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I. E. WEBBER
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PRODUCT PLANNING & DEVELOPMENT STAFF

CHRYSLER CORPORATION

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Director-Product Development
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G. P. O. Box 1320F
Adelaide, South Australia

Dear Walt:

Reference: Letter dated 11th May from D. C. Carter to I. S. Hall on hydraulic clutch actuator

Late in April of this year, I wrote to Don Carter requesting drawings on the above mentioned hydraulic actuator. I requested these drawings for the people in Special Vehicle Development who expressed interest in this device after hearing my verbal description. These drawings have been received and are now in the hands of Special Vehicle Development personnel. In his covering letter, mentioned above, Don requested one or two pieces of information from me, which I think I can probably supply. I am replying via you so as not to foul the system both here and in Adelaide. Anyway, here goes.

In answer to question one, I can only say that it depends on what sort of competition. For example, there are three basic forms of competition here. These are drag racing, stock car racing or Grand National events which are run mainly on banked tracks, and Trans Am type racing (circuit or road type of events for Mustang, Camaro, Challenger type cars with engines to 305 cubic inches.) The two most popular, and indeed best suited, engines for competition are the 426 hemi and the 340.

As far as drag racing is concerned, there are all manner of classes for just about any sort of vehicle from showroom floor condition to out-and-out dragsters or 'rails.' Both

manual and automatic transmissions are used. The faster modified vehicles use all sorts of special transmissions, rear axles and of course engines. Most significant transmission modifications are as follows. Manual transmissions have the blocker rings removed on all gears and rely on dog clutch engagement for gear selection. This is used only on transmissions for drag racing and the idea is to lessen the likelihood of missed shifts due to blockout. Otherwise the transmission is basically A833. Automatic transmissions come in for rather extensive modification aimed at increased durability and quicker shifts. The valve body is reworked to bring the rear band on whenever low gear is engaged, as the 1st gear over running clutch is rather prone to disintegrate when it is asked to suddenly take all the 1st gear torque by itself. Servo and clutch return springs are reduced in capacity to help provide harder, faster shifts and naturally lining material is improved for durability. Very high stall speed torque convertors are used and it is not uncommon to find the little Borg-Warner convertor from Ford Cortina or Hillman Hunter used behind the hemi engine in an attempt to get better low end acceleration. Another fairly new innovation which seems to be catching on for the lighter more accelerative cars is the "Clutchflite" transmission. This is basically a Torqueflite transmission which has the torque convertor removed and replaced with a conventional clutch. The idea of this is to try and improve top end acceleration (at the expense of bottom end). I cannot personally see too much to be gained from this, as one simply ends up with a three-speed gearbox. A conventional four-speed must be better even though it requires considerably more driver skill. Wherever possible a Dana 9-3/4" axle is used. This is a light truck axle which is good and strong. A "Detroit Locker" ratcheting type of differential is used. I will mention this diff. in detail in a moment. The preferred propshaft for all types of competition is the old ball and trunnion type shaft with of course a 7290 rear joint. It appears that this set up is stronger than the slip joint shaft.

Chrysler Trans Am cars (Barracuda and Challenger) are fairly new and the regulations do permit many major modifications but this type of racing is most like circuit racing in Australia in which the Pacer could and no doubt will find itself. The transmission used is a lightweight aluminium

A-833 which is selectively built up, with very few real modifications. There are four different sets of gear ratios available. Clutches are interesting. The clutch currently in use is a 10-1/2 inch single plate diaphragm made by Schieffer who specialize in racing equipment. It is basically a Borg & Beck U.K. design with six bolt attachment and stronger cover. This clutch is used to 8000 r.p.m. consistently with no trouble and does not have the bent diaphragm fingers. Currently under development is a four plate 7-1/2 inch diameter clutch for these cars. A pot type joint propshaft is used on these cars, driving an 8-3/4 axle fitted with a Detroit Locker differential unit. The 8-3/4 axle is preferred for this application as it is plenty strong enough and has the advantage of allowing very rapid ratio changes which is not possible with the Dana 9-3/4 or the Borg-Warner Ratios available are from 2.76 up to 5.66 with common usage being 4.10, 4.5, 4.8 ratios, I am enclosing a brief article on the Detroit Locker differential unit which is definitely the preferred design for competition usage as it does not rely on friction elements for its operation. This unit is readily available in Australia and is sold under the name "No-Spin" by Sid Osborne Industries in Adelaide. I will be very surprised if they do not have one readily available which will bolt into the Borg-Warner Australia axle, as they do make units to fit everything from Volkwagens to Caterpillar bulldozers.

Stock car racing (Dodge Daytona and Plymouth Super Bird) use the same basic drive train as described for Trans Am cars. Both use a fully-floating rear axle as a safety precaution. Also under development for both applications is a modified automatic transmission which looks very promising for use on the tighter, twistier circuits.

Now for question number 2 regarding propshaft, wheelbase and speed combinations. There are two basic bogeys that are aimed for. The Sound and Vibration people try and insist that vehicle critical speed lies above 100 m.p.h. This is not always achieved, particularly with 3.9 and 4.10 axles which are very popular options on performance cars. At the same time the Stress Lab insists that during critical speed operation,

the stress level in the aluminium gearbox case and extension housing must not exceed 12000 psi while propshaft stress must not exceed 18000 psi. Both these figures correspond to the endurance limit for the respective materials. Apparently, the weakest location is around the speedometer take-off hole in the extension housing. The above philosophy can best be summarized by saying that it is not considered imperative that the critical speed be outside the vehicle's performance potential, although this is of course highly desirable, as long as the stress so induced in any part does not exceed the material endurance limit. Actual critical speed in the car should not be too hard to determine although as pointed out above, by itself it does not mean much. A pickup placed on the rear of the transmission extension housing should be sufficient to indicate drive line resonance. Usually, this can be felt by placing a hand on the car as it is speeded up with the rear axle raised and the wheels removed. The most difficult aspect of strain gauging the transmission and extension housing is to first determine the location of points of maximum strain. This is usually done in the laboratory using a brittle coating technique.

Enclosed is a chart showing "F" Series propeller shaft usage on Chrysler Corporation cars. This might help serve as a guideline.

Walt, I hope the above rambling is of some assistance. Would you please forward to Don Carter. Thank you.

Sincerely,

Ian S. Hall

I. S. HALL

Enc.

cc: D. G. Ehr