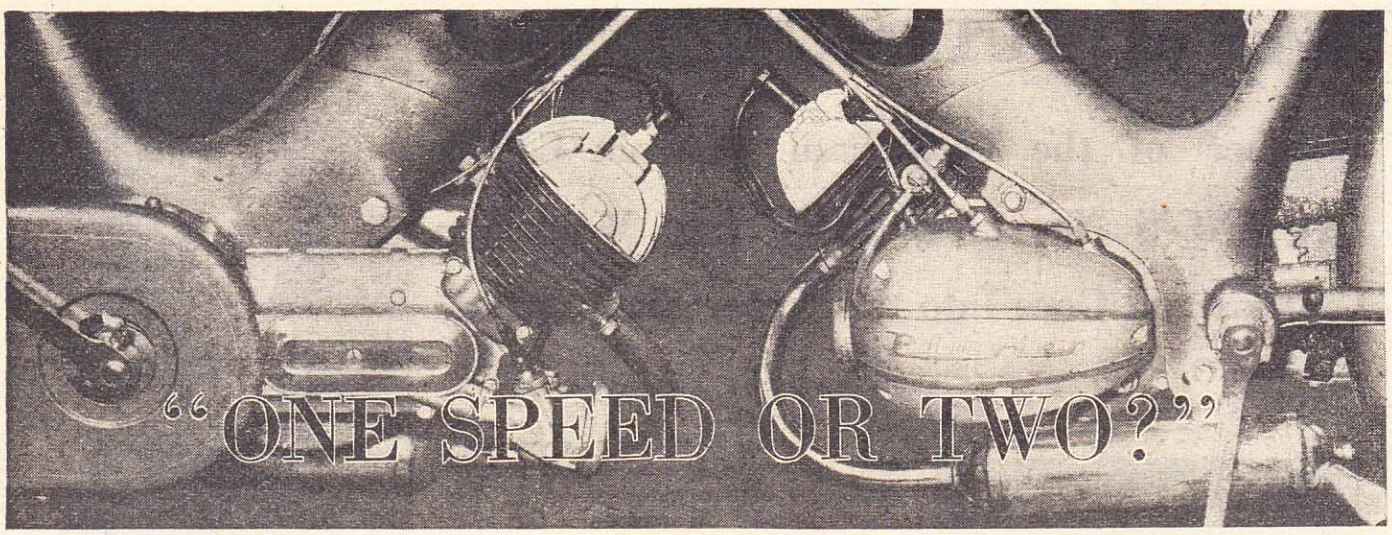

"ONE SPEED OR TWO?"

A "CYCLING" Investigation of the Comparative Advantages of Fixed and Variable Gears

THERE are some enthusiasts who see in the moped's possession, or lack of, a two-speed or three-speed gear the dividing line between a motor-assisted bicycle and a pedal-assisted motorcycle. That—attractive though such an arbitrary formula may be—is, however, a gross over-simplification. For some types of use, the variable gear may well be superfluous; for others, it can just as easily be essential. One thing is certain. Reliable data on the exact differences which exist between single- and two-speeders in the way of performance and handling are hard to come by, and it was to rectify this that CYCLING recently carried out a series of tests with two machines identical save for their gearing.

Chosen for the task were two Berini models—the M.21 single-speeder and M.22 two-speed machine. The reason for this decision was that here we have mopeds which utilize the same engine; the same clutch; the same frame and forks and the same ancillaries. The major differences between them are the use of a two-train, constant-mesh two-speed gear on the M.22, which also has 23-in. tyres in place of the 24-in. of the M.21. Overall gearing in the case of the single-speeder is 14.7 while the two-speeder offers a choice between 22.5 to 1 in bottom gear and 13.8 to 1 in top. The respective weights are 88 lb. and 90 lb., while the power output of the engine is identical in each machine—1.8 b.h.p. at 4,800 r.p.m.

Each of these two machines, kindly supplied for the job by Currys Ltd., the Berini concessionaires, was put through its paces on 13 different tests, embracing speed, acceleration, economy, hill-climbing, general road work, and performance under pedal power alone. The same speedometer and drive gear was used in each case, its accuracy on each machine being checked before the tests commenced.

First, maximum speed figures were obtained. As expected, these proved to be identical at 29 m.p.h. The single-speed M.21 reached its maximum in 25 sec. from rest, with just a dab of the pedals to help it get under way.

The same assistance was permitted the M.22, although it *could* have moved off from a standstill without it. Despite a relatively slow gear-change, the two-speeder showed a slight improvement over the M.21, but only to the tune of one second—24 sec. to 29 m.p.h., compared with 25 sec.

With speed and acceleration capacities established, the machines were taken on a series of circular runs. The first was short—just a mile in duration. Next came a six-mile run which contained two long descents, but only one major climb. This was a mile in length, but required only top gear. Finally a three-mile run was specified, but this contained a hill steep enough to bring the two-speeder down to bottom gear. These represented the type of journeys which the everyday moped would most likely be called upon to make—a short shopping expedition; a ride to work; a social visit in hilly country.

On the one-mile circuit, the single-speeder "broke the ice" with a run in three minutes flat—20 m.p.h. from a standing start, with four turns, two of them from minor to major roads. The first quarter of a mile was on a rise; the last quarter downhill.

The two-speed machine had no difficulty in knocking seven seconds off the time on this test. Even so, this represents an average of only 20.8 m.p.h.—little more than three-quarters of a mile per hour better than the single-speed moped could accomplish, and a clear indication that, where no steep hills occurred, the simpler machine could hold its own.

Two Speeds No Advantage?

This thesis was amply proved by the six-mile run. Besides several sharp and tricky bends, this contained five turns, four of them slowish. The two-speeder found it quite impossible to better the single-speeder on such a run, both models returning identical times of 13 min. 20 sec. (26.4 m.p.h.). Thus, where it was possible to use maximum speed for miles at a time, the mere possession of a variable gear obviously bestowed no advantage, even on the pull-away from the slow corners. At first, this was a surprise, in view of the slightly better acceleration figures recorded by the two-speeder, but the probable explanation is that the single-speeder lost out solely on the time taken to begin rolling. Acceleration from a rolling start, such as would be the case in pulling away from a slow corner, must have been almost identical in each case, with the split second taken up in gear-changing on the two-speeder.

counterbalancing the slightly slower pick-up of the single-speed machine.

There remained the three-mile run, containing six corners and a steep hill. Here, the two-speed gear proved its worth. Pedal assistance with the single-speed machine began half-way up the hill, and was continued until close to the crest. The point at which it was necessary to pedal was exactly that at which bottom gear was engaged on the M.22, which consequently needed no assistance at all. And its time for the trip was 8 min. 48 sec., compared with 8 min. 57 sec. on the M.21.

If the worth of the gear had been measured in miles per hour, however, it would not have shown up so well. The nine-second difference represented only a fractional improvement in speed from 19.1 m.p.h. to 19.4 m.p.h.; the importance lay elsewhere . . . in the saving of several hundred yards of pedalling and in fuel consumption.

How Much Petrol?

Fixed-speed figures tell only a part of this story. They show that at 20 m.p.h. a single-speed moped could cover 156 miles to a gallon of petrol compared with 160 miles for a two-speeder. However, both sets of figures are subject to a "plus or minus" tolerance of 2 m.p.g., and the truest comparison which can be given on the basis of these figures alone is to say that the maximum difference between the two machines, under equal conditions of wind, load and road, is 8 m.p.g. (assuming true readings of 154 and 162 m.p.g. respectively); while the minimum is no difference at all. Thus the advantage lies with the two-speeder, though it is only slight.

Tested over a hilly stretch, however, the two-speeder still showed a superiority. Over a set distance, 12 c.c. of petroil was used, compared with 12.6 c.c. fed into the single-speed machine. This 5 per cent. difference is equivalent to the postulated maximum saving deduced from the level-road figures; on the other hand it is twice the nominal difference of the level-road figures, which gives a strong indication that in hilly country the two-speeder would not only prove freer from pedal assistance, but would also be speedier and more economical. That the degree of economy effected would depend to some extent on driving tactics, however, was shown by two sets of uphill acceleration fuel readings, which showed no difference at all between single- and two-speed machines when a fairly consistent rate of acceleration was aimed at (each 4.3 c.c.), but which indicated that more rapid acceleration on the two-speeder, with bottom gear engaged for most of the distance, would result in a steep increase in the fuel used—4.8 c.c., or over 11 per cent. more.

Hill-climbing tests came down in favour of two speeds. A long grinding climb of a mile or so in length took 2 min. 34 sec. from a standing start on the M.22 compared with 2 min. 37 sec. on the M.21. Tackled from a flying start, the same hill was climbed by the single-speeder in 2 min. 25 sec., and the two-speeder could only equal it. When restarting on the hill was included, however, it was ascertained that the single-speeder required pedal assistance for 20 yards before sufficient speed had been gained to let the engine bear the whole strain, whereas the two-speeder required none at all.

Finally, comparative tests were made at pedalling the machine one-tenth of a mile uphill from a standing start. The single-speed model needed 67 seconds compared with 68 seconds for the two-speeder, and was considerably easier to pedal, though this was undoubtedly due to the fact that the seat was higher set to allow for pedalling in the course of riding.

What conclusions can be drawn from the data established during the tests? Really, only the obvious ones—that a single-speed moped is, taken all round, in no way inferior to the equivalent variable-geared machine save in the manner in which hills are surmounted. Here the rider's muscle power must take the place of a lower gear. Now moped pedalling in heavy kit, for instance, is not too easy a business, and the single-speeder's suitability must obviously be linked to its rider's abilities; the type of journey he intends to make daily; the kind of kit he intends to wear; and, most important, the nature of the terrain over which he must pass. For city work; for 10-mile journeys in flat or gently undulating country; even for short trips in frankly hilly country—in all of these cases, the single-speed machine would suffice.

The man who intends to ride long distances each day, or whose riding will be done in territory with stiff hills . . . the type up which the average touring cyclist would walk . . . and the man whose work is of such nature that he must wear heavy kit when riding, would be better satisfied with a two-speed machine. But in neither case should he imagine that he is purchasing a motor-cycle, assisted or otherwise!

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— COMPARATIVE FIGURES FOR THE BERINIS —

M.21—SINGLE-SPEED

Maximum Speed : 29 m.p.h in 25 sec. from rest.

Economy : 156 m.p.g. at 20 m.p.h.

Braking :

	From 20 m.p.h.	From 30 m.p.h.
Both brakes ..	12 feet.	Not applicable.
Front only	22 feet.	Not applicable.
Rear only	25 feet.	Not applicable.

Load carried during test : 200 lb.

Engine : Berini two-stroke; 40 mm. bore x 38 mm. stroke = 49 c.c.; c.r. 6.8 to 1; 1.8 b.h.p. at 4,800 r.p.m.

Gearbox : Countershaft clutch in unit with engine; single speed; gear primary and chain final drives.

Frame : Welded-up from steel pressings and tubular members; telescopic front forks; rigid rear end; integral fuel tank.

Tank : 1½-gal. capacity.

Lights : Head lamp fed direct from Bosch flywheel magneto-generator. Also rear lamp (extra).

Wheels and Brakes : Front brake 3¼-in. internal expanding; rear brake of coaster type. Chromium-plated rims with rust-proof spokes; 2.00-in. x 24-in. Vredestein whitewall tyres.

Equipment : Bulb horn; luggage carrier; rear stand, plug spanner.

Finish : Silver-green enamel with chromium-plated details.

Weight : 88 lb.

M.22—TWO-SPEED

Maximum Speed : 29 m.p.h. in 24 sec. from rest.

Economy : 160 m.p.g. at 20 m.p.h.

Braking :

	From 20 m.p.h.	From 30 m.p.h.
Both brakes ..	15 feet	Not applicable
Front only	32 feet	Not applicable
Rear only	27 feet	Not applicable

Load carried during test : 200 lb.

Engine : Berini two-stroke; 40 mm. bore x 38 mm. stroke = 49 c.c.; c.r. 6.8 to 1; 1.8 b.h.p. at 4,800 r.p.m.

Gearbox : In unit with engine; two speeds, with handlebar twist-grip change; nylon gear primary drive; chain final drive; separate pedalling chain.

Frame : Front section welded-up from steel pressings; rear end tubular; integral fuel tank; telescopic front forks.

Tank : 1½-gal. capacity.

Lights : Head lamp fed direct from Bosch flywheel magneto-generator; wiring for tail lamp provided.

Wheels and Brakes : Front brake internal-expanding, 3¼-in. diameter; rear brake of coaster-hub type; chromium-plated rims and rust-proof spokes; 2.00-in. x 23-in. tyres.

Equipment : Rear stand; luggage carrier; plug spanner.

Finish : Polychromatic grey-green and silver, with chromium-plated details.

Weight : 90 lb.

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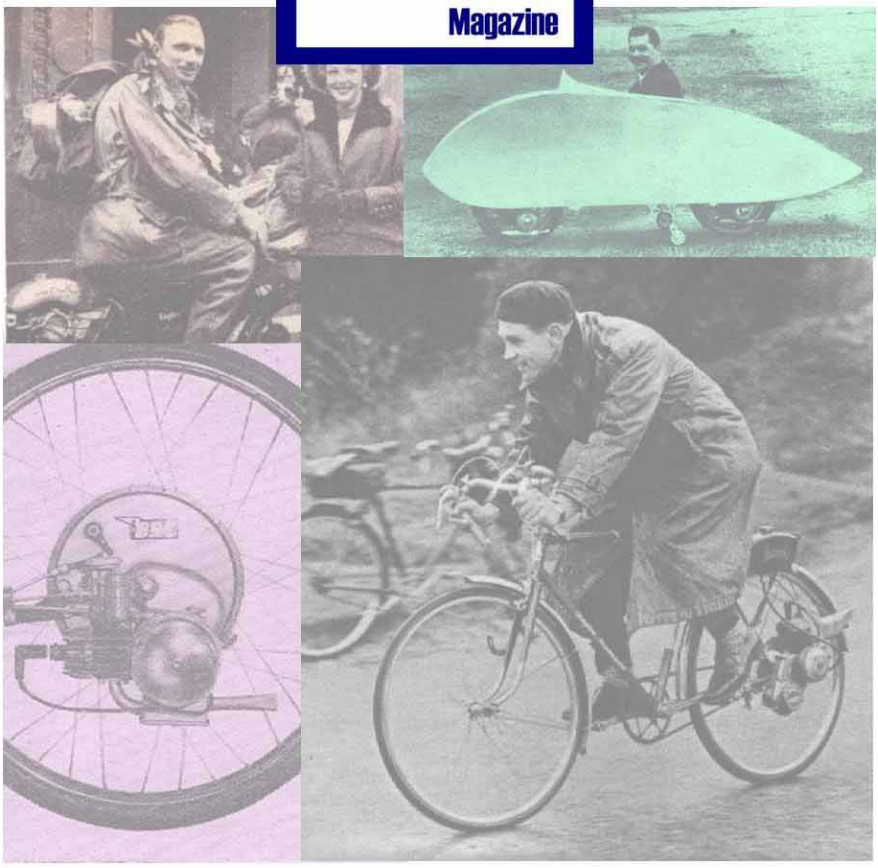

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