

## UNITED STATES PATENT OFFICE

2,355,823

## POLYGLYCOL ETHERS OF HIGHER SECONDARY, MONOHYDRIC ALCOHOLS

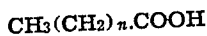
Fritz Schlegel, Duesseldorf, Germany, assignor,  
by mesne assignments, to The Procter &  
Gamble Company, Cincinnati, Ohio, a corpora-  
tion of Ohio

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The present invention relates to polyglycol ethers of higher fatty alcohols active in lowering surface tension and a process for the production thereof.

It is well known that normal fatty acids, such as caproic acid, oenanthic acid, caprylic acid, pelargonic acid, capric acid, n-undecylic acid, lauric acid, myristic acid, palmitic acid, margaric acid, and stearic acid, contain the carbon skeleton in the form of a straight chain. These carboxylic acids possess the general formula



whereby  $n$  represents a whole number from 4 to 16. The acids mentioned thus contain no branchings in their carbon skeleton. It is known that these fatty acids can be converted into ketones of the type



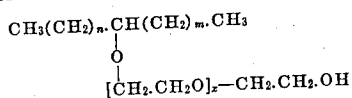
whereby  $n$  and  $m$  represent whole numbers from 4 to 16. When pure individuals are converted into ketones,  $n$  may also be  $=m$ ; but  $n$  and  $m$  are generally different, when mixtures of various fatty acids are converted into ketones.

It is known that these straight-chain ketones can be converted by hydrogenation into the corresponding secondary alcohols of the type



whereby  $n$  and  $m$  have the values just described. The conversion of the said secondary aliphatic straight-chain alcohols into neutral bodies active in lowering surface tension is one of the objects of the present invention.

A further object of the present invention is to convert these secondary alcohols into polyglycol ethers of the type



whereby  $n$  and  $m$  represent a whole number from 4 to 16, and  $x$  represents a whole number from 5 to 19.

A third object of the present invention is to produce especially good wetting agents that are not salts.

A final object of the present invention is to produce wetting agents and detergents remarkable for their low foaming property.

I have now found that the said straight-chain aliphatic secondary alcohols, in which the hydroxyl group is attached practically in the center of the molecule, can be caused to react with con-

siderable quantities of ethyleneoxide in the presence of small quantities of caustic alkali or alkali alcoholates, forming valuable agents active in lowering surface tension, whereby, according to my invention, 6 to 20 mols ethylene oxide are used per mol alcohol.

According to my invention, conversion is effected in a closed vessel, preferably an autoclave equipped with a stirring device, at a temperature of from 100 to 200 degrees C. The ethylene oxide may be admitted either in gaseous form, or in liquid form by means of a measuring pump. Conversion is initiated by raising the temperature to about 100 degrees C. According to the quantity of reagents present, the reaction mixture is heated to a temperature of up to 200 degrees C. by the heat of reaction liberated.

Addition of ethylene oxide to the secondary alcohols takes place in the presence of an agent with an alkaline reaction, whereby the presence of 0.5 to 2 per cent of caustic potash or caustic soda, calculated on the alcohols, has proved to be the most effective. But alkali alcoholates, such as sodium methylate, sodium ethylate, potassium ethylate, and the like, may also be used in the same proportions.

The reaction products are wax-like. If necessary, more particularly when the reagents used are of commercial grade, they can be freed by distillation in vacuo from readily volatile components and any quantities of alcohol not affected by the reaction. The said wax-like products are soluble in water, especially in hot water, giving a clear solution. They are able to emulsify oils, fats, and tarry compounds to a remarkable degree. They further possess an excellent property of wetting textiles, metals, glass, and porcelain, more particularly in conjunction with alkaline detergents. For that reason, the products prepared by addition of ethylene oxide to the said secondary alcohols are specially well suited for cleansing and degreasing articles soiled with oil or tar, or sheet metal and other materials treated by oil hardening, cold rolling, or other method of fabrication. The said wax-like products soluble in water can be successfully used in laundering and for the cleansing of very dirty cleaning cloths, workmen's overalls, and textiles of a similar description used in industries and trades. Apart from that surprisingly good property of wetting and cleansing, the detergent liquids prepared from the said products develop much less froth than do other polyglycol ethers with a neutral reaction, which feature makes it possible to use them in washing and spraying

machines. It is well known that the agents hitherto used in machines of that type develop foam or froth to such an extent that the detergent liquors prepared therefrom cannot be utilized to the full extent, besides being awkward to handle.

The following example may serve to illustrate the nature of my invention and a method of carrying it into practical effect, but my invention is not confined to this example.

#### Example

A mixture of caproic acid, oenanthylic acid, caprylic acid, and pelargonic acid, produced by the oxidation of a straight-chain paraffin, is converted by ketonizing it in any familiar way into a mixture of aliphatic ketones with a chain length of from 11 to 17 carbon atoms. The said mixture of ketones is then converted by hydrogenation, for example, according to the process of U. S. Patent No. 2,108,133, into a mixture of the corresponding secondary alcohols.

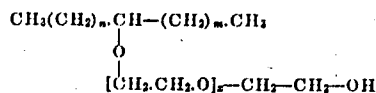
22.5 kilos of the said mixture of alcohols are gradually treated with 40 kilos ethylene oxide in the presence of 400 grams very finely ground caustic soda at an initial temperature of about 100 degrees C. in an autoclave equipped with an agitator, while stirring well. It can easily be demonstrated by measurement of the pressure that the ethylene oxide begins to be absorbed at a temperature of about 100 degrees C. The heat of reaction liberated serves to raise the temperature of the reaction mixture to from 170 to 180 degrees C., which temperature is maintained, either by cooling or by additional application of heat, until the ethylene oxide has been completely absorbed.

After completion of the reaction, the reaction mixture is freed from unconverted alcohol by distillation in vacuo. The residue is a wax-like product which is admirably adapted for the preparation of a detergent liquor for degreasing light metals or oil-hardened iron parts. Such a detergent liquor should contain preferably a mixture of 78 parts by weight of sodium metasilicate ( $\text{Na}_2\text{SiO}_3 \cdot 5\text{H}_2\text{O}$ ), 19 parts by weight of caustic soda, and 3 parts by weight of the said wax-like product in 3,000 parts by weight of water.

Conversion of the said secondary alcohols can also be effected in the same way by means of 52 kilos ethylene oxide, the result being a paste with excellent wetting properties.

Now what I claim is:

1. As a new product, compounds having the formula



whereby  $n$  and  $m$  represent respectively a whole number from 4 to 16, and  $x$  a whole number from 5 to 19.

2. As a new product a wax-like mass consisting of polyglycol ethers of higher molecular, monohydric secondary, straight chain aliphatic alcohols, having at least 11 carbon atoms.

3. Compounds of waxy consistency having high wetting powers but low foaming power consisting of polyglycol ethers of monohydric secondary straight chain aliphatic alcohols having from 11 to 35 carbon atoms in the chain.

4. The process of producing polyglycol ethers having high wetting powers and low foaming power from higher molecular, monohydric secondary straight chain aliphatic alcohols derived by the hydrogenation of ketones obtained from fatty acids having from 6 to 18 carbon atoms in the molecules, which comprises heating such alcohols with from 6 to 20 mols of ethylene oxide per mol of alcohol in a closed container at a temperature of 100° to 200° C. in the presence of an alkalinity-imparting agent.

5. The process of producing compounds having high wetting power and low foaming power from compounds having hydrocarbon chains of inadequate lipophilic characteristics, which comprises forming ketones from fatty acids having from 6 to 9 carbon atoms, hydrogenating the ketones thereby forming secondary alcohols and reacting the alcohols with ethylene oxide in a quantity between 6 to 20 mols to each mol of alcohol in a closed container at a temperature of 100° to 200° C. in the presence of caustic soda to form polyglycol ethers of said alcohols thereby imparting hydrophilic qualities to balance the lipophilic qualities of the hydrocarbon chains of the alcoholic component.

6. Compounds of waxy consistency having high wetting powers but low foaming power consisting of polyglycol ethers of monohydric secondary straight chain aliphatic alcohols having from 11-17 carbon atoms in the chain.

FRITZ SCHLEGEL.