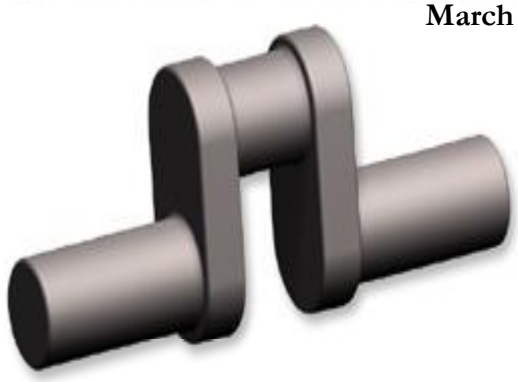
Bay Area Engine Modelers Club
www.baemclub.com

The Crank Calls

March 2025



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Contact Paul Denham at
pedenham@comcast.net

NEXT MEETING

Saturday, March 15, 2025, at the Golden Gate Live Steamers clubhouse site in Tilden Park, Orinda, CA

Gate opens at **9:00 am**

Meeting starts at **10:00 am**

Upcoming Events

- March 15: BAEM meeting at GGLS
- April 19: BAEM meeting at GGLS
- May 3: STEAM Discovery Festival, Solano
- May 17: BAEM meeting at GGLS

See below for more details regarding events. Watch Crank Calls, BAEM emails and BAEM web page for updates. BAEM meetings are usually 3rd Saturday of the month except December.

MEETING NOTES

The Bay Area Engine Modelers met at the Golden Gate Live Steamers clubhouse on February 15, 2025. Sixteen members attended. Paul Denham update club status: finances are in good shape and annual $25 dues are payable. Paul also noted the importance of the Crank Calls newsletter in sharing activities with broader membership and as a recruiting tool.

February meeting

BAEM's YouTube Channel: https://www.youtube.com/channel/UCZ7VbDw_y0GtNm1n6KWiQkg

NEW MEMBERS/VISITORS

BAEM members are reminded that visitors are welcome at our club meetings, and we're always looking for new members, whether or not they have a specific machining project in mind.

TREASURER REPORT

Annual $25 dues are payable for 2025. Please give your check to Paul Denham, or mail it to Deirdre Denham at 1937 Merchant St, Crockett, CA 94525. Make checks payable to "BAEM".

CLUB BADGE

If you are a member in need of a badge, contact Mike Rehmus (editor@modelenginebuilder.com) who has offered to produce them.

SHOWS AND EVENTS

Shows present an opportunity to show off our fine engines and meet potential new members of our club. After all, what could be better than spending a day hanging out with people who are fascinated by our model engines, and want to hear all about what we've been doing?

Coming up on Saturday, May 3, we have the S.T.E.A.M. Discovery Festival at Solano Community College. (S.T.E.A.M. stands for Science, Technology, Engineering, Arts, Mathematics. Nothing to do with that product of boiling water.)

https://steamdiscoveryfestival.com

A bit closer to home, on May 31-June 1 we have the GGLS Spring Meet and Open House. Saturday is just for the GGLS folks, who always appreciate our work. Sunday is open to the general public.

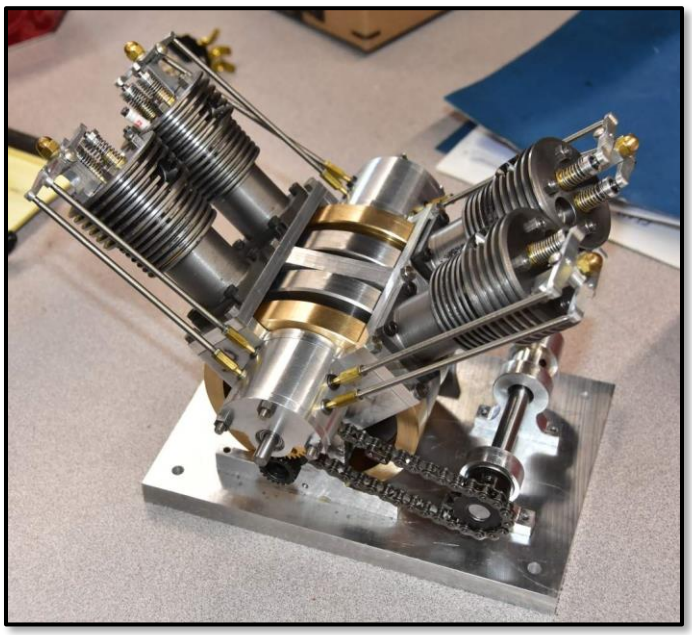
FIRST POPS

No first pops at the last meeting.

BITS AND PIECES

Carl Wilson is giving away bar stock. Talk to Paul if you have specific project needs. Mike Rehmus had a flyer showing machine tooling he has for sale.

Paul Denham is making continued progress on a custom four-cylinder "Double Ducett" derived from Randall Cox's two cylinder Hoglet design and model airplane engine castings from Dwight Giles.

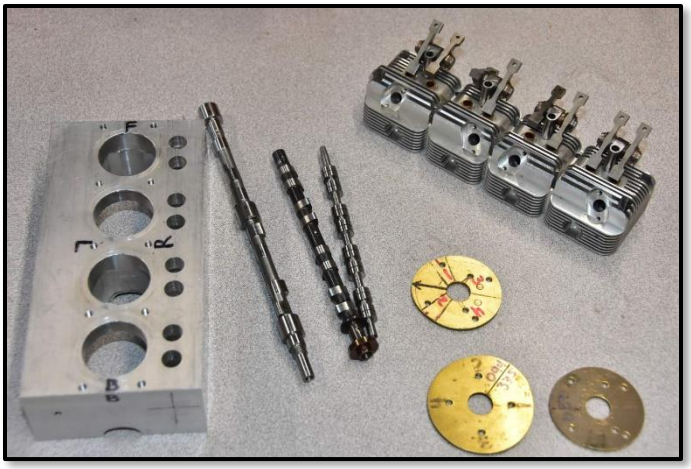


Paul Denham's Double Ducett

This project presents Paul Denham at his best: a creative new design utilizing his fine workmanship crafting skills and technical knowledge, fashioning a work of art. New features this month include valves, rockers, push rods and cams. Several combustion timing options were considered. The starter is connected to the crank shaft via chain gears. Carburation and exhaust design is still in progress.

We look forward to learning about Paul's progress with this project when he gives us an update at the next meeting.

Peter Lawrence is noted for the number of projects is undertakes in parallel. To support multiple needs Peter assembled a shop-made cam grinder and has recently been refining his design of three arc master cams. Last month he showed his derivation of a flank arc that is tangent to both the base and nose arc while meeting his lift criteria. Using the design trigonometry, he mills the master cams by drilling holes at each arc center using the mill DRO. Arcs are then cut using a rotary table. Peter had several master cams and assembled cam shafts to share. Details regarding his calculations are provided in the attachment to this newsletter.



Cylinder head and camshaft masters for grinding.

One of Peter's projects is a ¼ scale Cirrus inline four-cylinder aircraft engine. Peter showed the impressively machined head assembly with valve guides, rockers, and cooling slots. Machining of the base is also underway.

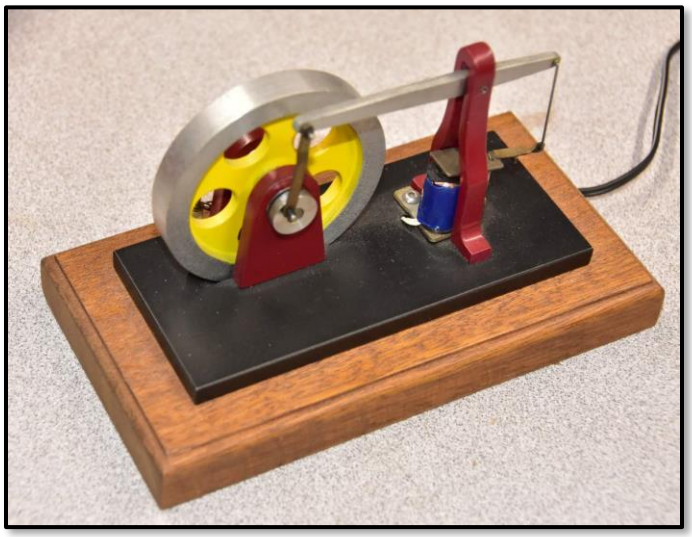
Larry Zurbrick acquired an X-Y axis table and has been working to add DRO. He discovered flexible shaft connectors were too short to adequately connect the step motors to the drive shafts. His solution was to machine new motor mounts using FreeCad (https://www.freecad.org/) and the OEM motor mounts as samples. Larry has the DRO software and electronics working and is proceeding with assembly.

Larry is also rebuilding the variable speed head on his Bridgeport mill that was "running loud". He found a H&W Rebuild Kit for the J2 head and shared some of the issues he discovered with the spindle and drive bearings. He is also wondering how chips got into the engine drive compartment.

Charlie Reiter brought some items of interest. One was a telescoping gage set for measuring O-rings up to 3 inches. Anyone with experience with trying to accurately measure O-rings would appreciate this tool. It was 3D printed using internet plans (https://www.printables.com/model/441539-imperial-o-ring-gauge).

Charlie demonstrates his o-ring measuring device.

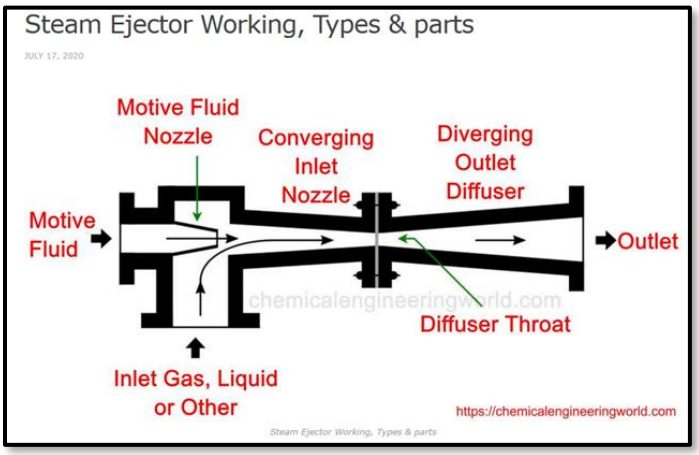
Charlie also showed a small electrically powered engine. He said he selected this item to share since he was not motivated to haul in a larger project.



Electric engine????

Charlie is also restoring a Climax model steam locomotive. Smaller items associated with this effort were a shop made locomotive whistle and fabricated steam ejectors. Steam ejectors can be used to produce vacuums. Charlie shared that British locomotives would

typically use vacuum powered brakes while US locomotives would use steam powered brakes. Charlie's collection of ejector parts included several complete ejectors he had forgotten he machined.



Steam Ejector

Charlie and 4-tone train whistle

RAMBLINGS

Got a favorite YouTube machinist that you'd like to recommend? Let us know. Think this topic should be omitted from future newsletters? Let us know.

Working on an interesting project? Got a great BAEM story? Share it with us here. Send us pics and project details, and your hard work will be shared with the entire club.

FOR SALE

Last month, we informed BAEM members about Carl Wilson's offerings, described below. We don't know the current status, so check with Carl to see what is still available at this point.

Longtime BAEM member Carl Wilson is offering for sale a huge chunk of model engineering history.

Long before Mike Rehmus started publishing *Model Engine Builder*, long before *Strictly IC*, long before Village Press began publishing *Machinist's Workshop* and *Home Shop Machinist*, there was the first of this kind: ***Model Engineer Magazine***.

Per Wikipedia: "***Model Engineer*** magazine was first published (in the United Kingdom) to support the hobby of model engineering in 1898 by Percival Marshall, who was to remain its editor for over 50 years. The magazine addressed the emergence of a new hobby — the construction of models (often working) and experimental engineering, largely in metal. It transcended class barriers, appealing to professional engineers, jobbing machinists and anyone interested in making working mechanisms."

Carl Wilson is offering for sale his extensive collection of *Model Engineer Magazine*. Vols 1 – 11 hardbound reprints; 68, 80, 84 original hardbound; and 82 – 173 loose in boxes. Approximately 104 vols @ 2 vols per year = 52 years. These occupy about 23 lin ft of shelf space. Best offer, local pickup only. These are on the second floor and will have to be carried downstairs. Located in Mountain View. Carl Wilson talleyho123@yahoo.com

But wait, there's more!

Carl's shop has been sold and the buyer has allowed him to advertise and show some of it to members of Bay Area Engine Modelers. Specifically:

--**a Sunnen hone w/ mandrels**. This is a mix of an early Sunnen body and a shop-built oil pan and pump. Also included are several external hones.

--**a DIY tap burner**. All the electrical and vibrator parts are OEM but from different machines and assembled into a working machine. I have successfully burned out 4 – 40 to 5/16 – 18 taps.

--**a Taiwan vertical mill**, 8" x 30" table, Bridgeport J head w/VFD, and BP slotting head.

--**an electronic dividing head** based upon a SpinDex w/40:1 worm gearing driven by a stepper motor and a micro-stepping Division Master drive. This is mounted on a ball bearing linear slide driven For and Rev by a DC motor. This was used for cutting clock gears.

--**Other small tooling** including measuring tools may be available.

Pictures on request and you may see these items in his shop. Carl is acting as the agent of the owner. You will be buying from the owner, not from Carl.

Located in Mountain View. Carl Wilson talleyho123@yahoo.com

Got something you'd like to sell? Your ad is free and will be seen by likely customers.

NEWSLETTER CONTRIBUTION

Your contributions to this newsletter are appreciated: workshop reports, tech articles, reviews, historical pieces, whatever. You contribute, we'll figure out how to post it. Send your contributions to either or both of us. Thanks!

-Mike Byrne at mgbyrne3@comcast.net

-Wes Wagnon at weswag@ix.netcom.com

BAEM Tech Talk Recap: three-arc cam geometry

Peter Lawrence

The "three arc cam" is mathematically defined by any four of the following five parameters:

Base radius,
Lift,
Nose radius,
Duration semi-angle, and
Flank radius.

Given any four parameters, the fifth can be found using the "[triangle] law of cosines" and/or "[triangle] law of sines."

See the drawings below for clarification of parameters and formulae.

The formula for the Flank radius (given B, L, N, alpha) is:

let d = (B + L - N),
let F = (B*d*(1.0 + cos(alpha)) + L*L/2.0 - L*N), and
let F = F / (B - N + d*cos(alpha)).

Alternatively, the formula for the duration semi-angle alpha (given B, L, N, F) is:

let d = (B + L - N),
let x = (d*d + (F-B)*(F-B) - (F-N)*(F-N)) / (2.0 * d * (F-B)), and
let alpha = arccos(x);

The exact coordinates of the center of the flank can be computed knowing its radius
and the duration semi-angle, using simple sine/cosine trigonometry (aka polar to rectangular).

How does one go about choosing cam parameters?

In Liston's 1938 "*Aircraft Engine Design,*" I found the rule-of-thumb that lift should be 1/4 valve diameter. This makes it so that the valve isn't the limiting factor, given that the ports and valves are the same size. I found a couple model engine designs with less lift than that. If a high rpm engine is desired, the lift in these engines should be increased (and design adjustments made if that interferes with the top of the piston).

Bob Hettinger compiled a table of parameters for a large collection of published model engine designs, plus the full-sized V8 engine in his Chevy. I supplemented that with R.R. Merlin, De Havilland Cirrus and Gypsy, and Duesenberg J8. The "spread" for all these cams is pretty narrow, and the "average" is:

110-deg split between exhaust and intake lobes,
130-deg duration for 3-arc cams, and
120-deg for flat flank.
Lift was approximately 1/2 base radius, and nose radius a little less than lift, sometimes equal.
For example, my Duesenberg cam is:

B = 3/16 (3/8 diameter),
L = 3/32,

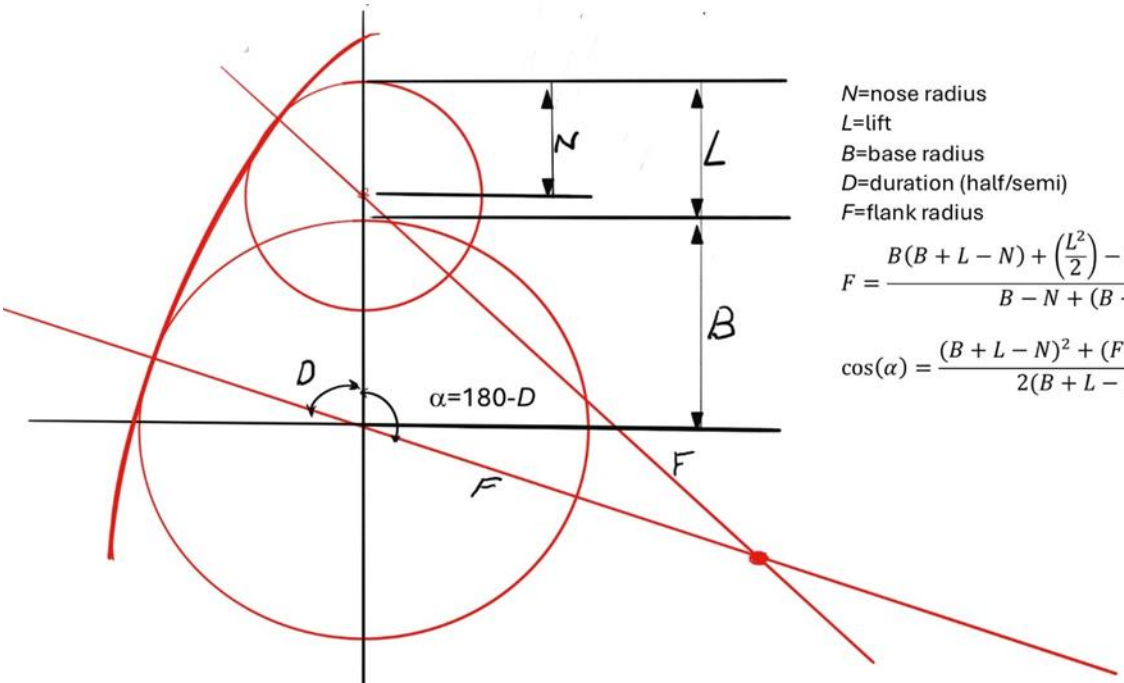
N = 1/16,
A = 65-deg (130-deg duration), and
F = 0.670 (from the equation).

I also reviewed a paper about the Toyota Prius engine with "variable valve timing." The engine computer varies the "optimal" timing, depending on (high, med, low) RPM and (high, med, low) LOAD. I concluded there's no one optimal cam timing, you can only optimize for a given particular operating condition.

So us engine modelers typically use 110-deg split and fairly symmetric timing. These choices make our engines easy to start. We don't care about MPG. We just want lots of noise at high RPM :-) !!!

Finally, I note that Paul Denham claims that advancing the exhaust amplifies the noise, because the exhaust valve opens before the cylinder has fully expanded, creating a more powerful exhaust pulse. I have not tried it.

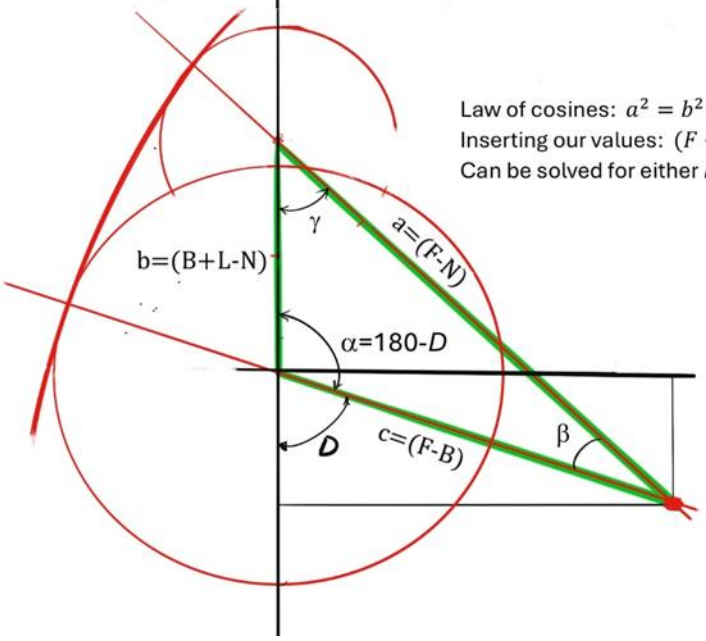
3-Arc Cam Formulas



N=nose radius
L=lift
B=base radius
D=duration (half/semi)
F=flank radius

$$F = \frac{B(B+L-N) + \left(\frac{L^2}{2}\right) - LN + B(B+L-N) * \cos(\alpha)}{B - N + (B+L-N) * \cos(\alpha)}$$

$$\cos(\alpha) = \frac{(B+L-N)^2 + (F-B)^2 - (F-N)^2}{2(B+L-N)(F-B)}$$



Law of cosines: $a^2 = b^2 + c^2 - 2bc * \cos(\alpha)$
Inserting our values: $(F-N)^2 = (B+L-N)^2 + (F-B)^2 - 2(B+L-N)(F-B) * \cos(\alpha)$
Can be solved for either *F* or α.

Coordinate location of Flank radius center:
$X = (F-B)\sin(D)$
$Y = -(F-B)\cos(D)$