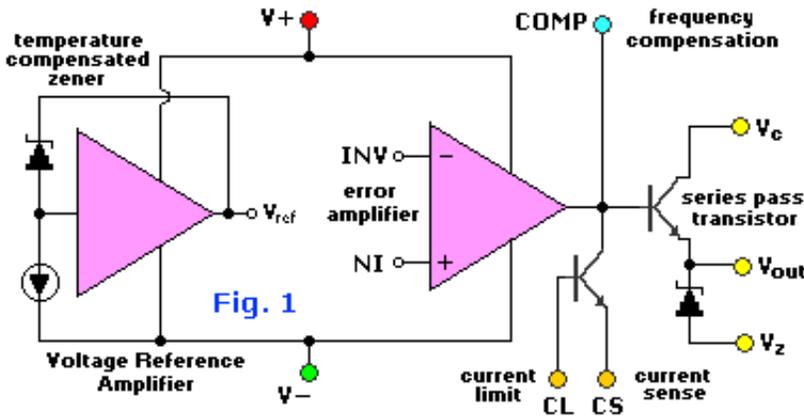




Bench Top Power Supply -- Part 1.

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"This 30 volt Bench Top Power Supply is rated at 10 amp, and it is so versatile and powerful that it will slowly turn your regular 115VAC power drill. It was designed to work under the most extreme circumstances and short-circuit protected (within specs), even in the 10-Amp setting. Cooling (optional) fan(s) keep the semiconductors and the large cooling rib cool automatically."

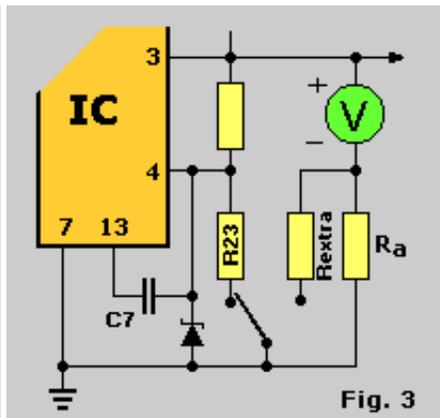
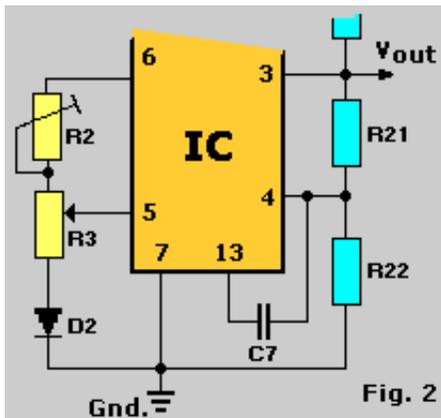


Simplified circuit of the 723. Courtesy Fairchild Semiconductors.

Introduction:

This "jumbo" power supply is built around the monolithic voltage regulator IC from Motorola, the MC1723, which is a more modern version of the old uA723 from Fairchild Semiconductors. Other versions of this IC, like the LM723 from National and others, and even the old MC723 metal-can will work too. Though the prototype of this powersupply used the ceramic military version of the 723. The uA723 voltage regulator was designed by Bob Widlar and first introduced in 1967, and used ever since. It is a flexible, easy-to-use regulator with excellent

performance. Looking at Fig. 1., this 14 pin regulator is not of your average type. You find this regulator everywhere, in a variety of applications including military. This IC can function both as a positive *or* negative voltage regulator and designed to deliver a load-current of 150mA DC. With external 'pass' transistors the output current can be increased to significant levels, as in our project to about 10 amps (depending on your transformer). A special temperature monitoring circuit (optional) will activate two to four CPU fans (optional) automatically if the temperature of the large cool rib exceeds an adjustable temperature and activate or deactivate the fans within a 2.3°C temperature variation. Pretty good for a 'cool' rib in my opinion. Even at 1 amp the cool rib may get warm, but at 10-amp it gets really hot and so the fans will not only keep the temperature at a safe level it also is an added safety feature to give this powersupply a life-span of at least 30 years! The semiconductors in the shaded, light yellow area on the **Circuits Diagram** below go all on the large cool rib. See Fig. 5.



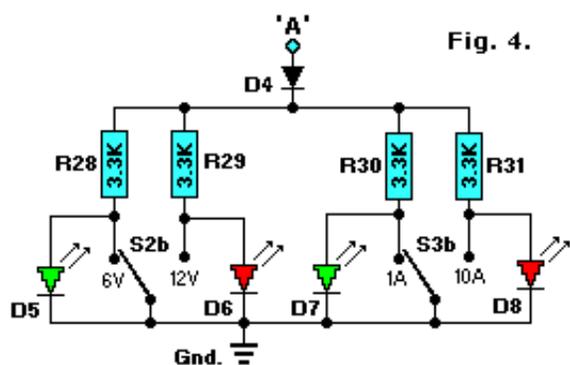
Voltage Output in 'Low' setting is variable from 0.7 - 6 volts (more later why the 0.7V), in the 'High' setting the voltage is variable from 3 - 30 volts. Current is adjustable in the 'Low' position from 0 - 1 amp and in the 'High' setting from 1 to 10 amps. 0.1% line and 0.03% load regulation. Ripple is less than 0.001Vpp. Scale tolerance Low: 0.2%, High: 0.5%. Another welcome feature is the short-circuit protection. Beautiful chip. The

normal commercial temperature range is 0°C to 70°C (MC1723CD, CL, CG, and CP package). The military

version (MC1723G or L) can handle a temperature range of -55°C to $+125^{\circ}\text{C}$. That one you can really freeze or cook!

Voltage Regulation:

Shown in Fig. 2. was the initial idea of voltage regulation and method we will be using. As mentioned before there are two scales, 0.7 to 6 volts and 3 to 30 volts. A nice problem way to do that is with a DPDT switch (S2). Plus we will add a Led to indicate which scale we are on. This toggle-switch switches both the volt-scale and the volt-meter. In Fig. 3. you can see how, by putting one side of S2 to ground via one resistor, the output voltage is in the 3 - 30V scale, and the other side of S2 via another resistor (R-extra) to switch to the 0.7 - 6 V scale. At the same time we switch a parallel resistor with it as a shunt for the panel-meter. If we calculate the value of this resistor to represent the meter R_1 for the 6V scale, then everything is a piece-of-cake. A single pole switch is in this scenario sufficient, without limiting any performance. A second pole is used to switch the led-indicators, making S2 a double-pole-double-throw type. The 'Voltage' on the front panel is controlled with potentiometer R3 and the scale adjusted with trimmer pot R2.



The Led indicators have a voltage of between 1.8 and 2.0 volts dc and the current no more then 25mA max. They can also use be used to glow on AC, only then an extra diode will be required (see Fig. 4.) which also protects the Led's just in case we accidentally connect them the wrong way. Point 'A' is connected to the same as indicated on the circuit diagram. Leds D6 & D8 are for the 30-volt and 10-amp respectively and D5 & D6 are the 6-volt and 1-amp settings but are not lit because they are shorted by the switch S2b and S3b. Resistors R28 to R31 are chosen accordingly to input voltage. A rule of thumb is about 100 ohms

per volt input voltage. This means a little less than 10 milliamps per Led and that is enough to light them up. Depending on the Led type you use (regular, high-, or ultra brightness) you may have to adjust these resistors to suit your needs. You could use trimmer pots instead of resistors but that is such an overkill and waste. So, not needed, just a bit of tinkering may be required. The method of short circuiting the unused leds was chosen since this was the simplest and cheapest way of going about it. They also serve as a "On/Off" indicator of the power supply when it is switched on because a minimum of two led's will always be on. It is okay to use two bi-color leds but they are more expensive.

Part 2 - of this project will start with the construction of the large cool rib, mounting and wiring up all semiconductors, and (optionally) the cooling fans. Then the back panel and the 115VAC wiring of the on/off switch, transformer, fuse holder and powercord/receptacle, and last the bridge rectifier BR1 and the large electrolytic capacitor C3. There are lots of photographs and pictures to help you get through all this. The Printed Circuit Board and Lay-out are also available in Part 2. The finished product is a worth while project and outperforms many commercial units.

Bench Top Powersupply -- 0-6/1-30V & 0-1/1-10A

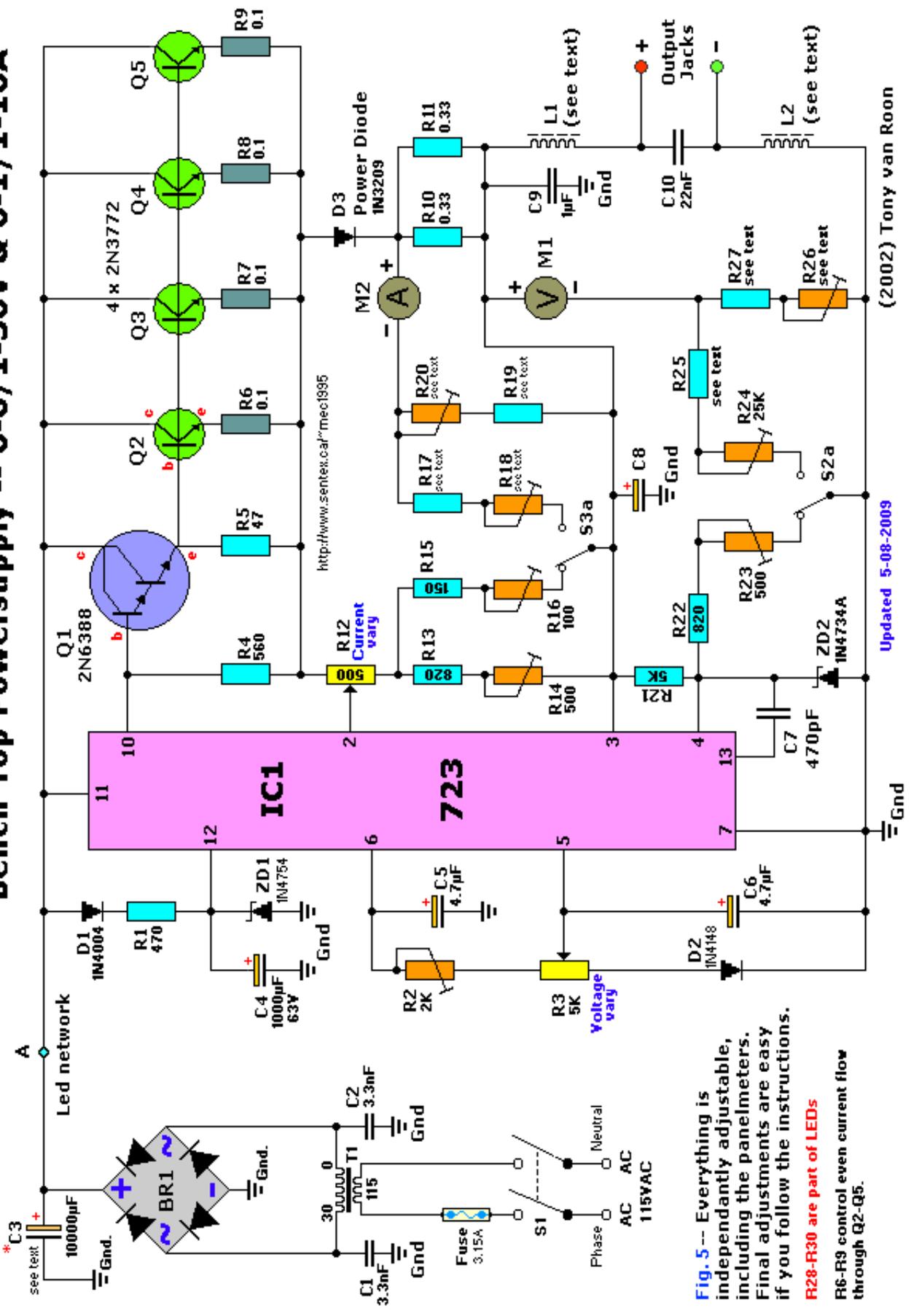


Fig. 5-- Everything is independently adjustable, including the panelmeters. Final adjustments are easy if you follow the instructions. **R28-R30 are part of LEDs** R6-R9 control even current flow through Q2-Q5.

Updated 5-08-2009

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Click [here](#) for a full size version in horizontal view. Only the diagram above prints correctly though.

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