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PROCESS OF APPLYING GRAPHITE TO ENGINE PISTONS AND CYLINDERS.

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To all whom it may concern:

Be it known that I, JOHN THOMSON, a citizen of the United States, and a resident of the borough of Brooklyn, city and State of New York, have invented Processes of Applying Graphite to Engine Pistons and Cylinders, of which the following is a specification.

This invention has a general relation to engines, particularly as in automobiles; and, being so considered, is comprised in a process of applying an adherent coating of highly comminuted graphite to the co-ordinating surfaces of engine-cylinders and their pistons with the objects of diminishing friction and largely, or even wholly, preventing them from scoring and seizing.

When first assembled and put into operation, an engine must be coddled and carefully "worked-in," otherwise the pistons are liable to jam, by heat-expansion, against the cylinder-walls, which frequently results in scoring either or both of the co-ordinating surfaces, causing them to adhere or, as it is usually termed, "freeze." Furthermore, an engine may run well up to and at a moderate rate of speed; but, when further speeded-up and necessarily more highly heated, the pistons will be further diametrically expanded and may impose such an intimacy of physical contact that admission of oil is prevented, and again damage is liable to ensue. In these circumstances, cylinders must be rebored and new pistons be specially fitted thereto. The foregoing objections are wholly overcome by proceeding according to the present process; which may be thus epitomized:

A process or mode of applying coatings of comminuted graphite upon metallic surfaces, such as the peripheral surfaces of pistons and upon the contiguous inner surfaces of cylinders, which shall be so adequately adherent to the metal as to subtend the utmost lubrication and endurance possible to derive from two graphited surfaces, each rubbing upon the other of them.

The preferred material and maneuver whereby to realize the benign advantages inherent in this process, will now be set forth.

Thus, the graphite, preferably artificial, must be in the form of a dust of molecular-like fineness and, by addition of water, be brought to a semi-pasty or paint-like consistency, such as may be termed an aqua-graphitic dope. An excellent example of ready-to-hand material, which is peculiarly well adapted for this purpose, is the so-called de-floculated graphite produced by the process of Acheson, marketed under the trade-name of "Aquadag."

All surfaces, prior to being coated, must be very thoroughly cleansed, as by means of alcohol. The aqua-graphitic dope is then readily applicable by means of a soft brush, such as camel's hair. The moist coating must be left undisturbed until the water therein has completely evaporated, which is sufficiently evidenced when the dark pasty dope changes to a dull grayish-black. Then this dried-out film or plating should be briskly buffed with cloth, such as wool, canton-flannel or linen, when the dull graphite takes on a bright, glossy appearance. The particular and highly important feature of this buffing operation is to set and solidify the graphitic film; and it may be still further condensed and more intimately driven into the minute underlying metallic pores by burnishing or planishing, as with polished hardened steel.

If the primary coating is not sufficiently thick, an additional application, or several of them, may be added; but each film should be allowed to dry-out before adding another. The thickness of the plating which can thus be quite uniformly applied may run from, say, one ten-thousandth up to several thousandths of an inch.

If oil is applied to the glossed surface, graphite is not thereby released and floated off; but, on the contrary, may be again cloth-rubbed, effecting what may be termed "an oil finish," the color thereof becoming somewhat darker than before. Yet, were dry dust mixed with oil, this oil-dope being applied to metallic surfaces, the graphite will not adhere as in the former instance; on the contrary, if rubbed with a cloth, it will come off with the oil, exactly as is in the case of aqua-dope if it is rubbed before the contained water is evaporated.

It would seem to be a logical assumption that, when the content of distilled water is evaporated at atmospheric temperature (and it may even be heated to the vaporization point) the graphite would again be found in its primary form of dust; but, the reasons to the contrary being what they may, it does not.

Astonishingly adherent graphitic films

can thus be applied to paper, tin-foil, lacquer, buffed brass, hand scraped surface plates and highly polished hardened steel, such as needles. Hence, when the application is made upon relatively rougher machined or ground surfaces which, as microscopically viewed, present a vast aggregation of "hills and valleys" the latter function as graphitic reservoirs and furnish a fresh supply as and when the obtruding "hills" are elided. These imprisoning "valleys" may be augmented in depth and area, as by etching, knurling or wire-brushing.

In gas engines, the pistons necessarily attain and maintain a higher temperature than that of their containing cylinders. Consequently, the practice has become well established to fit pistons, when cold, some thousandths of an inch lesser in diameter than the cylinders; the exact amount depending upon the co-efficient of expansion of the metal employed. When started, cold, the annular spaces between the pistons and their cylinders are usually sufficient to permit an objectionable leakage; and it is during the period when pistons are taking heat and expanding that split packing rings play their most important part.

Hence, if pistons can be primarily so closely fitted as to quickly expand into actual physical contact, beyond which they become self-clearing, then the duty imposed upon split-rings become merely nominal. And that is precisely the condition which is realized by the practice of this process; for starting with pistons whose diameters are about the same as in established practice: with graphitic films added thereto of thicknesses which will approximately fill the clear annular spaces, when cold, they will self-clear, when expanded, to the nearest possible amount short of actual physical interlocking of one surface with the other of them. In the case of metal-to-metal, scoring and freezing would undoubtedly ensue; but with graphite-to-graphite the co-ordinating surfaces will planish, condense and rub off until a minute clearance is effected, and without possibility of detrimental consequences. If oil is present, all well and good; if not, nearly equally so; for the frictional co-efficient of graphite-on-graphite is a close second to that of oil itself.

The practice of this method can also be well extended to the sides of split packing rings and the groove-walls in which they are mounted, whereby their endurance is greatly increased over that of metal-to-metal impingements.

After a short period of operation, the appearance of the cylinders and their pistons simulates that of a mirror; consequently, a merely nominal supply of oil is more efficient than would be a copious supply if the rubbing surfaces were metal-to-metal. Per contra, if no oil reaches the graphitic surfaces, the engine runs on; whereas, if metallic surfaces are deprived of oil, the engine stalls. In certain cases, the dope needs be applied only to the pistons or to the cylinders, as may be preferred, as portions of the applied coatings will be transferred from one to the other of them, the reciprocating movement of the pistons acting to planish and solidify the co-relating surfaces.

Erosion of the graphitic films proceeds with surpassing slowness, thereby subtending long periods of satisfactory performance; and even then their efficiency can be quickly restored, at a negligible expense, by the re-exercise of this process.

If a piston is compositely formed of a metal cylinder and solidified graphitic rings therein, as in the case of this applicant's Patent No. 1,426,022, August 15th, 1922, the aqua-graphitic dope can well be applied to the bearing surface, or surfaces, of the said rings; whereby, if worn down, their desired diameters can be restored.

While this process has been described in connection with engine pistons and cylinders, it is deemed self-evident that it would be merely a case of double-use to otherwise utilize it; as, for example, on sliding surfaces and cams of machinery, and on journals, spindles, shafts and their bearings.

What I claim is:

The process of applying adherent coatings of comminuted graphite upon the co-ordinating metallic surfaces of engine cylinders and pistons, which consists in cleansing the said surfaces; coating them with a dope formed of graphitic dust and water; evaporating the water-content from the dust and then setting and solidifying the residual graphitic film, as by buffing it, or by buffing and planishing it, in place.

This specification signed on the 12th day of March, A. D., 1923.

JOHN THOMSON.