two timer

A SWITCH-PITCH TORQUE CONVERTER FOR 6-SPEED AUTOMATICS

By Steven M. Green

Torque converter design has always been a compromise between stall speed and efficiency. High stall speed converters are necessary with modified engines to launch the car properly, but anything over a 2500 rpm stall speed is too "loose" for street use. Excessive slippage and heat build-up are unsatisfactory on the boulevards.

An ideal torque converter would have a high stall speed in first gear to multiply engine torque, and then a low stall speed once the car is moving for economical operation. One possibility, which was discussed in the March '77 issue of CAR CRAFT, is a lock-up converter. Chrysler has adopted a similar design in its '78 cars. Another possibility is the old GM two-speed converter device originally installed on the mammoth GM models in 1964. (Remember "Switch the Pitch"?)

Kenne-Bell Performance Products of Pomona, California, has unearthed a supply of new parts necessary to convert a Turbo 400 transmission to a two-speed torque converter package. Essentially, the parts consist of a different pump assembly, input shaft, torque converter and solenoid.

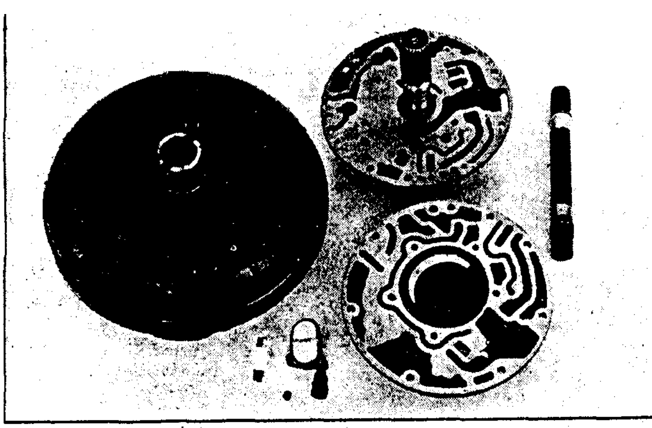
The heart of the system is the stator, which is the middle element in the torque converter. In the standard position, the converter will produce a 2000 rpm stall speed; in the high position, a 3000 rpm stall speed results.

The system is controlled by an electric solenoid which routes the pressurized flow of transmission oil to a piston in the center of the stator. In turn, the pressure forces the piston to move, which changes the angle or pitch of the stator blades. The flatter the pitch, the higher the stall speed and torque multiplication will be. Since the converter is electrically activated, the driver can switch it manually for each gear-in essence, creating a six-speed automatic transmission. The stator change can also be signalled automatically with a full-throttle kickdown switch.

The K-B setup performs as well on the street as on the strip. During normal driving there is minimal slippage and fuss. Reliability is no problem, since the parts have endured GM's testing and development. All components are stock, except for some machining on the stator piston.

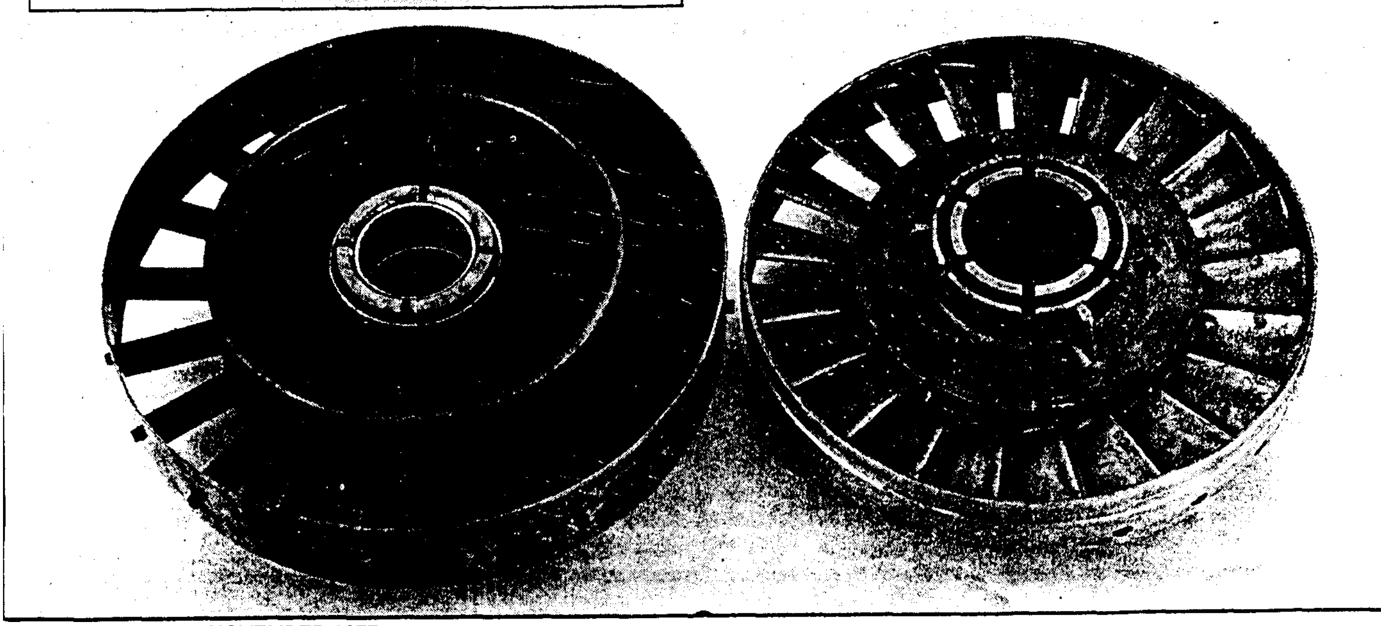
Sometimes the best new idea is an adaptation of an old idea. What was once designed for a Buick Roadmaster might well make you the local master of the road.

An inexpensive adapter is available to mate a Chevy small-block to a complete Buick switch pitch Turbo 400 transmisson.

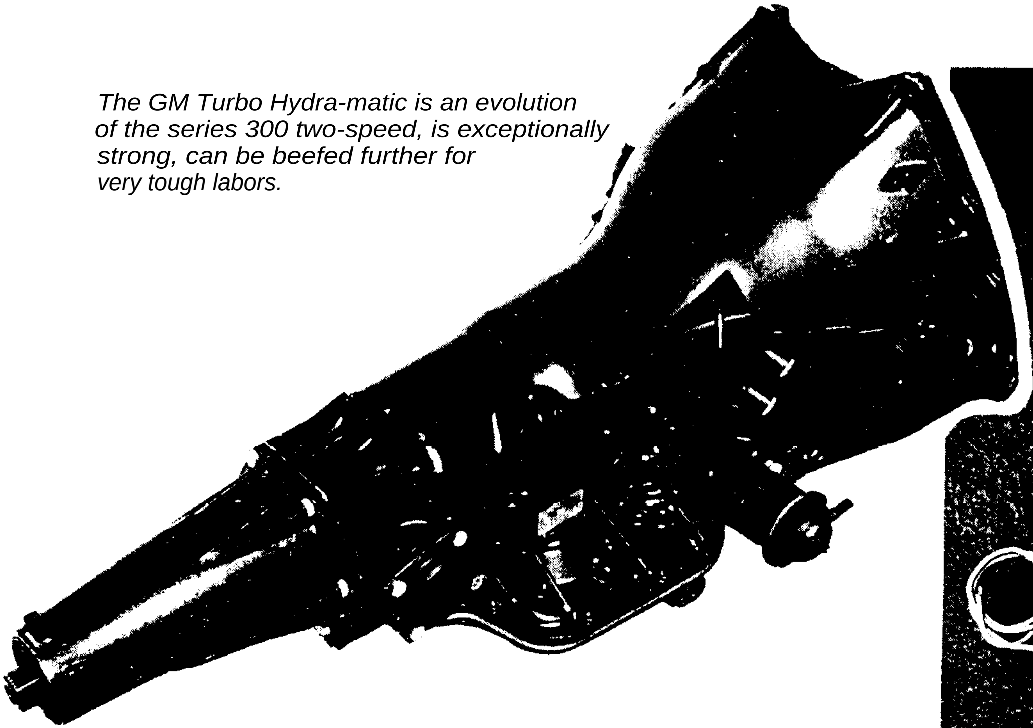


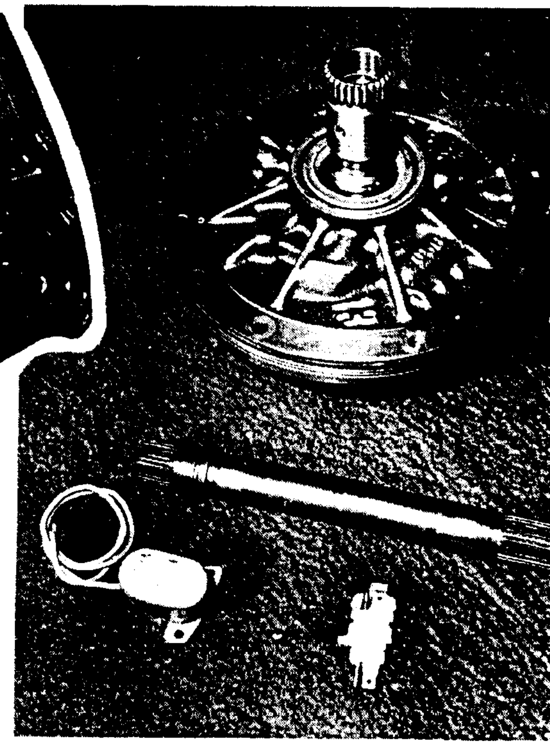
The complete conversion kit (left) from Kenne-Bell includes the torque converter, pump, input shaft and solenoid.

*Heart of the system (below) **is the variable pitch stator (on left), compared with a fixed pitch stator (on** right). These components are welded inside the torque converter.'*

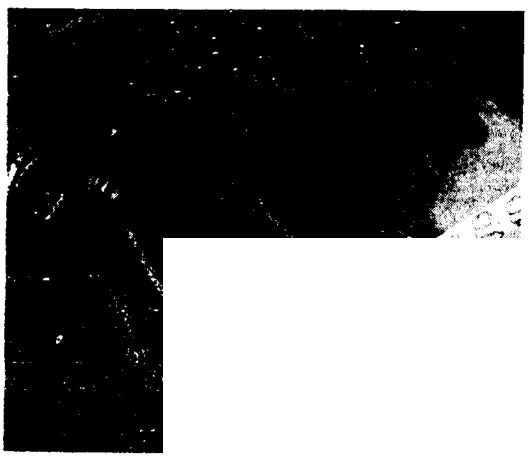


The GM Turbo Hydra-matic is an evolution of the series 300 two-speed, is exceptionally strong, can be beefed further for very tough labors.



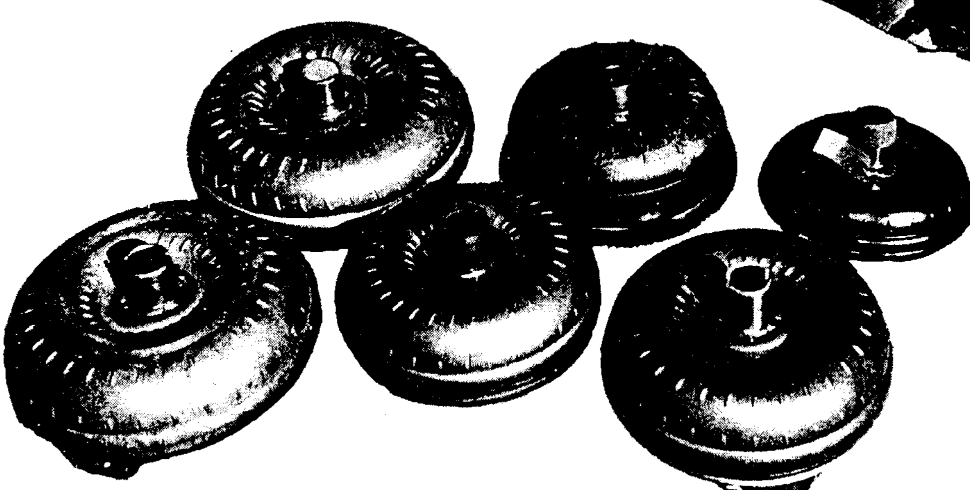


If the Turbo has a fixed pitch stator, part of the conversion required is pump assembly and switch units, available through K-B. Pump assembly has drilled turbine shaft.



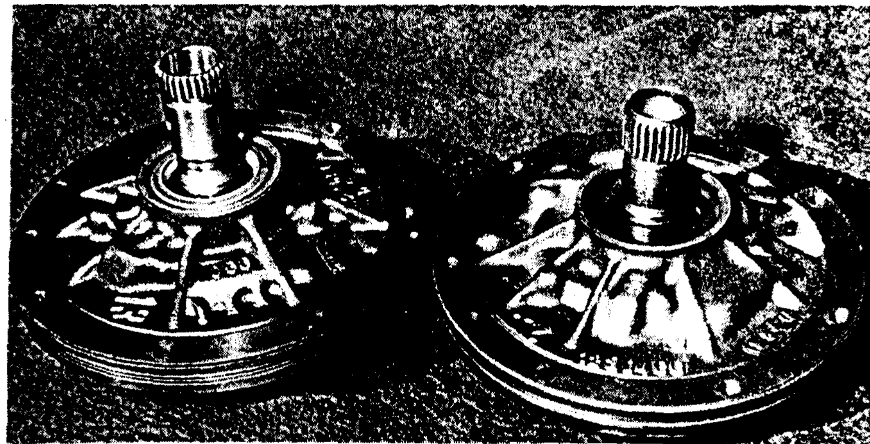
SIX

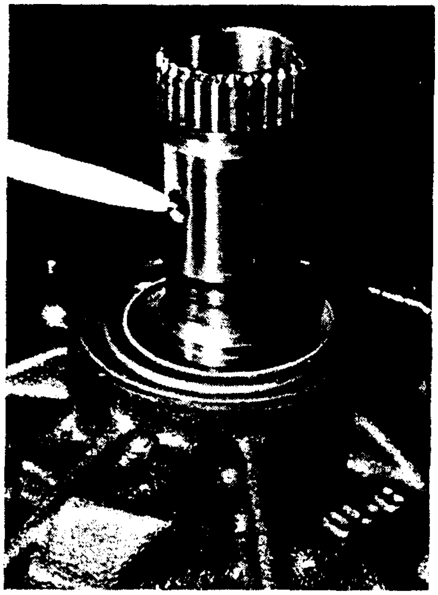
Key to identification of variable pitch stator-equipped Turbos is small electrical connection at left rear of housing. VP units were made from 1964-'67, used in heavier cars.



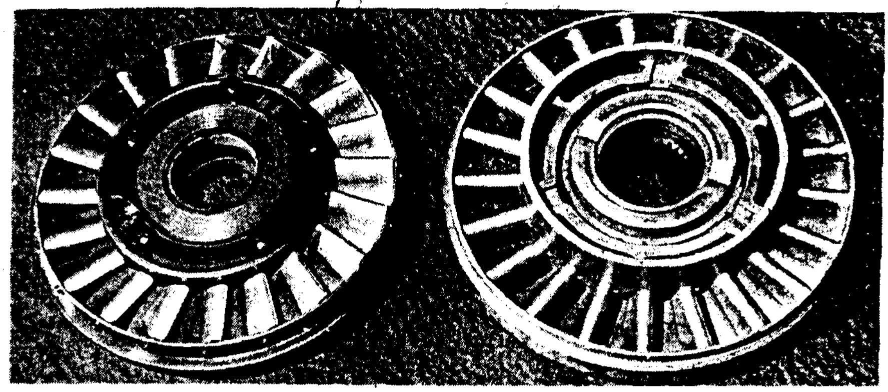
Jim Bell, part of the Kennedy-Bell Buick combine, displays one of the special K-B variable pitch converters used to get cars off the line quicker, keep Turbo Hydra-matics more efficient. Shown are a few of the converters tested during development of "switch-pi tch " six-speed.

Pump for variable pitch stator is at left, unit for fixed stator is at right. Note apparent difference in shafts.





Pump shaft is also drilled to pass oil along to operate stator blades All these parts must be'in excellent condition.



Difference in stators is readily apparent. Unit at left has movable blades, fixed unit on right is cast as one piece. Units shown are for different cars, thus difference in size.

SPEED STREET/STRIP AUTOMATIC

WITH A FEW SIMPLE MODIFICATIONS, THE TURBO HYDRA-MATIC CAN BE-TUNED INTO A REAL TRICK-SHIFTING TROPHY GRABBER

By Tex Smith

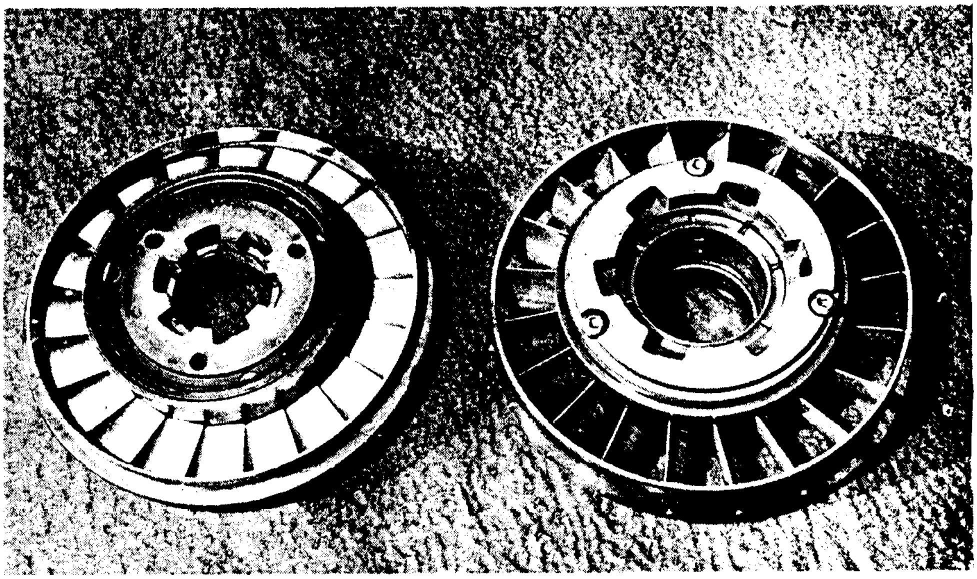
All the time you hear about this or that hot dog's super-secret trick stuff that he uses to make the big quarter-mile runs. Sometimes there are tricks, but usually it's all a batch of superstitious smoke deployed to put a mental hole shot on the opposition. Not so with a scoop we've just unearthed out at Kennedy-Bell, Glendora, Calif.

For a number of years now, the K-B duo has been laying it on competition, and doing it with a most incongruous machine - a Buick. While it is true the pair are considered inside-outsiders (they help the factory in performance evaluations), they don't work with the bundles of lettuce so many performance consultants do. They're just ordinary hot rodders with a special pass to the engineering department. Which means, in short, that they are in the same boat with the rest of us when it comes to getting that extra speed or cutting a quicker ET.

Back in 1964, General Motors introduced a new three-speed automatic transmission to the performance market, just in time to keep up with the spiraling demands of super engines. These new automatics were originally introduced in the big cars, such as Cadillac and Buick, but became standard options the following year for all smaller GM lines. The success of this transmission, the series 400 Turbo Hydra-matic is now history, but one peculiar design attribute has gone largely unnoticed. And this is the K-B secret.

When the Turbo Hydra-matic transmission was introduced, it included two different kinds of stator assemblies, the fixed stator for general applications and the variable pitch stator (VP) for the heavier cars. The variable pitch stator is a hydraulically-adjusted mechanism to make the torque converter more or less efficient. It has been virtually discarded by automatic transmission experts, who are normally working with lightweight vehicles and can therefore rely on the fixed pitch stator. Kennedy-Bell has used the variable pitch stator with great success, however, because they are working with heavier cars and usually with engines having excellent low-end torque. It is necessary to understand the function of a torque converter to appreciate the variable pitch stator.

The idea behind any automatic transmission is to put the maximum engine power on the road with a minimum loss of power enroute. As



Blades in open and closed position, showing how much affect they have on oil flow and unit efficiency.

adjusted by the mechanic, the automatic will shift at exactly the right time relative to engine rpm and torque. Getting this power into the automatic is a load absorption device - the converter, or fluid coupling. Early automatics used a fluid coupler, which is simply a slipping clutch. The torque converter actually multiplies available torque.

The Turbo Hydra-matic converter is similar to most units, including a driving member (pump impeller), driven member (turbine) and reaction member (stator). The stator is what we're concerned with here.

In the variable pitch (VP) design, the individual stator blades are hydraulically-operated to assume either high or low angle, with the low angle (about 13 degrees to the plane of rotation) being the position for maximum efficiency. At wide throttle settings, where good acceleration and overall performance are both demanded, the blades switch to a high angle (about 26 degrees). This high angle is also used when the engine is idling in gear, to effectively reduce the tendency of the car to creep (the unit is less efficient at the high angle, thus giving less torque multiplication). In the fixed stator design, the blades are stationary at the maximum compromise efficiency angle, at about 23 degrees.

The torque converter housing resembles two small wash basins welded together. This housing and hydraulic pump **are welded together to rotate** at engine rpm. As the housing/pump spins, it picks up oil at its center and discharges the fluid at the pump rim between the blades.

The pump shells and blades are shaped to make the flowing oil spin in a clockwise direction toward the turbine blades, causing the turbine to turn. At low engine speeds, the oil force is not sufficient to turn the turbine efficiently, but the efficiency increases rapidly as rpm increases. The oil flow in the turbine blades and shell is reversed, so it leaves the turbine center spinning counter-clockwise.

When this has happened, the turbine has absorbed the force required to reverse the oil flow direction, thereby creating greater torque at the turbine than is being directly delivered by the engine. The process of multiplying engine torque through the converter has begun.

Were the counter-clockwise spinning oil allowed to continue unrestricted to the *inner* section of the pump from where it came, the oil would hit the pump blades in the wrong direction, hindering the pump rotation and canceling out any torque advantage. The stator assembly prevents this. The stator is fitted between the pump and turbine, mounted on a one-way roller clutch. This clutch is a sort of sophisticated roller bearing, constructed so that it will turn in a clockwise direction, but when it tries to turn counter-clockwise, the rollers are jammed between outer and inner races. They then lock up. The oil from the turbine spinning counter-clockwise is then again reversed across the stator blades and hits the pump inlet spinning in the correct direction.

The energy of this oil pressure is added to the engine torque already turning the pump, and the overall torque is again multiplied. With the engine running at full throttle, transmission in gear, and the car motionless, a converter is thus capable of multiplying engine torque by about 2-to-1. This multiplication factor will depend upon the automatic, but the Turbo fixed stator delivers 2-to-1 while the VP stator gives an even better 2.5-to-l. That extra-five-tenths makes the difference in racing.

As the turbine and car speed increase, the direction of oil flow leaving