Course in Gas Engineering

This Course will consist of a series of practical talks on the theory and practice of the gas, gasoline and oil engine. They will be simple, illustrated where necessary, and of such a nature that the gas engine owner may easily adapt them to his daily engine work.

LESSON IV.

Gas Engine Cooling.

IN preceeding lessons considerable space was devoted to the proper mixtures of fuel and air necessary to obtain the best results. In this connection here is an interesting little experiment anyone can try with the ordinary four-stroke cycle engine. Start the engine in the usual way and after it gets running nicely close the fuel valve a little at a time quite slowly until explosions begin to occur in the muffler. Now throttle the air supply by holding a piece of cardboard or a piece of board on the other end of the air pipe, thus reducing the air supply, and note the effect.

The explosions will cease in the muffler and the engine will work nicely because the supply of air has been cut down to make the correct mixture with the fuel admitted. By working carefully the fuel valve and air pipe may both be closed and yet the explosions will occur regularly and be all right but will not have much force because only a small amount of fuel is taken into the cylinder at each charge.

If when the amount of fuel is cut down so low, the air pipe were left with the full opening, the mixture would be so lean that it would not ignite at all and the engine would stop. When an engine runs on a weak or small charge as just explained it will of course not develop much power. This little experiment not only illustrates the effects of fuel and air mixtures, but illustrates also a means for governing a gas engine which is made use of in many engines, as will be more fully explained in a subsequent lesson.

The cylinder of a gas engine is made of a close grained cast iron and when well designed the walls are of practically uniform thickness throughout. This is necessary on account of the intense heat, which would cause unequal expansion and dangerous strains if the metal varied much in thickness. The cylinder is bored as smooth as possible and in the best constructions it is ground to a perfectly smooth finish. Some manufacturers claim that they grind the cylinder slightly tapering, making them two or three thousandths of an inch smaller at the head end than at the crank end. Then when the engine is in operation the greater heat at the head end causes greater expansion and the cylinder sides become exactly parallel. Such refinements in construction are practiced only on the higher priced machines such as automobile engines and the like. Ordinary gasoline engines cylinders are merely bored out as true as possible on a boring machine.

It has been proven by experiments that there should be no pockets or chambers on the side of the combustion chamber in which a part of the charge may accumulate. It appears that where such is the case that the gases so trapped explode a little later than the main charge and are liable to set up waves of pressure in time of synchronism with the waves of the main explosion. These two waves of force occurring at the same time and meeting are apt to have the effect of a blow on the inside of the cylinder, causing an abnormally high pressure for an instant which strains the entire engine without in any way increasing its power.

The truth of this assertion has been proven by taking indicator cards from an engine having no such pockets, then screwing a short piece of pipe capped on the outer end into the combustion chamber, and taking indicator cards again, the extremely high pressure were clearly shown on the cards. This fact would seem to indicate that the inlet and exhaust valves should both open directly into the clearance space of the cylinder, or if they open into a chamber on the side of the clearance space, ignition should take place in the valve chamber.

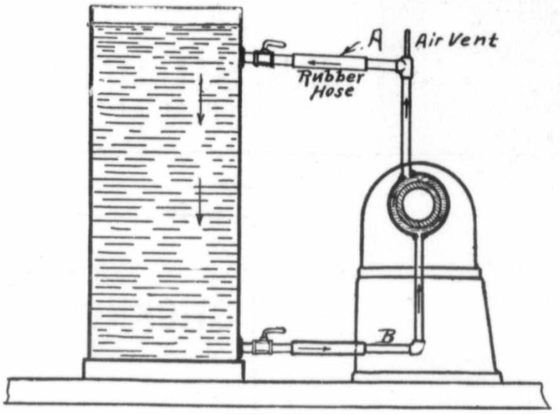

FIGURE I

Surrounding the cylinder and separated from it by short space, the exact amount depending upon the size of the cylinder, there is an outside casing or jacket. This casing is usually made of cast iron, although in some instances it is made of copper. When made of cast iron, it may be entirely separate from the cylinder or it may be cast with the cylinder and attached thereto at intervals in the process of casting. The space between the cylinder and this outer casting contains the cooling liquid, which may be either water or oil. Water being cheap and easy to obtain, is more commonly used than oil.

Since the temperature of combustion in a gas engine cylinder ranges between two thousand and three thousand degrees, and since cast iron melts at a temperature of about two thousand three hundred degrees it is evident that some means must be provided to carry away the excess heat. This is accomplished generally by means of circulating water or oil around the cylinder. Sometimes, however, in small sized engines ribs or spines of metal are cast on the outside of the cylinder, thus providing a large radiating surface which conducts the heat away from the cylinder to the air. Such engines are known as air cooled engines. This method works very satisfactorily with engines up to about 10 horse power, but in sizes above this the heat can not radiate rapidly enough to keep the cylinder cool.

Where either water cooling or oil cooling is resorted to there are two methods of circulating the liquid around the cylinder, either