TALKING ELECTRONICS®

A NEW MAGAZINE FOR EXPERIMENTERS

$1.20*

N.Z. $1.40

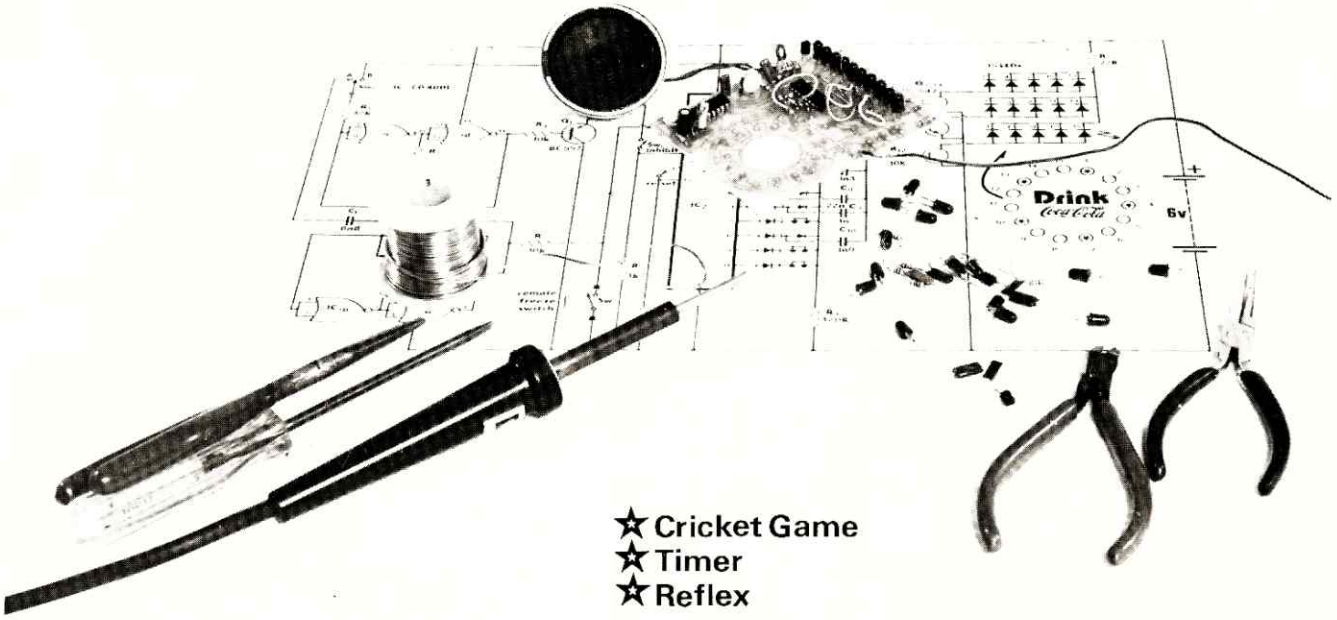
Issue No 3.

1 Amp Power Supply

Square Wave Oscillator

Binary Counter

The Experimenter Deck Continues....



☆ Cricket Game
☆ Timer
☆ Reflex

Counter Module

7 Segment Display

FREE TRANSISTOR OFFER P.31

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TALKING ELECTRONICS

Editorial...

Vol.1 No.3

With this third issue we have consolidated four of our main themes. You will notice our projects extend through a number of issues, becoming progressively more involved as they run and link up with other projects to produce a complex result; more complex than you would have accepted if it were presented individually.

Our circuit descriptions are very basic and are aimed at the beginner. In our field of digitals, the circuits do not come any simpler and we can only extend upwards and outwards from this ground plane. If you feel unfamiliar with some of the terms and terminology I suggest you join an electronics club. Electronics is so fulfilling you will find yourself eating, drinking and sleeping electronics. It can become your whole life. To become a competent electronics person, this is the way it must be. We are providing the ground plan. It is up to you to apply the data. Let's see.

Colin Mitchell.

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Publisher

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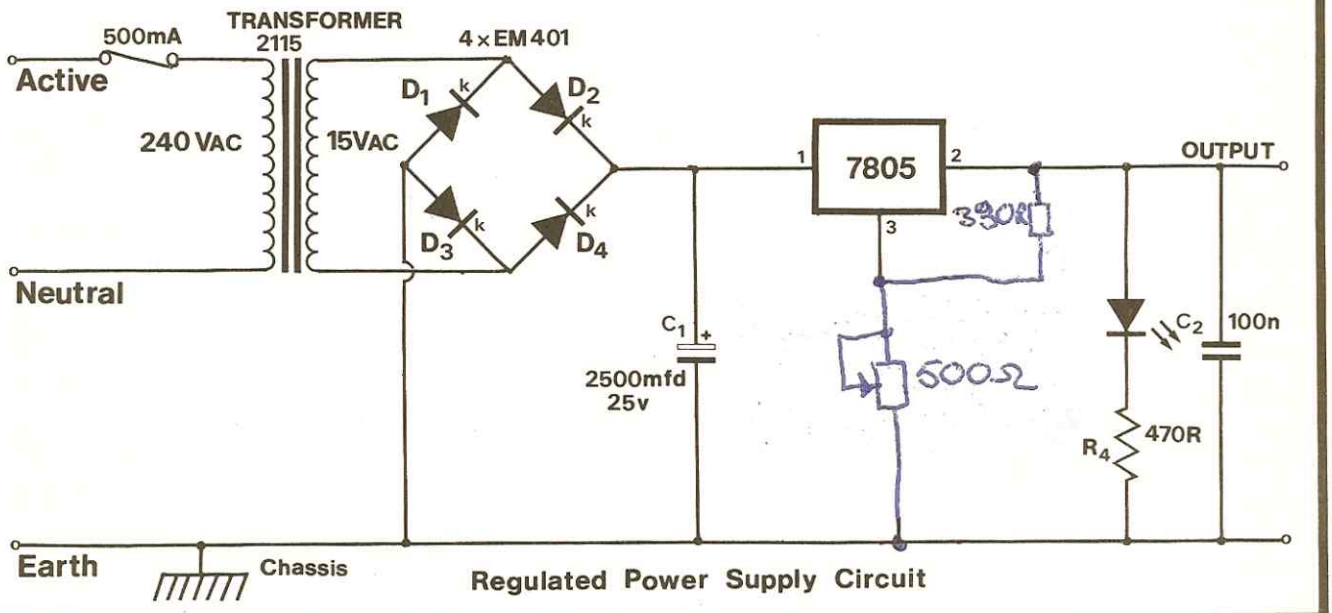
POWER SUPPLY

by Ashley Emery

NOT TO BE CONSTRUCTED WITHOUT SUPERVISION

A fully regulated 1 Amp power supply suitable for our range of projects.....

PROJECT COST: $25



Regulated Power Supply Circuit

Our 1-amp power supply.....

If you take the Editors advice and build at least one project a month, you will soon realize how quickly you go through batteries. But don't be put off, build a fully regulated power supply.

As well as powering all the projects in this magazine, its voltages are suitable for powering items such as TV games, race car sets and calculators.

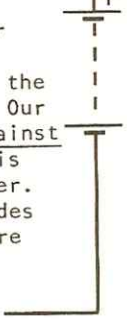
This power supply provides 4 useful fixed voltages: 5v, 6v, 9v and 12v; all at less than 100mv ripple, at full load current of 1 amp.

The 5v range is required for TTL projects and those calculators which use 3 penlite cells. It is important to keep the voltage below 6v for these circuits as the TTL IC's operate on a narrow voltage of 4.5v to 5.5v.

The maximum current capability of this power supply is 1 amp. If you happen to overload the output, don't worry, full overload protection is provided by the 7805 regulator.

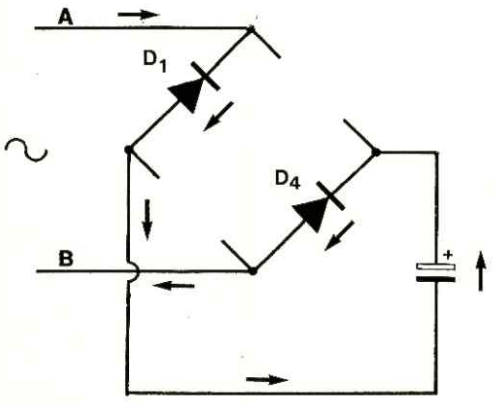
HOW IT WORKS

The operation of the circuit is very simple and can be explained with the aid of three diagrams. There are two ways of expressing the flow of electricity around a circuit. CONVENTIONAL CURRENT FLOW and ELECTRON FLOW. We will be considering the direction in which the electrons flow and it may look as if we have made a mistake according to the direction of the arrow on the diode. Unfortunately when the diode was invented, and its symbol introduced, the inventors of the day naturally thought electricity flowed out of the positive terminal of the battery and into the negative. This means that when a diode was inserted into a circuit with the anode lead towards the positive terminal of the battery, it was forward biased and the current would flow out of the cathode of the diode. Thus they drew the arrow in the direction of the supposed current flow. It was later discovered current was a flow of free electrons and the arrow became known as the direction of CONVENTIONAL CURRENT FLOW. Our description of ELECTRON FLOW will be against the arrows. The 240v AC from the mains is stepped down to 15v AC by the transformer. This voltage is then rectified by 4 diodes D_1 D_2 D_3 and D_4. They are

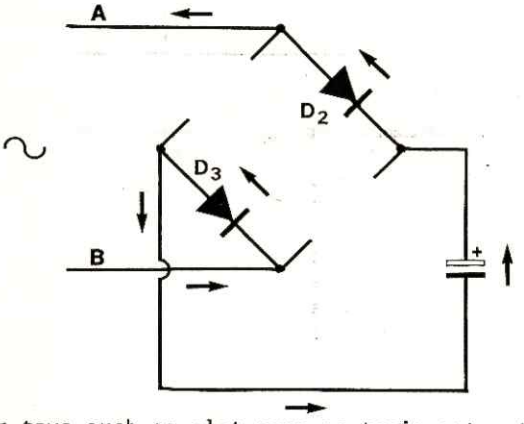


Few, if any, hobby clubs allow mains projects to be constructed as there can be a danger of faulty wiring producing a nasty shock. This project must be inspected by your teacher before turning it on.

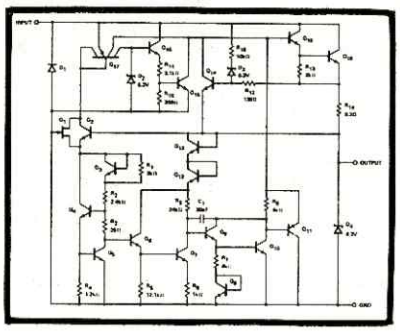
arranged as a "Bridge Rectifier". Although there are 4 diodes, only 2 are in operation at any one time. If we take the instant where the electrons are emerging from point A of the 15v winding, diodes D_1 and D_4 are the only two which allow the electrons to flow. Diodes D_2 and D_3 are reverse biased and have no effect on the circuit. The path becomes as shown in this diagram: The electrons are charging the 2500mfd electrolytic.



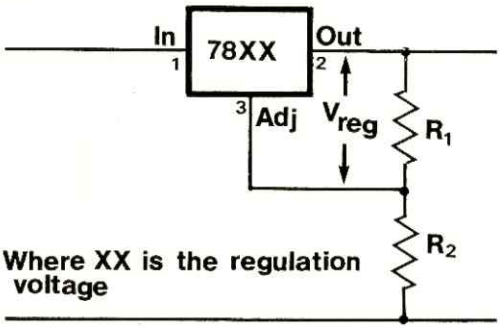
One half cycle later, the electrons are emerging from point B and diodes D_3 and D_2 are fully conducting, while D_1 and D_4 have no effect. This exchange takes place 100 times per second so that the 2500mfd electrolytic receives a small amount of energy in each $\frac{1}{2}$ cycle.



For toys such as slot cars or train sets, this voltage would be sufficiently good enough. But for projects containing CMOS IC's and pulse circuits, the ripple contained within this DC voltage would cause false triggering. In addition we are designing a power supply which is variable from 5v to 12v. So to further smooth this voltage and accurately reduce it to 5v, we need a VOLTAGE REGULATOR. For this function we have chosen a 7805. It looks very much like an ordinary transistor and could very well be mistaken for one. It is a three-leaded device with pins labelled: IN, COMMON and OUT.



INTERNAL CIRCUIT (7805)



It is basically a 5v regulator but with clever circuit design, can be arranged to regulate to almost any voltage and still maintain the capacity to shut-down should the current rise to beyond about 1 amp. The two external resistors needed to provide this higher voltage can be obtained from the formula:

$R_1 = \frac{V}{.02}$ R_1 is the resistor connected between pins 2 and 3.

$= \frac{5}{.02}$ V is the normal voltage of the regulator (in our case 5v)

=250 ohms.

Use a 500 ohm trim pot which can be adjusted down to 250 ohms.

$R_2 = \frac{D}{.025}$ R_2 is the resistor connected between pin 3 and ground
D is the difference between the normal output voltage of the IC and the required output voltage. In our case these are: 0v, 1v, 4v, and 7v.

The values of R_2 work out to be 0 ohms, 39 ohms, 150 ohms and 270 ohms.

QUESTION: Can you measure the output current of this regulated power supply by placing an ammeter across the output?

ANSWER: NO, definitely not! The power supply will see the ammeter as a SHORT-CIRCUIT and will shut down to give zero output. To overcome this, use a 20 ohm 10watt resistor in series with the ammeter on the 12v or 15v range and read the current flowing.