

# UNITED STATES PATENT OFFICE

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## WASHING AND CLEANSING

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The present invention relates to washing, and more especially to the mechanical washing of materials such as greasy dishes, kitchen utensils, silverware, golf-balls, milk bottles, greasy metal articles, and so forth. Greasy dishes, silverware and kitchen utensils are frequently washed in dish washing machines. In order to remove the grease from such articles strong alkalies are employed which will saponify and peptize the grease. For example, sodium carbonate, caustic soda, trisodium orthophosphate, sodium meta- or ortho- or other alkaline silicate, and sodium aluminate, or mixtures thereof, are frequently employed in dish washing machines. These alkaline detergents are used instead of soap, since soap does not saponify grease, and moreover to be effective must form suds which is objectionable in the commercial dish washers.

In the manual washing of greasy dishes, tableware, clothes, and other domestic articles, as disclosed in my Patent No. 1,956,515, granted April 24, 1934, reissued October 8, 1935, as Re. No. 19,719, the use of soap is prevalent. In this type of washing the articles to be cleansed, if undeformable, such as dishes and tableware, are wet with a detergent solution tolerable to the hands on account of its relatively low pH value, and are rubbed with a cloth or brush to remove the soil and grease. Walls are washed similarly, the hands coming in contact with and being occasionally immersed in the detergent solution. Other articles, such as clothing, may be satisfactorily cleansed by a solution of low pH value containing soap, owing to their flexibility and permeability to the cleansing solution, whereby they may be forcibly moved through the detergent solution, the solution being driven back and forth through the pores of the fabric. Such goods may be rubbed or squeezed mechanically or manually, by which action fresh detergent solution is brought in contact with the fabric and forcibly removed therefrom. Low pH values are desirable in this type of washing, not only for the purpose of protecting the skin against the effect of high alkalinities, but because of the adverse effect of high alkalinities on certain types of fabrics, particularly woolens and silks. Painted walls, if washed or scrubbed with detergent solutions having high pH values, are damaged through the attack of the alkali on the paint. This causes a progressive dulling of the paint, followed by its gradual removal. For washing of painted walls, detergent solutions having low pH values are used by preference.

Even at the low pH value characteristic of soap solutions commonly used for such purposes,

the removal of grease and soil proceeds satisfactorily by peptization on account of the scrubbing action given the articles and the suds formed by the soap. In the mechanical washing of undeformable articles such as dishes and tableware, there is little or no rubbing action, the washing being usually accomplished by the forcible projection of the detergent solution against the surfaces to be cleansed. It is therefore desirable to impart to the water a more vigorous detergent action, in order that proper peptization and saponification of the grease or other soils may occur. In the mechanical washing of beverage bottles, the presence of strong alkalies is desired for the purpose of sterilizing these bottles, and in many cases the use of strong hot caustic soda solutions is made mandatory by public health authorities in order to insure sterilization of milk bottles and the like. Detergent solutions having an alkalinity sufficient to exert appreciable sterilization or sufficient detergent action to satisfactorily peptize and saponify grease and soil in the absence of rubbing, are undesirably alkaline for use with the unprotected hands.

The type of washing to which the present invention relates is primarily that which for one or a number of the foregoing reasons is conducted at high alkalinities and is especially adapted to the washing of undeformable surfaces which are not harmed by relatively high pH values. By "high alkalinities" I have reference to the alkalinities of detergent solutions having a pH value in excess of 10.5, and more particularly to detergent solutions having a pH value sufficient to peptize grease and other adherent soil or sterilize the articles, in the absence of soap and/or rubbing, and also to saponify grease, when the washing solution is hot.

Difficulty, however, has been encountered in the use of strongly alkaline detergents, particularly in hard waters, that is to say, waters containing calcium and/or magnesium compounds. The action of the alkaline detergent, such as caustic soda or sodium carbonate, in part saponifies the grease, forming glycerol and a sodium fatty acid soap. In the presence of the hard water, for example a calcium-containing water, the sodium soap is immediately broken down to form a calcium soap which is insoluble. The calcium soap which is thus formed at the surface of the grease, hinders saponification of the remaining grease and its removal by the peptizing effect of the alkaline detergent. The calcium soap is also deposited upon the surfaces of the dish washer, forming a scum-like deposit which is difficult to remove.

Another effect of the alkaline detergent is to cause the precipitation of the calcium and magnesium salts. For example, the effect of adding an alkaline reagent to a calcium bicarbonate water is to neutralize the bicarbonate and precipitate lime as calcium carbonate. In the case of trisodium phosphate, the phosphate radical may combine with the calcium to form a precipitated tricalcic phosphate. These precipitates are known to adhere to the dishes and also tend to be enmeshed in the lime soap deposits.

I have found that these difficulties may be avoided and removal of the grease and soil accomplished without the formation of the calcium and magnesium deposits, such as the calcium and magnesium soaps or insoluble salts by adding to the water an alkali-metal metaphosphate in addition to the alkaline detergent. The action of the alkali-metal metaphosphate is to sequester the calcium and magnesium in the hard water and/or soil in the form of very slightly ionized soluble complexes, from which the calcium and/or magnesium is not taken by the soaps produced in the saponification of the grease by the alkaline detergent used, or precipitated from the hard water by the detergent per se.

The material which I prefer to use is the soluble sodium metaphosphate sometimes called "Graham's salt". Graham's salt is believed to consist principally of sodium hexametaphosphate. The sodium hexametaphosphate is assumed to be a complex of the general formula  $\text{Na}_2(\text{Na}_4\text{P}_6\text{O}_{18})$ , although some authorities believe that salts of the formulas  $\text{Na}_5(\text{NaP}_6\text{O}_{18})$  and  $\text{Na}_4(\text{Na}_2\text{P}_6\text{O}_{18})$  may also be present. Sodium hexametaphosphate in readily soluble form may be prepared by strongly heating monosodium dihydrogen orthophosphate, and rapidly cooling the molten mass. The quick cooling is apparently essential to the formation of a readily soluble salt. Upon slower cooling of the molten mass, there is a tendency to form other sodium metaphosphates, such as sodium trimetaphosphate which is soluble but which is not effective in repressing the precipitation of calcium and magnesium, and sodium monometaphosphate which is difficultly soluble. I cool the mass sufficiently rapidly so that the sodium metaphosphate is obtained principally in the form generally accepted as sodium hexametaphosphate. The metaphosphate employed should be readily water soluble and capable of effectively sequestering calcium in a but slightly ionized condition. I prefer to prepare the hexametaphosphate so that it contains a few per cent of pyrophosphate. This may be done by admixture of a small amount of disodium monohydrogen orthophosphate with the monosodium dihydrogen orthophosphate before the heating. When I speak of metaphosphate therefore, I mean either the pure metaphosphate or metaphosphate containing a few per cent of pyrophosphate. While I prefer to use sodium hexametaphosphate, other metaphosphates may be employed, such as the trimetaphosphates.

While I do not know with certainty the exact chemical reactions occurring, whereby the metaphosphate sequesters the calcium and magnesium to prevent their precipitation, I believe that the chemical reactions probably occur as I will now describe them. The following explanation is in accordance with the observed facts and is given as a theoretical discussion of what I believe occurs. It will be understood therefore that the invention is not limited to this theoretical explanation. The experimental work on sodium hexa-

metaphosphate indicates that it probably has the molecular formula  $\text{Na}_2(\text{Na}_4\text{P}_6\text{O}_{18})$ . When sufficient sodium hexametaphosphate is added to a calcium-containing water, I believe that a soluble sodium calcium metaphosphate complex is formed, probably  $\text{Na}_2(\text{Ca}_2\text{P}_6\text{O}_{18})$ . This complex when ionized probably yields the sodium radical and a  $\text{Ca}_2\text{P}_6\text{O}_{18}$  radical. The latter radical probably ionizes to a but very slight extent to yield free calcium ions. The extent to which the ionization of this radical occurs appears to be governed by the excess of sodium metaphosphate employed. At the pH values characteristic of the alkaline detergents employed for saponifying grease in washing, this necessary excess appears to be such that from 6 to 10 formula weights of sodium metaphosphate ( $\text{NaPO}_3$ ) are required for each formula weight of calcium (Ca), in order to so minimize the ionization of the calcium as to prevent the formation of insoluble precipitated calcium soap.

Magnesium probably forms a corresponding complex radical with sodium hexametaphosphate which, like the calcium-containing radical, has but a slight degree of ionization which may be repressed by an excess of the sodium hexametaphosphate corresponding to the excess required to repress the ionization of the calcium.

In carrying out my process, an alkaline saponifying detergent is added to the water, together with enough of the sodium metaphosphate to prevent the formation of the insoluble calcium soaps. Such excess will also prevent the formation of the calcium salts, such as calcium carbonate and calcium orthophosphate. While it is possible, by analysis of hard water, to calculate the amount of the sodium metaphosphate to be added, this amount in practice can be readily determined by experience in adding the sodium metaphosphate to the point where observation indicates that the calcium precipitates are prevented.

As an alkaline detergent, I prefer to use one which has a high pH value, since it more effectively saponifies the grease. Sodium meta- or ortho-silicate, sodium meta-borate, and trisodium phosphate have high pH values in aqueous solution and energetic saponifying action upon the grease, and may be advantageously employed. Caustic soda is also suitable. Other alkaline detergents and mixtures thereof may be used, such, for example, as sodium carbonate, and borax, which, however, have a lower pH value in aqueous solution, particularly the borax.

I use an alkaline detergent which will impart to the solution a pH value in excess of 10.5, and especially in excess of 11.

Since the soluble alkali metal soaps formed by the interaction of the alkaline detergent and the grease are precipitated by hard water in the absence of metaphosphate, such soaps are not available in the washing operation for the purpose of peptizing and stabilizing the suspension of the grease, greasy soil and other soil removed from the articles to be cleansed. One advantage of the use of alkali-metal metaphosphate in such washing operations is that by preventing the precipitation of these soaps they are retained in solution where they are effective in the cleansing operation. The amount of soap thus rendered available is not sufficient to form such quantities of suds as will be detrimental to the washing process, but is of advantage in heightening the detergent action of the solution.

While I prefer to use the sodium metaphos-

phate, other alkali-metal metaphosphates may be used, such, for example, as potassium metaphosphate, lithium metaphosphate, and ammonium metaphosphate. All of these metaphosphates are preferably used in the soluble form commonly known as hexametaphosphate.

The water which is treated is used in washing in the same way as water is now used, namely, as hot water which is forcibly projected against the dishes in the case of a dish washing machine. Hot water is preferably used, as at elevated temperatures the grease is melted, and its saponification and peptization proceed at a more rapid rate than with relatively cold water. However, the advantages of my process are as apparent with cold water as with hot water, inasmuch as the formation of insoluble calcium and magnesium deposits is similarly prevented. For washing dishes, silverware, kitchen utensils, etc., it is preferred to use the water in washing machines because of its strongly alkaline nature. However, it may be used in washing dishes manually, more especially if the hands be protected as by rubber gloves.

The process may also be used in removing grease from other grease-laden articles. For example, the palm oil used in the cold-rolling of steel sheets may be removed by scrubbing the sheets with hot water containing an alkaline detergent and the metaphosphate. In this case the alkaline detergent has a saponifying action upon the palm oil and the metaphosphate prevents the formation of calcium or magnesium precipitates when hard water is employed.

Another example of the use of my process is for the prevention of deposits in drains from sinks and wash basins, and for the removal of such deposits which have previously been formed. In the drains and traps associated with sinks and wash basins, particularly in hard water territories, there is a gradual accumulation of material which obstructs the drains and traps and prevents the free flow of water therethrough. This obstructing material consists largely and in many cases predominantly of lime and magnesium soaps formed by the interaction of soaps and the hardness in the water, interspersed with wetted dust or grit, or hair, or particles of food, etc. There may also be present in such obstructing material quantities of grease. Water which has been used in carrying out my process, and which is sent to waste through such drains will not precipitate lime soap therein, and due to its softness will retain unsaponified grease in emulsified condition so that it will not deposit.

Caustic soda with or without the addition of other agents in small quantity has been employed in the past for cleaning drains. As an example of one of the addition agents, I cite the use of granules or turnings of aluminum of 10-20 mesh approximately which in strong caustic solutions causes generation of hydrogen. The action of the caustic soda is to form a strongly alkaline solution which attacks and saponifies the greases, and which may to a limited extent attack and metathesize the lime soaps to form sodium soaps. The effect of the aluminum, if used, is to facilitate the attack on the greases, hair or soap, by providing mechanical agitation by the evolution of hydrogen, as well as to generate heat by combining with the caustic. The action of the caustic soda on the obstructing material is, however, adversely affected by the precipitation of the salts of calcium and/or magnesium insoluble in strong caustic soda, and by the incompleteness of the

metathesis of calcium and magnesium soaps. I have found that if strongly alkaline solutions, containing an alkali-metal metaphosphate with or without the addition agents, such as aluminum in pieces as described, heretofore employed, be placed in contact with these deposits, no insoluble salts of calcium or magnesium are formed and the lime and magnesium soaps present in the deposits are completely dissolved, whereby the cleaning action proceeds satisfactorily to completion. The periodic use of a compound consisting of a mixture of a strongly alkaline detergent with an alkali-metal metaphosphate in cleaning sinks and wash basins will prevent the formation of and accumulation of these deposits, and remove any deposits that may have formed since the preceding cleaning as the waste water ran through the drain or trap.

In the washing of soiled and greasy articles by my process, the alkaline detergent and the metaphosphate may be added separately to the water, or they may be added to the water in the form of a mixture containing the alkaline detergent and the metaphosphate. Usually about equal amounts of the metaphosphate and alkaline detergent are employed. As a specific example, a mixture of 50% sodium metasilicate and 50% sodium hexametaphosphate is suitable for washing greasy articles with the usual hard waters. The total amount to be added can be readily determined by experience, the amount of alkaline detergent being sufficient to effectively remove the grease, and the amount of metaphosphate sufficient to prevent the formation of calcium and magnesium precipitates.

As another specific example, a mixture of 45% trisodium phosphate and 55% sodium hexametaphosphate is suitable for washing greasy articles with the usual hard water. As a third example, a mixture of 70% caustic soda and 30% sodium hexametaphosphate is suitable for washing beverage bottles, milk, soda or beer bottles.

A preferred mixture for the cleansing of dishes, silverware and aluminum, and other utensils, in automatic dish washers consists of a mixture of 40% sodium hexametaphosphate, 40% sodium metasilicate, 15% trisodium phosphate, and 5% caustic soda. The percentages of the sodium metaphosphate and the sodium metasilicate may vary between 25 and 63%. The trisodium phosphate may vary between 10 and 48%, and the sodium hydroxide may be between 2 and 8%. The percentages given herein and in the claims are for trisodium phosphate monohydrate. If other of the hydrates are employed, the percentages will vary accordingly. In place of using the sodium salts, such as sodium hexametaphosphate, sodium metasilicate, trisodium phosphate, and caustic soda, I may use the corresponding salts of the other alkali metals. These mixtures have in solution pH values adequate to cleanse the dishes and utensils. Furthermore, the presence of sodium metasilicate in the alkaline mixtures prevents the corrosive attack on aluminum and similar metals commonly experienced with trisodium phosphate and caustic. When silverware and aluminum are washed at the same time with this mixture, and provided they be in electrical contact, the tarnish is removed from the silver.

The effect of metallic aluminum and alkaline salt solutions in removing tarnish from silver is well known, and if desired aluminum construction parts may be used in the dish washer so that if silver is repeatedly washed in contact there-

with, the silver will remain bright. If a detergent solution embodying suitable proportions of silicate and other alkalis be used, such as my preferred mixture, the aluminum construction parts will be unattacked and will remain clean and bright.

The composition of the mixtures given above as examples may be varied if required to meet specific conditions. Thus, where the water contains relatively large quantities of bicarbonate radical and relatively low quantities of calcium, it may be desirable to employ larger proportions of the alkaline detergent, in order that a more economical use of the mixture will be had. Such waters require relatively larger quantities of alkali to attain a suitable pH value, than waters containing little or no bicarbonate radical.

For waters which contain little or no bicarbonate and relatively large quantities of calcium, it may be desirable to employ a mixture containing larger proportions of sodium metaphosphate than those set forth above. In general, the quantity of alkali-metal metaphosphate required increases with the calcium and magnesium content of the water and of the soil to be removed. The quantity of alkaline detergent required increases with the bicarbonate content of the water, with the acidity of the soil, and with the pH value required for accomplishing the removal of the grease and dirt. However, the detergent compositions as set forth above are, in general, satisfactory for all of the usual conditions, provided sufficient quantities be used to cleanse the articles as well as to prevent the accumulation of deposits.

The solid phases formed by precipitation from hard water during the washing process are of different degrees of insolubility. The lime soaps formed during the washing of greasy dishes are highly insoluble. Calcium phosphate is less insoluble, and calcium silicate and carbonate still less insoluble, the solubilities being expressed in gram-equivalents of calcium present at saturation concentration. Hence, to prevent saturation with respect to calcium soap, a greater excess of the metaphosphate is necessary than to prevent the precipitation of calcium phosphate, and more is needed to prevent precipitation of calcium phosphate than to prevent precipitation of calcium silicate or calcium carbonate.

I am aware that the order of insolubility of the solid phases discussed above may be altered by varying the concentrations of the soluble soaps, phosphates, silicates and carbonates present in the detergent solutions, and it is to be understood that in setting forth the above relative solubilities, I have reference to the solubilities commonly characteristic of alkaline detergent solutions in practical use.

The number of formula weights of sodium metaphosphate which must be present for each formula weight of calcium in order to prevent the precipitation of a solid phase varies inversely with the solubility of that phase. It may therefore be found desirable to employ somewhat larger proportions of metaphosphate in a detergent compound for use under conditions where lime soap would precipitate if the metaphosphate were not used, than would be necessary where calcium phosphate is the most insoluble solid phase which might form. Still smaller proportions of metaphosphate need be used where neither calcium soap nor calcium phosphate can be formed, but only calcium silicate or calcium carbonate. Where sodium metasilicate is used as the alkaline detergent, calcium silicate will be precipitated

from a hard water, and where trisodium phosphate is used, calcium phosphate will precipitate. It may therefore be desirable to use somewhat greater proportions (in chemical equivalents) of metaphosphate in a sodium-metaphosphate-trisodium phosphate mixture, than in a sodium-metaphosphate-sodium-metasilicate mixture, but such variation in proportions from those set forth above as suitable will not be great and are of principal interest for economy of metaphosphate in washing where, due to the character of the soil, little or no soap will form.

Where I speak of a mixture of an alkaline detergent and a metaphosphate, it is to be understood that any commercial form of the alkaline detergent may be used, and that the two may be combined as a powder, as mixed flakes, as a pressed or moulded or cemented block, or in solution, or in any physical form found desirable for use. However, where a free-flowing powder or mixture is required, I prefer to use one of the lesser hydrated forms of the alkaline detergent, such as trisodium phosphate monohydrate rather than the dodecahydrate, because of the fact that sodium hexametaphosphate tends to abstract water of hydration from hydrated salts and form hard caked masses which are no longer pulverulent. Furthermore, it is to be understood that by "alkaline detergent" I have reference not only to the sodium salts of this type, but also to similar salts of the other alkali-metals, such as potash.

The chemical mechanism of my process is apparently as follows where used to wash greasy articles: The alkaline detergent saponifies the grease at the grease surface exposed to the water. The saponification consists in the splitting of the grease into glycerol and a sodium soap, both of which are soluble and are carried away, exposing fresh grease surfaces. The alkaline detergent also peptizes and removes the grease, so that the grease removal is a combination of saponification and peptization. The metaphosphate permits this action to occur freely by preventing the conversion of the sodium soap into an insoluble lime or magnesium soap, which would prevent free access of the detergent solution to the grease. The sodium metaphosphate also prevents the precipitation of lime salts which would tend to adhere to and cloud the dishes or other articles being washed. The metaphosphate also completely prevents the building up of scum-like deposits on the sides of the dish washing machine or other receptacle.

The deposits which are built up on dishes washed several times in the usual manner with a hard water and an alkaline detergent alone may be removed by washing the dishes by my process. Heretofore, the practice has been to give such dishes a treatment with vinegar, acetic acid, or dilute mineral acid for the purpose of dissolving the precipitated calcium or magnesium carbonates, phosphates, silicates or soaps. The fatty acids formed by the acid decomposition of lime and magnesium soaps, and the greasy coating on the deposits, resist the complete penetration by the acid reagent and require that the dishes be subsequently wiped to remove the deposits. Furthermore, these acid reagents have no detergent power to remove grease and food soil, and they must be applied in a separate operation, distinct from the washing operation.

By my process the deposits are dissolved by the solvent effect of the metaphosphate, whereby the detergent solution is maintained continuously unsaturated with respect to the calcium and mag-

nesium salts and soaps, while the strong alkalinity simultaneously saponifies and peptizes the grease which permeates the deposits. The removal of the deposits is therefore unimpeded by the grease which may be present or by any separation of fatty acids.

While I have described the steps of my process with particular reference to the saponification of organic greases and the prevention of the formation of insoluble soaps by interaction of hard water with the products of saponification, my process is not so limited, but may be applied to articles bearing other adherent soils which may form insoluble deposits with hard water, or the removal of which is adversely affected by hardness in the water. Thus, buttermilk and cheese containers, soft drink bottles, and the like may advantageously be washed by my process.

Furthermore, while I have specifically described the preferred procedures and material used, it will be understood that the invention is not so limited, but may be otherwise embodied and practiced within the scope of the following claims.

I claim:

1. A washing composition containing about 40% sodium hexametaphosphate, about 40% sodium metasilicate, about 15% trisodium phosphate, and about 5% sodium hydroxide.

2. The process of cleansing greasy articles, which comprises subjecting them to calcium containing water having a pH value of at least 10.5 and containing an alkali-metal saponifying detergent and an alkali-metal metaphosphate which is water soluble and capable of sequestering calcium in a but slightly ionized condition, the alkali-metal saponifying detergent being used in amount sufficient to effectively saponify the grease without rubbing, the alkali-metal metaphosphate being used in amount sufficient to prevent the precipitation of lime soaps from the water in the presence of grease.

3. The process of cleansing greasy articles, which comprises subjecting them to calcium containing water having a pH value of at least 10.5 and containing an alkali metal saponifying detergent and an alkali-metal hexametaphosphate, the alkali-metal saponifying detergent being used in amount sufficient to effectively saponify the grease without rubbing, the alkali-metal hexametaphosphate being used in amount sufficient to prevent the precipitation of lime soaps from the water in the presence of grease.

4. The process of cleansing greasy articles, which comprises subjecting them to calcium containing water having a pH value of at least 10.5 and containing an alkali-metal saponifying detergent and sodium hexametaphosphate, the alkali-metal saponifying detergent being used in amount sufficient to effectively saponify the grease without rubbing, the sodium hexametaphosphate being used in amount sufficient to prevent the precipitation of lime soaps from the water in the presence of grease.

5. The process of cleansing greasy articles, which comprises subjecting them to calcium containing water having a pH value of at least 10.5 and containing an alkali-metal saponifying detergent and sodium hexametaphosphate, the alkali-metal saponifying detergent being used in amount sufficient to effectively saponify the grease without rubbing, the amount of sodium hexametaphosphate used being from

6 to 10 formula weights for each formula weight of calcium.

6. The process of cleansing greasy articles, which comprises subjecting them without the use of soap in sufficient quantity to give foaming to forcibly projected calcium containing water having a pH value of at least 10.5 and containing an alkali-metal saponifying detergent and an alkali-metal metaphosphate which is water soluble and capable of sequestering calcium in a but slightly ionized condition, the alkali-metal saponifying detergent being used in amount sufficient to effectively saponify the grease without rubbing, the alkali-metal metaphosphate being used in amount sufficient to prevent the precipitation of lime soaps from the water in the presence of grease.

7. The process of cleansing drains containing deposits of alkaline earth metal compounds and grease, which comprises subjecting the deposits to the solvent action of a solution having a pH value of at least 10.5 and containing an alkali-metal saponifying detergent and an alkali-metal metaphosphate which is water soluble and capable of sequestering calcium in a but slightly ionized condition.

8. The process of cleansing drains containing deposits of alkaline earth metal compounds and grease, which comprises subjecting the deposits to the solvent action of a solution having a pH value of at least 10.5 and containing an alkali-metal saponifying detergent and sodium hexametaphosphate.

9. A washing composition for cleansing greasy articles, containing an alkali-metal saponifying detergent and an alkali-metal metaphosphate which is water soluble and capable of sequestering calcium in a but slightly ionized condition, the alkali-metal saponifying detergent being in amount sufficient to produce in aqueous solution a highly alkaline solution having a pH value of at least 10.5, the alkali-metal metaphosphate being in amount sufficient to prevent the precipitation of calcium soap in the washing of greasy articles in such highly alkaline solution.

10. A washing composition for cleansing greasy articles, containing an alkali-metal saponifying detergent and sodium hexametaphosphate, the alkali-metal saponifying detergent being in amount sufficient to produce in aqueous solution a highly alkaline solution having a pH value of at least 10.5, the sodium hexametaphosphate being in amount sufficient to prevent the precipitation of calcium soap in the washing of greasy articles in such highly alkaline solution.

11. A washing composition for cleansing greasy articles, containing an alkali-metal metasilicate and sodium hexametaphosphate, the alkali-metal metasilicate being in amount sufficient to produce in aqueous solution a highly alkaline solution having a pH value of at least 10.5, the sodium hexametaphosphate being in amount sufficient to prevent the precipitation of calcium soap in the washing of greasy articles in such highly alkaline solution.

12. A washing composition containing about 25 to 63% sodium hexametaphosphate, about 25 to 63% alkali-metal metasilicate, about 10 to 48% tri-alkali-metal orthophosphate, and about 2 to 8% of an alkali-metal hydroxide.

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**Disclaimer**

2,035,652.—*Ralph E. Hall*, Mount Lebanon, Pa. WASHING AND CLEANSING. Patent dated Mar. 31, 1936. Disclaimer filed Sept. 10, 1948, by the assignee, *Hall Laboratories, Inc.*

Hereby enters this disclaimer of claims 9, 10, and 11.

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