March 7, 1944. F. BRECKENRIDGE 2,343,742

WASHING APPARATUS

Filed Nov. 21, 1939 5 Sheets-Sheet 1

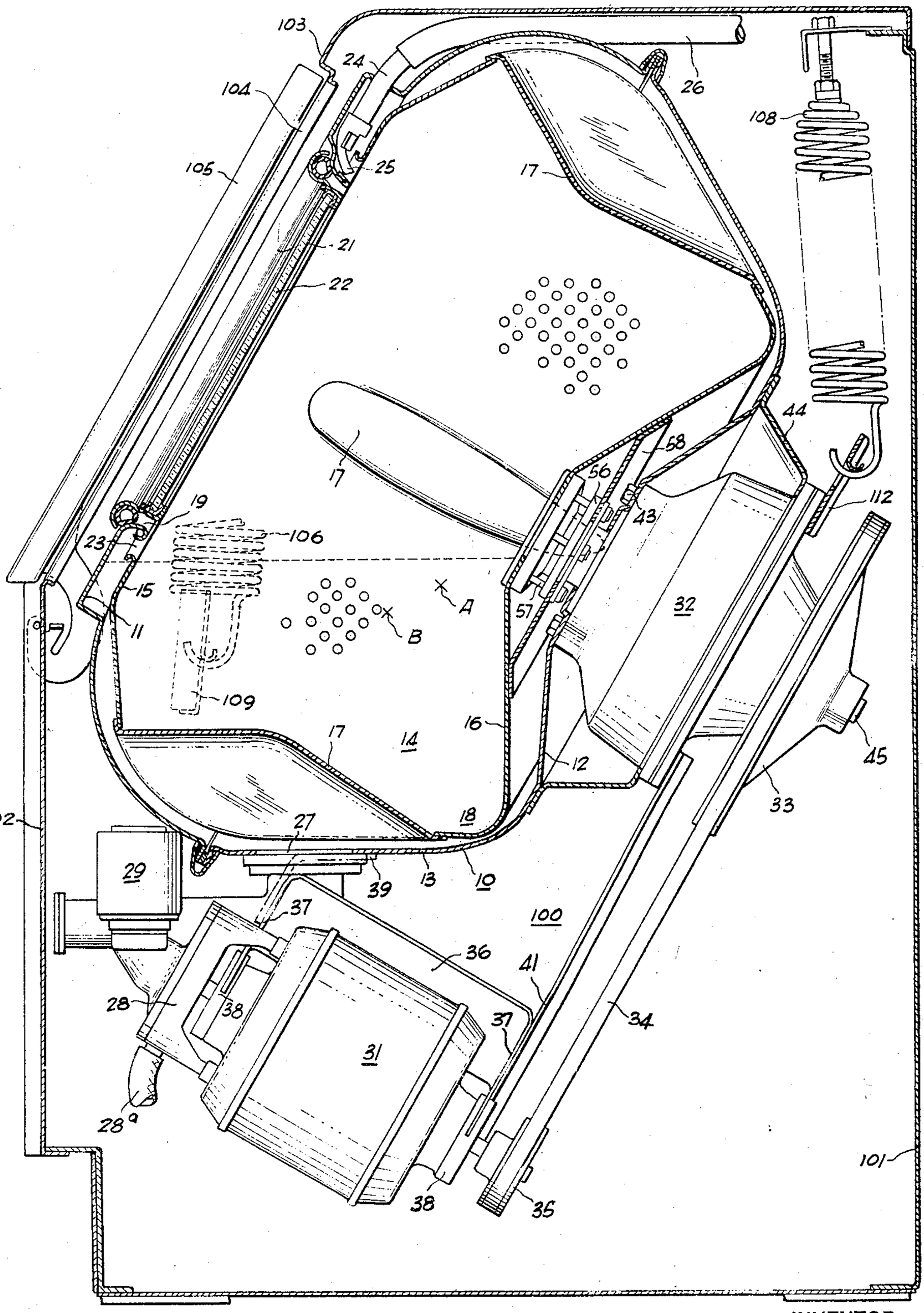

Fig. 1.

WITNESSES:
R. J. Ridge.
E. H. Lutz.

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WASHING APPARATUS

Filed Nov. 21, 1939 5 Sheets-Sheet 2

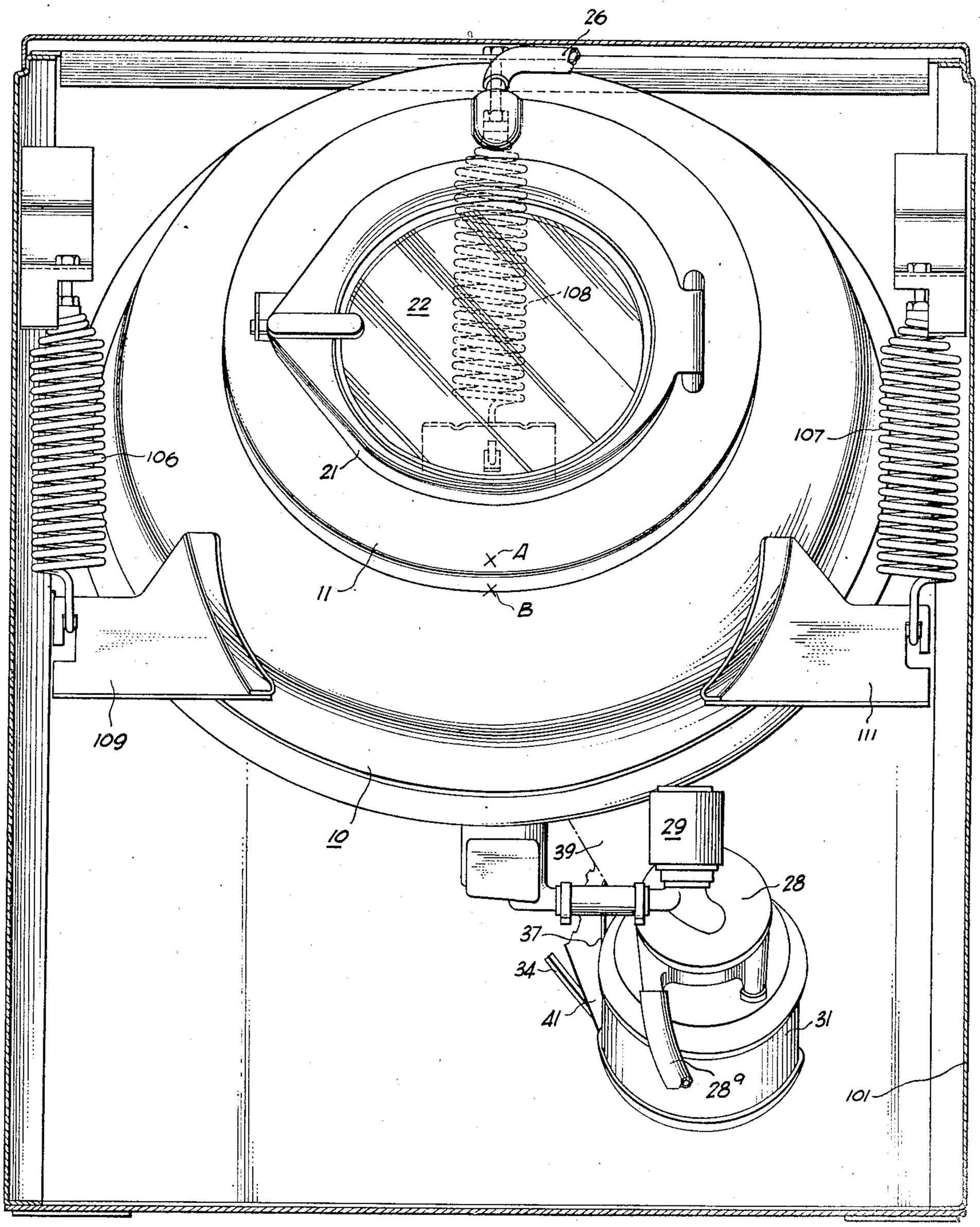

Fig. 2.

WITNESSES:
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WASHING APPARATUS

Filed Nov. 21, 1939 5 Sheets-Sheet 3

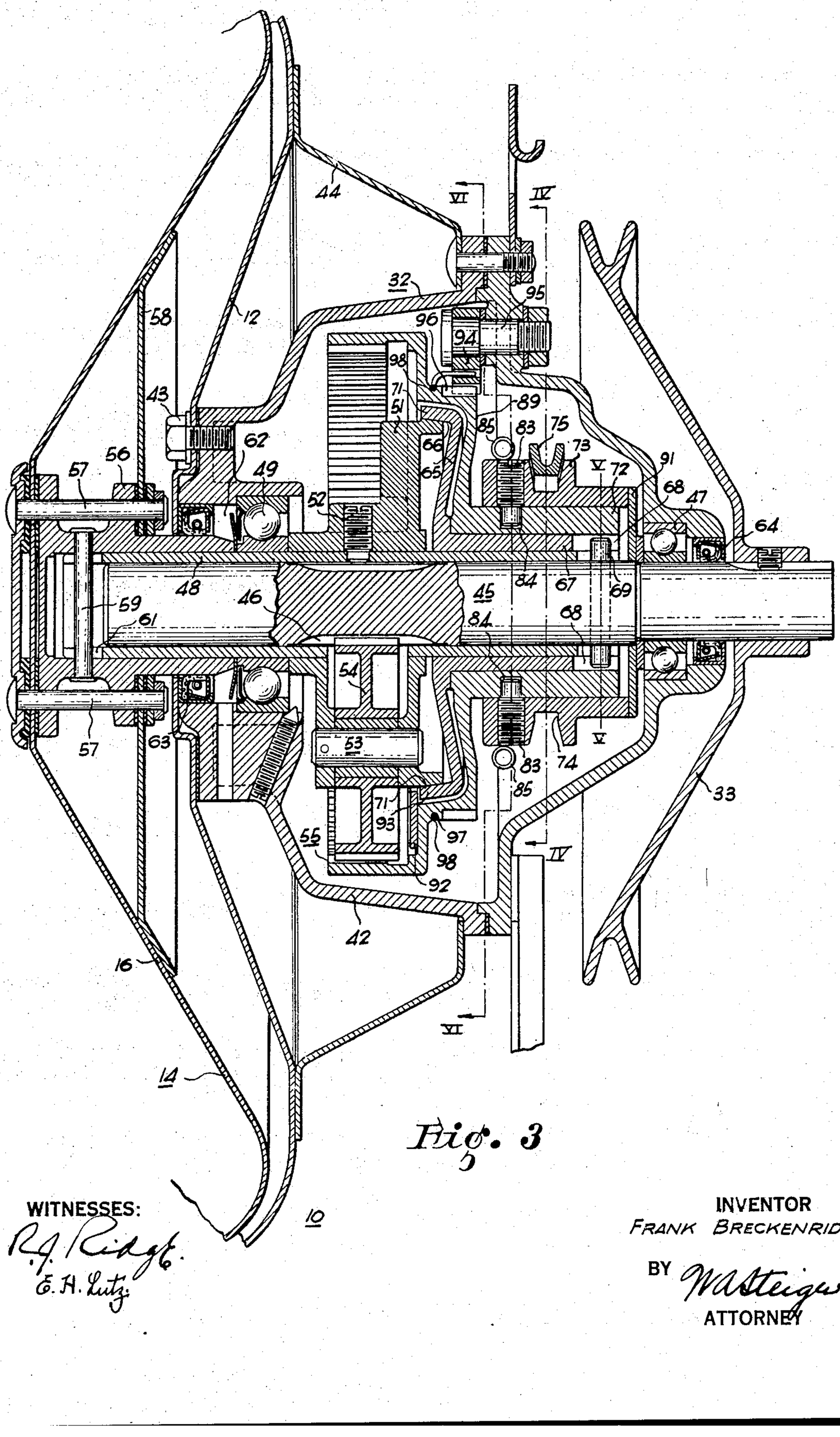

Fig. 3

WITNESSES:
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March 7, 1944. F. BRECKENRIDGE 2,343,742

WASHING APPARATUS

Filed Nov. 21, 1939 5 Sheets-Sheet 4

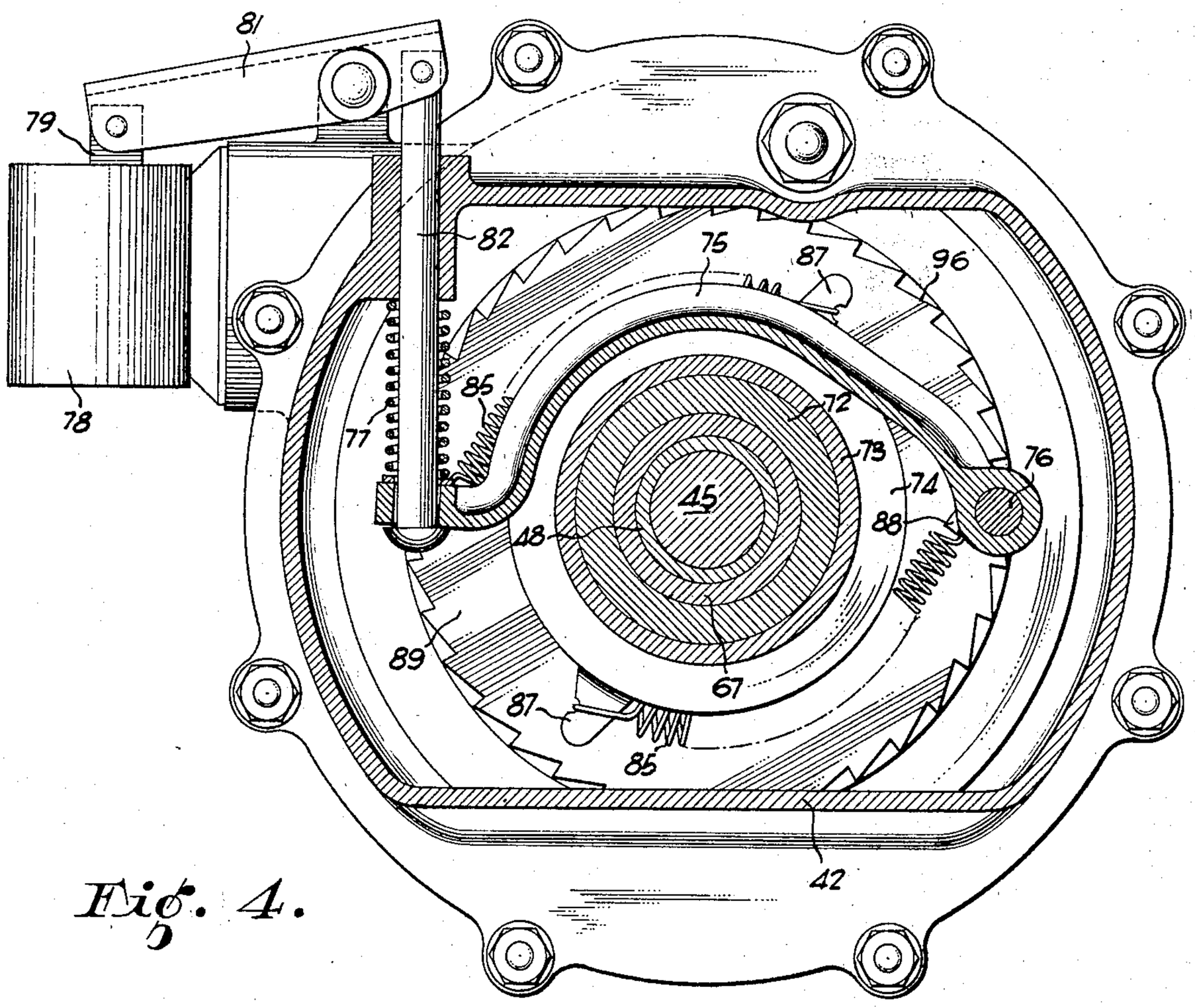

Fig. 4.

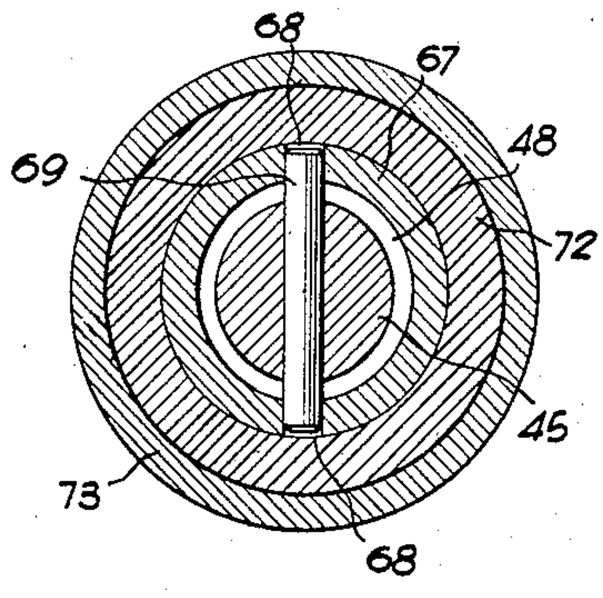

Fig. 5.

WITNESSES:
R. J. Ridge.
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March 7, 1944. F. BRECKENRIDGE 2,343,742

WASHING APPARATUS

Filed Nov. 21, 1939 5 Sheets-Sheet 5

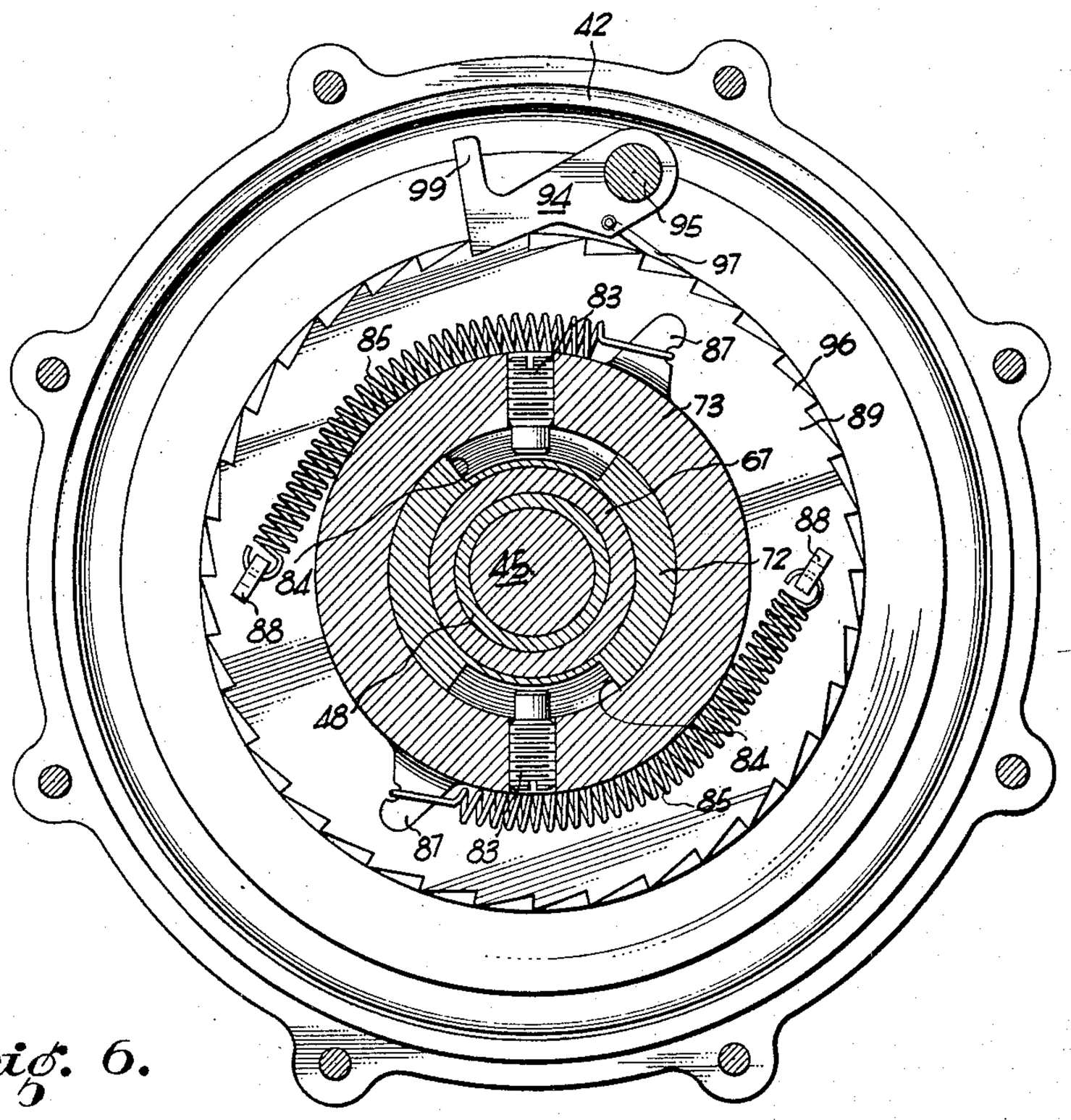

Fig. 6.

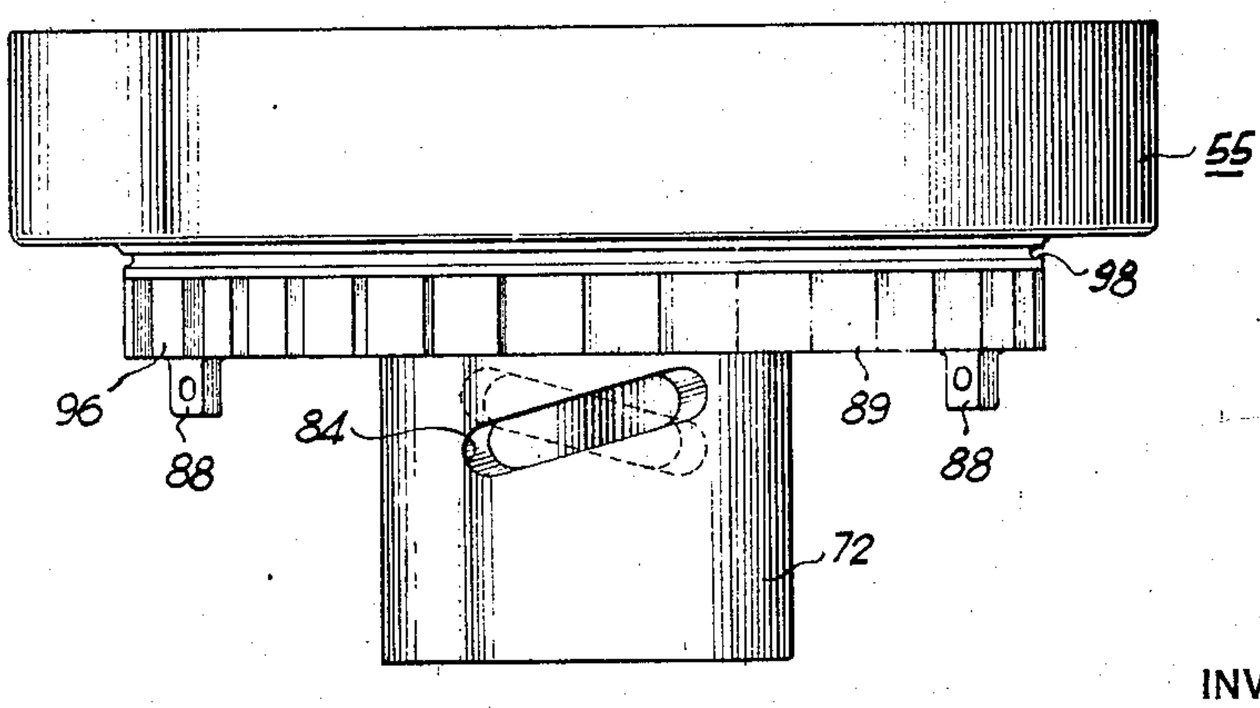

Fig. 7.

WITNESSES:

R. J. Ridge

Andrew J. Cook

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FRANK BRECKENRIDGE

BY Wastlegis

ATTORNEY

Patented Mar. 7, 1944 2,343,742

UNITED STATES PATENT OFFICE

2,343,742

WASHING APPARATUS

Frank Breckenridge, Mansfield, Ohio, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application November 21, 1939, Serial No. 305,512

3 Claims. (Cl. 68—24)

My invention relates to apparatus for washing fabrics and for centrifuging water therefrom and has for an object to provide improved apparatus of this kind.

It is a further object of the invention to provide improved apparatus of the character set forth in which the fabrics are washed and centrifuged in a single basket rotatable about an axis inclined from the vertical, wherein the basket, tub, and driving means for the basket are compactly arranged and readily assembled.

It is a further object of the invention to provide improved washing apparatus of the character set forth having a resiliently supported unitary structure which includes the tub, basket, and a motor driven two-speed driving mechanism for the basket, the driving mechanism and its motor being so disposed that they effectively function as inertia stabilizers for reducing the vibratory movement of the unitary structure.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a vertical sectional view of a washer and spinner constructed in accordance with my invention;

Fig. 2 is a front view of the washing and spinning unit with portions of its enclosing casing being broken away;

Fig. 3 is an enlarged vertical sectional view of the two-speed mechanism shown in Fig. 1;

Figs. 4 and 5 are transverse sectional views taken along the lines IV—IV and V—V, respectively, of Fig. 3;

Fig. 6 is a transverse sectional view taken along the line VI—VI of Fig. 3 and showing details of the clutching apparatus; and,

Fig. 7 is a view in elevation of the orbit gear and clutch actuating structure.

Reference will now be had to the drawings wherein I have shown my invention applied to a washer of the type disclosed and claimed in my copending application, Serial No. 203,804, filed April 23, 1938, now Patent 2,296,257, and assigned to the assignee of the present application. The claims in this copending application are directed to the arrangement and form of applicant's tub and basket structure. It will be understood, however, that this invention is applicable to other forms of washing machines wherein the clothes-containing basket is actuated about an axis that extends generally horizontal or which is arranged at an angle to the vertical. In defining generally horizontal, I mean an axis which extends either horizontally or which may be inclined from the horizontal at an angle of 45° or less.

The washing and spinning apparatus in the embodiment disclosed includes a tub structure generally indicated at 10 and of frusto-conical formation, the tub structure including an end wall 11 of major diameter, and an inner end wall 12 of minor diameter. The end walls 11 and 12 are connected by a side wall 13 which is well rounded, as shown in Fig. 1, where it joins the end walls 11 and 12. The axis of the tub is inclined at an angle of the order of 30° from the horizontal, the inclination being such that the larger end wall 11 of the tub structure faces forwardly and upwardly.

A perforate basket, generally indicated at 14, is rotatably disposed within the tub structure and substantially coaxial therewith. The configuration of the basket 14 closely follows the configuration of the tub 10 and the basket is relatively closely spaced within the tub so that the major portion of the washing water contained within the tub occupies the basket. The basket 14 includes an end wall 15 at the large end thereof and an end wall 16 at the inner or small end thereof, the latter end wall defining a reentrant portion of the basket and forming a dome or hump within the basket. In this connection, it will be noted that the end wall 12 of the tub also forms a re-entrant portion of the tub and is arranged in nested relation with the dome or hump 16. A series of vanes 17 are circumferentially spaced within the basket 14 for agitating the clothes therein during the washing period as described hereinafter.

In the present embodiment four vanes are shown but it will be understood that a greater or lesser number may be employed. As shown, the vanes extend from adjacent the end wall 15 of the basket toward the end wall 16 but terminate short of the latter so that an uninterrupted annular region indicated at 18 is formed within the basket adjacent to the dome or hump 16. The vane and basket structure which I have shown is disclosed and claimed in the application of Stuart R. Baird, Serial No. 268,103, filed April 15, 1939, now Patent 2,296,267, and assigned to the assignee of the present application.

An access opening 19 is formed in the end wall 11 of the tub structure and is closed by a suitable gasketed door 21 preferably including a transparent central portion 22. The access opening 19 registers with a relatively large opening 23 formed in the basket 14. The openings 19 and

23 provide access to the interior of the basket for the ingress and egress of fabrics to be washed. Water is admitted to the interior of the tub in any suitable manner, such as, for example, by means of a conduit 24 having a nozzle 25; the conduit 24 being connected to a suitable source of water supply by means of a flexible conduit 26. As the control of the admission of water to the tub forms no part of the present invention, it is not deemed necessary to describe the controlling apparatus in detail.

Discharge of water from the tub is effected through an opening 27 formed in the bottom side wall 13 of the tub, which opening 27 communicates with the inlet of a pump 28 having a discharge conduit 28a leading to a suitable drain. Passage of water from the opening 27 to the pump 28 may be controlled by a suitable electrically operated valve generally indicated at 29. The pump 28 is driven by an electric motor 31 which also operates to rotate the basket during the washing and spinning operations as described hereinafter. As the construction of the apparatus for discharging the water from the tub forms no part of the present invention, it has not been shown in detail and it will be understood that any suitable means for controlling the discharge of water from the tub may be employed.

Rotation of the basket at relatively low speed of, for example, 48 revolutions per minute during the washing period and at a relatively high speed of the order of 460 revolutions per minute during the spinning period is effected by a two-speed mechanism 32, which in accordance with my invention, is secured to the end wall 12 of the tub structure. The two-speed mechanism 32 is actuated by a pulley 33 which is driven by a belt 34 from a high speed pulley 35, the latter being rotated by the motor 31 at a speed of approximately 1725 revolutions per minute.

The motor 31 which I prefer to employ for driving the pump 28 and the two-speed mechanism 32 is of the type commonly employed for driving conventional domestic washing machines. This form of motor includes a supporting cradle 36 having bracket portions 37 which support a pair of resilient rings 38, the latter enclosing hub portions of the motor 31 and defining a resilient support for the motor. In accordance with my invention, the cradle member 36 is rigidly secured to the tub structure 13 by means of a bracket 39 shown in broken lines in Fig. 1. The bracket member 39 may be secured to the cradle 36 and the tub 13 in any well understood manner such as, for example, by welding. The opposite end bracket portion 37 of the cradle 36 has a brace 41 suitably secured thereto, which brace is attached to the housing of the two-speed mechanism 32 in any suitable manner.

The two-speed mechanism 31 which I prefer to employ is of the planetary gear type, the various rotating elements of which are disposed substantially concentrically about the axis of the basket 14. A two-speed mechanism of this general type is disclosed and claimed in the copending application of H. E. Edwards, Serial No. 353,049, filed August 12, 1940, and assigned to the assignee of the present application. In this copending application, the claims are directed to the structure of the multiple speed mechanism. The mechanism 32 is illustrated in detail in Figs. 3 to 7, inclusive, and includes a housing 42 that is secured to the end wall 12 of the tub structure by means of bolts 43. An annular wall or bracket 44 is secured to the end wall of the tub 12 and to an intermediate portion of the housing 42 for bracing the latter. The two-speed mechanism is provided with a main driving shaft 45 that is rotated by the pulley 33 in counter-clockwise direction as viewed in Figs. 4 and 6, which shaft 45 has sun gear teeth 46 cut in an intermediate portion thereof. The outer end of the shaft 45 is journaled in an end portion of the housing 42 by means of an anti-friction bearing 47 and the inner portion of the shaft 45 is journaled within a sleeve 48 which surrounds a substantial portion of the shaft 45. The sleeve 48 is journaled by an anti-friction bearing 49 in the opposite end of the housing 42.

Rotation of the sleeve 48 is effected by a planet gear supporting member 51, the latter being keyed to the sleeve 48 by means of a set screw 52. The supporting member 51 carries a stub shaft 53 upon which a planet gear 54 is rotatably carried, the gear 54 meshing with the sun gear teeth 46. The planet gear 54 also meshes with an orbit gear 55 which is maintained stationary during washing periods or during the periods that the planetary gear mechanism is effective to reduce the relatively high speed of the shaft 45 to the slow speed at which the sleeve 48 and the basket 14 are rotated. During spinning periods or when the basket 14 and sleeve 48 are rotated at the same speed as the shaft 45, the orbit gear 55 is free to rotate with the shaft 45.

As shown in Fig. 3, the basket 14 is secured to the sleeve 48 and rotates at all times therewith. The rotating basket structure includes a hub 56 which is secured to the central portion of the hump or dome 16 of the basket 14 by means of bolts 57. An annular reinforcing wall member 58 may also be employed for attaching the hump portion 16 to the hub 56. The means for attaching the hub 56 to the sleeve 48 includes a pin 59 that extends radially across the hub and which is disposed within an axially-extending slot 61 formed in the end of the sleeve 48. A substantial portion of the hub 56 extends longitudinally of the sleeve 48 and within an opening 62 in the end of the housing 42. A conventional seal 63 is provided between the hub 56 and the inner wall of the opening 62 for preventing the leakage of oil from the housing 42 and leakage of solution from the tub at this point. In this connection, a second seal 64 is disposed between the housing 42 and the shaft 45 adjacent the bearing 47 for the same purpose.

The mechanism for effecting the two-speed operation of the sleeve 48 and basket will now be described. This mechanism includes a movable clutch member 65 having an internal clutching surface 66 and a hub 67 which is journaled on the sleeve 48, which hub 67 is provided at its outer end with longitudinally extending slots 68 within which a pin 69 extends. The pin 69 is rotatable with the shaft 45 so that the clutching member 65 rotates at all times at the same speed as the shaft 45. The internal clutching surface 66 cooperates with an annular clutching surface 71 that is formed on the planet gear supporting member 51. It is by means of these clutching surfaces 66 and 71 that the planet gear mechanism is locked and rotation of the sleeve 48 effected at high speed.

The orbit gear 55 is provided with a hub 72 that is journaled on the hub portion 67 of the clutch member 65. A collar 73 is carried by the hub portion 72 of the orbit gear 55 and is rotatable therewith. The annular collar 73 is provided with a circumferentially extending slot 74

having tapered side walls which are engageable with a movable braking member 75, wedge shape in cross section, as best shown in Fig. 3. This movable braking member 75 is pivotally carried by the housing 42 as shown at 76 in Fig. 4 and is biased into engagement with the collar 73 by means of a spring 77. The brake is released by means of an electro-magnet 78, the armature 79 of which is connected by a pivoted lever 81 to a link 82, the latter being connected to the movable braking member 75.

Engagement and disengagement of the clutching surfaces 66 and 71 is in response to the operation of the brake. In other words, during periods when the movable braking member 75 is disengaged from the collar 73, the clutching surfaces 66 and 71 are engaged and, when the movable braking member 75 engages the collar 73, the clutching surface is disengaged. The mechanism for engaging and disengaging the clutching surfaces 66 and 71 will now be described.

The collar 73 is rotatable with the hub member 72 of the orbit gear at all times but may be moved through a limited arc with respect to the hub 72 during which movement the hub 72 is moved axially with respect to the collar 73. This operation is effected by a plurality of pins 83 secured to the collar 73 and having their ends projecting into a plurality of respective slots 84 formed in the orbit gear hub 72. The slots are angularly disposed in the hub so that they define segments of a helix. The collar 73 is biased at all times in counter-clockwise direction with respect to the hub 72 by a pair of springs 85, one end of each being connected to respective arms 87 formed on the collar 73 and the other ends of which are respectively connected to projecting lugs 88 carried on the side of the wall portion 89 of the orbit gear 55. Accordingly, the springs 85 impart an axial thrust to the collar 73 toward the right as viewed in Fig. 3, which thrust is resisted by a stationary thrust plate 91 which bears against the housing 42. As axial movement of the collar 73 is restrained, the arcuate movement of the collar 73 in counter-clockwise direction effects axial movement of the hub 72 and of the orbit gear 55 toward the left through the connection defined by the pins 83 and the slots 84. This movement effects engagement of the clutching surfaces 66 and 71. Conversely, arcuate movement of the hub 72 counter-clockwise with respect to the collar 73 during periods when the brake member 75 is in engagement with the collar 73 effects movement of the hub 72 axially to the right and disengagement of the clutching surfaces 66 and 71. The latter movement as will be apparent, also expands the springs 85. Axial movement of the hub 72 from the position shown in the drawings to the clutch open position is limited by the thrust plate 91. In order to disengage the clutching surfaces 66 and 71 when the hub portion 72 is moved to the right as described, one or more overhanging fingers 92 are provided on the wall portion 89 of the orbit gear which fingers engage the annular end surface 93 of the movable clutching member 65.

Clockwise movement of the oribt gear 55 is prevented by a pawl and ratchet mechanism associated with the orbit gear 55 and the housing 42. This mechanism includes a pawl 94 pivoted at 95 to the housing 42 and ratchet teeth 96 associated with the pawl, which teeth are formed on the orbit gear wall member 89 as best shown in Fig. 6. During periods when the orbit gear 55 is rotated in counter-clockwise direction, the pawl 94 is lifted out of engagement with the ratchet teeth 96 in order to provide for more quiet operation at this time. The means for lifting the pawl 94 includes a spring 97 which is pivoted to the pawl 94 but which is maintained in frictional engagement with a circumferentially-extending slot 98 formed in the wall member 89 of the orbit gear. It will be apparent that during counterclockwise operation of the orbit gear 55 the tendency is for the spring 97 to rotate with the orbit gear so that the pawl 94 is swung clockwise about its pivot as viewed in Fig. 6, out of engagement with the ratchet teeth 96. Rotational movement of the pawl 94 about its pivot 95 is limited by a stop 99 which is engageable with the housing 42. Any clockwise movement of the orbit gear 55 swings the pawl 94 downwardly because of the connection of the spring 97 to the pawl and its frictional engagement with the orbit gear whereby the pawl 94 is brought into engagement with the ratchet teeth 96 and, therefore, prevents further clockwise rotation of the orbit gear. The operation of the two-speed mechanism will now be described.

As shown in the drawings, the brake magnet 78 is energized so that the brake is disengaged, the apparatus at this time effecting high speed operation of the basket 14 for centrifuging water from the clothes. The clutching surfaces at 66 and 71 are engaged and the springs 85 are contracted. The hub portion 72 of the orbit gear is moved to its extreme left position as viewed in Fig. 3. The drive is, therefore, from the high speed pulley shaft 45, through the pin 69, the clutching member 67, the clutching surfaces 66 and 71, the planet gear support 51 and the sleeve 48 which carries the basket 14. When the spinning operation is to be terminated, the brake magnet 78 is de-energized so that the braking member 75 is engaged with the collar 73 through the action of the spring 77. Retarding the movement of the collar 73 effects arcuate movement of the orbit gear hub 72 relative to the collar 73 so that the orbit gear 55 is moved to the right because of the connection between the pins 83 and slots 84 as described. Movement of the orbit gear to the right effects opening of the clutching surfaces 66 and 71, it being understood that the fingers 92 engage the end 93 of the clutching member during this transition. It will be understood that, prior to this operation, the orbit gear is rotated counter-clockwise at high speed so that the pawl 94 and the ratchet teeth 96 are disengaged.

After the brake is applied, deceleration of the orbit gear is effected until rotation of the orbit gear is terminated. The tendency then is for the orbit gear to rotate in clockwise direction because of the planetary gear drive as is well understood. However, any slight movement of the orbit gear in clockwise direction caused by slipping of the brake will immediately swing the pawl 94 downwardly into engagement with the ratchet teeth 96 for preventing any further clockwise rotation of the orbit gear. Accordingly, during the washing operation or when the basket is operated at low speed, the pawl and ratchet mechanism prevent rotation of the orbit gear. During the washing operation, the drive is from the high speed shaft 45 through the sun gear teeth 46 and the planet gear 54 which now rotates within the stationary orbit gear 55, whereby low speed rotation of the planet gear support 51 within the orbit gear is effected. The support 51,

therefore, drives the basket 14 at relatively low speed through the sleeve 48.

During washing periods, the tub 10 contains a substantial quantity of water, the level of which is indicated by the broken line in Fig. 1. As the basket is rotated, the clothes contained therein are elevated to an upper region of the basket by the vanes and drop from the inclined portions thereof upon the dome or hump 16. The fabrics then descend across the dome and launch in the body of washing water and are directed forwardly therein. This cycle continues during the washing period. When the washing of the fabrics is terminated, the discharge valve 29 is opened and the water is pumped from the tub. The basket 14 continues to operate at relatively low washing speed for a period of time during which the fabrics are elevated and dropped upon the dome as described before, but, as they descend from the dome with the tub devoid of water, they tend to cling to the surfaces of the dome and gather uniformly in the uninterrupted annular space 18 adjacent the dome, which space defines a portion of the basket of minimum diameter. Accordingly, in this position they offer less resistance to the acceleration of the basket which is next effected.

Acceleration of the basket to its high extracting speed is effected by energizing the brake magnet 78 as described heretofore. As the basket accelerates the fabrics move upwardly and forwardly to a region thereof of larger diameter so that centrifuging of the water therefrom is more effectively carried out. Furthermore, as this region is adjacent the access opening, the fabrics may be more readily removed from the basket after spinning. The described method of washing the fabrics, then collecting the same in the portion of the basket of minimum diameter and finally centrifuging the fabrics in the region of the basket of larger diameter is disclosed and claimed in my copending application, Serial No. 339,841, filed June 11, 1940, and assigned to the assignee of the present application.

From the foregoing description it will be apparent that the tub 10, basket 14, the two-speed mechanism 32 and the driving motor 31 define a unitary structure generally indicated at 100, which may be supported in any convenient manner. An enclosing casing 101 is provided for housing the unitary structure 100 and it preferably has a portion of the front wall 102 thereof inclined as shown at 103. The inclined portion 103 of the front wall is disposed in a plane normal to the axis of the basket and includes an opening 104 disposed about the axis and closed by a suitable door 105.

Preferably, the unitary structure 100 is resiliently supported within the casing or housing 101 so that it is free to vibrate in all modes. As shown, three springs 106, 107, and 108 are employed so that they define a three-point support for the suspended structure. The upper ends of the springs are suitably attached to the casing 101 and the lower end of the spring 106 and 107 support respective brackets 109 and 111 suitably secured to the tub 10 on opposite sides of the portion thereof of major diameter adjacent the front end of the tub. The spring 108 supports a bracket 112 disposed adjacent the rear end of the tub and preferably carried by the housing 42 of the two-speed mechanism 32 as shown. It will be understood that other suitable forms of resilient supporting mechanisms may be employed for supporting the unitary structure.

It will be apparent from the foregoing description, that, by disposing the two-speed mechanism upon the end wall of a tub having its axis disposed at an acute angle from the vertical and arranging the driving motor beneath the tub, that a compact assembly is provided. The overall depth of the unitary structure 100 and the amount of weight thereof that is non-uniformly displaced with respect to the axis of the tub are minimized. With this construction, I am enabled to employ a standard motor which represents a reduction in the production cost over arrangements wherein the motor is specially built as a part of the speed reducing mechanism.

In this connection, quieter operation is obtained with a standard motor over a geared head motor. Furthermore, a geared head motor is non-symmetrical in shape and, thereby, complicates the flexible support of the tub, when such support is employed. Where the unitary washing and spinning structure is flexibly supported, my improved arrangement of the motor and speed reducing mechanism upon the tub is advantageous, as they function as inertia stabilizers for reducing the amplitudes of the vibrations in the various modes. The mass of the basket, tub and speed reducing mechanism is distributed substantially uniformly about the axis of the rotating basket 14. The mass of the motor is spaced below the axis and stabilizes the suspended structure. As the major portion of the mass of the suspended structure is distributed uniformly about the axis, the center of inertia about which the structure is free to vibrate is adjacent to but slightly below the axis. The approximate centers of inertia with the tub empty and loaded with water are shown at A and B, respectively, in Figs. 1 and 2. I have found that, by providing a suspended structure with its center of inertia disposed in the position shown and carried by a three-point resilient support, the natural period of the various modes of vibration may be maintained at more nearly constant frequencies without providing relatively large masses distributed on the suspended structure for effecting this desirable result.

From the foregoing description, it will be apparent that I have provided an improved machine for washing and spinning clothes in a single basket having its axis of rotation inclined with respect to the vertical and wherein the overall dimensions of the structure are maintained at relatively low values and wherein objectional vibrations are precluded. Furthermore, the driving members for the basket including the motor and multiple speed mechanism may be economically produced and assembled to the tub and basket.

While I have shown my invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In apparatus for washing fabrics and for spinning fluid therefrom, the combination of a tub structure of substantially frusto-conical formation and having its axis arranged at an acute angle from the vertical so that the end of the tub of major diameter is faced upwardly and for-

wardly, a substantially frusto-conical basket coaxially aligned within the tub structure, a multiple speed mechanism for rotating the basket and having a housing secured to the end of the tub of minor diameter, a motor carried by an under portion of the tub structure for driving the multiple speed mechanism, first and second springs disposed on opposite sides of the tub structure adjacent the end thereof of major diameter, a third spring for supporting a rear portion of the tub structure and secured thereto adjacent the end wall of minor diameter, said springs defining a resilient three-point support for the tub structure and permitting vibration thereof in all modes.

2. In washing apparatus, the combination of a generally cylindrical tub structure, a basket rotatably disposed within the tub substantially in coaxial relation therewith, said basket having its axis of rotation extending generally in a horizontal direction, a multiple speed mechanism for rotating the basket and carried by a central portion of the end wall of the tub structure, a motor for driving the multiple speed mechanism and carried by an under portion of the tub structure, resilient means for supporting the tub structure and defining a three-point support therefor, said resilient means including first and second springs disposed on opposite sides of the tub structure adjacent an end thereof spaced from the multiple speed mechanism and a third spring for supporting the portion of the tub structure adjacent said multiple speed mechanism.

3. Apparatus for cleaning fabrics and for centrifuging cleaning fluid therefrom, the combination of a basket rotatable about an axis inclined substantially from both the vertical and horizontal, a tub having an end wall and a side wall extending forwardly and upwardly therefrom and enclosing the basket, a multiple speed mechanism secured to said end wall of the tub and rotatably supporting the basket, said mechanism being adjustable to rotate the basket at relatively low and high speeds during the washing and centrifuging of the fabrics, respectively, a motor carried by an under portion of the tub structure for driving the multiple speed mechanism, and a series of downwardly-extending springs spaced horizontally from each other for resiliently supporting the tub, multiple speed mechanism and motor as a unitary structure, said springs being connected to horizontally-spaced portions of the unitary structure and said motor being disposed in a region defined by downward projections of said springs.

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