FARM GAS ENGINE FUEL ECONOMY

WHEN fuel costs are high, it would seem that there would be every inducement on the part of the engine user to see that the engine he is buying should be an economical fuel consumer. If we were to figure out the various items that went into the cost of operating a gasoline engine, such items as gasoline, or kerosene, lubricating oils, batteries, repairs, etc., we would find, of course, that the fuel consumed constituted the largest portion of the operating expense. If we could reduce the fuel cost any considerable percentage, it would result in a larger amount in dollars and cents saved in a year than an equal ratio of reduction in any of the other items of operating cost.

Many of the engine manufacturers and many dealers, however, seem to be of the opinion that the farmer is not interested in the cost of operation, that the initial cost of the engine seems of greater importance to him than what it is going to cost him to keep the engine in operation. If this is true, it must be so very largely because of a failure on the part of selling forces to show what economical fuel consumption in an engine means.

In the first place, it is self evident that any engine which operates with a very low fuel consumption must be a correspondingly highly efficient engine. No matter how good the materials used in its construction, no matter how well they are put together, if a wasteful use of fuel results, that engine is not highly efficient. Efficiency of this sort begins in the designing room, and is the result of great skill on the part of the designer who planned the important details of the engine. Sometimes an engine that is extremely wasteful in fuel may be overhauled and made efficient, or at least less wasteful. It depends upon what is the cause of its inefficiency. But, as a rule, a company that puts out a high fuel-using line of engines never becomes noted for the contrary quality until its line has been much redesigned.

Good fuel economy means considerably more, in other words, than the mere saving of so much money that would otherwise have to be spent for gasoline. There are so many things that can cause increased fuel waste that when a low fuel rate is secured it indicates a very satisfactory condition. Just as it is usual to consider that a house that is cool in summer and warm in winter is probably built in a durable,

Portion of Headland, Brandon Plowing Demonstration just before the Flag dropped

strong and safe way and is likely to be a good investment, so any engine that does its work without needless cost for fuel supply is probably a very good engine.

Take the matter of compression, which is so important in relation to the rate of fuel that will be used. It is generally known that the fuel mixture in any gas engine is compressed so that where it is fired a greater amount of pressure will be secured, meaning more power. In a general way, about four times as great a pressure is the result after the explosion as existed at the time of ignition. One would perhaps wonder then why extremely high compression pressures were not used, and herein lies one of the points for skilful designing engineers to solve at the drawing board, long before the first engine is built. As you compress the fuel mixture the pressure creates a heated condi tion, and this compression may be carried up high enough so that the mixture will fire itself without other ignition help. Certain types of engines utilize this means. In the customary type of farm engine, however, battery or magneto ignition is used, and the charge must not be compressed to a point where self-ignition occurs. Bearing in mind the fact that an engine that has run for some time gets quite warm and that this adds to the easy firing of the warmed mixture coming into the cylinder, the compression must be made so that even on hot days in the harvest fields and under the hottest of suns, pre-ignition will not occur. High compressions with resulting high explosive pressures mean that engines must be made strong to withstand the strains. Not taking into account any other factors, the higher the compression of an engine the greater the explosive pressure, or power from each charge. Such an engine, therefore, will be a low fuel user.

Other factors, however, do have to be taken into account, and too great compression, or the unskilful designing of even moderate compressions, may result in an unsatisfactory engine with breakages, preignition, short life, overheating and a long train of troublesome habits. The truly good design of an engine, then, results in one where the compression has been so handled that an economical fuel rate is secured along with freedom from the troubles incident to too great compression.

Ignition is another important factor in the amount of fuel used. Of course, it goes without saying that whenever a charge of fuel is introduced into the cylinder and is exhausted from the engine without being burned, then there is a fuel waste as well as loss of power. Therefore, an engine, to be known as a fuel economizer, must have a good ignition system that will fire every charge taken into the cylinder. If it misses 5 per cent of the charges, it is certainly wasting 5 per cent of the fuel. As a matter of fact, it will probably waste more, because when one charge is missed there is probability that some of the unburned mixture may help to make the next succeeding charge overrich so that it fails to ignite also. A missing ignition, therefore, may cause quite a considerable waste of fuel and when an engine has been in use for a long time, an engine that at first may have made an excellent fuel record may become quite the reverse.

Of course, an engine that does run without fuel waste probably has a good igniter, but it does not always follow that a good igniter results in low fuel rates. The time when the ignition takes place is a most important factor. We give an engine compression in order that the mixture may be ignited at a high pressure, but if the ignition does not occur until the piston has passed along its outward stroke after reaching the point of highest compression, we are actually firing the charge at a weakened compression pressure. Also, the explosion is occurring during the real power stroke and the piston has a shortened space of time in which to receive the pressure before the exhaust valves open and possibly permit a considerable extra part of the pressure to escape through the exhaust without having done any useful work. On the other hand, if the spark fires the charge before reaching the highest compression point, the pressure is exerted against the motion of the crankshaft and the engine tries to reverse itself, being prevented from doing so by the inertia momentum of the flywheels which carry it along, but with much loss of power. And whenever, for any reason, power is lost, extra fuel is needed to produce the power needed. Not only that, but the early ignition tends to wreck the engine, and in time will certainly do so.

It is pretty safe then, to assume that an engine with a fuel rate that is low is equipped with an igniter that is doing good work every time it is needed and that is properly timed to give the spark correctly.

Needless to say, waste of fuel always accompanies an improper carbureter adjustment or a poor carbureter. In this statement is intended to include all such matters as the design of the fuel and exhaust passages, the design and timing of the inlet and the exhaust valves, etc. In other words, the economical engine must have a correct fuel mixture, which must be properly introduced into the cylinder, fired and exhausted. Anything which impedes the progress of this event tends to make the engine give less power and use more fuel.

Adjustment of the carbureter is, of course a most important factor, assuming that a good make of carbureter is used. The changing quality of the fuels available has provided increased difficulties for the carbureter manufacturers to solve, and a carbureter of 15 years ago would not handle much of the low-grade fuel that is now poured into the supply tanks of farm engines, automobiles, trucks and tractors. Automobile users know by dear experience that changes in the weather often affect the action of the carbureter and the amount of fuel used.

The timing of the valves, their size, lift and the shape of the inlet and exhaust passages are all items which the purchaser of the engine cannot affect. He should understand, however, something of their importance and the fact that inefficient design in any of these points means low efficiency for the engine and trouble for its owner. There have been many instances of engines whose efficient performance was wonderfully augmented by such appar-

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