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Speakman

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[54] **WASHING MACHINE**

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[52] **U.S. Cl.** ..... **68/13 R;** 68/16

[51] **Int. Cl.²** **D06F 39/04**

[58] **Field of Search** ..... 68/13 R, 15, 16; 134/105

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[57] **ABSTRACT**

A machine for washing textile materials is provided with a source of visible light which irradiates the wash liquor containing a photoactivator and the textiles therein, providing a means for removing stains from the textiles.

9 Claims, 4 Drawing Figures

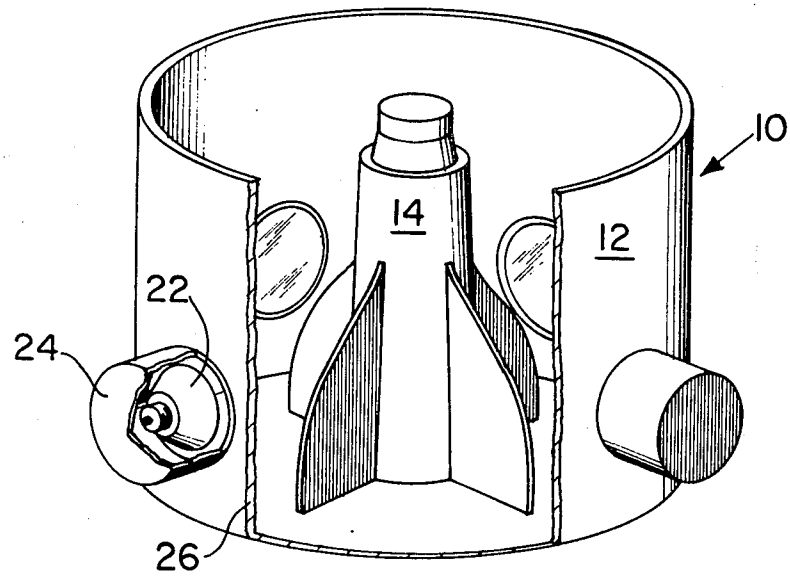


Fig. 1

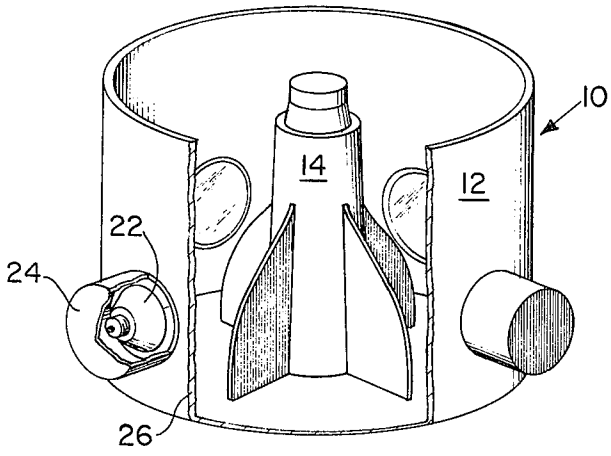


Fig. 2

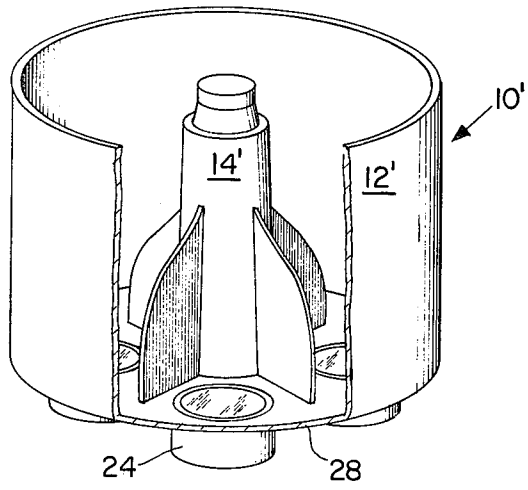


Fig. 3

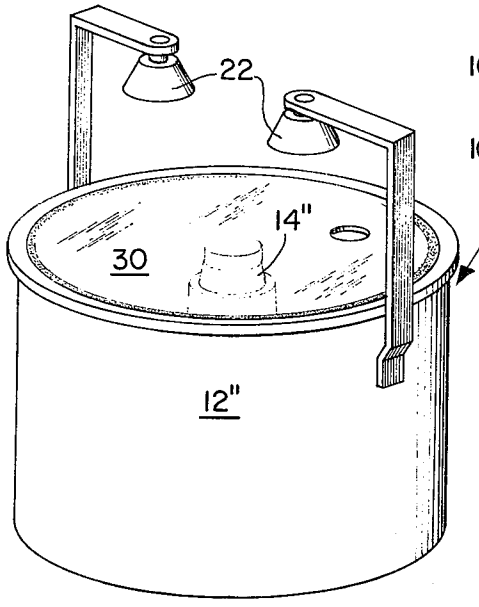
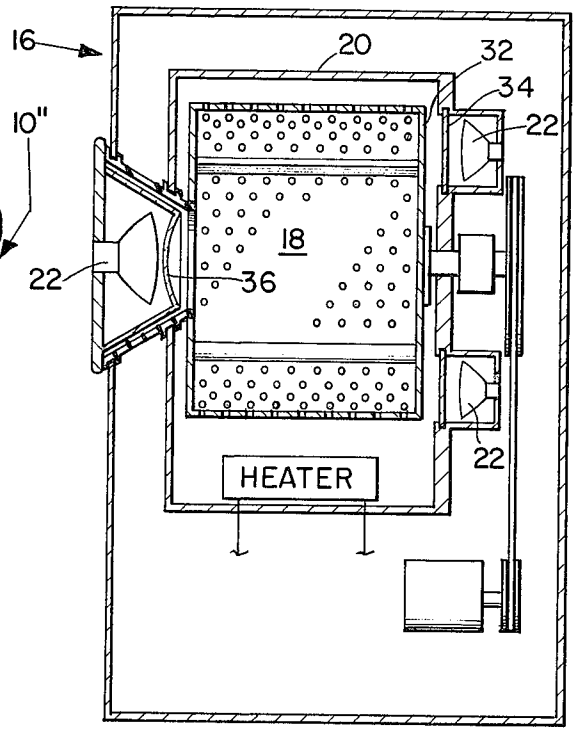


Fig. 4



WASHING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to a machine for washing textile materials.

My co-pending patent application Ser. No. 259,236, filed June 2, 1972, and now abandoned, incorporated herein by reference, relates to a process for removing stains from textiles which comprises treating the textiles in the presence of atmospheric oxygen, with an aqueous liquor containing at least one alkaline detergency builder salt and a minor amount of a photoactivator selected from the group consisting of eosin, rose bengal, fluorescein, chlorophyll, metal-free porphyrin and, preferably, sulphonated zinc phthalocyanine, the textiles being irradiated during the treatment with visible light, which includes light of wavelength at least 640 nanometers (nm). The process is conveniently carried out in combination with a washing process using a detergent composition comprising an organic detergent, alkaline builder salts and a photoactivator as defined above, the textiles being irradiated with visible light during a combined washing and bleaching process. This is accomplished by exposing the fabric to sunlight or a suitable artificial light in the washing solution or in a separate step in which fabrics wet with a solution containing a photoactivator and an alkaline detergency builder salt are exposed to sunlight or a suitable artificial light.

Accordingly, it is an object of this invention to provide a machine for washing textile materials with a source of visible light directed to irradiate the wash liquor.

Another object of this invention is to provide a process for washing textile materials in a machine with a source of visible light directed to irradiate the wash liquor, said wash liquor containing at least one alkaline detergency builder salt and an effective amount of a photoactivator.

SUMMARY OF THE INVENTION

According to the present invention a machine for washing textile materials is provided with a source of visible light which irradiates the wash liquor containing a photoactivator and the textiles therein, providing a means for removing stains from the textiles.

DESCRIPTION OF THE DRAWING

FIGS. 1–3 are schematic perspective illustrations of top loading, tub-type washing machines embodying the present invention, and

FIG. 4 is a schematic side elevational cross-sectional illustration of a front loading, tumbling-type washing machine embodying the present invention.

DESCRIPTION OF THE INVENTION

According to the present invention a machine for washing textile materials comprises a vessel adapted to hold an aqueous wash liquor containing photoactivators and the textiles to be washed, means for providing relative movement between the wash liquor and the textiles, and at least one visible light source secured to the machine by any convenient means and adapted to irradiate at least part of the wash liquor and the textiles when in the vessel, the said light source having a power of at least 100 watts and emitting light of wavelength 640 nm. and higher.

Preferably the machine also comprises means for controlling the wash liquor temperature at a desired value, such as heating means. When the aforementioned light source is submerged in the wash liquor it also can be a source of heating.

The washing machine may have the features of any suitable type of domestic or commercial washing machine, for example, a fixed tub machine **10, 10'** and **10''** (FIGS. **1, 2** and **3**) in which the contents of the tub **12, 12'** or **12''** respectively, are agitated by a paddle or pulsator **14** or a tumbler type machine **16** (FIG. **4**) in which a perforated cylinder **18** containing the articles to be washed revolves within a fixed cylinder **20** which holds the washing liquor.

In the case of the fixed tub machine **10, 10'** or **10''**, the light source which may comprise one or more lamps **22** each suitably encased in a waterproof container container **24,** can be mounted in the side wall **26** (as shown in FIG. **1**) or the bottom wall **28** (as shown in FIG. **2**) of the vessel or tub **12** or **12'** wherein such submerged light source additionally provides a source of heat for the wash liquor.

Another alternative, shown in FIG. **3,** is to construct the lid **30** of the fixed tub machine at least in part of transparent glass or plastics material and the light source may comprise one or more lamps **22** above the lid mounted externally to a side or bottom wall of the vessel so as to irradiate the contents of the tub **10** through the glass or plastics material. In the case of a tumble type or revolving cylinder machine **16** (as shown in FIG. **4**), one end (**32** and **34,** respectively) of both the interior or perforated cylinder **18** and the exterior or fixed cylinder **20** may be constructed wholly or partly of the transparent material, the lamps **22** being mounted externally to irradiate the contents of one or both cylinders. Front loading tumbling machines frequently have a transparent door **36** and one or more lamps **22** may be conveniently mounted in front of the door, so that light is directed through the transparent door **36** into the drum **18.**

Incandescent tungsten filament lamps are often suitable. An especially suitable light source is a quartz lamp having an iodine coated tungsten filament. Preferably the lamps should have reflectors to direct the light into the wash liquor. A commercial example of a quartz lamp is that sold by General Electric under the model number GE Q 250 PAR 38 (G.E. quartz lamp 250 watt parabolic aluminized reflector 0.38 inch).

It has been found that for domestic washing machines of 5–14 gallons capacity which take loads of 4–10 lb. of textiles, a suitable intensity of illumination is obtained by using from one to four 150 watt to 250 watt tungsten filament reflector lamps. Alternatively, from one to four 250 watt quartz lamps may also be used.

Very effective cleaning and stain removal of household cotton goods may be obtained in a fixed tub domestic washing machine of 8 gallons capacity with the front metal panel of the tub replaced by a sheet of plate glass and a battery of four 250 watt tungsten filament reflector bulbs mounted immediately outside the glass panel.

The invention also provides a method of removing stains from textiles which comprises washing the textiles in a machine according to the invention by means of a wash liquor containing a photoactivated cleaner (e.g., a bleach) while irradiating at least part of the wash liquor and the textiles with at least one light source having a power of at least 100 watts and emit-

ting light of wavelength at least 640 nm.

The invention is illustrated by the following Examples.

EXAMPLE I

Four standard tea-stained cotton swatches each 2½" × 2½" were washed with a 3 lb. load of normal soiled laundry in an 8 gallon Hoover, single-tub washing machine, of which the front panel of the tub was replaced by a sheet of plate glass with four 250 watt tungsten filament lamps mounted immediately outside the glass so as to irradiate the wash liquor. The wash liquor was of tap water (15 grains/gal.) and contained 0.5% by weight of a granular detergent of the composition set out below. Washing was carried out at 120°F for 30 minutes under constant illumination from the four 250 watt lamps.

The washing powder had the following composition by weight:

Sodium dodecyl (linear) benzene sulphonate	17.6%
Sodium toluene sulphonate	1.8
Sodium tripolyphosphate	46.2
Sodium silicate	7.3
Coconut fatty acid monoethanolamide	1.9
Sodium carboxymethyl cellulose	1.0
Ethylene diamine tetracarboxylic acid, Na salt	0.3
Perfume	0.1
Moisture	10.0
Sodium sulphate	balance

The washing was repeated with the amounts of photoactivator and cleaner (sodium perborate) shown in the following table, the amounts being by weight of the wash liquor. The degree of stain removal is shown in the table.

Photoactivator	Sodium perborate	% Stain removal
2 ppm.	0.1%	72%
10 ppm.	0.1%	95%
10 ppm.	0	71%
0	0	40%

The photoactivator was sulphonated zinc phthalocyanine.

EXAMPLE II

Preparation of Cotton Strips

Cotton muslin cloth (180 thread counts per inch), fabric brightener free, is cut into 4" × 5 foot strips. Ten such strips are washed twice (one deep rinse between washings) with a fabric brightener-free heavy duty detergent. 17 gallons of city water is used (10 grains per gal.) at a temperature of 140°F and the product concentration is 0.25%. The strips are thoroughly rinsed (3 deep rinses) in cool water and dried at medium heat in a steam dryer.

Preparation of Black Tea-Stained Strips

To 5 liters of city water is added 5 ounces of Lichee's black tea (grown in Formosa and processed in Hong Kong by the Ying Mee Tea Company) in a Pyrex vessel. The water is brought to a boil and allowed to simmer for 90 minutes with occasional stirring. The tea brew is then strained through a double cheese cloth and poured back into the vessel and enough hot water is added to bring the tea brew to the 5 liter mark. Five 4" × 5 foot strips of muslin previously washed as above, are placed in the vessel and the tea brew is boiled again for 90 minutes with occasional stirring. The cotton strips are then simultaneously carefully rinsed in a large bucket, without swishing, containing 3 gallons of cool water, run through a padder roll under 5 lbs. of pressure and hung on a portable dryer. After drying the strips are then placed in a 120°F room for 24 hours. The strips are not allowed to come into contact with any metal during the complete process. The strips are then ironed flat with a medium cool iron.

Stain Removal Test

A 17 gallon capacity Lady Kenmore wringer type fixed tub machine was modified by securing to the sides of the tub and about ½ inch from the bottom, four 250 watt quartz lamps each suitably encased in a watertight container with a glass lens. 35 liters (enough to cover the light sources) of city water (10 grains per gallon) and 140 grams of fabric brightener-free granular detergent of the following composition was added for each test run.

Sodium dodecyl (branded) benzene sulphonate	26.2%
Sodium toluene sulphonate	2.5
Sodium tripolyphosphate	34.4
Sodium silicate (SiO_2/Na_2O ratio = 2.0)	6.7
H_2O	7.8
Sodium sulfate + minors (omitting fabric brightener)	balance

The cloth load consisted of four 4" × 9" black tea-stained cotton strips as prepared above and three 6" × 6" unstained cotton strips. The total weight of the cloth load was about 20 grams.

Eighteen washing conditions were performed: at starting temperatures of 75°F, 100°F, and 120°F and at washing times of 30 min., 45 min., and 60 minutes under constant illumination. At each condition one run was made with no photoactivator present and another run was made with 1 ppm sulphonated zinc phthalocyanine present. All the washings were repeated so each condition was done twice.

During the washing the wash liquor temperature was observed to rise about 40°F. per hour. The temperature rise was observed to be generally linear with time and only slightly dependent on the starting temperature. Thus the observed temperature rise of the wash liquor with a starting temperature of 75°F was 42°F in 60 minutes; at 100°F starting temperature the rise was about 38°F in 60 minutes; and at 120°F starting temperature the rise was about 37°F in 60 minutes.

The effectiveness of the photoactivator was obtained for each time and starting temperature as follows:

a. the reflectance value (L) was obtained for each black tea-stained strip before washing.

b. the reflectance value (L) was obtained for each black tea-stained strip after washing.

c. the change in reflectance (ΔL) was then obtained by subtracting the value obtained in (b) from (a).

d. the values obtained in (c) for the black tea-stained strips washed in the wash liquor without photoactivator were averaged and then subtracted from the average of the values obtained in (c) for the black tea-stained strips washed in the wash liquor containing 1 ppm photoactivator present.

The results obtained are given in the table below. In general terms, a positive value shows a benefit for the

presence of the photoactivator when the wash liquor and cloth load is illuminated. For example, at a starting temperature of 75°F and 30 minutes washing time, it is shown that the treatment which included photoactivator resulted in 4.6 ΔL units change greater than the same treatment but without photoactivator.

Any suitable reflectance meter can be used for determining the reflectance values. The meter used in this work was the Gardner XL-10.

Starting Temperature	Difference in ΔL's Observed Washing Time 30 min.	45 min.	60 min.
75°F	4.6	7.1	9.0
100°F	5.8	10.1	12.6
120°F	9.0	11.3	14.6

The data show that the illuminated washing treatment which includes a photoactivator is in every instance more efficient in removing black tea stains from cotton muslin strips compared to the treatments without photoactivator. In determining the visual significance of this data it is helpful to know that the human eye can distinguish differences of about 1.0 or greater in reflectance values among black tea-stained muslin strips. The data also show that increased washing time and higher starting washing temperatures increase the effectiveness of the photoactivator in tea stain removal.

What is claimed is:

1. A machine for washing textile materials comprising a vessel for holding an aqueous wash liquor containing photoactivators and the textiles to be washed, means for providing relative movement between the wash liquor and the textiles, and at least one source of visible light secured to the machine and directed so as to irradiate at least part of the wash liquor and textiles, the said light source having a power of at least 100 watts, and emitting light of a wavelength of at least 640 nm.

2. A machine according to claim **1** wherein the light source is a tungsten filament light bulb of at least 100 watt power.

3. A machine according to claim **1** wherein the light source is a quartz lamp of at least 100 watt power.

4. A machine according to claim **1** wherein the light source is mounted in a side wall of the vessel and is submerged in the wash liquor in use.

5. A machine according to claim **1** wherein the light source is mounted on a closure lid thereof.

6. A machine according to claim **1** wherein the light source is mounted externally to a side wall of the vessel and directed to irradiate the contents therein.

7. A machine according to claim **1** which additionally comprises means for controlling the wash liquor at desired temperatures.

8. A machine according to claim **1** wherein the light source is mounted in a bottom wall of the vessel and is submerged in the wash liquor in use.

9. A machine according to claim **1** wherein the light source is mounted externally to a bottom wall of the vessel and directed to irradiate the contents therein.

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