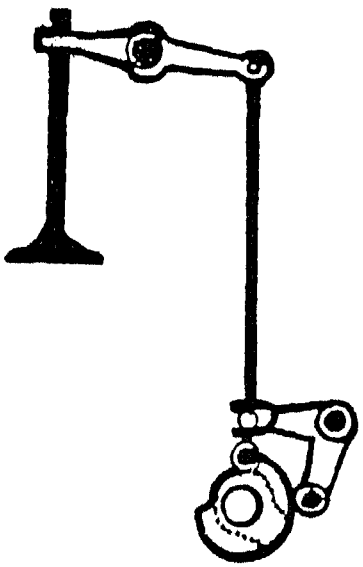
Chapter X

Three-armed rocker desmodromics with the camshaft in the crankcase (group 7A)

The systems belonging to the groups 6A and 6B make use of two rockers, group 7 systems use only one rocker. Group 7 systems use separate cams for opening and closing, usually positioned on one common camshaft. We distinguish the use of an overhead camshaft in group 7B and 7C from those engine layouts in which the camshaft is situated in the crankcase (group 7A).

Because of the camshaft's location in the crankcase, these types are still equiped with two rockers. One rocker is pushed by the camshaft while the other operates the valve. Both connected by a push-pull rod (see figure 1).

We know of three such systems. As early as 1905 a patent was granted for a 7A system to the 'Nürnberger Motorfahrzeuge-Fabrik Union'. As we will see further on, this system is in fact not fully desmodromic. In 1926 John Holt Booth and others presented an extensive patent application. One of the figures in this patent concerns a system belonging to this chapter.



Fugure 1: Typical group 7A design

By far the most interesting 7A variant was introduced in 1962 by the British B.M.G. firm. A patent application was made for this system which was then in production. The B.M.G.

kit was offered as an aftermarket system for the Velocette Venom motorcycle.

Nürnberger Motorfahrzeuge-Fabrik Union

This should have been one of the first patented desmodromic valve trains (1905). Actually only the push-pull rod S is operated by a group 7A system (see figure 2). As with the Zedel system (see chapter II) only the first link in the distribution chain is desmodromic. If only there had been a rigid connection between rocker and valve stem, then one could consider it a complete desmodromic system.

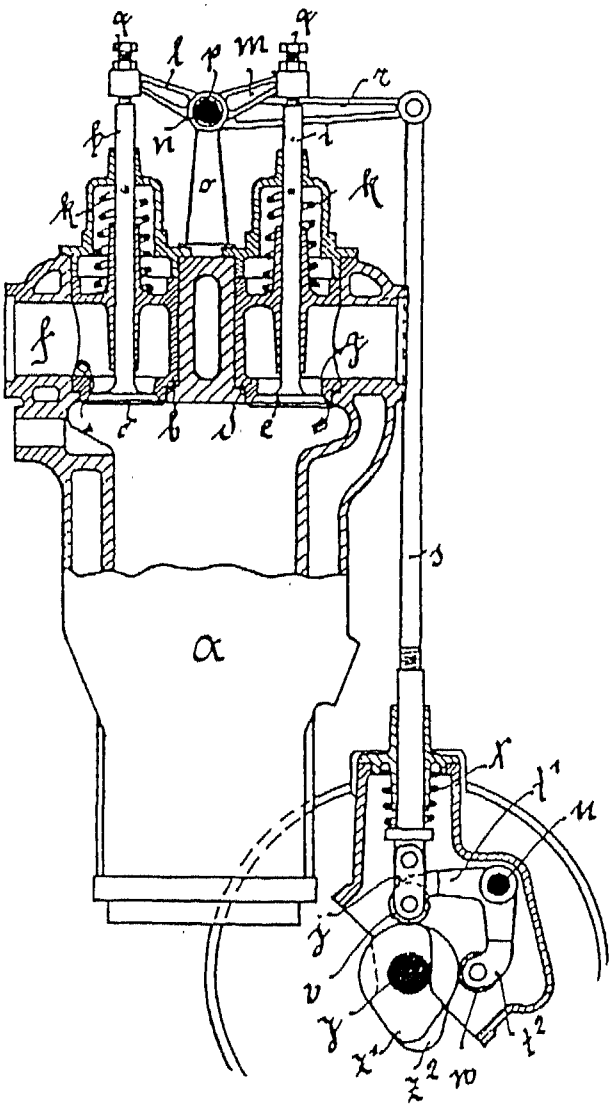


Figure 2: The patented Union-distribution

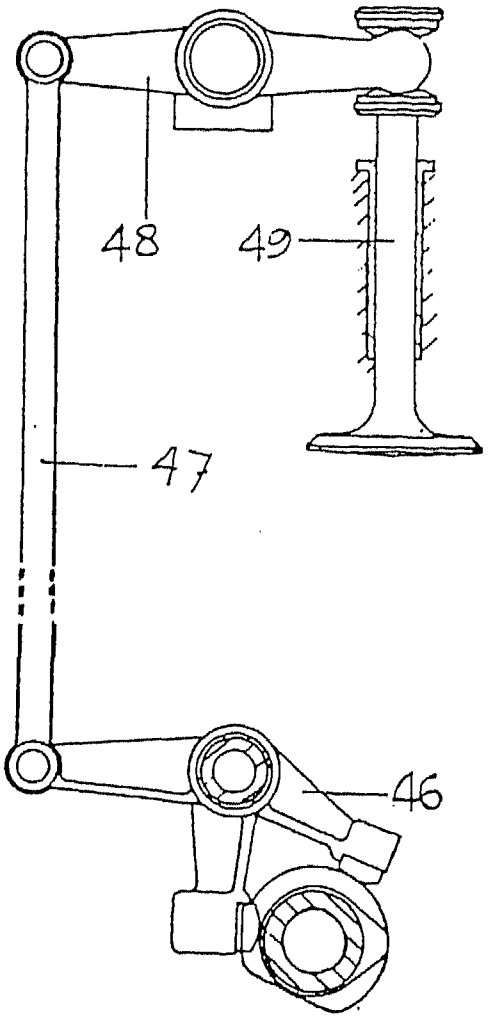


Figure 3: Design by Booth

The operation is as follows:

Cam Z1 works together with cam follower V, the latter being connected with push-pull rod S by way of an intermediate part. Cam Z1 makes the push-pull rod move up, by which

the three-armed rocker L-M-R turns to the left and thus opens inlet valve C. Meanwhile, cam Z2 works together with roller W which is connected to rocker T2. Cam Z2 makes the push-pull rod move down, by which valve C closes and valve E opens. However, both inlet C and exhaust valve E are closed through the pressure exerted by the springs K. This type of system prevents any valve overlap an absolute necessity for any modern high speed engine.

John Holt Booth

One of the most striking things of the English patent 268,602 from 1926 is the fact that no less than four inventors are mentioned: John Holt Booth, Francis Amyas Sidwell, William Paget Smyth and Thomas Manfred Booth (see also group 4 and 7B). The 7A system makes use of a three-armed rocker 46 which operates the valve by way of push-pull rod 47 and rocker 48. In this way it is possible to positively control opening and closing events of the overhead valve with the camshaft situated in the crankcase.

B.M.G. Motorcycles Ltd. / Velocette

In the early sixties Bill Woods, an employee of B.M.G., invented a desmo system for Velocette Venoms. A patent application was saught in 1962. Figures 4 and 5 represent two patent drawings which illustrate how the system works. Opening cam 33 and closing cam 34 are both situated on the camshaft. They are surrounded by cam follower 28. Shaft 30 is the pivot-point of cam follower 28, the latter being equiped with two arms 31 and 32. As drawn the opening cam 33 has turned rocker 28 counter clockwise by which push-pull rod 7 has achieved its highest position fully opening the valve. As the camshaft continues it's counterwise rotation closing cam 34 operates

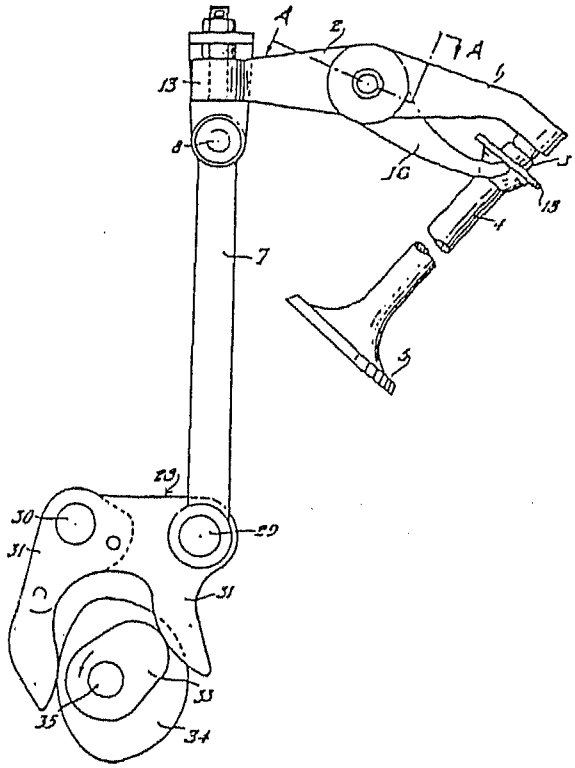


Figure 4: Patent-drawing of the BMG-system

arm 32 of rocker 28. Thus the valve is positively closed.

A remarkable detail of the B.M.G.-desmo is the connection between the opening and closing rocker (see figure 5). Arms 1 and 2 of

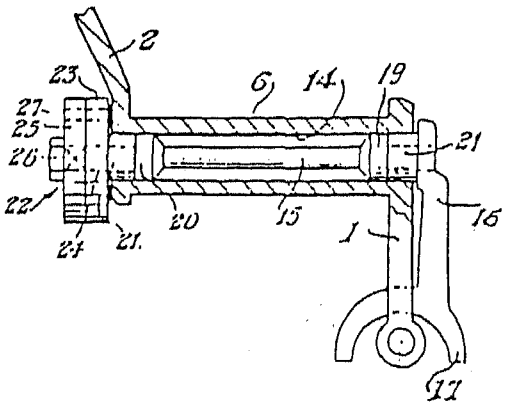


Figure 5: The BMG-system uses a torsion-bar

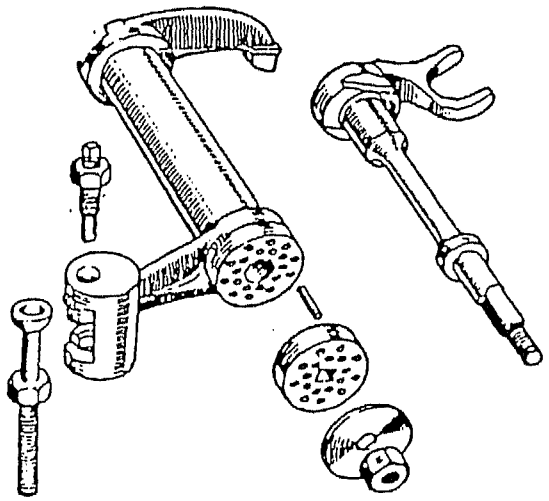


Figure 6: The Vernier coupling

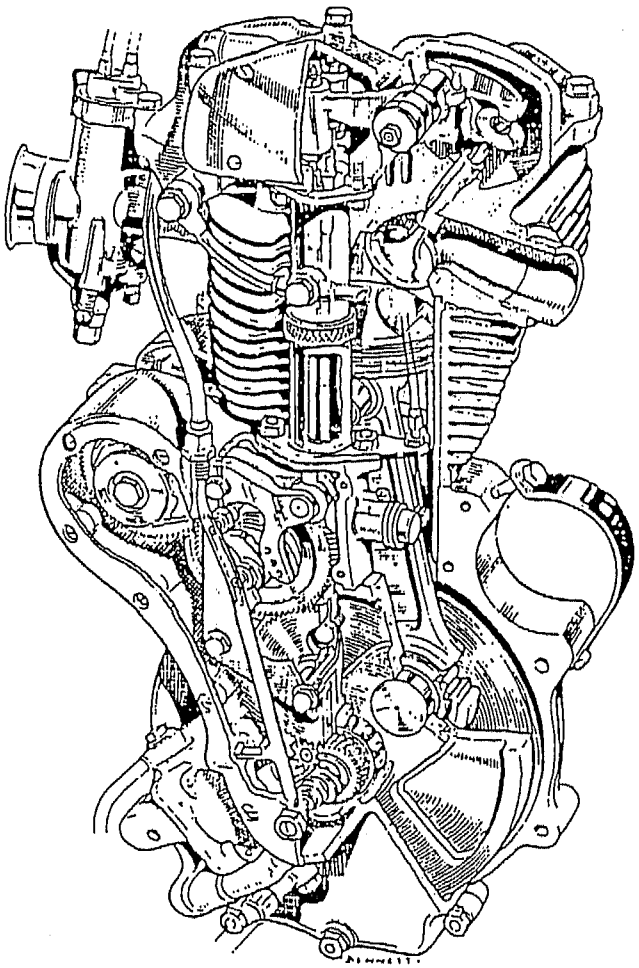


Figure 7: The 500 cc Velocette Desmo

the rocker are integral to each other, yet closing arm 16 can rotate independently. By means of a torsion bar 15 closing arm 16 is connected with the arms 1 and 2. Worthy of note, the initial tension of torsion bar 15 is adjustable by a Vernier coupling 23-25. Figure 6 displays the operation of this connection.

Manufacture and use

The B.M.G. desmo system actually was produced and used in Velocette motorcycles. It is an interesting fact (to the best knowledge of the authors) this was the first application of desmodromic valve gear in motorcycles for street use. Up to then, the use of desmodromic engines was restricted to race cars and bikes. It should be understood Velocette proper never offered any desmo motorbike to the public. Instead, the system was sold as a conversion kit by private Velocette specialists B.M.G.

Figure 7 elegantly shows an exploded view of a desmo Velocette. It illuminates the cams, rockers (one for each valve), the push-pull rods and the rocker in the cylinder head which operates the exhaust valve.

The shape of the desmo opening-cam is identical to the non-desmo cam. Consequently, during roadtests there was little difference between the conventional and the desmo Venom. Yet, there is one important benefit. Journalist Vic Willoughby discovered that the desmo engine easily achieved 7600 rpm in the lower gears, while the standard Venom's valves started to float at 6600 rpm. This appears to give creedence a motorcycle tester from the American motorcycle monthly 'Cycle World' once saw a B.M.G. Velo to 9000 rpm without damaging anything.

That the desmo Velocette has the same cam-profile as the standard production Venom, points out Woods did not have the immediate intention to tune the engine. Actually his intention was to increase the reliability by means of desmodromic valve gear. Woods was rather worried about floating valves, which in these days of inferior valve springs often resulted in piston-valve contact.

With desmodromics he found his ideal solution to avoid damage to valves and cylinder

heads. With a desmodromic engine the valve gear is always under control, even at extremely high revs.

Properly designed, a desmo engine should give a power increase. It was estimated the B.M.G.-Velocette desmo-engine (a 500 cc single) produced 3 b.h.p. over standard, because no energy was wasted opening the valves against spring tension, and further because valve timing will be followed more precisely.

B.M.G. produced their conversion kit from 1962 till 1967. By then prices of materials and wages had risen considerably; the selling price apparently became too high. Nevertheless enough kits were sold to recover costs of development and design. No one knows how many kits were sold; specific data is missing. In the sixties, the B.M.G./Velocette conversion kit cost 38 pounds sterling, not a small amount of money at that time.

Perhaps it was because of the anticipated high production costs or just complacency Velocette abondoned consideration of this interesting project, after showing some early interest in it. Nine months after sending a parcel which included his desmo kit to the Velocette factory, Woods received his parcel back.....dusty and unopened!

One could say the B.M.G. desmo kit was a succes, albeit a limited one. Their patented system was produced and sold in a small series. Accordingly, the B.M.G./Velocette has obtained a modest but memorable place in the history of desmodromic valve gear.