

The lag and lead of the valves is not the same for all engines. The slower the speed the later the valves may open and the earlier they should close, and vice versa. For mechanical intakes, the valve opens from 7 to 10 degrees after inner dead centre and closes from 10 degrees to 40 degrees after outer dead centre, while for automatic intakes the valve opens about 20 degrees after and closes 10 degrees before the corresponding centres. The exhaust valve opens 25 to 45 degrees before outer dead centre and closes from 3 to 10 degrees after inner dead centre. The diagram in figure 4 should aid in remembering the positions at which the valves should open and close.

The timing of the valves is effected first by putting the gears in mesh at the proper point. If, for example, the particular engine that is being timed should have its intake valves open 10 degrees after inner centre, then the crank shaft is turned 10 degrees past centre and held in that position while the cam shaft with its gear is rotated till the long side of one intake cam is just beginning to bear on the intake push rod of that cylinder, and then the gears are slipped in mesh. Before proceeding further, the timing of this one valve should be checked over to make sure that the gears are meshed exactly right, and not one cog too far either way. When the gears are right for one valve they will be right for all other valves operated from that cam shaft. In the T-head engine there are, of course, two cam shafts, each of which must be timed separately.

After the gears are properly meshed, the push rod must be inspected, and adjusted if necessary. Its length should be such that it begins to push up on the valve stem almost immediately the cam begins to raise the push rod. If the push rod is made too long, it will hold the valve slightly open even when the short side of the cam is in contact, thus causing loss of power. If it is too short a "noisy tappet" will result. To avoid these troubles it is customary in adjusting the push-rod to leave about the thickness of a thin sheet of paper between it and the valve stem when the short side of the cam is in contact. With the gears in proper mesh and the push rods all the right length the timing of the valves will be as intended for that engine.

Need of Ignition Timing.

But the valves are not the only part of the engine that needs timing. The spark timing is equally important. To get best results from the fuel used the expansion of the power stroke must become effective just as the piston passes inner dead centre. If the fuel mixture burned with an instantaneous explosion the spark would need to occur just as the piston reaches the centre—but it does not, indeed it burns rather slowly compared with explosives such as gunpowder, dynamite, etc., consequently the spark must occur before inner center in order to allow time for the fuel to be completely burned just as the piston rounds the centre. The time required for a charge to burn is the same whether the engine be running fast or slow, consequently there must be provision made for changing the timing of the spark with the speed of the engine—the faster it runs the more the spark must be advanced, the slower the more the spark must be retarded. Speaking in a general way the spark must be changed about 5 to 7 degrees for each change of 100 revolutions in the speed of the engine. Figure 4 shows the spark occurring before inner centre. Spark timing will be considered more in detail under Ignition Systems.

NOTE.—This is the second of a series of articles by Prof. W. H. Day, on Gasoline Engines. The first appeared in the issue of June 13 and described internal combustion engines. These articles should prove intensely interesting and beneficial to many of our readers. The use of gas engines in various forms is becoming quite common and these articles should aid the owner of an engine to better understand his machine and thus place him in a position to prevent or to overcome difficulties which occasionally arise with power machines.—EDITOR.

Width and Length of Belting.

EDITOR "THE FARMER'S ADVOCATE":

What width and length of rubber belting will be necessary to use with a six-horse-power kerosene engine to run a 30-inch circular saw? Is a 4-inch, 4-ply belt liable to slip or run off the pulleys? R. P.

Ans.—The correspondent has not given enough data to permit of a definite solution. We should know the diameter of the pulley on the saw. For single belting a common formula for width is:

$$W = \frac{900 \times H}{S}$$

W = width of belt in inches.

H = horse-power to be transmitted.

S = Speed of belt in feet per minute.

Let us apply this formula. A 30-inch saw should run 1,200 r. p. m. Suppose the pulley is 7 inches in diameter, then the speed in feet per minute is:

$$\frac{7 \times 22 \times 1,200}{2} = 2,200$$

For any other size of pulley, calculate the belt speed in a similar way.

And the engine is 6 h.-p.

Therefore width = $\frac{900 \times 6}{2,200} = 2\frac{1}{2}$ inches, nearly, for single belting.

For double belt the formula is:

$$W = \frac{630 \times H}{S}$$

Hence in this case:

$$W = \frac{630 \times 6}{2,200} = 1\frac{3}{4} \text{ inches, nearly, for double belting.}$$

From this the correspondent will thus see that a 4-inch 4-ply belt should be quite ample.

Now as to length, in theory this is immaterial, provided the belt is tightened according to its length, i. e., the shorter the belt the tighter it must be, and vice versa. But in practice it is found that a very short belt puts undue strain on the bearings and shafting, while on the other hand a long belt is liable to be unsteady because of flapping. About 20 to 25 feet between the shafts is good practice.

W. H. D.

Boiling Water.

All motorists, and particularly those who are not thoroughly experienced, become somewhat alarmed when the water in their radiator begins to boil. Sometimes the water over-heats because of a mistake made by the driver. For instance, he might forget to advance the spark. Just as soon as he remedies his error, the water will reach a normal temperature again. Water boiling occasionally does not do any harm. There is an over-flow pipe coming up within a close distance of the radiator cap, and by means of this the expanded water can be drained to the ground, and should steam be developed it also is capable of exhaustion without danger.

If the boiling water continues for sometime, however, the supply of water in the radiator must be replenished. If all the indications point to the boiling mark, you should be careful about removing the radiator cap, because there is real danger from scalding, for the water may burst forth like a young geyser. It is the better plan to stop the motor and allow the water to cool down if you think the over-heating has been excessive and that the water, upon the cap being released, may rush into the air. Should you notice that the over-heating seems to be chronic, it would be well to search out the cause of the trouble. Perhaps in the first instance there may be a lack of water, and if so, such a condition can be easily cared for. It is just possible that the fan belt is damaged or loose or broken, and so does not work effectively. Common sense will tell you how to remedy this difficulty. If the spark lever has been retarded too far and you have run your machine any distance, make it a point in the future before getting well under way to see that the spark is properly advanced. Sometimes the circulation of the water is almost stopped by a collection of foreign matter or sediment. Under such circumstances drain the radiator and wash it out properly until all dirt has been thoroughly removed. You will understand that if the water cannot circulate, then the jackets around the combustion chambers cannot perform their mission by reducing to a minimum the heat caused by the constant explosions.

A lack of lubrication will induce over-heating. If you do not drain the oil from your crank case at regular intervals you will soon subject your power plant to unnecessary friction. The oil in the crank case has a tendency to wear out and, just like any other mineralized substance, loses its life and becomes inactive. You should remove all the old oil periodically. Clean out the crank case with kerosene and put in a complete new supply of oil. Putting in fresh oil with old oil does not maintain a proper standard. You must remove the worn-out lubricant and replace it with fresh stock. New oil keeps the engine from over-heating, because it has sufficient body in it to reduce friction. If the cylinders in your car become heavily carbonized there is going to be a tendency to boil the water. We have mentioned, in a number of previous articles, the system by which this carbon can be removed, either in your own garage by means of tools, or at any public garage with the oxy-acetylene system. It may not be necessary to give as a further cause of boiling water, the use of too rich a mixture. Even novices at the motoring game know that when you are turning out a combination of gasoline and air that is out of proportion, the consumption of the extra gasoline is going to over-heat the motor, and hence the water that flows through the

jackets. It is also a matter of every-day information that dirty spark plugs tend toward rising temperatures. You can easily remove your spark plugs for inspection. If you find they are fouled, gasoline will in most instances take away the foreign matter.

We know of one motorist who was greatly annoyed at the constant over-heating of the water in his radiator. Having had considerable experience with automobiles, his pride was hurt when he realized that he had exhausted all his knowledge in endeavoring to locate the trouble. Upon taking the car to an expert, it was some little time before the latter secured a correct diagnosis. And what do you think he found was the difficulty? Nothing more nor less than that the fan belt blades had in some unaccountable manner become so bent that they were not creating an adequate circulation of air through the radiator. We have not heard of many similar instances. We think that should your power plant develop the habit of over-heating, you will find the cause of the trouble behind some of the usual symptoms that we have outlined. Sometimes, however, peculiar situations will arise. You cannot set down exact rules for the handling of a motor car. This means that each driver should always be on the alert. Keep every moving part of your car under inspection at all times. Should any part become bent, torn or out of alignment, remedy it without delay, or it may eventually cause a considerable amount of trouble.

AUTO.

THE DAIRY.

Butter-fat is 100 per cent. digestible; no wonder it is good for children.

A scrub bull allowed to run in the field with the cows will never do his owner any good.

It has been proven possible to produce clean milk having a low bacterial count without expensive barns or equipment.

Daughters of King Segis Pontiac Count have broken 100 different world's records for various combinations of milk and butter production.

Some move for accredited herds free from tuberculosis is in order in Canada. Dairymen generally must awaken to the peril of this disease.

About 50,000 cattle are tested each year for tuberculosis in New York State. The percentage of reactors has dropped from 22 per cent. a few years ago to 11 per cent.

A dairy council has been organized in Minnesota for purposes of education and publicity. So far, farmers who sell butter-fat have agreed upon an assessment of $\frac{1}{8}$ cent per pound of butter-fat.

Low Banks Queen Pontiac Korndyke, with 535.0 lbs. milk in seven days, ties the American champion for world's championship honors as a junior two-year-old. She freshened under 24 months of age.

A 14-year-old Kansas Holstein has recently completed a 21-lb. record in 7 days, the fat average being 5.92 per cent. Some of her fat reports show percentages of 8.6, 9 and 8.9 per cent.

Milk is important as a food, because it is the most complete and well-balanced of any single food. Moreover, it contains certain principles or substances which make it vitally necessary for babies and children.

Rose De Kol Wayne Butter Boy has recently com-



Shade in the Pasture Means Comfort for the Herd.