

per gallon. On this basis of relative heat values and efficiencies a Diesel-type engine would drive a car 26 miles on a gallon of oil, as compared with 12 miles with gasoline. But 7.66 gallons of oil can be purchased for the price of one gallon of gasoline, so that the distance covered for 23 cents worth of fuel would be 200 miles with oil and 12 miles with gasoline, or 16.6 times.

In a comparison of vertical and horizontal Diesel engines the detail most discussed is the piston. Vertical builders call attention to the weight of the piston, and the side pressure thereby produced on the cylinder bore, in the case of the horizontal engine. The fact that the first Diesel engines were built vertical, and that excessive height was undesirable, probably led to the use of trunk pistons. For the same reason a connecting rod of a length but slightly more than five cranks has been used in vertical engines. An analysis of the forces prevailing throughout the cycle of operations shows that the side pressure on the cylinder walls, due to the angularity of the connecting rod, is far greater than the pressure due to the weight of a piston, even though the piston lies horizontally. Any increase in connecting-rod length means a proportional decrease in the side thrust. Ordinarily an increase in the length of the connecting rod of one crank length decreases the side thrust an amount equal to the weight of a piston and wrist pin, or, in other words, a vertical trunk-piston engine with a connecting rod five cranks long is subjected to about the same side pressure on the cylinder wall as a horizontal trunk-piston engine with a connecting rod six cranks long.

**Type of Diesel Engine and Lubrication.**—The matter of cylinder lubrication is another feature of superiority in horizontal engines. In the vertical type it is absolutely essential, in order to secure a distribution of the lubricant around the cylinder bore, to supply the oil through a number of feeds, as many as four per cylinder on the smallest sizes and more on larger diameters. A horizontal cylinder, on the other hand, even of the largest size that is practicable to build, can be effectively lubricated over its whole surface from a single feed on the upper side. Gravity helps to distribute the oil.

**Success in Diesel-Engine Operation.**—On the showing of economy of the Diesel engine, one might ask why the engines are not in more general use. One answer is that those who are in a position to reap the most benefit are not aware of the possibilities. Perhaps they have heard of an oil-engine installation that has not come up to expectations. Without investigation, they immediately condemn oil engines in general. Or it may be that even when an engine of a suitable type has been installed, satisfactory operation is not obtained on account of the failure of the men in charge to properly care for the engine.

It is evident that in a machine that requires uniformly high pressure to properly ignite the fuel charge, any appreciable leakage of valves or piston rings results in faulty ignition. This applies to the compressor which furnishes the spraying air as well as to the power cylinder. On the other hand, a little intelligent care will prevent trouble of this kind. I know of no case where the proverb, "a stitch in time saves nine," is more applicable.

Another cause of trouble that is avoidable is overloading. A moment's consideration will make plain the ill effects of overloading. In any internal-combustion engine the amount of fuel burned is limited by the oxygen in the charge of air at the end of the compression stroke. In the case of a Diesel-type engine the time available for burning the fuel charge at full load will not exceed 35

deg. of crank travel. In the case of an engine running 200 r.p.m. this is equivalent to  $1/34$  of a second. During this time the oil must enter the cylinder, come in contact with the necessary oxygen, and be consumed. There must of necessity be some excess oxygen in order to effect complete combustion of the fuel. The effect of overloading is to increase the fuel charge so that the amount is greater than can be burned clean with the air that is available. The result is that combustion continues after expansion has begun, and if the overload is great it may even be that the charge will be still burning when the exhaust valve is opened. The temperature of the exhaust gases is then so far above normal that the valve becomes distorted with the heat, causing leaks which still further aggravate the trouble. If an engine be allowed to run with a leaking valve it is only a question of a few hours until both valve and seat will be cut out by hot gases blowing through at high velocities. The secret of success in operating a Diesel engine is in taking care of just such relatively small items. When you find an owner who condemns this type of engine, you will generally find that he is careless, and allows his engine to get out of order in some small particular, and then complains about unreliability, high cost of repairs, etc.

## AMERICAN ROAD BUILDERS' ASSOCIATION.

The fourteenth annual convention of the American Road Builders' Association will be held in Mechanics Building, Boston, Massachusetts, during the week beginning February 5, 1917. The programme, which is in course of preparation, will include papers and discussions on subjects connected with road and bridge building and street paving by the foremost authorities of the United States and Canada.

In connection with the convention, and in the same building, will be held the eighth National Good Roads Show. This exposition will include exhibits by leading manufacturers in the United States of the machinery and materials used in road and paving construction and maintenance.

This exhibition, which has been a feature of the American Road Builders' Association conventions for a number of years, has increased in size and interest year after year. The coming exhibition takes on added importance on account of the enormous sum of money appropriated under the recently enacted Federal Aid Law and the additional large sums to be expended for road building by the various states and smaller units of government.

Mechanics Building, in which the convention and Good Roads Show will be held, is admirably situated and fully equipped for the purpose. It is located on Huntington Avenue, within convenient distance of the leading hotels and business district of Boston. The building is well lighted and heated, and is thoroughly modern in its appointments. It contains ample space for practically any number of exhibits, and is adaptable to exhibits of any size, as the floor plans just published indicate.

The management announces that the services of Mr. H. G. McConnaughy have been secured as director of exhibits. Mr. McConnaughy has had many years' experience in this line of work and is well-known in connection with the management of the exhibitions held under the auspices of the American Electric Railway Manufacturers' Association.