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PROCESS OF REMOVING ENGINE CARBON

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This invention relates to processes of removing engine carbon; and it comprises a process wherein the carbon deposits in gasoline engine cylinders are treated with a small quantity of a pyroxylin solution, said solution containing a solvent capable of blending with tar and the like and the treated carbon is afterwards exposed to heat; all as more fully hereinafter set forth and as claimed.

In spite of its hard and resistant nature, the so-called carbon deposit in the gasoline engine cylinders must be regarded as a sort of concrete in which an aggregate of particles of actual coke is bonded by a matrix of tar or pitch. Mechanically, this deposit is often hard, strong and resistant and its removal is frequently a matter of considerable difficulty. All sorts of carbon removing liquids have been proposed; most of these implicitly, though not often explicitly, having the function of entering the deposit and dissolving the tarry or pitchy binder. Insofar as these liquids are of an aliphatic hydrocarbon nature they are very little efficacious for the reason that the binder is a material resistant to gasoline, and therefore to most similar hydrocarbons. Benzol compositions are somewhat more efficient.

In the present invention carbon is peeled off, disintegrated and removed by a sort of compound action, partly mechanical.

We have discovered that the carbon deposit can be removed from the metal surfaces of the combustion chamber by allowing a film of glue or similar material to form and dry over the deposit. This film when taken off mechanically, or on separating spontaneously by drying, strips the carbon deposit off with it. This is true even when the deposit is excessively hard and adherent. A similar effect is obtained when the film is composed of a pyroxylin or nitro cotton lacquer material instead of glue. The action of the film in taking off the carbon deposit is facilitated in this case because the lacquer solvents contain materials which soak into the deposit dissolving the tarry binder and softening the whole mass. This does not occur so readily with the aqueous medium in which glue is dissolved. The softening action of the lacquer solvents may be adjusted by changing the solvents themselves and their volatility may be controlled so that they evaporate at the proper rate, leaving a coherent pyroxylin film in a short time. While a glue film in a combustion chamber can be decomposed by running the engine, thus distintegrating and ejecting the deposit, such an action occurs much more readily with a film of pyroxylin which decomposes rapidly as soon as heat is applied.

Our preferred manner of treating the deposit in our present invention is to treat the same with a solution of pyroxylin, or "soluble gun cotton," in one or more of a number of solvents. These pyroxylin solutions are in part colloidal in their character and to this extent such pyroxylin may not penetrate far into the coating save where cracks and fissures occur. On the other hand, the solvents and some film pyroxylin are taken up by the pitchy or tarry binder of the carbon concrete in the engine, and thus weaken the coked structure. These pyroxylin solutions are of such a concentration that as the solvent is removed the shrinkage in forming a pyroxylin layer is great. This contraction of a shrunk film under tension is due to the natural evaporation of the solvent from the outer surface. Such a film, once formed, already contains much of the carbon deposit.

On exposure of the treated carbon deposit to heat a number of things happen, all conducing to the disintegration and removal of the carbon deposit. The remaining absorbed solvent is volatilized and its volatilization may be more or less explosive. The pyroxylin which has put the coating under strain and such as has impregnated the deposits decomposes with a further disintegrating effect. In practice it is found that when the treated deposit comes under heat it shells and peels off, sometimes (at first) in rather large fragments, leaving practically clean metal behind. The large fragments rapidly disintegrate into a powder which is blown out with the exhaust.

The pyroxylin solution may be squirted or sprayed into the cold cylinder, the cylinder

allowed to stand for a short time and then the engine put in operation. The solution may be forced into the cylinders and the excess siphoned off; or the solution may be used as a paint for the inner surfaces when the head is removed. The film separates easily bringing the coke with it. In making a pyroxylin solution for the present purposes, ordinary celluloid or scrap from photographic film may be employed; and most of the ordinary solvents are efficacious for the present purposes. Better results, however, are obtained by special solvents. Most pyroxylin solutions contain large amounts of what are called "non-solvents", generally benzol or toluol. Unlike gasoline, these aromatic hydrocarbons are taken up rather freely by the tarry matrix of the carbon deposit softening the deposit as a whole. Coal tar light oils are usually a desirable component of the present carbon remover. However, pyroxylin dissolved in a mixture of acetone and benzol or in one of acetone and coal tar light oil works well, as does a mixture of ethylene dichlorid, ethyl acetate and monoethyl amine. Acetone alone as a solvent for pyroxylin works, but acetone mixtures are better. Ordinarily, the amount of pyroxylin used in the carbon remover may range from 1 or 2 per cent up to 7 or 8 per cent. The limit of concentration is in general the viscosity of the solution.

In using these pyroxylin solutions is removing carbon deposit from the interior of engine cylinders it has been found that explosion of the pyroxylin is not really necessary, in any case, for removal of the deposits. However, rapid decomposition is readily effected when the engine is put into use and the fine carbon blows out through the exhaust harmlessly.

The peeling and explosive functions of the nitro-cellulose are important factors in the carbon removal and the blending of a little pyroxylin with the various tar solvents which have been proposed for removing carbon, materially improves their efficiency.

In general most of the wide range of solvents ordinarily effective for pyroxylin may be used; but the effectiveness of the process may be improved by the addition of solvents designed especially to penetrate and soften the binder of the carbon deposit or to promote wetting action of the deposit. The usual procedure is to make up the concentrated solution of pyroxylin in ethyl alcohol or ethyl acetate, or in some acetone mixture, and then to dilute this solution with appropriate solvents or softeners for the deposit to bring about the desired penetration. Examples of such substances are chlorbenzene, brombenzene, dichlorethyl ether, ethylene dichloride, quinoline, secondary butyl acetate, cresols, aniline, and furfural. These substances may be introduced in varying proportions. In general, however, only small amounts of the higher boiling substances should be employed so as not to interfere too much with the ready formation of the coherent film. It is desirable to combine adequate penetration of the deposit with a good peeling film. The usual admixture of benzene, coal tar light oil, water gas tar distillates, mentioned above, would also occur at this time.

In order to facilitate penetration of deposit and formation of film the procedure may be modified in such a way that a dilute solution of the pyroxylin or one of the above mentioned deposit softening solvents is first applied. After a short interval of time a more concentrated solution of quicker drying properties is introduced. Improved results may even be obtained by several applications of the same solution with time intervals for allowing penetration.

In a specific remover made under the present invention about 16.5 parts by weight of commercial lacquer nitrocotton were dissolved in a mixture of 50.5 parts of ethyl alcohol and 33 parts ethyl acetate, and this solution was diluted with an equal weight of a mixture of equal quantities of benzene and chlorbenzene.

In another example the above stock solution of nitro-cotton in ethyl alcohol and ethyl acetate was diluted with an equal weight of ethylene dichloride. The final composition of the mixture was 8.25 parts nitrocotton, 25.25 parts ethyl alcohol, 16.5 parts ethyl acetate and 50 parts ethylene dichloride.

In the above examples allowance has been made for the ethyl alcohol with which the nitrocotton is wet for convenient handling.

What we claim is:

1. The process of removing carbon from internal combustion engines and the like which comprises coating the deposit with a penetrating, film forming composition suitable for producing a peeling film, allowing the film to form and to peel and then removing the said film together with the engine carbon loosened by the action of said film.

2. The process of claim 1 in which the film forming composition comprises a dilute solution of pyroxylin.

3. The process of claim 1 in which the film forming composition comprises a solution containing solvents suitable for penetrating and softening the tarry binder of said carbon deposit.

4. The process of removing carbon from internal combustion engines and the like which comprises applying to said engine carbon a pyroxylin composition containing a solvent suitable for penetrating and softening the tarry binder of the carbon deposit selected from a class consisting of benzol,

toluol, coal tar light oils, acetone, ethylene dichlorid, ethyl acetate, monoethyl amine, chlorbenzene, brombenzene, dichlorethyl ether, quinoline, secondary butyl acetate, cresols, aniline and furfural, permitting a film to form and thereafter removing the resulting film together with the engine carbon loosened by the action of said film.

5. The process of removing carbon from internal combustion engines and the like which comprises applying to the surface of the carbon deposit a penetrating pyroxylin composition, suitable for producing a peeling film, allowing a film to form, decomposing the resulting film with heat and removing the residues of film and of carbon loosened by the action of said film.

6. The process of claim 5 in which the pyroxylin solution is a dilute solution of pyroxylin in a solvent having the properties of penetrating and softening the tarry binder of said carbon deposit.

7. The process of removing carbon from internal combustion engines and the like which comprises applying to the surface of the carbon deposit a dilute solution of pyroxylin in a solvent having the properties of penetrating and softening the tarry binder of said carbon deposit and thereafter applying to said surface a more concentrated pyroxylin solution having quicker drying properties, permitting the solution to form a film and thereafter removing the said film and the carbon loosened by the action of said film.

8. The process of removing carbon from internal combustion engines and the like which comprises applying to the surface of the carbon deposit a composition comprising pyroxylin, ethyl alcohol, ethyl acetate, benzene and chlorbenzene, permitting a film to form and then removing the resulting film together with the engine carbon loosened by the action of said film.

In testimony whereof, we have hereunto affixed our signatures.

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