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BICYCLES and  
MOTOR CYCLES

## THE ENFIELD CYCLE COMPANY LIMITED

Your Ref.

Our Ref.

HEAD OFFICE AND WORKS  
REDDITCH  
WORCS. ENGLAND

3rd May, 1961

Major F.W. Smith  
Major V.T. Mountford  
Mr. V.L. Young.  
Mr. J.J. Booker  
x Mr. R.E. Thomas  
Mr. G.H. Baker  
File

### Report of Development Work in Progress April 1961

Paragraph No.s refer to Minutes of the Development Meeting held on April 19th.

#### 1. Silencing

Some woven asbestos rings of both round and square section have been received from Turner Brothers Asbestos Co. Ltd. These are, of course, jointed rings. They appear to do the job satisfactorily but are not so convenient as the copper asbestos washers. A price has been asked for but unless this is substantially less than that for the copper asbestos type, the latter is to be preferred.

Some sample 'O' rings of a different grade of rubber have been received from the Pioneer Oil Sealing and Moulding Co. One of these has been tried but, while it stands heat better than our standard material, it is not so good as the asbestos or copper asbestos rings and costs more than twice as much.

An enquiry has been made for 'stabbed' material with different size and pitch of the holes, but our present suppliers cannot provide this.

The brazed up silencer (which needs no joint washer) has been fitted to

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1. Silencing (Cont)

the 750 cc machine which, however, has done very little running owing to the engine being rebuilt with the deep sump crankcase.

2. Heavy Gauge Front Forks

No further tests.

3. New Fork Head Clip

There is nothing further to report on the new ball head clip for the Clipper Models.

4. Pressed Steel Casquette for Leading Link Fork

The pattern for the ball head clip for this is in hand as are the tools for the pressed steel casquette.

5. Lubrication on 700 cc Engines

Some tests have been run with an engine modified to drain oil from the inlet cam tunnel directly back to the oil tank and the timing case by means of an external pipe to the sump. The return oil pump was modified to enable both primary and secondary sides to collect oil from the sump.

These tests showed that the system does not work in the way one would expect. When first starting the engine, oil flows up the pipe from the sump to the timing case, after a time the flow stops and later oil flows, as one would expect, down the pipe. This phenomenon occurs both when the balance hole between the crankcase and the timing case is sealed up and when it is open. It does not appear, therefore, that the upward flow in the pipe is due to a pressure differential between the crankcase and the timing case. Presumably this upward flow is the result of oil from the crank shaft being forced beneath the sump cover plates into the sumps which, after a period of standing, are already full.

It also appears that the cam tunnels do not fill with oil up to the level of the drain holes. This is no doubt due to oil leakage past the cylinder spigots. These must have clearance and this clearance cannot reasonably be held to very close limits so that the rate of leakage no doubt varies from one engine to another as is proved by the fact that complaints are sometimes received of oil building up to the top of the push rod tunnels and filling the rocker boxes. It is very unfortunate, therefore, that the cam tunnels break into the holes in the crankcase where the cylinder spigots fit. An attempt to seal off this break-through was not successful but the casting could be modified to prevent it, at the cost of machining separate recesses for the cams and making the cams slightly narrower. Reducing the width of the cams should affect their life since

5. Lubrication of 700 cc Engines (Cont)

the tappet feet are in any case not large enough to make tangential contact over the full width of the cam at about half lift.

6. Cross Cylinders and Pistons

I have had some correspondence with Mr. Cross regarding the design of his pistons. He does not agree to reducing the radial thickness of his rings (and increasing the free gap) which would help to save weight. If, however, new dies are to be made for pistons for the 700 cc engine it is important to know whether a Cross gasket or one of copper or other material is to be used, since the Cross gasket reduces the compression volume by about 4 cc thus enabling a piston with less dome on it to be used thus saving piston weight without loss of strength. (A slightly lower dome is desirable in any case, since the larger cylinder capacity increases the compression ratio by 1 ratio).

Cross gaskets of the section used to date are not suitable for the 700 cc engine on account of the proximity of the push rod tunnel seal. Thinner section wire could, however, be used so as to keep the O/D of the gasket the same as with the 692 cc engine. In theory the thinner the section the better the seal should be.

7. Chrome Plated Cylinder Bores

No further action has been taken pending the availability of cylinders to send to Messrs. Monochrome.

Meanwhile, I have had some literature and a visit from a representative with regard to the metal spraying of aluminium cylinders. Apparently there are two methods in use: (a) to spray on about .003" radial thickness of molybdenum and lap this to the finished size required and (b) to spray a very thin coating of molybdenum and follow this with about .015" of steel which is then fine bored and honed like cast iron which it very much resembles in structure.

The advantages over chrome plating are: (1) the porous nature of the sprayed metal which holds oil and (2) the final finishing to size is much easier assuming that method (b), which is recommended, is used. Methods (a) and (b) cost about the same, about 4/- per cylinder for the spraying. The initial boring before spraying need not be especially smooth or accurate, an ordinary machined finish being all that is required.

Messrs. Metco are prepared to spray sample cylinders for us free of charge. They do not undertake contract work but can supply the necessary equipment, which need not be very costly, or can give us the names of firms who would spray cylinders for us.

5. Lubrication of 700 cc Engines (Cont)

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8. Slotted Clutch Plates

These have been removed from the Constellation machine after 600 miles and have been sent to the Service Department for fitting to their box sidecar machine. Three more sets have been slotted and are ready for fitting to various machines.

9. Oil Filter on 250 cc Machine

The order has been placed for these.

10. Batch Tests

No more machines have been submitted for test.

11. Reynolds 250 cc Frame

Nothing to report, still waiting on Reynolds.

12. Nylon Roller Cage

Delivery of production cages is now awaited.

13. Five Speed Gear Boxes

If this is to be fitted to the Constellation, either as standard or as an optional extra, consideration might well be given to using coarse pitch for the high gear pinions. Experience, particularly in the U.S.A. has shown the coarse pitch pinions to be stronger than the standard ones. According to Mr. Hill coarse pitch cannot be used for the sliding gears of the 5-speed box but could be used for the "high gear" pinions which are transmitting load on all the indirect ratios. One failure has already been experienced with the fine pitch pinions in this position although the second pair seems to be standing up.

14. The Scooter

The gear change mechanism has been freed as much as possible including slacking off the spring behind the indexing ball. It is now possible to engage all the gears, though with difficulty. This mechanism is reminiscent of steering column mounted gear shifts on cars which contain so many joints with friction and/or lost motion at each, that at best they cannot compare with the slick change provided by a floor mounted remote control lever and at worst they almost are impossible to use. This hand change is almost in the latter category and there is no doubt that a rocking foot pedal would give a better gear change.

The basic difficulty is in the design of the Albion gears which require four pinions to be moved a considerable distance for each

#### 14. The Scooter (Cont)

gear change. With a four speed box this puts the conventional twist grip control, as used on the Lambretta, virtually out of the question owing to the range of movement required which must put the clutch lever in a very inconvenient position in first and fourth gears.

The use of a step by step ratchet mechanism theoretically allows half the available movement of the twist grip to be used for each gear change instead of only one third of the movement as with the Lambretta type of change. In practice, however, this advantage is discounted by the necessary small amount of backlash in the ratchet mechanism. The advantage of always having the clutch lever in the best position (except when actually changing gear) remains.

To get the best out of the present mechanism the following modifications are suggested:-

- (a) If possible a modification to the method of attaching the cables to the twist grip so as to take up backlash in the ratchets with the minimum amount of movement followed by a greater leverage ratio for the actual movement of the gears.
- (b) The use of heavier cables with non collapsible outer casings to reduce lost motion to a minimum.

Apart from the gear change, the setting of the Zenith carburettor obviously needs attention.

#### 15. Bottom Link Forks for Crusader Sports Model

These have now been run for 45 laps (67 miles) on the M.I.R.A. Pave circuit. The springing is a little on the soft side for this type of work and the speed over the worst sections had to be kept down to 15 m.p.h. to prevent bottoming.

#### 16. 350 Crusader Engine

This has been fitted into a frame and ridden on the road. The preliminary results were most encouraging, the machine, being obviously much livelier than the writer's 350 Bullet (which has a 9.3 : 1 compression ratio) and apparently at least 5 m.p.h. faster.

Examination showed that the engine had been assembled with Sports cams whereas standard Crusader cams should have been fitted. Even when these were changed, however, the performance was affected very little although the exhaust noise was reduced - and also the noise from the valve gear - so that slap from the rather slack fitting piston (a flat topped one of Enfield manufacture as used in the Model WD/CO) was more noticeable.

16. 350 Crusader Engine(Cont)

At first the engine was difficult to start owing to a tendency to clutch slip when kickstarting. This was cured by fitting six 14 gauge clutch springs instead of three which made the operation too heavy for comfort. Probably three 13 or 12 gauge springs would prevent slip but as these are more liable to set, it would be better to use six springs of lighter gauge wire, say 15 g.

After changing the cams and fitting the six clutch springs the machine was taken to the M.I.R.A. proving Ground primarily to test the clutch, gears and primary chain. This test will be the subject of a separate report but it may be said that the results were considered satisfactory although the rider did succeed in burning the clutch out. Prior to this test the machine was tried for maximum speed on the timing straight when the best one way speed recorded was 50.37 m.p.h. and the best mean speed 83.46 m.p.h. For comparison the following figures were recorded on the last batch test on a 350 Bullet :- one way 84.13 m.p.h., mean 78.28 m.p.h.

The following are the probable reasons for the greatly superior performance of the new model:-

- (i) Smaller, lighter machine with lower riding position.
- (ii) Better shaped combustion chamber (8:1 compression ratio with a flat topped piston).
- (iii) Shorter connecting rod giving maximum piston speed sooner after T.D.C. but possibly contributing to the rather pronounced piston slap.

17. Under 250 cc Engine

Mr. Thomas has made some suggestions for using a gear driven vertical shaft with cams and possibly the contact breaker at one end and a gear pump at the other. No details have been worked out but this arrangement, if not thought too unconventional, would give practically all the benefits of an h.h.c. engine probably at a lower cost, since an c.h.c. engine with a chain driven cam shaft must have another of some kind for the oil pump. <sup>drive</sup>

18. Cross Cylinder Head Joint

See remarks in paragraph 6 above.

19. New Rear Brake Covers

No comment except that the prototype brakes with the new cover plates continue to perform satisfactorily.

20. Modification to Oil Pump Spindles

No comment.

21. Bottom Link Forks with Bonded Rubber Suspension

The fork links have been received from Mr. Baker and are ready for fitting to a 250 cc machine.

22. Siba Self-Starter

This has not yet been tried either with two 'Police Type' batteries or with four standard batteries used as a 24 volt system.

RA. Wilson Jones

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