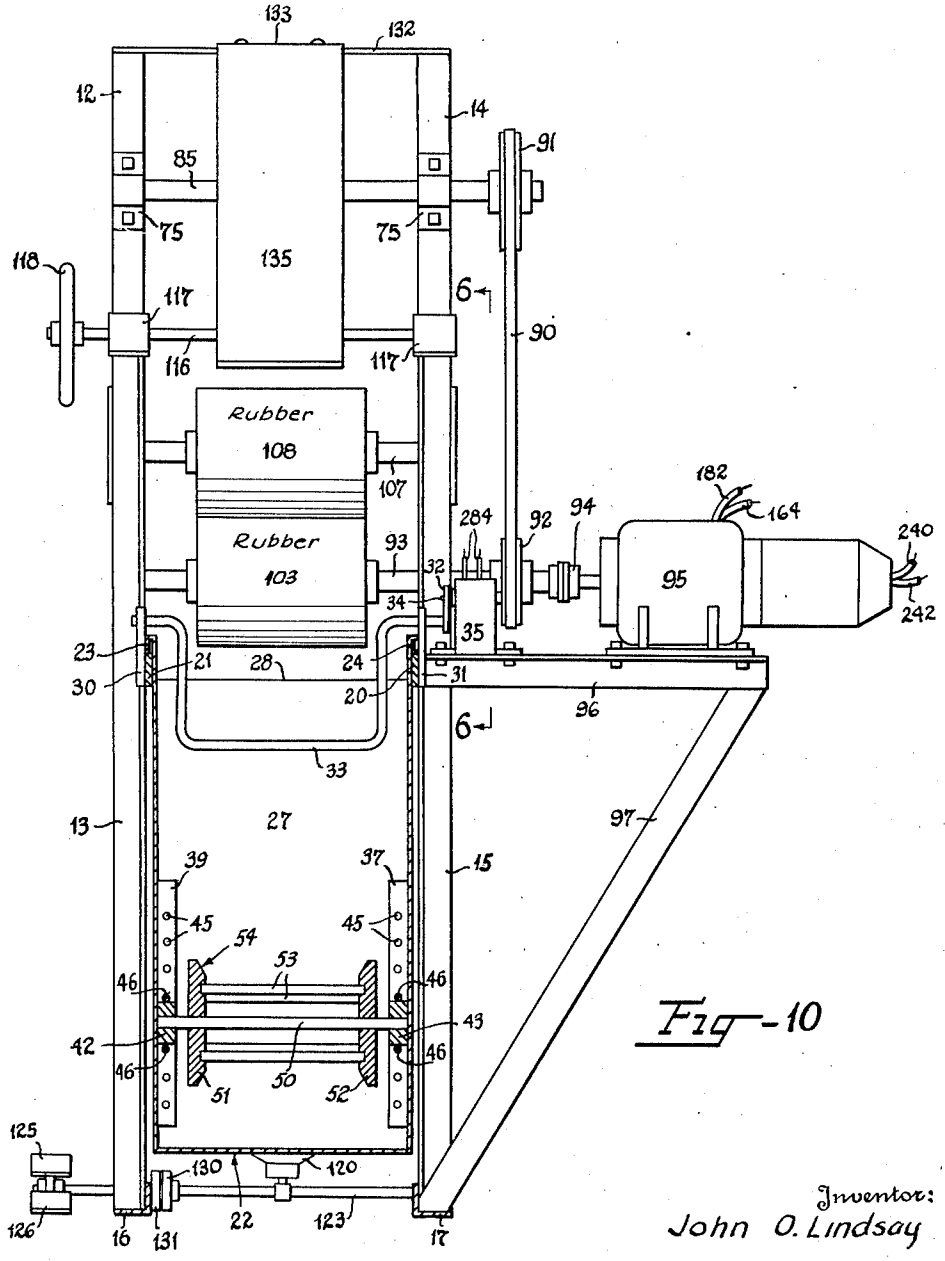


Fig-10

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April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

Filed Feb. 25, 1946 9 Sheets-Sheet 8

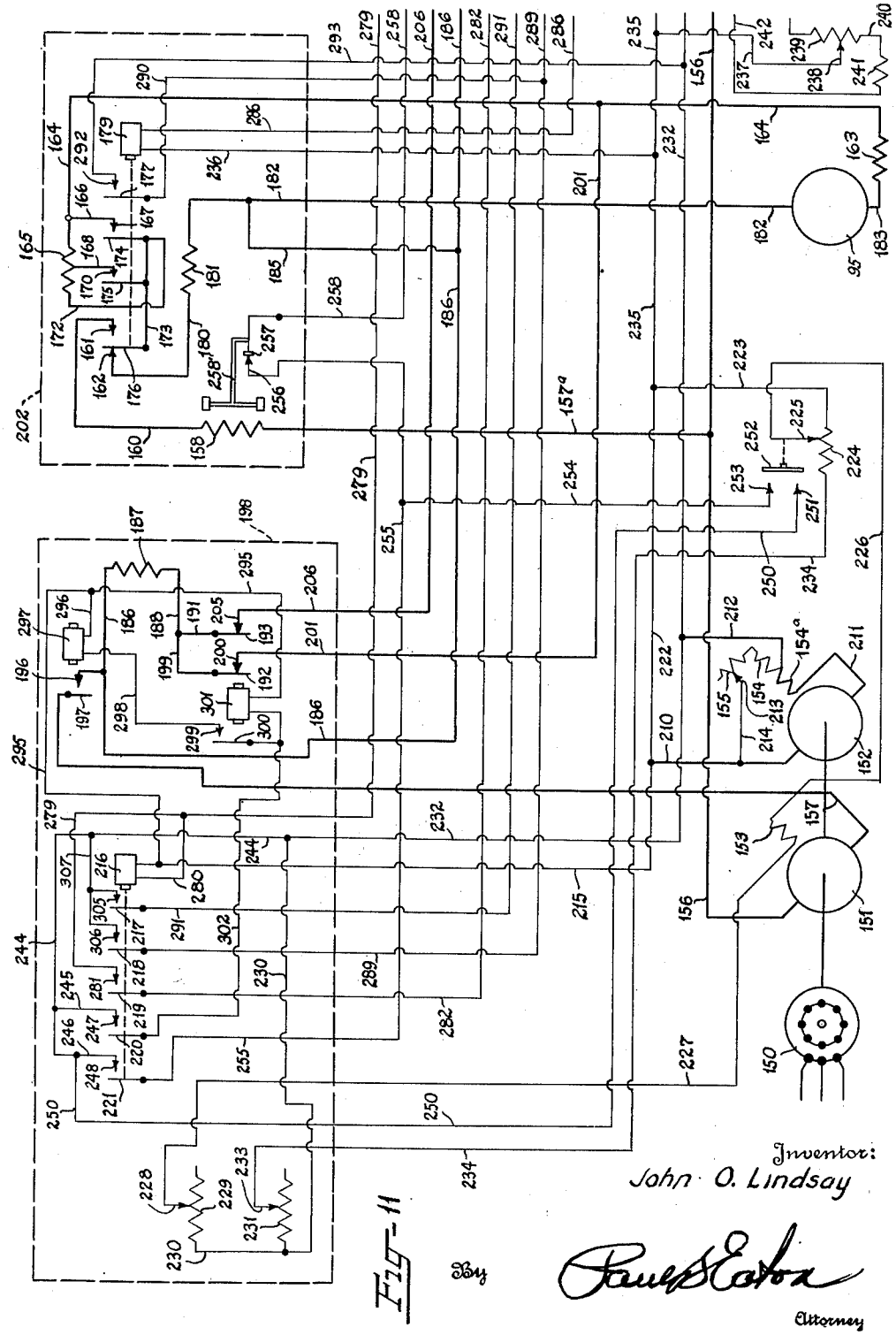


Fig-11

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April 18, 1950 J. O. LINDSAY 2,504,554

CLOTH WASHING APPARATUS

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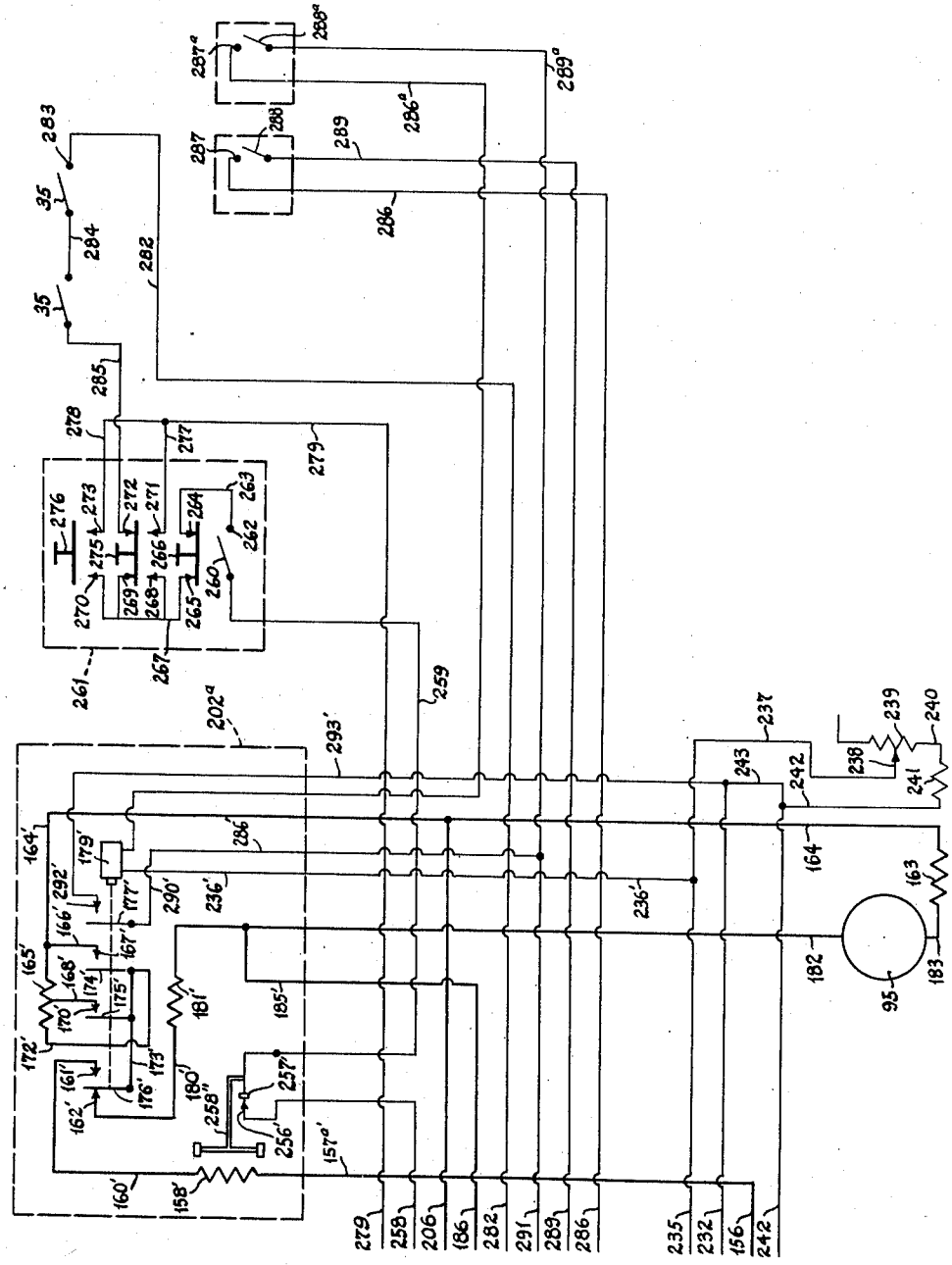


Fig. 11A

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Patented Apr. 18, 1950 2,504,554

UNITED STATES PATENT OFFICE

2,504,554

CLOTH WASHING APPARATUS

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Application February 25, 1946, Serial No. 649,940

11 Claims. (Cl. 68—9)

1

This invention relates to a cloth washing machine and more especially to a machine having a plurality of tubs with means for passing the cloth into the first tub and wetting it as it passes into the first tub, maintaining a plurality of folds in the cloth in each tub, and then withdrawing the cloth successively from one tub and depositing it in another tub and maintaining a predetermined amount of slack cloth in each tub together with means for regulating the motors for each tub to thereby regulate the feeding of the cloth from one tub to the other in acordance with the amount of cloth in each tub. The invention also comprises means whereby, when a predetermined tautness appears in the cloth in one tub, the motors driving the withdrawal of the cloth from tubs will automatically be stopped.

It is another object of this invention to provide a cloth washing machine having a plurality of tubs through which a length of cloth is successively moved, each tub having a circulating hot water system and a flexible water changing system and whereby the cloth can be washed safely due to limit switches which remove responsibility of cloth breakage or damage from the operator and, thereby, requiring less supervision.

It is another object of this invention to provide a cloth washing machine having a plurality of tubs with means for feeding cloth from one tub to the other and having means for maintaining the same amount of slack cloth in each tub at all times by means of a feed control system for controlling the movement of the cloth from one tub to the other, together with means for wetting the cloth as it enters the first tub and for spraying the cloth as it emerges from each tub.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

Figure 1 is a top plan view, largely schematic, and showing nine units coupled together with a portion of the control system therefor being shown;

Figure 2 is a top plan view of the first three units of the mechanism and being shown on an enlarged scale from that shown in Figure 1;

Figure 3 is a sectional view of the lower portion of the structure shown in Figure 1 and taken longitudinally through Figure 5 at the level substantially along line 3—3 in Figure 5;

Figure 4 is a vertical sectional view taken substantially along the line 4—4 in Figure 5;

Figure 5 is a front elevation of the machine looking from the left hand end of Figure 4;

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Figure 6 is a detailed elevation taken substantially along the line 6—6 in Figure 10;

Figure 7 is an elevation of one of the nip rolls with portions broken away;

Figure 8 is a side elevation of the apparatus at the junction point of two tubs;

Figure 9 is an elevation from the other side at the junction point of two tubs;

Figure 10 is a vertical sectional view taken substantially along the line 10—10 in Figure 4;

Figures 11 and 11A show a schematic wiring diagram employed with the apparatus;

Figure 12 is a sectional view of the foot operated drain valve and taken along the line 12—12 in Figure 5;

Figure 13 is a cross-sectional view taken along the line 13—13 in Figure 3.

This machine comprises a plurality of tubs into which the cloth is passed successively and there could be any desired number of tubs even though the preferable number is about nine as is shown in Figure 1. The framework of the apparatus comprises left hand end uprights 10 and 11 and a plurality of pairs of uprights 12 and 13 disposed on one side of the machine and companion uprights 14 and 15 disposed on the other side of the machine. A pair of base angle members 16 and 17 support the bases of all of the uprights.

Secured to the proximate faces of all of the uprights are strap iron members 20 and 21. The strap iron members 20 and 21 are adapted to support a plurality of tubs 22. The upper side edges of these tubs extend outwardly and downwardly as indicated at 24 and 23 to provide flanges which rest on top of the strap iron members 20 and 21 to form the sole support for the tubs 22.

Each tub has a vertical rear end wall 26 and a curved front end wall 27, the front end wall 27 of each tub being bent forwardly and downwardly at 28 to provide a recess into which the upper end of wall 26 of the next adjacent tub is adapted to fit. The strap iron members 20 and 21 have upwardly extending lugs 30 and 31 in which are pivotally mounted the ends of a U-shaped rod 33 which extends downwardly and across each of the tubs.

Each of the U-shaped rods 33 has a lever 32 associated therewith which is slotted to receive the arm 34 of a limit switch mechanism 35. Each tub has mounted therein a pair of vertically disposed and parallel angle irons 37 and 38 secured on the inside surface of one of the side walls of these tubs and on the other side wall of the tub

are secured similar angle irons 39 and 40. Adapted to slide between these brackets 37 and 38 and 39 and 40 are bearing blocks 42 and 43. These angle irons 37 to 40, inclusive, have a plurality of coinciding perforations 45 therein through which a pin 46 can be inserted below and above the bearing blocks 42 and 43 for adjusting the position of the bearing blocks 42 and 43 vertically with respect to angle irons 37 to 40, inclusive.

Rotatably mounted in these bearing blocks 42 and 43 is a shaft 50 having fixedly secured thereon head members 51 and 52 between which are disposed a plurality of rods or the like 53, collectively forming a reel 54. Each wash box 22 has an anti-splash vane or baffle plate 55 vertically disposed therein which is supported in any suitable manner, as by means of rods 56 and 57 being secured to or penetrating the side walls of the wash box and the baffle plates 55 being curled therearound.

Each wash box 22 has a poteye spray 60 disposed therein and through which the cloth 61 is adapted to pass as it goes out of one wash box into another wash box. The first wash box in the machine has also a poteye 62 for saturating the cloth with water as it enters the first wash box to prevent the cloth from floating on top of the liquid or water in the first wash box.

Each wash box has an outlet opening 65 connected to a pipe 66 which has a valve 67 therein which valve is connected at its other side by means of pipe 69 to a main drain pipe 68, for maintaining a low water level in each tub. The first tub in each group has an overflow outlet 63 for use when the cascade method of washing is used. When the cascade operation is carried out, all valves 67 are closed and all water is discharged through opening 63.

The system also embodies a supply pipe 70 having branches 71 with a valve 72 therein for admitting water to each of the wash boxes and also for supplying the poteyes 60 and 62 through branch pipes 64. The poteyes are also supported by a pipe or rod welded thereto at one end and having its other end welded to the sidewall of the wash box. The rate of flow through the poteyes is controlled by a valve 70a in pipe 70. Each of the poteyes 60 and 62 has perforations 74 through which the water is forced against the cloth passing therethrough.

It is to be observed that every third wash box in the machine has its rear wall at the highest elevation and its front curved wall is slightly lower which hooks over the upper edge of the next wash box adjacent the front end; and these wash boxes in batteries of three gradually decrease in height as clearly shown in Figure 4 so that the overflow from the third wash box in each battery of three will flow into the next tub in that group and into the middle tub and into the first tub and out of the overflow pipe 63 in the first tub of that group.

The front uprights 10 and 11, have rotatably mounted in suitable bearings 75, a shaft 76 on which is fixedly mounted a grooved pulley 77. The shaft 76 has fixed thereon a V-pulley 78, having a V-belt 79 thereon, which is also mounted on a V-pulley 80 of a conventional variable speed mechanism 81. The variable speed mechanism 81 has another V-pulley 82 on which is mounted a V-belt 83 which is mounted on a V-pulley 84 fixed on a shaft 85, likewise having a grooved wheel 86 fixed thereon, for feeding the cloth to the second wash box of the series.

The shaft 85, with its grooved wheel 86, is driven by means of a V-belt 90 mounted on V-pulley 91 which extends downwardly and is also mounted on a V-pulley 92 fixed on a shaft 93 which is connected by a suitable coupling 94 to a variable speed motor 95. Motors 95 are supported by a pair of angle brackets 96 welded at one end to strap iron 20 and their outer ends are supported by braces 97.

The uprights 12 and 13 have a bearing block 100 fixedly secured therein and the uprights 14 and 15 have a bearing block 101 therein in which the shaft 93 is rotatably mounted. This shaft 93 has fixedly secured thereon a lower squeeze roll 103. The uprights 12 and 13 also have a vertically adjustable bearing block 105 slidably mounted therein, and the uprights 14 and 15 have a bearing block 106 vertically adjustable therein in which is rotatably mounted a shaft 107 on which is fixedly mounted upper squeeze roll 108. These upper bearing blocks 105 and 106 each has resting on its upper surface a compression spring 110 against which fits the lower enlarged end of a shaft 111 which has a worm gear 112 fixed on their upper ends which form gears 112 mesh with worms 115 fixed on a shaft 116 rotatably mounted in housings 117. And spanning the distance between the uprights 15 and 14 and 12 and 13, respectively. Identical housings 117 having a worm 115 and a worm gear 112 are disposed on both sides of the machine. Each shaft 116 has a hand wheel 118 thereon by means of which the shaft 116 can be turned to increase or lessen the pressure on springs 110 to thereby regulate the amount of squeezing action imparted to the squeeze rolls 108. The shafts 111 may be slidably keyed in a conventional manner in the worm gears and may be threaded in a suitable fixed block, not shown, intermediate their ends to have up-and-down movement to regulate the pressure on the top rolls 108. The nine tubs are operated in groups of three (three groups), and the cascade flow from the third tub in each group is drained out of the first tub of each group; hence, no water flows from group to group.

Each tub has an opening 120 in its bottommost portion which is normally closed by means of a valve 121 fixed on an arm 122 integral with a shaft 123 oscillatably mounted in suitable bearings 124 between the upright members 12 and 13 and 14 and 15, and this shaft 123 has oppositely extending pedals 125 and 126, pedal 125 being depressed by the foot of an operator to lower the valve 121 to close the valve; whereas, when pedal 126 is depressed, it will force the stopper or valve 121 up out of the opening 120 to open the valve and thus drain the tub. Shaft 123 has fixed thereon a friction disk 130 which fits against a friction plate 131 fixed to angle 16. These cause shaft 123 to remain in the position to which it may be moved.

Both of the squeeze rolls 103 and 108 are of the same construction; and in Figure 7 the upper squeeze roll is broken away, it comprising a cylinder 127 having hub portions 128 which are secured to its associated shaft 107 and each of the squeeze rolls has a fixed covering of rubber or other similar material 129.

The uprights 12 and 15 have disposed across the top thereof, and bridging the distance therebetween, a strap iron member 132 on which is disposed a hood 133 having downturned portions 134 and 135 for preventing splashing of the liquid from the fabric as it passes over the reel or grooved pulley 77. This guard or hood is provided to cover all of the grooved pulleys 77 ex-

cept the first one over which the dry cloth passes before going into the first tub.

The electrical diagram for driving and controlling the washer comprises an ordinary three phase alternating current induction motor 150. This motor 150 drives a direct current generator 151. The motor 150 also drives an exciter 152. Generator 151 has a shunt field 153 associated therewith; while exciter 152 also has a shunt field 154a and an exciter field 154 associated therewith. Also a variable resistance 155 is associated with the exciter 152. Leading from the generator 151 are wires 156 and 157. Wire 156 has a branch 157a which leads to one side of a heating element 158. To the other side of heating element 158 is led a wire 160 which leads to a contact point 161. Associated with contact 161 is another contact 162.

Each washer motor 95 has associated therewith a series field 163 and a wire 164 leads from one side of this field to a fixed resistance 165. Branching from wire 164 before it reaches fixed resistance 165 is a branch wire 166 which has a contact point 167 on the end thereof. Leading from an intermediate portion of fixed resistance 165 is a wire 168 which has a contact 170 on the end thereof. Leading from the other side of fixed resistance 165 is a wire 172 which is connected to a wire 173.

Electrically integral with wire 173 are movable switches 174, 175, and 176. These movable switches 174 to 176, inclusive, and switch 177 are connected together by a suitable insulated operating element, shown in dotted lines, which is attracted by a magnet 179 to move the switches 174 to 177 to closed position as will be presently explained.

Contact 162 has connected thereto a wire 180 which has a fixed resistance 181 therein. Connected to the other side of fixed resistance 181 is a wire 182 which leads to the other side of washer motor 95 while a wire 183 leads from the washer motor to one side of series field 163.

Leading from wire 182 is a wire 185 which connects to a wire 186 which leads to one side of a fixed resistance 187. From the other side of fixed resistance 187, a wire 188 is led having branch wires 189 and 191. These wires 189 and 191 are connected to movable switches 192 and 193. Wire 186, before it reaches one side of fixed resistance 187, has a branch wire leading to a fixed contact 196 which cooperates with a movable switch 197 which is connected to wire 157 which leads back to the D.-C. generator.

Master control box into which wire 157 leads is shown in dotted lines as designated by reference character 198. In this control box there is shown movable switches 192 and 193. It is understood that although I show only two washer motors in this diagram, in case there were nine washer motors employed as shown in the drawings, then there would be nine movable switches such as 192 and 193.

Associated with movable switch 192 is a fixed contact 200 which has connected thereto a wire 201. This wire 201 is connected to wire 164 which leads to the number one washer motor 95 and also goes to the interior of number one washer control box indicated in dotted lines and designated by reference character 202. Associated with movable contact 193 is a fixed contact 205 which has a wire 206 connected thereto which wire 206 goes to the second washer motor 95 and also to a second washer motor control box 202a. All the other portions of the second washer control box will have like reference characters

as in the first washer motor control box as it is to be understood that there would be as many washer control boxes as there were washer motors in the complete machine. The parts for motor control box 202a have a prime notation added thereto.

The exciter 152, which has already been described as having a series field 154a and a shunt field 154 and a resistance 155, has a wire 210 leading from one side thereof and the wire 211 leads from the other side and is connected to one side of the series field 154a. From the other side of the series field 154a is led a wire 212. The variable resistance 155 has associated therewith a movable contact 213 which is connected by a wire 214 to wire 210. Regulation of the position of movable contact 213 controls the voltage output of the exciter 152.

Wire 210 has connected thereto a wire 215 which is connected to one side of a solenoid coil 216 of a solenoid switch which actuates movable contacts 217, 218, 219, 220, and 221. Wire 210 also has connected thereto a wire 222 which has connected thereto a wire 223 which leads to one side of a variable resistance 224, which has associated therewith a movable contact 225 which has connected thereto a wire 226 which leads to one side of the shunt field 153 of D. C. generator 151. From the other side of the shunt field 153 of D. C. generator 151, a wire 227 leads to a movable contact 228 associated with a resistance 229. The resistance 229 has connected thereto a wire 230 which is also connected to a variable resistance 231. The wire 230 also is connected to a wire 232 which is connected to wire 212 leading from the exciter.

Resistance 231 has associated therewith a movable contact finger 233 which has a wire 234 connected thereto which leads to one side of variable resistance 224. Wire 222 which is connected to wire 210 and also to wire 223, which has been described, is also connected to a wire 235 which wire has connected thereto a wire 236 which is connected to one side of solenoid 179 which actuates the switches 174 to 177, inclusive. Wire 235 has also connected thereto a wire 237 which leads to a movable contact 238 which is associated with a resistance 239. This resistance has connected thereto a wire 240 which leads to one side of a shunt field 241 associated with each washer motor 95.

From the other side of the shunt field 241 is a wire 242 which is connected to a wire 243 which, in turn, is connected to wire 232 which, as previously described, is connected to wire 212 leading from one side of the exciter. Connected to wire 232 at the junction point where wire 230 is connected thereto, is the wire 244 which has branch wires 245 and 246 connected thereto which have fixed contacts 247 and 248, respectively, connected thereto. The branch wire 246 has connected thereto a wire 250 which leads back to fixed contact 251 which has associated therewith a movable switch 252 which is structurally connected to movable contact 225 so that when movable contact 225 is moved all the way over to the left in the wiring diagram to completely eliminate all of the variable resistance 224, it will cause the movable switch 252 to contact the contact points 251 and contact 253 which has a wire 254 connected thereto which, in turn, is connected to a wire 255 which leads to movable switch 221 in the main control box 198. Wire 255 is connected to a fixed contact 256 which is normally in contact with a movable con-

tact 257 which is a portion of a thermal-operated relay 258'' which is adapted to move away from a fixed resistance or heater 158 when current is passed through resistance 158 to heat the same when an overload occurs on a washer motor 95. When an overload occurs in the washer motor, the thermal-operated relays will move to the right in the wiring diagram, thus, to move the movable contact 257 away from fixed contact 256 to break a circuit between wire 255 and the wire 258 connected to relay 258'' and to movable contact 257. Wire 258 leads to another fixed contact 256' in control box 202*a* for each additional washer motor in the machine; and like reference characters are applied to the mechanism shown in the control box 202*a*. After leaving the last contact point 257 in the last thermal-operated relay associated with the last washer motor in the machine, a wire 259 leads to a movable switch 260 in a push button station box 261. Movable switch 260 is manually operable and can be moved manually to open or closed position. Associated with movable switch 260 is fixed contact 262 which has connected thereto a wire 263 which leads to a contact point 264 of a manually operable push button switch comprising another fixed contact 265 and a movable switch 266. Fixed contact 265 has connected thereto a wire 267 which is connected to fixed contacts 268, 269, and 270. Fixed contact 268 has a companion fixed contact 271; and fixed contact 269 has a companion fixed contact 272; while contact 270 has a companion fixed contact 273. A movable push button switch 275 is adapted normally to contact the contact points 269 and 272 but may be moved manually into contact with fixed contacts 268 and 271. Movable switch 276 is normally out of contact with the contacts 270 and 273 but may be manually moved into contact with these fixed contacts 270 and 273. Fixed contacts 271 and 273 have connected thereto wires 277 and 278 which are connected to wire 279 which returns to the interior of the control box 198 and has a wire 280 connected thereto which is connected to the other side of solenoid 216 to which wire 215 is connected. The wire 279 also leads to fixed contact 281 whose movable switch 219 is actuated along with other movable switches by the solenoid 216 of the solenoid switch for operating a plurality of movable switches in the control box.

Fixed contact 281 cooperates with movable switch 219 previously described. To movable switch 219 is connected a wire 282 which leads to a fixed contact 283 which forms a part of limit switch 35 previously described and which is adapted to be opened when greater than desired tension occurs in the cloth being processed in the machine. There is a limit switch 35 for each tub in the apparatus and they are all connected in series by means of a wire 284 so that when any one of the limit switches 35 is moved to open position by an undesirable increased tension in the cloth in a particular tub, then all of the washer motors will be stopped. From the end limit switch 35 a wire 285 leads to fixed contact 272 in the push button station.

It has already been described as to how wire 235 is connected to solenoid 179 of the solenoid switch which controls the movable contacts 174 to 177, inclusive. To the other side of solenoid 179 is connected a wire 286 which leads to a fixed contact 287 which has cooperating therewith a movable switch 288 which is manually operable. The switch 288 has a wire 289 connected thereto

which is connected to movable switch 218 in the main control box 198. This wire 289 has connected thereto a wire 290 which leads to movable contact 177 in washer control box 202. In the main control box there has already been described a movable switch 217 and this has a wire 291 connected thereto which leads back to movable switch 288*a* in another single pole switch which has associated therewith a fixed contact 287*a* connected to another wire 286*a* which leads back to a magnet 179' in washer control box 202*a* for the second motor of the machine. It is evident that for every additional washer motor in the machine there will be a movable contact 177 added in each of the washer control boxes, there being a washer control box for every one of the motors in the machine. In the main control box 198 there are shown two movable switches 217 and 218 for the two control boxes 202 and 202*a*. In the main control box will be added an additional similar switch and similar wires leading therefrom for each additional washer motor in the machine; and, likewise, for every additional washer motor in the machine there will be added an additional movable switch such as 192 or 193 in the main control box. And, likewise, there will be a limit switch added in series to the two switches shown and designated at 35 for each additional washer box in the machine. Associated with movable switch 177 is a fixed contact 292 which has a wire 293 leading therefrom which is connected to wire 232.

Connected to wire 215 immediately before it reaches solenoid 216 is a wire 295 which has a branch 296 connected thereto which passes through a solenoid 297 of a solenoid switch and wire 298 leads from the other side of solenoid 297 to a fixed contact 299. Associated with fixed contact 299 is movable switch 300 which is actuated by a magnet 301, wire 295 being extended and being connected to one side of magnet 301, and from the other side of the coil a wire 302 is connected to movable switch 220. Wire 302 is also connected to movable switch 300. Movable switches 217 and 218 have associated therewith fixed contacts 305 and 306 to which are connected a wire 307, which wire 307 is connected to wire 244.

In the second motor control box 202*a* like parts have like reference characters with the prime notation added and the same description will apply, except that in box 202*a* wire 290' is connected to wire 286' which in turn is connected to two wires 291 and 289*a* and wire 286*a* is connected to one side of magnet 179'.

Method of operation

In operation, the machine comprising a plurality of tubs, such as nine tubs as shown in the drawings, is threaded up with a length of cloth and each tub contains the proper amount of slack cloth and hot water. Preliminary to starting the machine in operation, movable contact 225 of variable resistance 224 is moved all the way to the left in the wiring diagram which causes switch 252 to contact the contact points 251 and 253 and completely eliminates the resistance 224 from the control circuit. This places the variable resistance in series with the shunt coil 153 of the D. C. generator. This will insure that the machine will start at the minimum speed. It is understood that the motors 95 have not as yet started. All of the manually operated switches 288 and the like are in closed position before the machine is started. This closes the

circuit through the exciter 152 and the magnetic coil 179 back to the single pole switches 288 and the like, switch 218 being out of contact with fixed contact 306.

The machine is now ready to start into operation, and push button switch 276 is manually operated to momentarily close the circuit through contacts 270 and 273 and exciter 152 through switch 252 which is in contact with contacts 251 and 253. The circuit is also established through contacts 256 and 257 which are in contact with each other, the circuit being established through all of the contacts 256 and 257 for each washer box motor control; and the switch 260 will be contacting contact 262 which contacts will be in closed position, and the circuit will also be established through switch 266 which is in contact with contacts 264 and 265; and the circuit will be further established through switch 275 which will be in contact with fixed contacts 273 and 274. The circuit will also be established through magnet 216 in the master control box and back to the exciter 152 causing the moving of movable switches 217, 218, 219, 220, and 221 to closed position. Thus, with movable switch 218 in contact with fixed contact 306, the circuit is completed back to one side of the exciter 152. This energizes coil 179 in the washer box motor control and moves switches 174, 175, and 177 to closed position and, at the same time, moves switch 176 to open position away from its fixed contact 162.

When switch 220 is moved into contact with fixed contact 247, the circuit is completed from one side of the exciter 152 through movable switch 220 through magnetic coil 301, back to the exciter 152, thus energizing magnetic coil 301 which will move switches 192 and 193 to open position and will move switch 300 to closed position, which will complete the circuit through magnetic coil 297 which will energize this coil and move switch 197 to closed position. This completes the power circuit from the D. C. generator 151 through the washer motors 95, through the series field 163 of each of the washer motors to pass current through the closed switches 174, 175, and 176 through the heater element 158 back to the D. C. generator 151. The washer motors 95 then run at minimum speed.

If there is an overload in any one of the washer motors, the heater 158 in the control box for that particular washer motor will become heated which will repel the relay 258'' and its contact 257 away from contact 256 to open the circuit at that point which will serve to stop all of the washer motors in the machine.

When it is desired to start this machine, the length of cloth 61 is first led through the machine and by placing it over the grooved pulleys 77 and 86 and through the poteyes 62 and 60 and beneath the reel spokes 54 and between the squeeze rolls 103 and 108 and the cloth is fed from the machine into subsequent machines for further processing. Before the machine is started, with the cloth threaded therethrough and with the tubs filled with water, the first step is to connect the electrical circuit to the motor generator set comprising A. C. motor 150, D. C. generator 151, and exciter 152. Then, the movable contact arm 225 is moved all the way to the left in the wiring diagram which causes the movable switch 252 to contact fixed contacts 251 and 253 to thus close a circuit between wires 254 and 250. Then, all of the single pole switches 288, there being one for each of the motors 95, are moved to closed position. By the arm 225 being moved all the way to the left in the wiring diagram, it will insure that the washer motors will start at minimum speed. Switch 260 is moved to closed position. Switches 266 and 275 will be in the position shown in the wiring diagram and in this position, switch 276 will be manually moved to closed position. Closing of switch 276 will energize magnetic coil 216 which will move switches 217, 218, 219, 220, and 221 to closed position. The moving of movable switch 220 to closed position will energize magnetic coil 301 which moves switch 300 to closed position and moves switches 192 and 193 to open position. The moving of switch 300 to closed position will energize magnetic coil 297 which will move switch 197 to closed position. The closing of switch 218 will energize magnetic coil 179 which will move switches 177, 174, and 175 to closed position and will move movable switch 176 from contact 162 over against fixed contact 161. Switch 197 being moved against contact 196 will close the power circuit from the D. C. generator 151 through the washer motor control box for each of the motors and through the closed switches already described in the washer control motor boxes to energize each of the washer motors to start each of the motors into operation.

If it is desired to increase the speed simultaneously in all the washer motors 95, then movable contact 225 will be moved to the right in the wiring diagram which will increase the voltage to all of the washer motors 95 and thus increase their revolutions per minute. If it should be found that the cloth in some of the washer boxes is too taut or too loose—that is, having too many folds of cloth deposited therein when it is too loose, or not having enough cloth deposited therein when it is too taut—the particular motor for that washer box can have its speed regulated by the moving of movable contact arm 238 with relation to resistance 239 either to increase or to decrease the speed of that particular washer motor 95.

In the event that the cloth in any tub becomes too taut and the operator should not notice the same and decrease the speed of the motor 95 in that particular box, this tautness in the cloth will move the swingable rod 33 which will open the switch 35 for that particular wash box which will stop all of the motors in the entire machine because all of these switches are in series. The opening of any one of the switches 35 de-energizes the magnet 216 which will disconnect the motor circuit which, in turn, will energize the magnets 301.

When the entire machine has been stopped on account of the cloth in one of the washer boxes becoming too taut, then as a preliminary to restarting the entire machine, the switch 275 would be moved from the closed position shown in the wiring diagram over against contacts 268 and 271 which will be held manually in this position while the machine is running slowly, even with one of the switches 35 open. While the machine is thus running slowly, the motor for the particular washer box which has been stopped on account of its switch 35 being opened, will be slowed down by moving the particular contact arm 238 to the right in the wiring diagram which will decrease the voltage and cause a decrease in the speed of the washer motor 95 for that particular washer box to thus allow an accumulation of cloth in that particular washer box. When the proper amount of cloth has been deposited in each of the washer boxes and the machine is ready for starting in normal opera-

tion, then the switch 275 will be allowed to move back under its normal spring tension to the position shown in the wiring diagram at which time the above-described starting operation will be resumed. When it is desired to stop the entire machine immediately, it is only necessary to momentarily open switch 266 by manual pressure which will automatically and quickly stop all portions of the machine. When the machine is stopped, it is desirable to stop it instantaneously and not let it coast as would occur if the circuits leading to the motor generator set were disconnected. By opening the switch 266, the stopping of the machine is effected quickly on account of the fact that by opening of this switch 266, magnet 301 is energized which allows switches 192 and 193 to move to closed position which short circuits the armature and series field of the washer motors through switches 192 and 193 and resistance 187.

By the use of this machine, the same amount of slack cloth can be maintained in each container at all times by the feed control system, such as the individual rheostat control for each motor. Due to the fact that the same motor which drives the first set of squeeze rolls, also drives the grooved wheel 77 which feeds the cloth into the first tub, a constant or equal speed between the dry cloth being fed into the first tub and the wet cloth being taken away from the first tub can be maintained.

Each of the reels 54 in each of the containers being vertically adjustable, it provides a better control of the cloth through the machine. A machine of this type provides less supervision and labor personnel and, thus, lowers the operating cost of washing cloth and, also, lowers the breakage cost since it is impossible to break the cloth on account of the limit switches. The first spray, or poteye, 62 in the first tub of a series wets the cloth before it enters the first container and, thus, prevents the cloth from floating on the surface of the water in the first container.

In starting this apparatus, the cloth to be washed is tied to a feeder or threader cloth and is threaded through the entire machine with the proper amount of slack in each container; and then, the containers are filled with water and the cloth is started through, and after that, automatic control is exercised over the cloth and the operation of the machine.

The herein described apparatus has many advantages over other types of cloth washing machines heretofore employed. It does a better wash by way of cascade tub arrangement, that is, the water flowing from the last tub of the series into the next adjacent tub and so on until the front tub is reached, where the water overflows. Also, the squeeze rolls being disposed between each of the containers removes soiled water from the cloth before it enters the next container.

It is desirable to use hot water in this system, and thus, a circulating hot water system is provided causing the water to flow from one tub to the other tub, thus saving a great amount of water. It also provides a flexible water-changing system in that water can be admitted to all or part of the tubs, or only to the last tub of a series to allow it to cascade to the front tub of a series before leaving the tubs.

In cloth having a low tensile strength, such as rayon and the like, the cloth can be washed safely due to the limit switches which remove responsibility of cloth breakage from the operator and thereby requires less supervision. In the case that the cloth will not stand squeezing, such as crepe or artificial seersucker and the like, the cloth can be run over the grooved wheels 86 at the top of the machine instead of running it through the squeeze rolls. The squeeze rolls, or nip rolls, 103 and 108 are covered with soft rubber and therefore will not harm the cloth being passed therethrough; and, as pointed out, they are adjustable as to pressure between them for different types and weights of fabric being passed therebetween.

In the drawings and specification there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only, and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. Apparatus for washing fabrics comprising a plurality of containers arranged in a row and joined together and having front and rear walls, with the upper portion of the front wall of one container being joined to the upper portion of the rear wall of the next succeeding container, the rear wall of each container being at a higher elevation than the front wall thereof whereby when water is admitted to the last container in a series and the last container in the series is filled with water, it will overflow into the next adjacent container and from the next adjacent container to the container adjacent to the next adjacent container, means for feeding a piece of fabric into the first container, means for wetting the fabric as it enters the first container, means for spraying water onto the fabric as it emerges from one container and is fed into the next container, and means for feeding the fabric from one container into the next container and squeezing excess water from the fabric after it leaves one container and before it enters the next container.

2. Apparatus for washing cloth comprising a plurality of containers arranged in a row and means for feeding a fabric into the first container in the row, means for withdrawing the fabric from one container and squeezing excess liquid therefrom and depositing it in the next adjacent container, means disposed in the bottom of each container under which the fabric is passed to insure its immersion in the liquid within the container, each container having means for feeding liquid thereto and overflow means for allowing surplus liquid to flow from one container into the next container, means associated with each container for stopping the driving means for the withdrawing means when the fabric becomes too taut in any one of the containers, and variable speed motors for driving each of the means for withdrawing the fabric from one container and feeding it into the other container.

3. A cloth washing machine comprising a plurality of containers arranged in end-to-end relation, each container having a reel therein beneath which a length of cloth is adapted to be passed, means for feeding the cloth into the first container, means for wetting the cloth as it enters the first container, means for applying water to the cloth as it emerges from each container, a pair of squeeze rolls disposed between one container and the next adjacent container and through which the cloth is passed to remove excess water therefrom, a motor for driving each set of squeeze rolls, the cloth being adapted to have a plurality of folds disposed in each container at all times, and means for admitting water

to the last of a series of containers, the proximate walls of adjacent containers being joined together to allow the water to flow from the first container into the second container and so on throughout the series, the height of the front walls of each container diminishing from rear to front of the machine to permit water to flow from one container into the next adjacent container until it reaches the front of the machine, the front container having an overflow pipe to allow surplus water to flow out of the first container in the machine.

4. A cloth washing machine comprising a plurality of containers arranged in end-to-end relation, each container having a reel therein beneath which a length of cloth is adapted to be passed, means for feeding the cloth into the first container, means for wetting the cloth as it enters the first container, means for applying water to the cloth as it emerges from each container, a pair of squeeze rolls disposed between one container and the next adjacent container and through which the cloth is passed to remove excess water therefrom, a motor for driving each set of squeeze rolls, the cloth being adapted to have a plurality of folds disposed in each container at all times, and means for admitting water to the last of a series of containers, the proximate walls of adjacent containers being joined together to allow the water to flow from the last container into the second container and so on throughout the series, the height of the front walls of each container diminishing from rear to front of the machine to permit water to flow from one container into the next adjacent container until it reaches the front of the machine, the front container having an overflow pipe to allow surplus water to flow out of the first container in the machine.

5. Apparatus for washing cloth comprising a plurality of containers arranged in end-to-end relation, the adjacent walls of the containers being secured to each other, the adjacent walls of the containers progressively rising in height from front to rear of the machine, means for feeding a length of cloth into the first container, means for wetting the cloth as it enters the first container, means for submerging the cloth in each container, a pair of squeeze rolls disposed between the rear portion of one container and the front portion of the next succeeding container through which the cloth is adapted to be passed from one container to the other, a motor for each set of squeeze rolls for driving the squeeze rolls, and means for spraying water onto the cloth as it leaves one container and before it passes through the squeeze rolls into the next container.

6. Apparatus for washing cloth comprising a plurality of containers arranged in end-to-end relation, the adjacent walls of the containers being secured to each other, the adjacent walls of the containers progressively rising in height from front to rear of the machine, means for feeding a length of cloth into the first container, means for wetting the cloth as it enters the first container, means for submerging the cloth in each container, a pair of squeeze rolls disposed between the rear portion of one container and the front portion of the next succeeding container through which the cloth is adapted to be passed from one container to the other, a motor for driving each set of squeeze rolls, means for spraying water onto the cloth as it leaves one container and before it passes through the squeeze rolls into the next container, each of the containers having means for admitting water thereinto, the first container having an overflow pipe disposed at a lower elevation than its front edge, and means for cutting off the supply of incoming water to all of the containers except the last container in a series, whereby when the last container in a series is filled, it will overflow to the next adjacent container until all containers are filled with water and the surplus will flow out of the second-named overflow pipe in the first container.

7. In a machine for washing a length of cloth comprising a plurality of tubs arranged in end-to-end relation, means for feeding cloth into one end of the first tub, a pair of squeeze rolls disposed between each pair of adjacent tubs and through which the cloth is passed when leaving one tub and entering the next tub, variable speed means for driving all of the squeeze rolls, there being a driving means for each pair of squeeze rolls, means for starting all of the variable speed means for driving all of the squeeze rolls at minimum speed, means for causing all of the variable speed means for driving all of the squeeze rolls to run at normal speed, means for stopping all of the driving means for the squeeze rolls when any one of the same becomes overloaded, means for simultaneously stopping all of the squeeze rolls, and means for applying a retarding action to the driving means for all of the squeeze rolls to stop the same quickly.

8. Apparatus for washing a length of cloth comprising a plurality of tubs arranged end-to-end, a pair of squeeze rolls disposed between each pair of adjacent tubs, a variable speed electric motor for driving each set of squeeze rolls, means for automatically stopping all of the motors when the cloth becomes too taut in any one of the tubs, means for driving all of the squeeze rolls at minimum speed when first starting the machine, means for varying the speed of each motor for each set of squeeze rolls, means for automatically stopping all of the motors for driving the squeeze rolls when any one of the motors becomes overloaded, and means for short circuiting the motors when they are stopped to prevent coasting of the motors.

9. Apparatus for washing a length of cloth comprising a plurality of tubs arranged end-to-end and increasing in height as they progress through the machine, means for feeding water to the last tub in a series and allowing it to overflow from one tub into the other until it reaches the first tub in the machine, means allowing overflow of surplus water from the first tub in the machine, means for spraying water onto the cloth as it enters the first tub, means for spraying water onto the cloth as it leaves each tub to wash soiled water therefrom, and a pair of squeeze rolls disposed between each pair of adjacent tubs.

10. A cloth washing machine comprising a plurality of containers arranged in end-to-end relation, each container having a reel therein beneath which a length of cloth is adapted to be passed, means for feeding the cloth into the first container, means for wetting the cloth as it enters the first conainer, means for applying water to the cloth as it emerges from each container, a pair of squeeze rolls disposed between one container and the next adjacent container and through which the cloth is passed to remove excess water therefrom, a motor for driving each set of squeeze rolls, the cloth having a plurality of folds disposed in each container at all times, and means for admitting water to the last of a

series of containers, the proximate walls of adjacent containers being joined together to allow the water to flow from the one container into the next container and so on throughout the series, the height of the front walls of each container diminishing from rear to front of the machine to permit water to flow from one container into the next adjacent container until it reaches the front of the machine, the front container having an overflow pipe to allow surplus water to flow out of the first container in the machine.

11. A cloth washing machine comprising a plurality of containers arranged in end-to-end relation, each container having a reel therein beneath which a length of cloth is adapted to be passed, means for feeding the cloth into the first container, means for wetting the cloth as it enters the first container, means for applying water to the cloth as it emerges from each container, a pair of squeeze rolls disposed between one container and the next adjacent container and through which the cloth is passed to remove excess water therefrom, a motor for driving each set of squeeze rolls, the cloth having a plurality of folds disposed in each container at all times, and means for admitting water to the last of a series of containers, the proximate walls of adjacent containers being joined together to allow the water to flow from the first container into the second container and so on throughout the series, the height of the front walls of each container diminishing from rear to front of the machine to permit water to flow from one container into the next adjacent container until it reaches the front of the machine, the front container having an overflow pipe to allow surplus water to flow out of the first container in the machine.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
107,686	Hudson	Sept. 27, 1870
1,259,526	Knibiehler et al.	Mar. 19, 1918
1,348,943	Hallock	Aug. 10, 1920
1,653,451	De Ybarrondo	Dec. 20, 1927
1,696,386	Corey	Dec. 25, 1928
1,817,797	Baker	Aug. 4, 1931
1,894,694	Knutsen	Jan. 17, 1933
2,084,189	Bulford	June 15, 1937
2,276,605	Andrews	Mar. 17, 1942
2,422,651	Ayers	June 24, 1947