Glen Kyle always has been somewhat eccentric to the traditions that have grown up around the very specialized sport of Class A hillclimbing. For example, against the tried and true Indians and Harley-Davidsons, he has campaigned a Vincent for several years, choosing to follow his own thinking in motor design.

The net result has been three National Championships, in 1963, 1965, and 1966. And since Glen injured his wrist and sold the Vincent to 1969 National Champion Beese Wendt in 1967, the machine has taken one more AMA Championship and a Canadian National Championship, further proving the soundness of his technical leanings.

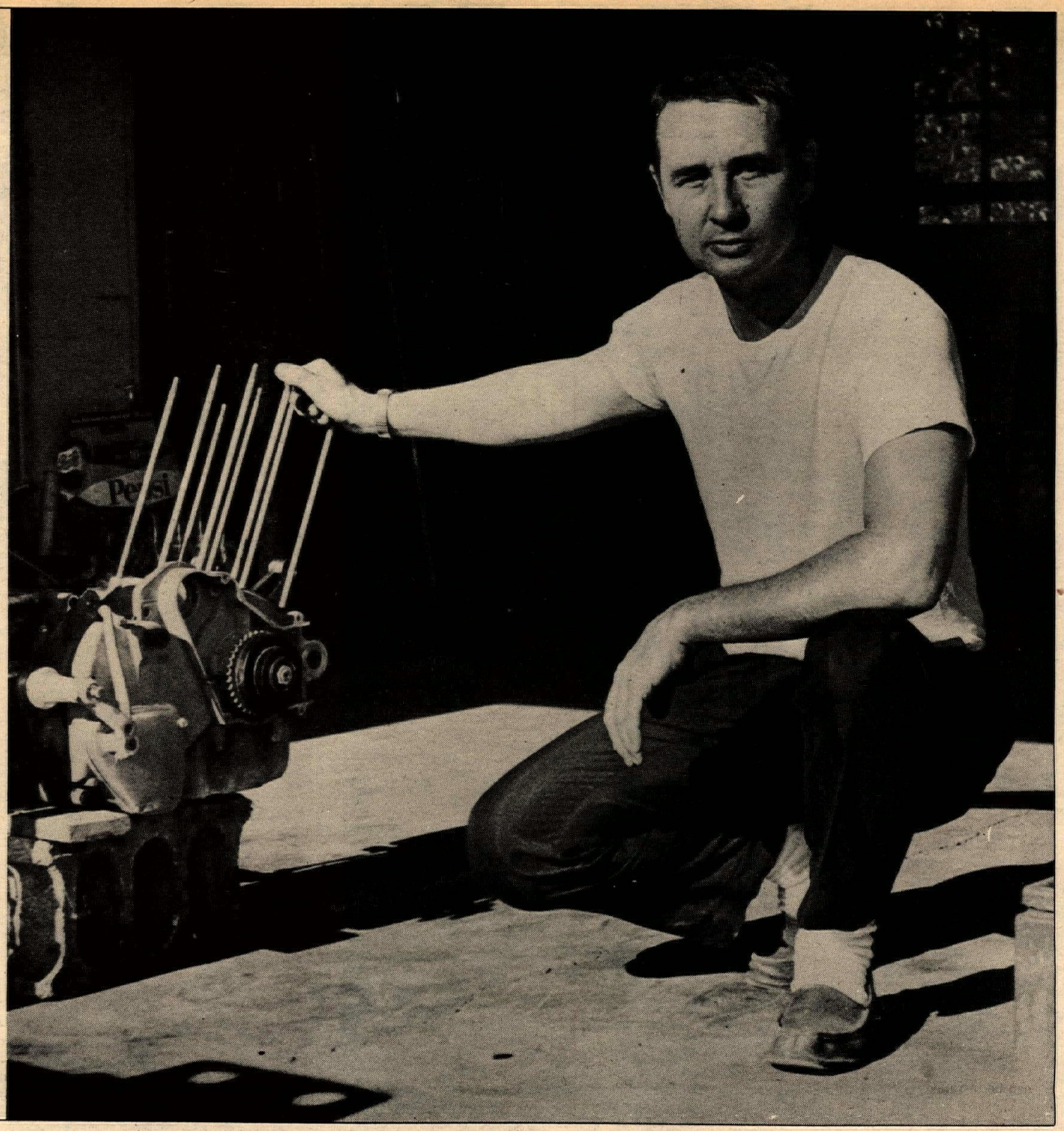
TEXT AND PHOTOS
BY ED YOUNGBLOOD

Kyle, an extraordinary machinist from Goshen, Indiana, and father of three, found himself too busy to ride when he recovered from his injuries. Instead, he had taken up flying and was considering doing it commercially.

However, when he decided it wiser to stay with his established profession, he realized that flying as a mere hobby was not satisfactory for him. It was too time-consuming and too expensive.

Glen began to miss the hills and the noise of the Class A fuelers. A general idea for his new hillclimbing special had been forming in his mind for several years now, and in 1969 he began to lay plans with a new motor he had never seen the insides of. It was a cammer, and that is all he cared about. Theoretically, it was what he wanted, and the practical problems would just have to be worked out in the shop.

The following is the story of his revolutionary, fuel-burning, overhead cam hillclimber.



HOW GLEN KYLE

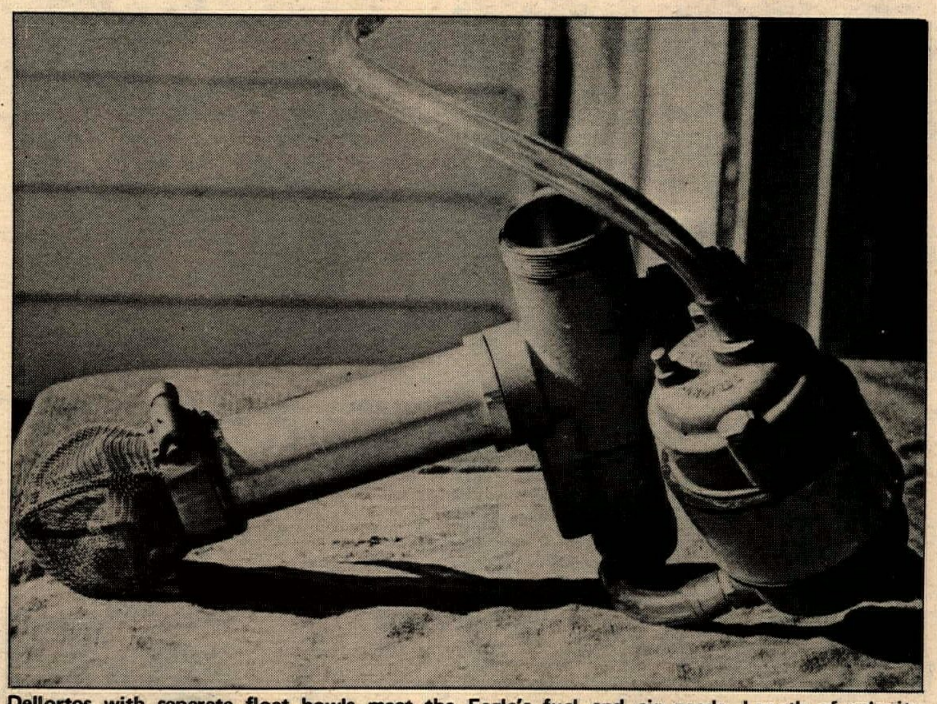
Long before Glen Kyle injured his wrist, turned his Vincent over to Beese Wendt, then sold it to him in 1967, he had been thinking of an overhead cam Class A hillclimber. The dream was a logical conclusion of the direction his engineering theories had taken during his career as a professional rider.

Kyle concentrates on the breathing efficiency of the internal combustion engine. Because the runs for a hillclimber are relatively short, such a special machine has needs similar to those of a dragster. Within reasonable limits, one doesn't worry about heat and piston speed. Tremendous horsepower in one place and at one time is needed, so attention should be directed to the greatest volumetric efficiency over short periods of time.

The motor must inhale and exhale great gulps of gas and air as rapidly as possible. Achieving this goal had led Kyle down what seems to be a strange road with the successful Vincent. The final result was a motor that reversed the major rules that most racing engines follow.

For example, with a track racer the tuner frequently bores out a slightly smaller motor in an effort to increase the volume while keeping the stroke and thus the amount of piston travel the same. With the hillclimbing Vincent, though, Kyle took the opposite approach. He began with a 1000cc machine and sleeved it down to 750cc. This gave him a motor that would conform to the AMA motor limit for overhead valve Class A hillclimbers, and it gave him a motor with a long stroke and oversized combustion chambers.

Right is a stock valve. Compare it with the replacement valve on the left. It began as a Chevrolet part.



Dellortos with separate float bowls meet the Eagle's fuel and air needs. Length of velocity tube is determined mathematically. The screen supplies the bare minimum of air-cleaning.

With the 1000cc Vincent heads he had room for valves that were very large in comparison to what he could get into any other 750cc engine. A great amount of piston travel didn't matter. The runs are short and overheating and seizure are unlikely if lubrication is adequate.

So through the small-bore Vincent with its large valves and oversized combustion chambers, Kyle achieved the volumetric efficiency he wanted for his Class A bike. However, mechanical efficiency, he felt, was limited by the design of the pushrod motor. An overhead cam machine would have less reciprocating weight and therefore a higher rate of acceleration, but such a mechanism was not available on any suitably large motor.

Glen at first toyed with the idea of grafting 450cc Ducati heads to the Vincent cylinders. It was a makeshift scheme based on necessity rather than desirability, for nothing else was available. Mounting problems would have to be solved, then driveshafts would have to be fabricated and mounted to transfer the power from the Vincent's camshafts to the Ducati heads. It sounds impossible, but, afterall, Kyle had fabricated many of the parts for the Vincent, including the pistons.

But then the three-times National Champion cracked his wrist, sold his Vincent, and went into a brief retirement. During this period, at least two desirable motors became available, and, fortunately, when Kyle returned to professional competition, he could shelve the idea of the overly difficult Ducati-Vincent marriage.

At first the Honda Four was considered. It had the overhead cam design Kyle wanted, and it was the proper size, but it also was heavy, and the multiplicity of cylinders would cause tuning problems. For best results, one wants to plug one carb into each cylinder, so with more cylinders come more problems with carburetor syncronization. Besides, Glen couldn't seem to interest anyone at Honda in the possibility of having a Honda National Hillclimbing Champion, and he wasn't about to invest around $1500 in a road bike and pull out its motor for experimentation.

In the meantime, Jim Snell of Snell's Cycle in Muskegon, Michigan, suggested the 750cc Laverda cammer that was being marketed by Jack McCormack as the top of the American Eagle line. Kyle liked the idea of an overhead cam twin, so Snell entered a formal request with McCormack International for a motor.

Apparently Jack McCormack liked the idea also, for in the spring of 1970 a nearly complete engine arrived in a crate. It was a used motor taken from a street machine on the west coast. It lacked the electric starter, and nothing else from the bike was included.

But Glen Kyle had all he needed. Immediately he took the motor to his home machine shop and pulled it down. It looked clean. Cylinders, cams, pistons, and valves showed little wear. And to his greater pleasure, Kyle discovered that the machine he chose on a hunch was in fact a tuner's delight. He had gotten it only for its cammed heads and its availability, but inside he discovered features of design that held promise of a superlative competition engine.

First, there is a very hefty and very sufficiently mounted crankshaft. In all there are five bearings; balls hold the shaft in the

MAKES THE EAGLE FLY

outer cases, caged rollers supply support on the inner cases, and a fifth needle bearing is mounted in the primary drive cover.

Lifters are oiled by positive lubrication right through the rocker arms and onto the cams. The camshafts are driven by a double row of chain. In short, every feature of the motor appears to be designed for heavy use.

Also, much room for modification seems to have been designed into the machine. Valves are mounted in the heads at very wide angles, leaving plenty of room in the center of the dome between the valves. Also, the iron skulls around which the aluminum head has been cast are very thick, leaving much room for

Right is the stock Eagle piston. Left is the replacement part constructed from an M.C. forged BSA Victor piston. The crown has been welded up and machined to its present size. Notice the heavy knurling on both skirts. Kyle lets his pistons fit loosely, relying on rings for compression.

enlargement.

In fact, the combustion chambers were undersized, and when Kyle machined them out to match the cylinders in diameter, what had been ample room for larger valves became even roomier. Likewise, all ports and valve guides are designed so that plenty of cutting, reporting, and polishing is possible.

So Kyle had not only an overhead cam engine of the right volume. He also had a motor he could modify to his heart's content.

As we mentioned, the tuner feels that breathing is of major importance in a hillclimbing motor, so for a description of his special preparations, it is only appropriate that we begin with the upper end.

Kyle machined out and recontoured the iron combustion chambers in the Eagle's head. Formerly, the chambers had been under-sized, their diameter being somewhat smaller than the diameter of the cylinders. This was done because a larger chamber contains more area, and therefore larger valves can be installed.

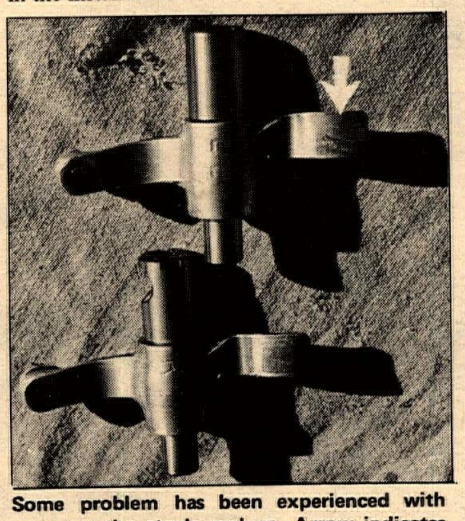
Then the inlet ports and valves were enlarged a full quarter inch each, from 1½ inches to 1 3/4 inches. Exhausts were increased from 1 5/16 to 1½ inches. The new valves to be installed began as 327 cubic inch Chevrolet valves, and were properly modified for contour and length.

But the new combustion chamber size left a great empty area that the rather flat-topped stock pistons did not fill. The replacement parts are M.C. brand forged pistons for the BSA Victor, chosen by Kyle for their generally correct size. They did much to fill the need, but still a considerable amount of material had to be built up on the crowns by heliarc welding. Then they were machined to shape with large flat areas ground away for valve clearance. Also the skirts were liberally knurled to help hold oil. Following Kyle's theories, they are a very loose fit. He relies upon the rings rather that the piston fit for compression. With the loose fit, Kyle intends the motor to blow before a piston will overheat and stick.

Wrist pins and connecting rods are stock, though the rods are lapped for clearance.

With the huge valves comes a healthy appetite. To satisfy it, the 1 1/8 inch DelLorto carburetors with rectangular slides have been replaced by 1¼ inch DelLortos with separate float bowls. Properly modified for the fuel diet, they contain oversized jets. As is the practice with Class A hillclimbers, no kind of flow-restricting air cleaner is installed. Only a screened cap is used to discourage entry by small birds.

Carburetor and exhaust tuning is purely mathematical, based on an article that once appeared on the subject years ago in Hot Rod Magazine. Kyle said it made sense and went into great detail, so he filed it away, assuming the author knew his business. With no dynamometer available, Glen has had to rely upon such theoretical preparation, but performance has not indicated any real error in the installations.



Some problem has been experienced with wear on the stock rockers. Arrow indicates where fuel-diluted oil has failed to properly lubricate.

The results of the mathematics are long velocity tubes on the DelLortos and megaphoned exhaust pipes. Exhaust pipe diameter at the head remains stock, but the length of the pipes as well as the rate of magaphone taper have been determined by the Hot Rod article. Kyle suspects that after major engineering problems are solved, eventually the Eagle will have to go on a dynamometer for practical refinement.

The unneeded electric starter was not included with the motor, and the generator went in like fashion, into the scrap heap. The absence of the two armatures probably removes about 15 to 20 pounds from the motor. Spark is supplied by battery and double points. Further weight is removed in the transmission. Everything is eliminated except the main shaft and one gear, giving the hillclimber a simple in-and-out box for transmission of power. This not only eliminates total weight; it also avoids the rotating weight and friction that absorb much valuable horse power.

Early runs resulted in problems with the clutch. To strengthen the unit, Kyle has added one steel plate and one friction plate, and has upped the spring tension. Finally, a whole home-made unit may be necessary, but to date the beefed-up standard clutch seems to be working.

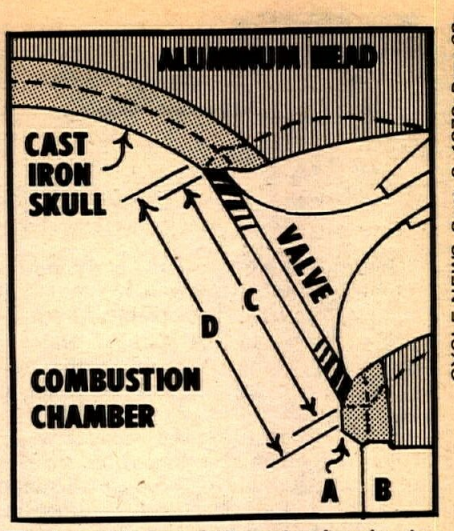
Along with the gears and shafts in the transmission, shifting and kick starter mechanisms were removed to reduce weight. Starting is by a portable crank that turns the sprocket on the right side of the engine that originally held the starter drive chain.

The clutch is engaged by a cable and lever mechanism operated by the left foot, leaving the rider's left hand free to operate only the kill button.

The mild steel frame was designed and fabricated by Kyle according to a procedure developed over the years. Glen has his own frame jig consisting of a piece of chanel iron with mounts for front and rear axles. The length between the axles is based on much experience on the hills. The correct fork angle and length (also based on practical knowledge) is determined, the motor is set in the chanel-iron as far forward as possible, then the welding and bending begin. The sprouting result is a two-piece Vincent-type frame bolted to the front and the rear of the motor and using the cases themselves as members of the frame. Furthermore, the frame that Kyle has completed may be modified through the installation of rigid units or short shock absorbers. The whole rear section can move slightly on a pivot at the back of the engine, and small shocks mounted at the front of the upper rear frame tubes allow the rear section to work like a Vincent frame.

However, early runs convinced Glen that suspension was not desirable for this particular machine. The shocks have been replaced by rigid tubes, and finally a lighter and totally rigid rear frame section will be designed and built. Also, for some reason, Kyle discovered that the Eagle worked better with a rear section about three inches longer than any he had used before.

The front forks are made from BSA down tubes and BSA springs with home-made lower tubes. Total travel is three inches. Also, an Indian brake of about 1950 vintage is installed on the front to help with return trips down the hill. The front wheel is a twenty-one incher.



The Laverda's iron skull combustion chamber is undersized in stock form, leaving a lip (A) whose diameter is smaller than that of the cylinder (B). Scooping the skull out creates a larger combustion chamber, increasing valve seat diameter by as much as a quarter inch, from diameter (C) to diameter (D). The dotted line indicates the surface of the new, larger chamber and port.

The rear hub was built by Kyle from aircraft aluminum and is basically a copy of a Vincent hub, though stronger.

The only reliability problems with the exception of the clutch weakness have been the result of the use of fuel. Mainly, the fuel attacks and rapidly destroys the rubber cam chain tensioners. Kyle feels that either he will fabricate new tensioning discs from aluminum, or use none at all. The chain can be strung tightly, and tensioners may not be necessary on the brief runs. Also, the fuel rapidly dilutes the oil and wear has been experienced where the rocker arms ride on the cams. Chrome plating has not solved this problem, and perhaps rockers will need to be built from different material. Unlike the tensioners, however, wear here has not effected performance.

Also, an all new dry clutch assembly may come later. Although the 2.3/1 primary drive ratio takes some of the load off the clutch, Kyle still feels that a wet clutch is a disadvantage for a hillclimber. He states that pulling out of a clay pit with a heavily chained rear wheel probably puts much more load on the clutch and drive chain than any dragster ever experiences.

Glen Kyle's American Eagle now weights about 330 pounds wet. This is five pounds more than his old Vincent, and even that, he says, was on the heavy side. However, properly distributed weight can be an advantage to a hillclimber if the motor is powerful enough to move it. Horsepower for the 750cc engine has reached about 90.