Dec. 3, 1935. G. H. SCHIEFERSTEIN 2,022,829

WASHING MACHINE

Filed July 8, 1932

Fig.1

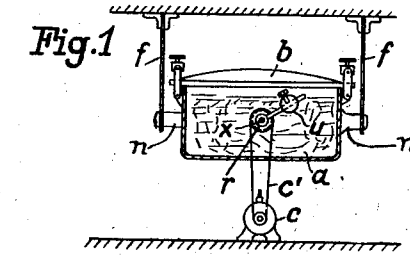
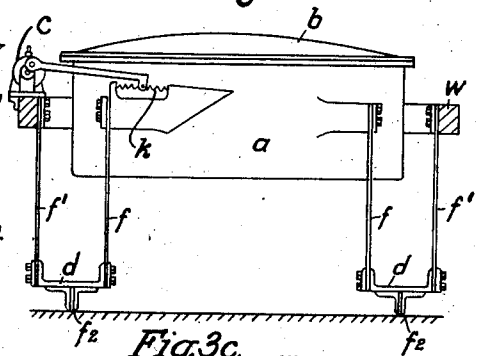


Fig.3



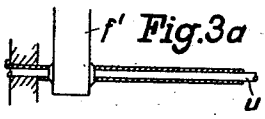


Fig.3a

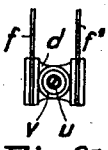


Fig.3b

Fig.2

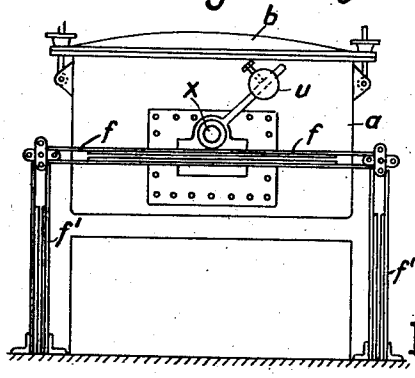


Fig.3c.

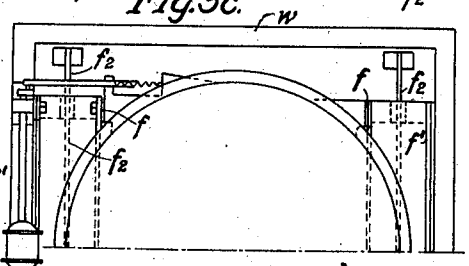


Fig.5

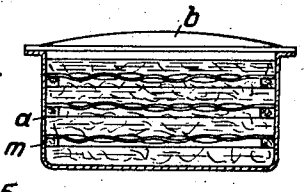


Fig.4

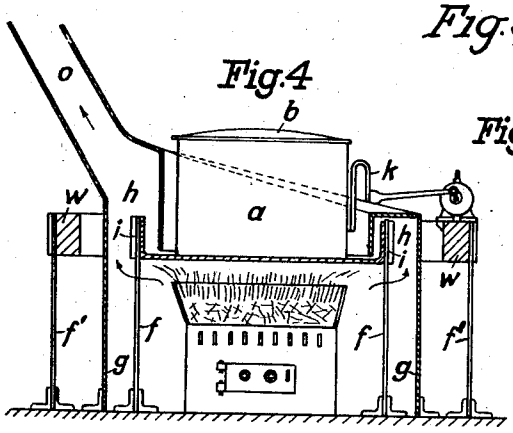
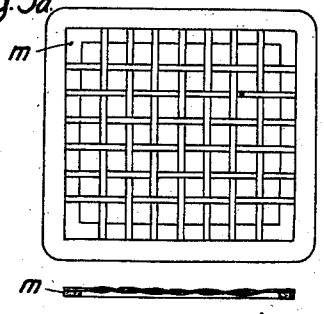


Fig.5a.



Inventor:

Georg H. Schieferstein,

By Sommers & Young

Attys.

Patented Dec. 3, 1935 2,022,829

UNITED STATES PATENT OFFICE

2,022,829

WASHING MACHINE

Georg Heinrich Schieferstein, Berlin, Germany

Application July 8, 1932, Serial No. 621,490
In Germany July 11, 1931

10 Claims. (Cl. 68—21)

This invention relates to washing machines for cleaning fabrics and articles of all kinds, especially household linen.

It is known to employ reciprocal movement in methods of washing and cleaning by machinery. Thus, for example, machines have long been known in which household linen is moved to and fro in the washing liquid, usually by means of separate pins or paddles which engage the articles that are to be cleaned, in order to ensure their reciprocating movement. At the same time, the walls between which the linen is moved are generally provided with ribs, to imitate the operation of washing by hand. Of course, in such cases, the rate of movement must be kept down within relatively low limits, since otherwise the articles (fabrics and the like) are easily torn or destroyed.

In order to prevent damage of this kind attempts have also been made to obtain a cleaning effect in revolving vessels, but even the results obtained by these means cannot be considered satisfactory, since, in this case, the reciprocating movement, which certainly assists the cleaning process, is lacking and, as the rotational velocity increases, the resulting centrifugal force nullifies the operation.

The discovery on which the present invention is founded is based on the circumstance that the sole important point in the mechanical cleaning of the fabrics and the like is that the liquid charged with detergent, loosening and bleaching agents should be drawn or forced through the fabrics as frequently and intensively as possible, in order to detach the adherent constituents (dirt). Consequently it is not essential for the "linen" as such to be moved to and fro, but it can easily be conceived that a substantially more intensive cleaning occurs when the "linen" is kept stationary and the liquid is allowed to flow back and forth at a high speed, or if reciprocating movements are set up in the liquid and the "linen" is merely submerged therein because, in that case, it is stimulated into reciprocating movement by the liquid and must therefore lag in the phase by reason of its own inertia. Given rapid changes of movement, this really means that there is set up between the reciprocating movement of the liquid on the one hand, and the "linen" on the other, a relative movement which is equivalent to drawing or forcing the liquid through towards both sides.

A further discovery on which the present invention is founded, is based on increasing the power (energy per second) necessary for the washing process by raising the frequency of the oscillations, in order to minimize both the forces and stroke which contribute to objectionable stresses in the linen.

In order more clearly to understand the nature of the invention, reference is made to the accompanying drawing, which illustrates diagrammatically and by way of example several embodiments of apparatus suitable for carrying out the invention.

Fig. 1 is a diagrammatic side elevation of a resiliently supported washing vessel.

Fig. 2 is a side elevation of a modified form of resiliently supported washing vessel.

Fig. 3 is a side elevation of a counter-balanced resiliently supported washing vessel.

Fig. 3*a* is a side view partly in section of a modified form of attachment of supporting springs of Fig. 3.

Fig. 3*b* is a side view of Fig. 3*a*.

Fig. 3*c* is a plan view of half of Fig. 3.

Fig. 4 is a diagrammatic side elevation of a resiliently supported washing vessel together with heating means.

Fig. 5 is a side sectional view of a washing vessel; and

Fig. 5*a* is a diagrammatic plan view of a reticulated means to be inserted in the vessel of Fig. 5.

In the embodiment illustrated in Figure 1, *a* is a vessel closed by a cover *b* and serving to contain both the cleaning liquid and the fabrics to be cleaned. *u* denotes a weight eccentrically mounted on a shaft *x* passing transversely through the vessel and rotated, for example by a motor *c* through belt c_1. Such an eccentric weight may obviously be mounted on each side of the vessel. The said shaft *x* is surrounded inside the vessel, by a close-fitting tube *r*, so that neither the shaft itself nor the lubricant can come, in any way, into contact with the articles to be cleaned. The vessel *a* is oscillatably suspended from a fixed member by resilient springs *f* attached to projections *n* on the sides of the vessel *a*. Rotation of shaft *x* carrying eccentric weight *u* sets up an unbalanced condition of forces in the direction of flexure of springs *f* and vessel *a* is, therefore, caused to oscillate, which movement causes the cleaning liquid to move relative to and through the articles to be cleaned, whereby the desired washing is obtained.

In the modification illustrated in Fig. 2, the vessel *a*, closed by the cover *b*, is supported on the springs *f*, *f* and *f'*, *f'*, arranged at relative right angles, whereas the eccentrically mounted weight is rotatably mounted on the shaft *x* as

shown in Fig. 1. Whereas the machine according to Fig. 1 describes reciprocating movements in the horizontal direction, the machine according to Fig. 2 is able to oscillate in the direction of any convenient radial straight line drawn through the shaft *x*, it has any desired direction of motion and may describe elliptical or circular oscillations according to the design of the springs, which may be of any convenient type. Whilst the movements of the machine according to Fig. 1 have a constant amplitude, those of the machine in Fig. 2 vary in amplitude according to the force applied. In this manner the eccentrically weighted motion transmitting mechanism may serve to simultaneously counteract the inertia of the vessel *a*.

Another embodiment of the machine is illustrated in Fig. 3. *a* is the washing vessel, closed by the cover *b* and mounted on four springs *f*, *f* located at equally spaced points around the periphery of vessel *a*, and having their directions of flexure parallel. This vessel is surrounded by a frame *w*, serving as a compensating mass, which also rests on four equally spaced springs *f'*, *f'*. The springs *f* and *f'* are both fastened to rigid base frames *d*, which in turn are resiliently connected to the foundation by means of springs f_2. This yieldable arrangement permits an oppositely directed counter-balancing of the forces set up in springs *f* and *f'*, so that an equilibrium exists between the oscillations of vessel *a* and the compensating mass *w*. A modification of the connecting means of the resilient members is illustrated in Figs. 3*a* and 3*b*. According to this modification, the springs *f* and *f'* are connected to a common block *d* which in turn is freely rotatable on a shaft *u*. In the devices according to Figs. 3, 3*a* and 3*b*, the washing vessel and the counter-balancing frame are connected to move in opposite directions relative to each other. The practical advantage of such a potential reaction coupling is based on the circumstance that the relatively undamped frame, which is chiefly intended to balance disturbances of force and mass, acts as a store of energy in relation to the washing vessel, which has to perform the real useful work of setting up movement between the "linen" and the water.

The actuating means for the devices according to Figs. 3 and 4 comprises a motor and flexible energy accumulating coupling members *k* between the frame *w* and the vessel *a*. The actuation by means of this motor and flexible coupling sets up an action and reaction in the two oscillating units at a phase displacement of 180° which serves to produce a particularly advantageous compensation of forces.

It is self evident that a machine according to Figs. 1, 2 and 3 may be heated, electrically, or by gas (without chimney flue), in known manner, and needs no special illustration. On the other hand, the heating of an oscillatory unit by means of a wood, gas or coal fire with a flue, is not quite so simple.

An illlustration is therefore given in Fig. 4, of the manner in which such heating can be performed without disturbing the oscillatory operation. *a* is the washing vessel mounted on the springs *f*, *f*, and *w* is the frame which is mounted on the springs *f'*, *f'* as hereinbefore described. The machine can be driven by hand or by a small motor through the loose energy accumulating coupling member *k* (a spring bent in the form of a U), so that the vessel *a* and the compensating mass *w* can oscillate relatively with a phase displacement of 180° and therefore balanced in respect of mass. Between the two oscillatory units is inserted a sheet-metal cylinder *g*, the upper portion of which is formed into an annular passage by the insertion of a second wall. Extending into this annular passage is the projecting bottom of the washing vessel *a*, to the annular flange *i* of which are attached the springs *f*, *f*. In this manner, a passage *h* is formed, which leads the heating gases to the discharge flue *o*, as indicated by the arrows. All the other parts of the heating arrangement can be carried out in the usual manner.

The washing vessel may be of any desired shape, for example, round or rectangular. As already mentioned, a phase displacement is set up between the walls of the vessel and the water, during the oscillatory movements. Similarly, a phase displacement is set up between the water and the "linen" and, according to the present invention, it is precisely this phase displacement that is utilized for performing the actual work of washing.

In order to increase this effect—other conditions being equal—wooden frames *m* (Fig. 5) may be provided, the interior space of which is fitted with a lattice of webbing, interlaced string or the like. If the vessel be charged by covering the bottom with a layer of the articles to be cleaned, placing one of the said frames on said layer, and proceeding in the same alternating manner, the articles are divided into layers by the frames, and the latter (reticulated units) move in phase with the vessel, whereas the articles, and also the water, lag behind the movement of the vessel and, consequently, an additional effort of friction is set up between the reticulated frames and the articles.

Of course the reticulated frames, which have a certain flexibility, may also be replaced by any other types of structure, such as perforated sheet metal or woven metal screen and the like.

It is immaterial for the scope of the present invention whether the machine is actuated by a hand crank, or by any convenient known source of mechanical energy, or whether known positive devices, such as eccentric rods, cranks and the like between the source of energy and the driven member, or any kind of so-called loose-coupling devices for oscillatory units be employed.

In the operation of the applicant's washing machine the cleansing action does not depend upon the moving of the laundry but rather depends upon the intensity of the relative movement between the clothes and the liquid cleansing medium. It would therefore also be possible to obtain an excellent cleansing action by maintaining the laundry stationary and imparting a sharply reciprocating motion to the liquid.

According to the applicant's invention, the oppositely-directed relative movement between the liquid and the laundry is produced by imparting a rapid reciprocatory motion to the liquid and merely suspending the clothes freely in the said liquid. The suspended laundry is moved by the oscillations of the liquid and therefore by rapidly changing the direction of the movement of the liquid, for example, by imparting oscillations at the rate of at least 200 per minute to the liquid, the said liquid will move in a direction opposite to the movement of the laundry at the instant of the changing of direction of the liquid. In this manner, the liquid washing medium is forced through the laundry to be washed.

In washing machines which are oscillated or

reciprocated at a smaller frequency of oscillation, the liquid washing medium and the clothes will move together from one side of the washing vessel to the other instead of moving relative to each other, and therefore the only cleansing action produced by such machines will be due to the rubbing of the laundry against the inner walls of the washing vessel which are commonly constructed in a ribbed formation for this very purpose.

A further great advantage of the applicant's washing machine over the machines known heretofore consists in the smaller amount of wear and tear of the laundry. The relative movement between the clothes and the liquid is much easier on the laundry than the forcing and rubbing of the laundry against the rigid walls of the vessel.

Due to the yielding action between the laundry and the liquid when the two are moved relative to each other, the laundry is much less easily torn. The applicant has greatly improved this yielding action by inserting a flexible coupling between the prime mover and the washing vessel. This flexible coupling has a tendency to eliminate the stress of the starting torque and acts as an energy-accumulating element. The use of such flexible coupling also prevents excessive wear of the bearings and supports of the driving means and the washing vessel.

In the oscillation of masses at a high frequency, undesired vibrations are often set up which are especially detrimental to the foundation and building in which the washing machine is housed. In order to overcome this objectionable vibratory action, the applicant has resiliently mounted an auxiliary mass *w* adjacent the washing vessel and imparts an oppositely-directed relative movement thereto, whereby an especially advantageous weight compensation and counter-balancing of mass action results so as to minimize the tendency toward vibration.

What I claim is:

1. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, actuating means for imparting oscillations of a frequency of at least 200 per minute to said vessel, and an energy-accumulating flexible coupling interposed between said actuating means and said vessel.

2. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, a flexible energy-accumulating member connected to said vessel, said vessel and energy-accumulating member comprising an oscillatable unit, and actuating means connected to said energy-accumulating member for imparting oscillations to said oscillatable unit.

3. In a washing machine in combination, a washing vessel, a compensating mass, a resiliently mounted base frame, means for resiliently mounting said washing vessel and compensating mass on said base frame, and actuating means for imparting at least 200 oscillations per minute to both said vessel and said mass at a phase displacement of 180° to each other.

4. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, said vessel and said members constituting an oscillatable unit, a compensating mass, resilient means for supporting said compensating mass, said compensating mass and resilient means constituting a second oscillatable unit, and means for imparting oscillations to one of said units which is connected to the other unit to impart oscillations of a frequency of at least 200 per minute thereto.

5. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, said vessel and said members constituting an oscillatable unit, a compensating mass, resilient means for supporting said compensating mass, said compensating mass and resilient means constituting a second oscillatable unit, and actuating means connected to said oscillatable units to impart oscillations of a frequency of at least 200 per minute to the said unit at a phase displacement of 180° from each other.

6. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, said vessel and said members constituting an oscillatable unit, a compensating mass, resilient means for supporting said mass, said compensating mass and resilient means constituting a second oscillatable unit, a supporting element for connecting said resilient members and resilient means, resilient supporting means for resiliently supporting said element on the base of said machine, and actuating means for imparting oscillations of a frequency of at least 200 per minute to said vessel.

7. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, said vessel and said members constituting an oscillatable unit, a compensating mass, resilient means for supporting said mass, said compensating mass and resilient means constituting a second oscillatable unit, a supporting element for connecting said resilient members and resilient means, and actuating means for imparting at least 200 oscillations per minute to said vessel.

8. In a washing machine in combination, a washing vessel, resilient supporting members, means for mounting said vessel on said members, said vessel and said members constituting an oscillatable unit, a compensating mass, resilient means for supporting said mass, said compensating mass and resilient means constituting a second oscillatable unit, a supporting element for connecting said resilient members and resilient means, means for mounting said element on the base of said machine, and means for imparting oscillations of a frequency of at least 200 per minute to said vessel.

9. In a washing machine in combination, a washing vessel, reticulated partitions in said vessel, resilient supporting members, means for mounting said vessel on said members, and means for imparting at least 200 oscillations per minute to said vessel.

10. In a washing machine, a vessel for containing washing liquid and articles to be cleaned, a pair of springs supporting said vessel, said springs being capable of resilient flexure in the same direction, a mass connected with said vessel but movably mounted relative thereto, and means for moving said vessel and said mass relatively back and forth with a phase displacement of 180 degrees and with a frequency of at least 200 oscillations per minute, whereby the vessel and mass are completely balanced relative to force and mass action in the direction of flexure of the springs, and the washing liquid is moved relative to the articles to be cleaned.

GEORG HEINRICH SCHIEFERSTEIN.