Rotary valve engine pdf

I'm not robot!

Posted 05 March 2014 - 12:34 At it is presented a Disk Rotary Valve. It comprises a pair of oppositely acting fronts firmly secured to each other. The fronts seal a pair of oppositely arranged ports (chamber ports) of the combustion chamber. The overall "pressure" force acting on the rotary valve is from small to zero, leaving its bearings unloaded. The combustion chamber is rid of hot spots (like, for instance, the hot exhaust poppet valves of the conventional engines, or like the hot chamber ports of the state-of-the-art exhaust rotary valves). Every point of the combustion chamber is equally related with the intake and with the exhaust. On this reasoning the compression ratio can further increase. Multicylinders: a splined shaft drives all the rotary valves of a line (or bank) of cylinders. Without having a pathway to the exhaust, any gas leakage from the combustion chamber during the compression / combustion is recycled: it returns into the cylinder at the next suction cycle. Variable Valve Actuation: Any thoughts? Thanks Manolis Pattakos Posted 05 March 2014 - 22:36 There has been various forms of rotary valve heads for many engines over the decades. I believe some aircraft used them. The only one I know anything about was the Dunstall rotary valve head for a grey Holden. Evidently sealing was a real issue. Look at the Early Holden Racing thread on TNF. There is a few pics of the engines there. I do know where there is a couple. Posted 05 March 2014 - 22:37 The valve has large temperature gradients. What are your thoughts on distortion due to differential expansion? Another positive - the chamber has lots of spare surface for placement of spark plugs injectors etc. Edited by gruntguru, 05 March 2014 - 22:37. Posted 06 March 2014 - 03:45 Rotary valves always seem like an attractive idea - but surprisingly, despite enormous effort there has never been a commercially successful rotary valve arrangement. But possibly Manolis can do it - he's done a lot of other good stuff.I also get the impression that the poppet valves-and-cam system may actually have better breathing characteristics than an RV arrangement. The cam-type systems open the valve quickly, then "dwell" (at least to some extent) in the open position, then close quickly. Whereas the RV doesn't open-dwell-close - it does the lot at the same rate. So for both systems, for the same total duration of the induction opening, the cam-types may allow the greater mass airflow despite the apparent much greater in area induction "hole" size of the RV - it may not be better.This is just my opinion (and I am only a bloody dog after all) - I don't know what the "official" opinion on the breathing capabilities of both types is. Posted 06 March 2014 - 09:28 Gruntguru, regarding the sealing, the following were added to the web site: For the sealing between the pair of flat-fronts and their respective chamber-port-lips, only the one of the three dimensions is significant: that one along the rotation axis of the rotary valve (i.e. the distance between the two disks and the width of the combustion chamber); the displacement of the rotary valve along the other two dimensions does not affect the sealing. And because the heavy forces applied on the flat fronts cancel each other "internally", such a displacement is easy to be realized and to be controlled (Variable Valve Actuation). In comparison, the slightest displacement, at any direction, of a spherical rotary valve changes significantly the sealing between the spherical rotary valve and the port it controls. The sealing of a disk rotary valve having flat fronts is tolerant to deformations of the cylinder head because, as before, only the one of the three dimensions really matters: that one along the rotation axis of the disk rotary valve; significant deformations of the chamber along the other two dimensions do not affect the sealing. Between its chamber ports the chamber (i.e. the cavity into the cylinder head) is like an open ring; if the diameter of the ring is for some reason increased (due to the high pressure into the chamber, for instance, or due to the temperature etc) the effect on the sealing is insignificant. The pressure in the chamber cannot essentially affect the width of the ring, i.e. it cannot affect the dimension of the "ring" along the rotation axis of the rotary valve. The lower part of the chamber is "enclosed" and is strongly supported by the lower end of the cylinder head. With the dimension of the ring shaped chamber (or cavity) among the chamber ports being small along the rotation axis of the disk rotary valve, proportionally small is the effect of the temperature difference between the rotary valve and the chamber walls on the sealing. The limit of the width of the combustion chamber (i.e. of the width of the cavity into the cylinder head) is set by the diameter of the spark plug (or of the injector). For instance, with a distance of 15mm between the two disks, the expected thermal deformation is six times smaller as compared to the case wherein the two ports were arranged at the sides of an 80mm bore cylinder. The smaller the distance between the two disks, the less the thermal expansion and the less the stressing expansion, and the less the bending flexing (the major causes affecting the clearance between the flat-fronts and the chamber-port-lips). Kelpiecross, the rhythm the valve opens depends on the shape/geometry of the chamber ports and on the shape/geometry of the intake ports. For instance, a trapezoidal form of the valve opening versus the crankshaft angle is easy. The absence of the "valve stem obstacle" allows more free breathing. From another viewpoint, if you want a specific valve-area vs crankangle, you can achieve it by selecting the proper shape for the intake, exhaust and chamber ports. The overlap is substantially different than in a conventional four-valve engine because in the second the intake valves are almost in touch with the exhaust valves. In the PatRoVA, during the overlap the openning area and the closing area are at opposite sides of the combustion chamber (scavenging?) Thanks Manolis Pattakos Posted 06 March 2014 - 09:55 Rotary valves always seem like an attractive idea - but surprisingly, despite enormous effort there has never been a commercially successful rotary valve arrangement. But possibly Manolis can do it - he's done a lot of other good stuff. I also get the impression that the poppet valves-and-cam system may actually have better breathing characteristics than an RV arrangement. The cam-type systems open the valve quickly, then "dwell" (at least to some extent) in the open position, then close quickly. Whereas the RV doesn't open-dwell-close - it does the lot at the same rate. So for both systems, for the same total duration of the induction opening, the cam-types may allow the greater mass airflow despite the apparent much greater in area induction "hole" size of the RV - it may not be better. This is just my opinion (and I am only a bloody dog after all) - I don't know what the "official" opinion on the breathing capabilities of both types is. My thoughts too. Possibly usefull with a lower RPM engine, truck, aircraft etc. Though really reinventing the wheel. The Dunstall Dunstan? Holden I referred too was quite a powerful engine for its type, reputedly more powerful than the popular Repco crossflowhead though the Waggott twin cam made more power and reliability. The rotary valve was quite peaky and I believe never resolved oil contamination caused reliablity problems. It is very hard to beat a simple poppet valve, it flows a lot of gas in and out, seals easily and even at very high RPM is surprisingly reliable. Look at Nascar, 800hp@10000rpm on a 2 valve 6 litre. Rotary valve has been tried and discarded. I cannot see it coming back. Posted 06 March 2014 - 11:44 The David Dunstall rotary valved Holden - it certainly looks fierce. I thought I remembered that it was "twin-cam" - that is; had two rotary "cams" - but it looks like it had one only. ?topic=6684.0 Posted 06 March 2014 - 15:31 The construction from Mr. Pattakos is very interesting. I know a few rotary valve System. Many system have a sealing problem. Another system have a bad combustion chamber. I believe the airflow is not optimal by system Pattakon? And I thik the Aspin-system is a bad system. Too much problem. F1 engine MGN W12 with rotary valves. F1 Motor mit Drehschieberinlass v8 rotary valve engine australian built Coates CSRV Engine on Sustainable Planet RCV -Engine. mwv2 saltster rotary valve engine mwv2 BIG NED - The Ultimate Street Fighter - Story The Bishop rotary valve on a F1 V10 engine. Rotary Valve head for grey motor ?topic=19105.0 Edited by Speedman, 06 March 2014 - 16:38. Posted 06 March 2014 - 17:55 Sorry my engish is so bad.   My idea for better valve-sealing. A rotary O-seal on the inside of the cylinderhead. The O-seal is between cylinderhead and rotary valve. The O-Seal rotating in the cylinderhead (red) so we have a lapping and polishingthe effect. No sealing problem. A similar system of DVL rotary valve system Edited by Speedman, 06 March 2014 - 18:19. Posted 06 March 2014 - 22:47 The David Dunstall rotary valved Holden - it certainly looks fierce. I thought I remembered that it was "twin-cam" - that is; had two rotary "cams" - but it looks like it had one only. ?topic=6684.0 It is basically simple. The 'cam' comes around with a hole through it and the air fuel comes in, and the exhaust gets out. No valve springs, just you have to seal all 12 holes. Which was the issue. I dont know how many heads were sold. They were marketed by Southcotts here in Adelaide. I have seen a head assembly off the engine that had been [and was going to be again] used on speedway. The power band was quite suitable for a midget but that was really before my time. But the Repco headed engines were more reliable. I dont know if a Waggott twin cam was ever used on a midget, it would have been quite bulky and the capacity would have had to be reduced too. They were used in boats and road racing though. Posted 07 March 2014 - 04:02 My idea for better valve-sealing. A rotary O-seal on the inside of the cylinderhead. The O-seal is between cylinderhead and rotary valve. The O-Seal rotating in the cylinderhead (red) so we have a lapping and polishingthe effect. No sealing problem. Thank you Speedman; your English are fine for me. Having a seal like those used in Coates' spherical rotary valves (CRV) is a reasonable solution. And I think that what you mean is not a pair of "rotary O-seals" but a pair of "stationary O-seals" in touch with the rotating flat-fronts. On the other hand, the basic idea behind the PatRoVa rotary valve is to avoid -if possible- the seals (like the O-seals you propose) and the inevitable problems the seals introduce (friction, wear, lubrication etc). In the PatRoVa rotary valve the sealing is based on the substantial reduction of the clearance between the flat-fronts and the chamber-port-lips. The problem is not to absolutely seal the combustion chamber; this is not possible (think the quantity of compressed gas / mixture that inevitably escapes through the piston ring gaps and through the "piston rings / cylinder liner" "contact" in the conventional engines). The true problem is to reduce the leakage into acceptable limits and to recycle any leakage. Thanks Manolis Pattakos Posted 07 March 2014 - 05:46 Sorry my engish is so bad. My idea for better valve-sealing. A rotary O-seal on the inside of the cylinderhead. The O-seal is between cylinderhead and rotary valve.The O-Seal rotating in the cylinderhead (red) so we have a lapping and polishingthe effect. No sealing problem.   A similar system of DVL rotary valve system � I am not much of an expert on rotary valves - but isn't the main problem the fact that you cannot use rubber/teflon etc. or anything else organic due to the fact that the seals will be exposed, at least to some degree, to the very hot combustion gases? Posted 07 March 2014 - 08:12 I am not much of an expert on rotary valves - but isn't the main problem the fact that you cannot use rubber/teflon etc. or anything else organic due to the fact that the seals will be exposed, at least to some degree, to the very hot combustion gases? The O-Seal is not PTFE (Teflon) or rubber or another plastic. Bronze oder gray cast iron or crystalline graphite is suitable. No problem with hot combustion gases. No problem with lubrication. Crystalline graphite is very very interessting material. Good self-lubrication and temperature-resistant. @Manoli But still the O-seal in my idea, rotating in the cylinderhead, similar the DVL-System .This is very importent. The rotating O-seal is so self grind and so ever leakproof. When the o-seal not rotating then is the seal soon leaky. The DVL-Rotary system is one of the few rotary valve system with allmost perfect seal. The big problem by DVL is the bad combustion chamber and problem with high temperature in Cylinderhead, not problem with rotating o-seal. DVL system is from a BMW war airplane engine with very good properties. The solution by rotary valve engine is the rotating tight body. Do you build your PatRoVa-engine in real? I like high rpm engines. Do you understand german (Swiss)? Edited by Speedman, 07 March 2014 - 10:37. Posted 08 March 2014 - 05:02 But still the O-seal in my idea, rotating in the cylinderhead, similar the DVL-System .This is very importent. The rotating O-seal is so self grind and so ever leakproof. When the o-seal not rotating then is the seal soon leaky. The DVL-Rotary system is one of the few rotary valve system with allmost perfect seal. The big problem by DVL is the bad combustion chamber and problem with high temperature in Cylinderhead, not problem with rotating o-seal. DVL system is from a BMW war airplane engine with very good properties. The solution by rotary valve engine is the rotating tight body. Do you build your PatRoVa-engine in real? I like high rpm engines. Do you understand german (Swiss)? Hello Speedman. I searched on Internet but I didn't find a drawing or photo of the DVL rotary valve. Have you some link of a photo or drawing of the DVL? The flat-fronts of the PatRoVa rotate "almost" in touch with the chamber-port-lips. Why to use rotating O-seals (I suppose one per disk of the rotary valve, in grooves cut on the flat-fronts) and not stationary O-seals (in grooves cut on the chamber-port-lips, i.e. on the cylinder head)? In the second case the O-seal is like those used by Coates in his CRV rotary valves. If you think of the PatRoVa as a spherical rotary valve having infinite diameter, then it is clear how the Coates seal-technology can be applied to the PatRoVa valve. However by completely avoiding the O-seals / O-rings (and the architecture / geometry of this disk rotary valve fits with it), a lot of problems are solved. PatRoVa prototype: We are planning to make one, but other pattakon projects have higher priority. Take a look at the PatMar engine at for which the US-patent has just been granted. Think its advantages over the state-of-the-art Diesels / Natural Gas engines (for remote power-generator-sets, for instance). Or take a look at the HyDesmo valves at for which the US-patent has been approved a couple of days ago and is to be granted in a few weeks. Hydraulic, Desmodromic, Digitaly controlled, high-revving VVA (an evolution of the MultiAir / UniAir / TwinAir of Fiat / INA), Or take a look at the CVJ coupling at for which the US-patent has been approved and is to be granted in a couple of months. Think if it can replace the Rzeppa CV joints in the drive shafts of the front-drive cars, Or take a look at a 2nd Tilting Valve prototype at (and at) that seems quite promising for portable flyers. On the other hand, a PatRoVa prototype seems relatively simple and cheap to be made. Yet, it would be better if someone experienced in this field (rotary valve technology) would participate in the project. "Do you understand german (Swiss)?" No. However everybody understands the international language of "drawings / pictures / images / animations". Just draw it and I will understand it. For instance, show me with a hand made sketch what you mean by the "rotating O-seal". Thanks Manolis Pattakos Posted 08 March 2014 - 08:23 Hello Manoli I know your website since few years. Your website is very interesting. I am interested almost 35 years with internal combustion engines. I know very very much combustion engine patents, variable valve timing systems, variable intake systems and transmission systems, and CVT-Gears. I made earlier ecu-tuning tools, today no longer. I have even a model engine (webra) with rotary valve engine (cross valve) and many other model engines (two stroke, four stroke an a wankel engine) My english is too bad for a good explanation of the rotating seal. But I try it anyway. The most rotary valve system have a big problem with sealing. Rotary valve system with rotating tight body (in my case or DVL) have absolutely no sealing problem. The DVL engine have another problems but absolutly no sealing problem. This engine has a perfect sealing. Two draws but two various engine with the same valve system. Usually rotary valve engine is grains of sand, dirt or combustion residues a big problem, the valve is then leaky. By rotary seal is this no big problem. The rotary seal polished/grinds/lapping the wear away. The seal is every tight. Is it very importent the the seal rotaing. The lapping-effect is only rotary seal possible. Does the o-seal no rotate, then is the valve soon leaky. With modern material you need little oder no lubrication in den seal. For example: crystalline graphite need no lubrication. Your PatRoVal engine with rotary seal in intake-and exhaust would have a perfect seal. I have this model engine, is but no my video. Webra T4-40 wit cross rotary valve. The cross-system is not perfect, has a The same engine but bigger webra t4-80 I hope you untersood me now. Edited by Speedman, 08 March 2014 - 11:44. Posted 08 March 2014 - 17:24 Hello Manoli I know your website since few years. Your website is very interesting. I am interested almost 35 years with internal combustion engines. I know very very much combustion engine patents, variable valve timing systems, variable intake systems and transmission systems, and CVT-Gears. I made earlier ecu-tuning tools, today no longer. I have even a model engine (webra) with rotary valve engine (cross valve) and many other model engines (two stroke, four stroke an a wankel engine) My english is too bad for a good explanation of the rotating seal. But I try it anyway. The most rotary valve system have a big problem with sealing. Rotary valve system with rotating tight body (in my case or DVL) have absolutely no sealing problem. The DVL engine have another problems but absolutly no sealing problem. This engine has a perfect sealing. Two draws but two various engine with the same valve system. Usually rotary valve engine is grains of sand, dirt or combustion residues a big problem, the valve is then leaky. By rotary seal is this no big problem. The rotary seal polished/grinds/lapping the wear away. The seal is every tight. Is it very importent the the seal rotaing. The lapping-effect is only rotary seal possible. Does the o-seal no rotate, then is the valve soon leaky. With modern material you need little oder no lubrication in den seal. For example: crystalline graphite need no lubrication. Your PatRoVal engine with rotary seal in intake-and exhaust would have a perfect seal. I have this model engine, is but no my video. Webra T4-40 wit cross rotary valve. The cross-system is not perfect, has a seal-problem. The same engine but bigger webra t4-80 I hope you untersood me now. Thank you Speedman. Your prototypes are impressive. Please correct me if I am wrong in the following: In the DVL system the rotary valve is a thin gear rotating at 1/4 of the crankshaft speed by the gearwheel (R) at right. Above the rotary valve there are two intake passageways (E) and two exhaust passageways (A). The rotary valve has two holes / ports (C). Between the rotary valve and the combustion chamber there are two pairs of O-seals (D) for the intake and (D’) (not shown) for the exhaust. Due to the difference of the linear speed of the rotary valve as it touches each O-seal at its far from the cylinder axis side and at its near to the cylinder axis side, each O-seal rotates about its center. It does not revolve about the cylinder axis. It just rotates into its “groove”. So, the groove of the O-seal (D) is stationary / fixed. Only the O-seal rotates. In the case of the PatRoVa the O-seal will be placed in a groove of the cylinder head (as you draw it). The O-seal spins around its axis. The groove of the O-seal is stationary on the cylinder head. Due to the difference of the linear speed of the disk on the outer and inner sides of the O-seal, the O-seal will rotate. Question: Where the DVL rotary valve (S) abuts to take the combustion loads? By comparison, the “combustion forces” acting on the PatRoVa rotary valve cancel each other. In the DVL system the exhaust ports are only for the exhaust and thereby they are hot (around 800 deg Celsius?), while the intake ports are cold as the intake poppet valves (around 400 deg Celsius?). By comparison, the chamber ports of the PatRoVa are for both, the intake and the exhaust, so their temperature is significantly lower than the exhaust ports of the DVL system. In the DVL there are needed four O-seals, in the PatRoVa only two. With your long experience in the Rotary Valve engines, what is the worst disadvantage you see in the PatRoVa architecture? For instance, in comparison with the state-of-the-art Coates spherical valves. Thanks Manolis Pattakos Posted 08 March 2014 - 18:12 Hello Manolis I do not know if I have understood all questions correctly. But I try to answer. In the DVL system the rotary valve is a thin gear rotating at 1/4 of the crankshaft speed by the gearwheel (R) at right. Above the rotary valve there are two intake passageways (E) and two exhaust passageways (A). The rotary valve has two holes / ports (C). Yes that's right. So, the groove of the O-seal (D) is stationary / fixed. Only the O-seal rotates. Yes that's right. With your long experience in the Rotary Valve engines, what is the worst disadvantage you see in the PatRoVa architecture? For instance, in comparison with the state-of-the-art Coates spherical valves. A good question. I believe the combustion chamber (PatRoVa) is maybe OK for long-stroke engine but difficult for shot-stroke engine. And I do believe that's the Coates spherical valves is not tight by longtime. I think the PatRoVa has a similary problem. Actually has all rotary valve system the same problem. I maintain the Coates spherical valves is leaky in 200 or a little bit more hours. A grain of sand or oil coal and the valve is leaky. My model engine with cross valve has the same problem. Is very sensitive. In the DVL there are needed four O-seals, in the PatRoVa only two. Yes that's right. Take two cylinder liners (intake an exhaust) and your valve system is almost perfect tightly, but the cylinder liners must rotating. Question: Where the DVL rotary valve (S) abuts to take the combustion loads? I don't understand this sentence. In the DVL system the exhaust ports are only for the exhaust and thereby they are hot (around 800 deg Celsius?), while the intake ports are cold as the intake poppet valves (around 400 deg Celsius?). The exhaust valve of convention engine is also 800 deg celsius. this is not a really problem. But i believe the o-seal is not 800 deg celcius rather less. The o-seal has a good and permanent contact with rotary valve and thus a good cooling. By comparison, the chamber ports of the PatRoVa are for both, the intake and the exhaust, so their temperature is significantly lower than the exhaust ports of the DVL system. I do not know if this is a beneficial. A very hot intake is not good for a good cylinder filling. The cold intake air is heating. This is not good for good performance. best regards Speedman Edited by Speedman, 08 March 2014 - 20:01. Posted 09 March 2014 - 03:42 While it makes for a very interesting topic of discussion on forums like this, the rotary valve design proposed suffers from many of the same problems that previous rotary valve designs have. These include weight, packaging, sealing, production cost, durability, heat transfer, friction losses, lubrication, etc. It is naieve to think that the auto companies are too stupid to appreciate the potential benefits of rotary engine valves. There are very sound reasons all of the engines manufactured by auto companies all use the same form of valvetrain. It's because poppet valves work very well and they are very cost efficient. Posted 09 March 2014 - 09:14 It is naieve to think that the auto companies are too stupid to appreciate the potential benefits of rotary engine valves. There are very sound reasons all of the engines manufactured by auto companies all use the same form of valvetrain. It's because poppet valves work very well and they are very cost efficient. Hi bigleagueslider Nobody think the auto companies are stupid. The auto companies are very very conservative. The automobile industry picks up the theme rotary valve engine again and again. Just nobody knows it. But the automotive industry likes to use standard parts not unconventional parts. What's wrong with rotary valve engine in motorsport? The is for Motorsport is but later forbidden. This system is from Ilmore and Ilmore is a very competent Motorsport company with very many victorious in the formula 1 and indycar (but with conservative valve system) When Ilmore think the rotary valve system is in Motorspor good then is the chance probable good for Motorsport. 25 years ago nobody believed in the hybrid drive. Today it is everyday. I don't think that the rotary valve engine in the large series has a chance but in a small series(sport vehicles). best regards Speedman Edited by Speedman, 09 March 2014 - 09:47. Posted 10 March 2014 - 04:44 Hi bigleagueslider Nobody think the auto companies are stupid. The auto companies are very very conservative. The automobile industry picks up the theme rotary valve engine again and again. Just nobody knows it. But the automotive industry likes to use standard parts not unconventional parts. What's wrong with rotary valve engine in motorsport? The is for Motorsport is but later forbidden. This system is from Ilmore and Ilmore is a very competent Motorsport company with very many victorious in the formula 1 and indycar (but with conservative valve system)When Ilmore think the rotary valve system is in Motorspor good then is the chance probable good for Motorsport.25 years ago nobody believed in the hybrid drive. Today it is everyday. I don't think that the rotary valve engine in the large series has a chance but in a small series(sport vehicles). best regards SpeedmanSpeedy - there is nothing wrong with tackling problems that the big companies have been unable to solve completely (like rotary valves). If you thought everything possible had been invented nobody would bother with any new research/inventing at all. But, as you say, they are not stupid. I suspect the that the answer to the RV puzzle is not going to be as easy as cast iron ring seals etc. - the answer is needs to be something much more novel.I was interested to see that you also take an interest in "CVT-gears". If you mean a mechanical variable ratio all-teeth-and-gears etc./positive engagement system I would be interested to hear some of your ideas. This is a much more tricky problem than RV's etc. People have been trying to solve this problem for 500 years or more with absolutely no progress at all.I would be interested in Manny's views on the subject of "CVT-gears" as well. Posted 10 March 2014 - 04:58 Hello Speedman. According the drawing of the DVL, the overlap is more than extreme. Isn’t it? The pressure forces acting on the DVL rotary valve during the combustion are heavy. For an 80mm bore cylinder, the four holes (A) and (E) seem as having a total area of, say, 25cm^2, which means that with a pressure of 40 bars into the cylinder, the rotary valve – and its support i.e. where it abuts – receive a force of 1 ton. This load increases with the square of the cylinder bore. This is why I asked where the rotary valve abuts / is supported. Without a thrust roller bearing, or at least a good lubrication, the system A reasonable question for the DVL system is “why they use so thin rotary valve?”. If the rotary valve had a few times bigger width (i.e. bigger height along the cylinder axis), its flexing due to the combustion pressure would reduce a lot. But there is a problem here. As the “hole” / port (C) of the rotary valve passes over the intake port (E), the space into the (C) hole “inside” the rotary valve fills with a quantity of mixture. Later this “hole” /port (C) passes over the exhaust port (A) and this quantity of mixture goes unburned towards the exhaust. The bigger the height of the rotary valve, the more the unburned mixture that goes unburned to the exhaust. Even with a thin rotary valve, this remains a problem. Even with perfect sealing (i.e. zero leakage from the four O-Seals of the DVL), a percentage of unburned charge finds the way to the exhaust. In comparison, the PatRoVa, no matter how thick (wide) the two disks are, has no such problems. Besides, any leakage from the combustion chamber through the chamber ports returns into the cylinder during the next suction cycle. A mistake: I wrote that the O-Seals rotate inside their grooves due to the difference of the linear speed of the rotary valve at the outmost and innermost sides (relative to the rotary valve center) of the O-Seal. The correct explanation is different: Take the friction force applied by the rotary valve on a point P1 of the O-Seal surface. The point P1 is at an eccentricity R from the rotary valve center O, and at an eccentricity r from the center K of the O-Seal. Then, with the O-K line (i.e. the line from the center of the rotary valve to the center of the O-Seal) as symmetry axis, take the symmetrical point of the P1 on the O-Seal “contact” surface, say P2. The two friction forces acting on the P1 and P2 points of the O-Seal are equal, but they are not opposite. The one is normal to the line O-P1, the other is normal to the line O-P2. Their constituents along the line O-K form a pair of forces that tries to rotate the O-Seal about its center K. The more the distance of the P1 from the O-K line, the stronger the pair of forces; which means the outermost and the innermost parts of the O-Seal surface (i.e. the points of the O-Seal on, or nearby, the O-K line) do not help the rotation of the O-seal. The pairs of forces cause the rotation of the O-Seal. Thanks Manolis Pattakos Posted 10 March 2014 - 10:30 Hi Manolis Hello Speedman. According the drawing of the DVL, the overlap is more than extreme. Isn’t it? Yes this is, but the under image is not a good example. There are various constructions dvl. Upper and lower image are not the same engine. But the rotary valve is almost the same. The upper image is the better example. Please speaks we from upper image. I want only explain the fundamental principle of rotary o-seal valve system with the DVL- engine. The pressure forces acting on the DVL rotary valve during the combustion are heavy. For an 80mm bore cylinder, the four holes (A) and (E) seem as having a total area of, say, 25cm^2, which means that with a pressure of 40 bars into the cylinder, the rotary valve – and its support i.e. where it abuts – receive a force of 1 ton. This load increases with the square of the cylinder bore. This is why I asked where the rotary valve abuts / is supported. Without a thrust roller bearing, or at least a good lubrication, the system I don't like the DVL-engine. I know the problem with the disc valve. It is only a explanation for the prinzip of rotary seals. I said, the DVL engine has other problems as seal. Your PatRoVal engine with rotary o-seal (cylinder liners) und your engine i would say is better. A mistake: I wrote that the O-Seals rotate inside their grooves due to the difference of the linear speed of the rotary valve at the outmost and innermost sides (relative to the rotary valve center) of the O-Seal. I hope i have understood right your text. No Mistake. This is absolutely correct. Therefore rotating the O-seal. That's the trick. The o-seal and the rotary valve grids (lapping) permanent and the valve is always tightly. So is a sandkorn or combustion residues or oil coal not a big problem but a big problem by conventionally rotary valve engine. Scratchs in conventionally rotary valve engine are a big problem, little scratchs in DVL rotary valve engine are almost no problems. I don't like the DVL engine but i do like the rotary valve principle. By good conventionally valve engine rotating the valve also. The famous engine engineer Ludwig Apfelbeck (also BWM engine Engineer) has DVL system co-developed. In comparison, the PatRoVa, no matter how thick (wide) the two disks are, has no such problems. Besides, any leakage from the combustion chamber through the chamber ports returns into the cylinder during the next suction cycle.   When your engine has scratchs in the disc valve then will be the problem bigger and bigger. You do not believe? You'll see it. But do like to prove the contrary. best regards Speedman Edited by Speedman, 10 March 2014 - 13:56. Posted 10 March 2014 - 12:29 Hi Speedy - there is nothing wrong with tackling problems that the big companies have been unable to solve completely (like rotary valves). If you thought everything possible had been invented nobody would bother with any new research/inventing at all. But, as you say, they are not stupid. I suspect the that the answer to the RV puzzle is not going to be as easy as cast iron ring seals etc. - the answer is needs to be something much more novel.   I do believe you understand me very bad. My english is too bad. And i said: rotary valve system could have maybe a chance in very small series not in large series. That's not the same. In the most motorsport series are rotary valve system forbidden. The rotary valves system have presumably no great future but one little but interessting chance. I will and wanted never revolutionize the automobile industry with rotary valve systems! Itn't my novel is'nt novel of BMW engine development department in 2. World War. Based only on the DVL motor And today there are far more new modern materials and coating than it was then. A few examples: crystalline graphite(with oder without aluminum matrix, titanium nitride, DLC, Metal matrix composit etc. I would be interested in Manny's views on the subject of "CVT-gears" as well. Please not in this topic. This is a engine topic. I don't not really like CVT-gears, but i am interessting CVT-Gears. CVT-Gears are not fundamentally bad. An exmaples: The CVT (Lineatronic) of Subaru (3. Generation) relatively popular and surprising good, many people are lucky. CVT-Gears will better and better. Double-clutch transmissions have circa 20 years needed from Motorsport (Porsche 956 PDK) until in the series Wholesalers. In Asia in various Country are CVT-Transmission relatively popular in Europe not., but it's change. It's take Time. But i prefer in the moment the gear-wheels. I'm looking for and try development a form-locking CVT-Gear. That's a big challenges. I will not discuss cvt gearbox here in this topic and I have too little time. Sorry best regards Speedman Edited by Speedman, 10 March 2014 - 14:10. Posted 11 March 2014 - 04:32 Speedy - I presume that this means you have no significant new ideas on the subject of "CVT-gears"? Posted 11 March 2014 - 07:35 Speedy - I presume that this means you have no significant new ideas on the subject of "CVT-gears"? That's right, but other peoples has interessting ideas. I have im moment too little time for this topic. Edited by Speedman, 11 March 2014 - 07:41. Posted 13 March 2014 - 08:14 Hello. Here is the design for a compact (and easy to make) PatRoVa prototype cylinder head (dimensions less than 100mmx100mmx100mm) the valve area (together with the free flow) make it suitable for big cylinder capacities (say 400cc, 500cc, 600cc). According the "valve area vs the crank angle" plot (similar to - but with differences - the conventional "valve lift vs crank angle" plot), the port design is too conservative. By redesigning the ports it is easy to make it as wild as required by the application. The same cylinder head from outside: And here with and without the rotary valve, from various viewpoints. Any thoughts? Thanks Manolis Pattakos Posted 13 March 2014 - 08:54 Impressive. Is compression ratio not a little bit too high or is a diesel or for methnol? Timing cross aerea (i don't found a english word) too small ? For my opinion is the valve overlap (inktake, exhaust time) too small. I don't like the combustion chamber. Best regards Edited by Speedman, 13 March 2014 - 09:17. Posted 13 March 2014 - 10:20 Is compression ratio not a little bit too high or is a diesel or for methnol? Timing cross aerea (i don't found a english word) too small ? For my opinion is the valve overlap (inktake, exhaust time) too small. I don't like the combustion chamber. Best regards Hello Speedman. The 17:1 and the 21:1 are the maximum possible compression ratios with the specific cylinder head (25cc cavity - or combustion chamber - volume) on a 400cc and on a 500cc cylinder, respectively. I.e. with the specific design the dead volume cannot drop below 25cc. Depending on the clearance between the piston crown and the cylinder head (i.e. the distance when the piston is at the TDC), the compression ratio in the case of the 500cc cylinder is from 21:1 (zero clearance between the cylinder head and the piston crown) to anything below it. For instance, with a clearance between the cylinder head and the piston crown equal to 1/4 of the piston stroke, the compression ratio drops to 4.33:1 (CR=(500+(500/4)+25) / ((500/4)+25) = 650/150) = 4.33). With a clearance of only 1.5mm and a piston stroke of 80 mm (i.e. cylinder bore:89mm for 500cc) the compression ratio drops to 15.5:1. Speedman: "Timing cross aerea (i don't found a english word) too small ?" I think you mean the "valve area" during the overlap. It seems small, but it can increase. After the initial tests, the intake and exhaust ports can extend (but removing material from the disks of the rotary valve) as necessary. Speedman: " I don't like the combustion chamber." However, the combustion chamber is compact and can provide as much turbulence and swirl as required. Do you remember the reverse tumble of the first direct injection lean-burn Mitsubishi GDi? What I see in this combustion chamber is an opportunity to reduce the quantity of the residual gas, i.e. an opportunity to further reduce the temperature of the cycle. In the conventional engine, with the intake and exhaust valves almost touching each other, the "scavenging" of the combustion chamber during the overlap cannot be efficient. In the PatRoVa with the "flat" cavity and with the intake and exhaust openings arranged at opposite ends of the combustion chamber, things are substantially different. Thanks Manolis Pattakos Posted 13 March 2014 - 14:00 The 17:1 and the 21:1 are the maximum possible compression ratios with the specific cylinder head (25cc cavity - or combustion chamber - volume) on a 400cc and on a 500cc cylinder, respectively. I.e. with the specific design the dead volume cannot drop below 25cc. Depending on the clearance between the piston crown and the cylinder head (i.e. the distance when the piston is at the TDC), the compression ratio in the case of the 500cc cylinder is from 21:1 (zero clearance between the cylinder head and the piston crown) to anything below it. For instance, with a clearance between the cylinder head and the piston crown equal to 1/4 of the piston stroke, the compression ratio drops to 4.33:1 (CR=(500+(500/4)+25) / ((500/4)+25) = 650/150) = 4.33). With a clearance of only 1.5mm and a piston stroke of 80 mm (i.e. cylinder bore:89mm for 500cc) the compression ratio drops to 15.5:1. But is rather theoretical. Mazda and Ferrai has engine with circa 1:14 with 98 octane fuel an with a good knocking management ecu. Do you remember the reverse tumble of the first direct injection lean-burn Mitsubishi GDi? Yes i do, but i think system of mitusbishi is not the best solution. The piston are heavy. Not good for sport or race engines. Edited by Speedman, 13 March 2014 - 14:06. Posted 15 March 2014 - 08:08 Speedman, In the Wankel Rotary engine (say, for instance, the Mazda RX-8) the compression ratio cannot go beyond 18:1. This is because there is a minimum dead volume between the piston and the casing. But anything below the 18:1 is possible. All you have to do is to increase properly the volume of the cavities / bowls on the piston. In a similar way, there is a maximum compression ratio in the case of the PatRoVa. And this ratio has to do with the volume of the cavity (or combustion chamber) into the cylinder head, and with the displacement of the cylinder. Then, by selecting the clearance between the piston and the cylinder head (for instance by replacing the gasket with a thinner -or with a thicker- one), you can have any compression ratio below the maximum possible one. The 21:1 (for the 500cc) is quite high. With flat crown and lower operating temperature, the piston of the PatRoVa has no reason for not being the lightest one for the specific bore - stroke. In order to: simplify the prototype construction, to decrease its weight, to improve the access of the cutting tool where it is necessary (front surfaces, chamber port lips), etc, the following arrangement seems promising : Any thoughts? Thanks Manolis Pattakos Posted 15 March 2014 - 11:18 Hello Manoli Your PatRoVal construction is really impressive But I want to see and hear the running this motor, best at high speed rpm. In the Wankel Rotary engine (say, for instance, the Mazda RX-8) the compression ratio cannot go beyond 18:1. This is because there is a minimum dead volume between the piston and the casing. But anything below the 18:1 is possible. All you have to do is to increase properly the volume of the cavities / bowls on the piston. I like the RX-8, but i think you can't compare a Wankel combustion and combustion chamber with a combustion und combustion chamber of a piston engine. The differences are too large The combustion chamber of a wankel engine has a very great surface area. Too much thermal energy flows by practice to the surface area. Therefore the wankel engine has a bad efficiency and a very good knock resistance. The wankel has a relatively cold combustion chamber, because the great surface area, so is the knock resistance better then a piston engine. OK the Wankel hasn't also no hot exhaust valve, but the combustion chamber is not comparable. I have found a interessting rotary valve project of students. A conventionell Cross valve. The valve will not be long tight. Is not necessary, its only a competition. Homemade 4 Stroke Rotary Valve Engine Run 2 best regards Speedman Edited by Speedman, 15 March 2014 - 11:49. Posted 03 April 2014 - 08:33 Hello Speedman. I prefer to see and hear how this rotary valve / motor behaves at the low revs. Here are some photos (the last one is stereoscopic) of the main parts of the PatRoVa prototype we prepare: Thanks Manolis Pattakos Posted 03 April 2014 - 11:56 The 3D photo is amazing - 3D certainly helps the understanding of a complex shape. Oddly I can probably get a slightly clearer 3D image with my reading glasses off than with them on - the computer screen is normally pretty blurry with my glasses off. Posted 03 April 2014 - 19:27 The cylinderhead is amazing! Posted 28 May 2014 - 11:50 Hello. At they have been added a few photos of the first PatRoVa prototype engine: Here is a couple of stereoscopic photos: It has also been added a video of the PatRoVa prototype engine running on gasoline: at or at YouTube at ?v=6Q-EGdeS0ws Thanks Manolis Pattakos Edited by manolis, 28 May 2014 - 12:18. Posted 30 May 2014 - 06:46 Hi Manolis Awesome! The motor turns very quiet. What is the rpm? Do you have measured performance? best regards Posted 01 June 2014 - 03:24 Hi Manolis Awesome! The motor turns very quiet. What is the rpm? Do you have measured performance? best regards Thank you Speedman. The motor is a not-carefully-balanced single-sided harmonic-engine (for more, take a look at #harmonic). It is a single cylinder four-stroke; the architecture of its kinematic mechanism is the same as the architecture of the kinematic mechanism of the following 2-cylinder, 2-stroke harmonic engine: There are no external counterbalancing shafts. However with the proper selection of the balance webs (1D, 1C, 2D, 2B) this single-sided engine can be “perfectly” balanced (as perfectly as a Wankel Rotary). The "underneath mechanism" (cylinder, piston, "crankcase") was used for the first PatRoVa rotary engine prototype just because it was available. Bore: 75mm (the cylinder liner with the cooling fins is from an old Yamaha XT250) Stroke: 80mm Displacement: 353cc The same PatRoVa cylinder head can be used in conventional engines having a cylinder capacity from, say, 350cc to, say, 500cc). It is a low-budget "proof of concept prototype" at one of its first runs. It doesn't matter what the rpm is (everybody having a sound tachometer can check the rpm at the video), neither what its power output is. What really matters is the difference it brings to the rotary valves: compact combustion chamber, better sealing, zero total force on the rotary valve (look at the two small roller bearings wherein the rotary valve is supported), complete absence of hot spots in the combustion chamber, lower temperatures, higher compression ratios, wide valve area, etc. Some of them need to be proved in practice (the long term sealing quality, for instance), but till now everything goes according the theory. Thanks Manolis Pattakos Posted 01 June 2014 - 12:12 Hello A really nice project I think in the last time on micro engines with continuous combustion to drive a electric generator (also hybrid drive). The engine is multi-fuel able. Very little engine noise and a very little engine vibration. Mabe a range extender for litte electric scooter. A kind of gas turbine without fan but with a heat regenerator. Rotary piston internal combustion engine Drehkolbenkraftmaschine Drehkolbenmaschine best regards Posted 23 December 2015 - 13:21 Hello. With the Search and Re-Examination Report of the UK-IPO (United Kingdom Intellectual Property Office) just published, take another look and re-think the potential of the PatRoVa rotary valve. For instance, as a substitute of the Desmodromic cylinder heads of the Ducati Panigale: Thoughts? Objections? Thanks Manolis Pattakos Posted 25 March 2016 - 04:40 Hello all. Today the United Kingdom Intellectual Property Office (UK-IPO) granted the GB2,525,704 patent to the PatRoVa rotary valve Click at for the patent documents in the UK-IPO, then click on the “Documents” at right. For more:) Thanks Manolis Pattakos Posted 05 April 2016 - 21:02 Impressive stuff, Manolis Posted 09 June 2016 - 13:04 Hello. At the they have been added these two animations: The angular size (duration) of the exhaust port and of the inlet port on the rotary valve are by far larger than the angular size (“duration”) of the cylinder-head-port (which, by the way, serves both: the exhaust and the intake). The valve lift profile turns from triangular with soft “ramps” to trapezoidal with abrupt opening and closing “ramps”. Bore: 80mm Stroke:70mm Con-rod center-to-center: 125mm (=1.8*stroke) Displacement: 350cc per cylinder Cylinder head port area: 2*6.5=13cm2 According the following diagram / plot: with f1=40, f2=25, f3=75 and f4=85 degrees (measured on the rotary valve): exhaust duration: 230 crank degrees inlet duration: 250 crank degrees overlap: 30 crank degrees “sealed” duration (from the closing of the inlet to the opening of the exhaust): 270 crank degrees. The port areas and the timing can be by far more “racing” for higher than extreme revs; in such a case, a racing underneath mechanism (crankshaft, con-rod, piston, cylinder, crankcase) is required, capable to stand the punishment. Thoughts? Objections? Thanks Manolis Pattakos Posted 10 June 2016 - 03:23 Hi Manolis. Have you considered adding a movable plate in the sealing face between valve and head, to alter the duration? Rotating the disc could shift for example the closing events and a simple phaser could alter the opening events. Posted 10 June 2016 - 05:54 It has probably been said many times - but surely the engine's rotary valve needs better sealing than just close clearances. A normal piston needs only the slightest bit of wear etc. and the leakage past the piston becomes unacceptable - and that is with sealing (piston) rings. A piston running without rings fitted at all would be hopeless - and that appears to be what you are proposing. Maybe you should try and develop a sealing system using a sealing ring resembling a clutch's diaphragm spring - which can flex and keep sealing pressure on the two faces. Posted 10 June 2016 - 12:25 It has probably been said many times - but surely the engine's rotary valve needs better sealing than just close clearances. A normal piston needs only the slightest bit of wear etc. and the leakage past the piston becomes unacceptable - and that is with sealing (piston) rings. A piston running without rings fitted at all would be hopeless - and that appears to be what you are proposing. Maybe you should try and develop a sealing system using a sealing ring resembling a clutch's diaphragm spring - which can flex and keep sealing pressure on the two faces. Mazda have taken 40 years and in reality still have long term seal issues with the rotary. And there is more real scope in that situation for an effective seal. And that engine is in theory very simple and practical. But a limited production sports engine only. Too expensive to produce, too thirsty and too much of a drama with warranties. And compared with piston engines does not make enough power. This may be fine for a short term race engine that is rebuilt very regularly but for a rotary valve engine to go do 200000 reliable km will not happen. As I said a long time ago there is no real point in reinventing the wheel. Sure it is feasible but the even medium term sealing will always be the issue. And the emissions issue as well as useable torque while not insurmountable possibly is a job for a big manufacturer. Who I am sure look at it on occasion and dismiss it as impractical. Remember it took a good 50 years to make piston rings that were reliable and another 25 [and unleaded fuel with computer controlled ignition and fuel delivery] to stop them wearing out the bores prematurely. Ditto with valves Posted 11 June 2016 - 07:14 Adding a sealing element to Manolis' rotary valve is fairly trivial using highly reliable, mature technology - not comparable in any way to the challenge of sealing a Wankel. Posted 12 June 2016 - 05:11 Hello Kelpiecross. Quote from “However, the geometry of rotary valve systems is inherently different; in the Aspin concept below, the vertical valve cone is pushed up axially against the cylinder head, while the horizontal Cross valve is pressed up against the top half of the bearing surfaces. In both cases this can cause excessive friction and seizure, the root of the problem being that enormous forces are acting on the valve while it is moving.” End of Quote. The PatRoVa rotary valve is different than the known (state-of-the-art) rotary valves wherein the above quote is applicable; while it receives “strong” forces at its two opposite fronts (not enormous”, just “strong”, because it divides them by two, or by four in case the intake and the exhaust valves are on the same shaft, as explained at), the total force it receives is zero, no matter how strong is the pressure into the combustion chamber. PatRoVa’s bearings operate unloaded (the only load they bear is the tension of the timing belt / chain). And the geometry of the PatRoVa rotary valve is ideal for receiving these “strong” forces: the diameter of the hub that connects the two oppositely acting fronts is as big as desirable (40mm? 60mm? 100mm?), while the width of the two side disks is as big as desirable (25mm? 30mm? 50mm?). In the last animations, while the design is quite conservative, the port area is bigger and the rhythm at which the ports open and close (actually the valve-time area the working medium “sees”) is faster than in the Honda B16A2 VTEC engine (1600cc, 4-cylinder,160PS at 7600rpm). The 6.5cm2 port area of each combustion-chamber-port can easily increase at 10cm2 for racing applications. Can an 81mm cylinder make room for intake valves having similar flow capacity? They are required two intake valves of more than 40mm diameter each, it is required a significant clearance between them and between each of them and the cylinder liner. The basic part is extremely robust and inflexible. Nothing to do with rotary valves like those of Cross (and Cross-Bishop), or like those of Aspin. The cooperating surfaces have the simplest shape: plane. The distance between the two opposite fronts is small (30mm in the animation) decreasing the effect of the temperature difference of the two parts. All these make possible the efficient sealing even without sealing means. In this photo: the crankshaft has turned manually (i.e. the rpm are less than 300). The disks and the ports are dry and the manufacturing quality of the cooperating surfaces is not as required, nevertheless a conventional poppet valve is not doing better with the sealing of its valves. With the required manufacturing accuracy and a DLC coating on the oppositely acting fronts and on the combustion chamber port lips, the reliability may be better than that of the poppet valves. Thanks Manolis Pattakos Posted 12 June 2016 - 05:19 Hello Lee Nicolle. In case of using sealing means (like, say, those used in the Coates spherical rotary valves) things would still be way easier and the sealing more efficient than in a Wankel rotary, because the periphery of each chamber port is small, because the contact of the sealing means with the “front” surface whereon they abut is plane (and not linear), because the “sealing means” is not making “strange” movements (like those of the apex “rings” of the Wankel), etc, etc. However the challenge is the operation without conventional sealing means: no friction, no wear, no lubricant, better combustion, less cooling etc. As explained in the previous post, the strength / inflexibility of the rotary valve can increase as required (a 60mm diameter hub bridging two thick disks each receiving a 650Kp (1,400lb, case of 100bar peak pressure into the combustion chamber) causes a less than tiny deformation / increase of clearance). If necessary, a material like the INVAR can minimize or eliminate the thermal expansion. And a coating with the proper DLC can protect the cooperating surfaces from wear. When the leakage at, say, 300pm of a manual cranking (above photo) can be small, the leakage at 3,000rpm is ten times less (provided the same pressure is in the cylinder), the leakage at 6,000rpm is 20 times less and the leakage at 12,000rpm is 40 times less. And among the advantages of the PatRoVa architecture is that any leakage from the combustion chamber goes to the intake passageways in the cylinder head and is recycled in the next suction cycle. So, take another look. The PatRoVa brings in the rotary valves new features / characteristics that may change the rules of the game. Thanks Manolis Pattakos Edited by manolis, 12 June 2016 - 06:22. Posted 12 June 2016 - 05:41 Hello Gruntguru. You write: “Have you considered adding a movable plate in the sealing face between valve and head, to alter the duration? Rotating the disc could shift for example the closing events and a simple phaser could alter the opening events.” Or a pair of linearly moving plates, one per combustion chamber port. But with plates disposed between the combustion chamber port and the rotary valve ports, it is added friction / wear : the cylinder pressure pushes the plates onto the rotating fronts of the rotary valve. A solution that better fits with the “zero total force” characteristic of the PatRoVa rotary valve seems the upwards / downwards shifting of the rotary valve: Recently Suzuki filed a centrifugal VVT (variable valve timing) system for their motorcycles (application publication: US2016/0010517) . They claim the simple / automatic centrifugal control over the overlap is just fine as compared to the more complicated hydraulic etc phasers. With a “centrifugal” plate properly pivoted at the end of the exhaust port on the rotary valve, and a “centrifugal” plate properly pivoted at the beginning of the intake port on the rotary valve, plus the required restoring springs, the engine, depending on the revs it operates, can run with an overalp varying from a maximum to zero. The mechanims adds no friction, no wear. Depending on the design (shape of “centrifugal plates and location of their pivots), the big overlap can be at low medium revs or at high rpm (in Suzuki’s patent the big overlap happens at medium-low revs, and the small overlap, or the “no-overlap”, happens at high revs). On the other hand, a quite small overlap with plenty of valve time area seems preferable (say with an “ex-up” at exhaust if necessary) for all cases (low and high rpm) without the complication a VVT introduces. Thanks Manolis Pattakos Posted 12 June 2016 - 06:46 Adding a sealing element to Manolis' rotary valve is fairly trivial using highly reliable, mature technology - not comparable in any way to the challenge of sealing a Wankel.An example of this "mature" technology please?Manolis insists that no sealing is required apart from close clearances - presumably you disagree with this?

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