

water outlet is around this tube, thus raising the temperature of the incoming water.

The engine just described has been in successful operation for about two years, and from the beginning of its operation the exhaust gases, instead of being wasted during the winter season, were utilized to heat water for the heating system of the immense plant. The idea of utilizing exhaust gases for this purpose is, perhaps, not a new one, but it gave rise here to an entirely original idea. When the unprecedented increase in Mr. Ford's business demanded more power he analyzed the economy question from all angles, finally deciding, if possible, to adhere to the internal combustion prime mover. From an efficiency standpoint he reasoned that he could not use nearly all the heat energy from the exhaust gases, as his system would not increase in the same ratio as the necessary power; therefore, if gas engines were to be installed, much waste heat would be the result. His final decision was for an increased installation, comprising steam and gas units, and it is without doubt one of the most daring engineering undertakings in the engine line thus far presented.

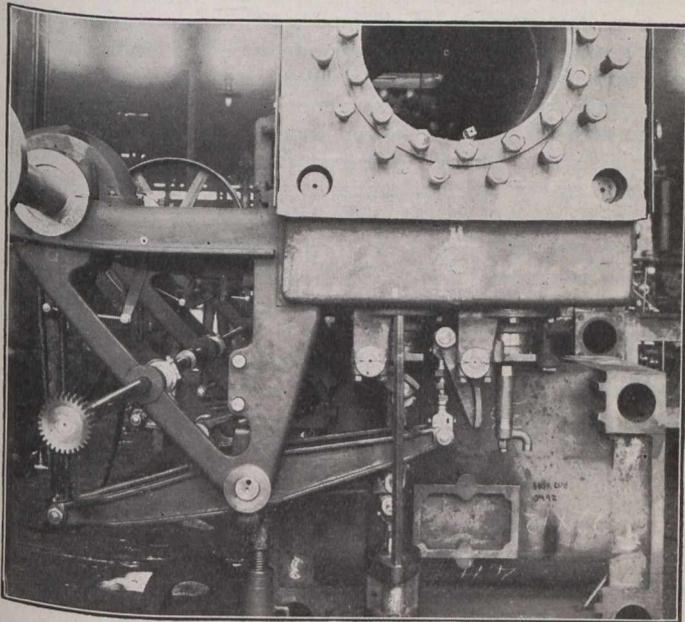


Fig. 4.—Valve Gear, with Exhaust Valve Cam in "Pause" Position.

During the past year he has placed orders for four 6,000 h.p. units, each direct-connected to a 2,250-k.w. d.c. Crocker-Wheeler generator. Each unit consists of a pair of 42 in. by 72 in. (stroke) gas cylinders, placed in tandem on one side, together with a 36-in. high-pressure and a 68-in. low-pressure by 72-in (stroke) tandem compound, condensing steam cylinder on the other side, the gas and steam engines driving a common crank shaft. The cooling water from the gas cylinders and pistons, which has its temperature raised usually to approximately 192° F., is to be used as feed water for the boilers, in which the steam will be raised to 150 lbs. pressure, and, by means of a superheater employing exhaust gases, the steam will be superheated to a stage insuring its dryness. By using the available heat units thus, and operating the steam engines as condensing units, it is aimed to obtain the most economic, practical prime mover so far attempted. The intention is to use one condensing apparatus of sufficient capacity to accommodate the combined steam units, the piping and valves being arranged so as to cut one or more units in or out of commission as occasion demands.

The completion and actual operation of this new installation is awaited with keen interest by the engineering profession, because as a venture of such magnitude it possesses many intensely interesting and novel features hitherto undeveloped.

From a thermodynamic standpoint expert opinion differs, some admitting that it will be an economical success, while others argue that if the units were entirely of the internal combustion type, the total efficiency would be higher, on the supposition that the cost of coal necessary for the steam boilers, added to the initial cost of boilers, condenser, settings and auxiliaries will amount to much more than the expenditure necessary for producing gas.

Another feature causing much discussion is the question of regulation. While it is true that each new wheel will weigh 100 tons as against 80 tons in the case of the former wheel on the all-gas unit, it is also true that the impulses in the steam unit will not harmonize, so to speak, with those of the gas unit, and, therefore, the question of regulation arises, even with individual or combined governing mechanism.

The general design of the new units is similar to the former gas engine where conditions permit. The frames and all gas engine parts are duplicates of the gas engine heretofore described. The steam valve gear mechanism will be operated by lay shafts, and poppet valves are used where necessary in order to have the design of steam cylinders harmonize as nearly as possible with the gas engine cylinders. If perchance it is desired in the future to convert the units into all-gas units very little alteration will be necessary except exchanging the steam cylinders and their valve gear and piping.

UNITED STATES WATER-POWER BILL.

The water-power bill, relating to the construction of dams across navigable streams, and known as the Adamson bill, was passed by the House of Representatives of the United States on August 4. In accordance with its requirements, plans and specifications for such dams must be approved by the Secretary of War and the Chief of Engineers before work of construction is commenced. Approval may include the condition that water-power to operate locks, etc., be supplied without cost, or a reasonable annual charge may be made for the benefits that accrue to the grantee by the authority given under the act. The dam shall be located so as to be best adapted to a comprehensive plan for the improvement of the waterway for the use of navigation and for the full development of the water-power. The rights granted under the act extend over a period of 50 years beginning on the date of the original approval. Upon two years' notice prior to the expiration of the grant, the United States has the right to take over the property of the grantee necessary and useful for the generation, transmission and distribution of energy, the payment therefor being based on the actual cost of the lands purchased and used by the grantee and the fair value of the other properties taken over. Allowance will be made for deterioration but not for goodwill or profit in pending contracts. The Secretary of War is empowered to prescribe reasonable rates of charges for energy transmitted in "interstate or foreign commerce." When the energy is used within a state having adequate regulation for rates and service to the consumer the Secretary of War will not interfere with the established rules for rates and service.

The semi-annual report of the operation of towns and cities, included in the hydro-electric system, for the first six months of 1914 shows surpluses in every case. A number of reductions will result. The city of Galt, with an average monthly surplus of over \$1,000, gets a 16 per cent. reduction which brings the domestic rate to about 2½ cents. Other towns are eager for reductions and it is expected a number will be granted. Toronto's rates have not yet been finally determined.