The Bay Area Engine Modelers Club, Branch 57 of EDGE&TA

The Crank Calls

June 2004

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NEXT MEETING
Swap and Run Engines Meet
June 19, 2004 – 10AM
At Robert Schutz's Shop
366 40th St. Oakland, CA

Check out the BAEM Web Site at www.baemclub.com
Send your project photos to the Web Master Jim Piazza.
Phone: 408-446-4825
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TO JOIN THIS CLUB
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TO LEWIS THROOP

Meeting Notes:
May 15, 2004 Meeting
Carl Wilson

As always, the first order of the day was introduction of guests. Chuck Leri and Don Garlow came down from Sacramento seeking information on pouring cast iron. Suggestions from the floor included: it can be done, but with difficulty and why not use a commercial foundry – Sunset Foundry in Valley Springs (phone 209-754-0601.) Art Shulenberger, president of Innovation Engineering, Inc. brought some goodies, of which more later.

Treasurer's Report:

Lew Throop said that we are not broke, yet, and he can pay all of our bills, so don't worry.

Events:

Dick Pretel gave a report on the Hillsborough Concours. It was a good show with about 250 cars, including an Alfa Romeo reportedly worth $4.1M. Dick is going to do a small show in Palo Alto for the Historical Society, see him for details. See Page 8 for BAEM Events.

Bits and Pieces:

Dick Remington built the Gade uniflow engine from the kit of castings by Morrison and Martin. It was mounted on a farm wagon base and had a nice finger jointed box with all of the ignition stuff. Dick says that it needs a more gasoline resistant paint.

Carmin Adams brought the piston and cylinder with liner from his Fairbanks 3 cylinder engine. There were also two shop-made hones with 3 spring-

loaded stones in each. They did a nice job of finishing the bore, but Roger Slocum reminded us that spring loaded hones cannot correct any errors in the geometry (shape) of the bore – it can only improve the surface finish, and can, if misused, introduce errors.

Al Vasallo showed us his helical milling fixture that he used for making the mixture controls for his carburetors.

Art Shulenberger displayed a mockup of his 5-cylinder "swashplate" engine. Well, it wasn't really a swashplate, because his plate doesn't re-

volve. Unfortunately I can't tell you much more because his "model" and the computer animation that accompanied it were so popular that I was unable to get close enough to find out how it works. I did see the connecting rod with its spherical bearings at both ends – a very nice piece of engineering and machining. These joints have a lot less friction than the swashplate. Art calls this design a "Z-crank. Other features of Art's design are variable compression, lowered vibration, and minimal piston side wall friction. One of the intended markets for this engine is small unmanned aircraft. Art, please come back and tell us more!

Pat O'Connor brought his spherical piston engine. The piston is a Lucite ball in a brass cylinder; the connecting rod is outside the cylinder, and the valve ports are in the crankshaft.

Al Aldritch's Cole's small hit-'n-miss engine has been repainted and Dwight Giles has done some repair work.

George Gravatt brought his model of the 1917 Novo engine made from a casting kit from PM Designs of Bend, Ore. George has the full-size prototype and said that the castings were very high quality and an exact reproduction. He uses a Mike Neal ignition system. One of the features of this engine is the fuel tank is in the base and has a pump to lift the gas to the carbu-

retor and an overflow pipe to return unused fuel to the tank.

Don Catalano showed some Wall parts. I unfortunately didn't record any other details.

Dwight Giles is working on the Sky Angel 36.

He also brought the crankshaft, rod and piston from a similar engine with a different bore. He also brought back his radius fixture, and – many thanks, Dwight – drawings of the fixture. Dwight used this to mill the round ends of the rocker arms for the Black Widow V-8s.

Ken Hurst ran his Black Widow. There is something about the roar of the exhaust of these high-speed multi-cylinder engines. Ken sure knows how to attract attention: build a superb engine, crank it up, and pull on the throttle rod. Wow! This engine has run up to 8,000 rpm. Ken plans to build a ¼ scale fiberglass bodied RC car for it. Stay tuned, this is going to be one amazing project.

Lew Throop has been building a radiator from a design by Bob Shores. He showed a finished radiator and the press tooling used to punch the holes in the tube sheets. The oval punch is held in the spindle of the mill and the die is

In Memory of Bob Shores

Bob Shores is no longer with us mortals, he passed away May 18th in Ruskin,Florida.
Bob was a leader in model engine design and construction.
As member of the Bay Area Engine Modelers, he was a friend to everyone in the club. Bob's contribution to the hobby of model gas engines was tremendous and we all will miss him and his talent.

Last New Year's Eve, Bob spoke of his club's membership in his web site: "It is composed of Good Guys, men of good will that are knowledgeable and helpful." This also is a fitting description of Bob Shores.

Our sympathy goes out to his wife Margaret (Pee Wee) & his children and grandchildren.

Ken Hurst, President Bay Area Engine Modelers BAEM

Secretary's report, May 15, 2004
Bob Kradjian

We all have memories of Bob Shores. His contributions to this wonderful hobby are remarkable. Not since Elmer Wall have so many beginners, as well as seasoned machinists, followed one man's designs. His integrity was impeccable. When he sold a book on ignition that did not meet his printing standards, he mailed another--at his expense--that was first rate. Not all know that he was a decorated and badly injured World War II hero. He once told me that..."If I can build this engine with one eye and half an ass, you can too!" His legacy will be in his engines and in the memories of his many friends. In addition he will be remembered as a patriot, family man, and a gentleman.

He will be missed.

For more information check out Bob's web site at www.bobshores.com

Click on the INFO key

TECH TOPICS BY PAT O'CONNOR

TECH TOPIC AT THE JUNE MEET

Since June will be a swap and run your engines meet, there is no Tech Topic.

Tech Topics: Let's Build an Engine
May 15, 2004
By Carl Wilson

The Tech Topic for March was machining the crankcase (block) of an automotive type engine. With that done we are ready to machine the cylinder liners and install them. A word of explanation here: liners are used in engines with aluminum blocks to provide a more wear resistant cylinder material. Liners are also used to simplify the coring of coolant passages in cast blocks. Dry liners are fully surrounded by the metal of the cylinder or crankcase; wet liners are that: wet – they are surrounded by the coolant and are retained by and sealed to the cylinder or block only at their top and bottom. The Wall 4, Challenger, and Black Widow engines are wet liner engines. An air-cooled engine with cast aluminum cylinders might have dry liners and most of the farm-type hit-'n-miss engines ran the pistons directly in cast iron cylinders. These Tech Topics are about models of automotive engines that have cast aluminum blocks and use wet liners.

Liners are about the simplest part of an engine. Some are just a straight piece of tubing; the fancy ones have a flange or lip at one end. Don't let that simplicity fool you. They are one of the hardest working pieces in the engine and must be made of the proper material and machined to rather fine tolerances. First the working conditions: the liners are exposed to the combustion heat and gases through about one third to one half of their length. The pistons and rings rub against the liners at speeds up to 1500 feet per minute. Below the oil scraper ring there is lots of oil splashed against the liner walls by the crankshaft and connecting rods; above the oil ring there must be minimal oil. The rings must seat against the liner so that oil does not pass up from the crankcase into the combustion chamber and combustion gases do not leak into the crankcase.

There are only a few materials that can meet these conditions, particularly because most materials do not wear (rub) against the same material very well. Aluminum against aluminum is one of the worst – unless it specially treated, aluminum will simply weld together and seize. Aluminum will work very well with cast iron but not with steel. Stainless steel is usually not a good wearing material either with itself or with another metal. Brass does not run well with itself, runs poorly with cast iron, and is OK with steel. Bronze is a good material to run against steel. Cast iron is about the only common material that will run well with itself, and it also works well with steel, especially hardened steel. The choices of materials that wear or rub against each other must be made in terms of "wearing pairs": you choose them together. Our choice of materials is limited. The blocks of many engines are cast in aluminum and use aluminum pistons with cast iron rings. That leaves basically two materials for liners: steel or cast iron.

Cast iron is available as round or cored round stock. It machines well but leaves your machine tools looking grubby. Cast iron dust is abrasive,

so remember to clean your machine thoroughly after a session. Just about any of the low to medium carbon steels can also be used. Some suggested alloys are 12L14 (leaded, free machining, screw machine stock), 1050 DOM tubing (medium carbon drawn over mandrel), and 4130 (chrome-moly) DOM tubing. Dwight Giles buys this good stuff from Aircraft Spruce: http://www.aircraftspruce.com/.

Now for the fine machining. While the materials choices are primarily about wear, the machining tolerances are about sealing. The outside surface of a wet liner has to seal against the block at the top and bottom of the liner to prevent water from leaking into either the combustion chamber or into the oil pan. The piston rings have to seal against the bore of the liner to prevent oil from leaking into the combustion chamber and combustion gases from leaking into the crankcase. Pistons and rings will be covered in a future report.

There are at least three ways to seal liners to the block: install the them with a interference fit, either by pressing or shrinking; use an engineering adhesive such as Loctite; install o-rings at the top and bottom of the liners. Each of these methods have their own dimensional allowances and tolerances.

The following recommendations are from Dwight Giles and are for engines of about 1" bore, aluminum block, steel wet liners:

1. Wall thickness of liners = 1/16"
2. Allowance for press fit = .002
   (outside diameter of liner is .002" larger than bore in block)
3. Allowance for finish of bore = .002 - .003" (bore is smaller than finished size)
4. Make liners 1/32" longer than hole in block. This excess will be machined later.

Dwight machines the bore of the block with a step at the bottom, and the liner with a step at the top.
This makes it easier to press the liner into the block. Let's try to describe this without drawings. The nominal size of both parts is 1 1/8"= finished bore of 1" plus two wall thickness of 1/16". Bore the block to 1.125" diameter to the required depth. Then counterbore to 1.130" leaving about one quarter inch length at the bottom bored to 1.125". Turn the liner outside diameter to 1.132 – 1.133" = the diameter at the top of the crankcase bore 1.130 plus the press fit allowance of .002 - .003". Next turn all of the length of the liner except for one quarter inch at the headstock end to 1.127 – 1.128 = the diameter at the bottom of the cylinder 1.125" plus the press fit allowance. The liner will slide straight into the bore leaving about a quarter inch at the top and bottom to press in and to make the required seal. Don't forget the extra 1/32" at the top to machine off later.

Dwight explained that he developed this design to overcome some problems that he experienced with pressed in liners. As the liner is pressed in it is guided only by the short length of engagement at the top of the block. As the liner descends, it can "wander" off center and fail to squarely engage the bore at the bottom.

Now is the time to hone or lap the bores to the final finish. The Tech Topic for May 2001 (written up June 2001) was on honing and lapping. This issue includes lot of tips plus the drawings for Roger Slocum's "home-made, quick and dirty" hone and Dwight Giles lap and it is available on the BAEM website. The hone presented by Carmin Adams was made to Roger's design. Again, the spring-loaded hones such as Roger's, brake cylinder and glaze breaking hones, and honing brushes will not correct the shape of the cylinder. They cannot remove taper, out-of-round, or bell-mouth. If improperly used they can in fact introduce these errors. Rigid laps such as the Sunnen and Superior do

not have this drawback, cut very rapidly, but are expensive. A design for a shop-made rigid hone is available on the web: http://www.chaski-test.com/pictures/3420-Honerpics.jpg.

A lap, although it is slower cutting, can correct errors of shape and is reasonably easy and cheap to make. Dwight uses #45 diamond compound with his lap. He uses the shank of a 1" end mill as a bore gage: he laps until the shank will just push into the bore. All of his bores are as close to the same size as he can make them. You should be able to hold two "tenths" with this method. Take extra care to make all the cylinder bores as close to the same size as possible. It is better for them to be all the same wrong size than for them to be different sizes. This makes machining the pistons and rings much easier.

Dick Pretel uses a somewhat different design. His liners are made from Class 40 cast iron and are completely finished including the bore before they are loctited into the block. The hole in the block is .003-.004" larger than the outside diameter of the liners to allow enough clearance for the Loctite to develop full strength. There is no press or shrink fit, no induced stress in the block, and no need to hone the liners after assembly. Dick has found that shrinking or pressing the liners can distort the aluminum block. He uses Loctite #640 for closer fits, and #609 or 620 for slightly looser fits. His liners are .090" wall and have a flange at the top, so the block has to be counterbored to suit. These liners are a purchased item or you can make 'em yourself and install them the same way. See Dick for details and the availability of liners and other parts.

Liners can be shrunk into the block. The block is heated to about 300 deg F. and the liner is chilled in the freezer. With any luck the liner should simply drop into place. Work fast! And have some means of pressing the liner into place should it stick part way in. There should be a flange on the liner to limit how far it goes in.

There were no comments on the use of o-rings to seal the liners, so no recommendations will be made here. Manufacturers of o-rings publish recommendations for material selection, and for design of o-ring grooves.

Upcoming 2004 Club Events
By Dick Pretel, Events Coordinator

BAEM Swap meet and Running Engines, June 19

GoodGuy's West Coast Nationals, August 27-29

Blackhawk Automotive Museum, November 20--probable date.

West Coast Engine Exhibitions For 2004
Gas Engine Antique Reproduction in Portland, Oregon September 25 & 26, 2004
Web Site: www.visalia.org Phone: 800-640-4888

2nd Annual Men, Metal, & Machines! Visalia Conventions Center Visalia, CA
October 23 & 24, 2004. Web Site: www.cabinfeverexpo.com/MMM

East Coast Engine Exhibitions For 2004 and 2005
Iron Fever Expo in York, PA. York Fairgrounds Expo Center
August 13th, 14th and 15th, 2004. Web Site: www.cabinfeverexpo.com/IFE

Cabin Fever Expo in York, PA. York Fairgrounds Expo Center
January 14th, 15th & 16th, 2005. Web Site: www.cabinfeverexpo.com/CFE

FOR SALE
Grizzly G1005 Mill-Drill $650
Contact Jim Piazza 408-446-4825
Email: jpiazza@ix.netcom.com

Corrections to the May 2004 The Crank Calls

Page 3 Correct Rudy Kouhoupt's name spelling

Page 4 Correct Roland Friestad's name spelling