The proportion of cylinder oil to engine oil used in the two-cycle type seems to be greater than in the four-cycle. In the four-cycle, the cylinder and engine oils used are about the same, according to builders' statements, while in the two-cycle, the cylinder oil is approximately twice the engine oil from actual practise during three months.

The four-cycle engine takes a little more room and is heavier than the two-cycle engine of the same power.

Briefly stated, the advantages of the four-cycle engine were: Well-established type with known maintenance and repair costs, smaller fuel consumption, greater simplicity; those of the two-cycle engine were: Less lubricating cost, steadier running, less liability of trouble from sulphur in fuel oil, greater output per cylinder, less cost per horse-power especially at high altitudes.

After due consideration, the company with which the writer was connected decided to try the two-cycle engine in actual practise, and two five-cylinder engines rated at 1,250 b.h.p. at sea level, direct connected to 815-kv.a., 6,600-volt, three-phase, 180-revolution generators, were installed. One of them has been in operation since December, 1914, and the other since March, 1915. The load at present is so small that only one engine is operated at less than 25 per cent. capacity, and it is too early to give any results of operation; however, from the numerous tests which we have made, parallel operation is quite easy.

The exciters are direct connected to engines and run in parallel on the regulator.

Before paralleling the generators, the exciters were run in parallel for half an hour, one engine having a slightly variable load of 90 kw. and the other no load. The variation of load on the two exciters did not exceed 10 amperes from the average of 90 amperes.

The two generators were then paralleled on a total load of 90 kw. and the variation of load between engines could hardly be seen on indicating wattmeters. After a sufficient length of time to satisfy ourselves that there was no difficulty in parallel running, we cut off the fuel supply on one cylinder of one engine, then on two cylinders. With one engine running on three cylinders and the other on five cylinders the load varied approximately 30 kw. between the two engines, after the governor had been adjusted to divide the load about equally. This test was then repeated after increasing the total load to 200 kw., with the same results. Later on, the two engines were connected in parallel, then the fuel supply was cut off altogether on one engine, running its generator as a motor; the fuel supply was then put on again, but we have been unable to make the generators fall out of step and they behave much better than any compound steam engines with which the writer has had experience. The current readings were too small to get reliable data on interchange of current between generators.

The engines use California crude oil of about 16 deg. B. gravity, heated to 120 deg. F. by means of the circulating water of the engines, except at start and finish of a run, when a lighter oil is used so that it will flow when cold.

Regarding cost of installation as compared to a steam plant, this has to be figured for each particular case. The character of the load has an important bearing on the total capacity of generating machinery to be installed.

With a steady load the total capacity of units is practically the same, as both have the maximum efficiency at rated load.

With a variable load, subject to high peaks, the Diesel engine plant would require a greater capacity than the steam plant, as, like all internal combustion engines, the Diesel engine has little overload capacity.

With conditions prevailing generally, on rated capacity of plant installed for total power between 1,000 and 2,500 kw., the cost of a Diesel engine plant compares favorably with a high-grade steam plant using condensing Corliss engines, superheater and economizer in boiler plant.

In designing a Diesel engine plant it is well to remember that the fuel consumption per effective b.h.p. is practically independent of the size unit used, that an engine can be started and put under full load in a very short time so that a greater number of units can be used if it suits the load conditions better.

DURABILITY OF CEMENT DRAIN TILE IN ALKALI SOILS.

THE disintegration of concrete when exposed to strongly alkaline soils and waters has been a subject of discussion by engineers and users of cement for the past 10 or 15 years. There are many concrete structures in certain districts which do not appear to be affected by the salts, but there are some which were apparently made of good materials and were well fabricated which show indications of being attacked.

Many engineers believe that well-fabricated concrete will not disintegrate when exposed to these alkali salts and that many cases of failure which have been reported have not been caused primarily by the alkali but resulted from the use of poor aggregate, improper methods of fabrication, or other causes which resulted in a poor quality of concrete.

A laboratory investigation was started in 1908 by the technologic branch of the United States Geological Survey to determine the effect of alkali waters on cements and concretes. In 1910 this work was transferred, with all structural materials investigations, to the Bureau of Standards. The investigations were continued and the results were published in 1912. Briefly, these investigations showed that practically all cements are attacked by alkali waters upon exposure in the laboratory, and complete disintegration can be obtained under certain conditions.

Following up the line of study, the Bureau of Standards began an investigation to determine the effects of these alkali soils on drain tile of various cement mixtures. The results of the first year's observations form the subject of a recent report prepared by Messrs. R. J. Wig and G. M. Williams.

The report points out that disintegration in the laboratory can apparently be obtained in two ways. If the cement specimen is somewhat porous and it is constantly supplied with a salt solution which is permitted to crystallize in the pores, disintegration may result from the mechanical force exerted. If hydrated cement is brought into intimate contact with certain sulphate or chloride solutions, the uncarbonated lime of the cement is subject to comparatively rapid solution, with a resulting decomposition of the cement. Laboratory tests, however, must always be interpreted with caution, as conditions often differ somewhat from service, and it is on this account that a field investigation was undertaken in which cement mortar and concrete mixtures of various qualities could be brought into intimate contact with alkali salts under natural conditions.