Paul L. Specht
707 SE Atlantus Ave.
Port St. Lucie FL 34983
[pathdab@bellsouth.net]

Simple P.S. Add-Ons

Enhance your next power supply project with an overvoltage protector and a smart LED output level indicator.

Whether you're a novice or seasoned veteran, one of the first home-brew projects you'll ever build is a power supply. It certainly is one of the most popular, and will find many uses in your DX shack. Perhaps you're building a supply from scratch, or refitting an existing supply with new updated electronics, but whatever the case, there are some important decisions to be made, such as output voltage and current handling capability. Just as important are other things that deserve attention, like overvoltage protection and output level indication, just to name two.

The first and most important circuit here deals with overvoltage protection, sometimes called OVP for short. This circuit protects the output of the supply from soaring dangerously high in the event that something goes wrong with the regulator. Should the circuit fail, you could wind up with the regulator input voltage at the output, and in most cases this is about 25 volts or more! With that much voltage going into any rig, I don't have to tell you what would happen — KAABOOM!

The next circuit is what I call a smart LED. This gives you an output level indicator when a voltage meter is not used. Having a single LED across the output is common on some power supplies, but all it tells you is that the supply is on. What it doesn't tell you is how much or at what level, and if you don't have enough voltage at the output you won't transmit at full power. Knowing what's going on under the hood of your power supply is always a good idea. Whatever your reason for using the smart LED, it will give you an accurate level indication, with a red/green status from a single dual-color LED.

About the circuits

My original OVP circuit consisted of a zener diode, a couple of resistors, and an SCR. The idea was that if the output voltage would rise to 15.5 volts or more, the zener would gate on the SCR, crowbarring the output, and blowing the fuse. Now, this was simple and worked OK, but sometimes it would kill my output pass transistor when it crowbarred. Deciding that this was no fun, I came up with a more circuit-friendly design, illustrated by **Fig. 1.**

This circuit centers on an SN7404N hex inverter IC chip made of 6 inverters that, when put together, can form a latch-type circuit. The same circuit can be made with 3 or 4 transistors and at least a dozen or so resistors, but by using the IC chip, all these parts can be eliminated and a much simpler circuit can be built. Starting with **Fig. 1**, a sample of the output voltage is applied to point "A" at the cathode end of zener D1. When the voltage reaches 15.5 volts or more, D1 fires and places a high at

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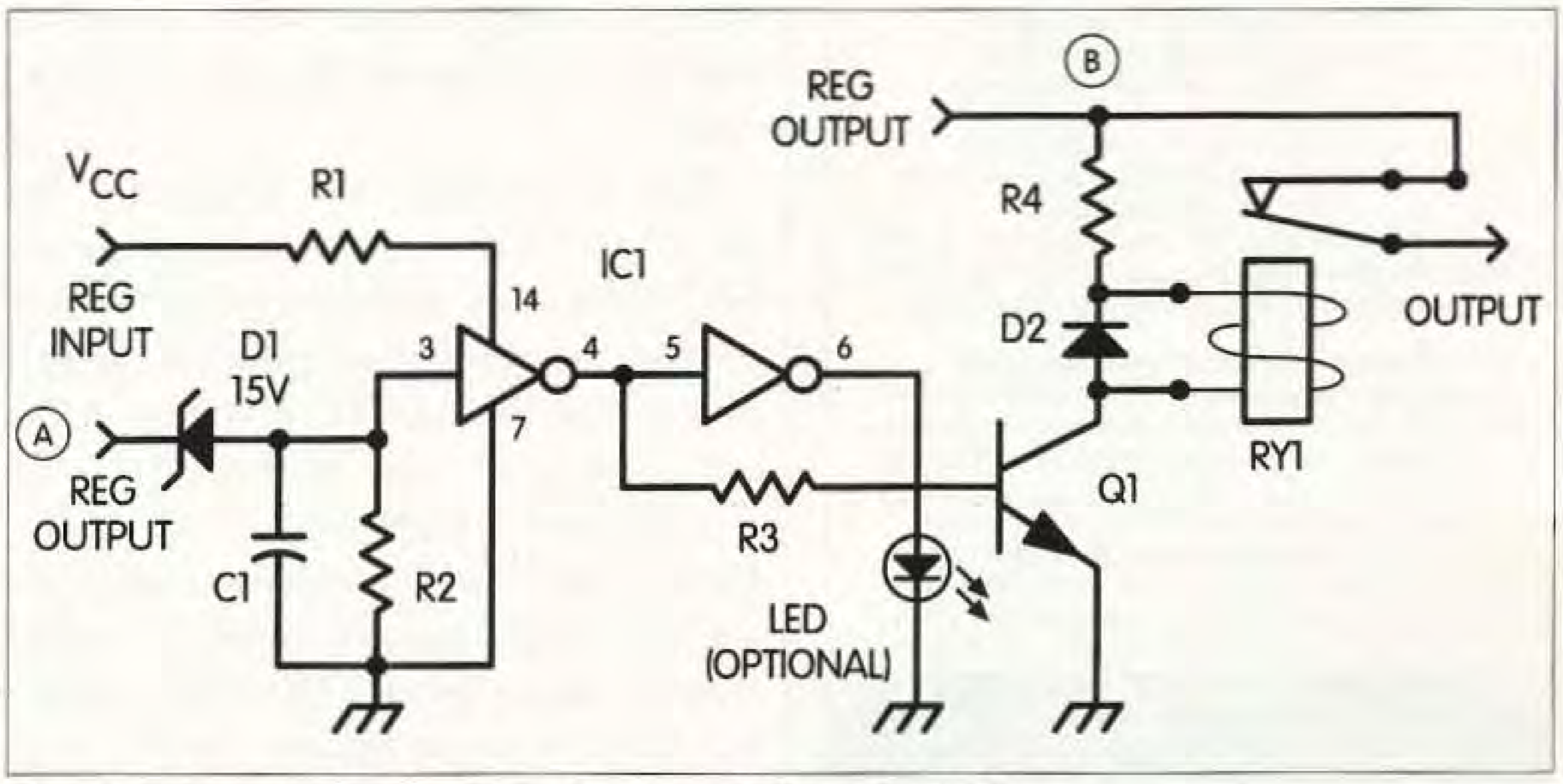

Fig. 1. Schematic for the OVP circuit and pinout for IC1.

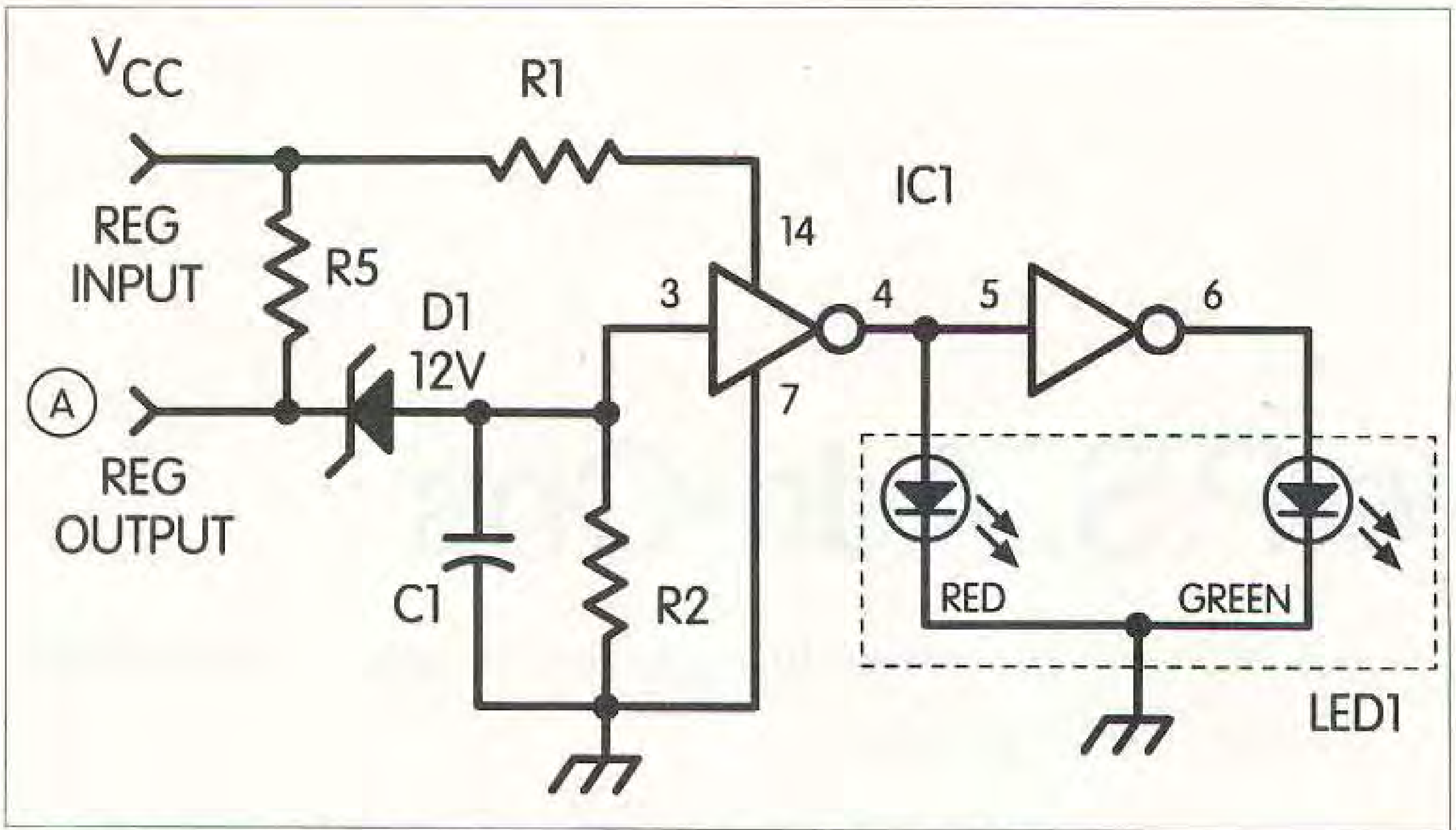

Fig. 2. Schematic for the smart LED circuit and pinout for IC1.

Part Name	Description	Value	RS Part No.
D1	Zener diode	12 V 1 W	276-563
D1	Zener diode	15 V 1 W	276-564
D2	Diode	WEP-170	276-1114
Q1	Transistor	2N2222 NPN	276-1617
IC1	IC	SN7404N	276-1802
R1	Resistor	680 ohm 2 W	--
R2, R3	Resistor	1k 1/2 W	271-1118
R4	Resistor	100 ohm 1/2 W	271-1108
R5	Resistor	1.5k 1/2 W	271-1120
C1	Capacitor	0.1 μF 50 V	272-135
LED1	LED red/green	Dual color	276-025
RY1	Relay	12 V 10 A	--
PCB1	PC board	Dual IC	276-159A
PCB2	PC board	Pre-etched	276-170

***Table 1.** Parts list.*

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pin 3, which is the input of the first inverter.

At this point, pin 4, the output of the same inverter, goes low, and the base drive for Q1, via R3, is cut off, shutting down the relay and disconnecting the output. R2 is the current limiter for the zener diode, and C1 bypasses any RF hash that might try to sneak in at the input, pin 3. VCC for the chip is supplied from the regulator input through R1. Beyond the IC, we have a basic off-the-shelf relay circuit. I selected R3 for the base circuit because the output on pin 4 goes to 3.8 volts when all is normal and the supply is not in OVP shutdown.

I didn't want a lot of voltage at the base of Q1, but if you're curious, what we do have is 0.75 volts at the base when the zener fires, and this is perfect to turn on the transistor. VCC for the relay circuit is picked off at point "B" via R4, providing 10.8 volts to power the relay circuit, and even if the power supply goes into OVP shutdown, R4's value is enough to provide a safe operating level for the circuit.

You may have noticed that pins 4 and 5 are tied together. The output of the first inverter is connected to the input of the next inverter. This was done so that you could add a red LED from pin 6 to ground, to have an OVP indicator on the front panel of your power supply. The second inverter acts as a driver for the LED, and R1 drops enough voltage for the whole circuit so that no LED current limiter resistor is needed.

Fig. 2 illustrates the schematic for the smart LED — it too centers on an SN7404N chip. A sample of the output voltage is applied to point A at the junction of R5 and D1. When the voltage reaches 13 volts or more, D1 will fire, placing a high at pin 3 of the IC. Pins 4 and 5 will go low, turning off the red LED, and pin 6 will go high, turning on the green LED. Once again, R2 is the current limiter for D1, and C1 bypasses any RF hash at the input pin 3. Also, VCC for the IC is supplied via R1 from the regulator input.

Somewhat of a voltage divider is formed by R5 in that it allows D1, a 12 volt zener, to fire a little above its rating (approximately 13 volts). The value of R5 was chosen to allow the circuit to operate at the output voltage of communication power supplies, but you can change its value and the value of D1 to monitor a wide variety for voltages and applications.

Construction

Construction of these circuits is relatively simple. If you're installing them into an existing power supply, they can be constructed on their own PC board, and then wired in. Or if there is enough room on an existing board, the circuits can be installed that way, eliminating the need to etch your own board. However, a lot of power supplies are built from scratch, and for the benefit of those who like to "roll their own," I have listed two pre-etched boards in **Table 1**, the parts list.

The first board listed can hold two

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DIP ICs or be broken in two, allowing two separate circuits to be constructed if one is all you want to build into your supply. The second board listed is more for constructing an entire power supply plus one or both circuits described here. This board has an upper and lower bus line and the foil pattern is laid out just like an experimenter's board, making it a lot easier to go from prototype to finished piece quickly. It's positively a nice way to go.

Once you've made your circuit board, wiring it in can be made much easier by using plug/jack wire assemblies. Basically, you have a plug made up of two or more wires and a jack that can be soldered onto your PC board. When the wires from the plug are soldered onto the corresponding areas of the power supply, just plug in your board and you're ready to go. The best source for these plug/jack assemblies is old discarded TV sets. Most TV shops throw a lot of sets away, and you can find some that have a wide range of wire count and size. The best ones to get are the ones that have their pins IC-spaced, making it easier to mount on your PC board.

Some of you may be thinking about the relay in the OVP circuit, considering the fact that the contacts are always closed during operation, bearing the burden of full load. The one I chose has a 12 volt coil and contacts rated at 10 amps, so this should be more than enough to handle most applications. The resistor R1 is a 2 watt and should not be substituted for wattage or value. You can use a higher wattage, never lower; the value was selected for best operation and is a common one, so no changes are needed.

I mention these two parts because they are the only ones you won't find at the local parts emporium. Most of the parts listed in **Table 1** can be found at your Radio Shack store or in a well-stocked junk box. The parts you can't find easily may be found at a TV repair shop. Stop in and get to know the owners. You may find you'll now have access to one of the biggest junk boxes in the world.

Final thoughts

Building and installing these circuits can be a lot of fun, and they are very useful. I know some people don't like to work with ICs that much, but these circuits are simple and can be put together in no time. The smart LED

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Central and South America, and afternoon paths to Japan, Australia, Asia, and the Pacific. Openings move west as the day progresses. A short-skip of 1,000 to 2,000 miles will be typical.

15–17 meters

Expect openings to many areas of the world, with good opportunities to Africa, South America, and the Pacific. Conditions often peak during local afternoon. Short-skip distances will be beyond 750 miles in the daytime and early evening.

20 meters

Good DX to most areas of the world opens from just after sunrise until mid-evening. Peaks are an hour or so after sunrise, again in the late afternoon, and before midnight. Expect a 500- to 1,000-mile short-skip during the day and 1,000 to 2,000 miles at night.

34/40 meters

Good worldwide openings can exist on (G)ood days. Daytime short-skip is limited to less than 1,000 miles, but nighttime skip will be in the 500- to 2,000-mile range. Noise levels can be quite high due to thunderstorms or hurricane activity.

80/160 meters

DX to Europe and the southern hemisphere can be observed after dark through local sunrise on (G)ood days, but will be limited by noise. As always, good activity on 40 meters indicates that the higher bands may be open, too. The gray-line path can be worked 30 minutes before until 30 minutes after local sunset. Daytime short-skip range is up to 500 miles. 500 to 2,000 miles can be expected at night.

Happy Thanksgiving!

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circuit is an old design of mine that I have used for several applications over the past 10 years, and the circuit has performed flawlessly. The OVP circuit is a more recent design, but it too has worked perfectly and will be installed in every power supply I build.

I can't stress enough the importance of installing an OVP circuit in any power supply you build. Also, if you buy one, check to see that it has an OVP circuit. If not, install one, and you'll be glad you did.

Never Say Die

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briefly introduced me and asked why I thought NASA faked the Moon landings, which he said he was totally convinced had really happened. This topic wasn't on the outline. Stan had read the list of the books I've written, which included *Moondoggle*, a book which explains how I became convinced that NASA had faked *all* of the Apollo Moon landings.

Stan's game was clear. He thought he'd be able to discredit me as a conspiracy nut to get even with me for complaining about him. So I explained some of the reasons that the Moon landings could never have happened. Then we went to commercials. At the end of the commercials they had a caller who insisted on being heard, saying that he wanted to rebut me. Stan was, of course, delighted to put him on.

It was a caller from Louisiana who said he had worked on the LEM for General Dynamics and that not one person at General Dynamics believed for a minute that we'd ever really been to the Moon. They knew that the LEM was a fake, and that their engineers had never been able to get it to fly.

Stan was dumbstruck. By then the hour was over. So much for my hosting the show. Phooey.

These two turkeys seem to think they are Click and Clack, the Tappet Brothers. They're not.

Numbers

The recent move by the FCC to force us to give them our social security numbers, which, as far as I know (which is fairly far), has no legal basis, is another move to replace our individual names with numbers.

If you stop to think about it, which few people have, our whole school system, which kids are forced by law to endure, is aimed at robbing us of our individuality and forcing us to be as much alike as possible. There is no room for individuality. We all have to take the same courses at the same time, and those who ask too many questions are humiliated and embarrassed into shutting up. The whole class moves along at the speed of the slowest children, no matter how boring this is for the brighter kids. I used to bring tiny colored beads in and make bead rings and bracelets during classes. Or sketch rocket ships.

Everyone is taught to the tests, not to increase their understanding of the world and their possible roles in it.

The textbooks are dreadful, further ensuring that the children will be bored stiff. Homework consists almost entirely of short-term memorizing irrelevant stuff for a coming test.

The whole system has been intentionally designed to produce workers who will do what they are told and not ask questions. Our larger business organizations, the military, and government all reward those who make no waves and blackball those who are creative.

Be born, go to day care, and watch Sesame Street, go to public school and learn, sort of, to read. Then pass tests of your short-term memory for a few years. This goes on through college and advanced degrees. Then you get a job, do as little as you can and stay employed, ask no questions, volunteer no ideas, and get your yearly wage increases, mainly through seniority.

This system used to result in your getting a gold watch and a modest retirement pension, which almost was enough to pay your nursing home and funeral costs. Now companies have wised up and lay you off before the pension costs escalate for them. And that leaves you making do with a Social Security check. Good luck.

My friends, we are the golden goose. We are paying Congress and the government to make sure this system stays intact. It's a gravy train for Congress — maybe you've noticed that politicians will spend millions to get or keep their Congressional seats. And hundreds of

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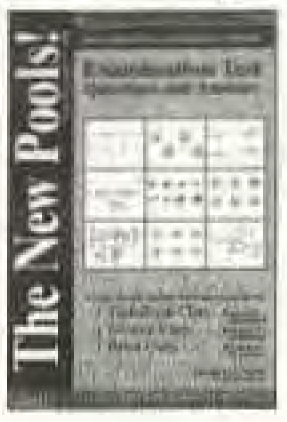

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