

May 12, 1942.

G. KUHN

2,282,332

WASHING AND CLEANING MACHINE

Filed Oct. 17, 1936

2 Sheets-Sheet 1

Fig. 1

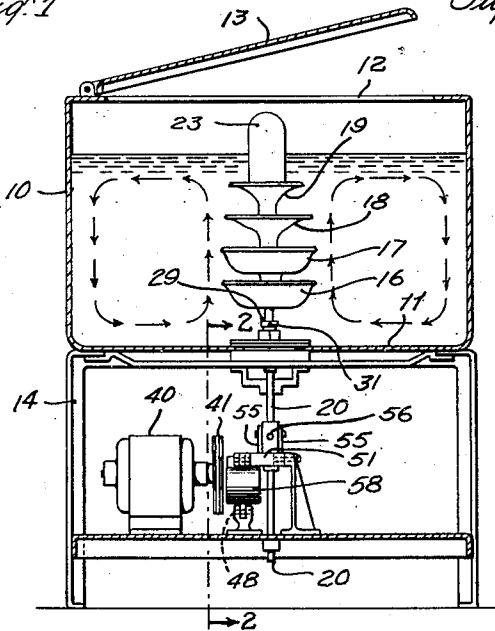


Fig. 3

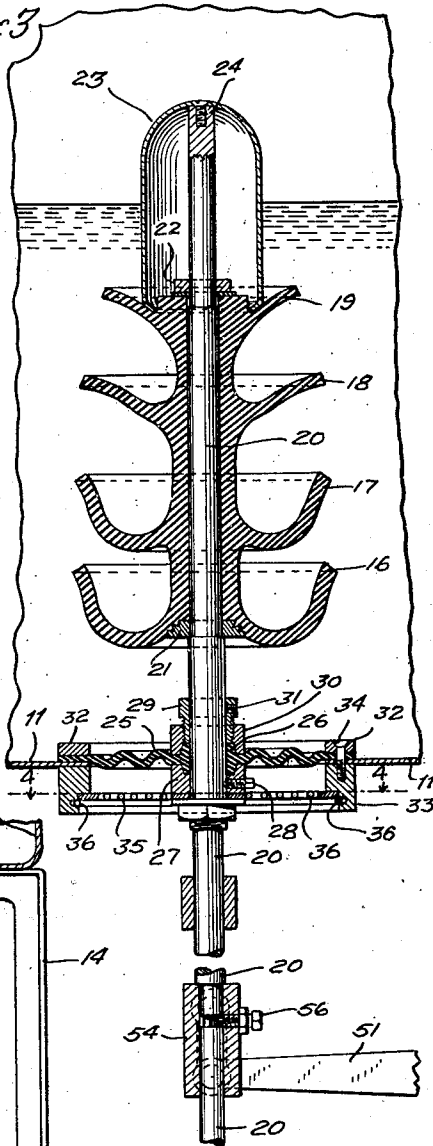
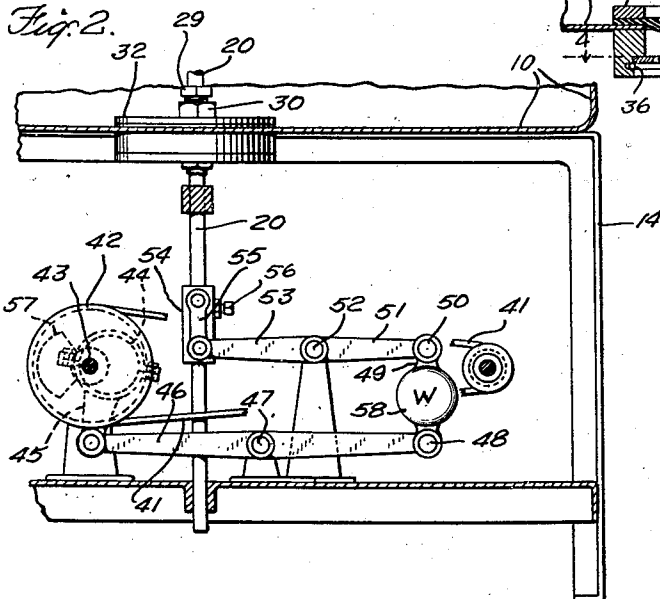


Fig. 2



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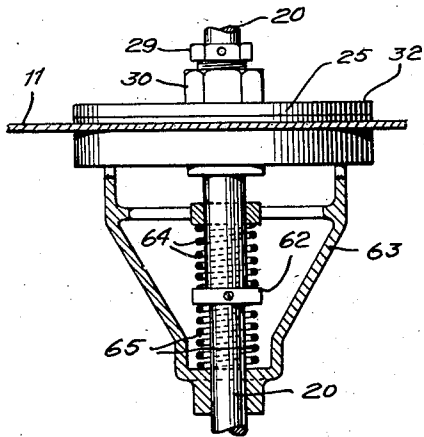
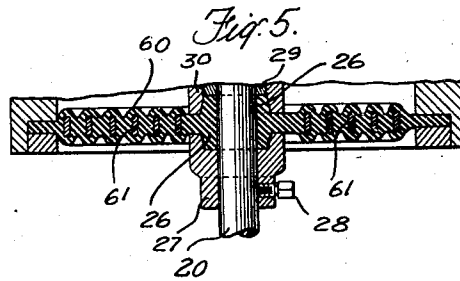
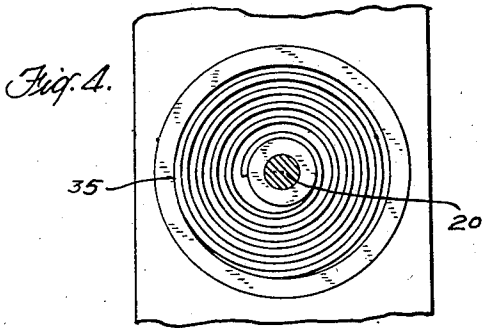
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2 Sheets-Sheet 2



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WASHING AND CLEANING MACHINE

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7 Claims. (Cl. 68—131)

This invention relates to the washing and cleaning of fabrics and articles and more particularly to power driven washing and cleaning machines.

The invention provides a washing and cleaning machine of extremely simple construction which provides all essential operations to effect a rapid and thorough cleaning or washing of the articles. These operations include circulation of the articles in the washing fluid, scrubbing and shaking of the articles, agitating and flexing of the fabric of the articles and rapidly pulsating the fluid through the fabric.

The machine of the present invention includes a rapidly reciprocating washing element submerged in the washing fluid, provided with one or more circumferential projections or discs serving as scrubbing surfaces and as means providing a unidirectional flow or circulatory motion of the fluid whereby the articles being cleaned are successively and repeatedly drawn into a scrubbing zone adjacent the washing element wherein they are scrubbed and vigorously shaken. Additionally, the motion of the washing element produces sufficiently vigorous pulsations which spread throughout the body of the fluid and serve to loosen and remove dirt by rapidly flexing and agitating the articles and pulsating the fluid through the fabric. The washing element also functions to untangle any fabric or article which may have become tangled with another or others during the washing action.

The intensity and rapidity of the washing action may be readily varied by varying the stroke or the speed of movement of the washing element or the rate at which it reciprocates, thereby to produce as gentle or as vigorous in washing action as may be desired to suit the particular type of fabric undergoing treatment. The structure of the washing element permits the use of an elastic material which will preclude injury to fabrics even with the most vigorous washing action. The speed and direction of the circulation of the fluid and the articles being treated may be altered by variations in the form and size of the washing element.

The invention will be understood from the following description considered in connection with the accompanying drawings forming a part thereof, and in which:

Fig. 1 is a more or less diagrammatic view in vertical section of a washing machine embodying the invention;

Fig. 2 is a sectional view of the operating mechanism for the washing element, taken sub-

stantially on line 2—2 of Fig. 1, and on an enlarged scale;

Fig. 3 is a vertical sectional view, on an enlarged scale, of the washing element and the parts immediately associated therewith;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 3;

Fig. 5 is a partial vertical sectional view showing another form of diaphragm for the washing element, and

Fig. 6 is a partial vertical sectional view illustrating another arrangement for biasing the washing element.

Like characters of reference refer to the same or similar parts throughout the several views.

Referring to the drawings, particularly to the machine illustrated in Figs. 1 to 4 inclusive, reference character 10 designates the tub of the machine which is preferably cylindrical in form with a closed bottom 11 and an opening 12 at the top which may be closed by a hinged cover 13. The tub 10 is secured to a supporting pedestal 14 which also serves to support the operating mechanism for the washing element.

The washing element is rapidly reciprocated with relatively short strokes in the treating fluid contained in the tub, and includes one or more scrubbing surfaces which also produce circulatory motion of the washing fluid and pulsations in the fluid which are sufficiently vigorous to flex and agitate flexible articles being treated and to cause the fluid to be forced through the fabric of the articles. In the form shown in Figs. 1 and 3, the washing element is provided with four spaced projections or discs 16, 17, 18 and 19 respectively. In this instance, the discs are constructed and arranged so as to cause the treating fluid and the articles being treated, to circulate in general as indicated by the flow lines in Fig. 1, that is, toward the center of the tub at the lower end of the washing element, upwardly at the center and along the element through the scrubbing zone, which may be considered as the space immediately surrounding the washing element, then radially outwardly from the upper end or portion of the element and downwardly at the wall or the peripheral portions of the tub. Although the washing element may be constructed of rigid materials such as metal, hard rubber, "Bakelite," etc., I prefer using elastic and flexible material such as live rubber, or suitable rubber composition reinforced with fabric, metal or other material where necessary. Greater circulation of the fluid and more gentle treatment of the articles is thus obtained. More specifically,

the discs 16 and 17 of the washing element may be flexible rubber cups. These cups are disposed so as to be concave upwardly, as shown in Figs. 1 and 3, and as they are reciprocated, the bottom of the cups flex and the walls, particularly the upper edge portions, expand and contract producing a pumping action which sucks the fluid and the articles at the bottom of the tub radially inwardly toward the washing element and into the scrubbing zone. Disc 18 should also be flexible but it should not possess the degree of concavity of cups 16 and 17. Instead it should have an upwardly inclined flange on the order of that shown in Fig. 3, so arranged that it functions to take hold of the articles brought into the scrubbing zone by the cups 16 and 17 and to feed them upwardly in a series of relatively fast jerks toward the disc or discs above. Disc 19 should be semi-flexible, that is, more rigid than the lower discs and is constructed and arranged to slap or pound the articles moving upwardly in the scrubbing zone and to push them and the treating fluid radially outwardly toward the wall of the tub in the upper portion of the fluid. This disc is curved outwardly and upwardly as shown in Fig. 3, with a concave lower surface, and in the form of the machine shown, is positioned to operate below the surface of the body of washing fluid. During operation, disc 19 functions to project fluid and the articles therein, outwardly toward the wall of the tub. Upon reaching or nearing the wall of the tub, the fluid and the articles will be forced to flow downwardly toward the bottom of the tub due to the action of the bottom disc 16 and 17 as previously described.

The discs on the washing element should be spaced apart a distance sufficient to allow each disc to fully perform its intended function. Although two pumping discs 16 and 17 are shown, a single disc of this character may be used where less vigorous circulation is desired.

The carrying and operating mechanism for the washing element illustrated in Figs. 1 and 3 includes a vertically disposed shaft 20 arranged and supported to be rapidly reciprocated and upon which the discs 16 to 19 are mounted. A supporting collar 21 is secured to the shaft 20 in an appropriate position to support the discs 16 to 19 in spaced relationship with the bottom of the tub. The discs 16 to 19 may be integral or one or more may be separate from one or more of the others. The hubs of the discs may be of sufficient axial length to provide the desired spacing between their outer edges. The nut and washer indicated 22, or other means, may be employed for engaging the upper end of the hub of the uppermost disc 19 to secure all the discs in position on the shaft 20. Various portions of the shaft may have different diameters as illustrated in Fig. 3.

The washing element is arranged so as to prevent splashing of the fluid in the tub during operation of the machine. One such arrangement is illustrated in Figs. 1 and 3 and constitutes a member designated 23 which is partly submerged in the fluid when the washing element is in normal or intermediate position as indicated in Fig. 3, and is constructed and disposed so that during movement of the washing element it will not strike or slap the surface of the fluid. Specifically, this non-splashing means in the form shown, includes an inverted aluminum cup-shaped shell having its lower end in contact with the upper portion of disc 19 and

with its closed spherically shaped upper end secured to the upper end of shaft 20 by suitable means such as screw 24. Aluminum is desirable for this purpose because of its light weight, but other materials may be employed. Also, the non-splash member may be of other shapes or configurations than that shown so long as the walls thereof are continuous and move parallel to the axis of reciprocation. During operation of the machine while the washing element is reciprocating in the treating fluid, it will be perceived that with the non-splash element 23 proportioned so that its wall is never entirely submerged or never entirely forced out of the treating fluid, the element will move through the treating fluid without causing any slapping or pounding of the surface of the water in consequence of which there will be no splashing. With an arrangement of this character, the washing machine may be operated with the cover 13 of the tub open without spilling or splashing any of the treating fluid.

A feature of the invention is the elimination of the necessity for a packing gland between the washing element and the tub. In the form of invention shown in Figs. 1 to 4 inclusive, such means constitutes a diaphragm 25 which is circular in form and is secured at its central portion to the shaft 20 of the washing element and at its outer peripheral portion to the bottom 11 of the tub. This diaphragm may be rubber or rubber composition, or rubber reinforced material, preferably such as will withstand the great number of flexings to which it will be subjected in use. Certain fabrics may be suitable for the purpose and certain metals may also be used such as corrugated spring metal. Preferably the diaphragm is of corrugated form in cross-section, as shown in Fig. 3, that is to say, the intermediate portion of the diaphragm may consist of a series of concentrically disposed and connected ridges presenting on either side, alternating concave and convex surfaces. The diaphragm should be sufficiently large in area so that flexing will not impose too severe a strain on any portion thereof. The hub 26 of the diaphragm is preferably of frustoconical configuration on both sides, as shown in Fig. 3, so that securing members having cooperating wedging surfaces may be employed to wedge the hub against the shaft 20 and thereby prevent leakage of fluid between the shaft and the diaphragm. As shown, a collar 27 is fixed to the shaft in the desired position by means of a set screw 28. The upper part of this collar has a cup-shaped portion with walls which function to wedge the hub against the shaft and which receives the lower part of the hub of the diaphragm. A threaded sleeve 29 having a screw collar 30 threaded thereon is then positioned immediately above the hub and is locked in place on the shaft by a set screw 31. Screw collar 30 may then be turned down against the hub of the diaphragm until the hub is forced against the shaft with the desired degree of pressure. The outer peripheral portion of the diaphragm is secured to the bottom 11 of the tub by clamping rings 32 and 33 or other suitable means. The diaphragm is pressed or squeezed against the tub and between one of the clamping rings by the screws 34 or other means. With this arrangement it will be perceived that a fluid tight connection is provided between the reciprocating washing element and the tub. This arrange-

ment is highly advantageous because of its great simplicity and because it provides a joint between the washing element and the tub in which there are no parts which slide relative to each other, so that adjustments are unnecessary and leakage is entirely prevented.

Another feature of the invention is the biasing of the washing element and its operating mechanism to prevent noise or knocking of the operating parts of the machine during operation where any looseness of the parts exists. One such means for accomplishing this purpose is shown in Figs. 3 and 4, and comprises a spiral spring 35 having its central portion secured to the shaft 20 and its outer peripheral portion secured to the tub or framework of the machine or other stationary part thereof. A spring ring 36 or other suitable means may be employed for securing this biasing spring in position. In operation, it will be perceived that whenever the washing element or shaft 20 is displaced from its normal position, shown in Fig. 3, spring 35 will impose a force upon the shaft 20 and the operating mechanism connected thereto, so that as the shaft moves into and out of its extreme positions of movement, that is to say, as the shaft 20 reaches the upper and lower limits of its stroke and thereafter moves toward its normal position, the biasing spring will prevent a shifting of the position of one or more of the elements of the operating mechanism in their bearings if any looseness or play is present in these bearings, thereby preventing any tendency toward knocking. The diaphragm 25 acts per se to a certain extent as an elastic biasing element and in some circumstances a diaphragm arranged in accordance with the invention may be sufficient to produce the required biasing action.

In the form of the invention illustrated in Figs. 1 to 4, the machine is operated by an electric motor 40 through suitable means by which the speed of the washing element may be varied. As shown, such means constitutes a belt drive 41 from the motor to a pulley 42 on operating shaft 43. Fixed to shaft 43 is an eccentric and strap 44 having an arm 45 which is pivotally connected to one end of a lever 46 pivoted at its center 47 to provide equal lever arms. The other end of lever 46 is pivoted at 48 to a connecting arm 49 to the other end 50 of which is pivoted a lever 51 fulcrumed at 52 at its center to provide equal lever arms. Arm 53 of lever 51 is forked and has its ends connected to a block 54 through a pair of links 55. Block 54 is mounted on reciprocating shaft 20 and may be fixed in a suitable position thereon by a set screw 56 or other means. The washing element assembly including the shaft 20 and the diaphragm 25 and biasing spring 35 may be removed from the machine by loosening set screw 56 and removing the screws 34 which secure the diaphragm to the tub. With this arrangement, all the discs of the washing element may be readily removed as a unit, after which the diaphragm may be removed for inspection, repair or replacement, without the necessity for removing the shaft 20. In this instance, all unbalanced forces produced during operation of the machine are counter-balanced so as to eliminate vibration. As shown, the eccentric and strap 44 are balanced by a counter-weight 57 fixed to shaft 43. This counter-weight is adequate in mass and is so positioned with respect to the eccentric and strap that all forces with

respect to this part of the operating mechanism are balanced during operation. A counter-weight 58 is supported on, or fixed to, connecting arm 49 which connects levers 46 and 51. The mass of this counter-weight 58 is adequate to counter-balance all unbalanced forces due to the reciprocation of the washing element. In this instance this weight should be equal to the weight of the washing element assembly including all parts connected to or supported on the washing element and the shaft 20. With this arrangement the center of gravity of the entire machine is maintained in a fixed position during operation, so that the machine may be operated without vibration.

In the driving or operating mechanism shown in Figs. 1 and 2, the stroke of the washing element is fixed, but its rate of reciprocation may be varied simply by altering the sizes of the pulleys on the motor shaft and the operating shaft 43, in the well known manner.

In Fig. 5 the diaphragm and the spiral biasing spring are combined in a single member. In the form shown, the diaphragm 60 has embedded within it a spiral biasing spring 61. The function and operation of this unit is the same as the function and operation of the separate diaphragm 25 and biasing spring 35 disclosed in Figs. 1 to 4, excepting that the biasing spring serves to support and reinforce the diaphragm.

In Fig. 6 two separate biasing springs are employed to perform the function of the single biasing spring 35 or 61. In this instance the shaft 20 is provided with a movable or removable collar 62 which may be fixed in position on washing element shaft 20 and the machine is provided with suitable supporting framework indicated 63 so that coil springs 64 and 65 may be maintained in the position illustrated in Fig. 6. With this arrangement it will be apparent that on the upstroke of the washing element and shaft 20 from normal position, biasing spring 64 will be operative for the purpose intended and as previously described, and on the downstroke from normal position, biasing spring 65 will be operative.

Forms of washing elements other than those disclosed in Figs. 1 and 3 may be employed, if desired.

Actual tests have indicated that very satisfactory results are obtained with a machine constructed and arranged as disclosed in Figs. 1 to 4 inclusive, with the washing element arranged as shown in these figures. With about 18 gallons of warm water and 4 ounces of soap in the tub and 12 pounds of soiled, dry clothes, and with the washing element reciprocating at the rate of 600 strokes per minute with a 1½ inch stroke, a perfect wash was obtained in 20 minutes of operation of the machine. The dimensions of the discs of the washing element in this instance were as follows; the lower cups 16 and 17 had outside diameters of 6 inches, and were 1½ inches in depth, disc 18 had an outside diameter of 7 inches and top disc 19 had an outside diameter of 5 inches. The cups were spaced about 2½ inches apart on the sleeve supporting them. During the operation of the machine, the water and the clothes continuously circulated in the tub in the direction indicated by the direction lines in Fig. 1 of the drawings, and in the manner previously described in connection with Fig. 1.

Although the washing elements disclosed herein are centrally or axially disposed in the tub,

it will be understood that other positions of the washing element in the tub will produce satisfactory results.

The washing elements constructed and operated as previously described produce a pulsating unidirectional flow of fluid. This character of flow is due to the fact that the discs of the washing element constitute fluid propelling projections, the upper and lower surfaces of which encounter different degrees of resistance to their passage through the fluid. With an element constructed and arranged as illustrated in Figs. 1 and 3, for example, the discs encounter less resistance on their downward movement than on their upward movement, which is due primarily to their shape, specifically their upwardly inclined circumferential surfaces. This action is present whether the discs are of rigid material and construction or of flexible material or construction. When, however, the discs are of flexible or elastic material or construction, the effective diameters alternately decrease and increase during operation on their downward and upward strokes respectively, whereby their fluid propelling action as previously described is further amplified. This pulsating unidirectional flow of the fluid carries the articles into proximity of the washing element which engages the articles singly and pulls them individually in a series of short, fast jerks past the scrubbing edges which shake, flex and briskly rub the fabrics and propel them through the scrubbing zone and then outwardly, after which they are carried by the currents of fluid to points in the tub where they begin a new cycle. Throughout the process of washing, the fluid continuously pulsates back and forth through the meshes of the fabric thereby loosening the dirt preparatory to its removal in the scrubbing zone. Whereas a steady pull would not loosen an article entangled in a mass, a series of fast, short jerks such as produced by the machine of my invention, readily does so.

Inasmuch as the rate and direction of circulation of the fluid, the intensity of the washing action, and other factors depend upon the shape, size, number and relative position and inclination of the surfaces of the discs as well as upon the operating speed of the washing element, it will be readily perceived that any or all of these factors may be modified as desired to meet any particular requirements.

In the embodiments of the invention herein disclosed, the washing element performs both the washing and fluid propelling functions.

Due to the unique character of the circulatory motion obtained in the machine of my invention in the forms disclosed in Fig. 1, the shape of the tub is immaterial, and rounded corners or inclined walls or the like are unnecessary, because during operation, the clothes or other articles discharged upwardly and outwardly upon the surface of the fluid impose their weight upon the other articles disposed at the outer peripheral portions of the tub and force these other articles downwardly and into the sphere of influence of the lower disc or discs of the washing element.

It will be understood that the direction of fluid circulation obtained during operation of the washing elements shown in Figs. 1 and 3 may be reversed merely by inverting the surfaces of the discs of the washing elements.

In the embodiments of the invention herein disclosed, the washing element is operated in a

substantially cylindrical tub, but the washing element may be shaped to suit any other shape of tub, such as rectangular, in which case the washing element may consist of rigid or elastic strips of a configuration to conform to the shape of the tub to produce uniform circulation of fluid throughout the tub.

It will be obvious that changes may be made in the form, location, relative arrangement and the materials of the several parts of the machine disclosed without departing from the principles of the invention. Accordingly no intention is entertained to limit the invention except by the scope of the appended claims.

What is claimed is:

1. In apparatus for treating articles with fluid comprising a tub having a reciprocating element therein carried by an operating shaft and means for reciprocating the shaft and the element, elastic biasing means comprising a spiral spring surrounding and acting upon said shaft and tending to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

2. In apparatus for treating articles with fluid comprising a tub having a reciprocating element in the tub carried by an operating shaft and means for reciprocating the shaft and the element, the shaft having a portion extending through an opening in a wall of the tub, a diaphragm closing said opening and having its outer peripheral portion secured in fluid tight relationship to the tub and its inner peripheral portion secured in fluid tight relationship to said shaft, said diaphragm having elastic biasing means which acts upon said shaft and tends to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

3. In apparatus for treating articles with fluid comprising a tub having a reciprocating element in the tub carried by an operating shaft and means for reciprocating the shaft and the element, said shaft having a portion extending through an opening in a wall of the tub, a diaphragm closing said opening and having its outer peripheral portion secured in fluid tight relationship to the tub and its inner peripheral portion secured in fluid tight relationship to said shaft, said diaphragm having a spiral spring embedded therein which acts upon said shaft and tends to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

4. In apparatus for treating articles with fluid comprising a tub having a reciprocating element in the tub carried by an operating shaft and means for reciprocating the shaft and the element, said shaft having a portion extending through an opening in a wall of the tub, a diaphragm closing said opening and having its outer peripheral portion secured in fluid tight relationship to the tub and its inner peripheral portion secured in fluid tight relationship to said shaft, and a spiral spring acting upon and surrounding said shaft to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

5. In apparatus for treating articles with fluid comprising a tub having a lineally reciprocating fluid propelling element in the tub carried by an operating shaft and means for reciprocating the shaft and the element, said shaft having a portion extending through an opening in a wall of the tub, a diaphragm closing said opening and

extending substantially normally to the shaft and having its outer peripheral portion secured in fluid tight relationship to the tub and its inner peripheral portion secured in fluid tight relationship to said shaft, and at least one coil spring acting upon and surrounding said shaft to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

6. In apparatus for treating articles with fluid comprising a tub having a lineally reciprocating fluid propelling element therein carried by an operating shaft and means for reciprocating the shaft and the element, a stationary member connected to the apparatus, and a spring surrounding and acting upon said shaft and having a portion operatively connected to the shaft and another portion connected to said stationary member and tending to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

7. In apparatus for treating articles with fluid comprising a tub having a lineally reciprocating fluid propelling element in the tub carried by an operating shaft and means for reciprocating the shaft and the element, said shaft having a portion extending through an opening in a wall of the tub, a diaphragm closing said opening and extending substantially normally to the shaft and having its outer peripheral portion secured in fluid-tight relationship to the tub and its inner peripheral portion secured in fluid-tight relationship to said shaft, a stationary member connected to the apparatus, and a biasing spring acting upon and surrounding said shaft and having a portion operatively connected to the shaft and another portion connected to said stationary member to prevent shifting of position of one or more parts of said reciprocating means to thereby prevent knocking.

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