Supposedly there is this magic "secret" Hindu plant. Make a tea out of it; then you sprinkle some lemon juice on it, steep it for a while. And Presto! It changes into a cheap gasoline substitute.

Or so the very latest pseudoscience techno-myth tries to tell us. Try the Keelynet for ongoing details. Use my link on www.tinaja.com.

Er, this one obviously and totally falls into "looks like a duck, quacks like a duck, and is about to lay eggs" subjective pseudoscience test.

But how can you tell for sure?

Gasoline grows on trees. Just let them rot for a geological epoch or two. It turns out that any plant can be used to make gasoline. Kudzu, grass clippings, tumbleweeds, you name it. No big deal. But scant few plants are even remotely worth all the time and trouble for you to do so.

The key questions you have to ask are these: (A) How many pounds of plant will you need for one pound of gasoline? (B) How much total energy has to go into the process compared to the energy you get back? (C) How expandable is their process to larger scale production? (D) What is their time to economic breakeven for the labor and capital that has to go into the production system? (E) What are the hidden and off-the-books societal costs for new infrastructure?

And, of course, (F) How badly will the government screw it up?

Yeah, those experts can sometimes be wrong. They typically overreact. But they’ll usually end up back on target once all of these key questions get properly asked.

Ferinstance, what appeared to be an outright scam in the 1920’s sort of wasn’t. Magic tablets were sold that instantly changed water into a motor fuel. "They" said it was impossible. But they were all dead wrong. There definitely are magic tablets which let you convert water into motor fuel. I use these tablets all the time.

Uh, there are a few minor and tiny side effects. Such as getting only 25 miles per engine. Instead of 25 miles per gallon. But let’s not quibble. The tablets work. Yes, you can still buy them today. Cheap, even.

Because these secret tablets are an underground product, only cavers use them. Ask any spelunker for details.

**PIC’s New Babies**

We have already seen that the new PIC series of microcontrollers are easily the components of the decade.

To the point where it is insane to ever again use a 555 timer or other bits-and-pieces solution to most any electronic sensing or control app.

The new PIC’s are incredibly fast, compact, and powerful micros which literally blow the competition away. We’ve also seen that the Basic Stamp from Parallax and the Scott Edwards Tools can be your quickest and best ways to get yourself PIC literate.

Well, there’s now a brand new pair of baby PIC’s. Per figure one.

Their PIC12C508 and PIC12C509 both cost under a dollar in quantity and come in an eight pin (!) minidip package. The ‘08 offers 512 bytes of EPROM and 25 bytes of RAM. The ‘09 doubles these values. You have several clock options: trimmable RC internal, external, or crystal. As with the other PIC’s, their powerful RISC instructions are mostly single cycle. Often executing three times faster in one-third the usual space.

There are up to six programmable I/O pins. Pin 5 can be general I/O or a timer clock input. Pin 4 doubles as a master clear or an external wakeup call. You can hang a crystal on pins 2 and 3, or a system clock on pin 2.

Analog input interface is easy. All you do is connect a capacitor and a resistor to any pin. Just briefly pull the cap low and then loop recheck it until it charges to a logic one.

Although it may be a tad tricky to write a multitasking UNIX kernel for either chip (a free ISMM if you do), these baby PIC’s open up whole new worlds of low end applications.

The free PIC12C5XX Data Book is published by Microchip Technology. Much more on PIC’s in general on my new Pick a Peck of Picks library shelf of www.tinaja.com.

**Color Organs and Psychedelic Lighting**

I guess its way past time to update certain ancient history. People have long wanted to relate music to colors in one way or another. On back in the sixteenth century, a Jesuit monk by the name of James Bertrand Castell created his Clavier au Lumier. This was sort of a harp with flat colored strings. The strings were viewed edge on. As the string was plucked, you could see all the vibrating colors.
Tech Musings

Fig. 2 – BLOCK DIAGRAM of a classic color organ. The audio input gets filtered into three or more channels. Audio energy in each filter band sets the dynamic brightness of the chosen lamp color for that channel.

The first "classic" electronic color organ designs appeared in the 1950's. One used thyratron "vacuum" tubes in a half wave design that only lit the lamps to partial brightness. Another used high-mu pentode audio output vacuum tubes to drive scads of series connected and easily burned out #49 pilot lights strings.

Figure two shows you that block diagram for the classic lamps-style color organ. Your speaker level input audio is somehow safety isolated and then lowpass, bandpass, or highpass filtered into (usually) three or more channels. Each channel’s output is then converted into some dc control voltage. That dc control voltage then modulates a "power amplifier" of some sort. Which in turn relates the amount of audio energy in the band to the brightness of one or more colored lights. For instance, the lows might be red, the mids green, and the highs blue. Or whatever.

I designed and published my first three channel solid state color organ in April of 1963. Back in *Electronics World*. This used brand new Silicon Controlled Rectifiers to control a few hundred watts of lamps per channel. The SCR’s were preceded by a full wave rectifier. That let the lamps go more or less smoothly from zero to full brightness.

Input audio went through some LC ferrite cup core filters, was converted to dc with germanium diode rectifiers, and then get used to control the phase advance of the unijunction transistor timing circuits.

This was followed a year later by a version which substituted neon lamp triggers for those costly unijunctions. In the Jan 1964 *Electronics World*.

The *Electronics Now* version came next. Actually found in our October 1965 *Radio Electronics* predecessor. This was the first unit to use voltage modulated four layer trigger diodes and the first to provide a line filter to attack the bad AM radio interference common to color organs.

Skipping a few forgettable designs which are best left forgotten, next in line was my *Musette*. In the July 1965 *Popular Electronics*. This was a five channel unit still featuring SCR’s and trigger diode modulation. Filtering was by resonant transformers. Color coded background controls did get added to improve the sensitivity and linearity. Brand new dichromic filter spotlights were used to dramatically improve color purity.

What I first called *Stereo Lamps*, but some epsilon minus renamed *Hi Fi a Go Go* appeared in the July 1966 *Popular Electronics*. This was just a low priced, compact and unfiltered single channel version. It was useful for psychedelic lighting apps.

I considered my "definitive" color organ to be the *Psychedelia I*. From the Sept 1969 *Popular Electronics*. Innovations here included new low cost full wave triacs having built-in heatsinks, a brand new $1 integrated circuit phase controller circuit, and steep-skirted two pole active filters having broad tween-channel guard.

Fig. 3 – THE FUNDAMENTALS BEHIND phase control of ac power. The turn on of a triac gets delayed after each ac half power cycle. The longer the delay, the lower the load current. Simple phase control is useful for lamps, heaters, and ac-dc motors. But NOT for fluorescents or induction motors.
bands. Use of prismatic lenses on the display gave the hex "flower power" type of patterns. You had a choice of three or six channels.

**Phase Control Fundamentals**

The fundamentals of an ac power phase control appear in figure three. A triac is a fast, efficient, and high voltage power ac switch. One that is turned on by a brief and low level pulse on its gate. The triac then stays on for the remainder of the power line half cycle. It automatically turns off when your main current drops to zero on the half cycle zero. Triacs are fully bidirectional. Either polarity of gate pulse can be applied on either polarity cycle.

If the triac is pulsed very late in each half cycle, the duty cycle is very low, and very little power reaches the load. The lamp lights only dimly.

When the triac gets pulsed in mid cycle, around one half of the power reaches the lamp. When it gets pulsed very early, the lamp lights to nearly full brightness.

Thus, you might want your input control voltage to determine the time delay after a zero crossing when the triac turns on. The higher the voltage the less your delay.

A modern triac circuit appears in figure four. For most applications, safety isolation is essential to prevent deadly "hot chassis" shock hazards. That is the purpose of the Motorola MOC3010 optotriac isolator. While you can get triacs from Radio Shack or Texas Instruments or Motorola, the definitive source is Teccor.

Usually, you will want to run your optoisolator "backwards" as shown. So that a low or logic zero input turns the triac on, and vice versa. Simply because many microcontrollers and other digital integrated circuits are better at sinking current to ground.

Two sources of specialized phase control integrated circuits are LSI/CSI and Signetics Philips. You can also get one-piece modules which include both triac and optoisolation. From CP Claire, International Rectifier, Crydom, or NTE. They are sometimes called dc-in ac-out solid state relays.

A minimum rating of 200 volts is needed for ac line operation, with 400 recommended.

But at $8 to $12 each, the one piece modules might not be cost effective against a pair of one dollar parts. The heatsinking options are also limited using modules. The smaller module power limit is a few hundred watts.

I have gathered several ac power control suppliers together for you as this month's resource sidebar.

**Back to the Present**

What can we do to further improve color organ designs? Obviously, the new baby PIC is screaming to be used as a phase controller. With care, you might even get three channels out of a single low cost chip!

You would first have to question whether you'd prefer to use a classic design or something new. The crucial key to a classic color organ is some effective display. Even with the best designs, viewing can get boring.

At any rate, if I were doing a new "classic" color organ, two features I
AC PHASE CONTROL RESOURCES

<table>
<thead>
<tr>
<th>Company</th>
<th>Address</th>
<th>Phone 1</th>
<th>Phone 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP Claire</td>
<td>107 Audubon Road #8, Wakefield MA 01880</td>
<td>(617) 246-4000</td>
<td></td>
</tr>
<tr>
<td>Crydom</td>
<td>411 N Central Avenue, Glendale CA 91203</td>
<td>(818) 956-3900</td>
<td></td>
</tr>
<tr>
<td>Galco</td>
<td>26010 Pinehurst Dr, Madison Heights MI 48071</td>
<td>(800) 521-1615</td>
<td></td>
</tr>
<tr>
<td>Grainger</td>
<td>2738 Fulton St, Chicago IL 60612</td>
<td>(312) 638-0536</td>
<td></td>
</tr>
<tr>
<td>Intl. Rectifier</td>
<td>233 Kansas St, El Segundo CA 90245</td>
<td>(310) 322-3331</td>
<td></td>
</tr>
<tr>
<td>LSI/CSI</td>
<td>1235 Walt Whitman Rd, Melville NY 11747</td>
<td>(516) 271-0400</td>
<td></td>
</tr>
<tr>
<td>Motorola</td>
<td>5005 E McDowell Rd, Phoenix AZ 85008</td>
<td>(800) 521-6274</td>
<td></td>
</tr>
<tr>
<td>Mouser Electronics</td>
<td>11433 Woodside Avenue, Santee CA 92071</td>
<td>(800) 346-6873</td>
<td></td>
</tr>
<tr>
<td>NTE Electronics</td>
<td>44 Farrand St, Bloomfield NJ 07003</td>
<td>(201) 748-5089</td>
<td></td>
</tr>
<tr>
<td>PCIM</td>
<td>2472 Eastman Ave #33-34, Ventura CA 93003</td>
<td>(805) 658-0933</td>
<td></td>
</tr>
<tr>
<td>SGS-Thomson</td>
<td>1000 E Bell Rd, Phoenix AZ 85022</td>
<td>(602) 867-6259</td>
<td></td>
</tr>
<tr>
<td>Signetics/Philips</td>
<td>PO Box 3409, Sunnyvale CA 94088</td>
<td>(408) 991-2000</td>
<td></td>
</tr>
<tr>
<td>Siemens Components</td>
<td>2191 Laurelwood Rd, Santa Clara CA 95054</td>
<td>(408) 980-4500</td>
<td></td>
</tr>
<tr>
<td>Teccor Electronics</td>
<td>1801 Hurd Dr, Irving TX 75038</td>
<td>(214) 580-1515</td>
<td></td>
</tr>
<tr>
<td>Texas Instruments</td>
<td>PO Box 809066, Dallas TX 75380</td>
<td>(800) 336-5236</td>
<td></td>
</tr>
<tr>
<td>Thomson CFS</td>
<td>40G Commerce Way, Totowa NJ 07511</td>
<td>(201) 812-9000</td>
<td></td>
</tr>
<tr>
<td>Signetics/Philips</td>
<td>PO Box 3409, Sunnyvale CA 94088</td>
<td>(408) 991-2000</td>
<td></td>
</tr>
<tr>
<td>LSI/CSI</td>
<td>1235 Walt Whitman Rd, Melville NY 11747</td>
<td>(516) 271-0400</td>
<td></td>
</tr>
<tr>
<td>Motorola</td>
<td>5005 E McDowell Rd, Phoenix AZ 85008</td>
<td>(800) 521-6274</td>
<td></td>
</tr>
<tr>
<td>Mouser Electronics</td>
<td>11433 Woodside Avenue, Santee CA 92071</td>
<td>(800) 346-6873</td>
<td></td>
</tr>
<tr>
<td>NTE Electronics</td>
<td>44 Farrand St, Bloomfield NJ 07003</td>
<td>(201) 748-5089</td>
<td></td>
</tr>
<tr>
<td>PCIM</td>
<td>2472 Eastman Ave #33-34, Ventura CA 93003</td>
<td>(805) 658-0933</td>
<td></td>
</tr>
<tr>
<td>SGS-Thomson</td>
<td>1000 E Bell Rd, Phoenix AZ 85022</td>
<td>(602) 867-6259</td>
<td></td>
</tr>
<tr>
<td>Signetics/Philips</td>
<td>PO Box 3409, Sunnyvale CA 94088</td>
<td>(408) 991-2000</td>
<td></td>
</tr>
<tr>
<td>Siemens Components</td>
<td>2191 Laurelwood Rd, Santa Clara CA 95054</td>
<td>(408) 980-4500</td>
<td></td>
</tr>
<tr>
<td>Teccor Electronics</td>
<td>1801 Hurd Dr, Irving TX 75038</td>
<td>(214) 580-1515</td>
<td></td>
</tr>
<tr>
<td>Texas Instruments</td>
<td>PO Box 809066, Dallas TX 75380</td>
<td>(800) 336-5236</td>
<td></td>
</tr>
<tr>
<td>Thomson CFS</td>
<td>40G Commerce Way, Totowa NJ 07511</td>
<td>(201) 812-9000</td>
<td></td>
</tr>
</tbody>
</table>

Would add are input compression and linearization. As figure five shows us, typical audio has ridiculously too much dynamic range for useful phase control of lights. Your lamps will be off or on most of the time, instead of smoothly tracking the music. Analog Devices has their low price SSM2165 speech compression chip that should be ideal for this.

The perceived brightness of a lamp is not at all linearly related to the phase angle. First because the phase angle versus power is an "S" shaped curve rather than linear. Secondly, because the eye is a nonlinear device that perceives light logarithmically. And thirdly, because an incandescent lamp has a very nonlinear resistance at low brightness levels.

So, we take our new baby PIC and convert each input control voltage into an 8-bit number 0-255. Then we table lookup a new number that sets up an acceptable phase delay for the desired apparent brightness level.

The table lookup would be closely matched to the lamps in use. Since your eye perceives equal brightness light in the ratio of one part green, two parts of red and three parts blue, you might want to select a different lookup for each color.

The aim is to let music produce as many different brightness levels as possible. As before, you’d never let the lamps go completely off. A very low background level is a first step towards linearization.

I guess I’d select digital bandpass filters these days. Both Maxim and Linear Technology have lots of fine selections for you here.

When you do your own design, do not forget to provide reliable safety isolation, always add some effective line noise filtering and shielding, and treat your input audio gently. Use the purest colors you can get.

Avoid yellow because it is typically overwhelming. Since an incandescent lamp is pretty much yellow to start with, filtering for other colors very much limits the light output. Go out of your way to prevent any and all white light from any pinholes, leaks, color recombination, or poor filters.

We found a lot more on lamps and lighting resources in MUSE95.PDF. Available on www.tinaja.com or in the Tech Musings reprints. Grainger, of course, is your prime source for lighting options.

**Going Non-traditional**

What about non-traditional color organ architectures? LED’s are one possibility. But power levels may be restricted and the blues will still be expensive. And you’d still be stuck with limited display options. Lasers are another possibility, but again the blues are a problem. More on laser approaches from MWK Industries or Meredith Instruments.

What if you instead combined a spectrum analyzer chip with a screen saver? The ultimate would be to use very sophisticated DSP techniques to attempt to isolate music instruments. Let each instrument be a color blob on the screen. Some kind of tracking comb filter, maybe. The louder the instrument, the bigger and brighter the chosen blob.

These blobs could wander around lava lamp style, continually showing new and interesting variations.

Different algorithms could also be keyed to mood or music style.

Texas Instruments has a new DSP demo board having a full real time audio spectrum analyzer built in. It might make an interesting front end for audio-to-color displays.

**New Tech Lit**

You can shortly expect the sudden demise of data books. Because they have become outrageously expensive to produce and maintain. New and free Acrobat based CD-ROM versions of full product data are freshly issued by Texas Instruments in a Designer’s Guide and Data Book. And by Linear Technology in a similar publication.

A great source for the tech ed stuff is Brodhead-Garrett. Who publish a free catalog. They stock everything
from solar energy to injection molds. *Castcraft* also prints a fat catalog chock full of machine shop stuff. *Stemgas Publishing* has magazines and reprints of interest to collectors of antique gas or steam engines.

*The Boy Mechanic III* is the latest reissue from *Lindsay Publications*. A thick 1919 reprint full of wondrously essential projects. Such as full details on building your own cement kiln.

From *Tapestry*, a complete line of fancier ink jet media. Glossies, clear, cling, golds, silvers.

*Ace Plastic* has a wide variety of unusual plastic shapes. Tubing, rod, squares, rounds, balls, cubes, rings, diamonds, wedges, and more. From *Castcraft*, a new flyer on casting and moldmaking.

*Contract Professional* is a brand new magazine for independent tech consultants. Also see the *Synergetics Consultant's Network* you’ll find on [www.tinaja.com](http://www.tinaja.com)For most individuals and smaller scale startups most of the time, any involvement whatsoever with patents is absolutely certain to end up as a total net loss of time, energy, money, and sanity. Find out why in my *Case Against Patents* package. Along with tested and proven alternatives which do deliver in the real world. As Per my nearby *Synergetics* ad. I have also still got some great surplus buys on Tek 1230 and Fluke 9010 logic analyzers. Most of the mentioned resources appear in our *Names & Numbers* or *AC Phase Control* sidebars. Be sure to check here before calling our no charge US helpline or visiting our [www.tinaja.com](http://www.tinaja.com) website. Let’s hear from you.