May 20, 1969 C. E. KURTZ 3,444,709

HYDRAULIC TRANSMISSION FOR FABRIC-TREATING MACHINES

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Fig. 1

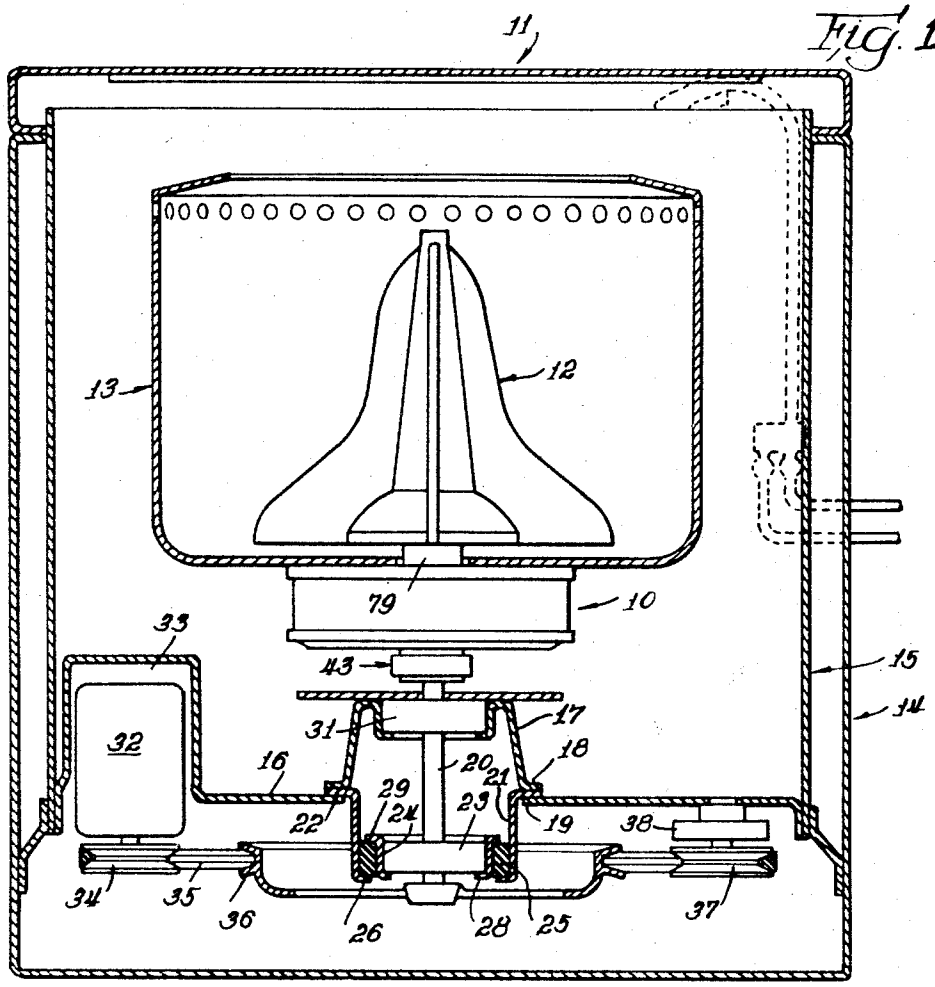
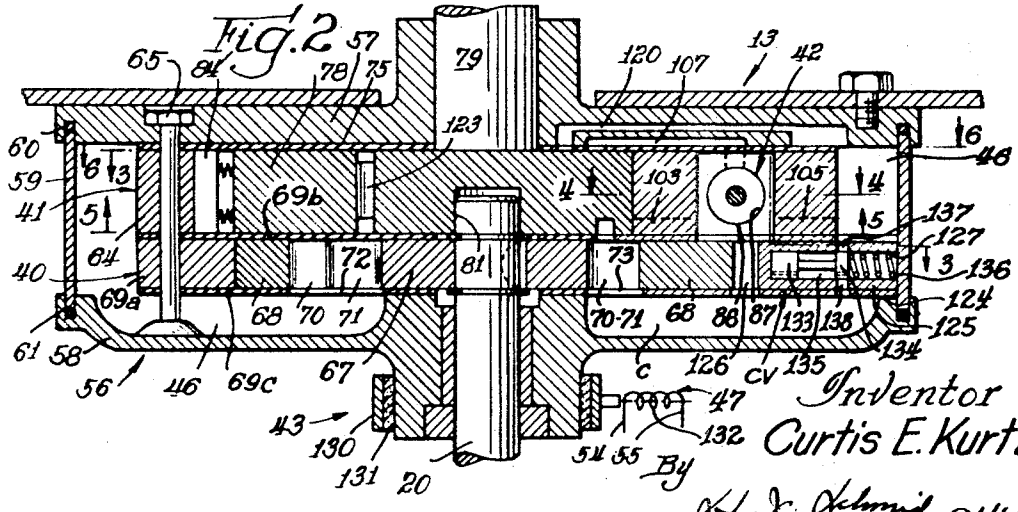


Fig. 2



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HYDRAULIC TRANSMISSION FOR FABRIC-TREATING MACHINES

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Fig. 3

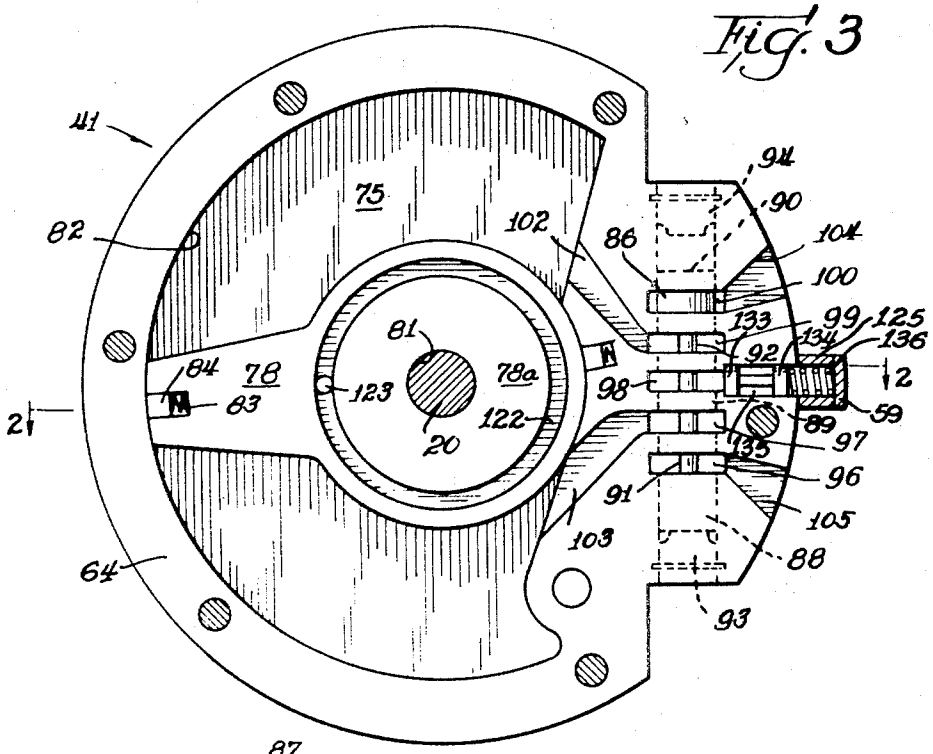
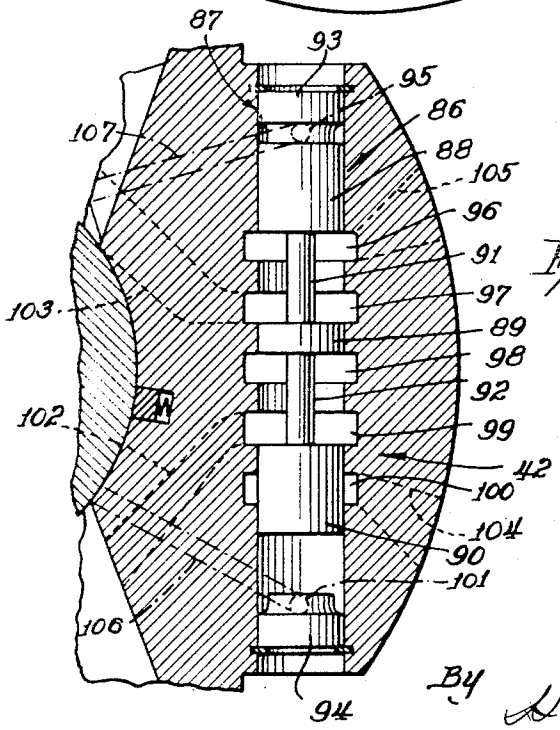


Fig. 4



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HYDRAULIC TRANSMISSION FOR FABRIC-TREATING MACHINES

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Fig. 5

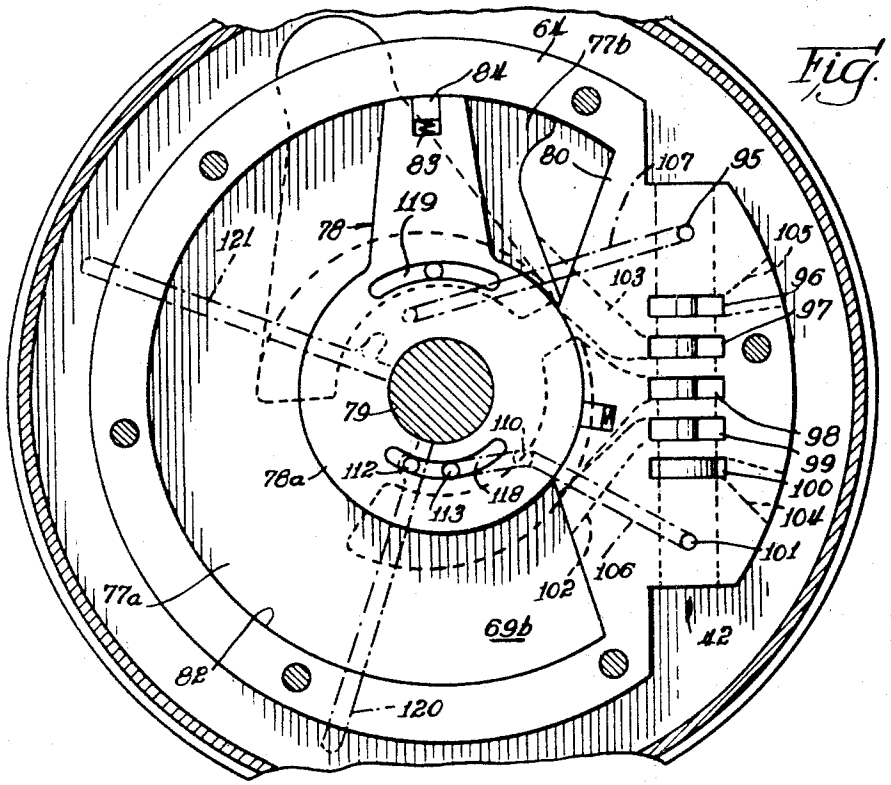
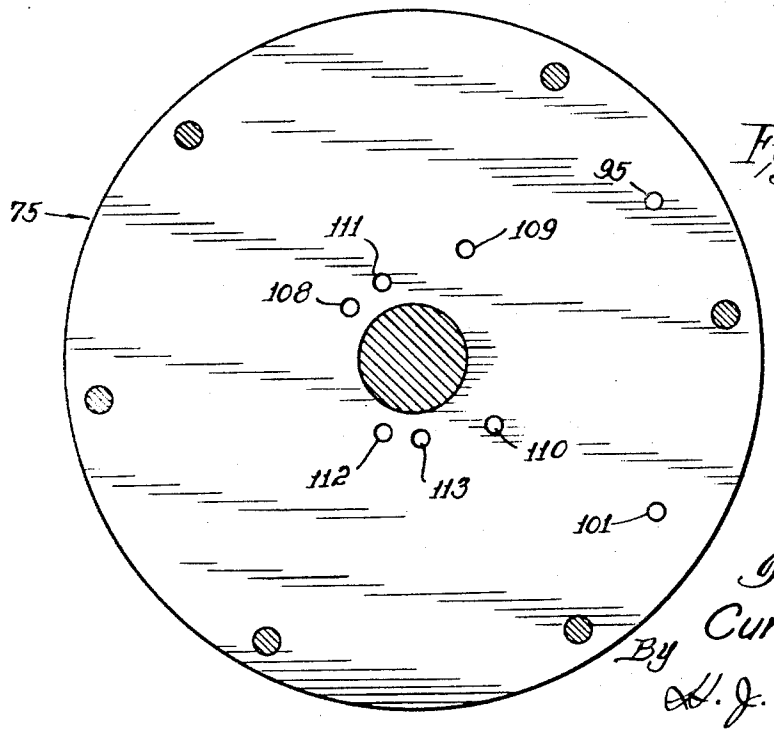


Fig. 6



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HYDRAULIC TRANSMISSION FOR FABRIC-TREATING MACHINES

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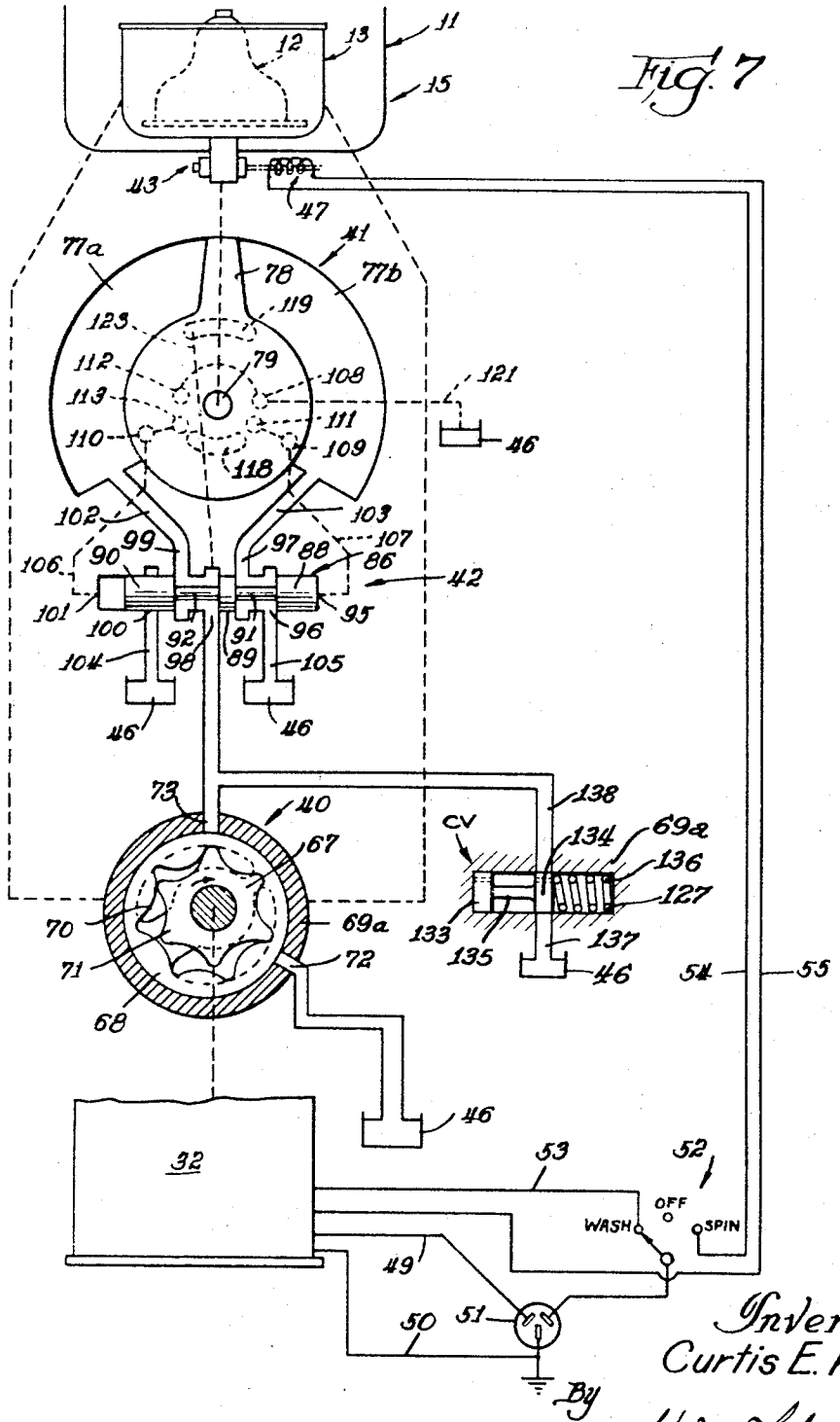
Fig. 7



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HYDRAULIC TRANSMISSION FOR FABRIC-TREATING MACHINES

Filed Aug. 21, 1967 Sheet 5 of 5

Fig. 8

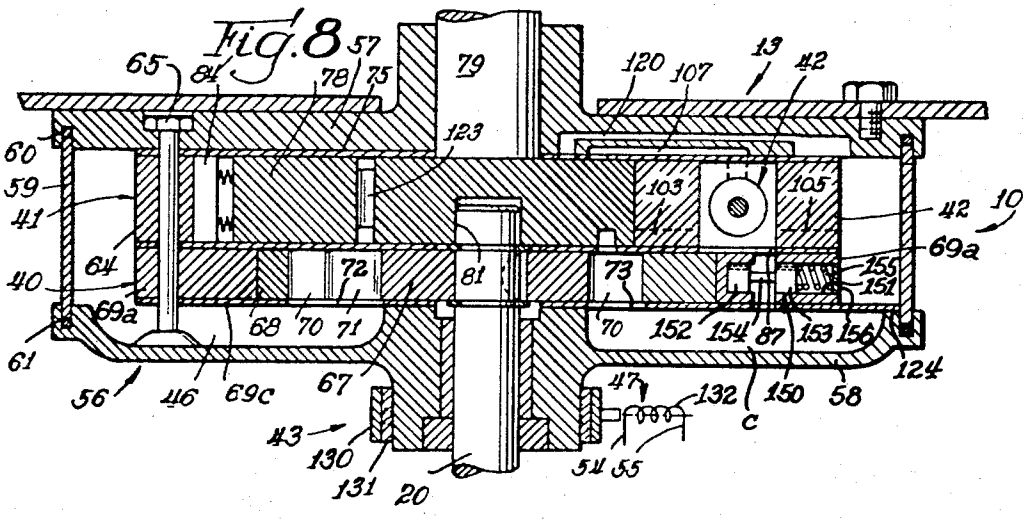
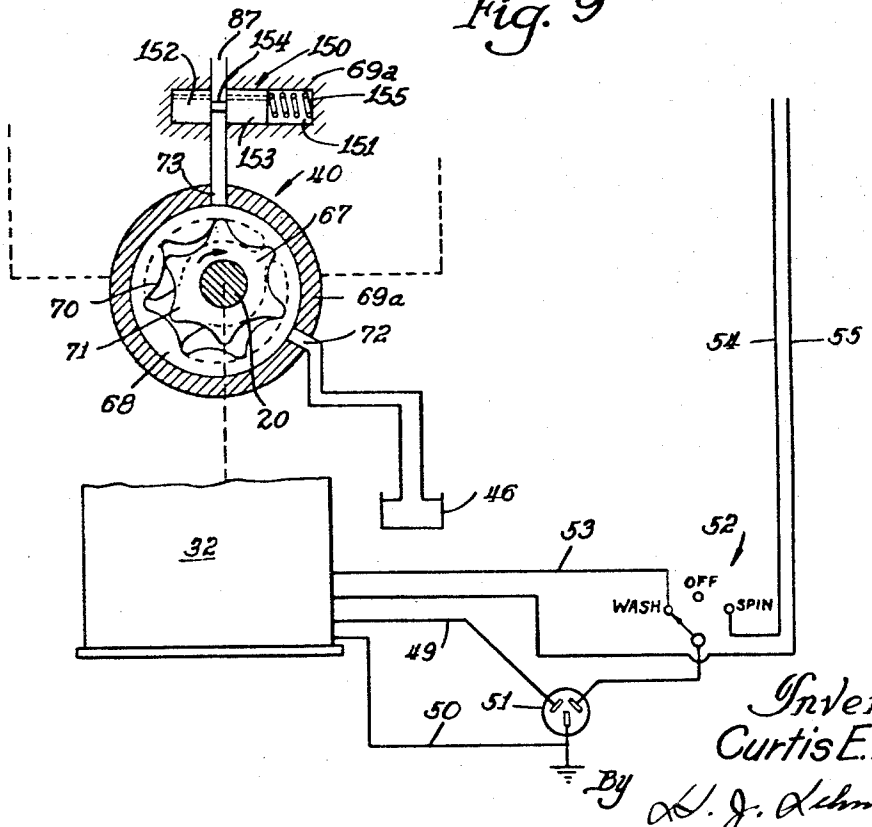


Fig. 9



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Patented May 20, 1969

3,444,709

HYDRAULIC TRANSMISSION FOR FABRIC-TREATING MACHINES

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Int. Cl. D06f 37/40, 37/36
U.S. Cl. 68—23 22 Claims

ABSTRACT OF THE DISCLOSURE

A transmission for operating an agitator and rotating a clothes container and having a pump comprising a pumping element and a housing therefor, the pumping element being rotatable to supply fluid to an agitator-operating hydraulic motor, and the housing being connected to the container; a brake for restraining rotation of the container by pump reaction and releasable to obtain container rotation; and valving centrifugally-operative by container rotation to control the fluid output of the pump to provide initial acceleration of the container and thereafter high speed.

Summary of the invention

This invention relates to a hydraulic transmission for fabric-treating machines.

An object of the invention is to provide an improved hydraulic transmission for fabric-treating machines having a rotatable fabric container, the transmission having a pump with relatively rotating driving and driven pump elements with the driven element being connected to the container, and having means, responsive to the speed of rotation of the driven element, to control discharge of the working pump fluid for providing pump reaction to the container to initiate rotation and thereafter acceleration of the container to the rotational speed of the pump driving element.

Another object of the invention is to provide an improved hydraulic transmission for fabric-treating machines employing a rotatable clothes container; the transmission having a pump including a pumping element, and housing connected to the container, flow of hydraulic fluid through the pump and discharge to the sump providing a reaction torque on the housing and container to initiate rotation thereof; and control means, responsive to the speed of rotation of the container, for influencing fluid flow to provide for acceleration of the container to approximately the speed of rotation of the pumping element.

Another object of the invention is to provide an improved hydraulic transmission for fabric-treating machines having an oscillatable agitator in a clothes container; the transmission having a pump with relatively rotatable drive and driven pump elements, with the driven element being connected to the container; a hydraulic motor connected to the agitator; valve means controlled by the agitator and controlling operation of the hydraulic motor to oscillate the agitator for a fabric-cleaning operation; a brake for preventing rotation of the container during agitator-oscillation, and releasable to utilize the pump reaction to induce rotation of the transmission and container, for drying the fabrics; and valving, responsive to the speed of rotation of the container, to control the pump operation to accelerate the container to about the speed of the pump drive element.

The improved hydraulic transmission is particularly designed for a fabric-treating machine having an oscillatable agitator in a rotatable clothes container, and a brake for preventing rotation of the container during agitator-oscillation; the transmission having a hydraulic motor connected to the agitator, a pump having a rotatable pumping element and housing element therefor, the pumping element providing fluid under pressure to operate the hydraulic motor for oscillating the agitator, the housing element being connected to the container, and operable when the brake is released, to rotate the container due to the pump torque reaction.

In one embodiment of the invention, the transmission control comprises a centrifugal force-responsive valve in the pump housing element and normally closed during the operation of the agitator-oscillating hydraulic motor, the valve opening in response to centrifugal force, upon brake release and container rotation, to permit unrestricted discharge of the pumped fluid to the sump with consequent initial near full capacity flow of the pump providing high reaction torque on the pump housing and thereby a heavy initial acceleration of the container and, as the flow and reaction torque decreases and relative rotation of the pumping and housing elements diminish, container rotation is provided with soft acceleration at high speed solely by the fluid friction and also the mechanical frictional engagement of the pumping and housing elements. In a second embodiment of the invention, the transmission control comprises a valve in the housing element and normally open during operation of the hydraulic motor, brake release causing pump reaction to rotate the housing element and the valve, the valve being responsive to centrifugal force, and closing in a manner to initially restrict fluid flow through the pump to accelerate the rotational speed of the container and thereafter to prevent fluid flow to hydraulically couple the pumping and housing elements so that the container rotates at approximately the speed of rotation of the pumping element.

Further objects and advantages of the invention will become apparent from the following description with reference to the accompanying drawings, the features of novelty characterizing the invention being pointed out particularly in the claims annexed to and forming part of this specification.

Brief description of the drawings

In the drawings:

FIG. 1 illustrates a clothes-cleaning machine embodying a preferred form of the hydraulic transmission of the present invention;

FIG. 2 is a vertical sectional view of the transmission and showing a pump, vane motor, and valving of the transmission, said section being taken on line 2—2 of FIG. 3;

FIG. 3 is a horizontal view of the vane motor and portions of the valving of the transmission, taken on line 3—3 of FIG. 2;

FIG. 4 is a horizontal view taken on line 4—4 of FIG. 2 and illustrating the hydraulic vane motor and control valving therefor;

FIG. 5 is a horizontal view taken on line 5—5 of FIG. 2;

FIG. 6 is a horizontal sectional view of the control valving, taken on line 6—6 of FIG. 2;

FIG. 7 is a schematic view of the improved hydraulic transmission shown in FIGS. 1–6;

FIG. 8 is a vertical sectional view of a modification of the transmission; and

FIG. 9 is a schematic view of the transmission shown in FIG. 8.

Description of the preferred embodiment

Referring to FIG. 1, a preferred embodiment of my improved hydraulic transmission 10 is shown in a fabric-treating or clothes-cleaning machine in the form of a washer 11 having an oscillatable agitator 12 to wash the clothes and a clothes container or basket 13 rotatable to extract washing liquid from the clothes.

The washer comprises a cabinet or casing **14** supporting a water container or tub **15** enclosed at its bottom end by a bulkhead **16** and a flexible rubber inverted cup-shaped member **17** overlying a central opening in the bulkhead and having an annular flange **18** connected to the opening-defining peripheral edge **19** of the bulkhead and in water-sealing relation thereto.

The basket **13**, agitator **12**, transmission **10**, and the transmission drive shaft **20**, are supported on a cylindrical steel mounting member **21** having its upper peripheral edge defined by a flange **22** extending between and connected to the flange **18** of member **17** and bulkhead edge **19**. More particularly, the drive shaft **20** extends through the members **21** and **17** and is rotatably mounted on the member **21** by a ball-bearing assembly **23**. The bearing assembly **23** provides a radial and thrust bearing and, for this purpose, there is disposed between and engaging the outer race **24** of the assembly **23** and the inner cylindrical surface of the member **21**, an annular resilient bushing **25** of rubber or the like. The bushing **25** is mounted on a radially inwardly directed annular peripheral flange **26** of the member **21**. The outer race **24** is substantially Z-shaped in cross section with its lower inwardly extending annular flange **28** thereof engaging the bottom of the bushing and the top flange **29** overlying the top of the bushing. It will be apparent that the described mounting arrangement provides for the basket, agitator, transmission and its drive shaft, being flexibly and solely supported at a point near the lower end of the drive shaft. Disposed within the upper opening of the flexible member **17** and surrounding the drive shaft **20** is a roller-bearing assembly **31**, the member **17** having a cylindrical flange engaging the outer race of the assembly **31**, the inner race of the assembly being secured to the drive shaft. The flexible member **17** is effective to vertically align the bearing assemblies **23** and **31** and resistively permits gyratory movement of the basket, agitator and transmission, about the lower end of the drive shaft due to an unbalanced load during rotation of the basket.

The drive shaft is connected to an electric motor **32** supported on the cabinet and extending upwardly into a pocket **33** formed in the bulkhead **16**. The motor **32** has a drive pulley **34** connected by a belt **35** to a pulley **36**, secured to the end of the drive shaft **20**, and to a pulley **37** connected to a water pump **38** provided for exhausting water from the tub through an opening in the bulkhead **16** during rotation of the motor.

Referring to the improved hydraulic transmission, and specifically to FIGS. 1–7, inclusive, illustrating a preferred embodiment of the invention, the important elements of the hydraulic transmission are a fluid pump **40** having its housing connected to the basket; a vane-type hydraulic motor **41** for driving the agitator; control valving **42** (FIGS. 4 and 5) for the motor **41**; a solenoid-controlled brake **43** for the basket **13**; and spin-control valve **44**.

A fluid sump **46** is provided which is illustrated for convenience in various places in the schematic view of FIG. 7, although, in actual construction, one fluid sump **46** is provided into which all of the exhaust connections for various elements of the transmission exhaust pressure. In FIG. 7, electric conductors **49** and **50** interconnect a source of power **51** with motor **32**, the conductor **50** being a ground conductor. The cycle selector switch **52** is connected to the motor by a conductor **53**. The switch **52** is schematically illustrated in a simplified form although, in the washer installation, the cycle selection would be performed by a sequential controller or timer well known in the art. Conductors **54** and **55** connect the brake solenoid **47** to the switch **52**.

Referring now more particularly to the transmission components, FIGS. 1–6 illustrate the structural components and their assembly in the transmission, while FIG. 7 schematically identifies the components in their operative relation to each other and to the agitator and basket and the drive motor and with particular reference to the fluid passages interconnecting the components in the performance of their functions in controlling oscillating movement of the agitator and rotation of the basket.

In general, and as shown in FIGS. 1–6, the transmission structure comprises a unitary assembly adapted to be drivingly connected to the agitator **12** and to the basket **13** at its upper end and to the drive shaft **20** at its lower end. More particularly, and as shown in FIG. 2, the transmission structure comprises a housing **56** provided by top and bottom annular plates **57** and **58**, and a cylindrical collar **59** extending between the plates and having their top and bottom edges received within circular grooves **60**, **61** respectively formed in the plates to provide the sump or reservoir **46** for the hydraulic fluid. Seals are positioned in the grooves and engage the collar to contain the fluid in the sump. The housing **56** contains, and its top and bottom plates **57** and **58** confine, the operating components of the transmission including the vane motor **41** having a housing **64**; control valve **42** in a portion of housing **64**; and the pump **40**. A plurality of bolts **65** extend through and connect the plates **57** and **58**, the vane motor and valve housing **64** to confine the vane motor **41**, the valve assembly **42** and pump **40** therebetween.

A positive displacement or expansible chamber type pump in the form of a conventional gerotor pump is shown in FIGS. 2 and 7 having an inner rotor **67** keyed to the drive shaft **20**, and an outer rotor **68** rotatable in a housing. The housing comprises a cylindrical ring **69***a* surrounding the rotors, and top and bottom plates **69***b* and **69***c*. The outer rotor **68** is provided with recesses **70** therein adapted to receive the teeth **71** on the inner rotor **67**. As seen in FIG. 7, rotation of the rotor in a clockwise direction, during the agitate cycle, causes fluid to enter the pump through the port **72** (FIGS. 2 and 7) in the housing plate **69***c* and, in a well-known manner, will act in the fluid chambers between the teeth **71** of the inner rotor and the recesses **70** of the outer rotor to provide fluid under pressure to a port **73** in the housing plate **69***c*.

The vane-type hydraulic motor **41** is shown structurally in FIGS. 2, 3, 4, and 5, and schematically in FIG. 7 and comprises the housing or body **64**, defining with a top fluid-passage plate **75** and plate **69***b*, a fluid chamber in which is received the vane **78** connected to the agitator shaft **79**. The body **64** has a wall **89** projecting radially inwardly into the chamber and dividing the chamber into two portions **77***a* and **77***b*. The wall **80** has its apex formed arcuately concave to engage the cylindrical side portion of the vane hub **78***a* to provide, with the vane, the expansible and contractible fluid chambers **77***a* and **77***b*. The vane **78** reciprocates as fluid under pressure is admitted alternately to opposite sides thereof into the chamber portions **77***a* and **77***b* to oscillate the agitator during the washing cycle. As seen in FIG. 2, the vane is formed integral with the agitator shaft **79** journalled in the top cover plate **57**, a portion of the pump inner rotor shaft **20** projecting into a central axial opening **81** in the vane. The vane has an arcuate tip conforming to the cylindrical interior surface **82** of the body **64** and, as shown in FIG. 3, the tip is provided with a recess receiving a spring **83** and plunger **84**, the spring actuating the plunger into engagement with the surface **82** to preclude fluid flow between the chamber portions **77***a* and **77***b*. It may be noted that the top cover plate **57**, plates **75** and **69***b*, and vane **78**, contain various fluid ports and passages cooperating with ports and passages in the vane motor housing **64**, in a manner later to be desribed.

As seen in FIGS. 2 and 7, the top surface of the hub **78***a* of the vane **78** is provided with two radially-spaced arcuate grooves **118** and **119** adapted to be connected to conduits **106** and **107**. As seen in FIG. 2, the plate **75** is positioned between its top side contacts the bottom of the plate **57** and its bottom side contacts the vane and

housing of the vane motor. To afford fluid communication between the valve **86** and vane motor fluid chambers, the plate **75**, as seen in FIGS 3 and 6, is provided with circular openings **108, 109, 110, 111, 112, 113**. The openings **108, 111, 112, 113** are located to communicate with and to be connectible to the arcuate groove **118** in the vane hub **78***a* (FIGS. 5, 6 and 7). The openings **109** and **110** are located to be connectible to the arcuate groove **119** in the vane hub **78***a* (FIGS. 6 and 7). The openings **111** and **113** are located respectively at the radially inner ends of the passages **160** and **107** of the valve housing and are connectible to the arcuate groove **118** in the vane hub **78***a*. The openings **112** and **108** are located respectively above passages **120** and **121** of the valve housing, which connect to the sump **46**.

The bottom of the vane hub **78***a* engages the top of plate **69***b* and is provided with a circular groove **122**, the vane hub **78***a* having a passage **123** extending therethrough (FIG. 2) terminating at its upper end in the groove **119** and its lower end being disposed above port **73** to receive fluid under pressure from the pump which flows simultaneously into the passage **123** and port **73**.

The passage **106** in the valve housing functions via port **101** to exhaust fluid from one end of the valve spool while fluid under pressure is admitted by passage **107** and port **95** to the other end of the spool to shift the spool and thereby cause fluid under pressure from the pump to flow to port **97** and passage **103** to chamber **77***b* of the vane housing. The passage **107** in the valve housing functions via port **95** to exhaust fluid from the other end of the valve spool while fluid under pressure is admitted by passage **106** and port **101** to the other end of the spool to shift the spool and thereby cause fluid under pressure from the pump to flow to port **99** and passage **102** to chamber **77***a* of the vane housing. In this manner, the vane motor controls the operation of the spool to direct fluid to, and exhaust fluid from, the motor chambers **77***a* and **77***b* to oscillate the vane.

In the preferred embodiment of the invention disclosed in FIGS 1–7, an important inventive feature is the provision of a valve assembly CV in housing ring **69***a* and located in a valve chamber **127** in a projecting portion **125** thereof extending toward and sealingly engaging the inner surface of the cylindrical collar **59**, the top and bottom sides of portion **125** respectively engaging the plates **69***b* and **69***c*, with plate **69***c* seated on a shoulder **124** of plate **58** in sealing relation therewith. The chamber **127** is cylindrical, extends radially of the axis of rotation of shaft **20**, and is closed at its radially inner end. A spool of the valve assembly CV is provided with spaced lands **133, 134** with an intervening groove **135**, the spool normally being positioned (as shown) by a spring **136**, compressed between land **134** of the spool and the collar **59**, so that the land **134** closes ports **137** and **138** in the housing **69***a* aligned with ports in plates **69***b* and **69***c* to normally prevent flow of hydraulic under pressure from working chamber C to the sump **46** during agitator oscillation by the vane motor **41**. The valve spool is hydraulically balanced by the provision of suitable passages drilled in the lands **133, 134**, as shown.

Referring to FIGS. 1 and 2, the transmission housing top plate **57** contacts the bottom wall of the basket **13** and is secured thereto by bolts extending through the basket wall and into the top plate **57** so that the transmission housing is secured to the basket. To prevent rotation of the basket and transmission during the washing-agitate operation, the hub of the transmission plate **58** is provided with the brake **43** comprising a brake band **130** having a friction lining **131** normally engaged with the hub to prevent rotation of the basket. The brake is released by the solenoid **47** having its winding **132** connected to conductors **54** and **55** (FIG. 7) providing an energizing circuit upon movement of the switch **52** to its "SPIN" position.

The vane motor housing **64**, as shown in FIGS. 3, 4, 5, and 7, contains the agitator control valve **42** including a spool **86** reciprocable in a tangential bore **87** in the housing under the influence of fluid pressure controlled by the vane **78** to direct fluid under pressure into one of the chamber portions **77***a* or **77***b* while simultaneously exhausting the fluid in the other chamber portion, to reciprocate the vane. More particularly, the spool **86** is provided with lands **88, 89**, and **90**, the lands **88** and **89** being separated by a groove **91** and the lands **89** and **90** being separated by a groove **92**. The ends of the bore **87** are provided with plugs **93** and **94**. The spool is shiftable in the bore **87** by fluid under pressure supplied successively to opposite ends of the spool.

Referring to FIGS. 2, 3, 4, 5, and 7, the area of the valve body around the valve **86** includes ports **95, 96, 97, 98, 99, 100**, and **101**. Fluid conduits **102** and **103** are respectively connected to chambers **77***a* and **77***b*, and to ports **99** and **97**. Conduits **104** and **105** are connected to ports **100** and **96**, respectively, and are exhaust passages connected to the sump **46**. Conduits **106** and **107** are connected to ports **101** and **95**, respectively.

Reference is now made to the schematic disclosure in FIG. 7 for an explanation of the operation of the transmission. In FIG. 7, when the movable member of switch **52** is positioned in engagement with the switch contact "WASH" to provide current flow through the motor windings in well-known manner, the electric motor **32** is energized and rotates the drive shaft **20** and the pump rotors **67** and **68** in a clockwise direction to provide fluid under pressure to the valve **42**, and thereby to the vane motor **41**, the valve CV being closed. Suction of the pump causes fluid to be drawn from the sump **46** into the port **72** of the pump.

The spool **86** of valve **42** controls pressure fluid flowing from port **73** of the pump through port **98** of the valve and directs the fluid through groove **92** of the valve spool, port **99**, passage **102**, into the chamber portion **77***a* of the vane motor to effect movement of the vane **78** in a clockwise direction. At this time, the fluid in chamber **77***b* flows through passage **103** and port **97** to port **96** and passage **105** to the sump. When the vane moves to a position where its groove **119** connects passage **123** to port **109**, passage **107**, port **95**, and to the valve chamber, fluid under pressure causes spool **86** to be moved to the left. Fluid is exhausted from the left end of the spool via port **101**, passage **106**, port **113**, passage **118** to port **112**, passage **120** to the sump **46**. Upon movement of the spool **86** to the end of its travel, fluid under pressure flows from port **98** to port **97**, passage **103** into chamber **77***b* causing vane **78** to be moved in a counterclockwise direction. At this time, fluid in chamber **77***a* is exhausted through passage **102**, ports **99** and **100** to passage **104** and sump **46**. As the vane rotates to a position where the end of vane groove **119** covers port **110**, fluid under pressure from port **123** flows through passage **106** and port **101** to the left end of spool **86** to move the spool to the position shown in FIG. 7. Simultaneously, the groove **118** of spool **86** is in registry with ports **111** and **108** so that the fluid is exhausted from the right end of the spool through port **95**, passage **107**, port **111**, groove **118**, port **108** and passage **121** to the sump.

It will be apparent from the above description that the vane motor is controlled to provide oscillating movement of the vane, and thereby the agitator, during the washing operation.

To effect rotation of the basket during the spin-extract cycle, movable contact member of the switch **52** is moved from its "WASH" position to its "SPIN" position to complete an electric circuit energizing solenoid winding **132** via conductors **54** and **55**, to cause the brake **43** to release its engagement of the hub of plate **58**. As the electric motor is energized to continue rotation of the pump in the clockwise direction (FIG. 7), the pump is effective to provide fluid under pressure to port **73** of its housing and to the chamber C. However, as the brake is released

when the agitator oscillation is effective, the pump reaction initiates rotation of the clothes basket and transmission. Upon rotation, the spool of valve CV is moved radially outwardly of the housing **69***a* by centrifugal force, against the closing action of spring **136**, to cause the land **134** of the valve to uncover passages **137** and **138**, to permit fluid in the chamber C to flow through port **138**, groove **135** of the spool, port **137** to the sump **46**. As a result, the fluid is circulated by the pump from sump **46**, intake port **72** of the pump, through the pump and from the pressure port **73** of the pump to the chamber C and to the sump.

When the brake is released, the transmission starts to spin, and centrifugal force starts to open the valve, against the action of spring **136**, to dump the hydraulic fluid to the sump, which limits the torque applied to the basket and reduces the rate of acceleration of the basket. When the fluid is allowed to freely recirculate through the valve housing and pump, and the brake is released, the pump reaction and the mechanical friction of the pump components causes coupling of the drive shaft **20**, through the transmission housing and pump, to the basket to cause the basket to spin at the desired speed to extract the water from the clothes in the basket. During the initial spin period, the valve is opened gradually by centrifugal force until the pump is flowing near its full capacity with a high reaction torque for high acceleration. As the capacity of the pump decreases and the spin relation between the pump elements and the housing approaches zero, the flow and reaction torque decreases, and soft acceleration occurs with the internal pump components' mechanical friction and the fluid friction causing the transmission and thereby the basket to attain the desired spin speed approximating the speed of rotation of the drive shaft **20**.

Description of second embodiment

FIGS. 8 and 9 illustrate an hydraulic transmission for a fabric-treating machine similar to that disclosed in FIGS. 1–7 inclusive, but differing therefrom by the employment of a centrifugal-operated valve control featuring a valve spool normally open to permit fluid flow to the vane motor for oscillation of the agitator during the washing operation and engagement of the brake, and closable by centrifugal force upon release of the brake and rotation of the transmission, to restrict and then prevent, by blocking, the passage of hydraulic fluid from the pump. This control is particularly designed for use with considerably greater fabric-content capacity than that of the basket of the machine of FIGS. 1–7. The resultant higher friction and inertia forces, engendered by the use of the larger capacity basket, require greater effort to provide the desired acceleration and attainment of the high spin speed, than could be obtained by the mechanical friction and fluid friction of the pump of the control of FIGS. 1–7. For this purpose, the control valve, shown in FIGS. 8 and 9, between the pump and the vane motor, is effective to close the pump output port so that the pump housing and rotors are hydraulically coupled to provide a positive drive between the electric motor and the basket.

Referring now to FIGS. 8 and 9, wherein like parts of the disclosure shown in FIGS. 1–7 are identified by the same numerical designations, it will be apparent the distinguishing feature resides in the provision of the control valve assembly comprising a valve spool **150** located in a cylindrical chamber **151** formed in the pump housing **69***a* and having lands **152** and **153** spaced by a groove **154**, the spool normally being positioned by a spring **155**, compressed between the land **153** and a plug **156**, the plug closing and sealing the outer end of the chamber **151**. To prevent flow of fluid, under pressure, from the chamber C to the sump **46**, the plate **69***c* extends toward and sealingly engages a shoulder **124** of the housing bottom plate **58**.

Fluid under pressure flows from the port **73** of the pump into the chamber C and through aligned openings in the plates **69***b* and **69***c* and pump housing **69***a*, and also the groove **154** in the spool, to the vane motor for oscillating the agitator, the brake **43** being applied to restrain rotation of the transmission housing.

At the conclusion of the washing operation and with the agitator still oscillating, the brake is released thereby causing, as in the centrifugal valve control of FIGS. 1–7, a reaction in the pump effective to start the basket and transmission to rotate. However, it will be apparent the valve spool **150** will be moved by centrifugal force, against the action of spring **155**, to initially restrict and partially gradually close the flow passage to the vane motor **42** from the high pressure fluid chamber C to accelerate the rotation of the transmission housing and basket. When the flow passage is closed by the valve spool land **152**, the pump rotors **68**, **71**, and housing **69***a* are hydraulically coupled to provide a substantially 1:1 speed ratio between the drive shaft **20** and the basket **13**.

It will be apparent from the description of the embodiments of the present invention that I have provided control valve arrangements for a fluid circuit of a pump having its housing element, for its pumping element, connected to the clothes container of a fabric-treating machine, the control valve arrangements being operable, by centrifugal force, to control flow of fluid through the circuit to hydraulically couple the pumping and housing elements together to thereby effect a reaction torque in the pump operative to rotate the container by the housing element providing a substantially direct drive connection between the electric motor drive shaft and the basket.

Although a pump of the gerotor or geartype has been shown to illustrate the present invention, obviously other positive displacement or expansible chamber type pumps, including vane type pumps, can also function satisfactorily and be used in practicing the invention.

While I have shown and described certain presently preferred embodiments of the invention, it will be understood that the invention is not limited thereto and it is intended to cover equivalent variations as fall within the scope of the appended claims.

What is claimed is:

1. In a fabric-treating machine, a rotatable fabric container; a motor having a rotatable drive shaft; a positive displacement pump including relatively rotatable elements including a pumping element and a housing element therefore, said pumping element being connected to said drive shaft and said housing element being connected to said container; and means, including valve means carried by one of said elements and operable by centrifugal force, for controlling flow of fluid by said pump to induce a reaction torque on said pump operative to rotate said container.

2. In a fabric-treating machine, a rotatable fabric container; a motor having a rotatable drive member; a positive displacement pump including a pumping element connected to said drive member, and a housing element for said pumping element and connected to said container; and means, including valve means carried by said housing element and operable by centrifugal force, for controlling flow of fluid by and through said pump to induce a reaction torque on said thousing element operative to rotate said housing element and thereby said container.

3. In a fabric-treating machine as defined in claim **2** wherein a spring engages said valve means and is operative to yieldingly oppose movement of said valve means by centrifugal force.

4. In a fabric-treating machine as defined in claim **2** wherein said valve means is a spool valve extending radially of the axis of rotation of said drive member and located to control the flow of fluid under pressure from said pump.

5. In a fabric-treating machine as defined in claim **2** wherein said valve means is normally closed and is opened by centrifugal force to provide for continuous fluid flow

through said pump, during rotation of said pumping element, to reduce the reaction torque on said housing element for rotating said housing element and thereby said container.

6. In a fabric-treating machine as defined in claim 5 wherein said housing element is mechanically and hydraulically frictionally engaged with said pumping element for effecting rotation of said housing element.

7. In a fabric-treating machine as defined in claim 5 wherein the pump has its intake and discharge ports in a fluid circuit including a sump, and said centrifugal force-responsive valve means is located in said circuit between said sump and one of said pump ports.

8. In a fabric-treating machine as defined in claim 5 wherein the pump has its intake and discharge ports in a fluid circuit including a sump, and said centrifugal force-responsive valve means is located in said circuit between said discharge port and said sump.

9. In a fabric-treating machine as defined in claim 5 wherein said pump is the gerotor type, the pumping element being an externally toothed gear connected to the drive member and meshing with an internally toothed ring gear rotatable in the housing element connected to the container.

10. In a fabric-treating machine as defined in claim 2 wherein said valve means is normally open and is closed by centrifugal force to hydraulically couple said pumping element and said housing element and thereby said drive member and said container.

11. In a fabric-treating machine as defined in claim 10 wherein said centrifugal force-responsive valve means is operable to throttle the flow of fluid by and through said pump in a manner to initially restrict fluid flow through the pump to provide a reaction torque on said housing element for accelerating the speed of rotation of said housing element and thereby said container, said valve means thereafter being closable to prevent fluid flow to hydraulically couple said housing element and said pumping element to provide a substantially direct drive between said drive member and container.

12. In a fabric-treating machine as defined in claim 10 wherein the pump has its intake and discharge ports in a fluid circuit including a sump, and said valve means is located in said circuit between said sump and one of said pump ports.

13. In a fabric-treating machine as defined in claim 10 wherein the pump has its intake and discharge ports in a fluid circuit including a sump, and said valve means is located in said circuit between said sump and said pump discharge port.

14. In a fabric-treating machine as defined in claim 10 wherein said pump is the gerotor type, the pumping element being an externally toothed gear connected to the drive member and meshing with an internally toothed ring gear rotatable in the housing element connected to the container.

15. In a fabric-treating machine, a rotatable fabric container; an agitator in, and actuable relative to, said container; an electric motor having a drive shaft; driving means for said agitator and operative to actuate said agitator for cleaning the fabric; driving means for said container and including a pump having a pumping element and a housing element therefor, said housing element being connected to said container for rotating said container to dry the fabric, and said pumping element being connected to said drive shaft; a device preventing rotation of said housing element during operation of said agitator-driving means, and releasable to provide for rotation of said container by the reaction torque exerted on said housing element by flow of fluid through said pump by said pumping element; and means, including a valve rotatable with said housing element and responsive to centrifugal force, during release of said device, for controlling circulation of fluid through said pump to couple said pumping element and said housing element for substantially unitary rotation of said drive shaft and said container.

16. In a fabric-treating machine as defined in claim 15 wherein said fluid is confined to flow in a closed fluid circuit, and said valve is located in said circuit and is operative by centrifugal force to control flow of fluid in said circuit and thereby pump operation.

17. In a fabric-treating machine as defined in claim 15 wherein the pump has its intake and discharge ports in a fluid circuit including a sump, and said valve is located in said circuit between said pump discharge port and said sump.

18. In a fabric-treating machine as defined in claim 16 wherein said valve is normally-closed and opens in response to centrifugal force to provide for continuous fluid flow from said pump discharge port to said sump to drivingly connect said pumping and housing elements by mechanical friction engagement and fluid friction connection of said elements.

19. In a fabric-treating machine as defined in claim 15 wherein said pump is the gerotor type, the pumping element being an externally toothed gear connected to the drive shaft and meshing with an internally toothed ring gear rotatable in the housing element connected to the container, said gears and said housing element being frictionally engaged to couple said gears and said housing element and thereby said drive shaft and said container for substantially direct drive.

20. In a fabric-treating machine as defined in claim 15 wherein said agitator-driving means is a hydraulic motor connected to said agitator, and valve means controls flow of fluid from said pump for operation of said hydraulic motor to actuate said agitator.

21. In a fabric-treating machine as defined in claim 18 wherein said valve is normally closed, upon release of said device, to prevent flow of fluid from said pump discharge port to said sump and thereby through said pump to drivingly connect said pumping and housing elements to initially provide maximum reaction torque on said housing element for accelerating the speed of rotation of said container, said valve means thereafter gradually opening in response to centrifugal force.

22. In a fabric-treating machine as defined in claim 16 wherein said valve is normally open and, upon release of said deviee, said valve closes in response to centrifugal force to prevent flow of fluid in said circuit thereby to induce a reaction torque on said housing element for rotating said housing element and said container.

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