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REDDITCH
WORCS. ENGLAND

26th May, 1961

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

Report of Development Work in Progress May, 1961

Paragraph No.s refer to Minutes of the Development Meeting held on May 9th.

1. Silencing

A quotation has now been received from Turner Bros. Asbestos Ltd. for both round and square section plaited asbestos rings as an alternative to the copper asbestos rings which are now on order. In quantities of 1,000, the square section rings show a saving of 4/6 per 100 and the round section rings a saving of 6/- per 100 as compared with the C & A rings. The plaited asbestos rings have been found to do the job adequately but they are more trouble to fit than the copper asbestos and it is questionable whether this small saving is worth while.

A supplier of stabbed sheet metal has now been found who offers alternative piercing. Some samples of these are being obtained.

The silencer with the front and middle portions brazed together has now been run for about 300 miles on a 250 cc and 200 on a Constellation including some high speed work at the M.I.R.A. proving ground. No trouble has been experienced with this which can be attributed to the braced-up construction although the end fell off at the M.I.R.A. proving ground and the spiral baffle had also become detached from the centre rod. It is doubtful, however, whether this silencer can be produced as cheaply as the built up one with an asbestos or copper asbestos sealing ring.

Mr. E. (Jock) Murray in the course of correspondence concerning his Constellation, mentioned a novel silencer system for which he has

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4. Lubrication

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1. Silencing (Cont...)

provisional patent rights and which was described in 'Motor Cycling' last October. This consists essentially of a spring loaded restricting cap fitting over the tail pipe of a conventional silencer. He has sent one of these caps, and a Clipper type silencer is being adapted to receive this as part of our long term policy to bring our exhaust noise level down to the as yet unspecified limits which may be called for by the Ministry of Transport. Mr. Murray claims that his device gives a very high degree of silence without loss of power, but it is difficult to see why this should be so.

2. New Fork Head Clip

No comment.

3. Pressed Steel Fork Head for Leading Link Fork

The sample pressing for the casquette portion of this fork head was found to be $\frac{1}{4}$ " too wide and has been modified.

A sample bronze casting of the fork head has been received and is being machined.

4. Lubrication on 700 cc Engines

A Constellation engine with the scavenge pump modified so that both the primary and secondary sides of the pump picked up oil from the sump has been tested at speed on the No. 2 circuit at the M.I.R.A. proving ground. The third gear was used for speeds up to 90 m.p.h. (speedometer reading) which was held on occasion for half the length of the straight before changing up. This corresponds to 7,000 r.p.m. assuming the speedometer to be accurate. The engine, which was otherwise standard except for the use of some experimental reinforced head gaskets supplied by Messrs. Coopers Mechanical Joints, showed far fewer oil leaks than is usual when driven at these speeds. There was initially a slight trace of oil round the driving side cylinder head joint, but this did not get any worse. Otherwise, the only oil leak of any magnitude was from the chain case joint. There was no smoke from the exhaust, but after 16 laps (37 miles) of high speed motoring, the oil level in the tank was found to be at the low mark on the dip-stick. The tank had been filled to the high mark before the machine left the Works since which it had done about 50 miles on the road and two runs down the timing straight in addition to the 16 laps on No. 2 circuit. Removal of the level plug in the primary chain case proved that a great deal of the oil loss from the engine was due to transference of oil into the chain case. The surplus oil in the chain case was drained out and a

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4. Lubrication on 70^{cc} cc Engines (Cont...)

further 12 laps (27 miles) were covered, again at high speed, but changing to top gear as soon as 90 m.p.h. was reached in third instead of holding it at this speed for a considerable distance as on the previous laps. At the end of this further period of running there was no loss of oil from the tank and no build up of oil in the chain case.

Examination of the chain case showed that the oil seal behind the driving side main bearing had been turning in its housing and had been assembled the wrong way round, thus making it more effective to prevent passage of oil from the chain case to the crank case than vice-versa. Bradford started assembling seals this way round at the time when we first allowed the crank shaft breather to discharge into the chain case, apparently with the idea in mind that this breather arrangement tends to create a pressure in the chain case and a vacuum in the crank case. I pointed out at the time, however, that it was far more important to prevent transfer of oil from the crank case to the chain case since we had always experienced a tendency to build up oil in the chain case when running at high speeds.

In addition to these tests at the M.I.R.A. proving grounds, ^{the} engine has been modified making the cam tunnels common with the main crank chamber and arranging the oil from the driving side push rod tunnels to drain directly back to the oil tank and oil from the timing side tunnel to drain into the timing case. The timing case drains by an external pipe leading to the sump and the scavenge pump is arranged so that both primary and secondary sides draw oil from the sump. This engine has been mounted on the bench and has been run-in ready for test.

5. Cross Cylinders and Pistons.

Nothing further to report.

6. Pistons for 250 cc Super Sports.

Arrangements have been made with Messrs. Hepworth & Grandage Ltd. to make the necessary modifications to the core of the dies for our Constellation pistons (their Ref. No. 14843) to enable castings from these dies to be used for all future Crusader, Crusader Sports, and Constellation Super Sports pistons. This will effect a considerable saving in weight of these pistons which will reduce the inertia loading on the connecting rod which has proved to be excessive when Crusader Sports machines are entered in long distance races on short circuits.

The effect of this modification to the dies will be to increase the weight of future Constellation pistons by an amount estimated to be two to two and a half drms. Since, however, we have large stocks of these pistons, and in view of the proposal to use the 750 cc engine for future Constellation production, this increase in weight is not thought to be serious.

6. Pistons for 250 cc Super Sports (Cont...)

Mr. Young has been notified of this modification. It is assumed that new dies will be required for the piston for the 750 cc engine since, if pistons for this are machined from the standard Constellation castings, they will, in any case, be some 10 or 12 drms heavier than standard Constellation pistons (due to the extra .040" diameter) and a lower piston crown is required with the larger capacity engine to give a compression ratio which is not unreasonably high.

7. Chrome Plated Cylinder Bores

Messrs. Monochrome report that they have now completed the plating jigs for the sample aluminium cylinders sent to them. Delivery of the plated cylinders is promised for the end of May.

The second pair of aluminium cylinders is being machined to suitable dimensions for metal spraying.

8. Clotted Clutch Plates

The Service Department report that the clotted clutch plates fitted to the works side-car outfit have reduced the dragging of the clutch to some extent but have not completely cured this trouble. None of the clutches fitted with the slotted plates have given any trouble due to the edges of the slots shaving away the friction material.

9. Oil Filter on 250 Machine

Mrs. Ford reports that delivery of these filters is not expected until mid-August.

10. Batch Tests.

As agreed at the last meeting a batch test has been run on a Meteor Minor Sports and a Crusader Sports. Weather conditions were excellent for obtaining good mean speeds but were not favourable for good maximum speeds as there was a light north easterly wind blowing up the hill with a tendency to equalize the speeds on the east and west runs.

The following results were obtained:-

Meteor Minor Sports engine, EA.35462, frame No. 7079.

| | West | East | Mean |
|-----------------------------------|--------------|--------------|--------------|
| Rider prone using Standard Rests: | 88.82 m.p.h. | 89.20 m.p.h. | 89.01 m.p.h. |
| " " " Pillion " | 91.83 " | 91.83 " | 91.83 " |

10. Batch Tests (Cont...)

Crusader Sports engine, SR.9099, frame No. 1856.

| | <u>West</u> | <u>East</u> | <u>Mean</u> |
|-----------------------------------|--------------|--------------|--------------|
| Rider prone using standard rests: | 74.39 m.p.h. | 74.71 m.p.h. | 74.55 m.p.h. |
| " " " pillion " : | 75.88 " | 77.78 " | 76.83 " |

Fuel consumption at 45 m.p.h.

| | |
|---------------------|--------------|
| Meteor Minor Sports | 46 m.p.g. |
| Crusader " | 65.67 m.p.g. |

The maximum speeds obtained are considered to be satisfactory but the fuel consumption figures are very poor. Previous Meteor Minor Sports machines have all returned a figure of over 70 m.p.g. and Crusader Sports, with the exception of the first one batch tested which gave 75.3, have all been over 80 and very often over 90 m.p.g.

Examination showed that the pilot jet air bleeds on both carburettors were screwed too far in, particularly on the Meteor Minor Sports which were screwed right home. The carburettors are being checked for needle position and jet sizes and the machines will be re-checked with the pilot air bleeds correctly set and any other necessary corrections made to the setting.

11. Reynolds 250 cc Frame

Nothing to report.

12. Nylon Roller cages

The bulk supply of these has now been received. Samples have been sent by air to Enfield India Ltd., who have been notified that we have thoroughly tested the nylon cages and that they will be receiving these in place of steel ones in the future.

13. Five Speed Gear Boxes

I have been assured by Mr. Hill of Albions that the second pair of high gear pinions fitted to the Constellation 5-speed box is considerably stronger than the pair which failed. As the second pair appears to be standing up satisfactorily, I have not asked for any pinions with coarse pitch teeth for this gear box.

The 5-speed gear box fitted to the proto-type Crusader Super Sports machine which has the leading link forks, does not give such positive gear changes as the second 5-speed box of this type. There is a tendency to go through the gears, particularly when changing up.

13. Five Speed Gear Boxes (Cont...)

Both these machines were taken to the M.I.R.A. proving ground on Thursday 25th May and were timed on the timing straight, the second machine being tried with various top gear ratios obtained by fitting smaller rear wheel sprockets. The following speeds were obtained:-

Machine with leading link forks standard gear ratios, top gear 6.14 : 1
Rider prone using pillion rests:-

| <u>West</u> | <u>East</u> | <u>Mean</u> |
|--------------|--------------|--------------|
| 83.10 m.p.h. | 85.17 m.p.h. | 84.13 m.p.h. |

Machine with telescopic forks, rider prone using pillion rests,
Standard Rear Sprocket, 49 tooth :

| | <u>West</u> | <u>East</u> | <u>Mean</u> |
|--------------------------------|--------------|--------------|--------------|
| | 79.98 m.p.h. | 80.17 m.p.h. | 80.07 m.p.h. |
| <u>48 tooth rear Sprocket:</u> | 6.02 : 1 | | |
| | 78.41 | 79.89 | 79.15 |
| <u>47 tooth rear Sprocket:</u> | 5.89 : 1 | | |
| | 77.78 | 79.42 | 78.60 |

The following speeds were obtained with the rider sitting upright accelerating from 40 m.p.h. in top gear at the timing hut giving a distance of about 550 yards for acceleration before reaching the light beams :-

49 tooth rear Sprocket:

| | <u>West</u> | <u>East</u> | <u>Mean</u> |
|--------------------------------|-------------|-------------|-------------|
| | 62.70 | 65.40 | 64.05 |
| <u>48 tooth rear Sprocket:</u> | 62.69 | 63.80 | 63.29 |
| <u>47 tooth rear Sprocket:</u> | 61.45 | 64.10 | 62.77 |

The following speeds were obtained from a standing start at the timing hut taking the machine up to 7500 r.p.m. on each gear. Fourth gear was reached on each test with the exception of the east run with the standard gear ratios when fifth gear was engaged just before crossing the first light beam:-

| <u>49 tooth rear Sprocket:</u> | <u>West</u> | <u>East</u> | <u>Mean</u> |
|--------------------------------|-------------|-------------|-------------|
| | 66.28 | 67.20 | 66.74 |

13. Five Speed Boxes (Cont...)

| <u>48 tooth rear Sprocket:</u> | <u>West</u> | <u>East</u> | <u>Mean</u> |
|--------------------------------|--------------|--------------|--------------|
| | 66.28 m.p.h. | 67.70 m.p.h. | 66.99 m.p.h. |
| <u>47 tooth rear Sprocket:</u> | 66.55 | 67.0 | 66.77 |

It will be noted that as the high gear ratio is raised the maximum speed is lowered so also is the maximum one way speed. On the day of the test, however, weather conditions were such that there was very little difference between the speeds on the east and west runs. With a westerly wind blowing, higher speeds would have been obtained on the east run and under these conditions, the higher gear ratios might be expected to show a higher one way speed.

As was to be expected, the speed at the end of 550 yards acceleration in top gear became progressively lower as the gear ratio was raised, though not to a very marked extent.

It will be noted that the mean speed after accelerating through the gears was highest with the 48 tooth rear sprocket but only by a very small margin. With the standard gear ratios, the fact that the rider changed gear just before reaching the light beams on the east run, probably accounted for a small drop in speed on this run. We note also that the highest one way speed on the west run after accelerating from a standing start, was with the 47 tooth rear sprocket. It must be pointed out that the figures given are the speeds obtained at the end of a certain distance and do not necessarily give an indication of the time required to cover that distance. It is quite possible that the slightly higher gear ratios obtained with the smaller rear wheel sprockets improve the acceleration times since they enable higher speeds to be achieved without either making an additional gear change or taking the engine past its peak r.p.m. On the other hand, the fact that in these circumstances slightly higher speeds have been recorded is no proof that acceleration up to that speed was in fact better.

The main object of the higher gear ratios is, of course, to reduce engine stresses when cruising at high speeds.

14. The Scooter

The gear change has been modified, cutting out the 'step by step' ratchet mechanism so that the clutch lever is in a different position for each gear. The change is still very far from positive and even when a weak indexing plunger spring is used is stiff to operate and clearly suffers from stretch of the cables and collapse of the outer casings under load. After a short period of use, some back lash developed in the cable mechanism due to one

14. The Scooter (Cont...)

or other of the above mentioned causes.

Mr. Welsher has modified the design to put the rocking arm operated by the cables directly on to the 'gear change operator shaft'. I have also suggested that he should use heavier cables and that the centre portions of the outer casings should be replaced by steel or copper tubes. Flexible casings must, of course, still be used at the ends to allow for the movement of the handle-bar when steering and the movement of the gear box due to the operation of the rear suspension.

The functioning of the Zenith carburettor has been much improved by lowering the taper needle. When in the lowest position, there is a tendency to a weak spot when coming off the pilot jet. Probably a slightly higher needle position and a smaller main jet would give better results. I have asked for some spare jets for this carburettor but it appears that this is a non-standard instrument. A new carburettor of the latest type has now been received and further work will be concentrated on this.

The rear suspension is certainly on the soft side. The front suspension seems rather hard. Owing to the method of mounting the engine on the swinging arm and the method of anchoring the front brake, there is a curious sensation of the rear end of the machine lifting when accelerating and the front end lifting when braking. The steering of the scooter does not strike me as bad by scooter standards; it is certainly much better than the Piatti though not as good as the Lambretta.

After trying out various needle positions on the old Zenith carburettor, the ignition was inadvertently left on for a short period. The starter then failed to turn the engine over although there was sufficient voltage from the battery to operate the horn and light the head lights to nearly full brilliance. It was found possible to start the engine by the 'run and jump' method but it was very difficult to paddle off owing to the width of the foot boards and centre stand. Since there is no kick-starter, the rider (particularly if a girl) might find it difficult to start the engine after standing for a long period with the parking lights on.

The centre stand is too low and hits the ground when cornering and is also too far forward unless we intend to provide a jack for use when changing the rear wheel.

15. Bottom Link Forks for Crusader Sports Model

The new set of the Armstrong dampers has been tried on the road and also on the 'ride and handling course' at the M.I.R.A. proving ground. The setting is considered to be too hard and arrangements were made with Mr. Blandford for a day at the M.I.R.A. proving ground to modify it to

15. Bottom Link Forks for Crusader Sports Model(Cont...)

give a comfortable ride under main road conditions with the minimum of bottoming on severe bumps.

16. 350 Crusader Engine

This has now covered a total of 1,709 miles. At 1367 miles the high gear layshaft pinion broke and the clutch centre key sheared when the engine back-fired when being kick-started. It is assumed that the pinion broke first then jammed the gear box thus causing the failure of the key. This pinion is apparently a standard HJ type and has not been especially strengthened. A standard replacement pinion has been fitted.

17. 175 cc Engine

It is too early for any report in view of the fact that Mr. Thomas has been on holiday since Whitsun.

18. Bottom Link Forks with Bonded Rubber Suspension

Nothing further to report.

19. Siba Self Starter on Crusader Machine

Two Lucas police type batteries were obtained and fitted to this machine. Although they were sent in the dry-charge state they were given a refresher charge after filling. At first they would turn the engine over even when the throttle was wide open but after a period of time they are giving no better results than the smaller batteries. Whether or not this indicates that the Siba generator is giving an inadequate charge is not known since there is no ammeter in this system.

.....R.A. Wilson-Jones.....
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9th May, 1961

Report of Bonded Rubber Leading Fork

This has been assembled into a Crusader Sports machine and ridden round the works but has not been taken on the road on account of the fact that the links are made of Malleable Iron and look weak for the work they have to do and also because there is no front mudguard to suit the fork.

The springing appears at first to be much too hard but the machine rides quite well over small bumps. This may be due to a characteristic of rubber in torsion which is believed to have a rising load/deflection curve, i.e. the 'rate' is low for small deflections and increases with larger ones. This is, of course, a desirable characteristic where movement is limited.

The angle of the fork tubes, or the length of the links, is not correct for this machine. The wheel is about 1" further back than with the standard telescopic fork.

The appearance of the fork is peculiar and far from being attractive.

The bottom lugs carrying the rubber units are 'fish tailed' to reduce stress concentration on the main tubes. This, however, is done in the wrong direction. The long points should be at the sides of the tubes, not fore and aft.

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