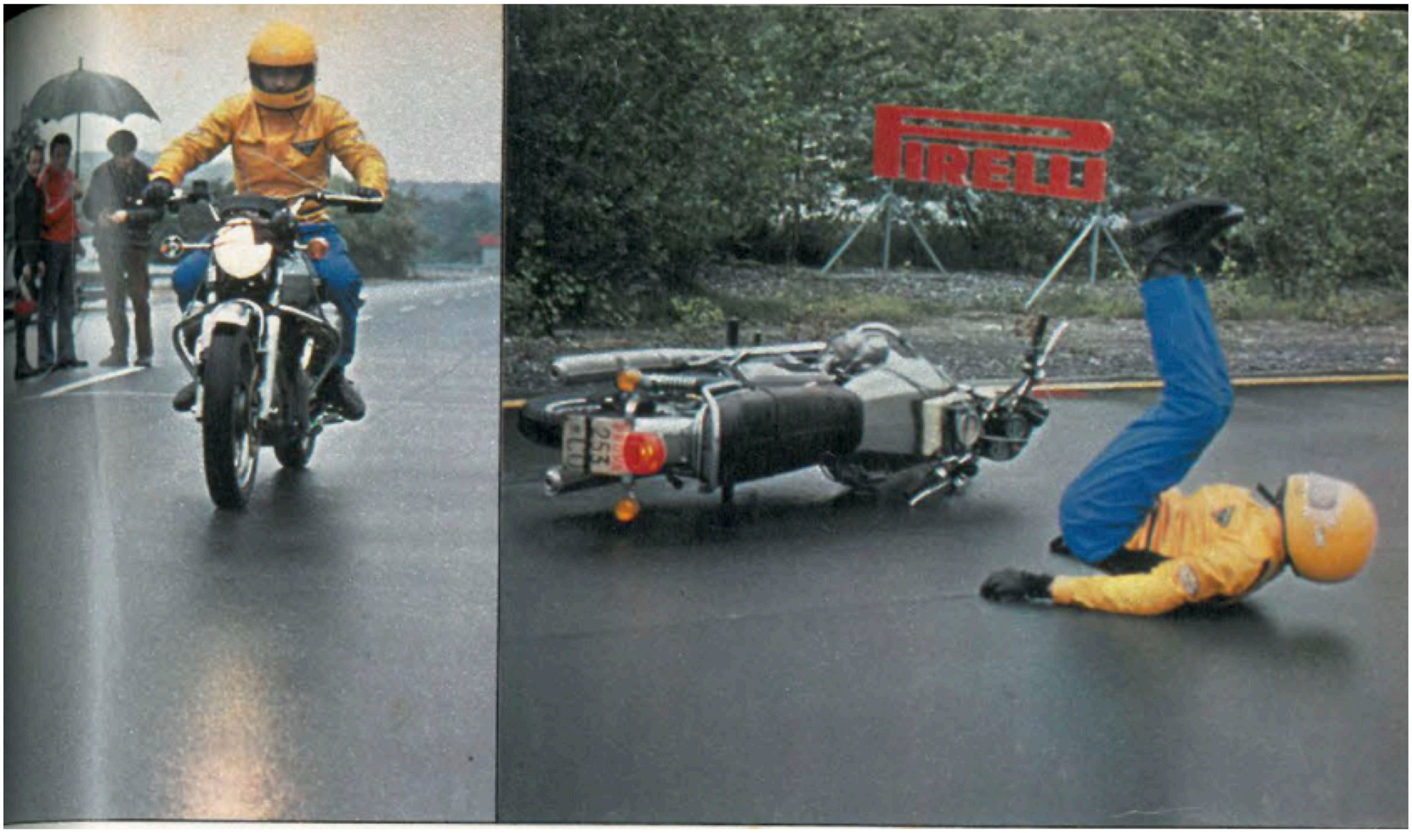
Top right next page, the (fortunately harmless) result of a braking test

Greater safety
Moto Guzzi 850
with the new integral braking system

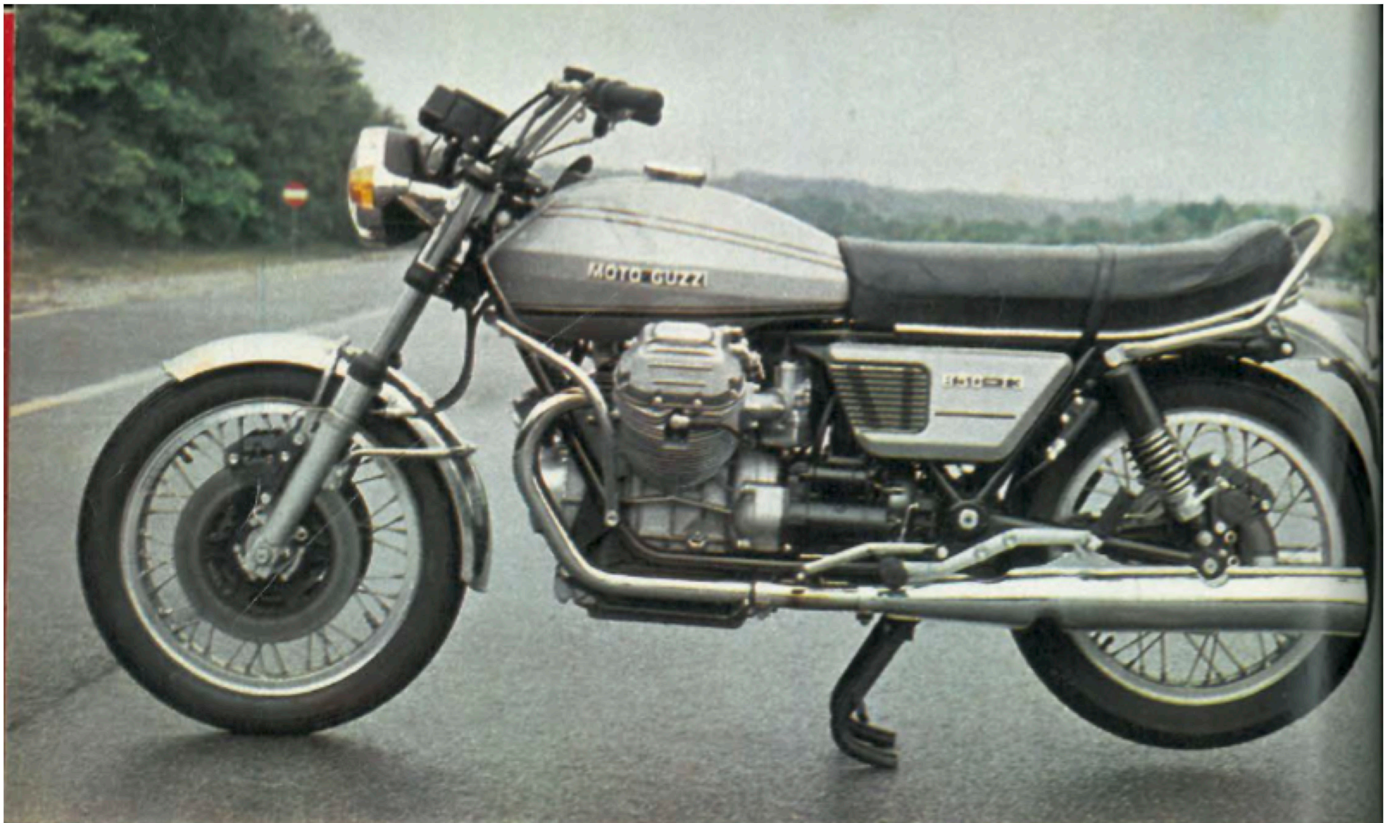
We have extensively tested the ingenious braking system of the new twin-cylinder T3 in all riding conditions. Using precision instruments we have seen an appreciable decrease in braking distance. We have also achieved significantly safer behavior in the wet, on gravel, and in cornering.

In the photo above, the decelorgraph used for our tests is visible on the tank. It is controlled by a switch on a flexible cable that the rider activates just before starting braking. Alongside, a safety factor for the Mandello twin-cylinder engines: you cannot start the engine without first pulling the clutch lever.



with only the front brake on wet asphalt. Despite paying attention, it was not possible to avoid locking the wheel in the end.

In the photo opposite, Brembo technician Remo Micheletti is measuring the temperature of the discs after the various braking tests. Values from 220C° to 240C° [430F° to 465F°] were found. In the photo above, Moto Guzzi test rider Antonio Piazzalunga is "disintegrating" the integral braking system for our comparative tests.

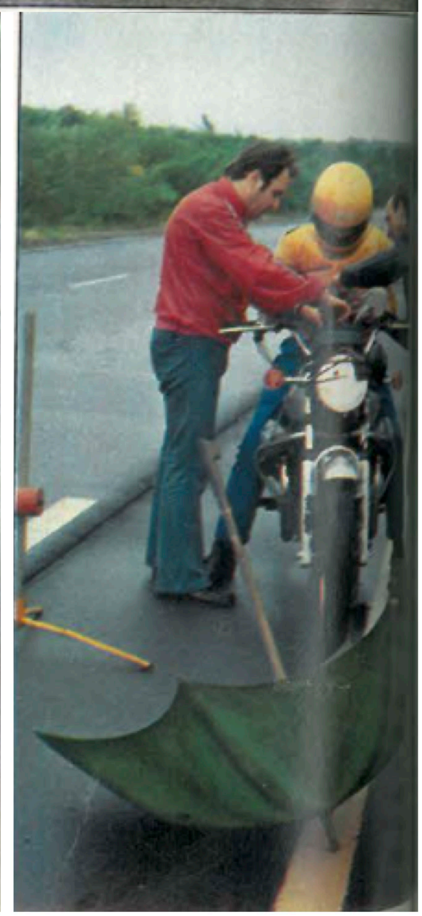


★ Less than two years after the birth of the 850T, which was presented at Motosalone Milan [EICMA] in 1973, Moto Guzzi has put into production a new edition of this model called the T3.

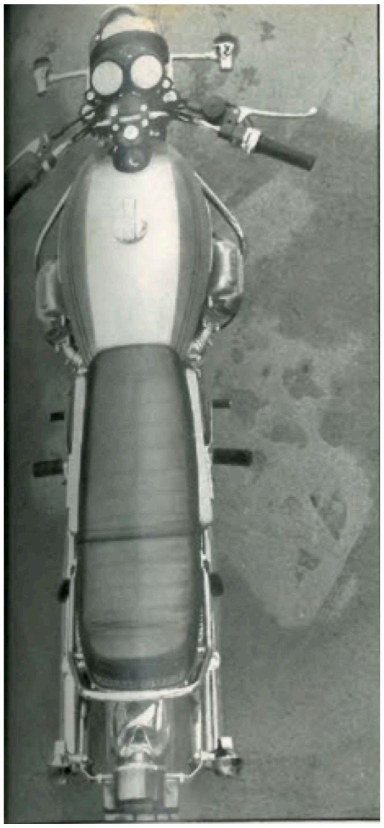
Our focus here on the T3 is justified not so much by its mechanical differences from the 850T, which are not too remarkable, but instead by a braking system that finally says something really new in the field of motorcycle braking.

It is true that motorcycle braking has seen a remarkable evolution in performance with the advent of disk brakes. But everything was always aimed at increasing braking power, while making most maneuvers more challenging.

This may seem like a contradiction, but in fact it is not, because it is sufficient to consider that beyond a certain limit, the use of more powerful brakes requires expertise and great attention, particularly on slippery surfaces.

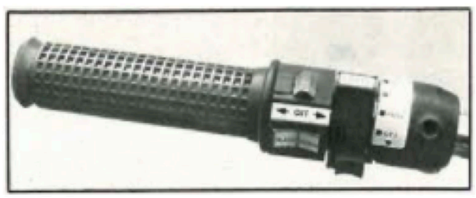


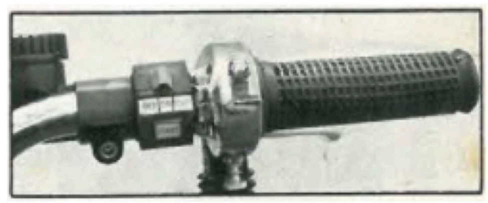
The photo above shows the powerful and exclusive line of the Moto Guzzi 850 T3. With this bike we also did braking tests on wet corners. In the photo on the right, Antonio Piazzalunga and Remo Micheletti change the decelerometer recording disc at the end of a test.



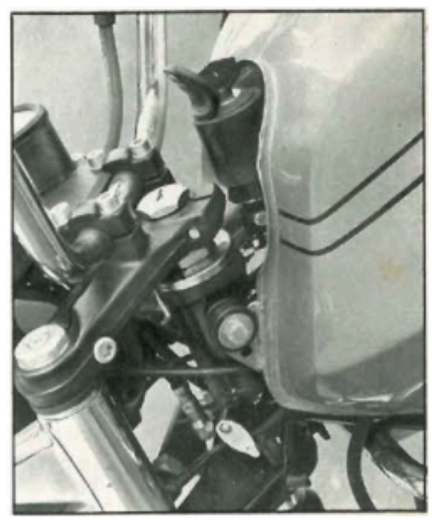
The standard crash bars are sufficiently protective without causing an increase in overall width. Cylinder heads are well exposed to airflow and therefore in the best conditions for proper cooling. The length of the saddle is noteworthy.

The handlebar controls require some familiarization before use. On the left, the turn signal switch above buttons for daytime headlamp flashing and the horn. Next to it, all the light controls are grouped in a single sliding switch equipped (at the bottom) with a safety button that prevents accidentally turning off the lights, with an ensuing and dangerous "leap in the dark." On the right, next to the dual-cable throttle, are the kill switch and the start button.





The new dashboard design. The four [sic] warning lights indicate neutral, running lights, low oil pressure, high beam, and battery discharge. The instruments have good readability, with needles unaffected by oscillation, but the odometer has no trip counter and the speedometer is definitely too optimistic, reading from 13 to 16% high depending on the speed.



The previous steering lock incorporated in the ignition switch has been moved to the side of the steering head.

Moto Guzzi instead have embarked on a new path, in which the enhancement of braking is intended to make it easier and above all safer. To do this, they have implemented so-called "integral braking." Let's see what it is.

Except for a few, distant, and almost forgotten exceptions, motorcycles have always had independently-operated brakes for each wheel. This does not present major drawbacks in normal braking, but in braking near the limit, things change, because the operator needs a combination of coordination, skill, sensitivity and attention that is rarely found among regular riders.

These are problems that no one had ever considered seriously. No one, that is, until the day the brilliant Moto Guzzi engineer Lino Tonti was involved in a pileup on Italy's major motorway, the Autostrada del Sole, while riding a V7 Sport. It was the summer of 1971.

The result was a brake system with a foot control that operates the rear disc and one of two front discs, while the usual hand lever operates the second front disc. Finding the proper distribution of braking effort between the two wheels required long testing and was obtained by a suitable dimensioning of the diameters of the discs, so that locking always occurs first on the rear wheel when the foot control alone is used. The hand lever is used to bring the front wheel to the braking limit.

Though this development is less than earth shattering from the construction point of view, the functional results are really amazing.

Among the most important results is that braking is toned down and made easier, removing the high anxiety the maneuver can induce in panic situations.

The result is a more casual use of the brakes to the advantage of driving safety.

We have seen this in our long test rides on roads, which for the most part were carried out in the rain. We have had further confirmation in the tests we carried out at the track with the collaboration of Pirelli, Moto Guzzi, and Brembo, the brake system's manufacturer.

Our experiments involved a series of braking tests at 50 to 100 kilometers per hour [31 to 62 mph] performed on a wet road using the same motorcycle, first with the front and rear brakes' controls separated, and then with the integral braking system.

In short -- as can be seen in the decelerometer plots on page 129 -- we found that results when using separate controls (both for deceleration and braking distances) were highly variable, because even for an experienced rider it is very difficult to consistently hit the braking limit on both wheels.

On the other hand, using the integrated system produced almost uniform results, both in deceleration and braking distance. So taking the average of the values obtained with the two systems argues strongly in favor of integral control.

But deceleration and braking distance are not an absolute standard for judging the new system. It must also be emphasized that while the separate front and rear controls were observed to produce really alarming skids, with integrated braking the wheels always remained in line, so that it was possible to brake safely even when cornering.

The new braking system is certainly the most important innovation of the T3 compared to the previous T. There are, however, other noteworthy developments.

The engine is characterized by smoother operation due to a different spark advance curve and various tweaks to the intake-exhaust system. Among other things, a cartridge air filter with a built-in engine breather is now fitted to the intake in order to capture oil droplets from the crankcase; intake noise is also very much reduced.

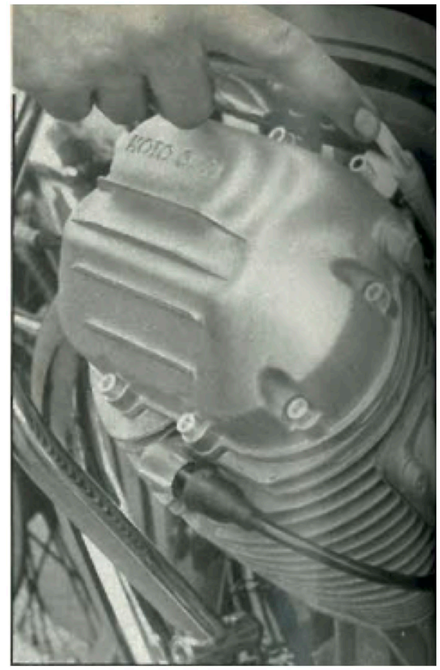
The addition of an engine oil filter has made it possible to increase the interval between oil changes from 3000 to 5000 km.

As for the transmission, mechanical improvements have been made to the internal gearing, to the drive shaft's Cardan joint and to the rear bevel gear box.

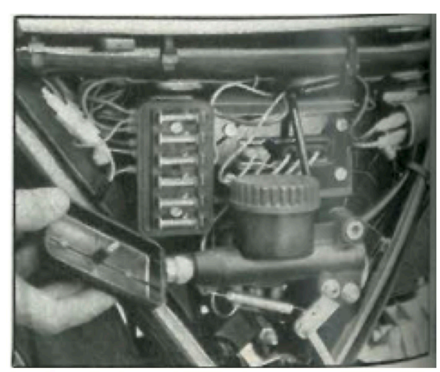
In addition to being less bulky, the new tappet covers allow use of the same knee guards as on the 1000, and it would be good if they were fitted as standard because for taller riders it is easy to touch the heads with the knees especially when transporting a passenger: luckily there is plenty of room on the saddle, so it is no problem for the rider to scoot a little further back.

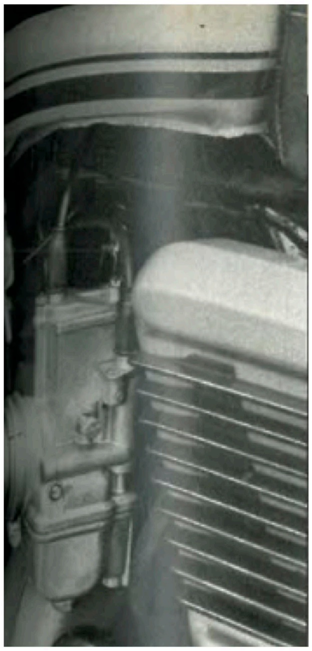
And while we are in the saddle we will give our riding impressions. Everything possible has already been said about the chassis, so we risk repeating ourselves: docile in tight quarters and city driving, in fast corners it really gives the impression of traveling on a track. We were surprised to find some oscillations on the straights at high speeds: the fault must however be attributed to the handlebars, which are too high for a bike of this performance. It is in fact sufficient for the rider to assume a lower operating position for everything to return to normal. Even the rear suspension is not up to the quality of the frame, while the fork, though working very well, dives too easily under braking.

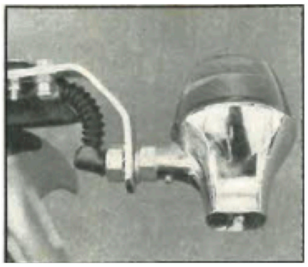
Overall, the ride comfort is excellent, apart of course from the handlebar which is tiring at high speeds.



Finally the two chokes are controlled by a single lever. Fixed to the left cylinder head, it is very easy to operate.

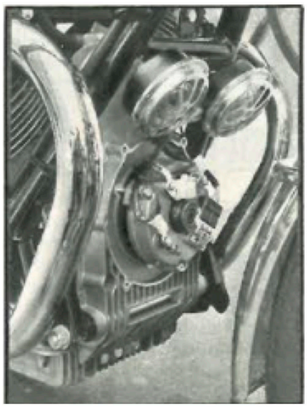




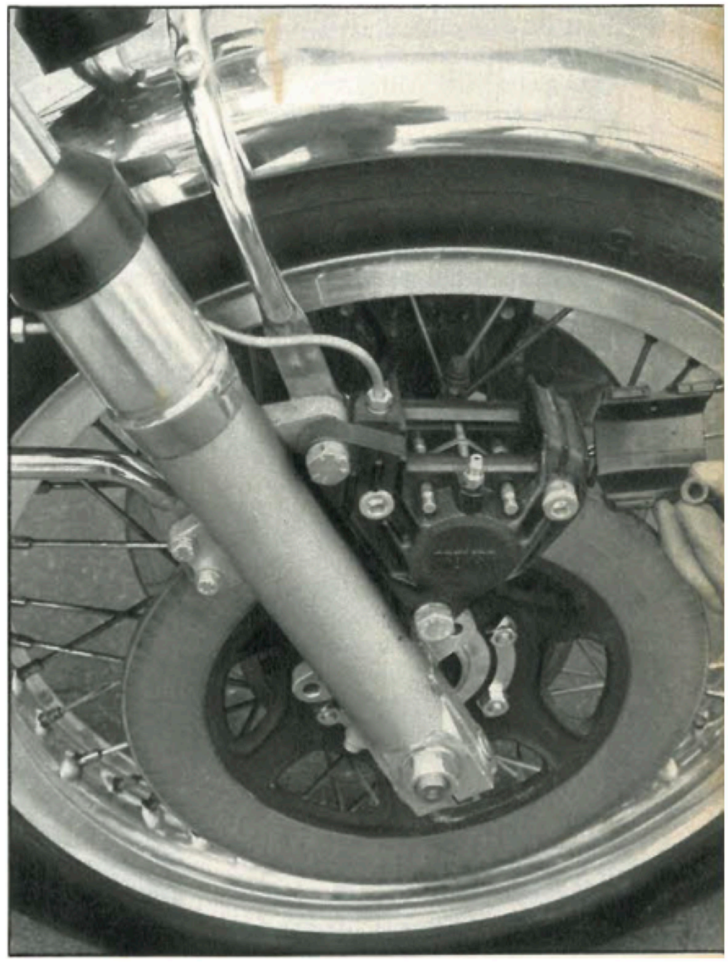


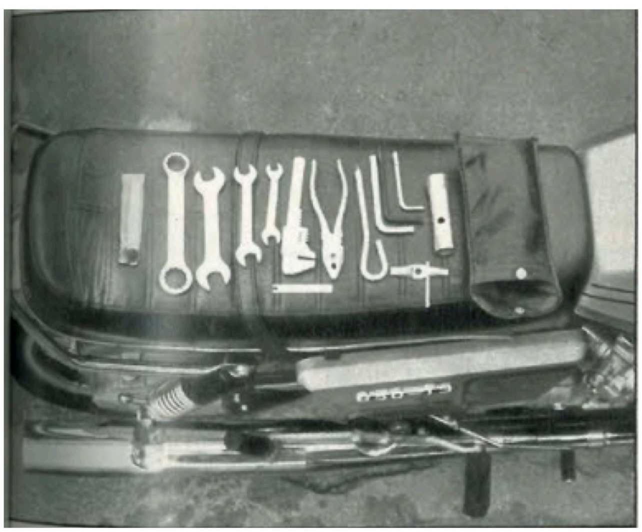
The electrical and control transmission cables are protected by rubber bellows. This is one of the rear turn signals.

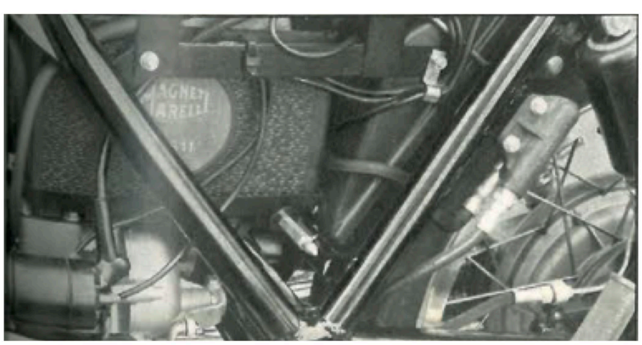
The front brakes consist of two 300 mm diameter discs and two double-piston calipers. Here we see the caliper controlled by the handlebar lever. from which the cover has been removed to check pad wear, along with one of the bleeder valve caps.



A new, more powerful alternator is keyed to the front end of the crankshaft. Also visible are the two horns, of adequate power for the performance of the bike.







The side panels are mounted elastically with a rather flexible fitting mechanism. Under the right-side one (opposite page) is the foot brake cylinder with numerous components of the electrical system, including the fuse box and the turn signal flasher. Unfortunately, these changes led to the disappearance of the two side toolboxes of the T. The modest supply of tools is therefore placed in a low capacity tray under the saddle without any anti-theft protection. We should add that on the left side, as you can see from the photograph, there would have been enough space for one of the toolboxes to survive. Also on the left, behind the rear tube of the frame, you can see the three-way manifold that connects the master cylinder of the pedal control with a front and rear caliper. For the moment, the use and maintenance booklet of the 850 T is still being distributed with the T3.

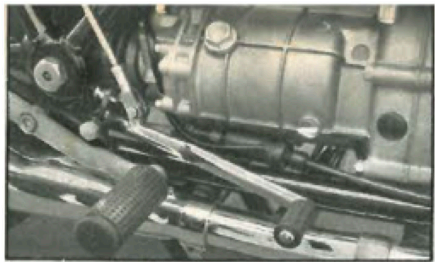
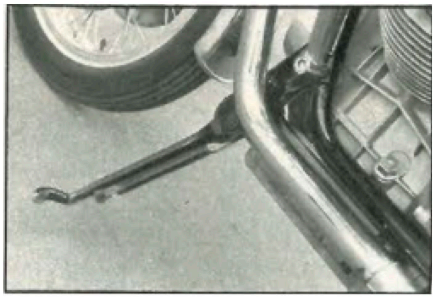
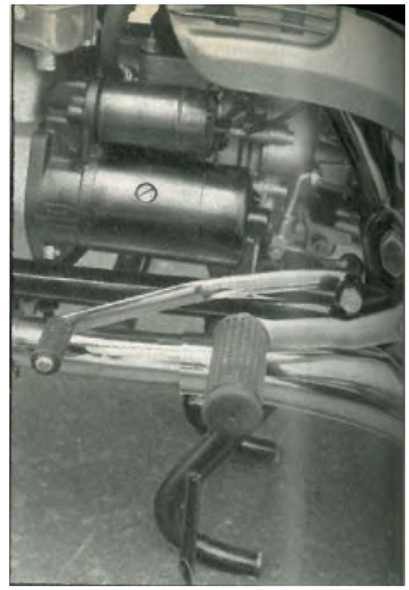
The engine seemed to us more silent and “well-rounded" in operation, and albeit with a certain roughness it pulls without drama even from very low revs (about 2000 rpm); the real power kicks in around 4000 rpm.

The clutch lever has the same very short engagement stroke as before but does not snatch and overall the power transmission seemed softer thanks to the good work of a new flexible coupling. However, given the architecture of the gearbox and clutch, which are in direct contact with the engine, the flywheel effect is pronounced; descending gear changes, especially in low ratios, must therefore be performed with a careful use of the clutch and preceded by an energetic application of the throttle.

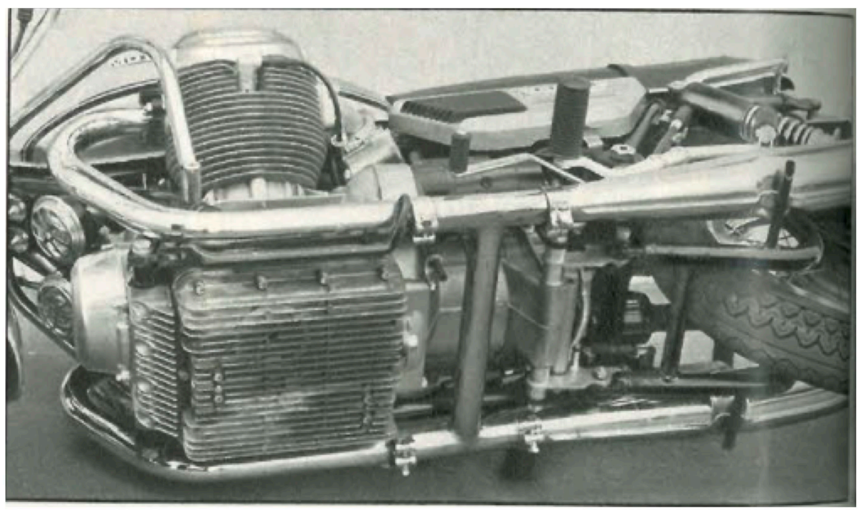
The famous rotational torque reaction is noticeable in practice only when in neutral; while underway in gear it poses no problems.

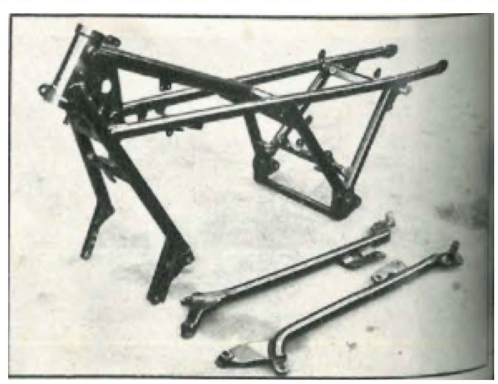
As for performance, the changes are minimal compared to the previous model. The acceleration in the first meters is not explosive because first gear is long, but after the initial sprint the progression is remarkable. As far as the maximum speed is concerned, we measured 182 km/h [113 mph]; obviously with a lower handlebar you could do better.

The new model is also good in terms of fuel consumption. Riding to take full advantage of its performance you cover 13 km / liter [31 mpg], while on a moderately sporting ride it yields about 15 km / liter [35 mpg], finally with a very light hand on the throttle you can reach almost 20 km / liter [47 mpg]. On the other hand, oil consumption is rather high.

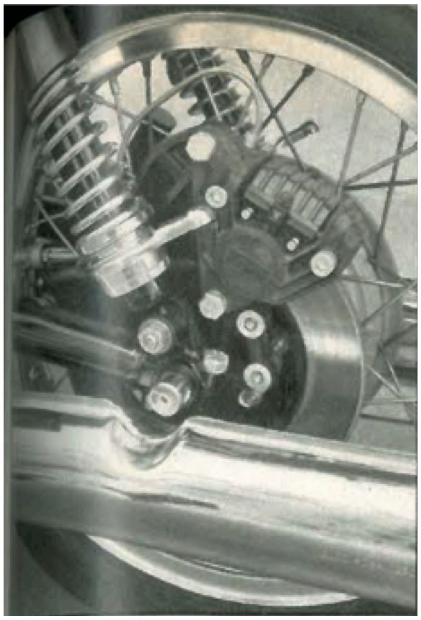
The foot control levers are ideally positioned for comfortable access and are also adjustable. Above right, the gear lever (with first gear down) produced some jamming during downshifting, probably due to imperfect adjustment of the control levers. Above left, we see the brake lever, on the other side of which the safety switch is visible on the clutch cable, which prevents starting if the clutch has not been disengaged. Also visible are the caps for adding and leveling gear oil. To retract the side stand while in the saddle it is necessary to have a tentacular leg, given the very forward position of the stand itself. Automatic return would be preferable. On the other hand, the centerstand is comfortable to deploy, requiring a reasonable effort considering the size of the motorcycle, but given its rather rearward position it poses some problems for the removal of the front wheel.





The now famous Moto Guzzi double cradle detachable frame does not require further comments. The view from below shows the extended finning of the sump and the exhaust crossover between the two pipes. A little ahead of the latter you can see the tube coming from the intake box where the crankcase breather gases are routed.

Testing: Giorgio Centanino, Mario Colombo, Riccardo Selicorni
Graphics: Walter Press
Coordination and photos: Carlo Perelli
Text: Giorgio Centanino
English translation: John Logan



The bevel gear box, the hub and the braking system are all new. The rear caliper is identical to the front ones and is controlled by the rear brake pedal in the same hydraulic circuit as the left front one, while its disc has a smaller diameter (242 mm) to obtain the most appropriate partition of the braking forces. The wheel assembly is much simpler than one might fear; in fact, it is sufficient to extract a pin to detach the caliper and its anchor in order to remove the wheel. The two slotted holes on the caliper attachment are used for mounting the V1000 I-Convert hydro model's parking brake. The shock absorbers have progressive springs and are adjustable to four load positions.

Why It Is Important to Prevent Wheel Lock

Locking a wheel affects braking distance as well as stability and maneuverability. This can be seen in diagram number 1, which shows both the longitudinal coefficient of friction of a wheel (solid line) and the transverse coefficient (dashed line) as functions of the percent of slippage the wheel undergoes in braking. 100% slippage occurs when the wheel locks.

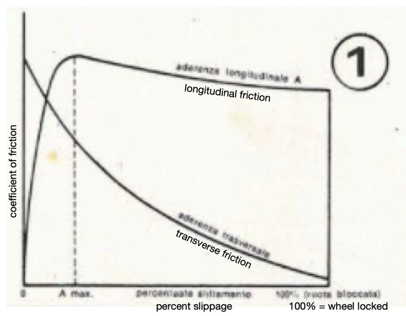
Note that the longitudinal coefficient of friction peaks at about 10 to 20% wheel slip, and then decreases gradually as slippage increases.

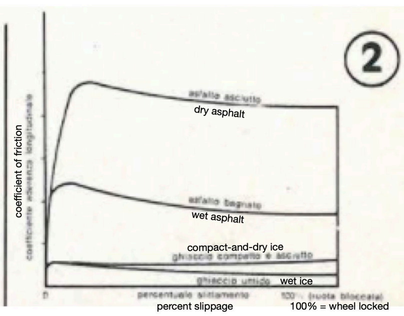
The first conclusion to be drawn is that braking distance will increase with wheel slippage, but this is not the worst consequence. Diagram 1 shows that the transverse coefficient of friction decreases much more rapidly than the longitudinal coefficient as wheel slip rises in an impending wheel lock.

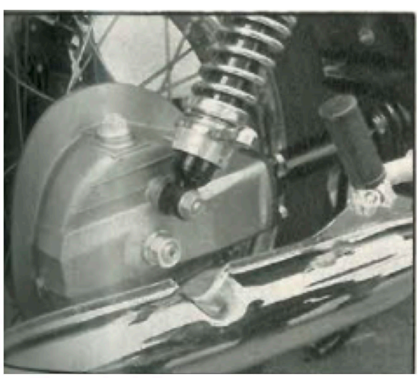
So if you lock the rear wheel, the loss of transverse tractions means a head-to-tail swap, while locking the front causes a loss of directional control from the tire, so that it continues on the trajectory it had prior to locking.

The above conclusions apply to cars too, but for motorcyclists the effect can be even worse as the bike falls over, often with nasty results.

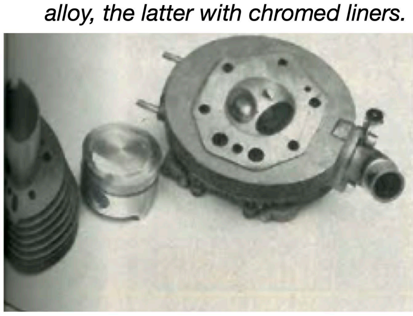
Diagram 2 shows comparative plots of longitudinal coefficients of friction for dry asphalt, wet asphalt, compact-and-dry ice, and wet ice.

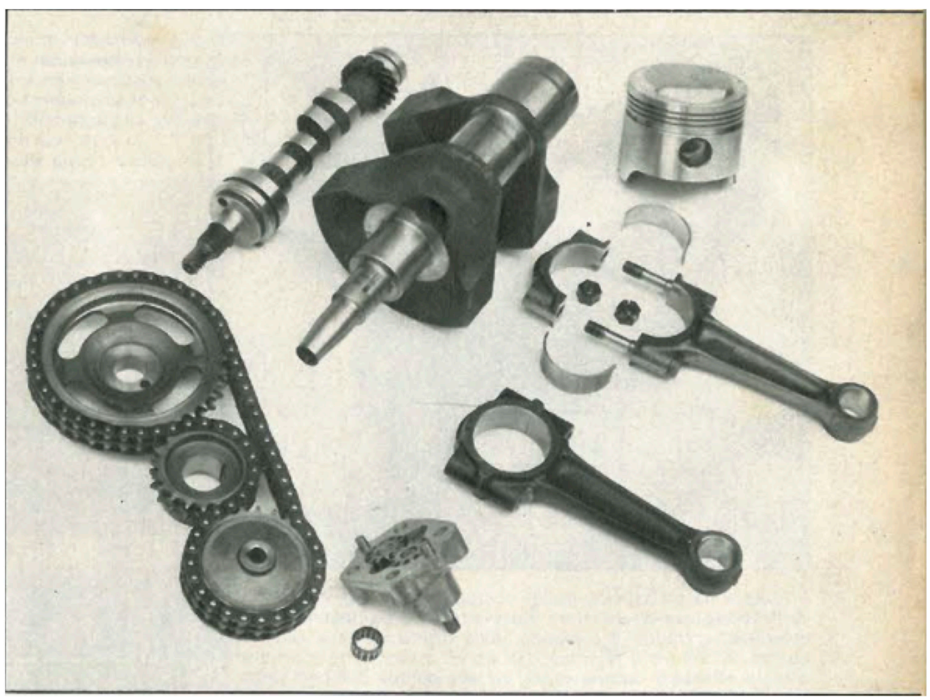




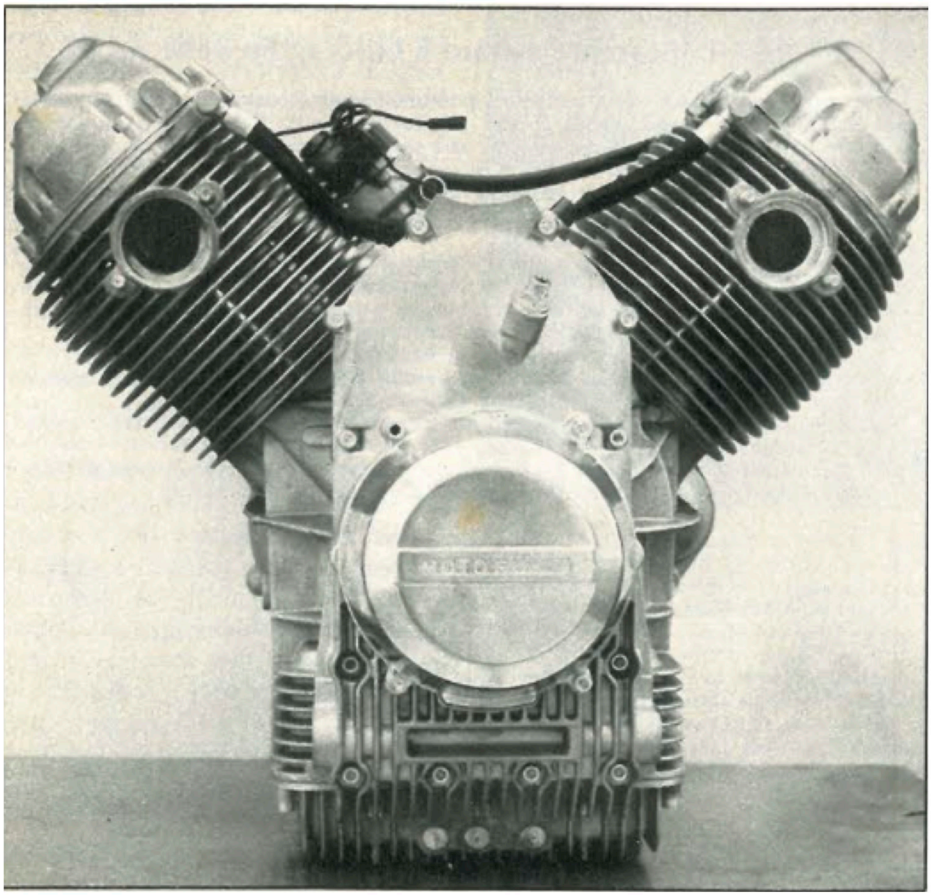


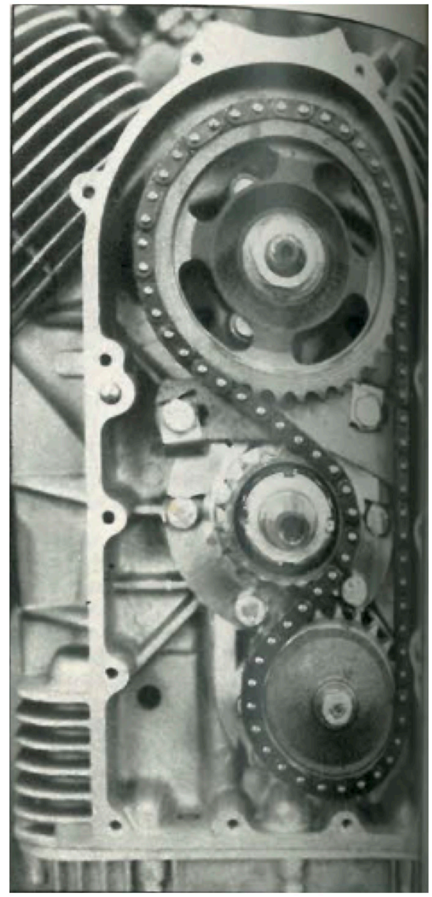
The head and cylinders are light alloy, the latter with chromed liners.



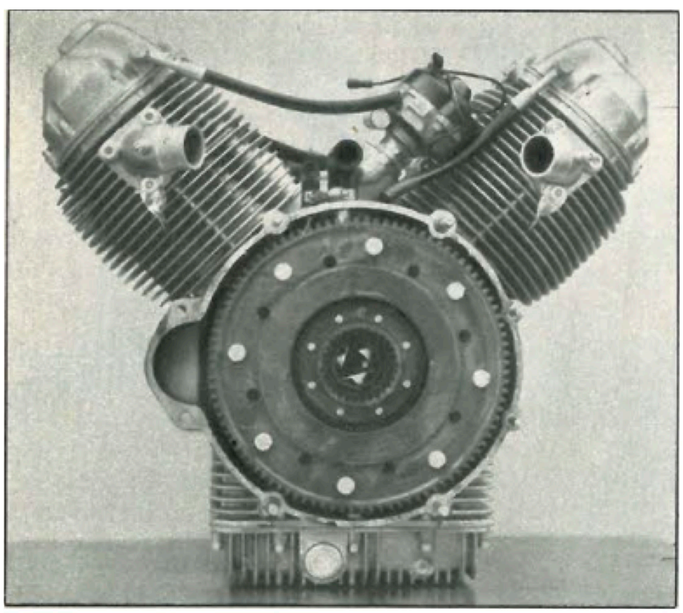


The main internal organs of the engine; you can see the powerful monobloc crankshaft and the automotive-type connecting rods that rotate on plain bearings. The the oil pump shaft rotates in the roller cage that can be seen next to it.

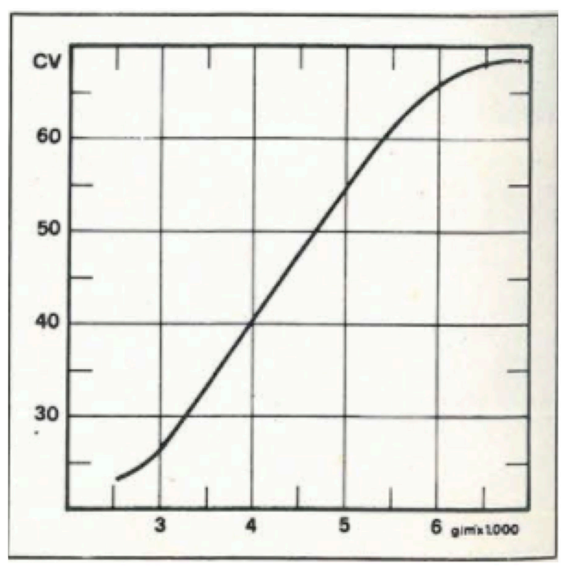




The one-piece crankcase is a beautiful example of light alloy casting. The new oil pan has received substantial modifications to accommodate the cartridge filter, the pressure-relief valve and the mesh filter that we see disassembled on the facing page. It is a little perplexing that to replace the filter cartridge it is necessary to disassemble the sump itself. It is interesting to note that the oil channels are integral to the castings.



The engine has a very compact appearance, made aggressive by the abundance of fins and stiffening ribs. The front case, above right, contains the duplex timing chain. In the center is the drive shaft pinion which transmits motion to the camshaft above, and to the oil pump below. The engine details are complemented by the always interesting horsepower curve, at right.

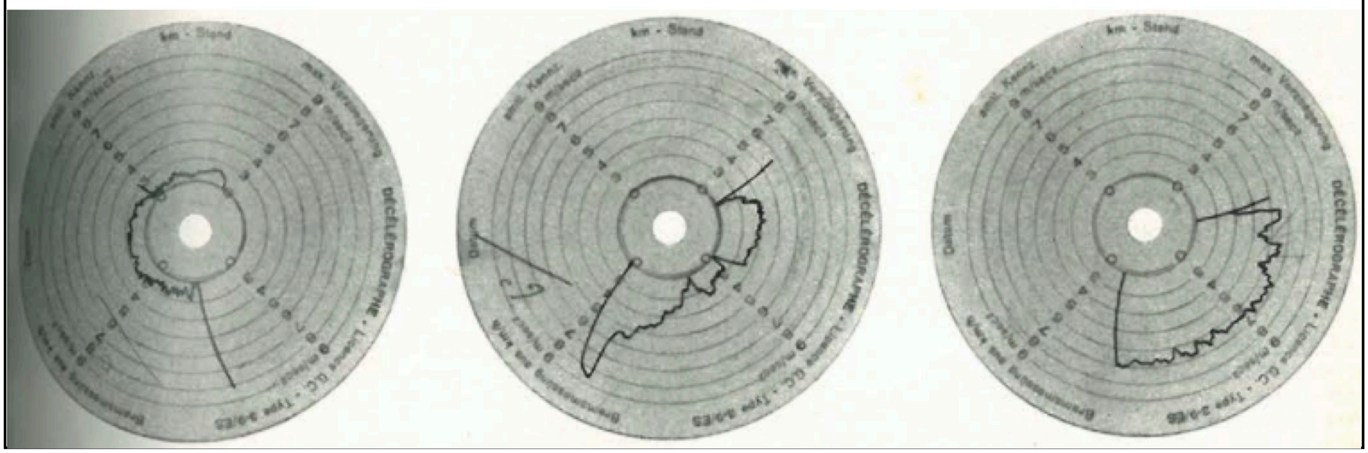


Braking Electrocardiograms for the 850 T3

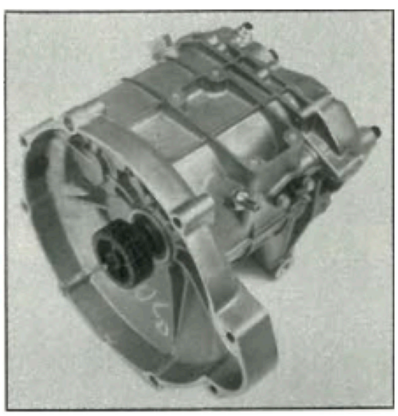
The three charts come from braking attempts from 100 kmh (62 mph) on wet asphalt. They are ink-pen tracings from the decelerometer that was attached to the gas tank. This precision instrument provides, as we see, the instantaneous value of the rate of deceleration as a function of time. Time itself is measured by an angle while the deceleration rate is indicated by the radial excursion of the pen. Diagram 1 shows the result of braking with the rear brake only, diagram 2 the result of using independent front and rear controls, and diagram 3 the integral system result.

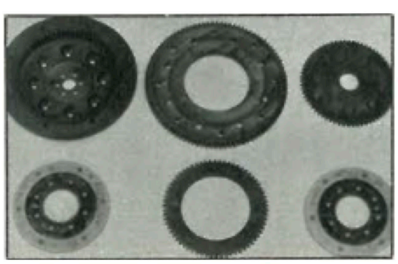
Diagram 2 shows that separated controls result in considerable discontinuity in the rate of deceleration due to the difficulty of separately bringing the two wheels to the friction limit, making it inevitable to reach the point of locking one or the other, forcing the rider to momentarily reduce braking to regain control of the bike. In these cases the majority of motorcyclists may renounce use of the front brake to concentrate attention on the back with the result of obtaining the very low rates of deceleration seen in diagram 1.

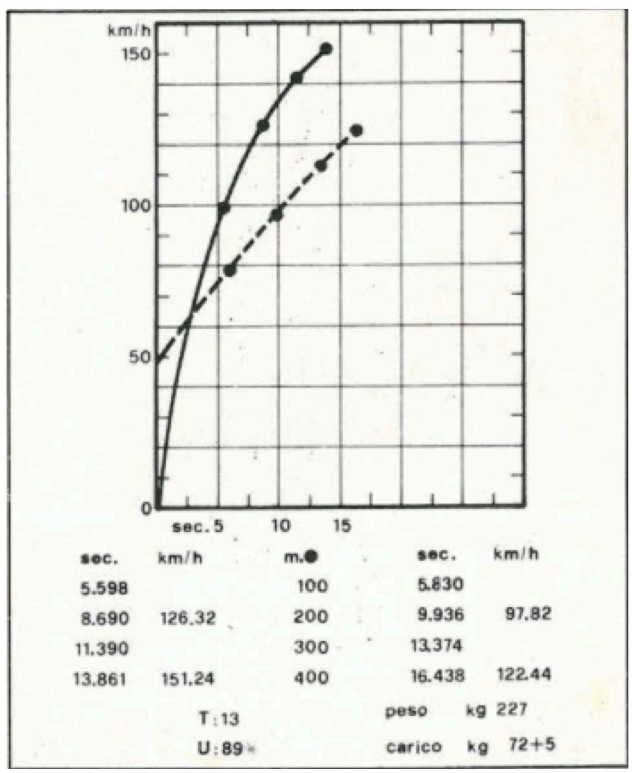
Using integral braking instead, having to operate a single control is much easier and proves the correctness of the system (diagram 3). Incidentally, we note that integral braking produced a deceleration rate near 7 meters per second squared [i.e, near 0.7 g] on wet asphalt, which is the value that the Italian Inspectorate of Motor Vehicles requires on dry asphalt to approve the braking system of a motor vehicle.



In the acceleration graph the dashed curve shows roll-on performance in fifth gear from a low speed [about 50 kph, or 31 mph].







At left, the separate gearbox is connected to the engine by the dry, two-plate clutch seen disassembled in the lower photo.

Le caratteristiche tecniche

MOTORE: bicilindrico 4 tempi a V frontale di 90°. Alesaggio e corsa mm 83 x 78 x 2 = 844,05 cc. Compressione 9,5 : 1. Distribuzione ad aste e bilancieri con asse a camme nel V dei cilindri comandato mediante catena duplex. Diagramma di distribuzione: aspirazione apre 20° prima del PMS e chiude 52° dopo il PMI; scarico apre 52° prima del PMI e chiude 20° dopo il PMS (con gioco di controllo di mm 1,5). Gioco di funzionamento, a freddo: aspirazione mm 0,20, scarico mm 0,25.

ACCENSIONE: a batteria con due ruttori ed anticipo automatico; anticipo iniziale 2°; anticipo automatico 31°; anticipo totale 33°; distanza tra i contatti mm 0,37 ÷ 0,43; candelle grado termico 240 scala Bosch; distanza elettrodi mm 0,6.

LUBRIFICAZIONE: motore, con olio nella sottocoppa del carter, pompa di mandata ad ingranaggi, valvola di regolazione pressione (Atm 3,8 ÷ 4,2) con segnalatore insuff. pressione sul cruscotto; filtri a rete e a cartuccia sulla coppa. Capacità coppa litri 3 olio SAE 10-50 sostituzione ogni 5000 km. Cambio, quantità kg 0,750 circa olio SAE 90, sostituzione ogni 10.000 km. Coppia conica posteriore, quantità kg 0,300 circa olio SAE 90, sostituzione ogni 10.000km.

ALIMENTAZIONE: a caduta, supercarburante, capacità serbatoio litri 24 di cui riserva litri 4 circa.

CARBURATORI: due Dellorto VHB 30 CD (destro) e VHB 30 CS (sinistro), con filtro aria comune, a cartuccia. Diffusore mm 30 getto max 120/100 getto min. 50/100, valvola gas 40, polverizzatore 265, spillo conico V9 fissato alla 2ª tacca. Vite regolazione minimo aperta di 1/2 giro per carburatore destro e sinistro.

AVVIAMENTO: elettrico con motorino 12 V - 0,7 CV, con innesto elettromagnetico telecomandato da pulsante sulla destra del manubrio.

FRIZIONE: doppio disco a secco sul volano motore.

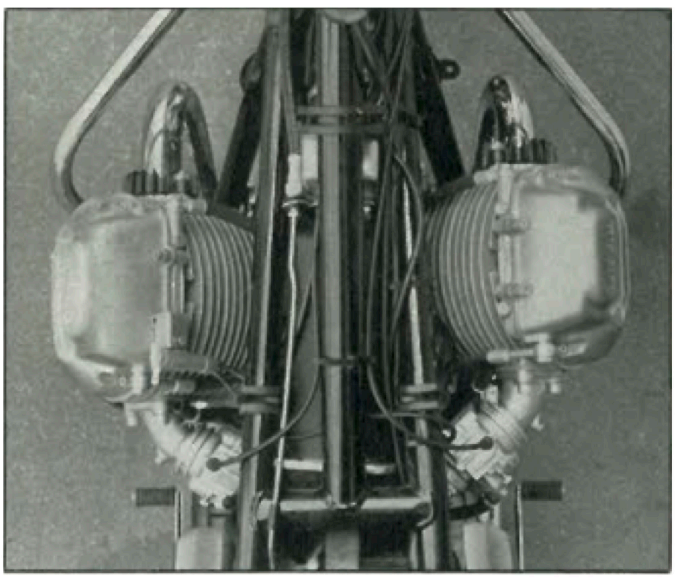
CAMBIO: a cinque rapporti in cascata con ingranaggi sempre in presa ed innesti a manicotti scorrevoli con denti frontali, comandato con selettore e pedale a leva singola sulla sinistra. Albero montati su cuscinetti. Rapporti interni: 1 : 2 (14:28) in prima, 1 : 1,3 (18:25) in seconda, 1 : 1,047 (21:22) in terza, 1 : 0,869 (23:20) in quarta e 1 : 0,750 (28:21) in quinta.

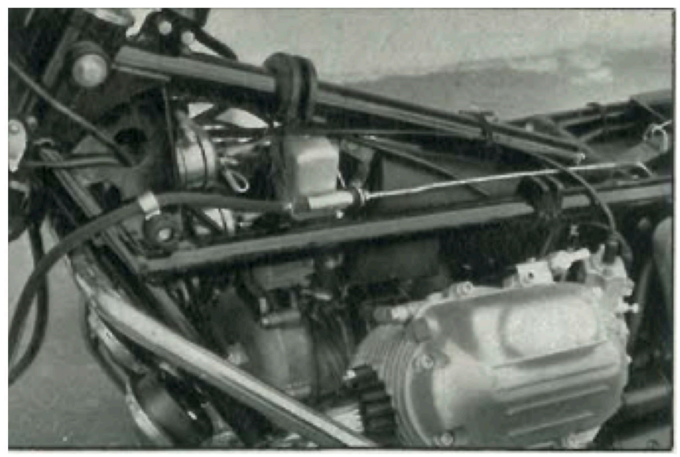
TRASMISSIONI: tra albero frizione e primario cambio, ad ingranaggi diritti e con parastrappi, rapp. 1 : 2,235 (17:21). Tra cambio e ruota posteriore, ad albero con doppio giunto cardanico omocinetico nel braccio destro del forcellone oscillante e coppia conica elicoidale posteriore, rapp. 1 : 4,714 (7 : 33). Rapporti totali di trasmissione 1 : 11,643 in prima, 1 : 8,08 in seconda, 1 : 6,095 in terza, 1 : 5,059 in quarta, 1 : 4,366 in quinta.

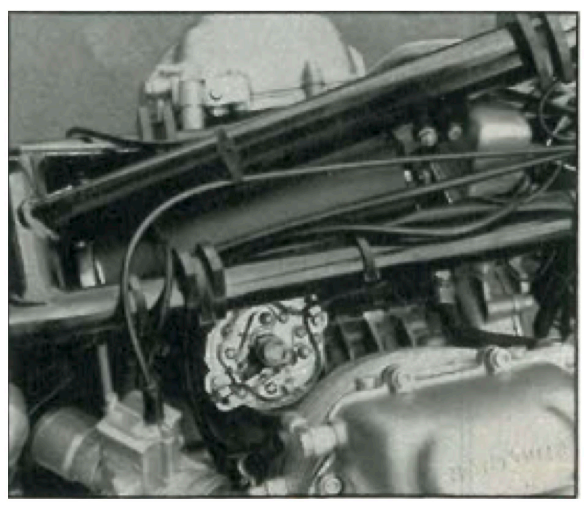
RUOTE E PNEUMATICI: cerchi in lega leggera 3/2,15 x 18 con pneumatici Pirelli 3,50-18 ant. e 4,10-18 post.; pressioni: ant. atm. 2,1 post. atm. 2,4 a solo e atm. 2,6 con passeggero.

IMPIANTO ELETTRICO: a 12 V, con generatore-alternatore 14 V - 20 Ah; batteria 32 Ah; faro anteriore asimmetrico da 170 mm con lampada bilux 45/40 W a lampada posizione 5 W a siluro; fanale posteriore con lampada bilux (posizione e stop) 5/20 W; lampada spia dinamo, olio, folle, luci 3 W sferiche; lampade illuminazione strumenti 3 W sferiche; avvisatore acustico; motorino avviamento 0,7 CV; 4 fusibili da 25 Ah.

DIMENSIONI: lunghezza mt. 2,200; passo mt. 1,47; larghezza (manubrio) mt. 0,780; altezza (manubrio) mt. 0,995; altezza sella mt. 0,810; altezza pedane mt. 0,325; altezza minima da terra mt. 0,15.







The top overview of the engine shows the slight offset of the cylinders. The tappet covers have been redesigned for a smaller size and are thus better protected by the crash bars. To make room for the air filter box, with its intake in the V of the cylinders, the coils have been moved behind the steering head; behind these you can see the alternator regulation unit. Along the left tube of the frame you can see the partly metallic and partly flexible piping that connects the caliper of the front left brake with the pedal control. Next to the right cylinder the ignition distributor assembly is visible without its protective cover. Note the cylinder head breather pipes have been moved to the rear of the tappet covers.