2.3 Engine Specifications and Descriptions

The following article first appeared in *The Motor Cycle*, shortly after the appearance of the 1939 Scott Clubman's Special. It was written by "Wharfedale" (Donald Smith), an old friend of the clan and a West Riding journalist of many years' standing. The excellent drawings were prepared by *The Motor Cycle* artists, and after the war reappeared again in *Motor Cycle Engines: Famous British Designs Analysed. Details of Modern Power Units, with unique Explanatory-type Drawings.* This was published by Iliffe in 1951 and ran to several impressions. Apart from rearranging the drawings slightly to suit the pages of Yowl, and actually having the gall to correct errors of syntax made by a respected writer, I have reproduced the article *verbatim*. There must be copyright extent somewhere, at least for another year, but the convolutions of the publishing world make it difficult to know where it now lies. I hope the legal owners, if they should come to learn of this little club's re-use of their work, will take a lenient view — just as they have done over all those unacknowledged reproductions of drawings and pictures made by various members of this club over the years. (Usually the printing or Xerox copying has been so bad that no-one would wish to be associated with their 'publication'!) Those of you who know all about the Scott engine, and have many years' experience, must be a little tolerant towards the rising generation who are still at the 'honeymoon' stage. The line drawings are among the best made of the famous twin, and all are to the same scale except that of the crankshaft and associated components, which is reduced somewhat in order to simplify the layout — *Ed.*

596 c.c. TWIN-CYLINDER SCOTT
Constructional Details of an Unconventional Engine: How it Operates
by "Wharfedale"

To many people the internal workings of the Scott engine are something of a mystery, because the mechanical design is quite uncoventional. Moreover, in a three-port two-stroke engine, using crankcase compression, the crankcase becomes more than a mere box to hold the crankshaft and its bearings. It is a functional part of the engine and its design enters very largely into the question of volumetric (or pumping) efficiency.

Again, the ports in the cylinder and the passages in the crankcase, in conjunction with the piston, are, in effect, the valve gear; in consequence, the piston must of necessity be of the correct design for this essential part of his work, as well as for its normal duty. Simple as the three-port two-stroke engine is in principle it calls for very great care in design and construction if really good results are to be attained.

Mechanically the Scott engine is also very remarkable in that it follows today, basically, the original conception of thirty years ago. The crankshaft and flywheel assembly, the use of roller bearings throughout, the retention of crankcase compression by specially designed glands, and so on, remain a tribute to the brilliance of the late Alfred A. Scott. Time has not changed the mechanical layout and it is only in detail and materials that improvement has been possible.

With compression-tight main roller bearings, built-up crankshaft, central flywheel and roller bearing big-ends, a very high degree of precision is called for, and when one reflects that the original design was laid out at a time when precision machining and standardized bearing assemblies were almost unheard of in commercial productions, the daring of it all becomes apparent; there was every justification for the slogan "years ahead".

This necessity for really accurate workmanship accounted for the excellence of the Scott engine. "Made to limit gauge" was a proud trade-mark for many years in a period when fine measurements were less common than they have since become.

The performance of a two-stroke engine is determined more by the original design and construction than by subsequent "tuning", and that, by the way, is a point that Mr. Harry Langman made when he was showing me the components of the "Clubman's Special" engine. "First and last", he said, it is accurate workmanship that controls the results. You cannot tinker with a two-stroke like you can with a four-stroke." Harry, incidentally, has grown up into the Scott tradition.

He was one of the original staff in Alfred Scott's time, and apart from an Army interlude (when he and I, so it chanced, were in the same unit) he has been associated with the Scott continuously as tester, trails rider, solo and sidecar T.T. racer, and lately factory executive.

"The Clubman's Special" has certain modifications from standard, and has a higher compression ratio, but otherwise the general description is applicable to all models.

The engine size now standardized measures 73mm × 71mm (596 c.c.) and the water-cooled cylinders with detachable aluminium head are inclined forward. The cylinder block is bolted to an aluminium casting generally referred to as the "crankcase," although the term is not exactly without explanation.

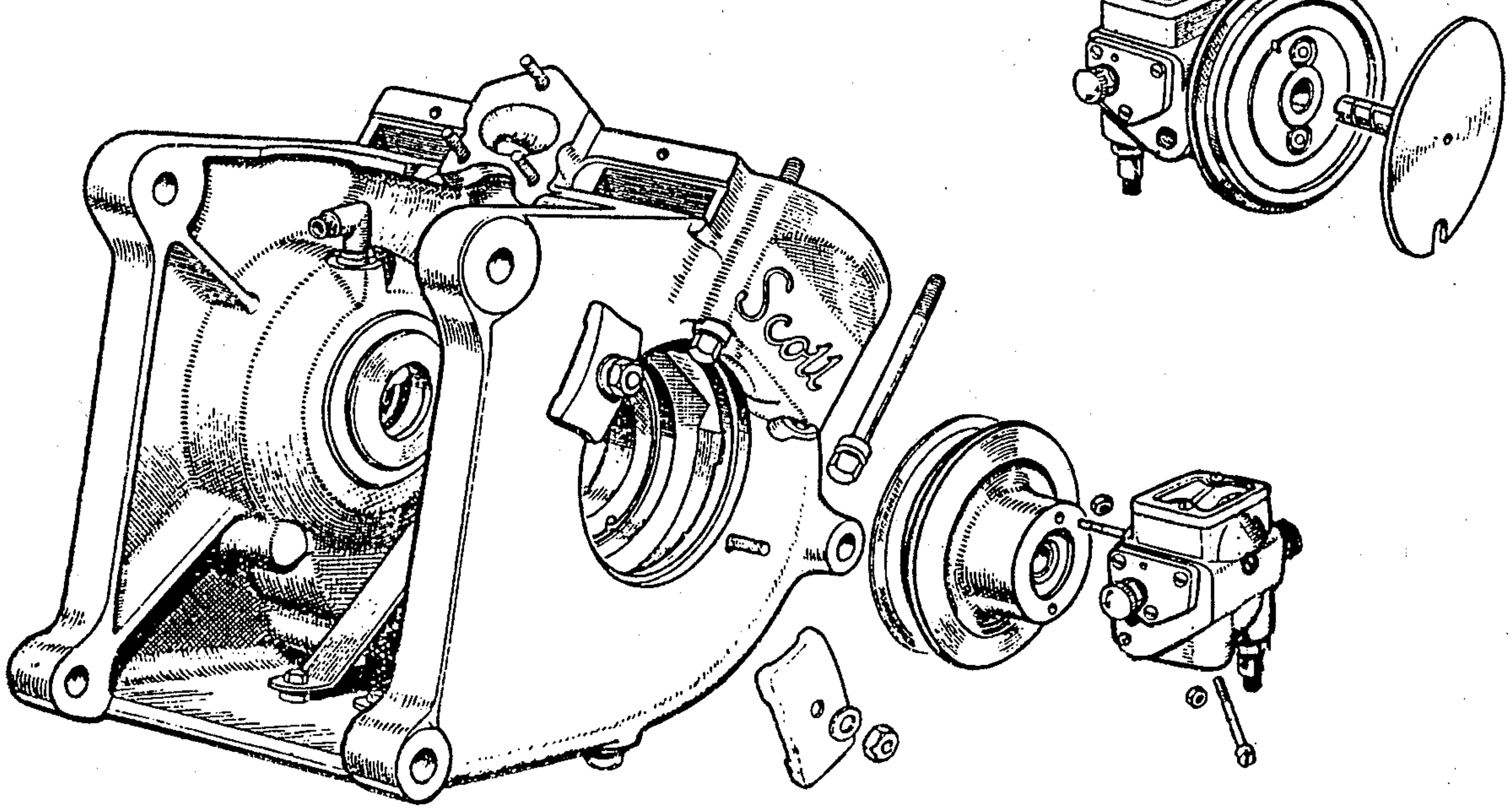
A two-stroke engine using crankcase compression requires that each cylinder shall have its own separate crank-chamber, and in the Scott the flywheel is located between the two chambers so that, to a certain extent, the engine may be regarded as two quite separate single-cylinder units, one on each side of the common flywheel. Thus the "crankshaft" is a large box enclosing the flywheel and forming an undershield, and at the same time incorporates the two crank chambers and the primary drive. The simile of two separate single-cylinder engines breaks down when we come to consider the induction system.

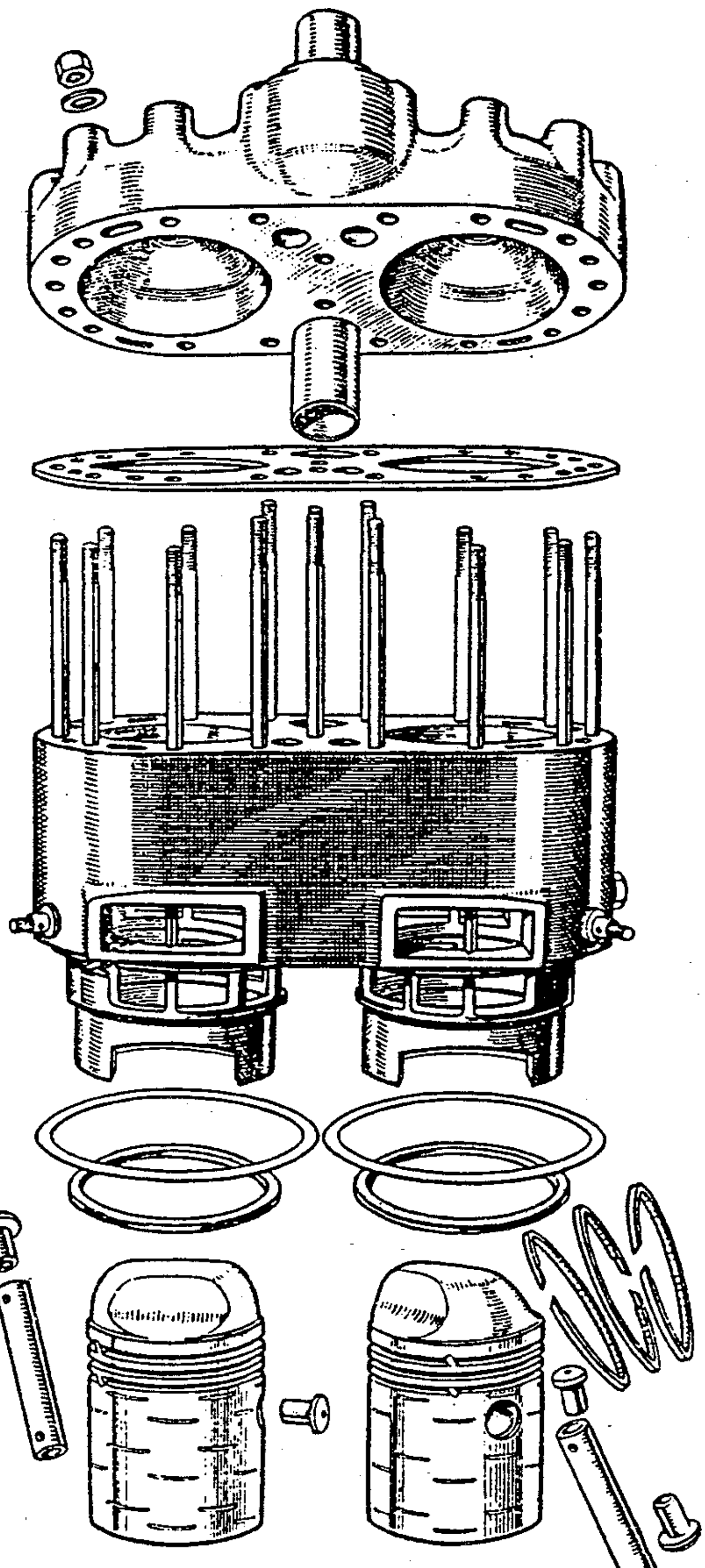
The carburettor is bolted to a flange on the crankcase casting in communication with a space which surrounds the lower part of the cylinder barrels, so forming a kind of manifold. This manifold space in the crankcase is very important, for its design has great bearing upon efficiency; its walls are highly polished and there are no pockets for obstructions to the gas flow. Unlike the manifold of a more normal type of engine, the whole inside of the intake system is exposed when the cylinders are removed.

Four power impulses in two revolutions of the crankshaft are given by the twin two-stroke, and the torque effect is similar to that of a four-cylinder-in-line four-stroke engine. For each power impulse there is a corresponding intake, so that the engine is drawing on the carburettor far more constantly than is the case with a 180-degree twin four-stroke. Moreover, as compression occurs in one crank chamber the other is drawing in, with the result that any blow-back as the inlet port closes on the one is taken by the other, and so on.

This "induction manifold" portion of the crankcase is quite deep, in the form of wells which receive the long projecting spigots of the cylinder barrels; the base flange of the cylinder block (below the water jacket) rests on the top surface and is pulled down by four bolts which are passed upwards through bosses on each side of the casting. The projecting parts of the cylinder barrels are turned to two external diameters, the lower portions being spigoted into the crankcase wells, while at the "steps" formed by the section of larger diameter (in which the inlet ports are cut) square-section rubber rings are fitted, linen rings being placed on the upper portions close up against the base flange.

Each cylinder has its own separate crank chamber, one on each side of the flywheel. The oil pum are attached to the crankcase "doors".





Sixteen studs arerate crank chamber, one on each employed to attach the aluminium head to the cylinder block. The drawing also shows the "stepped" spigots on the cylinder barrels with their series of rectangular ports.

When the cylinder block is tightened down the linen rings seal the joint between the base of the block and the crankcase, while the rubber rings are compressed against corresponding registers inside the wells, so sealing the annular manifold space.

Through the upper part of the projecting barrels, which coincide with the manifold, are six rectangular ports extending more than half-way round the wall, the clear inlet area being equivalent to nearly 40 per cent of the cylinder bore. These ports face mainly inward towards the centre line.

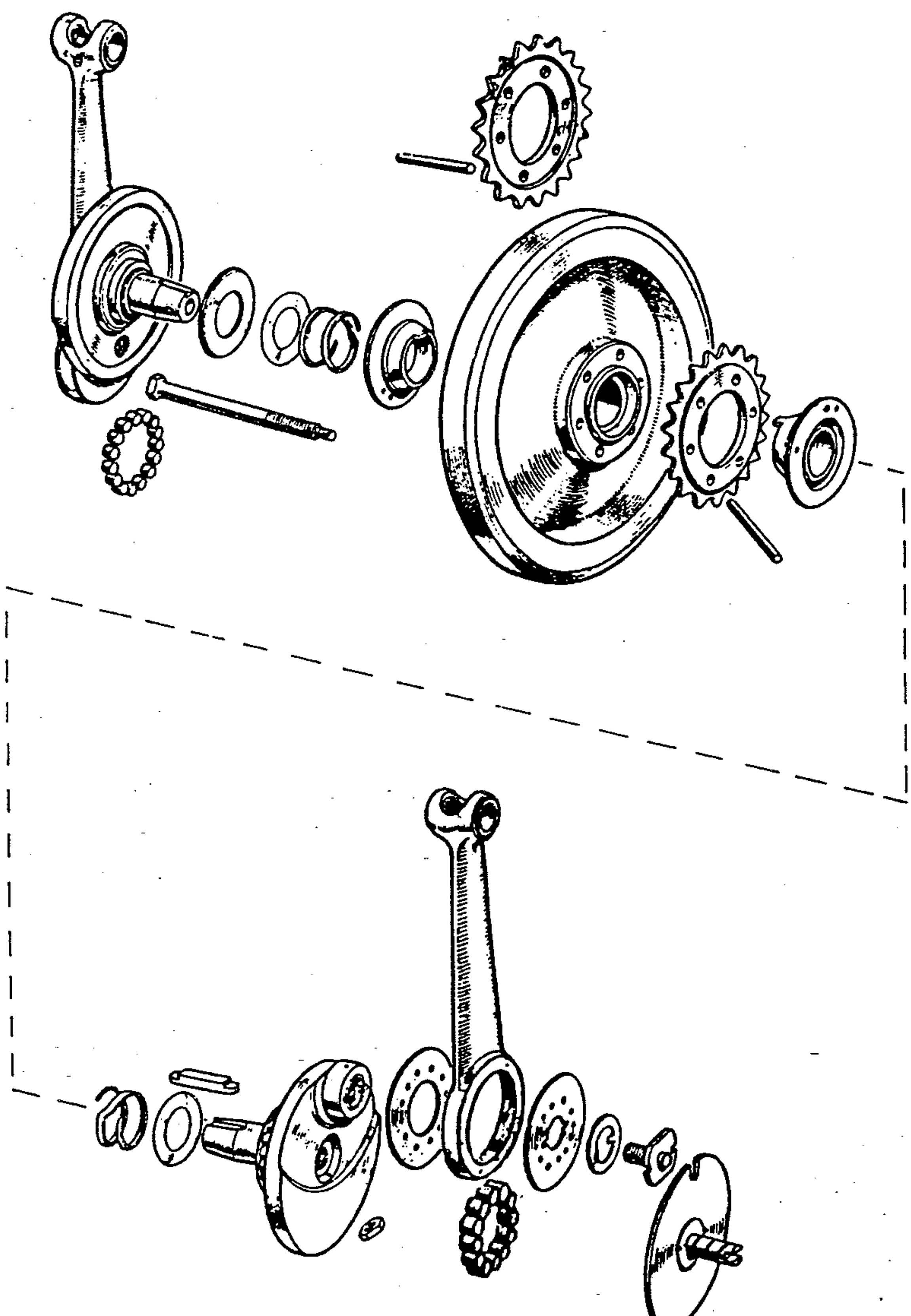
When the piston rises the ports are uncovered by the bottom of the skirt and gas passes through from the carburettor to "fill" the depression in the crank chamber. The big inlet area is essential for efficiency, as the period of full opening is brief, the piston beginning to uncover the port at about 58 degrees before top dead centre and finally closing it again 58 degrees after t.d.c., or about 120 degrees of crank movement as against 190 or more degrees in the case of a four-stroke. Rate of port opening is a function of piston speed and it cannot be altered unlike the valve lift of a fourstroke which can be varied by cam design irrespective of engine r.p.m.

As the piston descends the gas is compressed in the crank chamber, while the upper part of the piston begins to uncover the transfer port about 66 degrees before bottom centre. Gas is forced into the cylinder above the piston via the transfer passage, which is a detachable casting connecting the crank chamber below the manifold portion, which, it will be remembered, is sealed by the rubber base-ring) with the transfer port about a third of the way up the working position of the cylinder barrel. The exhaust port is directly opposite but slightly deeper than the transfer port ($^{15}/_{16}$in against $^{5}/_{8}$in). It is in the forward side of the cylinder wall and is, of course, uncovered by the piston at the same time as the transfer port, although, due to its greater depth, it opens earlier in the cycle of operations and closes later. But more on this point anon.

To digress a moment. Most two-stroke engines have the ports and transfer passages cast integrally in the cylinders, and as large ports (of great relative width, to give quick opening) weaken the barrel, the size has more often been determined by the structural strength than by efficiency. Additionally, integral casting makes the openings and passages inaccessible to machine tools. The Scott cylinder design permits all the ports to be machined to precise limits, so that accuracy of port timing is assured. All roughness can be removed, and as the downwardly projecting cylinder barrels extend well below the holding-down flange the inlet port dimensions do not affect the strength.

Since the exhaust and transfer ports are open at the same time, and as they face each other, the incoming gas would immediately shoot across and out of the exhaust if its flow were not controlled. This control is effected by the deflector top piston. Designing the "hump" on the piston crown is a highly critical matter, and whereas there are certain things that obviously must be avoided (like sharp angles or pockets), the ideal shape for any given engine is achieved only by a long process of experimenting.

As already mentioned, the exhaust port begins to open somewhat in advance of the transfer one, so that the pressure of the exhaust gas is reduced and its flow towards the port is initiated. When the transfer port opens the fresh cold charge from the crank chamber is shot up the side of the cylinder wall towards the head by the deflector and it tends to displace the hot exhaust gas rather than to mix with it, although, of course, some intermingling is unavoidable. This is one of the reasons why all two-stroke engines of the ported cylinder, piston-controlled type have a lower thermal efficiency than four-stroke engines of corresponding size.



The built-up crankshaft has a central flywheel to which are rivetted the engine and magneto drive sprockets. A single high-tensile bolt passes through the two hollow crankshafts, draws them together into the flywheel box and makes the whole assembly solid.

The new gas above the piston is compressed and fired in the usual way and the cycle is repeated, there being a power impulse each time the piston comes to the top. Mechanically the design is so closely associated with the functional working of the two-stroke cycle that it is necessary to explain the engine in terms of this relationship so that the reason for many of the details shall be evident. With the main outline disposed of, however, it is possible to look more closely into the mechanical details.

By arranging the flywheel and primary drive between the two crank chambers, a compact self-contained layout results. On the other hand, the transverse "couple" peculiar to two-cylinder engines with the cranks set at 180 degrees increases as the distance between the cranks increases. Some slight reduction of this width could be secured by having the flywheel elsewhere, but the Scott engine suffers remarkably little fron this particular force.

It is not obvious why the engine is so free from vibration. But one cannot overlook the possibility of the large central mass of the flywheel resisting the effect of the rocking couple in much the same way as brick will absorb a hammer blow without passing it on to the hand that holds it.

Location of the bearings may have an important influence on the matter, too. The mainshaft runs in two roller bearings and the crankpins are overhung, but the flywheel and the primary drive are supported *between* the bearings; the whole assembly is exceedingly stiff and compact in spite of the fact that it is necessarily built up from separate components.

Each crankshaft comprises a tapered stub which carries the inner race of the main roller bearing and engages with the flywheel centre. The web is a disc, thickened at one side for balancing purposes, and having a small boss to receive the inner race of the big-end roller bearing. In the crank chambers are pressed the outer races of the main roller bearings, and these are firmly fixed by means of locking rings which are shrunk in around the housings definite location is assured by four countersunk screws. This positioning is necessary because small oil ports in these bearing shells have to be "timed," as will be explained when we consider the lubrication system.

Since a two-stroke crank chamber must be compression tight, and as a roller bearing is anything but that, the problem is overcome by the use of spring-loaded glands. The rollers are assembled on the crankshaft race and faced by a ground disc or collar which slides on the mainshaft; this collar is backed by a spring.

The centre boss of the flywheel, on which the driving and magneto sprockets are riveted, is taper bored from each side. A keyway is cut straight through this double taper hole and a long key is fitted which registers with keyways in the tapered ends of the mainshafts projecting from the crank discs. The accuracy of these keyways in relation to the crankpins is most important, since the precision of the port timing is wholly dependent upon them.

A single high-tensile bolt through the two hollow crankshafts draws them together into the flywheel boss and makes the whole assembly solid; the workmanship here has to be above question, since the slightest malalignment would throw both the main and the big-end roller bearings out of truth.

. The nickel-steel connecting rods are of oval section, and they are as thin as possible to obviate large empty spaces in the crank chambers; the small-ends are offset to a slight extent. Oil hardened roller races are pressed into the big-ends, a feature of which is the unusually large diameter in relation to the width.

Bronze bushes are used in the small-ends, and to those unfamiliar with the Scott engine the large amount of metal taken out of the top of the bearing is unusual, but it has to be recollected that there is explosion pressure on the piston at every downward stroke, so that the upward inertia pressures on the upper half of the bearing are cancelled out in a way which does not obtain in a four-stroke engine.

Fairly long pistons of heat-treated Y-alloy aluminium are used, and as they are also the "valve gear" the clearances have to be set to very close limits, and to ensure the best results each piston is pronouncedly tapered or, more correctly, each part of it has its own diameter. There are four different diameters, ranging from 0.004in clearance at the skirt to 0.009in above the top piston ring. Replacement pistons turned parallel are a frequent cause of poor running, lack of power, and seizure. Short oil-distribution grooves are cut in the piston skirt, and there are three very narrow compression rings at the top.

Light hollow gudgeon pins float in the piston bosses. Obviously, since both the rings and the pins pass the cylinder ports, provision has to be made to prevent them catching. Dividing bars cross the exhaust and transfer ports, and for the same reason the large inlet port is divided into six sections. Stops are fitted in the ring grooves to prevent the ring gaps working away from the unported outer sides of the cylinder bores.

End movement of the gudgeon pins is prevented by the use of large, domed bronze buttons riveted into the outer ends of the pins; these buttons fit into recesses in the piston wall and prevent the pins working across to the inner sides and fouling the inlet ports.

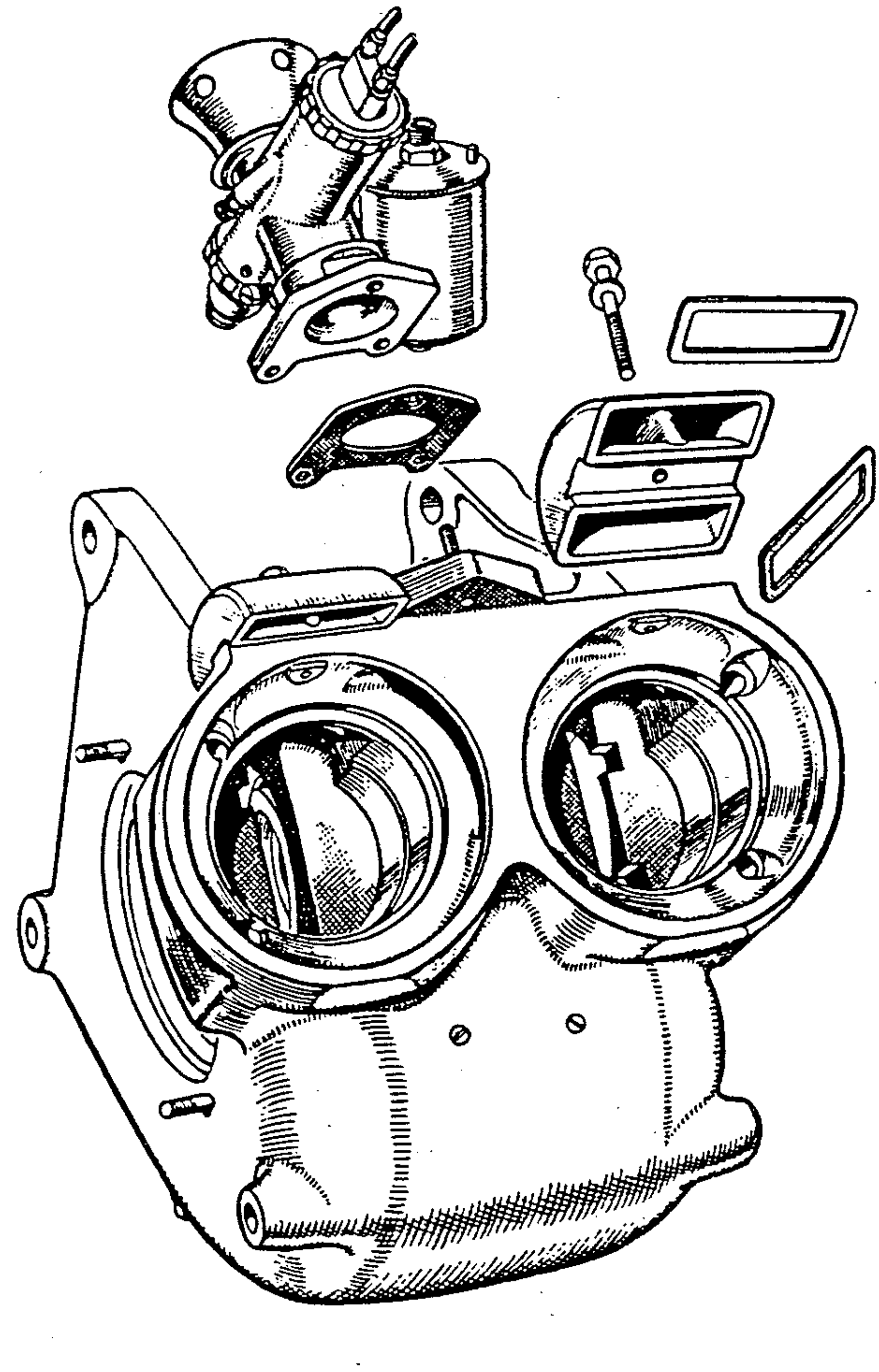
Lubrication is effected by two duplex Pilgrim pumps fitted on the crankcase "doors," which is the name given to the discs that close the outer sides of the crank chambers and through which the crankshafts and big-ends are assembled. Mains lubrication is provided by the pump on the off side, which delivers oil to recesses behind the shells of the mainshaft roller bearings. Ports in the inner faces of the shells coincide with ports in the spring-loaded packing glands, which themselves are definitely located in relation to the crankpins by tongues on their collars engaging with the key way in the flywheel boss. These ports in the glands and bearing shells are timed to register at the point of maximum crankcase depression so that oil is sucked through, lubricating the glands and the main bearings. Oil escaping from these is thrown across the face of the crank disc into a knife-edged groove around the rim, from which it goes owing to centrifugal force through a drilled hole in the crankpin to lubricate the big-end bearing.

The other pump delivers a limited quantity of oil via small-bore pipes to oil grooves in the cylinder bores between the inlet and transfer port levels, thus directly feeding the piston skirts.

Water-cooling is on the thermo-syphon system and both connections are made through brass pipes fixed in the cylinder head, which, incidentally, is held down by nuts on 16 high-tensile steel studs in the cylinder block; a copper and asbestos gasket makes both the water and compression joints.

From the union at the rear of the head the water rises to the radiator header tank, while the cool water from the base of the radiator passes down through the tube in front of the head. This tube extends well down inside the water jacket and is chamfered off at its end so as to direct the flow of water on to the cylinder walls in the region of the exhaust ports.

It will be realized that the all-round performance of a two-stroke engine such as the Scott is dictated almost entirely by (a) the possibilities of the original design, and (b) by the accuracy of manufacture. In short, such an engine is rarely susceptible to amateur "tuning." The Scott engine is one that is not excessively stressed mechanically, hence its well-known and quite remarkable longevity.



The "induction manifold" portion of the crankcase is in the form of two wells in which are located the spigots of the cylinder barrels. Four bolts passing through bosses on each side of the casting secure the cylinder block. Note also the detachable transfer castings.

486cc AND 532cc CYLINDER BLOCKS
Jack Frazer

Charles Lipscombe's letter in *Yowl* Vol. 15 No. 5 raises interesting points both of a general and a specific nature. In regard to his plea for the publication of more information of a technical nature, I am entirely with him. For those of us who are trying to hack our way through the Scott undergrowth a properly dimensioned sketch or drawing is more informative than the written word. The only difficulty is that someone has to do the research and produce the blessed thing; this brings me to his specfic query in regard to the Cylinder Blocks.

The Editor has enjoined us to get on our bikes and dig out the relevant information already available in previous issues of the Journal, but it would appear that he has happily relented by publishing on pages 107/109 what I take to be a reprint of the information previously put out in Vol. 5 No.11. I do not have this issue as my file is incomplete between 1966 and 1975 but, in any event, the information given appears to relate only to blocks with two exhaust ports. I, like Mr. Lipscombe, am interested in those with single exhaust ports and, in my case, specifically in earlier Squirrel engines (486cc 2 × 70 × 63.5) but with a passing interest in Standard engines (532cc 2 × 73 × 63.5).

I have five Cylinder blocks as above, details as follows:-

Item V *Engine No. S8882 (1925)* This is a flat-head (not water cooled) block with 1⅞" o.d. exhaust port and screwed-in holding down studs. Single angled plug holes to rear of each domed combustion space. Bore 70mm. I cannot at present measure the porting arrangements as the engine has been built up and has just come to life for the first time in living memory. I don't want to disturb it prematurely.

Item W *Engine No. 6380 (1923)* This is a flat head block with 1⅜" o.d. exhaust port and holding-down studs secured by cotters. Two angled plug-holes in each domed combustion space. Bore 70mm.

Item X *Engine No. T7313 (1924)* This is a flat head block with 1⅜" o.d. exhaust port and holding down bolts secured by cotters. One central axial plug hole and one radial plug hole at front in each cylindrical combustion space. Bore 73mm.

Item Y *History unknown.* This is a flat head block externally as X. Bore 73mm. Cylindrical combustion space. Believed Standard 532cc block.

Item Z *Engine No. 6469 (1923)* Probably not original. This a *water cooled head block* with 1⅞ o.d. Exhaust Port and screwed-in holding-down studs. One central axial plug-hole in each domed combustion space. Bore 70mm. Internal dimensions not available as engine in use.

Taking the liberty of making use of Mr Griffiths' helpful sketch, I tabulate below the dimensions of Blocks, W, X, and Y together with an additional sketch showing the disposition of the inlet ports as B5. I must say that the dimensions given are somewhat approximate due to the roughness of the castings and could show a variation of + or − 1/32". (It is years since I looked critically at Flyer and later blocks but the porting must have been better fettled to permit accurate measurement to 1/64" to yield the dimensions given in the earlier table.)

My comments on these measurements are as follows:

Measurement A Not stamped on any of these blocks at A1

B A different configuration of Inlet Ports

C Block W has been better fettled than the others and the ports are consequently slightly larger and more clearly defined.

From the above it will be apparent that the 486 cc and 532 cc are for all practical purposes identical in regard to porting and overall dimensions, and that the sole difference would appear to be in Sparking Plug arrangements, combustion space configuration, size of exhaust port and method of securing the holding down bolts.

Thus I would seem to have four different types of block as originally fitted to the 63.5 mm stroke engine:-

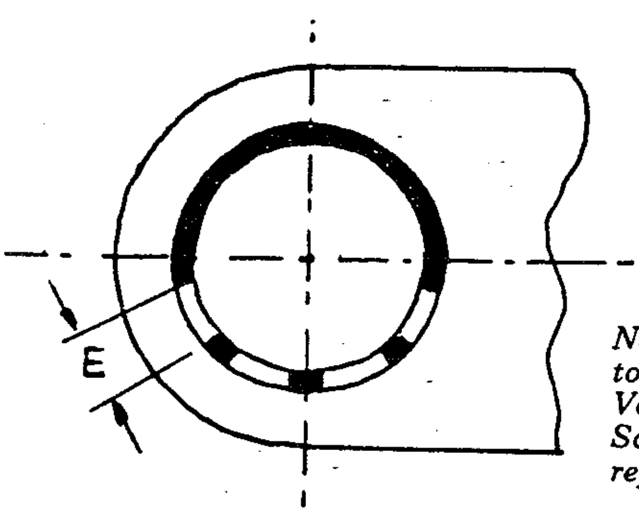
1. The Squirrel 486 block as W
2. The Standard 532 block as X and Y
3. The later large exhaust flat head 486 block as in V
4. The water cooled head 486 block as in Z

I realize that the picture would be more complete if I had the dimensions for blocks V and Z, but enough emerges to make one inquisitive about the provenance of the three different types of 486 block. Perhaps someone can provide the answer?

Furthermore there is the matter of Pistons for these engines. There is no obvious reason why the 70 mm bore block with its domed combustion space should not be bored out to 73 mm to increase capacity to 532 cc, but the massive standard 73 mm cast iron piston has few attractions. Were Light Alloy Pistons with a suitable crown contour to go into the domed combustion space ever available for 73 mm bore?

Casual inspection of other large bore Scott pistons for later machines would appear to confirm unsuitability for this particular purpose, but it would be interesting to know what was available in the hey-day of the 63.5 mm stroke engines. Possibly someone knows and can reveal all.

As a parting shot, does anyone have details and dimensions of the special cylinder blocks and heads made by Parker of Kendal for these engines? I have never seen anything except external photographs, and wonder whether any records of these interesting components still exist.



B5

Note: Letters and numbers refer to the drawings reproduced in Vol. 15, No. 5, the sections of Scott cylinder blocks. B5, reproduced here, is new - Ed.

	A	B	C	D	E	F_1	F_2	G_1	G_2	H_1
CODE	2	3	4	5	6	7	8	9	10	11
W	5⅝	B5	1 1/16	⅜	⅞	1 31/32	2 1/16	½	11/16	1 15/16
X	5 9/16	B5	1 1/16	⅜	¾	2 1/32	2 1/32	15/32	⅝	1⅞
Y	5 9/16	B5	1 1/16	⅜	¾	1 31/32	2 1/16	½	⅝	1 7/16

	H_2	I_1	I_2	J_1	J_2	K_1	K_2	L	M	EXH. STUB	BORE
	12	13	14	15	16	17	18	19	20		
W	2	2 1/16	NA	⅝	NA	2	NA	NA	3⅜	1⅜	70mm
X	2	2 1/16	NA	⅝	NA	1⅞	NA	NA	?	1⅜	73mm
Y	2	2 1/32	NA	⅝	NA	2	NA	NA	3⅜	1⅜	73mm

ALL DIMENSIONS ARE IN INCHES

V5/11 April 1968

BLOCKS, SCOTT, ASSORTED

It must be two or three years ago that Glyn Chambers set himself the task of tabulating details of all the Scott cylinder blocks he owned, and those he knew of in the hands of fellow Scott owners.

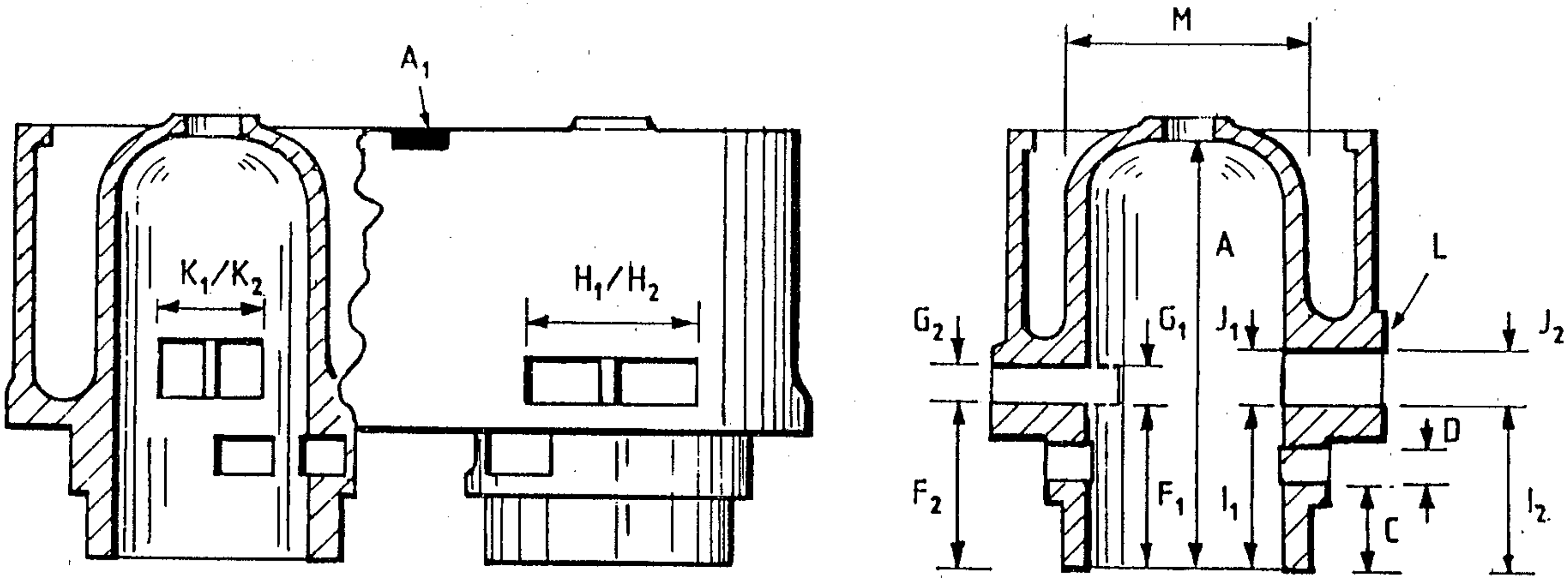
He gave Geoff Lee the accompanying chart and asked him and myself to add to it if possible. Geoff bunged one on as far as I can remember, but I think that all my blocks were identical to one of those already recorded. At least two engine dimensions seemed not to vary between all the years of the full crank case Scott long and short stroke alike, (1926 to '51), and these are from the top face of the crank case whereupon the block sits, to the centre line of the crankshaft, which on all the many varieties I've checked was 5¼" and from the bottom face on the block, which mates with this top face of the crankcase, via a paper joint, to the under surface on the block which compresses the cork or rubber ring, this was ⅞" with a further 1" of skirt sticking out beneath if original and unimproved. Oh, yes, and I almost forgot a third, the dimensions between the centre of both bores.

In fact as far as I can ascertain long and short stroke Full Flyer crankcases were identical from the point of interchangability apart from, of course, the larger hole in long stroke crankcases to accommodate the larger diameter cranks. This also entails, as we all know, a slightly larger crank-case door.

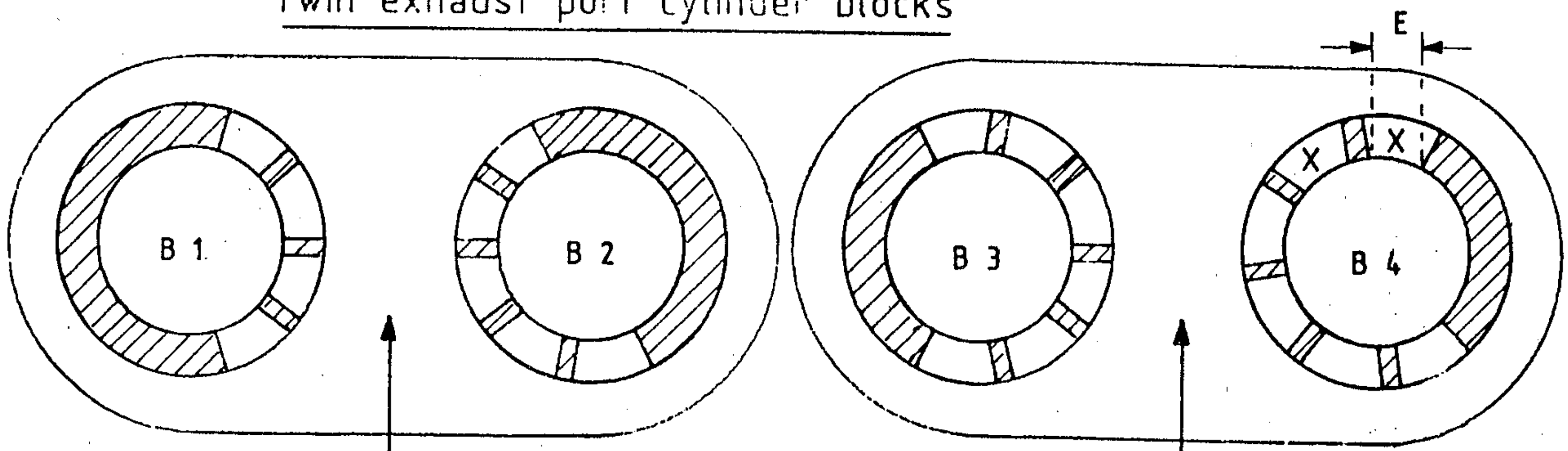
The chart is really only intended for academic interest, and is, I should imagine, far from complete. If any vitally interested party would care to add or criticise what has already been printed I should be most pleased.

G. C. arr. N. S.

Ed. Note. The chart referred to in this article has not been reproduced as it is superseded by the redrawn version on the following two pages.



Twin exhaust port cylinder blocks



Inlet port positions

V15/5 Aug.1987
redrawn for SOC
by A.R.Griffiths

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	REMARKS
FZ	5 21/32	4 B1	1 3/16	1/2	13/16	1 29/32	2 1/16	11/16	21/32	2	2	2	2 3/32	13/16	13/16	2	2	1 3/16	3 1/2	History Unknown
FZ	5 11/16	4 B1	1 3/16	1/2	13/16	1 15/16	2 1/16	11/16	23/32	2	2	2	2 1/16	3/4	13/16	2	2	1 1/2	3 5/16	History Unknown
FZ	5 43/64	4 B1	1 1/8	17/32	13/16	1 1/8	2 1/16	11/16	5/8	2	2	1 15/16	2 1/32	27/32	23/32	2	2	1 3/16	3	History Unknown
FY	5 49/64	4 B1	1 1/8	1/2	13/16	1 15/16	2 1/32	11/16	5/8	2	2	1 3/32	2 1/16	7/8	3/4	2	2	1 1/8	3 3/16	History Unknown
FY	5 49/64	5 B2	1 1/8	1/2	13/16	1 7/8	2 1/32	11/16	5/8	1 15/16	1 15/16	1 15/16	2 1/16	13/16	3/4	1 15/16	1 15/16	1 1/8	3 5/16	5 Inlet Ports (Uncommon)
RZ	5 25/32	6 B3	1 1/16	37/64	13/16	2 1/32	2 1/64	39/64	21/32	2 1/32	2 3/32	2 1/32	2 1/32	15/16	15/16	2 1/32	2 1/32	1 5/8	3 1/16	Porting Modified from Original
RY	5 13/16	6 B4	1 1/4	1/2	13/16	1 31/32	2 1/32	23/32	11/16	2	2	2 1/32	2 1/32	29/32	29/32	2	2	1 1/8	3 1/4	History Unknown High Inlet Ports
PY	5 3/4	6 B3	1 3/32	9/16	13/16	1 31/32	2 1/64	23/32	21/32	2	2	2 1/64	2 1/32	15/16	15/16	2	2	1 1/8	3 1/4	Genuine 1930 Sprint FZ Block, RY Porting
PY	5 13/16	6 B3	1 3/32	9/16	13/16	2 3/64	2 3/32	5/8	5/8	2	2	2 3/64	2 3/32	59/64	29/32	2	2	1 3/8	3 5/16	1934 Reynolds' Special
DPZ	—	6 B4	1 3/32	9/16	13/16	2 1/16	2 1/32	5/8	5/8	2	2 1/32	2 1/16	2 1/16	7/8	15/16	2 1/32	2 1/32	1 3/8	—	History Unknown
DPZ	—	6 B4	1 7/64	9/16	23/32	2 1/16	2 1/32	5/8	21/32	2 3/64	2 1/16	2 3/32	2 3/32	29/32	15/16	2 1/32	2 1/32	1 7/16	—	History Unknown
DPY	—	6 B3	1 3/32	9/16	13/16	2 3/32	2 1/16	11/16	11/16	2	2 1/32	2 1/8	2 1/8	55/64	31/32	2 1/32	2 1/32	1 3/8	—	1938 Flying Squirrel
DPY	—	6 B4	1 3/32	37/64	27/32	2 1/16	2 1/32	5/8	11/16	1 31/32	2 1/32	2 1/16	2 1/16	7/8	15/16	2 1/32	2 1/32	1 3/8	—	History Unknown
Un-Known	5 7/8	4 ?	1 1/8	3/8	13/16	2 1/16	1 31/32	1/2	9/16	2	2 1/32	2 1/16	2 1/16	19/32	5/8	1 7/8	2	7/8	3 1/4	

1	— Block type
2	— Cylinder bore height to dome (A), a dimension stamped on the block at (A1)
3	— Number of inlet ports and layout (B)
4	— Height of inlet bore from cylinder base (C)
5	— Depth of inlet ports (D)
6	— Approximate width of inlet ports (E)
7&8	— Heights of transfer port from cylinder base (F1) and (F2)
9&10	— Depths of transfer port (G1) and (G2)
11&12	— Widths of transfer port (H1) and (H2)
13&14	— Heights of exhaust port from cylinder base (I1) and (I2)
15&16	— Depths of exhaust port (J1) and (J2)
17&18	— Widths of exhaust port (K1) and (K2)
19	— Exhaust port manifold depth (L)
20	— [illegible]e casting external diameter (M)

ALL DIMENSIONS ARE IN INCHES

V15/5 Aug.1987

READERS' LETTERS

Birstall
Leicester

Dear Brian,

The preparation of the enclosed chart has been prompted by a recent problem which I experienced in a transaction involving an exchange of parts with a fellow club member. He required a pair of cranks for a 2-speed wide-bearing engine. Unfortunately I did not have a pair to offer. I had, what I thought to be, two R.H. cranks and these were accepted on the basis that one of the cranks could be converted to L.H. This would entail removal of the thread in the centre bore and re-cutting a new keyway at 180° for the flywheel key, accepting that the thread for the crankpin screw was incorrect hand.

A phone call a couple of days later following closer examination had revealed that the two R.H. cranks were quite different. Although both had the small diameter taper associated with 2- and 3-Speed Supers, it transpired that one of the cranks had the larger diameter main bearing bush and corresponding larger diameter threaded retaining ring of Flyer sizes i.e. 1.500" O.D. instead of 1.250" O.D. and therefore could not fit into the crankcase with standard ⅜" diameter rollers.

Needless to add that this part of the deal was 'frustrated' to say the least, but the following questions are posed.

1. Was this originally a short stroke Flyer crank modified on the taper and keyway to accept a Super flywheel for some reason although there is no evidence of amateur modifications?

2. Were some special super type crankcases made to accept the larger Flyer size main bearings with increased number of rollers?

3. Does anyone require this particular R.H. crank to match up with their existing L.H. crank? Any offers must be accompanied by the promise of a further explanatory article for a subsequent edition of *Yowl!*

Best wishes

John Underhill

Ed: There are other "odd" cranks to be found apart from the one described by John. The "R" type engine, fitted only to 1929 T.T. Replicas had their own special cranks, a few of which might still be alive and kicking today. Whilst dimensionally similar to other longstroke cranks, they do not have the disc section partially thinned down like other cranks. The thinning-down was presumably done to aid lubrication to the big-end bearings, but surely was the main cause of weakness in cranks?

For instant recognition of cranks:-

Longstroke cranks have the "knife-edge" oil groove round the inside face, and small oil hole in the crankpin. Short stroke cranks have the oil hole by the side of the crankpin.

LFZ and LFY engines (1934 only) had odd cranks. They are longstroke but have neither the hole in the crankpin, nor a hole at side of crankpin, nor the oil groove round the inside face! (LF info. from Jim Best.)

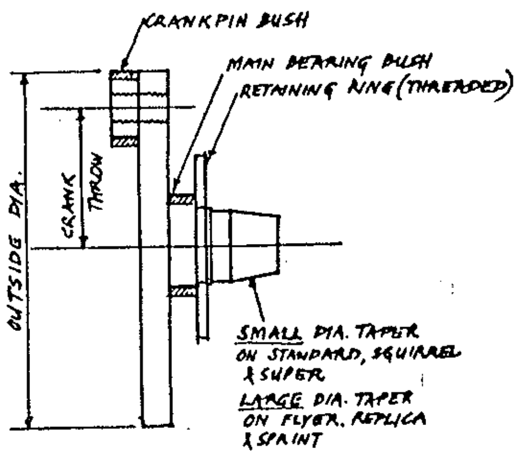
Well, like most Scott information, that has left matters about as clear as mud! Anybody else like to confuse the issue?

B.M.

SCOTT CRANK & CON-ROD IDENTIFICATION

V16/6 Oct.1989

MODEL	CAPACITY	CRANK	MAIN BEARING BUSH			CRANKPIN BUSH			CON ROD		
		THROW	BORE	O.D.	WIDTH	BORE	O.D.	WIDTH	B.E. BORE	WIDTH	CENTRES
STANDARD	532cc	1.250	1.000	1.250	.250	.750	1.125	.250	1.875	.250	5.625
SQUIRREL	486cc	1.250	1.000	1.250	.250	.750	1.125	.250	1.875	.250	5.625
SUPER	498cc	1.344	1.000	1.250	.250	.750	1.125	.250	1.875	.250	5.625
(NARROW)	596cc	1.344	1.000	1.250	.250	.750	1.125	.250	1.875	.250	5.625
SUPER	498cc	1.344	1.000	1.250	.250	.750	1.125	.375	1.875	.375	5.625
(WIDE)	596cc	1.344	1.000	1.250	.250	.750	1.125	.375	1.875	.375	5.625
FLYER	498cc	1.344	1.188	1.500	.250	.750	1.125	.375	1.875	.375	5.625
(SHORTSTROKE)	596cc	1.344	1.188	1.500	.250	.750	1.125	.375	1.875	.375	5.625
FLYER	498cc	1.406	1.188	1.500	.250	.750	1.125	.375	1.875	.375	5.813
REPLICA	596cc	1.406	1.188	1.500	:250	.750	1.125	.375	1.875	.375	5.813
SPRINT											
(LONGSTROKE)											



ALL DIMENSIONS IN INCHES

1. **R.H. CRANKS** — have L.H. thread crankpin screws, and R.H. thread main bearing bush retaining rings and tapped hole in centre bore.
2. **L.H. CRANKS** — have R.H. thread crankpin screws and L.H. thread main bearing bush retaining rings and plain hole in centre.
3. Standard, Squirrel, Super and Shortstroke Flyer
Crank outside diameter = 3.688
Longstroke Flyer, Replica & Sprint
Crank outside diameter = 3.813
4. Crankcase Cup Bores
Standard, Squirrel & Super = 2.000
Flyer Replica & Sprint = 2.250
5. The following components are not interchangeable between Super/Flyer models.
Crankcase cups, glands, gland springs, cranks, flywheels, crankcase doors.

NEW DEVELOPMENTS

(See centre pages)

George Silk (Jnr.) and D. Midgelow send the following information regarding the engine development, the exploded drawings of which appear on our centre pages.

"The crankshaft has been tested to the limit (6,000 r.p.m.) throughout this racing season, even to the extent of "hydraulicing" a blind head block in two. This requires 9¼ *tons*. We feel under these conditions a Scott crank might have dropped in half. However, the assembly has passed the test with flying colours and as a result the cranks are now available to order (delivery 10 to 12 weeks). These take the form of long or short stroke, the main bearings and housings fitted, seals and springs, valves, big end bearing (inner) also fitted. Cost as yet is tentatively fixed between £32 and £38 complete and built up to the big ends. New standard (reconditioned) rods and rollers etc. can be supplied. However, the cages still require further development in the realms as to which material to plate them with—as yet copper is not entirely satisfactory. The cages themselves however, have stood up remarkably well to consistent pasting and the fit of the bearings is excellent.

The diaphragm springs which take care of crank shaft end float are very simple in operation. The whole assembly could float .030in. - .040in. In fact the springs are so designed to let it float no more than .005in. either way. In practice the flywheel remains static (floatwise) thus proving the original idea of knife edges and minimum resistance.

What's next? Well already we have race proved our own design of piston, with transfer ports and inlet timing and strength with *lighter* weight. They do have one big bonus—they don't seize!!! Cylinder heads also have gone for a face lift. The effect is phenomenal—10 - 1 c.r. on petrol, a better flame path needless to say they are not Scott type, but very "squish".

As yet they are still in the experimental engine, but work is now under way to incorporate the pistons and heads in a top half conversion which will give a final magic size of 648c.c. If our results with the racing engine are anything to go by, apart from top speed the overall spread of power is quite something. To help out with the non availability of Burgess Silencers we have designed and are making a new type silencer that expands the power between 2,500 r.p.m. - 5,500 r.p.m. and is still quiet, not siamese, two per machine, but cleanable.

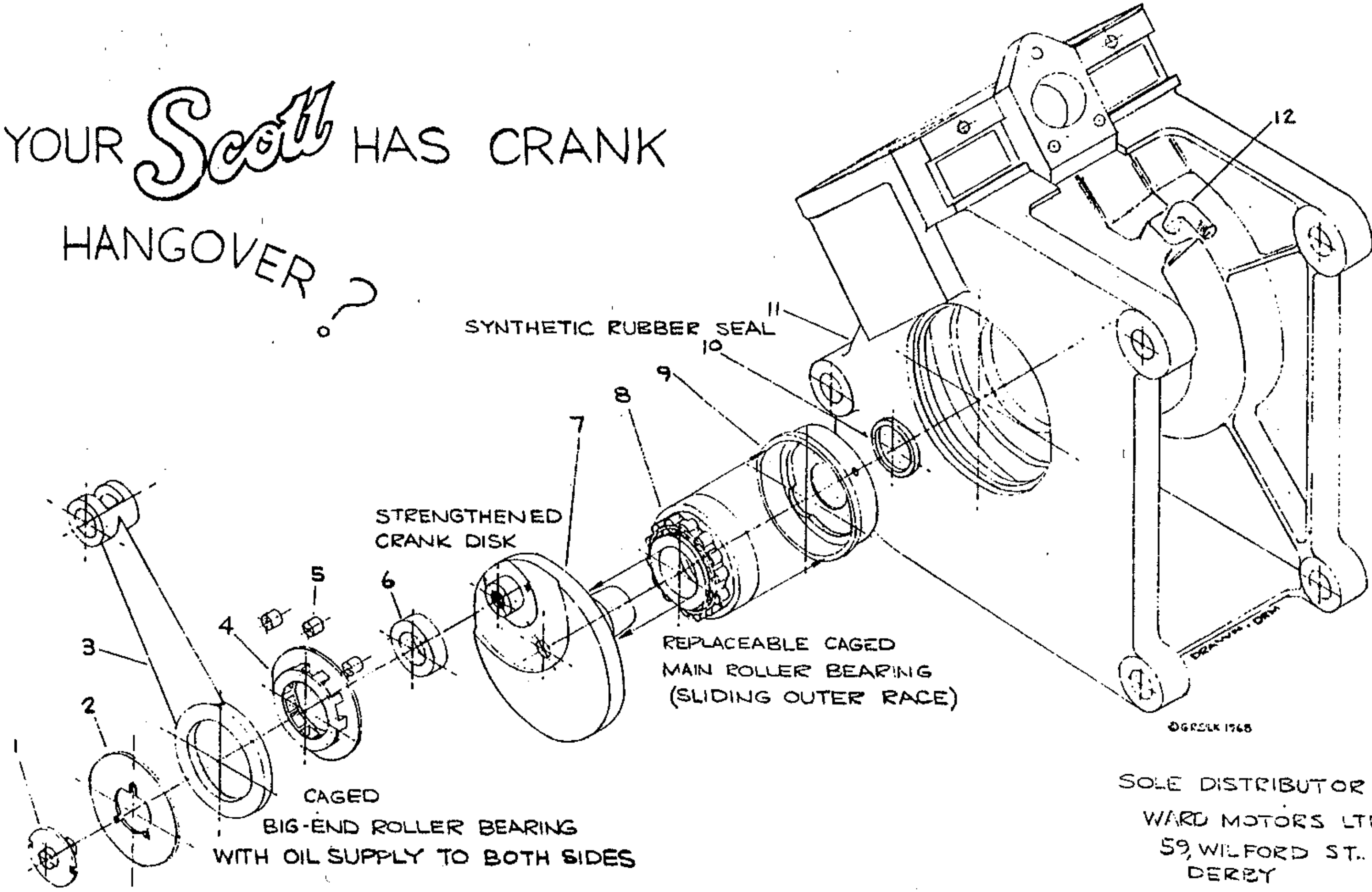
One regret we do have is that Scott's ever fitted a Pilgrim pump—will answer any comment on this subject, but honestly they don't even work FLAT OUT—don't take our word, ask Mike Broadbanks—he carries five spares with him!!!

We are still trying to solve the manufacturing problems concerned with a cam for an hydraulic "Best & Lloyd" type pump which is entirely satisfactory. Using such a pump it is possible to obtain perfect lubrication, and NO smoke.

Next year looks just as busy, apart from obtaining a lot more power and r.p.m. from the Vintage Sprint Special that Ivan Rhodes rides. There is an extra light (185lbs.) grass track Scott being assembled for Maurice Patey to ride. That is something else again.

Since the above was written—orders for 6 sets including two complete engines have been received, and a new order for fresh batches of forgings have been placed!

YOUR Scott HAS CRANK HANGOVER ?



SOLE DISTRIBUTOR :-
WARD MOTORS LTD.,
59, WILFORD ST.
DERBY

SILK CRANKS WILL MINIMISE THE EFFECTS

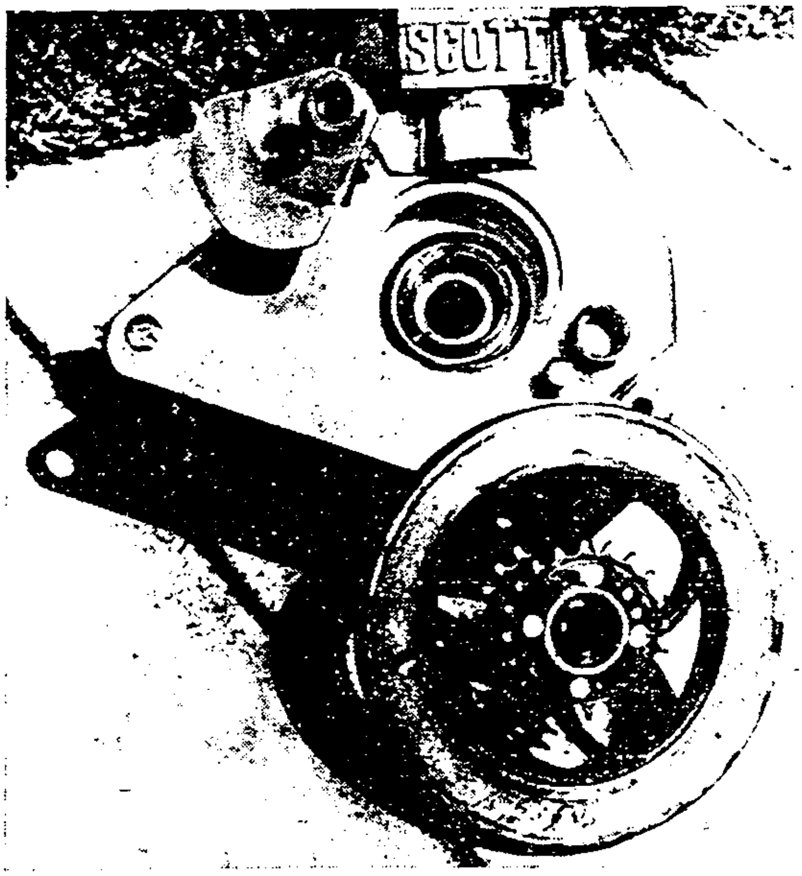
V6/3 Jan 1969

POTTY COMMENTS

I was very interested in Mr. Eric Curtis' account of his 1910 Scott but is not the "Lawrence" one older? However, I thought you would like to look at the 1911 Scott on which I am now working. Note the spoked lead-filled flywheel. Cranks are made up in one piece out of the solid with no detachable big-end and main bushes. This is unfortunate as the big-end track on one is very badly worn and I cannot fit later type cranks with detachable bushes as these are made for 13-roller main bearings instead of the 12-roller type. that mine has. I am having to have the pin ground down to take a specially made up big-end bush, and I don't think it will be quite ready for the Pioneer Run.

Now to get on my hobby horse again — please do not as Mr. Curtis advises, dunk your bits in Tide solution as there are far too many corrosive elements in this type of detergent. It may not be too bad on aluminium, but it very quickly eats into steel or other alloys — ask Malcolm Askwith.

Also in recent editions of *Yowl* (service sheets etc.. and in particular *Yowl* Supplement Part 4 (19) "to dislodge crank, partially slacken off bolt and strike hexagon head" — be it on your own head if you do, for without supporting the flywheel you will probably smash a cup. If someone can take



The 1910 Scott bottom half.

the complete assembly weight on the flywheel while this is being done, everything should be O.K. No objections to torsionally loosening the cranks (20) but be careful and make sure the pin is protected (old bush etc.) not as shown directly on the pin.

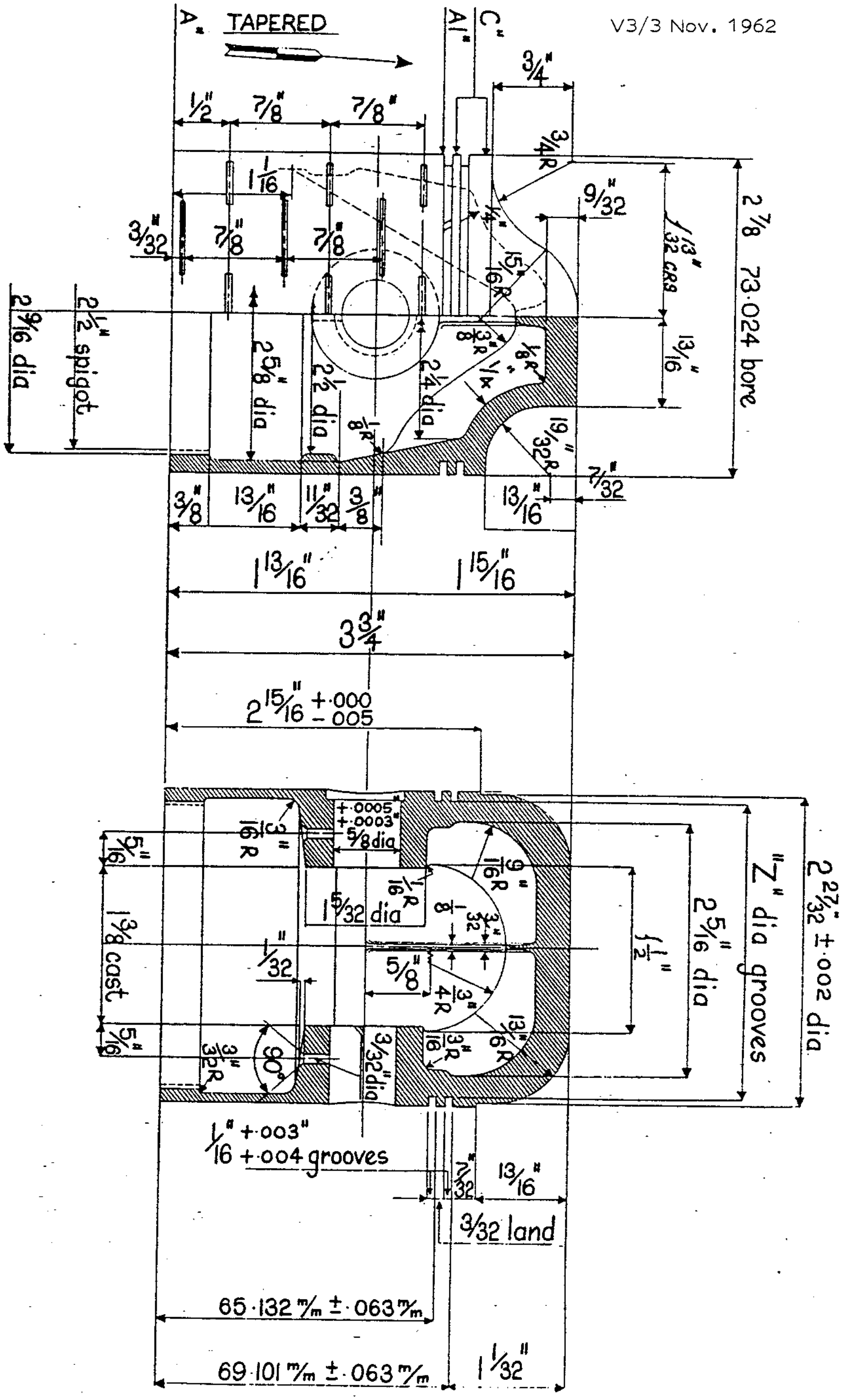
Briefly, let's see what we get for the £10-odd we pay for a pair of Scott-Hepolite pistons. Starting, logically, at the drawing-board. Hepworths copy the makers' original plans (Scott works drawing 20907 in this particular case.) From the master prints, patterns, dies and any special tools needed for produuction machining are designed and made. Piston blanks are diecast in HG412 aluminum alloy, and machined to the dimensions tabulated below. It sounds simple put like that! Inspection is rigorous—even on subsidiary piston equipment such as brass gudgeon-buttons and ring stop pegs. Crown thickness is checked before machining, and only castings within 1/64" of the specified drawing size are used. Other tolerances are more precise, as shown in the accompanying line drawings taken from Hepworth & Grandage print 5069. (One operation peculiar to Scott pistons is the cutting of oil-grooves after the skirts have been turned. A cutter with a 1/64" radius at the end is used, and six equally-spaced cuts 1/32" wide and ¾" long are made to the centre-lines shown). This table gives the standard and oversize dimensions to which tapers and ring-grooves are made:

Reference Letter.	Standard diameters	+ ·010	+ ·020	+ ·030	+ ·040
tapered "A"	72·872 72·847	73·126 73·101	73·380 73·355	73·634 73·609	73·888 73·863
to "A1"	72·808 72·783	73·062 73·037	73·316 73·291	73·570 73·545	73·824 73·799
"C"	72·67 72·62	72·92 72.87	73·18 73·13	73·43 73.38	73·68 73·63
"Z"	66·28 66·03	66.53 66·28	66·79 66·54	67·04 66·79	67·29 67·04

The story of piston ring manufacture would take more space than can be given in this already expensive edition of Yowl. Some idea of the immensity of Hepolites' production is given by these figures: St. John's works houses 500 production machines which turn out over a million piston rings every week—individually cast, form cast, centrifugally cast or formed from steel rail. Some rings need no less than 44 machining operations, others only seven — but every finished ring is subject to rigid inspection.

The Hepolite catalogue lists 16,700 types of piston rings—and this excludes all 'specials' ! !

Many of the replacement pistons made and stocked by Hepworth & Grandage Ltd. have a very limited sales potential, and are marketed for prestige rather than profit. (Scotts, of course, fall in this section!) Hepolites' proud claim is that they


A"
TAPERED
A1"
C"
3/4"
1/2"
7/8"
7/8"
3/4R
1 1/16
9/32"
3/32"
7/8"
7/8"
1/4"
15/16R
13/32" CRS
2 7/8 73.024 bore
2 9/16 dia
2 1/2" spigot
2 5/8" dia
2 1/2 dia
2 1/4 dia
3/8R
1/8R
1/4R
1/8R
13/16"
19/32R"
7/32"
3/8"
13/16"
11/32"
3/8"
13/16"
1 13/16"
1 15/16"
3 3/4"
2 15/16" +.000 -005
+.0005" +.0003"
3/16R"
5/8 dia
5/16"
9/16R"
1/16R
1 5/32 dia
1/8
3/32"
1 3/8 cast
1/32"
5/8"
3/4R"
1/2"
2 5/16" dia
"Z" dia grooves
2 27/32" ±.002 dia
5/16"
3/32R"
90°
3/32" dia
3/16R"
13/16R"
1/16" +.003" +.004 grooves
7/32"
13/16"
3/32 land
65.132 m/m ±.063 m/m
69.101 m/m ±.063 m/m
1 1/32"

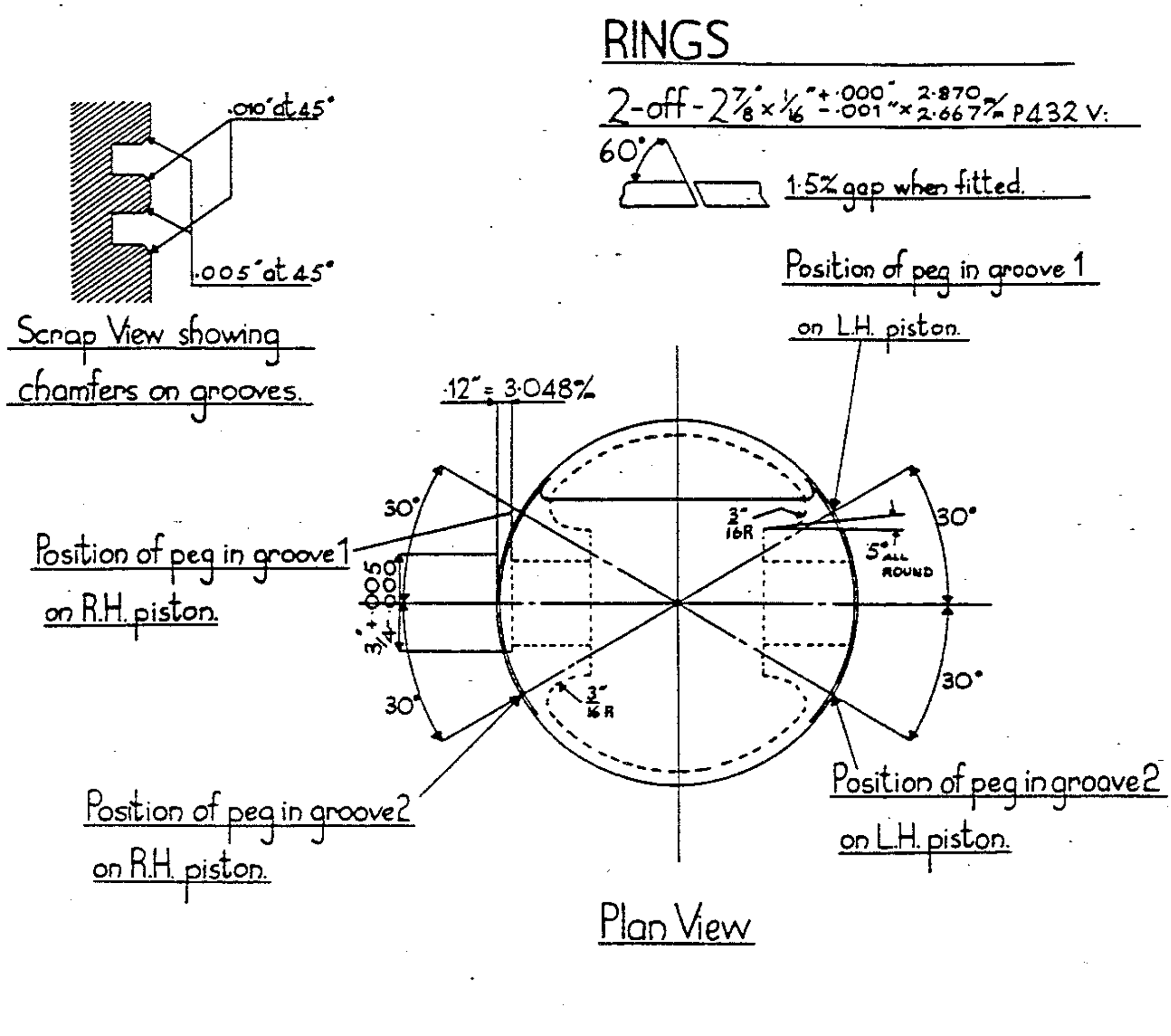
manufacture quality pistons for every engine made; and having glimpsed just a little of their giant organisation—which keeps open house to the technically interested—I am convinced that their products are all they are claimed to be.

Craftsmanship still lives at the old Scott factory.

* * * *

Sources and acknowledgements: Public Records Office; 'The Motor Cycle' and 'The Motor Cycle Trader'; Arthur Jennings, Charlie Hustwit and the late Jim Capstick; Mr. Hector and Mr. Dixon; Matt Holder and Harold Wood. Factory prints were made available by Harold Scott and Harold Wood.

Special mention muust be made of the courteous and generous help given by the Hepworth & Grandage Publicity Deparment and its manager, Frank White. They kindly provided the line blocks of Scott piston drawings, and also made the half-tone plates of the Saltaire works.



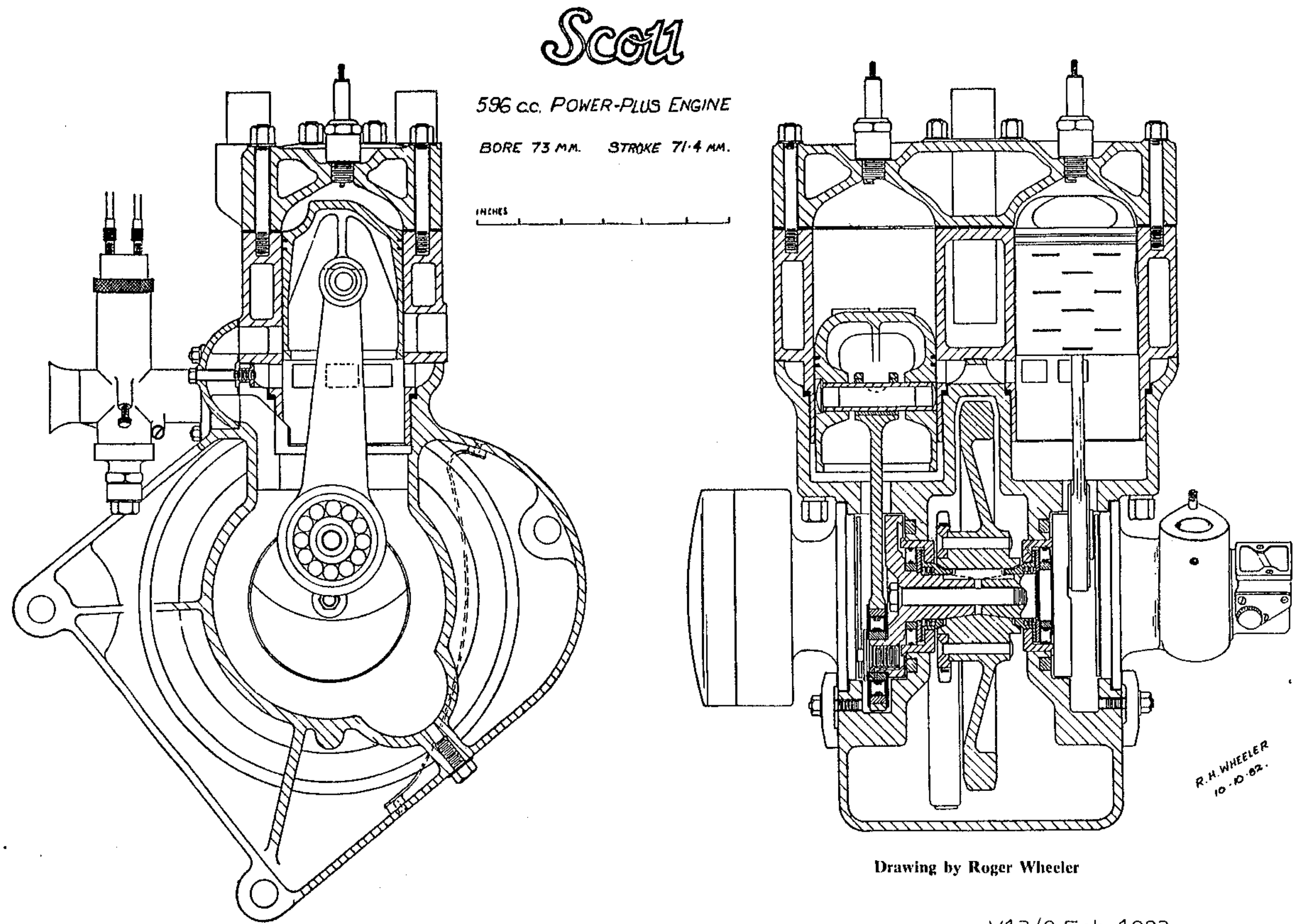
HEPOLITE — STOCK OF SCOTT PISTONS AND RINGS.

V3/5 May 1963

As at 27th November, 1962.

	Cylinder Bore	Type and Price	Std.	.020	.030	.040	.060
498 cc. Power Plus T.T. Replica. Sprint.	2.620"	Piston 5068 RH	X	X	X	X	—
		RH	X	X	—	X	—
		£4/6/0 each					
		Rings P.245.V. 3/6 each	—	X	X	—	X
498 cc. Flying Squirrel.	2.6825"	Piston 1418 LH	X	—	—	—	—
		RH	X	—	X	X	X
		£3/13/1 each					
		Rings P.294.V. 3/6 each	—	—	X	—	—
596 cc. Power Plus T.T. Replica. Sprint Flyer.	2.7/8"	Piston 5069 LH	X	—	X	X	—
		RH	—	X	—	X	X
		£5/7/6 each					
		Rings P.432.V. 3/6 each	—	—	X	X	X
596 cc. Flying Squirrel Clubmans Special.	2.7/8"	Piston 10593 LH	—	X	X	—	—
		RH	—	X	X	—	—
		£3/9/11 each					
		Rings P.432.V. 3/6 each	—	X	X	—	—
596 cc. Flying Squirrel.	2.15/16"	Piston 1417 LH	X	—	X	X	X
		RH	X	—	X	X	X
		£5/7/6 each					
		Rings P.466.V. 3/6 each	X	X	X	X	X

X — this indicates pistons and rings in stock at the present time, and the prices quoted are only applicable while these stocks last.



Drawing by Roger Wheeler

V13/2 Feb.1983

486cc AND 532cc CYLINDER BLOCKS

John Goss

Jack Frazer tabled some useful information about these $2^1/_2$" ($63^1/_2$mm) stroke engines with $2^3/_4$" and $2^7/_8$" bores, which was of interest to me, as I was slowly rebuilding a 1923 Squirrel. The engine of this machine, S 6795, and its frame, were among the first of the Squirrels completed for the Show in September 1923, as can be seen from the list of engines and frames John Underhill revealed a while ago, and this bike followed on from that first group. I noticed that my engine had only one rearwardly-angled plug in the cylindrical combustion space, and that it also had large undrilled bosses in the back of the block for the plugs to be fitted to the back face of the block. A central hole in the uncooled flat head had been filled — this seems to be common to most, if not all, flat head blocks, but is difficult to spot.

Project completed, I set about acquiring a complete set of parts to build up for a Parker rotary valve conversion I have. This conversion feeds into the transfer ports using a monobloc casting which also houses the ported rotary sleeve, with the inlet stub and ports being redundant. I suppose the inlet ports were blanked off to avoid ingesting unwanted air and grit, so a second barrel was required. My stock now includes three barrels plus the one off the bike, none similar to anything else! How typical of Scotts with their continuous development, but what a headache for us in later years. *Kieg Collection* photographs of '22 and '23 TT entries show some of the alternative plug positions you can expect to meet.

External features

Block S, $2^3/_4$" bore, 69.9mm (original bike). $1^3/_8$" exhaust, 1 rear-angled plug, cotter fixing, $^7/_8$" water connections, with rear angled to meet radiator, cast-in undrilled boss for rearward (horizontal) plugs. Cylindrical combustion space $5^5/_8$" A dimension, B5 inlet ports.
Block T, $2^3/_4$" bore. $1^3/_8$" exhaust, 2 *vertical* plugs, cotter fixing, water connections as S, no cast-in boss. Cylindrical combustion space $5^5/_8$" A dimension, B5 inlets.
Block U, $2^7/_8$" bore, 73mm. $1^9/_{16}$" exhaust, 2 angled plugs, cotter fixing, $^7/_8$" inlet and 1" outlet water connection, no cast-in boss. Cylindrical combustion space $5^{13}/_{16}$" A dimension, B5 inlets.
Block V, $2^3/_4$" bore. $1^9/_{16}$ exhaust, 1 rearward-angled plug, threaded fixing, 1" water connections with outlet almost vertical. $5^5/_8$" dimension, B5 inlets. Cast-boss for rear horizontal plug undrilled.

If you find a flat head block, look for these features — you may not want them all!

Actual port dimensions

Table as per Jack Frazer (see *Technicalities* 2.3.10 to 2.3.14) all similar to Jack Frazer's engines in port sizes.

	A	B	C	D	E	F_1	F_2	G_1	G_2	H_1
T	$5^5/_8$	B5	$1^3/_{32}$	$^3/_8$	$^3/_4$	$1^{31}/_{32}$	$2^1/_{16}$	$^{17}/_{32}$	$^{11}/_{16}$	$1^{15}/_{16}$
U	$5^{13}/_{16}$	B5	$1^3/_{32}$	$^3/_8$	$^3/_4$	$1^{31}/_{32}$	$2^1/_{16}$	$^{17}/_{32}$	$^{11}/_{16}$	2
V	$5^5/_8$	B5	$1^3/_{32}$	$^3/_8$	$^3/_4$	$1^{31}/_{32}$	$2^1/_{16}$	$^{17}/_{32}$	$^{11}/_{16}$	$1^{15}/_{16}$

	H_2	I_1	I_2	J_1	J_2	K_1	K_2	L	M	Ex. St.
T	2	$2^3/_{32}$	NA	$^5/_8$	NA	$1^{15}/_{16}$	NA	NA	$3^3/_8$	$1^3/_8$
U	2	$2^1/_{16}$	NA	$^{21}/_{32}$	NA	2	NA	NA	$3^3/_8$	$1^9/_{16}$
V	2	$2^1/_{16}$	NA	$^{21}/_{32}$	NA	$1^{15}/_{16}$	NA	NA	$3^3/_8$	$1^9/_{16}$

Block U is clearly a low compression engine of 532cc capacity with A at $5^{13}/_{16}$".

One other dimension not recorded before was the length of the exhaust port covers. The $1^3/_8$" and $1^9/_{16}$" exhaust stubs have stud centres on the covers $2^9/_{16}$" apart. This changed when the giant (final) exhaust stub was used, except on the cylinder block of my old Super, which had long covers filed back to fit the exhaust. Incidentally, the machining for the cylinder base broke into the exhaust passages and presumably this was filled with foundryman's putty by the works. Later engines had shorter port covers. Where is my old Super? Well, the present owner has a moustache — enough said.