

H. M. ELLER.
 PROCESS FOR REMOVING CARBON DEPOSITED IN INTERNAL COMBUSTION ENGINES.
 APPLICATION FILED JAN. 27, 1913.

1,081,950.

Patented Dec. 23, 1913.

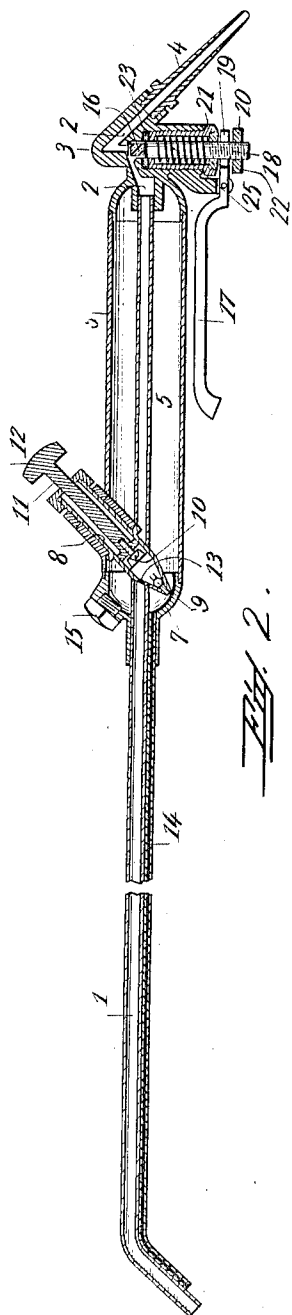


Fig. 2.

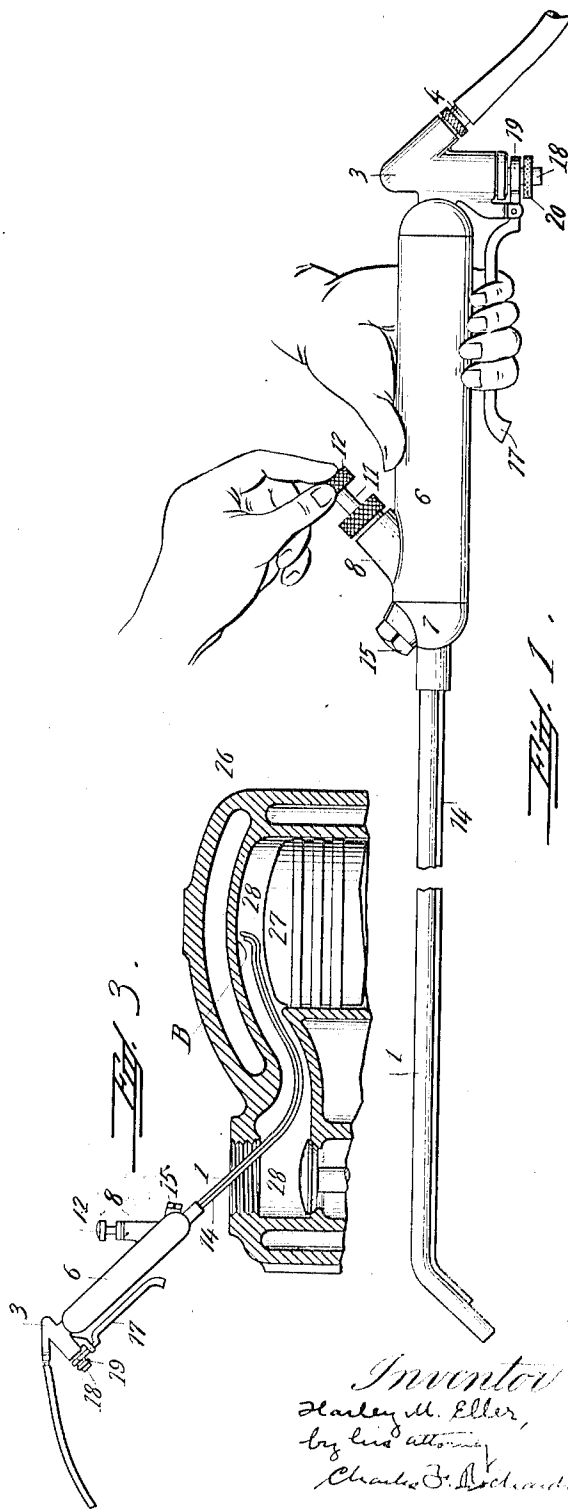


Fig. 3.

Fig. 1.

Witnesses

E. F. Duval.

H. P. Rineck.

Inventor

Harley M. Eller,
 by his attorney
 Charles F. Richmond.

UNITED STATES PATENT OFFICE.

HARLEY M. ELLER, OF WOLLASTON, MASSACHUSETTS, ASSIGNOR TO NORFOLK MANUFACTURING COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

PROCESS FOR REMOVING CARBON DEPOSITED IN INTERNAL-COMBUSTION ENGINES.

1,081,950.

Specification of Letters Patent.

Patented Dec. 23, 1913.

Application filed January 27, 1913. Serial No. 744,359.

To all whom it may concern:

Be it known that I, HARLEY M. ELLER, residing at Wollaston, in the county of Norfolk and State of Massachusetts, have invented a certain new and useful Process for Removing Carbon Deposited in Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

10 The object of my invention is to provide a method whereby carbon formed upon the piston head and the walls of the combustion chamber of an internal combustion engine, may be more successfully removed than has been the case heretofore. As is well known, this carbon may be quite evenly distributed over them, in mass, or only in particles, or patches, with free intervening wall surfaces; the carbon being usually more or less permeated with the lubricating oil of the cylinder. Among the various methods with which attempts have been made to remove such carbon, is that of lighting the oily carbon deposit, with a taper or match, and an atmosphere of oxygen, whereby all of the oil and much of the carbon may be consumed; more or less carbon in the form of particles and patches being left in a glowing state. This step may be termed "the preliminary burning out." Next, a jet of oxygen is supplied successively to the ignited patches, for the purpose of entirely consuming them. If for any reason the ignition of the carbon ceases, combustion has to be again started; often with great difficulty, because of the absence of the easily ignitable oil present at the first lighting, and also because the match or taper burns out quickly, and; oftener than not, not only before the visible carbon can be lighted, but before the carbon, concealed upon the invisible wall surfaces of the cylinder, can be located. But even with great care, a complete removal of the carbon is difficult, for, as much of the wall surface of the combustion chamber is invisible to the operator, it is impossible to see what there is, or what is taking place, thereon. While any of the unseen particles glow and light up the chamber, the operator can direct his oxygen jet in the direction from which the light and burning sparks of carbon come, and hope to find and consume them; but if these

ignited particles go out, the operator is not sure whether all have been consumed or not; if he decides yes, and they have been, all well and good; if no, and there are oilless particles left, it is very hard, even if found, to reignite them. Consequently, their removal is oftener than not, incomplete; and if they or any of them have become separated from the cylinder walls, as by the blast of the oxygen jet, and are scattered throughout the cylinder, they are extremely difficult to locate, and, being free, are likely to score the piston rings and the wall of the cylinder, when the engine is started. But in all events, the carbon has, by this inefficient method, to be lighted and relighted many times, and all with the result, of loss of time and patience; a great waste of oxygen; and an incomplete removal of the carbon.

Now by my method, I obviate the necessity of frequent and difficult relighting of the carbon, with tapers and oxygen; and I do so by injecting upon a considerable wall surface containing an ignited patch or particle of carbon, a spray of combustible fluid, say, a volatile hydrocarbon, as alcohol, kerosene, or oil, which at once becomes ignited, and starts combustion of the adjacent unconsumed carbon. The glow and sparks from the ignited carbon, show its location, whether it can be actually seen or not, and enable the operator to bring his oxygen jet into direct contact with the glowing patch or particles of carbon until it is completely consumed. In short, by the additional step of introducing a combustible fluid upon a particle of carbon while it is being consumed by combining with the oxygen of the jet, the combustible fluid ignites and burns sufficiently long to enable the operator to find and burn other ignited but unconsumed particles, and also to ignite more combustible fluid that may be sprayed on another portion of the wall of the cylinder, to detect particles there, if any there be; and so on throughout the combustion chamber. Obviously, during the performance of the process, there is always glowing carbon to combine with the continuous jet of oxygen; there is no relighting of matches or tapers; there is no waste of oxygen; and the operator, knowing he has gone over the

piston head and all of the wall surfaces of the chamber, with no glow or sparks showing, rests assured that there is no unconsumed carbon left.

While the successful operation of my new process is not dependent upon any particular form of apparatus, I make use of a new and useful device which is called a carbon-destroying torch, the inventor of which is Frederick A. McCarthy. This torch greatly facilitates the performance of the process, and is the best structure now known to me for this purpose, and is illustrated in the accompanying drawings, in which,

Figure 1 is an elevation of the torch; Fig. 2 is a longitudinal section of it; while Fig. 3 shows how it may be used in removing carbon from the interior walls of the combustion chamber of a cylinder of an internal combustion engine.

The carbon-destroying torch is of the following construction:—A copper tube 1, Figs. 1 and 2, which has been annealed for the purpose of giving it the desired flexibility, see Fig. 3, is in communication with a supply of oxygen through a channel 2 provided in a brass fitting 3 which has a suitable hose connection 4, connected to a source of oxygen, not shown. Surrounding one end portion of this tube 1, which may be termed the "oxygen tube," is formed a combustible fluid reservoir 5, comprising a cylindrical piece of sheet brass 6 connected with and soldered to said fitting 3, and also similarly connected and soldered to a fitting 7 surrounding the mid-portion of the oxygen tube. In the top portion of the reservoir, is mounted a pump 8, the mouth of which lies within the reservoir 5, and is controlled by a check valve 9 that permits the inflow, but prevents the outflow, of the liquid pumped by means of a piston 10, a piston rod 11 and pump handle 12. Between the piston and the valve, in the side of the pump, is an opening 13 to serve as a communication between the pump and what may be called a "combustible fluid tube" 14, of annealed copper lying in parallelism with the oxygen tube 1, but terminating a short distance from the end thereof; the joints formed between the oxygen tube, the combustible fluid tube, and the end fitting 7 of the reservoir, being closed as by soldering. Access to the reservoir is controlled by means of a threaded plug 15. The outside of this cylindrical reservoir serves as a handle for conveniently holding and operating the torch, as clearly appears in Fig. 2. In the fitting 3, at the inner end of the reservoir, is a valve 16 to control the feed of oxygen. It is operated by a finger lever 17, pivoted to the fitting and extending forwardly in operative parallelism with the reservoir, and connected with the valve stem 18 by a yoke 19 embracing the stem and capable of adjustment by a nut

20 secured to the outer end of the stem, and in engagement with the outside part of the yoke of the valve lever. This valve 16 is mounted in a metallic casing 21 in screw engagement with the fitting 3; the bearings for the valve stem 18 being a threaded ring 22, screwed into the outer end portion of this casing; and an opening in the bottom of the casing, abutting a leather packing 23. The valve is formed of india rubber, and engages a suitable seat 24 formed at the mouth of the channel 2 connected with the source of oxygen supply. In order that the valve may constantly tend to find its seat 24, a coil spring 25 surrounds the valve stem 18 and presses against both the bottom of the valve casing 21, and the threaded bearing ring 22 in the opposite end of the casing.

As appears in Fig. 2, the valve finger lever 17 being parallel with the reservoir handle 6, it is within the grasp of the operator, and may be easily manipulated simply by pressure of the fingers, when desired; while he may from time to time, discharge from the pump 8 small quantities of combustible fluid, by pushing down the handle 12, short spaces, until the charge is exhausted. The pump may be refilled by pulling the handle 12 outward, thereby drawing in a charge of fluid from the reservoir, past the check valve 9, which closes the moment the pump piston ceases its outward movement.

I will now describe how my process is carried out, reference being had again to Fig. 3, showing in section, an internal combustion engine cylinder 26, its spark plug and cap having been removed; and the piston 27 at the upper end of its stroke. The walls of the combustion chamber 28 and the piston head are assumed to be covered with a somewhat evenly distributed mass of carbon moistened with oil of the cylinder. The first and old step consists in a general burning off of the carbon. The torch is introduced into the chamber, through the spark plug opening, the end of the oxygen tube being brought close to some of the carbon, say that visible to the operator. The oxygen control lever 17 of the torch is then slightly pressed toward the handle 6 of the reservoir, thereby permitting a small atmosphere of oxygen to escape from the end of the oxygen tube 1, upon the carbon. A lighted wax taper is then pushed into the atmosphere of oxygen; the carbon at once begins to burn; the oxygen insuring and hastening the ignition. Combustion rapidly spreads over the walls of the combustion chamber and piston head and continues for a few moments. While much of the carbon is thus consumed, unburned patches, and particles, remain. Until now, combustion has been assisted by continuing a small supply of oxygen; but before this preliminary burning off has been completed, a small amount of a combustible

fluid in the reservoir 5, for example, alcohol, is forced from the reservoir by means of the pump, through the combustible fluid tube 14 and out of its nozzle upon a visible glowing particle or patch or carbon. The combustible fluid immediately ignites, and simultaneously starts to burning the adjacent unconsumed particles of carbon that have been moistened by the liquid. The artificial supply of oxygen is now directed upon these ignited particles of carbon and they are wholly consumed one after another; but when the sparks almost cease, indicating to the operator that this patch has almost been removed, a small additional supply of alcohol is sprayed upon the glowing carbon, and adjacent non-ignited carbon; it instantly lights, and, in rapidly burning, starts a new mass of carbon to burning. The jet of oxygen from the torch is then directed toward these glowing particles, and they are consumed in the manner described; the above sequence of operation being repeated until all of the carbon within sight has been done away with, speedily and easily. When, however, the carbon is not visible, greater difficulties are encountered, but easily overcome by means of my process. Continuous glow of particles concealed from view in the combustion chamber, may be brought about by introducing another small charge of alcohol upon some particles which are lighted, let us suppose, at B on a portion of the roof of the combustion chamber. It will be remembered that these oxygen and combustible fluid tubes 1, 14, Figs. 1 and 2, are of copper which has been annealed, consequently, they may be bent into any form adapted to direct the current of oxygen and that of the combustible fluid to that or any other portion of the unseen roof surface; such a bending of the tubes is shown in Fig. 3. Particles of carbon, as B, upon this roof surface being, as already assumed, ignited, a small charge of alcohol or combustible fluid is delivered upon them, but it must not be forgotten, that after each spraying, the liquid extends over a considerable area of unburned carbon, and, consequently starts all of the carbon in that area, aglowing. By a somewhat rapid movement of the oxygen nozzle from place to place, with occasional sprayings of alcohol, a large portion of the remaining carbon may be destroyed. However, in thus going somewhat rapidly over the entire wall surface of the combustion chamber and the piston head, there will be left particles and patches here and there, which must be found and burned. Obviously, these tubes are such that they may be bent and forced into form whereby their nozzles may be brought into close proximity with all of the surfaces making up the combustion chamber; these surfaces themselves aiding in giving to the inwardly pressed

tubes the desired form. After all of these surfaces have been gone over, in this somewhat general way, with the torch, the operator can again apply his torch nozzle to all of these surfaces; and, by a careful and systematic introduction of small charges of the combustible fluid, as often as the glow of the ignited particles seems to diminish, and by a constant supply of oxygen for consuming various particles of unconsumed carbon, he may continue this combustion until all particles or patches of carbon are consumed. In short, there is always some glowing carbon to ignite the new supply of combustible fluid, which, in turn, starts any unconsumed carbon to glowing for the purpose of indicating to the operator the presence and location of carbon to be consumed; and, further, all of the first mentioned benefits flowing from the use of by process, are attained.

In using alcohol or other combustible fluid that vaporizes quickly, to spray unconsumed carbon, care should be taken in not delivering too much of it, for if the supply is large, there is likely to be a violent explosion, not dangerous to the operator, but extremely annoying. This might be well illustrated by assuming the combustion chamber to have been cleared of carbon, when as a fact at the extreme inner side, there happens to be a glowing particle or patch; if the operator, under these conditions, introduces successive small charges, which later become ignited by this particle, the large atmosphere of combustible gas would explode with violence. I have found in using this torch that after a small supply of alcohol has been actually delivered to the ignited carbon, there remains in the tube a sufficient amount to ignite and burn at the end of the combustible fluid tube. While this flame may be made constant, and is not essential to the performance of my process, I do find that it greatly assists not only in preventing the above mentioned collection of combustible fluid, in case there is no ignited carbon at hand, but also in starting the combustion entirely anew in the combustion chamber, as where ignited carbon has ceased burning, but before the process is completed.

Having fully described my process and desiring to protect the same in the broadest manner legally possible, what I claim is:—

1. In the method of removing carbon from the combustion chamber of internal combustion engines; discharging upon ignited carbon and unignited carbon, combustible liquid for the purpose of igniting the liquid and carbon, to show the presence of the latter.

2. The method of removing carbon from the combustion chamber walls of an internal combustion engine, consisting, in ignit-

ing a portion of said carbon; supplying an artificial supply of oxygen to the ignited carbon; and in supplying, during this artificial combustion, a combustible fluid which
5 ignites and in turn ignites adjacent unburnt carbon, if any; said fluid being ignited by the ignited carbon.

3. The method of removing carbon from the combustion chamber of internal combustion engines, consisting, in igniting a
10 portion of said carbon; in directing an artificial supply of oxygen upon said carbon; in discharging upon an area including the ignited carbon, a combustible liquid which
15 at once ignites, and in so doing ignites and discloses other carbon within the area, that

must be supplied with oxygen, and be consumed.

4. In the method of removing carbon from the combustion chamber of internal combustion engines; discharging upon ignited carbon and unignited carbon separated by wall space free from carbon, combustible liquid, for the purpose of igniting the liquid and unignited carbon, to show
20 the presence of the latter.

In testimony whereof I affix my signature in presence of two witnesses.

HARLEY M. ELLER.

Witnesses:

E. F. UNIAC,

F. A. MCCARTHY.