DISCUSSION ON "WORKING RESULTS FROM GAS-ELECTRIC POWER PLANT. REPORT OF 30-DAY TEST ON SERVICE PLANT, RICHMOND WORKS, AMERICAN LOCOMOTIVE COMPANY." ATLANTIC CITY, N. J., JULY 1, 1908

J. P. Jackson: I have found, as I presume all who have dealt with gas power-plants have found, that the first question to be determined is that of reliability. Is it possible to have a plant that will operate continuously with good service under all conditions, a plant that will not shut down on account of trouble of one kind or another, as gas plants have a habit of doing?

The first cost of gas plants has been referred to, and it is admittedly high. A steam plant can usually carry a heavy overload but it is difficult to equal such service with a gas plant unless the gas is exceedingly rich. If the gas is poor even less than rated load is sometimes obtained.

Flexibility and reliability of the auxiliaries are essential. Can a spark system be made reliable: a system that can be fixed, in case it gets out of order, without shutting down the whole unit? Probably, with proper duplication, that can be done. Compressed air is usually used to start gas engines. I think many gas plants have had trouble because the compressed air apparatus has not been independent, so that in case the air is lost in the tanks, they can be pumped full in a few minutes. Circulating pumps and coolers are needed, unless water is inexpensive. Such water is for cooling the engines and for use in the scrubbers and vaporizers. If a suction producer plant is under consideration, a blower is necessary to start the fire and also suitable arrangements must be made for cleaning fires, if it is desired to run twenty-four hours a day.

So far as I am able to observe, if a small gas plant is in good running order the labor is less expensive than in the case of steam plants, though in most cases, such plants being still in the experimental stage, there is apt to be extra expense which materially raises the labor account. I believe, however, that when we get the gas engine to the same point of perfection, the labor will probably be a less expensive item than in the case of the steam plant. In a plant with a large load-factor the fuel cost will be less than that in a steam plant of small unit or size. The saving in coal has to be offset against other items, however. The cost of water is important, inasmuch as a water cooler and condenser must be used.

Deterioration and repairs have been enormous items of expense, which can be eliminated to a large extent. There is no reason why a well-designed gas engine cannot maintain its brasses, instead of having them eaten out by sulphuric acid; why it cannot continue to run with about the same stability as a steam engine.

So far as making the gas goes, producers for gas purposes are undoubtedly less expensive to keep up, and they need less

attention than steam boilers. They cost less originally. In gas plants there are needed gas testers that continuously record the character of the gas; these are as necessary as gauges in a steam plant to record the steam pressure. Suction gauges are scarcely sufficient.

I have spoken of troubles, because they have come forcibly to my notice. But I believe that so far as reliability of service goes, it should be possible to build a producer plant which will give just as reliable service as a steam plant, especially for small units in locations where the price of fuel is high. The annual cost, including depreciation on the higher first cost, labor, and fuel, and every other item of expense, should be in many cases less for the gas plant than for the steam plant.

J. R. Bibbins: The ability of a gas-power plant to carry overload is entirely a question for the designing engineer to decide. The maximum capacity of a gas engine is reached when the cylinder is full of mixture of maximum density; this is analogous to a steam engine taking full-stroke steam. At the present time engines of good construction are rated with a continuous overload capacity of from 10 to 15 per cent. In the plant at Richmond the engine has sustained a one-hour overload of over 30 per cent, or a three-hour overload of 19 per cent. These results were obtained with good gas, but conditions are not always so favorable, and conservative builders lower their ratings in order to cover contingencies entirely beyond their control. In fact, this particular engine has about 20 per cent excess capacity. A knowledge of future operating conditions would undoubtedly have enabled the designer of this plant to take advantage of this in electrical ratings.

The steam turbine, as built to-day in America, is exerting an embarrassing influence on the question of gas-power ratings, as American practice is extremely conservative. Compared with German practice, for example, it will be found that foreigners are much less conservative in overload ratings, as determined by temperature guarantees. If the same basis of rating existed for domestic machinery as for foreign generating machinery, even turbines, American practice in gas-engine ratings would not be so generally criticized, and the prime mover would not be called upon to compensate for deficiencies in plant equipment or operation. Standardization of gas-power practice is now being considered by the American Society of Mechanical Engineers. A committee was appointed last December, and within the next year it is probable that American practice will be well defined and placed upon a more logical basis than at present exists, where nearly every manufacturer has his own standards.

The principal object of the paper is to present some definite data on the operation of the modern plant, properly equipped and operated, data which clearly refutes the general charge of unreliability and costliness so often encountered. Such charges are usually based upon individual experience or general mis-

information. There is nothing unusual about the Richmond installation—a standard type of gas engine—a simple form of bituminous producer with independent auxiliaries for tar removal. The plant is capable of continuous operation through the use of water-seals at the producers; the lubrication and cooling of the engine are automatic; the ignition system is in duplicate; and the governing fully as sensitive as in standard steam practice—2 to 2.5 per cent variation of mean speed. Although a direct-current installation in this instance, the regulation obtained from this type of engine is sufficient to permit alternating current parallel operation without the use of spring couplings.