GOATLEY TRANSMISSION TECHNOLOGY


c.OAT

ANYTHING'S POSSIBLE…
IF YOU DON'T KNOW BETTER

Modern vehicles are evolving at tremendous speed to provide higher levels of comfort, tranquility, performance and, most of all, environmental sustainability. As a result, all automotive componentary is under scrutiny to provide solutions that will help to achieve these goals. A major component that impacts on almost all elements of vehicle design and performance is the transmission. It will play an ever increasing role in the evolution of future vehicles.

During the past 20 years, many automotive research and development companies pursuing innovation in transmissions have focused on new technology that combines the most desirable features of both traditional manual, and modern sophisticated automatic gearboxes. One of these innovative technological developments was the Automated Manual Transmission (AMT). It aimed to achieve fast, automated, ratio changes with little to no power interruption, whilst maintaining the low cost, reliability, and driveability of manual transmissions together with low weight, minimal space requirements and low production cost. These aims have understandably proved difficult to achieve over a long period. The advent of dual-clutch technology has achieved remarkable results, but further developments in AMT are still possible.

In New Zealand during the late 1990's, a young motorsport competitor dreamed of a faster more efficient gearbox for his Rally car. Through isolation and with minimal influence from mainstream transmission technology, Paul Goatley made a unique AMT. His gearbox used multiple wet clutch technology to select each ratio. Unknown to Paul, this concept had been tried many times by some of the worlds most well known automotive and component companies – without success. In contrast, Paul's ingenuity overcame previous technical barriers and he succeeded where others had failed. The transmission that still carries his name was not only innovative, but provided fast, reliable ratio changes together with numerous other features not previously possible with existing technology.

The discovery that enabled the Goatley transmission to work was subsequently patented throughout the world. It achieves the ultimate goals sought for AMTs and opens up new opportunities for automotive manufacturers. Now ready for final development, it is being made commercially available for technology users to incorporate into their own next generation transmissions.

INVENTION…
THE MOTHER OF NECESSITY

Paul Goatley is an automotive engineer in a small New Zealand rural community. His passion for motorsport together with a lack of financial resources inspired him to make a quick shifting, clutchless, sequential gearbox for his amateur Rallycar. Utilizing simple engineering principals with which he was familiar and systematically over-coming tooling and materials problems, he created a gearbox that worked extremely well.

Friends, who realized his achievements had significant application in mainstream automotive construction, funded an ongoing R&D and patent program. This gained the attention of independent technology evaluators who confirmed Paul's innovation was worthy of presentation to the international automotive community.

GOATLEY
TECHNOLOGY DEVELOPMENTS LTD

Goatley Technology Developments Limited is a small, specialist technology company formed to fund and guide the development of an AMT gearbox that was gaining considerable attention following publication in an international magazine.

Its New Zealand location has provided some very important advantages...

- The inventor was not constrained by existing technology and able to develop a transmission solution that was simple and inexpensive.
- The development costs through the early stages in a small rural New Zealand town were affordable for the early investors to achieve significant progress.
- As a result of relative isolation, the people of New Zealand have a heritage of finding innovative solutions to technical issues.

SMART TECHNOLOGY... THAT WORKS

The Goatley transmission is an electronically controlled, hydraulically actuated automated manual transmission. It was initially conceived as an adapter to a standard gearbox to enable fast, accurate, sequential gear changes. Its final form achieves that, but also opens the way for innovative manufacturers to utilize fresh thinking regarding the basic principles of transmission to create new, purpose built units.

A major strength of wet clutch technology is that it needs no special materials or tooling. Electro-hydraulic technology is well understood in terms of manufacture enabling minimal lead time to bring the concept to production. Special tooling, materials or knowledge is not required in manufacture or servicing.

The major success of the Goatley transmission is its ability to eliminate heat related issues that have proved problematic to other transmissions of this type.

A key attraction of the Goatley transmission is the compact nature of the unit, given that the traditional primary clutch or torque converter is eliminated. This will be of considerable benefit in addressing engine/vehicle downsizing issues.

Independent evaluation of the Goatley transmission has indicated that it is a viable, low cost option that is ideal for a number of other applications including transfer boxes, stop start technology and hybrid adaptation.

TESTING AND PROTOTYPES

Comparative bench testing has shown that the Goatley transmission is considerably more efficient than an automatic and almost as capable as a traditional manual gearbox in terms of energy transmission. Full throttle, seamless, clutchless up & down shifting without engine cut results in very fast ratio changes that remain smooth with little energy loss.

The additions of load/torque sensors enable this gearbox to skip gears not required. Destructive testing has shown that the prototype clutch packs of the Goatley transmission are capable of outperforming traditional primary clutches during startup and during heavy loading.

A number of working prototypes have been used for evaluation on the road. They include 5 and 8-speed competition vehicles that have endured harsh treatment in demanding environments. Well known international motorsport entities who have driven these vehicles and experienced the Goatley transmission, expressed enthusiastic approval at the ease of instant clutchless shifting.

The most recent prototype demonstration car features a transmission ECU that has shown the potential for very sophisticated control. For example, shift timing may be varied for specific tasks such as Comfort or Sport and ratio selection may be made in any order to suite load or terrain.

Hill starts and downhill engine braking are fully automated and stop/start control is simple given the ability to instantly select neutral when the vehicle stops and instantly engage the appropriate gear to restart.

SIMPLE PRINCIPLES… THAT WORK

The basic principle used by the Goatley transmission involves the utilization of small multiple-clutch packs to engage the drive between a gear and the shaft. Specially designed Goatley hubs replace the traditional synchro-hubs and cones.

The most recent prototypes, as in the demonstration saloon car, have been "Goatley-converted" conventional manual transmissions. The externally splined main shaft is retained and the adaptor hub is machined with an internal spline to engage conventionally on the shaft allowing both to rotate together. The gears are not splined and are able to freely rotate in relation to the shaft.

The adaptor hub is designed and machined to provide annular recesses into which mini multi-clutch packs and hydraulically actuated slave pistons are fitted. The pistons are supplied with hydraulic fluid through the transmission casing via passages provided in the hub.

Each clutch pack comprises a series of annular steel plates interleaved alternatively with a series of annular clutch plates. The steel plates are formed with dogs or teeth which engage in the hub and the clutch plates are formed with splines that engage to the teeth of the gears. In this way, the clutch plates are alternatively fixed to the shaft and the gear. When pressure is applied to the clutch pack, the plates lock together and provide drive. When the pressure is released, drive to that gear ceases.

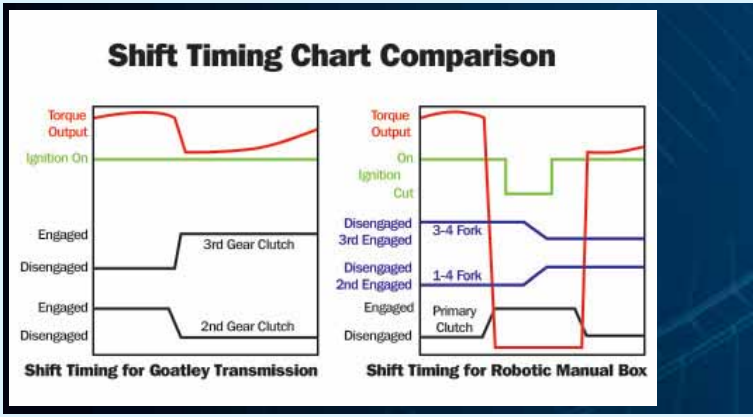
Ratio changes occur when one gear is simultaneously engaged to the hub while another is released. Coordination of the two movements results in an almost instantaneous exchange of the ratios in use and does not require the pressure on the shaft to be eased by an engine cut - with an associated reduction in speed. In similar manner, gradual grip of the 1st gear clutch pack can act as a conventional clutch to facilitate a start. Disengagement of all clutch packs results in neutral. Fluid pressure is typically provided by electro-hydraulic or electro-pneumatic accumulators and actuators together with solenoid valves.

Driver operated or automated control systems may be employed.

FEATURES WHICH MAKE THE GOATLEY TRANSMISSION UNIQUE AND VERY EXCITING ARE…

- Elimination of the Bell housing, flywheel and primary clutch
- Full throttle seamless clutchless shifting without engine cut
- Transmission always in neutral on startup
- No synchromesh cones or dogs, and fewer moving parts
- Any type of shift control
- Ratios can be preset to shift in any sequence - multiple sequences are available
- Driver or electronic adjustable shift timing... soft or harsh
- Reduced or eliminated wheel spin on up shifts and of lockup on down shifts
- Application in 4WD transfer boxes to enable engagement while moving
- Suitable for all automotive applications and power-plants. Small to large
- Ideal for all known future engine developments and stop-start technology
- Minimal tooling and setup costs compared with other new technology

SMOOTH AND QUICK… MINIMAL POWER LOSS



Data gained through bench testing has indicated this transmission has excellent shift characteristics...

SUPPORTING THE ENVIRONMENT

The Goatley transmission makes positive fuel savings and reduces the energy footprint through...

- Efficient energy transmission, and minimal energy loss, during ratio changes
- Reduced weight and size (by eliminating the substantial primary clutch and its bell housing) which enables more economical transmission packaging to assist overall vehicle aerodynamics and engine downsizing
- Lower manufacturing costs through use of simple known technology

AN OPPORTUNITY FOR DEVELOPMENT

Goatley Technology Developments Ltd (GTDL), who own the Goatley transmission intellectual property, has guided the development of the technology over the last eight years. International patents have been granted, the technology is proven at a prototype level, and the transmission is now ready for final development and commercialization.

We believe Paul Goatley, the inventor, has made a step-change improvement to AMTs which will lead to this type of transmission reaching its potential for performance and efficiency whilst delivering the ride comfort required by the driving public.

We believe it will also deliver very real additional benefits to the automotive industry such as space saving and increased efficiency because of its small size and weight. Additionally, features such as the ability to seamlessly skip gears may have a place in large commercial vehicle transmissions.

GTDL recognizes that it is not the organization to take their transmission to market, and is seeking to license or sell the technology and associated intellectual property to interested third parties.

Want to Know More?

We shall be pleased to provide more information on request.

A demonstration car is available for initial on-road evaluation.

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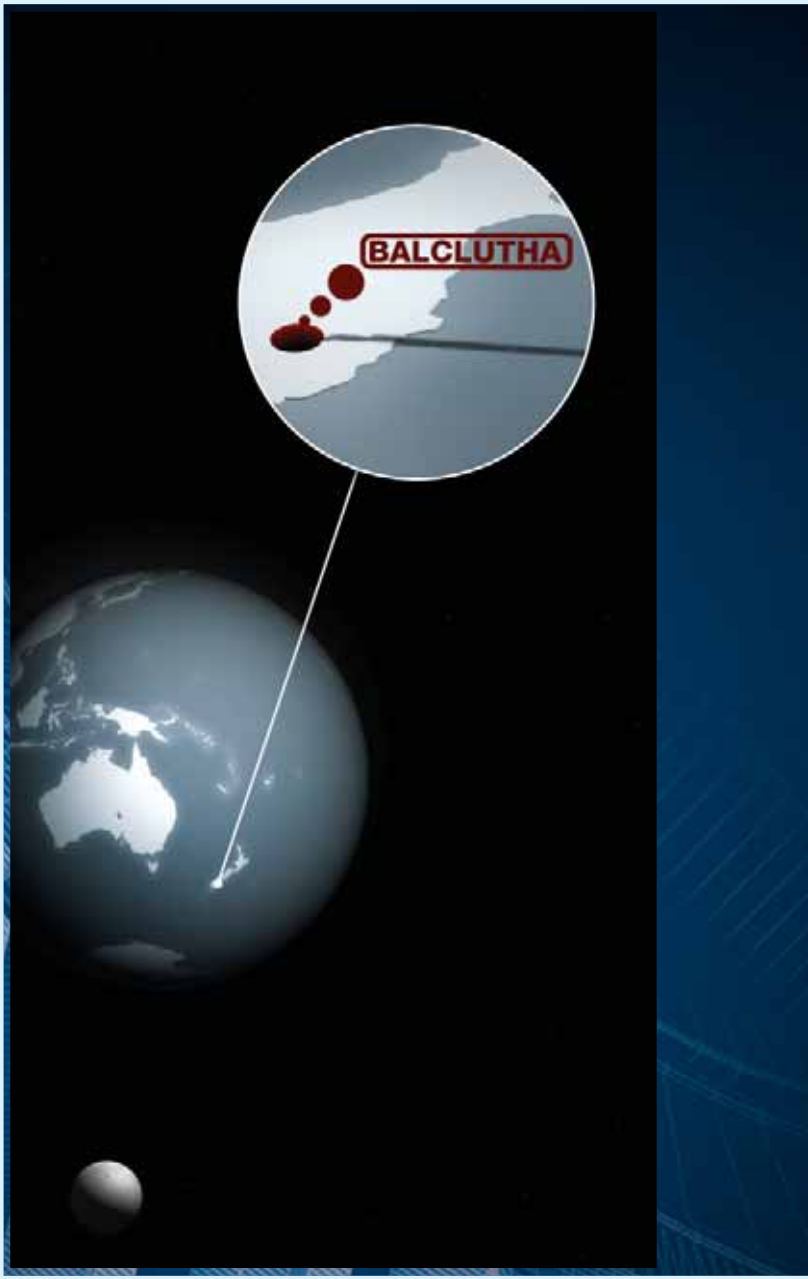

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