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TESTING OF SPARK PLUGS

The importance of spark plugs is appreciated by every operator of a gasoline engine, whether he happens to be an aviator whose very life depends upon the correct functioning of the ignition system on his engine, the physician who trusts to his automobile to get him in the shortest possible time to the bedside of a sick patient, or the ordinary owner of a "flivver" out for a Sunday's pleasure drive.

The best construction for a spark plug is something about which there is a great deal of argument. No two manufacturers are in agreement on this subject, as is borne out by the great variety of plugs now on the market, each of which seems to meet with a ready sale.

With the idea of testing the relative merits of all the different types, so as to be able to recommend, at least to government purchasers, the kind best adapted to their use, the Bureau of Standards of the Department of Commerce has developed a special series of tests for spark plugs and kindred appliances, such as magnetos and battery ignition systems.

A satisfactory test of an appliance ought to duplicate as closely as possible service conditions, though this end cannot always be attained. Fortunately, in the case of spark plugs, it is possible to test them both in the laboratory and when in service on an engine. Each laboratory test which the Bureau has developed aims to bring out the weakness or strength of a spark plug along some particular line, while the service test on an engine indicates the general efficiency of the device as a whole.

Thus, there is a test to determine the value of the porcelain or mica in the plug as an insulator and its ability to withstand temperature changes, another test determines the amount of gas leakage through the plug, while a third test is used to estimate the resistance of the assembled plug to mechanical shock. Lastly, the actual heat of the spark produced at the electrodes is determined under definite conditions in a special calorimeter. The second test is a particularly important one for the reason that although the loss of power in an engine through gas leakage of the plug is very small, this leakage has a tendency to overheat the plug and hasten its failure.

The apparatus used for this test may be of interest. It consists, first, of a short hexagonal piece of steel bored out to form a tube and tapped at points along two of its sides for the reception of the spark plugs to be tested. One end of this type is closed, while the other is connected by a flexible piece of copper tubing to a compressed air reservoir. This piece

of steel pipe or "bomb" into which the spark plugs are screwed is supported in a horizontal position by a wooden framework and is so arranged that a square metal tank containing oil heated by electricity may be placed so as to completely surround the tube, immersing the spark plugs for their entire length. Air pressure is admitted to the tube and if any leakage occurs at the spark plugs, it will bubble up through the oil. An inverted bell jar, the capacity of which is accurately known, is placed over each plug,and the time necessary to displace the oil in the bell jar with air is noted. The leakage of each plug in a given time under definite conditions of pressure and temperature can, therefore, be easily determined.

In making shock tests of assembled spark plugs, a special machine designed at the Bureau is employed. The plug is screwed into a mechanically-operated hammer which is caused to strike against a piece of steel rail by a cam mounted on a shaft driven through a belt and pulley from a small motor. It has been found through experience that a good plug will withstand a certain number of repetitions of this shock test, while an unsatisfactory plug will fail in a much shorter time.

The engine or service test, which will always be the final test for any type of plug, is carried out on the kind of engine for which the particular spark plug is designed. Thus, one for an aviation engine would be tested in the altitude laboratory under actual conditions met with in flight, while a plug for service on automobiles or trucks would be given a trial run on typical motor car or truck engines.

Not the least interesting sight in the spark plug laboratory is the case in which are arranged for exhibition purposes plugs which have been sent to the Bureau for test. The number runs into hundreds and there appears to be an almost endless variety of designs. Some of the plugs have been cut in two lengthwise, or "cross-sectioned," so as to more clearly indicate their construction and many are "fearfully and wonderfully made." As in every other mechanical device, simplicity and durability are prime requisites in a spark plug.

As a result of its extensive work on gas engine ignition, the Bureau hopes, among other things, to be able to specify those qualities which a spark plug must possess in order to give satisfaction in service.