Patented Oct. 25, 1932 1,884,767

UNITED STATES PATENT OFFICE

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PAINT AND VARNISH REMOVER CONTAINING ACTIVATED ACETONE

No Drawing. Application filed June 29, 1928. Serial No. 289,328.

This invention relates to a finish remover comprising ketonic condensation solvents and has for its object the production of a composition adapted for the softening of the finish coating from painted or varnished surfaces so that such softened finish can be readily removed.

Some of the commercially-used volatile solvent paint and varnish removers at the present time are made with benzol and acetone carrying three or four ounces of paraffin wax per gallon, with various modifications and additions.

The activity of a paint and varnish remover is usually tested in the trade by a method which is not absolutely reliable but nevertheless is regarded sufficiently convincing to the user. This method involves the application of some of the removing composition to a surface coated with a paint or varnish and noting the time taken for the surface to wrinkle. This wrinkling effect is regarded as an indication of the solvent action or "cutting power" of the removing composition, activity being in inverse ratio to the time required.

Hence the method adopted in conducting the tests carried out in connection with the development of the present invention was as follows: A piece of old painted wood was selected, taking care that the portion used had a good even, thick coat of paint. This was cut into strips. Various solvents were placed in a series of test tubes and a strip of the painted wood was put into each test tube. The time which elapsed before the first appearance of any wrinkling was noted accurately for each solvent by means of a stop watch. The comparative "removing action" was thus roughly represented by the number of seconds.

Solvent mixtures vary greatly in cutting power. In removers involving the use of a penetrating hydrocarbon, such as benzol, and a loosening solvent of an alcoholic or ketonic nature, a very great variation is observable in the cutting action depending upon the choice of solvents. Practically speaking, benzol is the most active and cheapest penetrating hydrocarbon. Acetone is probably the most readily available and highly effective ketone body which is being used in paint and varnish removers as a loosening solvent at the present time.

In the course of investigations in the field of paint and varnish removers, I discovered that a product obtained from acetone by treatment with a small amount of alkali would produce a substantial increase in cutting power of a remover as compared with acetone-containing removers otherwise of a similar character, and that other advantages would accrue from the employment of such alkali treated acetone.

In an effort to secure the quickest possible action for a paint and varnish remover, I proceeded first with the investigation of the cutting power of various single solvents of different natures, turning then to a mixture of two solvents, three solvents, and so forth. In this investigation important features have been observed which are illustrated in the following table, the tests being conducted on painted strips of the kind described above:

Table 1

Single solvents	Cutting power—seconds
Benzol	3600
Chlorobenzol	400
Anhydrous methyl alcohol	240
Anhydrous ethyl alcohol	1020
Isopropyl alcohol (98%)	2400
Diacetone alcohol	408
Acetone	80
"Activated-acetone" (as described below)	75
Methyl ethyl ketone	75
Mesityl oxide	210
Furfural	300
Ethyl acetate	105
BINARY MIXTURES (EQUAL PARTS)	
Benzol-anhydrous methyl alcohol	45
Benzol-anhydrous ethyl alcohol	150
Benzol-acetone	65
Benzol-"activated-acetone"	45
Benzol-methyl ethyl ketone	55
Benzol-furfural	90
Benzol-ethyl acetate	75
Acetone-anhydrous methyl alcohol	45
Acetone-diacetone alcohol	115
Acetone-furfural	40
Acetone-mesityl oxide	85
Acetone-methyl acetate	90
Acetone-methyl ethyl ketone	45
"Activated-acetone"-anhydrous methyl alcohol	35
Methyl ethyl ketone-anhydrous methyl alcohol	55
Furfural-methyl alcohol	35
Methyl acetate-methyl alcohol	25
"Activated-acetone"-mesityl oxide	25
"Activated-acetone"-methyl acetate	45
TERNARY MIXTURES (IN EQUAL PARTS)	
Benzol-anhydrous methyl alcohol-acetone	50
Benzol-anhydrous methyl alcohol-"activated acetone"	40
Benzol-anhydrous methyl alcohol-methyl ethyl ketone	32
Benzol-acetone-ethyl alcohol	90
Benzol-"activated-acetone"-methyl acetate	20

As stated, the main feature of the present

invention is the use of a product obtainable by "activating" acetone. This product contains a mixture of various ketone condensation products together with unconverted acetone.

When acetone is subjected to the action of a small amount of an alkali metal hydroxide, a portion of the acetone undergoes intermolecular condensation to form a number of products of higher molecular weight among which mesityl oxide, diacetone alcohol, phoron and iso-phoron are mentioned.

I shall now illustrate the preparation of the "activated acetone" of the present specification.

To prepare this product, commercial acetone, preferably in pure form, is treated with an alkaline substance capable of causing condensation, forming a certain proportion of products of higher boiling point. Alkaline condensating agents are, for example, quicklime, calcium hydroxide, barium hydroxide and similar alkaline earth metal hydroxides, and the like, which are substantially insoluble in acetone.

Sodium or potassium hydroxide can also be employed. The last two hydroxides are preferable and should be used in minute amounts (e. g., about 0.3%, more or less), and preferably in such proportions as will dissolve practically completely in the acetone. The acetone when exposed to a condensation agent of this character, or mixtures of such condensation agents, is permitted to undergo a reaction involving condensation, the treatment preferably being carried out at about room temperature for a period of a day or so, sufficient to bring about a substantial equilibrium between unchanged acetone and the higher boiling substances which are engendered. The acetone mixture is then preferably neutralized. When neutralizing the product it is desirable to avoid an excess of acid and therefore it is better (although not necessary in all cases) to keep the product near the point of neutrality approximating the iso-electric point. Various organic and inorganic acids may be used for the neutralization and the employment of gases containing carbon dioxide to form carbonates or bicarbonates are also not precluded. In some cases I may use the alkali treated but unneutralized acetone directly in remover compositions.

In connection with the neutralization it should be pointed out that when using the above product in the present invention, it is usually desirable to avoid the presence of any unnecessary dissolved solids of a seemingly inert character, because such substances present in the solvents used for paint and varnish remover usually tend to decrease the cutting power (or speed) of the solvent. For this reason, if and when neutralizing the alkali-treated acetone, it is advisable to use certain acids which form salts insoluble in acetone and in mixtures of acetone and other solvents used in paint and varnish removers. Tartaric acid was found to be one of the most satisfactory for the purpose.

After sufficient time for the reaction has elapsed, the alkali-treated acetone generally is neutralized with an acid and the resulting salt, if precipitated, may be separated either by filtering the liquid or by recantation. Or, in some cases, this precipitate may be allowed to remain in the composition. The product so obtained frequently will contain about 75% of unconverted acetone and about 25% of higher boiling liquids. The mixture of those several substances, thus readily and conveniently obtained, constitutes the preferred composite solvent or "activated-acetone" of the present invention. The term "activated-acetone" is used throughout this specification and the appended claims to cover this alkali-treated and neutralized product. The high solvent power of this "activated-acetone" can be seen from Table 1. I may also use various fractions of the foregoing containing mixtures of solvents obtained by condensation.

In connection with the above described method of preparation of "activated-acetone", it should be pointed out that acetone may occur both as normal or ketonic acetone and also as iso-acetone or enolic acetone. Enolic acetone has a structure corresponding to that of unsaturated alcohol (hydroxy propylene).

Enolization apparently plays an important part in the condensation of acetone to form the higher boiling acetone derivatives. When acetone is treated with a small amount of alkali, such as potassium hydroxide to form a higher boiling derivative thereof, under most advantageous conditions about one-eighth of its volume of diacetone alcohol will be formed with simultaneous formation of about another one-eighth of its volume of products boiling between 60° C., and 150° C. In one treatment of acetone with alkali, an equilibrium is reached in which one-fourth (or even slightly more) of acetone will undergo condensation, with about three-fourths remaining unreacted.

I have found that this unreacted acetone, when recovered from one alkali treatment or distillation and when again subjected to the same alkali treatment, is much less reactive than the fresh previously untreated acetone. This I regard as largerly due to a lower enolic content and therefore it appears that enolic acetone and not ketonic acetone is the actual substance which will combine with itself (by a condensation reaction) to form these higher boiling derivatives. The reactivity of commercial acetone derived from various sources differs somewhat, which may

be ascribed to some variation in the enolic content.

I have recorded in a copending application that certain substances may be added to acetone-alkali reaction mixtures which act as promoters of enolization, and which in consequence increase the yield of condensation products and bring about their formation in less time than would otherwise occur.

Such are substances containing the COH group, i. e., such materials as tertiary alcohols and aldehydes—particularly formaldehyde, are especially suitable as promoters. By the use of such promoters the yield of activated acetone can be increased to about 44% by weight of acetone taken.

The activated acetone used in most of the examples given in the present specification was made from a commercial grade of acetone by treatment with small amount (.03%) of potassium hydroxide in presence of 2% of 40% formaldehyde solution, allowing to stand for one day, finally neutralizing the products of reaction with tartaric acid, settling and filtering.

Referring to Table 1 representing the cutting power of various solvents, it should be noted that activated acetone as compared with other ketone solvents, such as acetone, methyl ethyl ketone, mesityl oxide, and diacetone alcohol, is the stronger and more active solvent.

The same observation is true for various mixtures of activated acetone with other solvents including hydrocarbons of the benzenoid type such as benzol and those of the non-benzenoid type such as petroleum naphtha.

From the same table it should also be noted that while activated acetone may contain mesityl oxide and diacetone alcohol, it is apparently not the presence of these two substances which produces the effect of the higher efficiency because a mixture of acetone with diacetone alcohol and acetone with mesityl oxide gave a cutting rate much slower than the rate for activated acetone itself. Therefore the potency of activated acetone cannot be credited to the primary condensation products individually considered, but rather to the joint or co-operative effect of various acetone condensation products fromed simultaneously in the course of reaction.

It was also observed that an alkaline reaction does not favor but rather depresses the solvent power of "activated-acetone" in removing compositions. Activated acetone prepared, as already mentioned, by using caustic alkalies and empolyed in the alkaline or unneutralized state gave results which are illustrated in Table 2. The table gives the cutting power in seconds as measured on the same type wooden strips and by the same method as previously described.

It is also within the scope of this invention to fractionally distill the activated acetone and use stated fractions only in the removers made under this invention, certain other fractions being available for other specific uses. Ordinarily however, I do not distill the activated acetone, which would add somewhat to the cost, since excellent removers can be produced when using the entire activated acetone, preferably after a careful filtration.

Table 2

Composition of solvent mixture used in each test	Activated acetone						Acetone
	Samp. 1		Samp. 2		Samp. 3		
	Alk.	Neu.	Alk.	Neu.	Alk.	Neu.	
Single solvents	90	60	75	60	70	55	80
Binary mixtures of above solvents with:							
Benzol	70	45	60	45	55	45	65
Petroleum naphtha	200	125	200	130	200	130	280
Anhydrous methanol	50	30	50	40	45	35	45
Ternary mixtures of above solvents and two other solvents:							
Benzol-methyl acetate	30	20	40	30	40	25	------
Benzol-anhydrous methanol	60	40	55	40	55	40	50
Petroleum naphtha-methyl acetate	60	35	60	35	55	40	------

Samples 1, 2 and 3, mentioned in table above were made from acetone using different alkaline catalysts for the reaction. One thousand cc. of acetone was used in each case and the reaction was catalyzed in sample 1 with one gram of potassium hydroxide; in sample 2 with one gram of quicklime (calcium oxide) and in sample 3 with one gram of barium hydroxide. It can be seen from the above table that the neutralized product is of especial value, the alkaline product giving in all cases a slightly slower rate of attack.

Having described the preparation and the finish loosening properties of ketone condensation solvents, which are the main features of the present invention, I will now give examples of the various paint and varnish removers made with the above materials. It is understood that all formulas given below should be regarded only as examples and that I do not wish to restrict myself to the exact proportions and components given in these formulas. All these examples will include in the formulas a wax, e. g., paraffin wax, as an agent to retard evaporation of the solvents and in some cases will also include nitrocellulose (scrap celluloid) as an agent to increase the consistency of the paint and varnish remover. It should be noted in this connection that the addition of various solids which are capable of dissolving in one of the solvents used in paint and varnish remover and to some extent carried into solution in the mixed solvent forming the remover, generally will result in cutting down of the

"speed" of a given solvent or of a mixture of this solvent and other ingredients, and therefore the cutting speed or rate of attack of wax-containing compositions will be slower than the cutting speed of a corresponding mixture without a wax, for example: the introduction of 1% of nitrocellulose of ½ second viscosity into acetone produced the following change in cutting speed as measured by the method described at the beginning of this application:

Pure acetone	80 seconds	
Acetone containing 1% of nitrocellulose.	130 seconds	62.5% retardation.

All removers made according to the formulas of the examples below were tested in the same manner on the same kind of painted surfaces, in order to obtain comparative figures. Each remover was placed on that surface in approximately the same quantity and the time was noted by means of a stop watch when the blistering or wrinkling of the surface was plainly observable. The cutting power was expressed in the number of seconds which elapsed before the appearance of such wrinkling. The proportion of ingredients is given by volume, including wax, (which was measured in the melted state).

The examples are all arranged in the form of a table (Table 3) giving compositions of removers as well as the cutting speed both for these removers and for a corresponding remover containing acetone in place of activated acetone in each case:

TABLE 3.—*Examples of paint and varnish remover compositions containing activated acetone*

Solvents	Example Nos.						
	1	2	3	4	5	6	7
Benzol	40		40	45	40		
Petroleum naphtha		30					
Trichlorethylene						40	
Monochlorbenzol							50
Anhydrous methanol	30	30		30	25		25
"Activated acetone"	30	40	30	15	15	30	25
Methyl acetate			30		15	20	
Scrap nitrocellulose				3			
Paraffin wax	2	2	2	7	2	2	3
Cutting speed in seconds	110	340	90	120	85	100	85
Cutting speed for corresponding remover containing non-activated acetone in seconds	160	547	125	165	110	120	125

These results are surprising since heavier solvents usually retard cutting action. Hence the formation of various higher-boiling solvents from acetone would be expected to reduce instead of increase the activity thereof.

The employment of activated acetone in paint and varnish removers thus is considered to be a useful improvement in the art, because it not only introduces a new solvent material of an important degree of cutting power into the paint and varnish remover field but also renders available one which can be easily and cheaply produced from so abundantly obtainable a raw material as acetone.

Activated acetone may be distilled to remove a part of the free acetone and the solvent of reduced acetone content thus obtained may be used in making paint and varnish removers. In this way I obtain a finish remover comprising "activated-acetone" containing free acetone present in a proportion less than that represented by the equilibrium point of alkaline condensation.

What I claim is:

1. A finish remover containing "activated-acetone" as a constituent thereof.

2. A finish remover containing "activated-acetone" and wax and a wax solvent.

3. A finish remover containing "activated-acetone" and methyl acetate, as wax precipitants.

4. A finish remover containing wax, a wax solvent selected from the herein described group consisting of benzol, trichlorethylene and monochlorbenzol, and containing "activated-acetone" and other wax precipitants selected from the herein described group consisting of methanol and methyl acetate, such remover being faster than a similar remover having the same composition but with ordinary acetone instead of the "activated-acetone."

In testimony whereof I affix my signature.

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