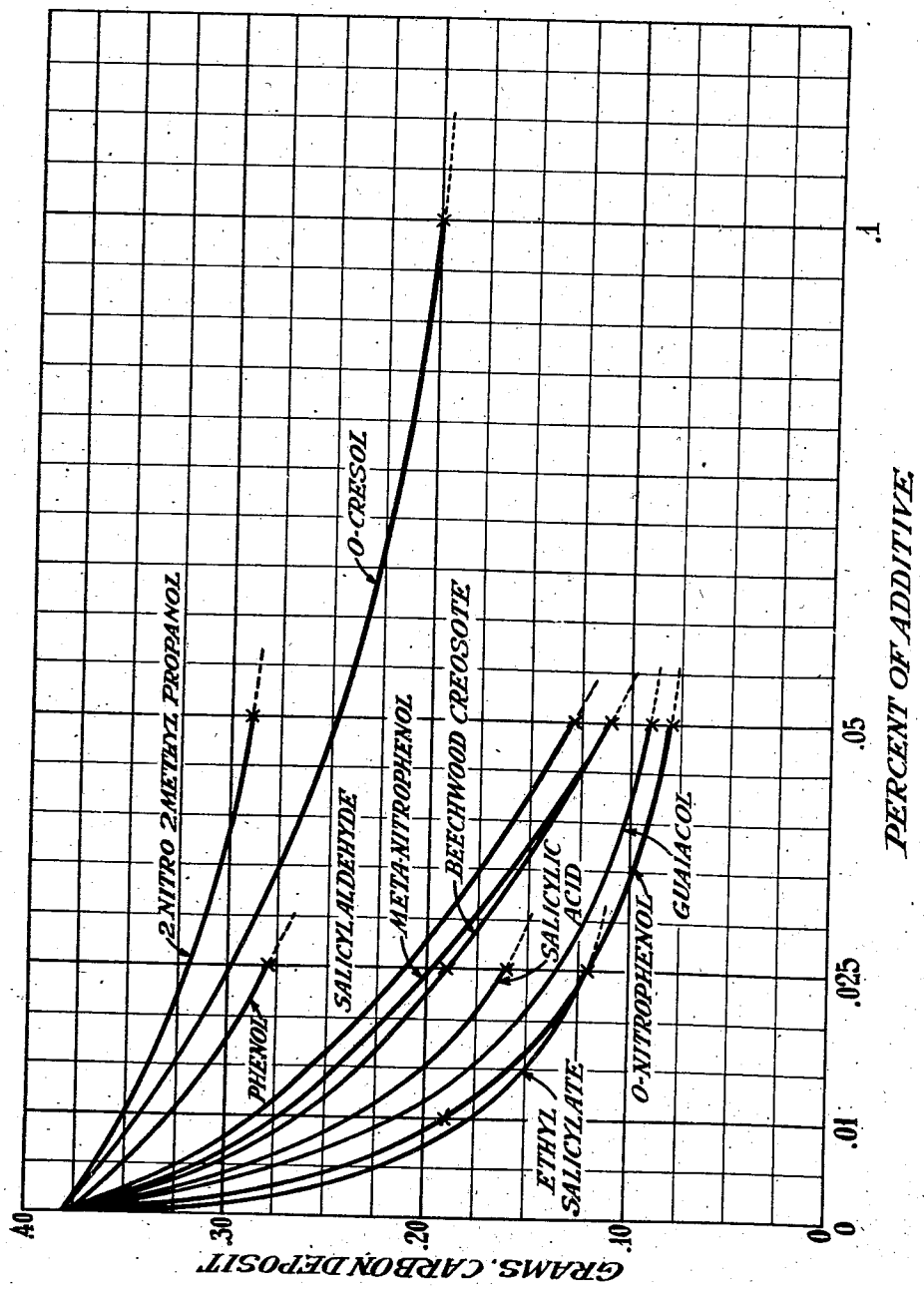
Sept. 5, 1944. W. A. PROELL 2,357,547

INHIBITOR FOR LIGHT BURNING OILS

Filed Oct. 27, 1941



Inventor:
Wayne A. Proell
By Gouart H. Kerslake
Attorney

Patented Sept. 5, 1944

2,357,547

UNITED STATES PATENT OFFICE

2,357,547

INHIBITOR FOR LIGHT BURNING OILS

Wayne A. Proell, Chicago, Ill., assignor to Standard Oil Company, Chicago, Ill., a corporation of Indiana

Application October 27, 1941, Serial No. 416,694

9 Claims. (Cl. 44—70)

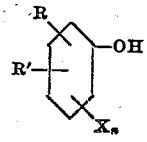
The present invention relates to inhibitors for light burning oils used in small stoves or for lighting purposes and referred to as stove and lighting naphthas. These naphthas have a boiling range within the approximate range of 100° F. to 500° F. and more typically a boiling point range of from about 130° F. to about 365° F.

Many kinds of stoves and equipment for lighting purposes include generators wherein the naphtha is heated and vaporized before burning takes place. These generators sometimes take the form of tubes or coils which may be heated by the flame itself or by any other source of heat to a temperature within the approximate range of 800° F. to 1200° F. In generators of this general type and under these conditions the naphthas or light hydrocarbon liquids form carbonaceous deposits in the generator. It is believed that these deposits may be caused by cracking of the naphtha or possible by some reaction with oxygen dissolved in the naphtha. When these deposits form too rapidly the use of the stove or lighting devices are seriously curtailed due to the necessity for frequent cleaning. It is therefore desirable to reduce or eliminate the formation of coke or other carbonaceous materials in such generators.

It is an object of the present invention to provide an inhibitor for stove and lighting naphtha to reduce the formation of carbonaceous material in the generators.

A further object of the invention is to provide an improved stove and lighting naphtha which will cause less carbon deposit and will eliminate the necessity for cleaning the stoves or lighting devices frequently. Further and more detailed objects of the present invention will become apparent as the description thereof proceeds.

It has been found that certain substituted phenols and substituted mono- and dialkylated phenols such as the substituted cresols, xylenols, ethyl phenols and the like, when added to the naphtha in small amounts, will inhibit the formation of coke and other carbonaceous material in the generator. Compounds of the above type which can be used in accordance with my invention have the formula



wherein R represents H or an alkyl group, R' represents H or an alkyl group, X represents one or more radicals selected from the group consisting of —OR'', —CHO, —NO_2, —COOR'', —OCOR'', —COR'' and —COOH radicals in which R'' represents an alkyl group and n is an integer from 1 to 3. Those substituted phenols, which have been found to be very effective, contain at least one activating side chain which appears to have the ability to increase the activity of the phenolic OH in so far as the present invention is concerned. In particular it has been found that the alkoxy phenols, such as guaiacol, creosol or alkoxy-phlorol and the like, salicylaldehyde, alkyl salicylates, such as ethyl salicylate, salicylic acid, cresotic acids, nitrophenols, nitrocresols and beechwood creosote, which contains approximately 40% to 60% of various alkoxy phenols including guaiacol, greatly reduce generator deposits.

It has been found that the inhibitor must contain a free phenolic OH group which is activated by an oxygen-containing side chain. Thus tests which were carried out with phenol, cresol and 2-nitro 2-methyl propanol did not give good results. The last mentioned compound contains a nitro group and an OH group in the same spacial relationship as in ortho-nitrophenol but the results obtained were unsatisfactory. Also, ortho-cresol, which differs from guaiacol only in the presence of an oxygen atom in the side chain, was not as satisfactory as the other substituted phenols mentioned above. While the ortho-substituted phenols appear to give the best results, the para compounds and meta compounds can also be used effectively.

Compounds of the above-mentioned type have been tested according to the following procedure. The particular apparatus used in these tests is an "instant lighting" type of naphtha hot plate. In this apparatus, a tank of naphtha is maintained under 40 pounds per square inch air pressure. A valve controls admission of the naphtha to a generator. The generator comprises a steel tube about 8'' long and with a bore of ¼'', terminated at one end by inlet fittings and at the other end by a nozzle and a seat for the valve. In operation, the amount of naphtha leaving the nozzle is controlled by the valve seat adjacent to the nozzle, so that the generator operates under a pressure of about 40 pounds, and is always filled with naphtha and naphtha vapors. The naphtha vapors pass from the nozzle into a Venturi air injector in which they are adequate-

ly mixed with air, and from there pass into the burners proper. One burner is immediately beneath the generator itself and supplies the heat required by the generator to vaporize and superheat the naphtha. In the particular apparatus used (a Montgomery Ward 1939 model hot plate), it was found that carbonaceous deposits accumulated in the generator, and that if these deposits exceeded 0.20 gram per 8 hour test run of 0.8 gallon of fuel, the fuel was unsatisfactory in that commercial use of the fuel would lead to many complaints from consumers. If the fuel gave a deposit of less than 0.20 gram in the above test, however, the fuel would perform satisfactorily in commercial use, even with prolonged runs. It is evident that the above critical limit of 0.20 gram will be different with different sizes of generators, but for test purposes the limit enables one to distinguish rapidly between poor and good fuel naphthas. Naphthas produced commercially, even though gum free and well refined, commonly show generator deposits from 0.22 gram to 0.40 gram. A naphtha giving a deposit of 0.4 gram caused such extensive plugging as to necessitate cleaning the generator after operating 2–3 hours, while naphthas showing 0.1 gram deposit rendered it unnecessary to clean the generator even after 48 hours of continuous burning.

The data obtained with the above apparatus is presented in the table which follows and in the accompanying drawing which forms a part of the present specification.

Table

	Naphtha	Deposit
		Grams
1	Control	0.38
2	1+0.05% 2-nitro 2-methyl propanol	0.29
3	1+0.025% phenol	0.28
4	1+0.1% ortho-cresol	0.20
5	1+0.01% orthy-nitrophenol	0.19
6	1+0.025% beechwood creosote	0.19
7	1+0.025% salicylic acid	0.16
8	1+0.05% salicylaldehyde	0.13
9	1+0.025% ortho-nitrophenol	0.12
10	1+0.025% ethyl salicylate	0.12
11	1+0.05% beechwood creosote	0.11
12	1+0.05% guaiacol	0.09
13	1+0.05% ortho-nitrophenol	0.08
14	1+0.05% meta-nitrophenol	0.11

It will be noted from the data appearing above that the substituted phenol compounds containing oxygen in the side chain when added to a naphtha in quantities of from about 0.01% to about 0.05% have a remarkable effect in reducing carbon deposits in generators.

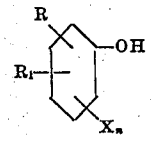
The data also show that when about 0.01% of a substituted phenol compound according to the present invention is added to a naphtha the carbon deposit is reduced by about 50%. Increased amounts up to about 0.5% of the additive will reduce the carbon deposits still further.

It will be obvious to one skilled in the art that various modifications may be made without departing from the spirit of the invention.

While the foregoing invention has been described with reference to various specific examples, these examples are not to be construed as limitations. The scope of the present invention is to be determined solely by the scope of the appended claims. Although certain theories regarding the formation of the deposits and the action of the inhibitors are stated hereinbefore it must be recognized that these theories are not binding and that the invention is not limited thereby.

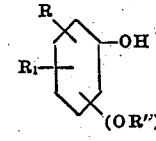
I claim:

1. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of a compound having the formula



wherein R represents hydrogen or an alkyl group, R′ represents hydrogen or an alkyl group, X represents one or more radicals selected from the group consisting of —OR″, —CHO, —NO_2, —COOR″, —OCOR″, —COR″ and —COOH radicals in which R″ represents an alkyl group and n is an integer from 1 to 3, then passing the naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

2. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of a compound having the formula



wherein R represents hydrogen or an alkyl group, R′ represents hydrogen or an alkyl group, R″ represents an alkyl group and n is an integer from 1 to 3, then passing the naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

3. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of an alkyl salicylate, then passing the naptha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

4. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of ethyl salicylate, then passing the naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

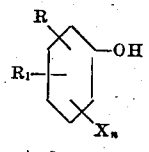
5. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of guaiacol, then passing the naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

6. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of a nitro-phenol, then

passing the naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

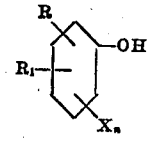
7. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha, said naphtha normally tending to form such deposits, comprising adding to the naphtha a small amount of orthonitrophenol, then passing the naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and finally burning said vapors for producing heat or light.

8. A method of preventing carbonaceous deposits in generators for heating stove and lighting naphtha in a system which includes the steps of passing said naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion and then burning said vapors for producing heat, the improvement which comprises adding to the naphtha a small amount of a compound having the formula



wherein R represents hydrogen or an alkyl group, R′ represents hydrogen or an alkyl group, X represents one or more radicals selected from the group consisting of —OR″, —CHO, —NO_2, —COOR″, —OCOR″, —COR″ and —COOH radicals in which R″ represents an alkyl group and n is an integer from 1 to 3.

9. An improved method for burning stove and lighting naphtha comprising passing a naphtha in a confined stream through a heating zone to generate vapors for subsequent combustion, said naphtha containing a compound having the formula



wherein R represents hydrogen or an alkyl group, R′ represents hydrogen or an alkyl group, X represents one or more radicals selected from the group consisting of —OR″, —CHO, —NO_2, —COOR″, —OCOR″, —COR″ and —COOH radicals in which R″ represents an alkyl group and n is an integer from 1 to 3, and then burning said vapors for producing heat or light, the presence of said compound greatly reducing the carbonaceous deposits which would normally tend to form in said heating zone.

WAYNE A. PROELL.