Jan. 12, 1965 W. C. FILES 3,165,226

OPERATING MEANS FOR TUB DOOR

Filed Oct. 8, 1962 4 Sheets-Sheet 1

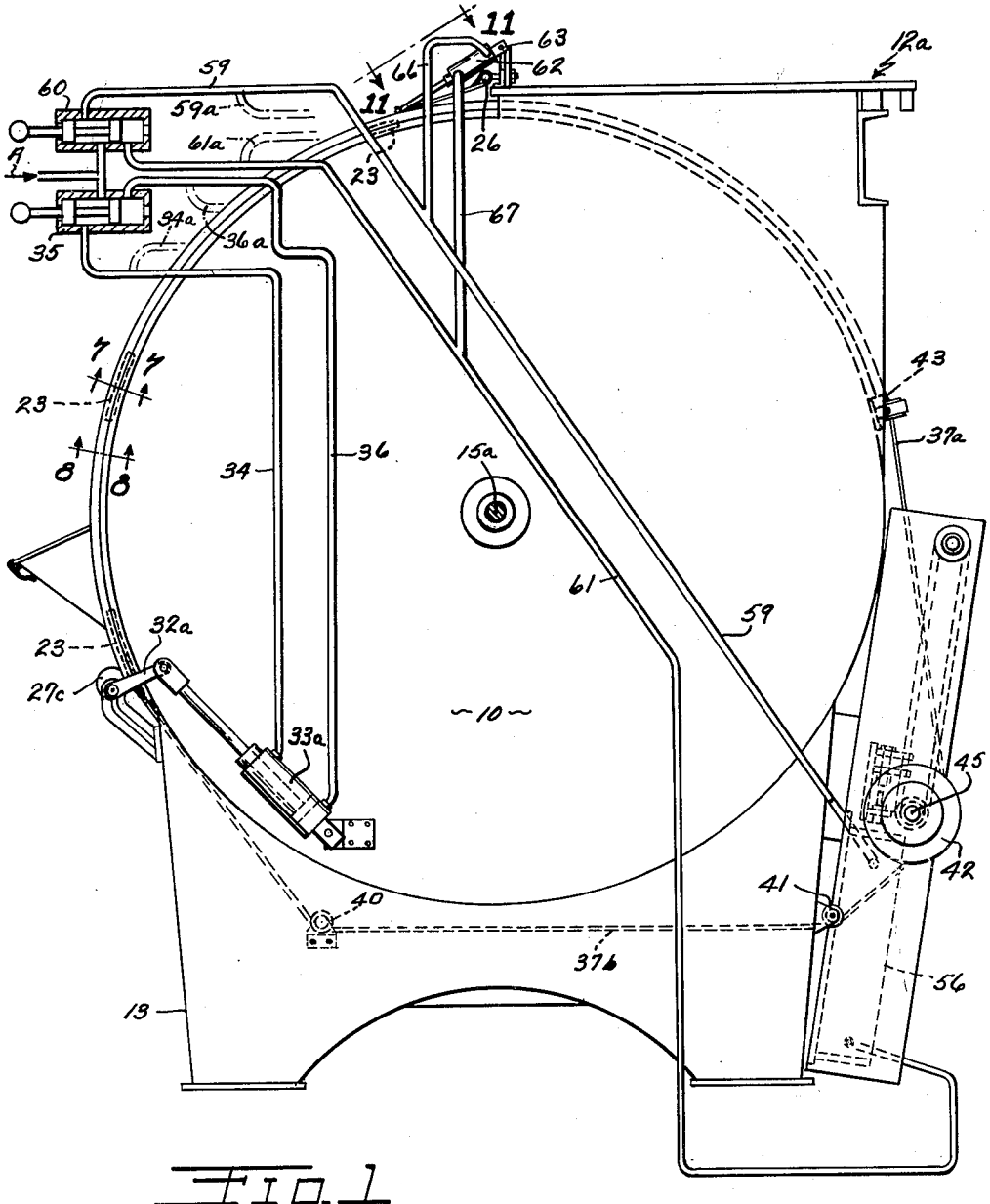


FIG. 1

INVENTOR.
WILLIAM C. FILES
BY
Meyer, Baldwin, Doran & Egan
ATTORNEYS

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Filed Oct. 8, 1962 4 Sheets-Sheet 2

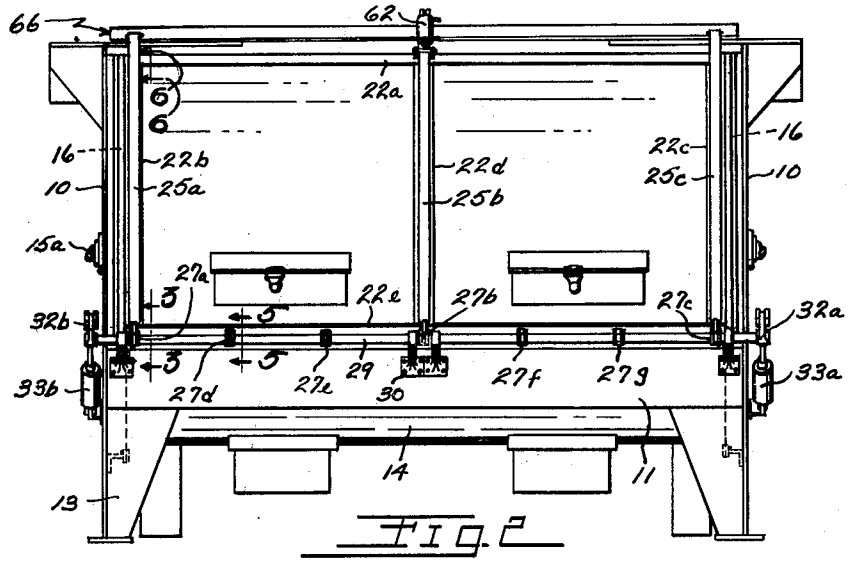


FIG. 2

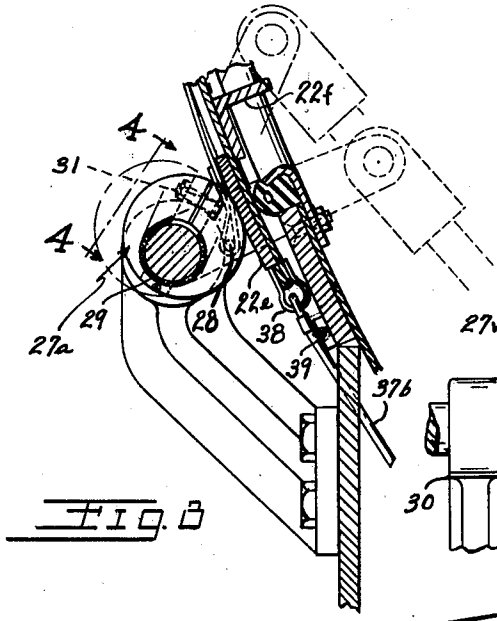


FIG. 3

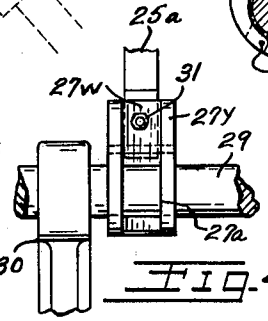


FIG. 4

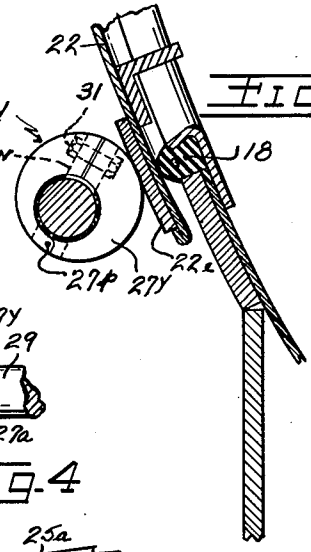


FIG. 5

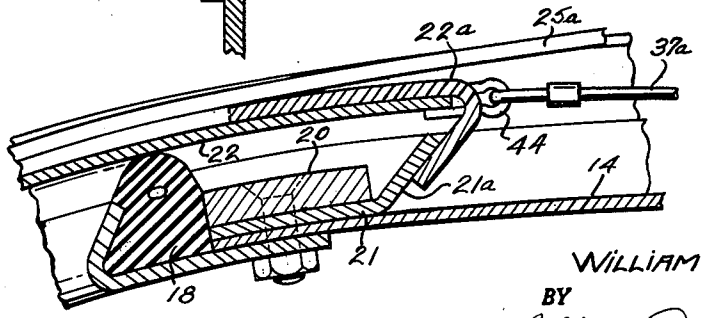


FIG. 6

INVENTOR.
WILLIAM C. FILES
BY
Myers, Baldwin, Doran & Egan
ATTORNEYS

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OPERATING MEANS FOR TUB DOOR

Filed Oct. 8, 1962 4 Sheets-Sheet 3

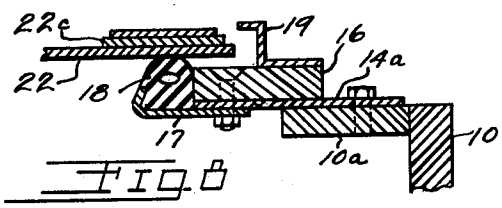


FIG. 8

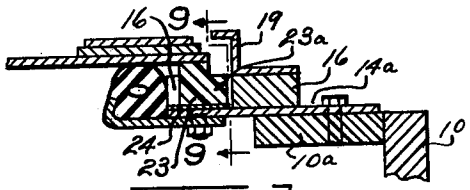


FIG. 7

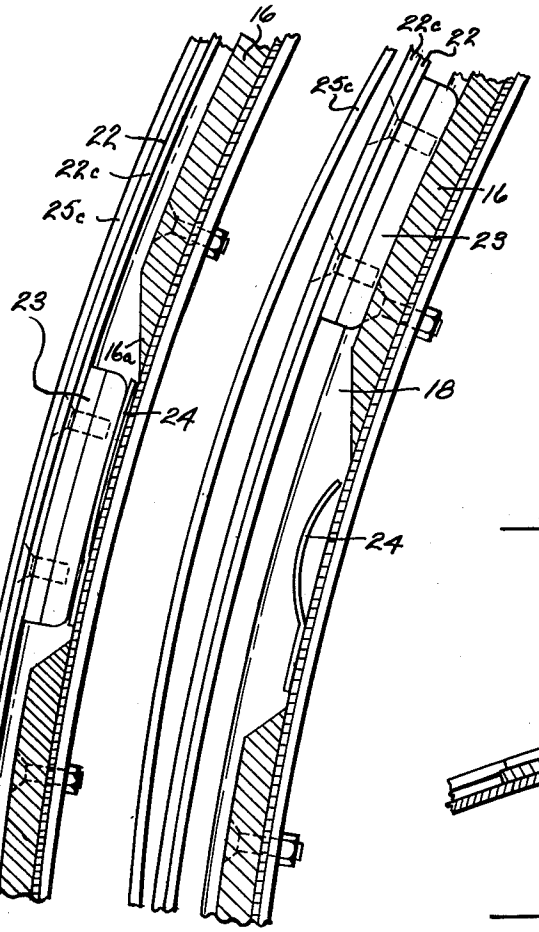


FIG. 9

FIG. 10

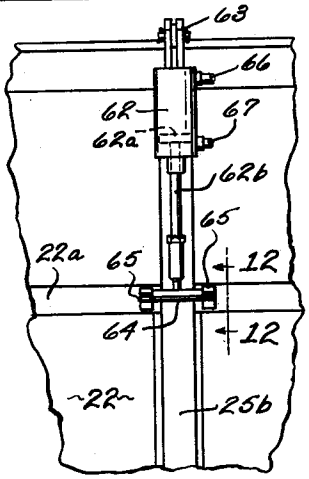


FIG. 11

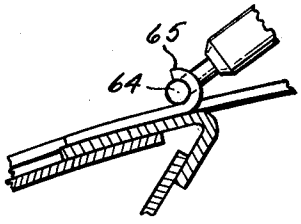


FIG. 12

INVENTOR.
WILLIAM C. FILES

BY
Meyer, Baldwin, Doran & Egan
ATTORNEYS

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OPERATING MEANS FOR TUB DOOR

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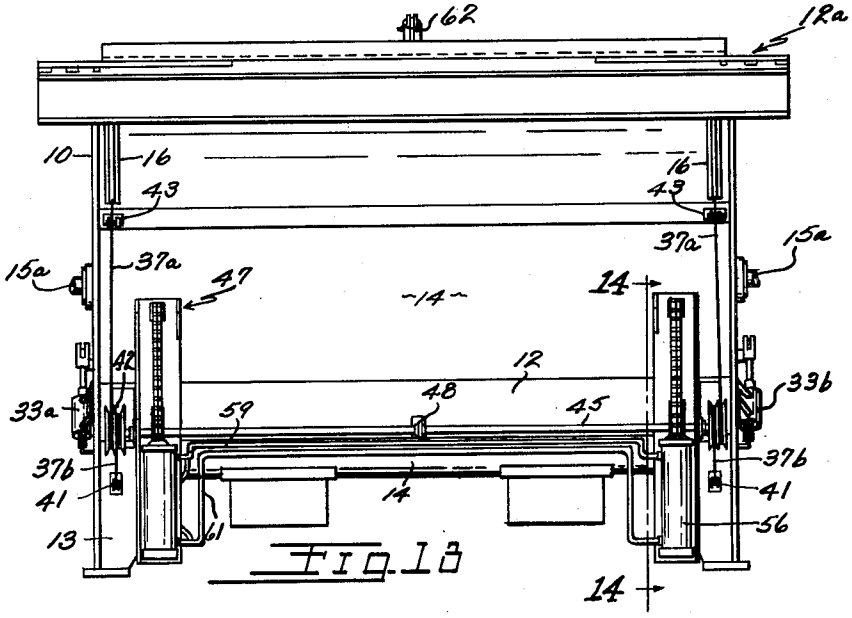


Fig. 13

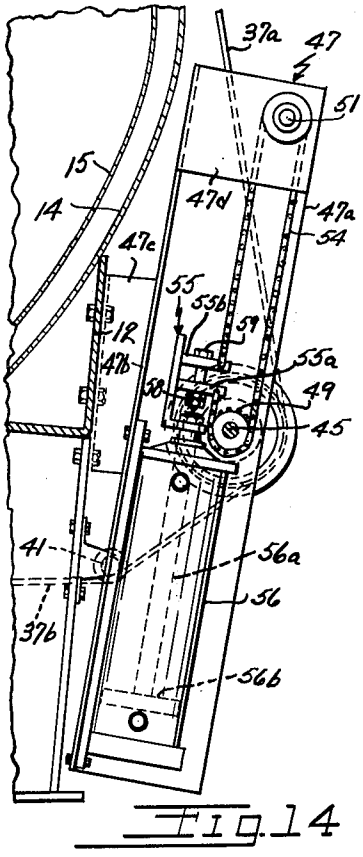


Fig. 14

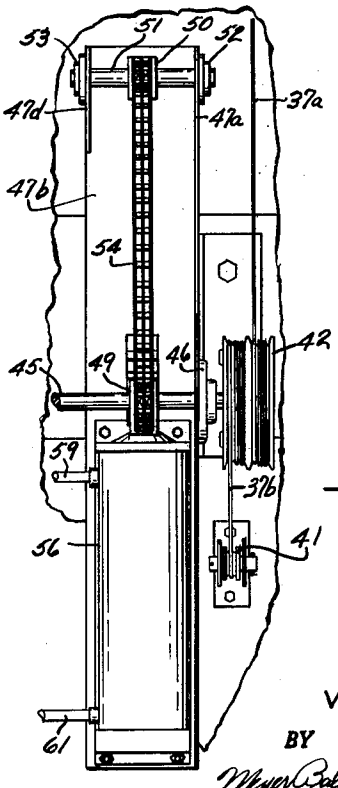


Fig. 15

INVENTOR.
WILLIAM C. FILES
BY
Meyer, Baldwin, Doran & Egan
ATTORNEYS

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3,165,226

OPERATING MEANS FOR TUB DOOR

William C. Files, Cincinnati, Ohio, assignor to McGraw-Edison Company, Elgin, Ill., a corporation of Delaware

Filed Oct. 8, 1962, Ser. No. 229,113
14 Claims. (Cl. 220—41)

This invention relates to novel and improved door mounting and door operating means for a cylindrical washer of the type wherein a work holding cylinder is rotatably mounted within a fixed tub, and wherein the tub in turn holds the usual working liquids for the washing cycle such as detergent, rinse water, and the like.

In such apparatus the work-holding cylinder is necessarily provided with a door for each of its compartments, and at the time of work loading and unloading these cylinder doors are successively brought to registry with the tub door. The tub door should be large enough and low enough to facilitate loading and unloading.

The long commercial cylindrical washer presents several problems with respect to operation and sealing of the tub door. The opening is, or should be, of adequate circumferential size, and should extend substantially the full length of the tub. The bottom edge of the door opening is customarily below the center line of the cylinder and as a result leakage is especially troublesome along this edge. When the door is of the one-piece sliding type it is quite massive and its weight and size add additional operating and sealing problems.

An object of the present invention is to provide novel and improved operating means for a tub door which effectively seals the bottom and side edges against escape of liquid.

A further object is to provide simple and convenient door opening means for a one-piece circumferentially sliding door which adequately overcomes the inertia encountered in raising the door to open position.

Other objects and advantages will be apparent from a study of the following description of one embodiment of the invention, in conjunction with the accompanying drawings, in which:

FIG. 1 is a right-hand elevational view of a washer, with the air-operated hookup for the door-operating means shown diagrammatically thereon, the several parts being in the position wherein the washer door is closed and sealed.

FIG. 2 is a front elevational view of the washer.

FIG. 3 is a sectional view, somewhat enlarged, taken on the line 3—3 of FIG. 2.

FIG. 4 is a front elevational view of the cam shown in FIG. 3 and somewhat enlarged, as seen from the direction 4—4 in FIGURE 3.

FIG. 5 is a sectional view taken on line 5—5 of FIG. 2 and somewhat enlarged.

FIG. 6 is a sectional view taken on line 6—6 of FIG. 2, also somewhat enlarged.

FIG. 7 is a sectional view taken on line 7—7 of FIG. 1 and somewhat enlarged.

FIG. 8 is a sectional view taken on line 8—8 of FIG. 1, and somewhat enlarged.

FIG. 9 is a sectional view taken on line 9—9 of FIG. 7.

FIG. 10 is a view similar to FIG. 9, but with parts in different positions, the door being started towards its open position.

FIG. 11 is a fragmentary view looking in the direction 11—11 on FIG. 1.

FIG. 12 is a sectional view taken on line 12—12 of FIG. 11.

FIG. 13 is a rear elevational view of the washer.

FIG. 14 is a view looking in the direction 14—14 of FIG. 13 and somewhat enlarged.

FIG. 15 is a straight-on view from the rear, of the unit shown in FIG. 14.

The main structure of the washer is shown, minus the cylinder drive equipment, end guard housings, and the other usual parts which are well-known in the art and can be of any suitable type. The tub 14 is supported by end heads 10, along with the respective front and back cross frame parts 11 and 12, and legs 13. Upper cross bracing and support structure, between extensions of the end heads, is indicated generally by 12*a*, FIGS. 1 and 13. Within the tub is a cylinder 15, FIG. 14, journalled in the tub end heads for rotation by means of shafts 15*a*.

The tube sheet or wall 14 extends around the back, bottom and top, FIGS. 2 and 13, terminating at the front somewhat below the centerline of the machine, as seen in FIGS. 2 and 3, and, at the top, a short distance forward of the vertical centerline, as seen in FIGS. 1 and 6. Along each of the two side edges of the door opening there is a circumferentially curved strip of the wall, 14*a*, supported on the flange part 10*a* of the end heads. Secured along each edge is a bracing and trick bar 16, and a member 17 holding a rubber gasket 18, FIG. 8. The gasket rectangularly surrounds the tub opening, the sectional views 5 and 6 showing it at the bottom and top respectively. Along the sides, a guide piece 19 is secured to the track 16. At the top, FIG. 6, is a reinforcing bar 20 and a strip 21 having an upwardly inclined edge portion 21*a*. Said edge portion engages an inclined portion of a reinforcing strip 22*a* along the top of the door 22 when the latter is in closed position. The door also has reinforcing strips 22*b*, 22*c* along the respective left and right side edges, 22*d* down the middle, and 22*e* along the bottom, FIG. 3. Near the bottom, on the inside, there is a reinforcing angle member 22*f*, which serves as an abutment for the door in fully open position.

Secured to the underside of the door along the two side edges are riders or slide buttons 23, FIGS. 7, 9 and 10, which may be made from a material of relatively low frictional characteristics such as some of the organic plastics, spaced as indicated on FIG. 1, near the bottom, top, and somewhat below the middle. These are L-shaped in cross section, as seen in FIG. 7, the bottom part 23*a* extending beyond the door edge. The track bar 16 has cutouts at the three positions, corresponding to the positions of the riders when the door is in closed position, FIG. 1. The track bar at these points is milled out for about half its width, FIG. 7, and to the length shown in FIG. 9, with the ends of the cutouts inclined as shown. When the door is in closed position, the rider buttons have dropped into these depressions of cutouts, and the door engages the rubber gaskets and can be pressed into tight engagement therewith, as shown in FIGS. 7, 8, 9, by means to be later described. When the door begins its opening movement, the buttons 23 ride up the inclined ends 16*a* of the track bars, and sliding engagement to open position takes place with the buttons riding on the track bars. In this position, FIG. 10, the sealing bands are loose, and the door is up, clear of the gasket. The spacing of the cutouts is uneven, FIG. 1, that is to say the intermediate one is not equi-distant between the top and bottom cutouts. If it were, the bottom and middle riders would drop into the middle and upper cutouts during the opening sliding of the door. By having the spacing unequal, two of the riders are always on the track while the door is opening, or fully open, and the other one cannot drop into a cutout. A leaf spring 24 at the bottom of each cutout assists somewhat, in ejector fashion, in relieving the weight of the door when the latter is unsealed by the initial opening movement. When the door is sliding with the riders 23 on the track, the laterally

protruding section 23*a* (FIG. 7) of the riders will be in proximity to the guide or retainer 19.

The means for pulling the door down radially for sealing are the somewhat flexible straps or bands 25*a*, 25*b*, 25*c*, at respectively the left, middle, and right of the door as shown, in FIG. 2. They are pulled down into tight engagement with the door on top of the door reinforcing strips, see 22*c* in FIG. 9. At the top end these bands are secured at 26 to a cross member of the washer frame, FIG. 1. At the lower end, each band is connected to and within respective cam members 27*a*, 27*b*, or 27*c* by a pin 28 (FIG. 3) this structure acting like a crank, so that when the member 27 is turned clockwise to the sealing position, it pulls the band tight, effecting a sealing engagement of the door, particularly the side edges, with the gasket, as previously noted. Midway longitudinally of the tub door opening there can be an arcuate bar (not shown) providing an underlying support upon which the central part of the door can be clamped by band 25*b* to give solidity.

The cams 27*a*, 27*b*, 27*c* are spaced along a shaft 29, supported in four bracket bearings 30 on a front frame plate. Also spaced on the shaft are four more cams 27*d*, 27*e*, 27*f*, 27*g*, similar to the preceding except that they are not connected to bands. The purpose of the cams is to exert pressure against the reinforcing strip 22*e* along the door bottom, thereby pressing the door into sealing engagement with the rubber gasket. The cam is preferably of split construction, hinged at one side, as by pin 27*p*, and having a web portion 27*w* in each half, through which fits a bolt 31. The circular end portions 27*y* of each half have a rough or serrated surface in the hole that fits over shaft 29, to afford a firm grip when clamped by the bolt. The cams can thus be initially and periodically adjusted individually on the shaft to compensate for any irregularity in the door, and equalize the tension to adjust the pull on the bands, etc. The camshaft at each end has connected thereto a lever 32*a*, 32*b*, and to each lever is pivotally connected the piston rod of an air cylinder motor 33*a*, 33*b*, supported on the respective end heads 10. Each motor is double-acting, and in FIG. 1 motor 33*a* is shown in the door-sealing position, the air going into the top of the cylinder by way of pipe 34 from manually operatable slide valve 35. To unseal the door, the valve is shifted inward, admitting air from source A through valve to pipe 36, and thence to the bottom of the cylinder. The broken-line pipes 34*a*, 36*a* shown in FIG. 1 as branching off of 34 and 36 indicate the connections to the left end motor.

The door opening and closing means are the same at each end of the washer being, so to speak, mirror images of each other, and the one at the right rear (FIG. 13) will be described, the same reference numbers being shown on each to avoid confusion. Cable portions 37*a*, 37*b* are connected respectively to the top and bottom of the door near each side edge and serve to move the door back and forth between its open and closed positions. Cable 37*b* is secured to the door bottom by any suitable means, such as the looped clip or eye hook 38, FIG. 3, and runs over small roller pulley 39, then pulleys 40, 41, under the tub, FIG. 1, and finally is wrapped a number of turns around a drum or hub 42. Cable 37*a* is likewise wrapped several times around the drum and then runs up over a small roller pulley 43 adjacent to the rear end of the door track 16, and then rides on the track, connecting to the upper edge of the door at eye hook 44, FIG. 6. The drum ends of cable portions 37*a* and 37*b* are rolled on the drum in such manner that when the cable 37*a* winds onto the drum, the cable 37*b* unwinds, and vice versa. In effect, 37*a* and 37*b* act as would one cable.

As seen in FIGS. 1, 14 and 15, the double-tracked drum 42 is secured to shaft 45. This shaft is journalled at 46 in the out-turned part 47*a* of a supporting frame or bracket 47, and extends across the left and right side of the tub and cylinder units, going through a supporting bearing 48 on the frame, as shown in FIG. 13. Operation of the door for the two units is thereby caused to proceed evenly by reason of simultaneous even traction at its two ends. The support frame 47 is mounted by an angle bracket 47*c*, FIG. 14, to the rear cross frame member 12 of the machine.

For operating the cable a sprocket 49 is secured on shaft 45, FIGS. 14 and 15, and an idler sprocket 50 is carried on a shaft 51 which is journalled at 52, 53 in out-turned carrier bracket parts 47*a* and 47*d*. A chain 54 extends around the two sprockets and is connected at its ends to a member 55 carried by the end of the piston rod 56*a* of an air cylinder 56, the latter being mounted on portion 47*b* of the carrier or frame. Member 55 constitutes adjustable connecting means comprising a main L-shaped part, secured by a nut to the outer end of the piston rod 56*a*, said main part having an integral leg 55*a*, and a leg 55*b* adjustably movable up and down with respect to the main part. As seen in FIG. 14, the two ends of the chain are connected to these legs. A bolt 57 extends through the two legs and, with nuts 58, allows the upper leg to be correctly positioned, so that the chain ends are held as shown, this being the same as a continuation chain, but permitting adjustment to remove undue slack. Leg 55*b* is therefore an independent and removable piece, but it has a flat side in contact with the main member 55 to prevent rocking or turning. The bolt should preferably fit snugly through parts 55*a*, 55*b* to keep 55*b* straight. Any equivalent slack-takeup arrangement could be used.

Motor 56 is double-acting, and is shown with the piston 56*b* retracted, air going to the top of the cylinder by way of pipe 59 from slide valve 60, FIG. 1 This has turned the cable drum counterclockwise, FIG. 14, the cables thereby sliding the door to closed position. Shifting of the valve to its other position will, of course, reverse the air flow, which then will go through pipe 61 to the bottom of the cylinder to effect upward sliding movement of the door to open position. The valve will, operate both the left and the right end motors, by reason of the cross-connecting pipes 59*a*, 61*a*, in the back view, FIG. 13. There is a digrammatic broken-line indication of this at the upper left of FIG. 1.

After the tub door has been unsealed by appropriate rotation of shaft 29, a considerable initial force is required to start the door on its upward opening movement since the pull at first is against inertia, gravity, the friction of the door on the gasket, and the climbing of the rider buttons 23 up the inclined end of the track cutout section. I therefore, provide a small auxiliary air cylinder motor 62, FIG. 11. This is pivotally mounted centrally of the tub length at 63 on a cross member of the upper machine frame. At the end of piston rod 62*b* is a T-shape traction member or cross head 64, engageable at its respective ends in a pair of hooks 65 secured to the top reinforcing strip 22*a* on the door, one end on each side of the band 25*b*. It will be noticed that air is connected to the top of the cylinder when the door is closed, coming by way of branch pipe 66 from pipe 59, the piston 62*a* and traction member 64 being, therefore, in forward, extended position. When the door seal is released by operation of valve 35 and motors 33*a* and 33*b*, and the valve 60 is operated to admit air through pipe 61 to the bottom of motor 56 to open the door, air goes at the same time through branch pipe 67 to the front end of cylinder 62, providing the auxiliary short pull for assisting in starting the door in its upward opening movement. The rearwardly open hooks 65, of course, thereafter move away from traction member 65. When the valve 60 is later operated to close the door, the traction member immediately is extended, sliding on band 25*b*, whereby to be again engaged by door hooks 65 when the door reaches closed position.

One of the novel and advantageous features of the door operating means herein disclosed is what I may call the movement amplifying effect of the power-applying means for door operation. The relatively short stroke of piston rod **56***a* of the motor **56**, acting through sprocket chain **54**, sprocket **49**, shaft **45**, and drum **42**, causes sufficient movement of the cable parts **37***a* and **37***b* to move the door between open and closed positions, the amplification being due to the fact that the drum is of greater diameter than the sprocket. The actual and relative sizes of the various parts will, of course, be such as to provide whatever movement is required.

What is claimed is:

1. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open positions, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being attached to the lower edge of said door, intermediate portions of said cable means being wound around a rotatable hub whereby, upon rotation of said hub in one direction said door is slid to open position, and upon subsequent rotation of said hub in the opposite direction said door is slid to closed positon, and means for maintaining said door in leak proof engagement with said housing when said door is in closed position.

2. A machine as defined in claim 1 including, in combination therewith raised segmental track means extending along each of the two circumferential side edges of said door opening, each said track means having recessed depressions therein at more than two circumferentially spaced points, said door having along each segmental side edge more than two projections, said projections being unequally spaced along a side edge, and said depressions being identically unequally spaced but registrable with said projections at one position only, said position being the closed door position.

3. A machine as defined in claim 2 wherein resilient sealing means is provided around the peripheral edge of said door opening, and wherein said door engages and compresses said sealing means when said projections drop into said depressions as aforesaid.

4. Apparatus as defined in claim 2 including, in combination therewith ejector spring means to assist in initial movement of the door away from sealed position.

5. Apparatus as defined in claim 1 wherein said means for maintaining said door in leak proof engagement with the housing includes flexible strip means overlying said door at a plurality of laterally spaced positions, said strips being fixed near one horizontal edge of said door opening, and being attached to rotatable means on a shaft near the opposite horizontal edge of said door opening, and, in combination therewith a plurality of cams carried on the same shaft on said housing and abuttable against the lower horizontal edge of said door, whereby rotation of said shaft simultaneously pulls said strips taut, and rotates said cams.

6. Apparatus as defined in claim 5 wherein said rotatable means which holds the ends of said strips are also of cam contour.

7. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open positions, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being attached to the lower edge of said door, and driving linkage including a power motor, a sprocket rotatable a relatively limited amount responsive to temporary actuation of said motor, a drum, said drum and said sprocket being each fixed on the same shaft whereby rotation of said sprocket is accompanied by rotation of said drum, said drum being of larger diameter than said sprocket, intermediate portions of said cable means being wound around the periphery of said drum whereby, upon rotation of said drum in one direction, said door is slid to open position, and upon subsequent rotation of said drum in the opposite direction said door is slid to closed position, whereby sprocket rotation is linearly multiplied in cable movement, and means for maintaining said door in leak proof engagement with said housing when said door is in closed position.

8. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open positions, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being attached to the lower edge of said door, and driving linkage including a power cylinder, a piston in said cylinder and a connecting rod movable linearly responsive to piston movement, a link chain, a sprocket engaging said link chain, means operatively engaging said connecting rod and said link chain whereby movement of said connecting rod moves said link chain and rotates said sprocket, a drum having a larger diameter than said sprocket, said drum and said sprocket being fixed on a common shaft whereby to rotate together, intermediate portions of said cable means being wound around the periphery of said drum whereby, upon rotation of said drum in one direction, said door is slid to open position, and upon subsequent rotation of said drum in the opposite direction said door is slid to closed position, the diametric relationship of sad sprocket and said drum achieving a linearly multiplied cable movement and door movement as compared to link chain movement so as to permit use of a relatively short stroke piston and connecting rod.

9. Apparatus as defined in claim 8 wherein said means operatively engaging said connecting rod and said link chain is adjustable to take up slack in the driving linkage.

10. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open position, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being attached to the lower edge of said door, and driving linkage including a power cylinder, a piston in said cylinder, a connecting rod extending from said cylinder and movable linearly responsive to piston movement, a link chain, means operatively engaging said connecting rod and said link chain whereby movement of said connecting rod produces movement of said link chain, a rotatable shaft, cable-receiving means on said shaft adapted to receive a part of said cable in encircling relationship whereby rotation of said shaft winds said cable and moves said door, a sprocket on said shaft engaged by said link chain whereby, upon activation of said motor and movement of said connect-

ing rod said link chain is moved, said sprocket is rotated, said shaft is likewise rotated and also said cable-receiving means to appropriately apply door-moving force to said door.

11. Apparatus as defined in claim 10 including adjustable means in the engagement of said connecting rod with said link chain.

12. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open positions, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being attached to the lower edge of said door, intermediate portions of said cable means being wound around a rotatable hub whereby, upon rotation of said hub in one direction said door is slid to open position, and upon subsequent rotation of said hub in the opposite direction said door is slid to closed position, auxiliary means for applying initial door-opening force to overcome initial resistance of the door to opening movement, and means for maintaining said door in leak proof engagement with said housing when said door is in closed position.

13. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open positions, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being

attached to the lower edge of said door, intermediate portions of said cable means being wound around a rotatable hub whereby, upon rotation of said hub in one direction said door is slid to open position, and upon subsequent rotation of said hub in the opposite direction said door is slid to closed position, auxiliary means for applying initial door-opening force to overcome initial resistance of the door to opening movement, power means for simultaneously energizing the said door operating means and the said auxiliary means, and means for maintaining said door in leak proof engagement with said housing when said door is in closed position.

14. In a machine of the character described wherein a generally cylindrical housing is provided with a door opening extending circumferentially partially therearound and across a portion of the width of said housing, and wherein a one-piece door is provided to slidably move around the housing surface between closed and open positions, operating means for said door including cable means having an intermediate portion extending circumferentially around and outside said housing, one end of said cable means being attached to the upper edge of said door and the other end of said cable means being attached to the lower edge of said door, intermediate portions of said cable means being wound around a rotatable hub whereby, upon rotation of said hub in one direction said door is slid to open position, and upon subsequent rotation of said hub in the opposite direction said door is slid to closed position, means for maintaining said door in leak proof engagement with said housing when said door is in closed position, including means for applying sealing pressure to the side edges of said door when the door has been moved to closed position.

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