

## GREAT ENGINES IN BITS

1971

# MOTO GUZZI

*Falcoone Nuovo*

Built to withstand the abuse of army conscripts, the last hurrah of Guzzi's flat single was engineered for yak-like hardiness and unhurried performance

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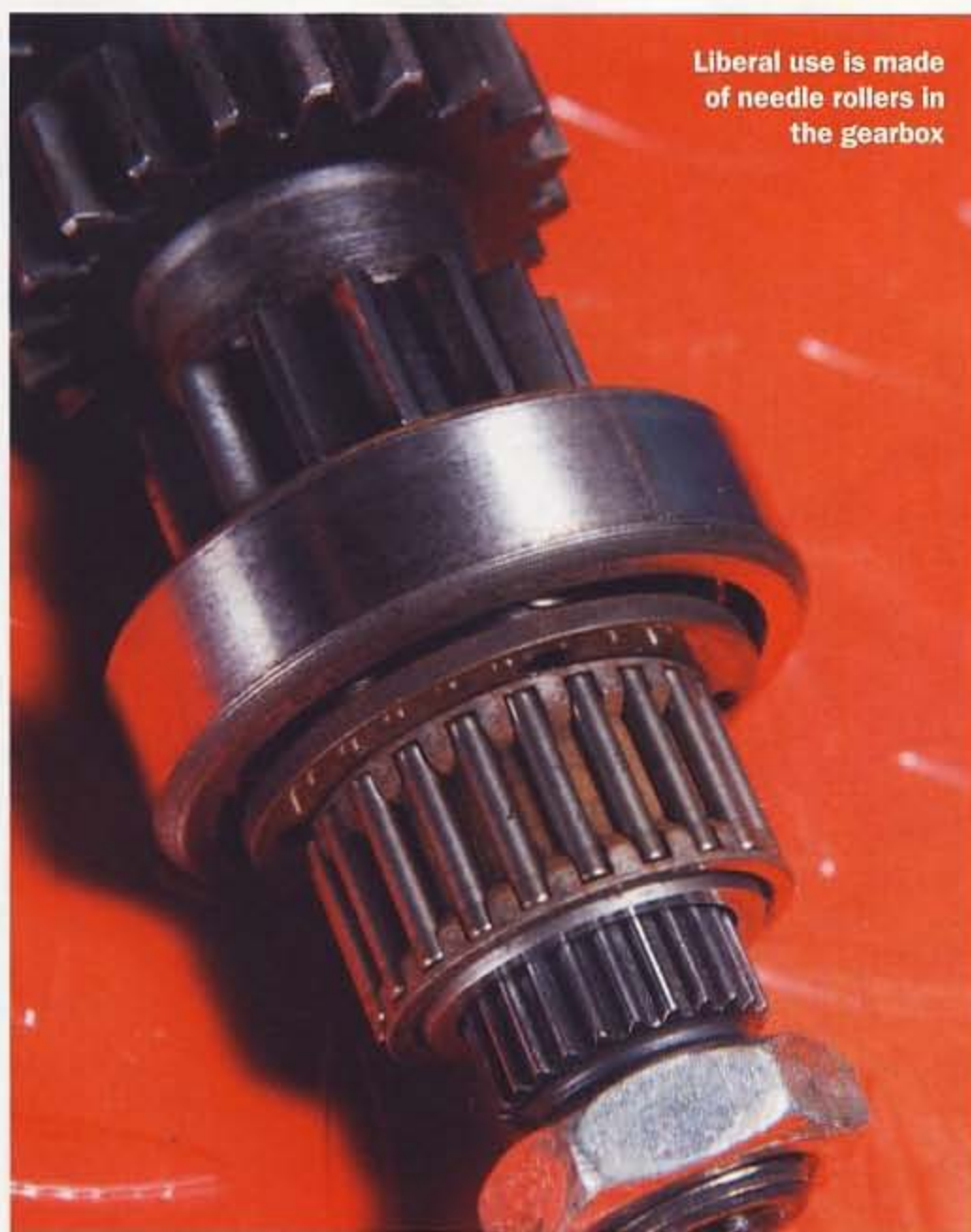
**M**oto Guzzi may have become synonymous with the longitudinal V-twin over the past 45 years, but the firm cut its teeth on an equally idiosyncratic engine format – the flat single. Guzzi's first production motorcycle, the Normale of 1921, was powered by a 499cc motor with its single piston punching horizontally towards the front of the bike – and the company continued to produce and refine that format until the Falcone Nuovo of 1969-76, despite a brief hiatus at the tail-end of the Sixties.

This engine is the final expression of the Mandello del Lario manufacturer's half-century of development of the flat single, an engine that reflects the individuality that has been a hallmark of Moto Guzzi since its early days. The Italian factory used the unorthodox format to win the first 500cc European road racing championship of 1924 and took it to a technical peak in the mid-Fifties with two 350cc world titles. By then a short-stroke double overhead camshaft unit was fitted in a radical spaceframe chassis with a wind tunnel designed dustbin fairing.

Guzzi withdrew from grand prix competition after 1957 (when its legendary 500cc V8 was still under development) to focus on commercial survival – but the four-stroke flat single lived on as a roadster, in the shape of the 500cc overhead valve Falcone. Launched in 1950, the basic model was joined by a Sport variant from 1952 to 1960.

By far the most popular 500 in Italy, where lightweights dominated, the rugged yet agile Falcone stayed in production until 1967. It gathered a strong following, especially among older riders who could be seen chuffing around Italian towns (helmetless, of course). Importantly for Guzzi, the police and military bought fleets of Falcons. By the late Sixties, the marque had entered a new phase with its longitudinal V-twin engine, originally developed for the military with government funding. However, the 500cc flat single was revived in 1969, mainly for fleet use,

'Sturdily built to withstand the most Neanderthal police riders, it can cover thousands of miles with minimal maintenance'



Liberal use is made of needle rollers in the gearbox

#### SPECIFICATIONS

### 1971 MOTO GUZZI FALCONE NUOVO

#### ENGINE/TRANSMISSION

**Type** air-cooled overhead valve flat single **Capacity** 499cc  
**Bore x stroke** 88 x 82mm **Compression ratio** 6.85:1  
**Carburation** 29mm Dell'Orto VHB **Ignition coil Spark degrees** 10° static, 44° at full advance **Points gap** 0.42-0.48mm  
**Valve sizes** inlet 45mm, exhaust 38mm **Valve timing** inlet opens 40° BTDC, closes 74° ABDC; exhaust opens 67.30° BBDC, closes 30° ATDC  
**Valve clearances** 0.1mm inlet, 0.2mm exhaust  
**Lubrication** wet sump, gear-driven pump  
**Primary drive** helical gears **Clutch** wet, multi-plate  
**Gearbox** four-speed **Output sprocket** 15 teeth  
**Final drive** chain **Power output** 26bhp at 4800rpm  
**Weight** 142lb (64kg)

when the Falcone Nuovo (New Falcon) appeared with the modernised engine featured here. Although not loved by the old guard of Falcone fans, the 1969-76 single is remarkable in being designed entirely for durability – even when neglected. Sturdily built to withstand the most Neanderthal police riders or the least willing military conscripts, it can cover hundreds of thousands of miles with minimal maintenance, though always at a stately pace.

Although this engine can be loosely described as a horizontal single, the cylinder actually tilts up by a few degrees. The alloy barrel has an iron liner spigoted into the alloy head and projects into the front of the box-shaped crankcase. The earlier Falcone had a discrete plated steel pushrod tube, but here a tunnel in the head and barrel castings encloses the rods. Four 12mm through-studs run from head to crankcase, with two additional stud fixings where the pushrod tunnel meets the case. Extensive finning along the cylinder's axis makes best use of the air flow.

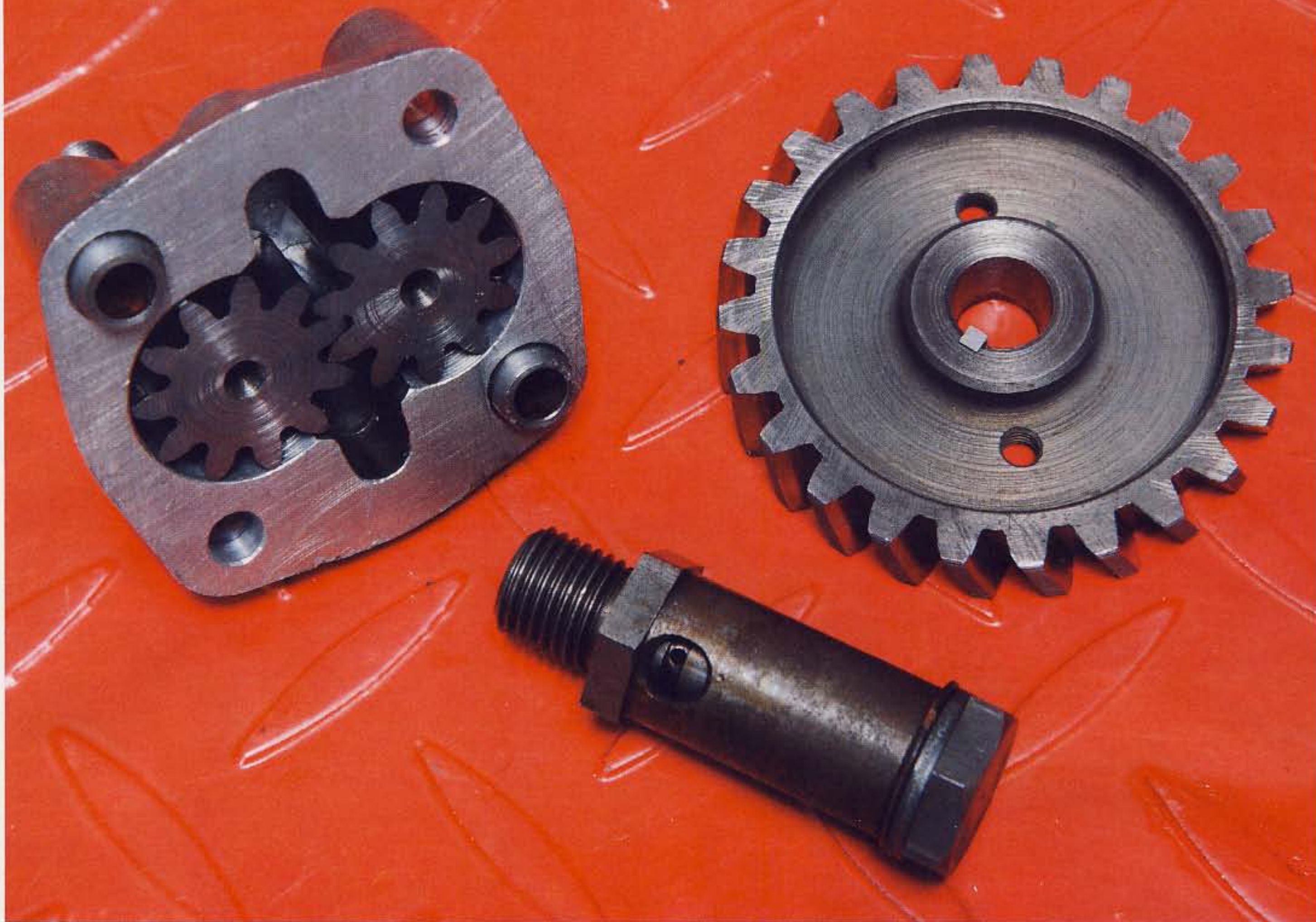
The inlet tract is at the top of the head, where mixture is drawn in from a 29mm Dell'Orto square-bodied carburettor mounted on an elbow tube and breathing through a large air filter. The exhaust port faces downwards and is angled slightly to the right, where the pipe leads to a huge double-deck silencer. The rocker boxes are integral with the head, with pressed-in rocker spindles that have oil feeds at one end and Triumph-like O-ring seals at the other. Each rocker bears on two plain pressed-in bushes. The spark plug is offset to the left in a hemispherical combustion chamber. Unusually the flat-topped piston has four rings – three plain and one for oil control, to maximise sealing and heat transfer. The long skirt has extensions at 90° to the gudgeon pin, where the main rubbing areas are. In neglected engines exposed to rainwater, the lower portions of the rings can rust solid in the bore.

The over-square bore and stroke dimensions of 88 x 82mm are the same as in Moto Guzzi's first engine and the majority of its subsequent 500cc road and race engines. Guzzi's trademark external flywheel makes it possible to use a simple one-piece crankshaft and compact transmission, avoiding an excessively long power unit. The flywheel is on the left, while a helically-cut gear on the right engages with another larger one meshing with teeth on the clutch body. A hefty eight-ball main bearing supporting the drive side of the shaft is located by a retainer plate screwed to the outer crankcase wall; its counterpart on the flywheel side is a roller bearing. The steel connecting rod has a bolted-on cap to retain plain bearing shells at the stout 50mm big-end journal and a pressed-in bush at the small end.

A pair of 2:1 reduction gears outboard of the primary pinions drive the camshaft which runs in a plain bush in the left crankcase half and a ballrace in the primary drive cover. The nose of the shaft extends through the cover to carry the cam and auto-advancing weights for the ignition points, located in a housing under a removable cap. Cylindrical cam followers slide side-by-



Twin gear oil pump,  
driving gear and  
pressure relief valve



## Engineers' notes

### LUBRICATION SYSTEM

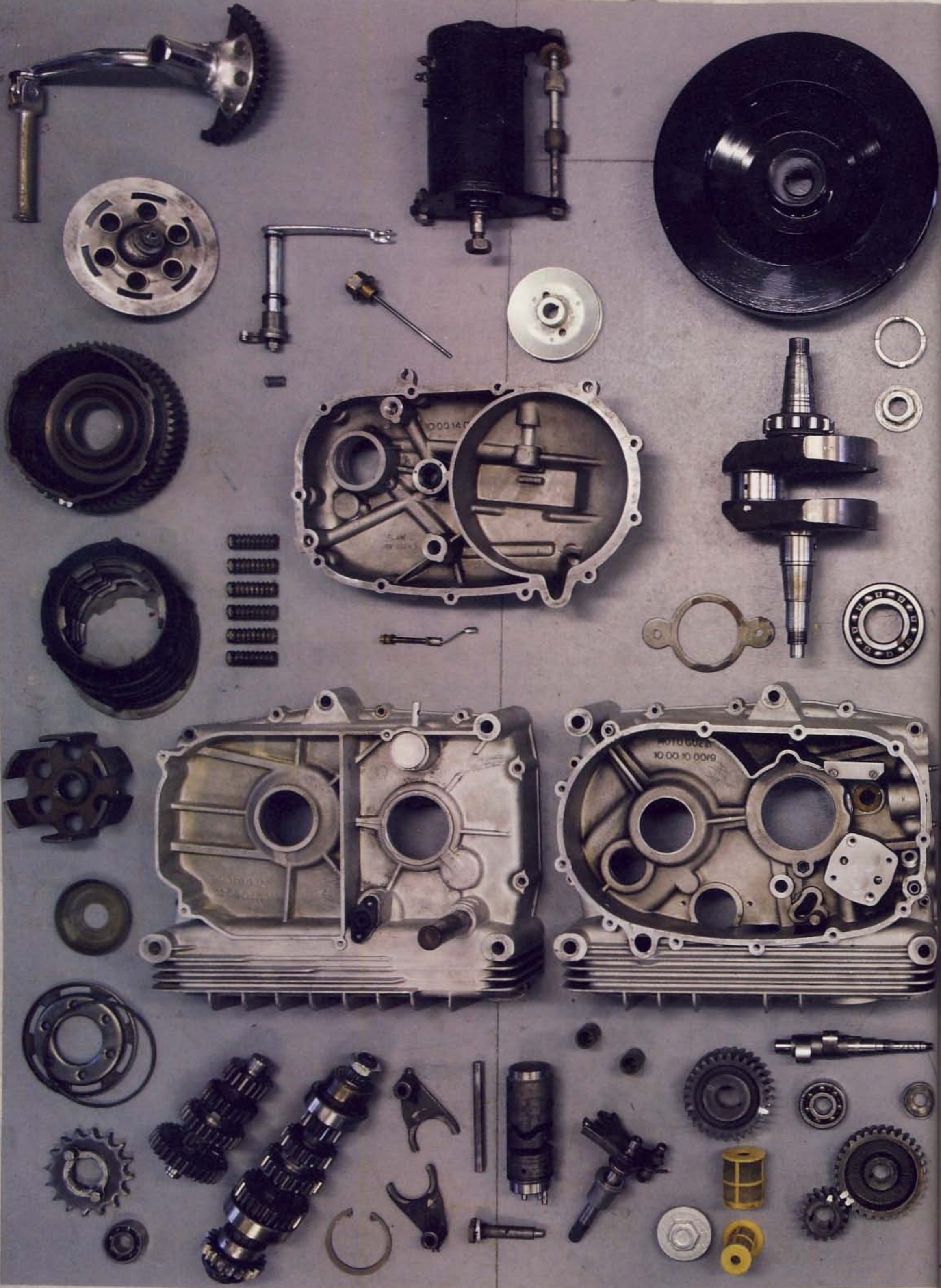
A wet sump lubrication system provides the high-pressure lubrication required by the plain big-end. A twin-gear pump mounted on the outer left crankcase wall has a helical driving gear that engages with the camshaft pinion. It sucks oil up from the finned sump through two concentric plastic mesh screens that can be dropped out for cleaning when the drain plug is removed. Early versions had inferior metal gauze here. Oil is sent along internal galleries into the timing and primary drive cover, where it is end-fed through crankshaft drillings to two outlets at the big-end. Splash under the piston reaches the small-end via holes in the gudgeon pin boss.

Another gallery in the cover sends oil to a pressure relief valve and oil warning light switch. A plate screwed to the crankcase wall above the camshaft acts as a dam to collect oil released from the valve and supply it the camshaft and followers. A third gallery leads to a take-off pipe for the top end. The pipe, with rigid and braided flexible sections, has banjo unions to feed oil through the rocker spindles and reach the two plain bushes in each rocker before draining to the lower part of the rocker box, from where another pipe returns it to the sump. The oil filler plug is in the lower part of the cover's clutch housing and carries a dipstick.

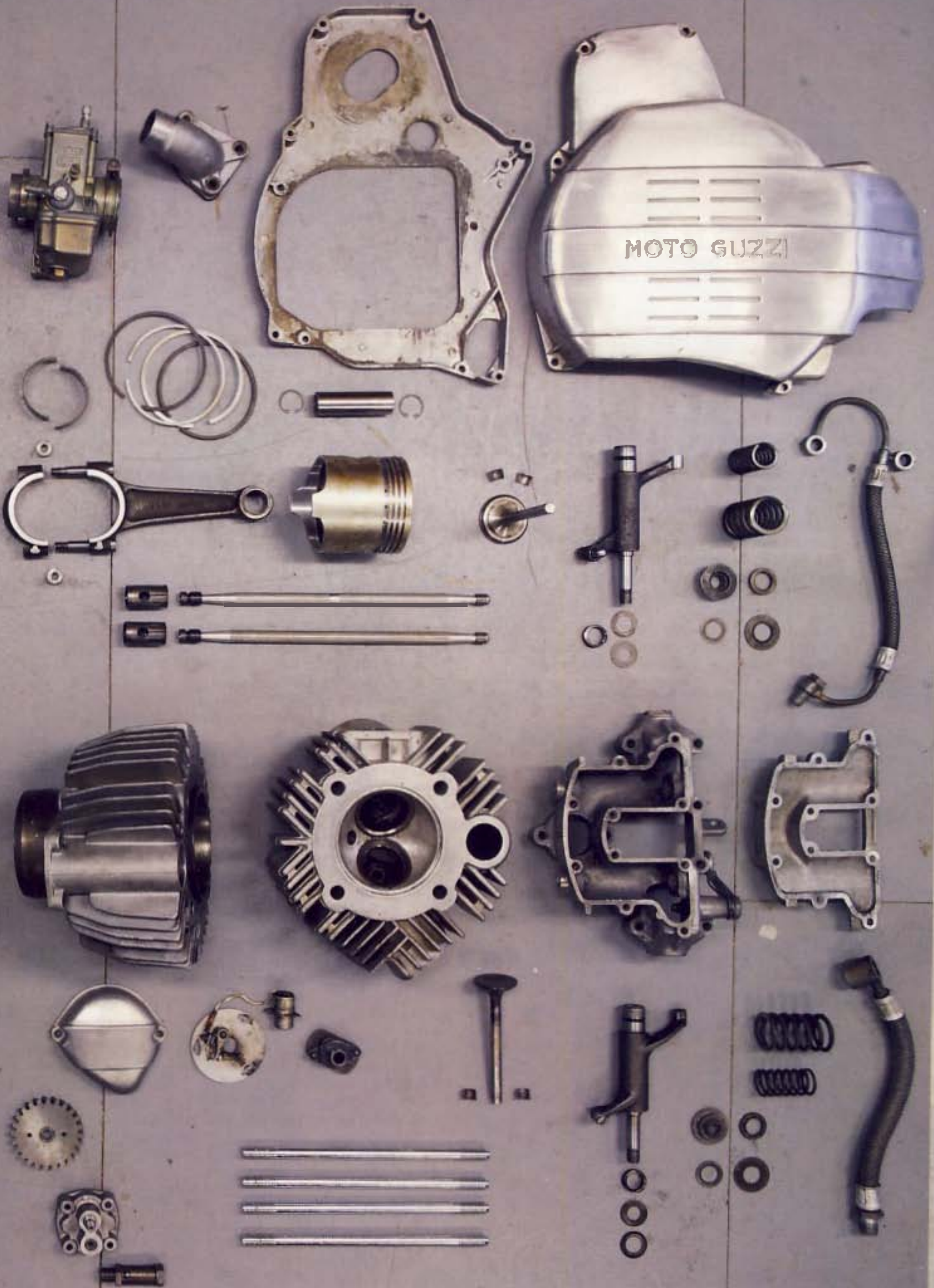
A housing in the upper left crankcase half contains a breather with a pressure-operated flap-valve and baffles. Escaping oil drips onto the drive chain and air is vented into a tube onto which a plastic hose is pressed.











MOTO GUZZI





side in the left crankcase half, with hardened facings to contact flat steel ferrules on the alloy pushrods. At the other end of the rods, surrounding the rocker buttons are steel cups which are threaded with locknuts for clearance adjustment, checked by removing hexagon plugs on the rocker box to insert a feeler gauge. Each valve has two springs, conventionally retained by caps and collets engaged with the valve stems; the valve guides are in phosphor bronze. An exhaust lifter lever for starting, mounted on the rocker box, is cable-operated from the handlebars.

The heavy-duty clutch has seven friction plates and eight plain driven plates, disengaged when two lifting fingers shift a pressure plate against the pressure of six springs. The fingers are keyed to flats on a vertical shaft pivoting in the primary casing with a long arm that connects to the clutch cable. The outer basket and driven gear assembly runs on a needle roller bearing, while the inner drum is splined to the gearbox primary shaft and retained by a nut.

The primary shaft, which carries the output sprocket and kickstart ratchet gear at its other end, is supported by two ball bearings in the crankcase walls. Its first gear driving pinion is integral with the shaft and two needle-rollers carry the sleeve gear for the top (fourth) 1:1 ratio. The shorter secondary shaft is below and slightly rearward of the primary shaft, with a small ballrace supporting it on the right and a needle roller on the left. It carries its first gear pinion on needle rollers. Gear changing is by a rocking pedal on the right which actuates a slotted drum below the shafts via a positive-stop mechanism with sprung plungers. A spring-loaded détente stop in the crankcase floor engages with the drum, which activates two selector forks; there is a switch for a neutral warning light. A shaft fixed in the left crankcase half carries the kickstart lever, which has a toothed quadrant to engage with the ratchet gear on the gearbox primary shaft.

A 12-volt dynamo on top of the crankcase powers the coil ignition system and general machine electrics. It is driven by belt from a pulley on the crankshaft inboard of the flywheel and can be swivelled on its mountings to achieve correct tension.

Many thanks to Dr Tony Lai and his wife Hazel for their patience, lunch and very welcome glasses of port

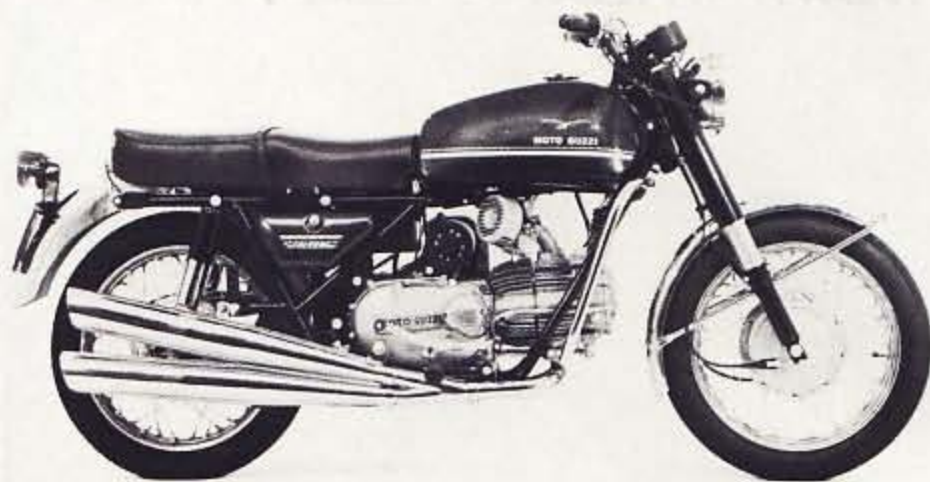


## FLYWHEEL IS A REAL SMOOTHIE

Although this is a low-revving engine, reputedly able to tickover at less than 150rpm, it would be wrong to call it a thumper. The external flywheel – 270mm in diameter and weighing 7.5kg – stores inertia to smooth-out power impulses. Fixed to the crankshaft on a keyed taper, the wheel is secured by a flanged nut, locked by a ring-nut on a left-handed thread. For removal, the ring-nut is loosened so that the hex nut can be undone and wound up against it. Then the ring-nut can be used as a puller.

Bright red and chrome-plate flywheels on earlier Guzzi singles were nicknamed 'bacon slicers', but the Nuovo's wheel hides under a large cover.

When the mpg hits your eye like a big pizza pie, that's Falcone



## FALCONE: ON THE ROAD AND IN THE WORKSHOP

Most Falcone Nuovos reached civilian hands through periodic Italian government surplus sales. Not surprisingly, some owners modify to achieve the more glamorous look of the earlier Falcone Sport. For the rider who likes a pleasant saunter around the lanes and doesn't care about sharp acceleration or achieving much more than 75mph, the Nuovo engine offers classic character with reliability and minimum maintenance. Café racers or TT daydreamers are better off looking elsewhere.

Falcone Nuovo fans will tell you that engines rarely need dismantling, but thanks to Dr Tony Lai we were able to photograph his stripped unit during a full rebuild of his 1971 bike. He bought it on eBay in a shabby state and bearing the colours of the Yugoslavian National Army.

Tony has a Moto Guzzi 750S which he's had for 25 years, but always fancied a big single of the same make. "It's really nice to work on," he says. "But I had to make a special tool to remove the left-handed ring nut holding the drive sprocket on, which has to come off before you split the cases. I welded four pegs to a very large socket to engage with notches on the nut. The standard alloy seal for the crankshaft end-feed is not good, so I've had a better seal made. Road Star Cycles in Dover (01304 202881) did that and other great work for me. I fitted iron valve guides and will add the German Holzdeppe aftermarket kit to give the inlet valve more lubrication."

## THE EXPERT'S OPINION

Stuart Mayhew of North Leicester Motorcycles knows the Falcone Nuovo well, since at least a hundred secondhand examples have been sold through the shop.

"There are many misconceptions about this bike and uninformed criticisms, but it just plods on regardless. Some ex-fleet bikes have been well maintained and some neglected. The ignition may be 25 degrees out but the engine still runs. We set to within half a degree. Tappet clearances are best set by ear, to avoid clatter. We don't believe an extra oil feed for the inlet valve is necessary: run an engine with the inspection cap removed and the standard feed will cover you in oil."

## OTHER FLAT SINGLES ARE ALSO AVAILABLE

A four-stroke flat-single engine has powered the world's most commercially successful two-wheeler – Honda's Super Cub step-thru, launched in 1958. On his 1954 European tour, Soichiro Honda was probably influenced by Guzzi and possibly the German Horex Rebell big-wheeled scooter's flat single.

There were Aermacchi flat singles from the 1950s to the 1970s, first on a 175cc roadster and then racers of up to 402cc, plus 250cc Harley-Davidsons after the 1960 takeover of Aermacchi. Less well known are Motobi singles, some of which sold in the US with Benelli badges. Guzzi also made two-stroke flat-singles from 65-110cc between 1951-66. Norton prototyped a double overhead camshaft 500cc flat single racer in 1953, never used in anger.





'The over-square bore and stroke dimensions of 88 x 82mm are the same as in Moto Guzzi's first engine'

With more fins than a pod of dolphins, the barrel and cylinder head stay way cool