THE ENFIELD CYCLE CO. LTD., REDDITCH, ENGLAND

Steve, with my compliments —

Farrell Flanagan
374 alma Rd
nth Caulfield
vic. 3161
australia

NOTES ON TUNING ROYAL ENFIELD "350 BULLET" AND "500 BULLET" MOTOR CYCLES FOR COMPETITION PURPOSES

The following notes describe the special components available for tuning standard 350 and 500 "Bullet" machines for use in various types of competitive events. Specially prepared "Bullets" are available for Trials, Scrambles and Short Circuit Racing events. Where these machines incorporate any of the special parts available this fact is indicated by a note in the text.

Compression Ratios:

Pistons giving the following ratios are available.

350 c.c.	6½:1*	Part No.	37714	1.9/64" dome.	Standard 1947/54.
	7¼:1*	" "	40220	9/32" dome.	Standard 1955.
	7½:1 ‡§	" "	35214	11/32" dome.	Racing on Petrol.
	8½:1	" "	35445 ‡	3/8" dome.	Racing on Petrol (80 octane +) or Petrol Benzol.
	10½:1†	" "	35663	11/16" dome.	Racing on Methanol.
500 c.c.	6½:1*	" "	38504	⅜" dome.	Standard.
	7¼:1*				Racing on Petrol.
	8:1†	" "	39596	17/32" dome.	Racing on Petrol (80 octane +) or Petrol, Benzol.
	9½:1†	" "	39597	45/64" dome.	Racing on Methanol.

Notes:

*These pistons are made of low expansion alloy and have split skirts.

All other pistons are heat treated "Y" alloy with solid skirts.

†These pistons are intended to be run with the head joint made by lapping (no gasket).

§This piston gives a ratio of 7¼:1 (suitable for racing on Petrol) when run with the head joint made by lapping (no gasket).

Cams:

Quick lift cams (standard on the Short Circuit Racer) are available for both sizes of engine. They have no quietening ramps, extra lift, higher acceleration on initial opening and final closing, lower acceleration over the nose of the cam (thus permitting higher r.p.m. free from bounce with same springs and valves) and a longer opening period. When set to the marks they give the following opening and closing points at .010" tappet clearance:-

Exhaust opens	82° before B.D.C.
" closes	43° after T.D.C.
Inlet opens	43° before T.D.C.
" closes	70° after B.D.C.

The standard cams at .012" tappet clearance give the following figures:-

	350 Bullet	500 Bullet
Exhaust opens	75° before B.D.C.	75° before B.D.C.
" closes	35° after T.D.C.	35° after T.D.C.
Inlet opens	30° before T.D.C.	40° before T.D.C.
" closes	60° after B.D.C.	70° after B.D.C.

These opening and closing points, however, do not give a true picture of the effect of the special cams which is largely influenced by the more rapid rate of opening and closing which they provide. The quick lift cams are beneficial above 4,500 r.p.m. and detrimental below that speed. They are therefore to be recommended when the course is of such a nature that close ratio gears can usefully be employed and the engine kept always above 4,500 r.p.m. On scrambles or short circuit courses with many sharp bends or steep inclines where the road speed must fall so that wider gear ratios are desirable, the quick lift cams are of doubtful value since under these conditions the loss of acceleration from a speed below 4,500 r.p.m. may cancel out the benefit to be gained from the mile or two per hour increase in maximum speed which they permit. For Trials of the nature of English One-Day or Scottish Six Days' events where low speed pulling is of paramount importance the quick lift cams are, of course, definitely detrimental.

Valves and Valve Springs:

All "Bullet" engines are fitted with light valves and springs strong enough to enable the peak of the B.H.P. curve to be exceeded without valve bounce. Further lightening of valves or fitting stronger springs is not recommended. The high speed performance of early 1954 and previous "350 Bullet" engines can be improved by fitting an inlet valve 1 9/16" top diameter (now standard) instead of 1½" diameter. This does not require the inlet port to be opened out but the seat must be cut wider to suit the valve and the corner between the seat and the bore of the port carefully radiused.

Carburetter:

The use of an Amal G.P. carburetter (standard on the Short Circuit Racers) gives a small improvement in maximum power and speed. Carburetter settings are affected to some extent by local conditions and experiments should always be carried out to arrive at the setting giving the best results. The following table gives the approximate settings for different types of carburetter on different fuels.

Machine	Fuel	Type of Carb.	Choke Bore ins.	Main Jet	Needle	Needle Position	Needle Jet	Throttle Valve
350 Bullet (Trials)	Petrol	Std.	15/16	140	Std.	3	Std.	6/3
350 Bullet (Std. or Scrambles)	Petrol or Pet-Benzol	Std.	1	140	Std.	3	Std.	6/4
350 Bullet (Scrambles)	Methanol	Std.	1	360	Std.	3	113	6/4
350 Bullet (S.C.Racer)	Petrol or Pet-Benzol	G.P.	1.1/16*	210	G.P.6	2	109	No. 5
350 Bullet (S.C.Racer)	Methanol	G.P.	1.1/16*	530	G.P.	3	125	No. 5
500 Bullet (Trials, Std. or Scrambles)	Petrol or Pet-Benzol	Std.	1⅛	180	Std.	2	Std.	29/3
500 Bullet (Scrambles)	Methanol	Std.	1⅛	460	Std.	3	113	29/3
500 Bullet (S.C.Racer)	Petrol or Pet-Benzol	G.P.	1.3/16	250	G.P.6	2	109	No. 5
500 Bullet (S.C.Racer)	Methanol	G.P.	1.3/16	640	G.P.	3	125	No. 5

* On earlier engine inlet port will require boring out to 1.1/16 in. to suit carburetter.

Racing Magnetos:

The Lucas "Wader" Magneto, fitted standard to Trials, Scrambles and Short Circuit Racing Bullets, not only gives a powerful and reliable spark at high speeds but is completely waterproof.

If a standard machine is to be used the dynamo portion of the Magdyno should be removed and replaced with a wooden block. If water is likely to be encountered the contact breaker, H.T. pick-up, etc., should be made as waterproof as possible with plasticine, insulation tape, etc.

Magneto timing varies according to the fuel used and the compression ratio. In general the higher the compression ratio the less advance is needed and a setting slightly later than standard may be desirable, e.g. $\frac{3}{8}$ in. before T.D.C. for the "350 Bullet" and $\frac{1}{4}$ in. before T.D.C. for the "500 Bullet". An excellent plan is to time the engine with more advance than is likely to be required and then find by experiment the position of the ignition control lever which gives the best results. Check the piston position at which the contact points open with the control in this position and then re-time to give this setting when fully advanced. The magneto should never be run with the control permanently retarded.

Gear Ratios:

Top Gear. Choice of gear ratio to suit the course is of the utmost importance. The power available from an engine depends on the speed at which it is running and top gear should be chosen so that when the machine is at the highest speed which can be reached on any particular course the engine is running at or near the speed giving maximum power. Gearing too high or too low will reduce the power available from the engine and therefore the speed of the machine. The power curve is usually nearly flat for about 500 revs. per minute before reaching its peak and on fast courses wear and tear will be reduced and reliability of the engine increase by gearing high so as to reduce engine speed. On the other hand, on slow courses where acceleration is of particular value it may pay to gear low so that at one or two points the engine exceeds the r.p.m. giving maximum power and approaches its safe maximum r.p.m.

The following table gives the road speeds corresponding to different engine speeds, tyre sizes and top gear ratios. The ability to reach the speeds quoted for the higher gear ratios and engine speeds will, of course, depend on the power available and the ability of the rider to streamline himself on the machine.

350 BULLET, TOP GEAR

Rear Spkt. T.	Engine Spkt. T.	C/shaft Spkt. T.	Top Gear Ratio	Rear Tyre Size in.	M.P.H. Road Speed Corresponding to 6,000	6,500	7,000
38	20	14	7.6:1	3.25-19	60	65	70
				3.50-19	61	66	71
				4.00-19	62	68	73
38	20	15	7.1:1	3.25-19	64	69	75
				3.50-19	65	70	76
				4.00-19	67	72	78
38	20	16	6.65:1	3.25-19	68	74	80
				3.50-19	69	75	81
				4.00-19	71	77	83
38	20	17	6.25:1	3.25-19	72½	78½	84½
				3.50-19	74	80	86
				4.00-19	76	82	88½
38	25	14	6.07:1	3.25-19	75	81	87
				3.50-19	76	82	88½
				4.00-19	78	84	90½
38	25	15	5.67:1	3.25-19	80	86½	93
				3.50-19	81	88	95
				4.00-19	83	90	97

continued.....

Gear Ratios (cont.):

Rear Spkt. T.	Engine Spkt. T.	C/shaft Spkt. T.	Top Gear Ratio	Rear Tyre Size in.	M.P.H. Road Speed Corresponding to 6,000	6,500	7,000
38	25	16	5.32:1	3.25-19	85	92	99
				3.50-19	86½	94	101
				4.00-19	89	96	104
38	25	17	5.1:1	3.25-19	90	98	105
				3.50-19	92	99½	107
				4.00-19	94½	102½	110

350 OR 500 BULLET TOP GEAR

Rear Spkt. T.	Engine Spkt. T.	C/shaft Spkt. T.	Top Gear Ratio	Rear Tyre Size in.	M.P.H. Road Speed Corresponding to 5500	6000	6500	7000
46	25	14	7.35:1	3.25-19	56½	62	67	72
				3.50-19	57½	63	68	73
				4.00-19	59	64½	70	75
46	25	15	6.86:1	3.25-19	61	66	72	77
				3.50-19	61½	67	73	78½
				4.00-19	63	69	75	80
46	25	16	6.43:1	3.25-19	65	70½	76½	82
				3.50-19	66	72	78	84
				4.00-19	67½	74	80	86
46	25	17	6.06:1	3.25-19	69	75	81	87½
				3.50-19	70	76	82½	89
				4.00-19	71½	78	85	91
46	25	18	5.72:1	3.25-19	72½	79	86	92½
				3.50-19	74	80½	87½	94
				4.00-19	76	83	90	96½
46	25	19	5.42:1	3.25-19	77	83½	90½	97½
				3.50-19	78	85	92	99
				4.00-19	80	87	94½	102
46	25	20	5.15:1	3.50-19	82	89½	97	
				4.00-19	84	92	99½	
46	25	21	4.91:1	3.50-19	86	94	102	
				4.00-19	88½	96½	104½	

500 BULLET TOP GEAR

Rear Spkt. T.	Engine Spkt. T.	C/shaft Spkt. T.	Top Gear Ratio	Rear Tyre Size in.	M.P.H. Road Speed Corresponding to 5,500	6,000	6,500
46	29	14	6.35:1	3.50-19	67	73	79
				4.00-19	68	75	81
46	29	15	5.91:1	3.50-19	71½	78	84½
				4.00-19	73½	80	87
46	29	16	5.54:1	3.50-19	76	83	90
				4.00-19	78½	85½	93
46	29	17	5.22:1	3.50-19	81	88	95½
				4.00-19	83	90½	98½
46	29	18	4.93:1	3.50-19	85½	93½	101
				4.00-19	88	96	104
46	29	19	4.67:1	3.50-19	90½	99	107
				4.00-19	93	101	110
46	29	20	4.43:1	3.50-19	95½	104	113
				4.00-19	98	107	116
46	29	21	4.23:1	3.50-19	100	109	118
				4.00-19	103	112	121

The above tables can be used in two ways. If the machine is fitted with a rev. counter the table shows the road speed corresponding to different engine speeds for any given combination of sprockets. On the other hand, if a reasonable estimate can be made of the maximum speed which can be reached on any particular course the table will indicate the gear ratio and sprocket combination which will enable the engine to be used to its best advantage at this particular road speed. 7,000 r.p.m. may be taken as the safe limit for the 350 c.c. engine and 6,500 r.p.m. for the 500 c.c. engine. Normally there is no point in exceeding 6,500 r.p.m. for the 350 and 6,000 r.p.m. for the 500, since these represent approximately the speeds giving maximum power. In long distance events where it may be desirable to save the engine from unnecessary high r.p.m. the gear ratio should be chosen so that 6,000 r.p.m. is not likely to be exceeded for the 350 or 5,500 r.p.m. for the 500. These lower engine speeds will entail little if any loss in maximum speed.

Having fixed top gear to suit the maximum speed likely to be usefully employed on the particular course it is very important to chose the correct internal ratios in the gearbox. Bottom gear is determined by the speed at which the slowest part of the course can be ridden. In Racing or Scramble events the engine r.p.m. in bottom gear at the slowest point in the course should preferably not drop below 4,000 when standard cams are used and 5,000 r.p.m. if quick lift cams are used.

Since there are no less than 216 possible combinations of sprockets size and internal ratios in the gearbox, giving 192 possible different bottom gear ratios, it is impossible to give a reasonably sized table showing the relationship between engine and road speed for all the possible bottom gear ratios.

The following table, however, shows the figures for every whole number ratio from 7:1 to 25:1. The table gives road speeds for 3.50-19" and 4.00-19" tyres, not only for 4,000 and 5,000 r.p.m., which as stated above may be looked upon as the minimum desirable engine speed when racing or scrambling, but also for 5,500, 6,000, 6,500 and 7,000 r.p.m., which may be taken as desirable maximum engine r.p.m. according to circumstances (see note above regarding maximum engine r.p.m. on top gear). The table also shows the road speeds corresponding to 2,000 r.p.m. which may be taken as the desirable minimum when negotiating slow sections in observed Trials.

SPEEDS IN BOTTOM GEAR

Gear Ratio to 1	Rear Tyre Size in.	Road Speed Corresponding to Engine R.P.M.						
		2000	4000	5000	5500	6000	6500	7000
7	3.50-19	22	44	55	60	66	71½	77
	4.00-19	22½	45	56½	62	68	73	79
8	3.50-19	19	38½	48	53	57½	62½	67
	4.00-19	20	39½	49	54	59	64	69
9	3.50-19	17	34	42½	47	51	55½	60
	4.00-19	17½	35	44	48	52½	57	61
10	3.50-19	15½	31	38½	42	46	50	54
	4.00-19	15½	31½	39½	43½	47	51	55
11	3.50-19	14	28	35	38½	42	45½	49
	4.00-19	14½	28½	36	39½	43	46½	50
12	3.50-19	13	25½	32	35	38	41½	45
	4.00-19	13	26	33	36	39½	43	46
13	3.50-19	12	23½	29½	32½	35½	38	41
	4.00-19	12	24	30½	33½	36½	39½	42½
14	3.50-19	11	22	27½	30	33	35½	38½
	4.00-19	11	22½	28	31	34	36½	39½
15	3.50-19	10½	20½	25½	28	31	33	36
	4.00-19	10½	21	26½	29	31½	34	37
16	3.50-19	9½	19	24	26½	29	31	33½
	4.00-19	10	19½	24½	27	29½	32	34½
17	3.50-19	9	18	22½	25	27	29	31½
	4.00-19	9½	18½	23	25½	28	30	32½
18	3.50-19	8½	17	21½	23½	25½	28	30
	4.00-19	8½	17½	22	24	26	28½	30½
19	3.50-19	8	16	20	22	24	26	28
	4.00-19	8½	16½	21	23	25	27	29
20	3.50-19	7½	15½	19	21	23	25	27
	4.00-19	8	16	19½	22	23½	25½	27½
21	3.50-19	7½	14½	18½	20	22	24	25½
	4.00-19	7½	15	19	20½	22½	24½	26
22	3.50-19	7	14	17½	19	21	22½	24½
	4.00-19	7	14½	18	19½	21½	23	25
23	3.50-19	6½	13½	16½	18½	20	21½	23½
	4.00-19	7	13½	17	19	20½	22½	24
24	3.50-19	6½	13	16	17½	19	21	22½
	4.00-19	6½	13	16½	18	19½	21½	23
25	3.50-19	6	12½	15½	17	18½	20	21½
	4.00-19	6½	12½	16	17½	19	20½	22

Intermediate Gear Ratios:

Having selected the most suitable top and bottom gear ratios the intermediate ratios should be selected to give the most suitable steps. For Racing these should be as even as possible unless there are some peculiar features of the course demanding for example an exceptionally low bottom gear at one particular point. For Trials it is desirable to have bottom and second fairly close with a wider jump to third and top. For standard use it is usual to have the widest gap between first and second gear and the closest between third and top.

Intermediate Gear Ratios cont.):

The following table gives particulars of the alternative gearbox ratios which are available, showing the number of teeth on each pinion and the internal ratio.

Ref. No.	Number of Teeth on Gear Pinions							Internal Ratio				Remarks
	Mainshaft			Layshaft								
	1st	Slider	Top	1st	2nd	3rd	Top	1st	2nd	3rd	Top	
Std.	30	25 x 21	18	18	23	27	30	2.78	1.8	1.3	1	Standard on Scrambles.
1	27	24 x 22	21	21	24	26	27	1.65	1.28	1.09	1	No K/starter
2	28	24 x 22	21	20	24	26	27	1.8	1.28	1.09	1	" "
3	27	24 x 22	20	21	24	26	28	1.8	1.4	1.18	1	" "
5	29	24 x 22	20	19	24	26	28	2.13	1.4	1.18	1	" "
12	31	26 x 21	17	17	22	27	31	3.3	2.15	1.4	1	Wide Ratios.
13	30	26 x 21	17	18	22	27	31	3.0	2.15	1.4	1	Standard on Trials Mods.
14	31	25 x 21	17	17	23	27	31	3.3	1.98	1.4	1	As 12 but higher 2nd.
16	27	24 x 21	18	21	24	27	30	2.14	1.67	1.3	1	Close Ratio with Kick-starter.

The following table, which shows the engine r.p.m. in each gear after changing up at 6,000 r.p.m. (assuming no drop in road speed), may give a clearer indication of the steps provided by the alternative sets of gear ratios.

Ref. No.	2nd	3rd	Top
Std.	3910	4290	4630
1	4670	5080	5520
2	4280	5080	5520
3	4670	5080	5070
5	3930	5080	5070
12	3890	3950	4230
13	4250	3950	4230
14	3580	4290	4230
16	4670	4670	4630

Note also — WM2 — 40 hole alloy rims needed for 3.25 — 350 tyres. (19")

NOTES ON TUNING ROYAL ENFIELD "350 BULLET" AND "500 BULLET" FOR COMPETITION PURPOSES

PART ONE

These notes were produced by the Enfield Cycle Company in about 1955 or 1956. They were sent to the club library by Farrell Flanagan from Australia, to whom many thanks.

There has been a lot of interest in the trials models and many club members own one. In addition Steve Linsdell's racing exploits have aroused interest in the Bullet's potential in that area.

I intend to reproduce the notes in three parts. This first one will cover pistons, cams, valves, carburretor and magneto. The other two will deal with gear ratios, for which there are extensive tables.

The following notes describe the special components available for tuning the standard 350 and 500 "Bullet machines for use in various types of competitive events. Specially prepared "Bullets" are available for Scrambles, Trials and Short Circuit Racing events. Where these machines incorporate any of the special parts available, this fact is indicated by a note in the text.

Compression ratios

Pistons giving the following ratios are available

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		7½ : 1	" " 35214	11/32"	dome	Racing on petrol
		8½ : 1	" " 35445	5/8"	dome	Racing on petrol (80 octane +) or petrol-benzol.
	†	10½ : 1	" " 35663	11/16"	dome	Racing on Methanol
500c.c.	$	6½ : 1	" " 38504	3/8"	dome	Standard
		7¼" : 1				Racing on petrol
	†	8 : 1	" " 39596	17/32"	dome	Racing on petrol (80 octane +) or petrol-benzol
	†	9½ : 1	" " 39597	45/64"	dome	Racing on Methanol

Notes

* These pistons are made of low expansion alloy and have split skirts. All other pistons are heat treated "Y" alloy with solid skirts.

† These pistons are intended to be run with the head joint made by lapping (no gasket).

$ This piston gives a ratio of 7¼ : 1 (suitable for racing on petrol) when run with the head joint made by lapping (no gasket)

Cams

Quick lift cams (standard on the Short Circuit Racer) are available for both sizes of engine. They have no quietening ramps, extra lift, higher acceleration on initial opening and final closing, lower acceleration over the nose of the cam (thus permitting higher r.p.m. free from bounce with same springs and valves) and a longer opening period. When set to the marks they give the following opening and closing points at .010" tappet clearance:–

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Inlet opens	30° before T.D.C.	40° before T.D.C.
Inlet closes	60° after B.D.C.	70° after B.D.C.

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Valves and valve springs

All Bullet engines are fitted with light valves and springs strong enough to enable the peak of the B.H.P. curve to be exceeded without valve bounce. Further lightening of valves or fitting stronger springs is not recommended. The high speed performance of early 1954 and previous "350 Bullet" engines can be improved by fitting an inlet valve $1\frac{7}{8}$" top diameter (now standard) instead of 1½" diameter. This does not require the inlet port to be opened out, but the seat must be cut wider to suit the valve and the corner between the seat and the bore of the port carefully radiused.

Carburettor

The use of an Amal G.P. carburretor (standard on the Short Circuit racers) gives a small improvement in maximum power and speed. Carburretor settings are

PAGE 3

350 OR 500 BULLET TOP GEAR

Rear Spkt. T.	Engine Spkt. T.	C/shaft Spkt. T.	Top Gear Ratio	Rear Tyre Size in.	M.P.H. Road Speed Corresponding to 5500	6000	6500	7000
46	25	14	7.35:1	3.25-19	56½	62	67	72
				3.50-19	57½	63	68	73
				4.00-19	59	64½	70	75
46	25	15	6.86:1	3.25-19	61	66	72	77
				3.50-19	61½	67	75	78½
				4.00-19	63	69	75	80
46	25	16	6.43:1	3.25-19	65	70½	76½	82
				3.50-19	66	72	78	84
				4.00-19	67½	74	80	86
46	25	17	6.06:1	3.25-19	69	75	81	87½
				3.50-19	70	76	82½	89
				4.00-19	71½	78	85	91
46	25	18	5.72:1	3.25-19	72½	79	86	92½
				3.50-19	74	80½	87½	94
				4.00-19	76	83	90	96½
46	25	19	5.42:1	3.25-19	77	83½	90½	97½
				3.50-19	78	85	92	99
				4.00-19	80	87	94½	102
46	25	20	5.15:1	3.50-19	82	89½	97	
				4.00-19	84	92	99½	
				3.50-19	86	94	102	
				4.00-19	88½	96½	104½	

500 BULLET TOP GEAR

Rear Spkt. T.	Engine Spkt. T.	C/shaft Spkt. T.	Top Gear Ratio	Rear Tyre Size in.	M.P.H. Road Speed Corresponding to 6,000	6,500	7,000
46	29	14	6.35:1	3.50-19	67	73	79
				4.00-19	68	75	81
46	29	15	5.91:1	3.50-19	71½	78	84½
				4.00-19	73½	80	87
46	29	16	5.54:1	3.50-19	76	83	90
				4.00-19	78½	85½	93
46	29	17	5.22:1	3.50-19	81	88	95½
				4.00-19	83	90½	98½
46	29	18	4.93:1	3.50-19	85½	93½	101
				4.00-19	88	96	104
46	29	19	4.67:1	3.50-19	90½	99	107
				4.00-19	93	101	110
46	29	20	4.43:1	3.50-19	95½	104	113
				4.00-19	98	107	116
46	29	21	4.23:1	3.50-19	100	109	118
				4.00-19	103	112	121

PART 2

The above tables can be used in two ways. If the machine is fitted with a rev. counter the table shows the road speed corresponding to different engine speeds for any given combination of sprockets. On the other hand, if a reasonable estimate can be reached on any particular course the table will indicate the gear ratio and sprocket combination which will enable the engine to be used to its best advantage at this particular road speed. 7,000 r.p.m. may be taken as the safe limit for the 350 c.c. engine and 6,500 r.p.m. for the 500 c.c. engine. Normally there is no point in exceeding 6,500 r.p.m. for the 350 and 6,000 r.p.m. for the 500, since these represent approximately the speeds giving maximum power. In long distance events where it may be desirable to save the engine from unnecessary high r.p.m. the gear ratio should be chosen so that 6,000 r.p.m. is not likely to be exceeded for the 350 or 5,500 r.p.m. for the 500. These lower engine speeds will entail little if any loss in maximum speed.

CONTINUED FROM PART ONE

/500 Bullet. An excellent plan is to time the engine with more advance than is likely to be required and then find by experiment the position of the ignition control lever which gives the best results. Check the piston position at which the contact points open with the control in this position and then re-time to give this setting when fully advanced. The magneto should never be run with the control permanently retarded.

CONTINUED FROM PART 3

The following table, which shows the engine r.p.m. in each gear after changing up at 6,000 r.p.m. (assuming no drop in road speed), may give a clearer indication of the steps provided by the alternative sets of gear ratios.

Ref. No.	2nd	3rd	Top
Std.	3910	4290	4630
1	4670	5080	5520
2	4280	5080	5520
3	4670	5080	5070
5	3930	5080	5070
12	3890	3950	4230
13	4250	3950	4230
14	3580	4290	4230
16	4670	4670	4630

NOTES ON TUNING ROYAL ENFIELD "350 BULLET" AND "500 BULLET" FOR COMPETITION PURPOSES

PAGE 4

PART THREE

Having fixed top gear to suit the maximum speed likely to be usefully employed on the particular course it is very important to choose the correct internal ratios in the gearbox. Bottom gear is determined by the speed at which the slowest part of the course can be ridden. In Racing or Scramble events the engine r.p.m. in bottom gear at the slowest point in the course should preferably not drop below 4,000 when standard cams are used and 5,000 r.p.m. if quick lift cams are used.

Since there are no less than 216 possible combinations of sprockets size and internal ratios in the gear box, giving 192 possible different bottom gear ratios, it is impossible to five a reasonably sized table showing the relationship between engine and road speed for all the possible bottom gear ratios.

The following table, however, shows the figures for every whole number ratio from 7 : 1 to 25 : 1. The table gives road speeds for 3.50-19" and 4.00-19" tyres, not only for 4,00 and 5,000 r.p.m., which as stated above may be looked upon as the minimum desirable engine speed when racing or scrambling, but also for 5,500, 6,000, 6,500 and 7,000 r.p.m., which may be taken as desirable maximum engine r.p.m. according to circumstances (see note in part 2 regarding maximum engine r.p.m. on top gear). The table also shows the road speeds corresponding to 2,000 r.p.m. which may be taken as the desirable minimum when negotiating slow sections in observed Trials.

SPEEDS IN BOTTOM GEAR

Gear Ratio to 1	Rear Tyre Size in.	Road Speed Corresponding to Engine R.P.M.						
		2000	4000	5000	5500	6000	6500	7000
7	(3.50-19	22	44	55	60	66	71	77
	(4.00-19	22½	45	56½	62	68	73	79
8	(3.50-19	19	38½	48	53	57½	62½	67
	(4.00-19	20	39½	49	54	59	64	69
9	(3.50-19	17	34	42½	47	51	55½	60
	(4.00-19	17½	35	44	48	52½	57	61
10	(3.50-19	15½	31	38½	42	46	50	54
	(4.00-19	15½	31½	39½	43½	47	51	55
11	(3.50-19	14	28	35	38½	42	45½	49
	(4.00-19	14½	28½	36	39½	43	46½	50
12	(3.50-19	13	25½	32	35	38	41½	45
	(4.00-19	13	26	33	36	39½	43	46
13	(3.50-19	12	23½	29½	32½	35½	38	41
	(4.00-19	12	24	30½	33½	36½	39½	42½
14	(3.50-19	11	22	27½	30	33	35½	38½
	(4.00-19	11	22½	28	31	34	36½	39½
15	(3.50-19	10½	20½	25½	28	31	33	36
	(4.00-19	10½	21	26½	29	31½	34	37
16	(3.50-19	9½	19	24	26½	29	31	33½
	(4.00-19	10	19½	24½	27	29½	32	34½
17	(3.50-19	9	18	22½	25	27	29	31½
	(4.00-19	9½	18½	23	25½	28	30	32½
18	(3.50-19	8½	17	21½	23½	25½	28	30
	(4.00-19	8½	17½	22	24	26	28½	30½
19	(3.50-19	8	16	20	22	24	26	28
	(4.00-19	8½	16½	21	23	25	27	29
20	(3.50-19	7½	15½	19	21	23	25	27
	(4.00-19	8	16	19½	22	23½	25½	27½
21	(3.50-19	7½	14½	18½	20	22	24	25½
	(4.00-19	7½	15	19	20½	22½	24½	26
22	(3.50-19	7	14	17½	19	21	22½	24½
	(4.00-19	7	14½	18	19½	21½	23	25
23	(3.50-19	6½	13½	16½	18½	20	21½	23½
	(4.00-19	7	13½	17	19	20½	22½	24
24	(3.50-19	6½	13	16	17½	19	21	22½
	(4.00-19	6½	13	16½	18	19½	21½	23
25	(3.50-19	6	12½	15½	17	18½	20	21½
	(4.00-19	6½	12½	16	17½	19	20½	22

Intermediate Gear Ratios:

Having selected the most suitable top and bottom gear ratios the intermediate ratios should be selected to give the most suitable steps. For racing these should be as even as possible unless there are some peculiar features of the course demanding for example an exceptionally low bottom gear at one particular point. For Trials it is desirable to have bottom and second fairly close with a wider jump to third and top. For standard use it is usual to have the widest gap between first and second gear and the closest between third and top.

The following table gives particulars of the alternative gearbox ratios which are available, showing the number of teeth on each pinion and the internal ratio.

Ref. No.	Number of Teeth on Gear Pinions							Internal Ratio				Remarks
	Mainshaft			Layshaft								
	1st	Slider	Top	1st	2nd	3rd	Top	1st	2nd	3rd	Top	
Std.	30	25 x 21	18	18	23	27	30	2.78	1.8	1.3.	1.	Standard on Scrambles
1	27	24 x 22	21	21	24	26	27	1.65	1.28	1.09	1	No K/starter
2	28	24 x 22	21	20	24	26	27	1.8	1.28	1.09	1	" "
3	27	24 x 22	20	21	24	26	28	1,8	1.4	1.18	1	" "
5	29	24 x 22	20	19	24	26	28	2.13	1.4	1.18	1	" "
12	31	26 x 21	17	17	22	27	31	3.3	2.15	1.14	1	Wide Ratios
13	30	26 x 21	17	18	22	27	31	3.0	2.15	1.4	1	Standard on Trial Mods.
14	31	25 x 21	17	17	23	27	31	3.3	1.98	1.4	1	As 12 but higher 2nd
16	27	24 x 21	18	21	24	27	30	2:14	1:67	1:3	1	Close Ratio with Kick starter

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NOTES ON TUNING ROYAL ENFIELD "350 BULLET" AND "500 BULLET" FOR COMPETITION PURPOSES

PART THREE

Having fixed top gear to suit the maximum speed likely to be usefully employed on the particular course it is very important to choose the correct internal ratios in the gearbox. Bottom gear is determined by the speed at which the slowest part of the course can be ridden. In Racing or Scramble events the engine r.p.m. in bottom gear at the slowest point in the course should preferably not drop below 4,000 when standard cams are used and 5,000 r.p.m. if quick lift cams are used.

Since there are no less than 216 possible combinations of sprockets size and internal ratios in the gear box, giving 192 possible different bottom gear ratios, it is impossible to five a reasonably sized table showing the relationship between engine and road speed for all the possible bottom gear ratios.

The following table, however, shows the figures for every whole number ratio from 7 : 1 to 25 : 1. The table gives road speeds for 3.50-19" and 4.00-19" tyres, not only for 4,00 and 5,000 r.p.m., which as stated above may be looked upon as the minimum desirable engine speed when racing or scrambling, but also for 5,500, 6,000, 6,500 and 7,000 r.p.m., which may be taken as desirable maximum engine r.p.m. according to circumstances (see note in part 2 regarding maximum engine r.p.m. on top gear). The table also shows the road speeds corresponding to 2,000 r.p.m. which may be taken as the desirable minimum when negotiating slow sections in observed Trials.

SPEEDS IN BOTTOM GEAR

Gear Ratio to 1	Rear Tyre Size in.	Road Speed Corresponding to Engine R.P.M.						
		2000	4000	5000	5500	6000	6500	7000
7	(3.50-19	22	44	55	60	66	71	77
	(4.00-19	22½	45	56½	62	68	73	79
8	(3.50-19	19	38½	48	53	57½	62½	67
	(4.00-19	20	39½	49	54	59	64	69
9	(3.50-19	17	34	42½	47	51	55½	60
	(4.00-19	17½	35	44	48	52½	57	61
10	(3.50-19	15½	31	38½	42	46	50	54
	(4.00-19	15½	31½	39½	43½	47	51	55
11	(3.50-19	14	28	35	38½	42	45½	49
	(4.00-19	14½	28½	36	39½	43	46½	50
12	(3.50-19	13	25½	32	35	38	41½	45
	(4.00-19	13	26	33	36	39½	43	46
13	(3.50-19	12	23½	29½	32½	35½	38	41
	(4.00-19	12	24	30½	33½	36½	39½	42½
14	(3.50-19	11	22	27½	30	33	35½	38½
	(4.00-19	11	22½	28	31	34	36½	39½
15	(3.50-19	10½	20½	25½	28	31	33	36
	(4.00-19	10½	21	26½	29	31½	34	37

Gear Ratio to 1	Rear Tyre Size in.	Road Speed Corresponding to Engine R.P.M.						
		2000	4000	5000	5500	6000	6500	7000
16	(3.50-19	9½	19	24	26½	29	31	33½
	(4.00-19	10	19½	24½	27	29½	32	34½
17	(3.50-19	9	18	22½	25	27	29	31½
	(4.00-19	9½	18½	23	25½	28	30	32½
18	(3.50-19	8½	17	21½	23½	25½	28	30
	(4.00-19	8½	17½	22	24	26	28½	30½
19	(3.50-19	8	16	20	22	24	26	28
	(4.00-19	8½	16½	21	23	25	27	29
20	(3.50-19	7½	15½	19	21	23	25	27
	(4.00-19	8	16	19½	22	23½	25½	27½
21	(3.50-19	7½	14½	18½	20	22	24	25½
	(4.00-19	7½	15	19	20½	22½	24½	26
22	(3.50-19	7	14	17½	19	21	22½	24½
	(4.00-19	7	14½	18	19½	21½	23	25
23	(3.50-19	6½	13½	16½	18½	20	21½	23½
	(4.00-19	7	13½	17	19	20½	22½	24
24	(3.50-19	6½	13	16	17½	19	21	22½
	(4.00-19	6½	13	16½	18	19½	21½	23
25	(3.50-19	6	12½	15½	17	18½	20	21½
	(4.00-19	6½	12½	16	17½	19	20½	22

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1	27	24 x 22	21	21	24	26	27	1.65	1.28	1.09	1	No K/starter
2	28	24 x 22	21	20	24	26	27	1.8	1.28	1.09	1	" "
3	27	24 x 22	20	21	24	26	28	1,8	1.4	1.18	1	" "
5	29	24 x 22	20	19	24	26	28	2.13	1.4	1.18	1	" "
12	31	26 x 21	17	17	22	27	31	3.3	2.15	1.14	1	Wide Ratios
13	30	26 x 21	17	18	22	27	31	3.0	2.15	1.4	1	Standard on Trial Mods.
14	31	25 x 21	17	17	23	27	31	3.3	1.98	1.4	1	As 12 but higher 2nd
16	27	24 x 21	18	21	24	27	30	2:14	1:67	1:3	1	Close Ratio with Kick starter