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CHRYSLER A-664 FUEL INJECTION SYSTEM

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ABSTRACT
The Chrysler low pressure continuous flow, speed-density fuel injection system was conceived as a low cost unit adaptable to high performance engines. The system was developed initially for individual intake port throttling and atmospheric port injection ahead the throttles. Because of high cost, this "upstream delivery" system was dropped in favor of a throttled manifold plenum system with nozzles delivering to each port at manifold vacuum. Response problems were encountered that were related to the "downstream delivery" system. These problems were not satisfactorily resolved during the development program.

CONCLUSIONS AND RECOMMENDATIONS

INTRODUCTION AND CHRONOLOGY

Early in 1956 a program was initiated to adapt the Chrysler Research-developed A-632 low pressure, continuous flow speed-density fuel injection system to the 392 cu. in. C-300 type engine scheduled for use in the "K" Series C-77 car being developed under the A-613 program. The Fuel Systems Laboratory undertook the task of providing a coordinating function between the various groups involved--Automotive Research Engine Design, Cold Test Laboratory, and Vehicle Test. A production version of the Research-developed fuel metering and induction systems was designed while Research parts were used for performance, endurance, metering unit calibration, and component development of the system. During this phase of the program Research continued to carry the major portion of the experimental development load.

As the production design was finalized and cost estimates became available, it was realized that cost reductions would have to be made in order to make the injection system commercially feasible. Cancellation of the C-77 car program, and with it the necessity for a fuel-injected engine in 1957, also occurred at this time (June, 1956).

The most promising area for cost reduction lay in elimination of the system of individual throttles at each intake port, required by the metering system in order to permit atmospheric pressure nozzle discharge locations. A metering system development (addition of a "metered fuel valve") gave promise of being able to tolerate below atmospheric (manifold vacuum) nozzle discharge, so a new program was initiated to pursue this possibility. Both Research and the Fuel Systems Laboratory facilities were utilized, with Engine Design providing design support.

In this new program (A-662) it was also an objective to make use of a number of new design concepts that had been developed to cope with deficiencies of the A-632 design. Of major importance was proper vapor handling to allow prolonged hot idle and improve hot starting.

The Fuel Systems Laboratory concentrated during the latter half of 1956 on determining the required design features of a fuel metering unit that would have the desired vapor handling characteristics. The Engine Design Department incorporated the principals developed into a new design, and limited procurement within the Engineering Division was started. Completion of this phase was interrupted, however, by the decision to release the Bendix Electrojector fuel injection system for "L"

INTRODUCTION AND CHRONOLOGY (Cont'd)

Series. Further Fuel Systems Laboratory development of the Chrysler system was deferred until completion of the major portion of the Electrojector program was completed, though Research continued the work first with a revised Research design metering unit, then with still another (and final) unit designed by Engine Design. This unit incorporated all of the most desirable features developed to date and was designed for volume production.

Limitations of the Bendix Electrojector fuel injection system in "L" Series production indicated the desirability of renewing emphasis on the Chrysler system. A program (A-664) was begun to complete development for "P" Series release, utilizing a high performance ram manifold "B" engine. This was shortly (January 1958) reduced in scope to a general development program, under which the ram manifold work was completed and the production-design control unit, utilizing sub-atmospheric delivery nozzles, was made operational on a car. However, many problems continued to exist, the major one being transient response. Concurrently, carbureted ram manifolds were developed that demonstrated equal performance capabilities. In view of this, and the apparent weak consumer market for fuel injection, the Chrysler program entered a final phase to determine if the transient response problems could be overcome. By mid-1959 it was concluded that, within the scope of the program, this was not possible.

CONCLUSIONS AND RESULTS

1. The A-632 low pressure, continuous flow, speed-density fuel injection system was developed to a point that permitted good operation over a moderate range of ambient temperature and pressure. Because of the cost and complication resulting from use of intake port throttles (eight throttles in parallel), this system was judged to be impractical for production. However, the injection control system was thought to be basically workable, meriting further development.

2. The A-664 adaptation of the A-632 fuel injection control to allow nozzle delivery to the ports downstream of a manifold throttle was shown to be adaptable to a ram-type manifold, permitting full realization of the output potential of the manifold-engine combination.

3. The major problem with the A-664 "downstream nozzle" system was transient acceleration response. This problem was associated with the lag in fuel delivery after sudden reduction in manifold vacuum. The fuel lag appeared to be partly a result of inadequate transient response of the control and partly because of the time required to re-establish flow equilibrium in the fuel nozzle delivery system.

4. Problems that were not completely solved, but appeared to be capable of solution were (a) cold start and warm-up mixture control and (b) altitude and temperature control.