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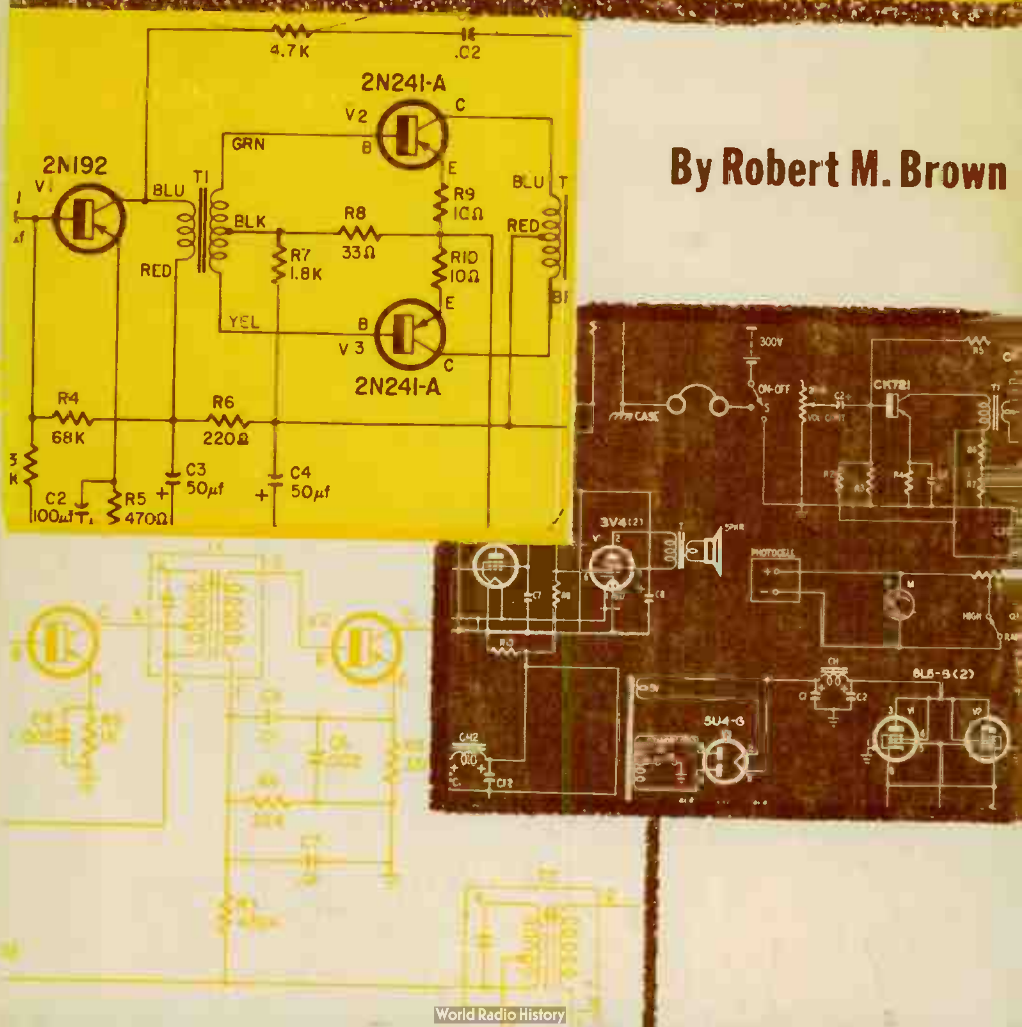
104 EASY TRANSISTOR PROJECTS YOU CAN BUILD

By Robert M. Brown



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Contents

Introduction

To those of us who have grown up with the transistor, it seems almost incredible that such a tiny device could have such a huge impact on electronics experimentation. For instance, back in those dark ages B. G. (before germanium) we had to be cautious of high voltage, and be careful not to drop a tube on the floor. Most of us formed the wary habit of working with one hand, while keeping the other in the pocket, after being bitten five or six times by the B-plus voltage. The "smoke test" of a new circuit meant just that, too—apply power and watch for the smoke pouring out if something wasn't right.

I still remember my first project; it failed the smoke test. Literally, clouds of white fumes erupted from it. The trouble? I had accidentally shorted the heater wire to ground, and the melting transformer insulation provided the smoke. What's a heater? If you don't know, it just proves there's been a whole generation of experimenters now who have worked only with transistors.

Here's a serving of relatively inexpensive, easy-to-construct, handy transistor devices covering all fields of electronics and reflecting the many advances made (and still in the making) in transistor technology. All the projects are simple—3 to 4 transistors at the most. The idea was to collect as many basic circuits as possible, rather than the most complicated circuits in existence.

To make room for all these circuits the usual involved explanations or circuit theory and kit-type instructions are conspicuously absent. If you have worked with transistors before—and by now if you haven't you must be living in isolation!

—you won't miss the superdetail. Just in case you have been in isolation, read on...

The biggest enemy the transistor has is heat. Most transistors which die do so because of excessively feverish conditions, either in operation or in installation. Heat problems during operation usually arise only with the bigger power transistors. These babies should be mounted on "heat sinks." (A heat sink is simply a fancy term for a lot of metal which can absorb any heat the transistor generates.) Many firms now market prepunched heat sinks to fit any kind of transistor, as well as mounting kits which insulate the transistor electrically while conducting harmful heat away. For smaller "TO-5" transistors, cute little finned heat sinks are available if you need them; most often you won't. If you don't have a heat sink or insulating kit handy, don't let the lack stop you. An ordinary chassis will carry away a surprising number of calories (yep, heat is measured in calories, too) and the 3M Company puts out a fantastically good insulating material under the name of "Magic" tape (Scotch Brand Type 310 for the purists). Five years ago I put together a DC-to-DC power converter for a mobile installation using this trick, and it's still going strong.

AVOIDING THE HEAT PROBLEM

Heat during installation is another matter. Transistors are normally so long-lived that it's tempting to solder them into position. The classic instruction for soldering transistor leads is to prevent soldering heat from running back up the lead and causing damage. Frequently, long-nose pliers are recommended. A better way of preventing damage, though, is to become a skilled solderer and use a good, hot iron. I shudder every time I read a recommendation that experimenters use 25-watt or smaller irons, and I use guns only in emergencies. For day-in, day-out construction, I use a soldering pencil with a 35-watt heating element, providing about 800^{o} at the tip. That's hot, and assures that the entire joint gets hot enough to make a good bond before the heat has time to run very far up any leads. My average time per solder joint is about 10 seconds. Almost any transistor can stand soldering temperatures so long as they're at least 1/8 inch away from the transistor case, and not applied for more than 15 to 20 seconds.

If you're doubtful about your ability to do it this way, though, you can clip-on heat sinks. Several firms market little spring-clip gadgets like backward tweezers for this purpose. You can also use the smallest size paper clamps or medium-sized alligator clips. Really cautious individuals can dispense with all risks by using sockets—but my experience has been that sockets are more trouble than they're worth. Since transistor prices are now down to such reasonable figures, my recommendation is to be bold and solder!

MAKING TRANSISTOR SUBSTITUTIONS

Speaking of those reasonable transistor prices brings up a frequently-asked question: What about substituting some other type of transistor in a circuit? The connection between substitution and price is simple. Frequently a batch of inexpensive transistors appears on the market, labeled as "similar to 2Nxyzz" or something of that sort. Can these be substituted in these circuits? I don't recommend it as a general practice, but if you're willing to approach the subject with an open mind and not insist on 100% performance in such cases, it will probably work in at least 8 cases out of 10.

The numbering system used for vacuum tubes gives you a pretty good idea of the relationships within "families" of tubes. That is, you can easily tell that a 5U8 and a 6U8 are somewhat alike, and a 6U8-B is tagged as a later version. But with transistors, such simple comparison isn't possible. For instance, the same actual transistor element may appear under as many as five different numbers (which bear no relation to each other) depending entirely upon what kind of package it's in! The proliferation of product numbers has puzzled engineers as well as experimenters. One firm sells a selected collection of transistor data sheets for $40 a set. And even with such data, you couldn't be sure that a substitution would work in any specific circuit. However, half the fun of experimenting in electronics is finding out what won't work. This means that you'll probably be substituting transistor types here and there. Do keep the same "polarity" of transistor; some circuits won't work if NPN units replace PNPs, or vice versa. Beyond that, invest in a good substitution guide to find out which are the readily available substitutes. And remember, you're on your own.

ABOUT THE CIRCUITS

Which brings us inevitably to the circuits themselves. Each schematic uses a standard format for listing parts values. Unless otherwise indicated, all resistance values are in ohms and all resistors are rated at 1/2 watt, fixed composition type. Those resistances indicated with "K" are in thousands of ohms and those marked "meg" are in megohms (millions of ohms).

Capacitance values are usually in microfarads and referred to as "mfd." Picofarads ("pfd") types are so indicated also. Picofarads are identical to the older "mmfd" and "mmf," but "pfd" is now the standard abbreviation. Electrolytic capacitors, used frequently in these circuits usually (whenever capacitance values greater than 1 mfd appear), also are rated by voltage, and voltage rating is seldom given in the schematics. Use the next higher standard rating than the supply voltage if you have any question. That is, if the circuit uses a 9-volt battery for power, use 10-volt ratings.

HANDY POWER SUPPLY

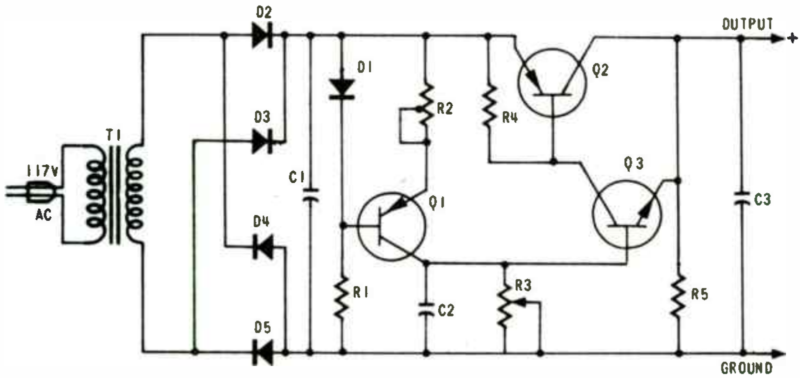
While most of the circuits show batteries as the power source, for general experimenting an AC power supply is often handier. You can rig up a power supply cheaply, or you can invest several hundred dollars in one. For general experimentation, something in between is best. The accompanying schematic shows a rather unusual circuit which I have used. This provides several amps (if your transformer and regulating transistor are husky enough) and offers adjustable output voltage. Since the circuit isn't exactly conventional, I'll explain just enough about it to let you vary parts values to fit your own ideas:

This supply uses an ordinary silicon rectifier diode instead of a more expensive zener diode to provide its reference standard; this is possible because the diode is used to generate a regulated <u>current</u> rather than regulated voltage. That's the function of transistor Q1. The adjustable resistor in Q1's emitter circuit varies the level to which current is regulated; the current will be whatever is necessary to maintain a voltage drop across the resistor exactly equal to that across the diode. This regulated current, in turn, is applied to the output voltage control variable resistor. Since the current flow is fixed, varying the resistor varies the voltage which appears across it. This voltage, finally, is applied to the base of the regulating transistor. The regulator acts like an emitter-follower circuit, providing an output voltage controlled by the voltage at the base, but an output current many times greater than the base current. The only thing to watch out for is to be sure to provide a good heat sink for the regulating transistor. This transistor is always dissipating power; all the voltage produced by the transformer and not applied to the load must be turned into heat by the regulating transistor.

And don't look for type numbers for the transistors and diodes; there aren't any. This is one of those circuits that works with just about anything. No two of the half-dozen of these supplies put together by myself and my friends have used the same set of parts values or transistor types, but all of them have performed the same. Q1 doesn't need to handle much power; we have used 2N43s, 2N404s, and 2N1303s in this position. The 2N404 is the least expensive of these and performs admirably. The power transistor must be able to handle the amperage you want to produce. Most of ours have used 2N441 or 2N278 15-amp transistors, but only because they were handy. If you don't intend to take more than 500 ma out of the supply, almost any PNP power transistor should work.

The third transistor, Q3, serves to make the power transistor behave as if it were an NPN instead of a PNP. Most of our units have used 2N1302s here (because we had boxes full of them out of a local surplus sale) but one used a 2N170 and it worked. Any "100-mw TO-5" NPN should do nicely. If silicon transistors are used, it probably wouldn't hurt any to use two diodes in series at D1, rather than just one. This, we haven't tried.

Back to generalities: There's a chance your neighborhood parts emporium may not have all the components required for these circuits (although transistor-circuit components are certainly more readily available than they were). However, you can always get the parts you need by mail order. Most mail order houses are happy to provide their catalogs free of charge; send for them as reference guides even if your corner



PARTS LIST

TRANSISTORS:
Q1, 2, 3—See text.

DIODES:
D1—Silicon rectifier diode, any type or voltage rating. Do not substitute non-silicon device. See text.

Unmarked diode bridge—Current and voltage rating determined by T1. See text.

CAPACITORS:
C1—500-1000 mfd, voltage rating twice the secondary of T1.
C2—25 mfd, rating same as C1
C3—25 mfd, voltage rating same as C1

RESISTORS:
R1—2.7K, 1-watt
R2—250 pot
R3—4-watt pot, linear taper, 50-ohms-per-volt maximum output desired. (1,000 ohms allows up to 20 volts; 500 ohms, 10 volts, etc).
R4—470
R5—4.7K, 1-watt

MISCELLANEOUS:
T1—Transformer, 115v AC primary, up to 24v AC secondary at desired current rating.

Adjust R2 until calibration of R3 is as desired at full scale. The rest of the calibration of R3 will follow automatically. The greater the value of R2, the lower the output voltage for a given setting of R3.

store has all you need. Most mail order houses advertise in many popular magazines.

Don't forget that you have to have a federal license to use any kind of radio transmitter, except a "restricted radiation device" (Part 15, FCC Rules and Regulations). While these circuits are flea-powered, they're still not legal to use unless you're licensed in the Amateur Radio Service. You can still build the transmitters without fear and test them in dummy loads (such as light bulbs)—but don't hook them into the antenna or feedline until that license arrives!

The author wishes to dedicate this book to his wife, Toni, whose diligence in keeping the files up to date—and her gentle prodding ("Are you ever going to get that book finished?!")—made the whole thing possible. Additionally, thanks are extended to Verne M. Ray (of TAB Books) for this opportunity.

Happy transistorizing!

Robert M. Brown
K2ZSQ, K7ZMS, W9HBF,
KOD-2239

1

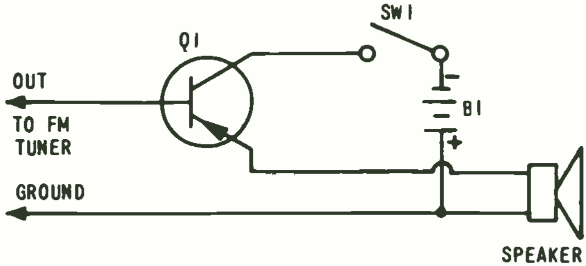
World's Smallest Amplifier

Well maybe we're fudging a little by calling this an amplifier, but it will permit you to run a small speaker from things like a tuner, tape deck, or phono pickup. Admittedly, the "fi" isn't very "hi," but the amplifier will sometimes come in handy for an audiophile. Even though the transistor in the circuit is a power type, a heat sink isn't necessary.

PARTS LIST

TRANSISTOR:
Q1—2N442
BATTERY:
B1—3 volts
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.
Speaker—8-ohm miniature

If you mount the speaker in a small cabinet, you can build the entire circuit right inside the speaker enclosure with the on/off switch sticking through a hole. Put alligator clips on the input leads for ease of connection to the tuner or tape deck output.



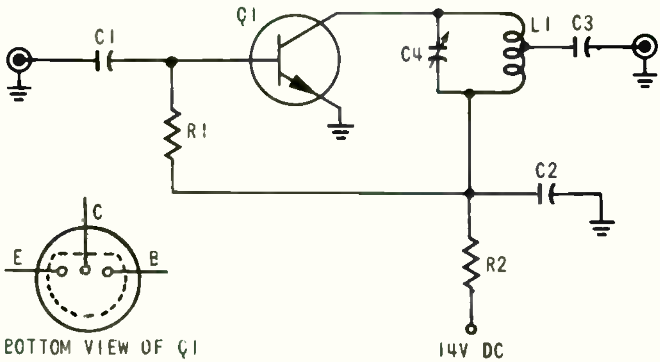
2

2-Meter Preamp

Looking for another 10 db of actual receiver gain (over your noise figure) on two meters? Would you believe you can do it with a transistor available for less than $1.00? Well you can with this circuit, developed expressly for 2-meter addicts who hang around the same frequency most of the time. Shortcuts have been taken to cut costs, although you'll see signals almost 2 "S" units stronger than they used to be without any hangups.

The circuit shown (and associated LC combination) was designed to preamplify 147-MHz signals. If you hang around the low end of the band, you'll want to add another half turn or so to L1. Otherwise, construction should be pretty easy to follow "as is." It is wise to bear in mind that regardless of how unprofessional it might look, use only the necessary component lead length during construction—avoid excessive leads like the plague. Keep all connections as short as humanly possible, and shield the preamp when completed.

It should be noted that this circuit does not have an extra tuned input circuit. In fact, it has none at all! This was done, as indicated above, to cut costs for our particular installation. If you are in a large metropolitan area, however, where it is entirely possible that strong commercial signals might cause some intermixing, it might pay to add a simple tuned LC input circuit to our little powerhouse. Best bet, though, is to try it as it stands before experimenting on your own.



PARTS LIST

TRANSISTOR:
Q1—GE 16L64
CAPACITORS:
C1, 2, 3—.001 mfd
C4—1-9 pfd piston trimmer, E. F. Johnson #189-4.
RESISTORS:
R1—100K
R2—1.5K
MISCELLANEOUS:
L1—5 1/2 turns of #14 wire, 5/16" inner diameter, spaced diameter of wire. Tapped at 1 1/2 turns from cold end.

3

FET Crystal Mike Amplifier

How about a preamp, PA system, and transmitter modulator all rolled into one? This interesting circuit can do it for you, provided you're willing to take a crack at building a gadget with a field effect transistor (FET) as its primary component. This dandy amplifier will respond to a frequency range of 10 Hz to 90 kHz ± 1 db, and has an input impedance of 22 megohms. The maximum RMS voltage output is 6. Some features for a two-semiconductor device that runs off a 22 1/2-volt battery!

The FET is a Siliconix "Unifets" U-110, something new on the market, yet not prohibitively expensive. Q2 is a readily available 2N2924. All other parts are standard junkbox components. The field effect transistor affords a high input impedance as indicated above, although it can be raised even further (to 1000 megohms) by bootstrapping the gate (G on Q1) to the source (S).

Construction is simple and straightforward. Keep connections short, observe proper battery and transistor polarities, and you are in business.

PARTS LIST

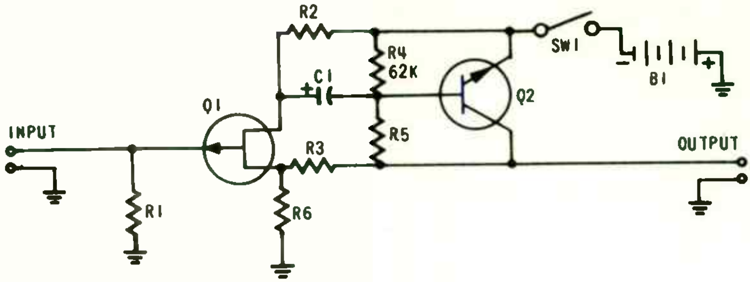
TRANSISTORS:
- Q1—U-110. See text.
- Q2—2N2924

CAPACITOR:
- C1—.5 mfd

RESISTORS:
- R1—22 meg.
- R2—12K
- R3—27K
- R4—62K
- R5—1.2 meg.
- R6—330

BATTERY:
- B1—22 1/2v DC, single "A"

MISCELLANEOUS:
- SW1—SPST. Oak type 200 or equiv.



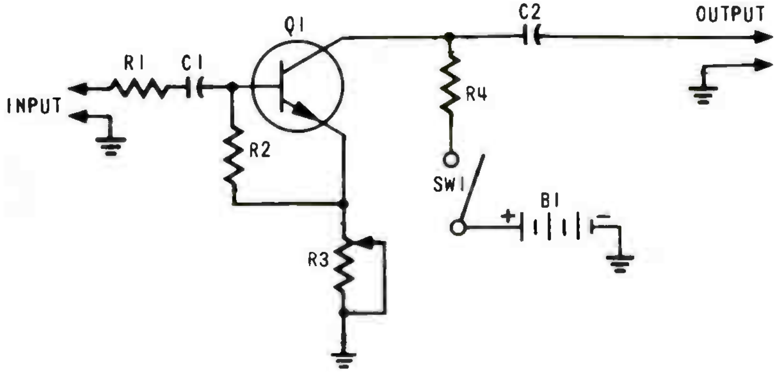
4

40 db Mike Preamp

Unbelieveable though it may sound, this one-transistor amplifier circuit can yield all the way to 40 db of gain, which will give you a mighty big sound on the channel. Using the latest in audio transistors, a General Electric GE-8, the preamp will do wonders for undermodulated transmitters or applications where the microphone is poorly matched to the modulator input circuit. It can be built in a small 1 1/2 x 2 x 2 1/2" minibox or plastic case, with a small hole drilled to accommodate the shaft of R3. This control varies the audio level to suit the occasion.

Output is connected directly to the mike fitting on the CB rig. No power need be drawn from the transmitter, since a 22 1/2-volt RCA VS-084 battery does a handy job all by itself. Additionally, current drain is extremely low and the cell should last for quite some time.

Construction is quite basic. As long as adequate shielding is provided as a precaution against AC hum inducement, you can pretty well lay it out yourself. Nothing is particularly critical. Infact, youcan to a certain extent substitute resistive and capacitive values, if you don't go too far afield of those suggested here.



PARTS LIST

TRANSISTOR:
Q1—GE-8
CAPACITORS:
C1, 2—1 mfd
RESISTORS:
R1—68K
R2—150K
R3—10K
R4—100K
BATTERY:
B1—22 1/2v DC, RCA VS-084 or equiv.
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.

5

Carbon-to-Crystal Mike Adapter

Any handbook will tell you how to change a crystal or ceramic mike system to accommodate a carbon microphone, but what if you need to do just the reverse? Many of the older-type surplus sets in use on ham bands utilize carbon mike circuits, and this is one of their primary drawbacks. The carbons sometimes sound pretty awful and require close talking to produce anything at the other end. With a ceramic mike and this adapter, though, you can sound like NBC's Chet Huntley.

PARTS LIST

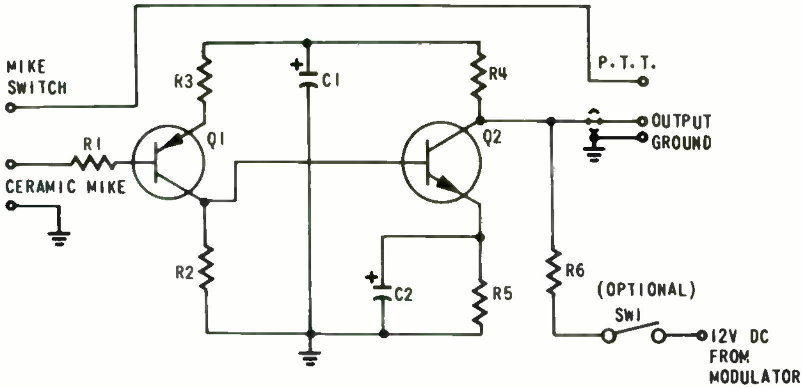
TRANSISTORS:
- Q1—2N414
- Q2—2N1302

CAPACITORS:
- C1—100 mfd, 15 WVDC electrolytic
- C2—15 mfd, 15 WVDC electrolytic

RESISTORS:
- R1—390K
- R2—6.8K
- R3, 4—1K
- R5—150
- R6—470

MISCELLANEOUS:
- SW1—SPST. Oak type 200 or equiv.

If you're willing to spend a few cents more for the new 1/10th-watt resistors and Cal-Rad miniature electrolytics, you can build the entire adapter right into the back of a ceramic mike, such as the Euphonics Model C47D. The little adapter gets its voltage from the original carbon mike circuit of the transmitter, so a battery isn't required. In fact, once you have built it into the back of the microphone, you can permanently seal it with the carefully applied heat of an ordinary soldering gun. A single "melting" ring around the mike will suffice, if the mike doesn't come apart by normal means (with screws). In this manner, you can use the inexpensive ceramic mikes normally carried at bargain prices by Radio Shack, Lafayette, B/A, McGee Co., Olson Radio, etc.



6

Dynamic Mike Booster

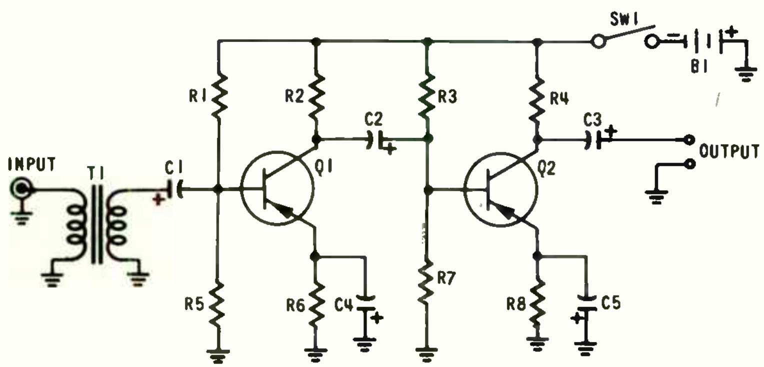
The beauty of the dynamic microphone is its cost—dirt cheap. Presently these mikes are flooding the parts suppliers, and the influx has resulted in lower prices than ever before. But the problem with them is their low output. If they can be given more oomph, they stack up well against the most expensive crystal types, and their characteristics are good enough to make a real quality-modulation addict turn cartwheels. The circuit shown here can be built right into the base of the microphone, inside the transmitter, or simply as an in-line booster. Miniature parts are used throughout.

Frequency response is terrific, though you probably won't be using it for music broadcasts. Total amplifier voltage gain: over 500 with an input of 5 millivolts. Battery drain: near negligible. Chances are you'll forget it even requires a battery, but check your polarities carefully. Notice that this circuit uses PNPs in a positive-ground configuration. Watch electrolytic wiring. If you should accidentally reverse the capacitor, it may be difficult to correct the problem later.

Construction is quite basic, although for microminiaturization you'll want to obtain tiny resistors and electrolytics and keep their leads extremely short. Additionally, it is wise to shield the finished booster to avoid picking up (and amplifying) stray AC line hum.

PARTS LIST

TRANSISTORS:
Q1, 2—2N111
CAPACITORS:
C1, 2, 3—5 mfd, 15 WVDC electrolytic
C4, 5—10 mfd, 15 WVDC electrolytic
RESISTORS:
R1, 3—120K
R2, 4—5K
R5, 7—12K
R6, 8—1K
BATTERY:
B1—9v DC
MISCELLANEOUS:
T1—Lafayette TR-97
SW1—SPST. Oak type 200 or equiv.

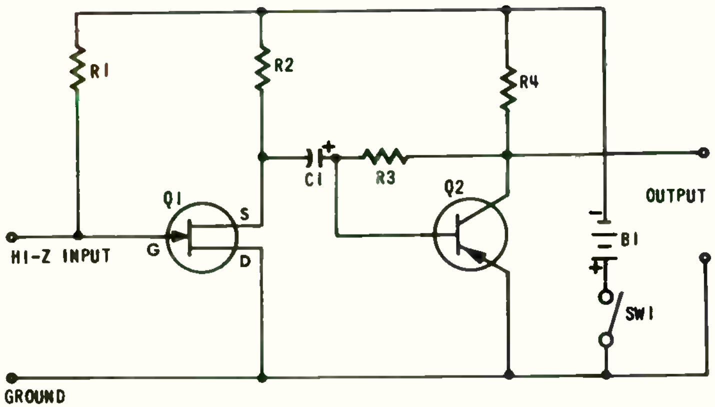


7

Mike Hi-Z Matcher/Preamp

The problem with a lot of conventional design transistorized audio amplifiers is that bass response frequently leaves something to be desired. In fact, a considerable number of the more inexpensive record players, TR radios, etc., sound downright tinny. If you have ever tried to drive such an amplifier with a standard crystal microphone (or crystal phono cartridge), you probably hit another snag—low volume.

This little FET (field effect transistor) matching preamp will eradicate your gripes permanently by matching your transistor amplifier's input to a crystal-type source. Both inexpensive and easy to build, the preamp can be built into an existing unit, or constructed as an outboard add-on device for more versatility. You might first want to "breadboard" the circuit and experiment a bit with the resistive values by using potentiometers instead of fixed-value resistors. If you do, however, be sure to preset each pot, using an ohmmeter, to the resistance specified in the parts list. If you forget this, you may damage the transistors after SW1 is closed. Afterwards, very slowly adjust the potentiometers no more than 20% plus or minus your preset resistance. Should you find that even more "hop" can be achieved in this manner, substitute fixed resistors for the newly-found values, taking the precaution, however, of reducing this figure by 7%. This will serve to prevent gradual TR breakdown, something that might develop after several weeks of continuous use. Regardless, you'll get bass response down to 20 Hz and plenty of overall oomph.



PARTS LIST

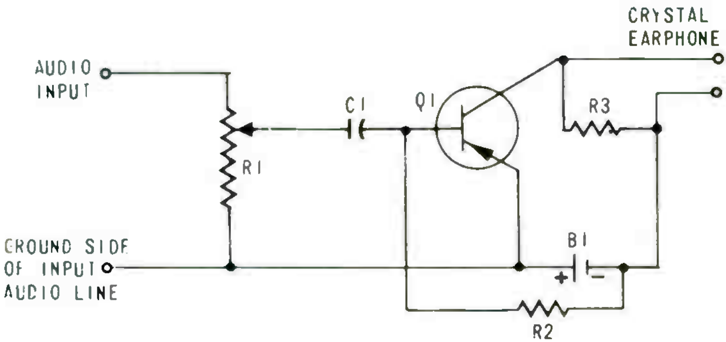
TRANSISTORS:
Q1—TIX881 FET
Q2—2N382
CAPACITOR:
C1—5 mfd, 15 WVDC electrolytic
RESISTORS:
R1—2.7 meg
R2—2.7K
R3—390K
R4—3.9K
BATTERY:
B1—9v DC
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.

8

Add-On Amplifier Stage for BC Receivers

This simple circuit, which requires only a 1 1/2-volt penlite cell to power it, is just the thing for pepping up sluggish crystal and crystal/transistor broadcast band receivers. It affords an extra stage of audio amplification which draws no power from preceding stages, and packs a real whallop in what it does to those weak signals.

Although designed primarily for small BC receivers such as those found in this book, it can be adapted to commercial receivers by simply installing the unit as indicated in the diagram, after checking for "hot" connections. If currents can be measured on a meter at either the audio output lead or ground (such as at the chassis of an AC/DC set), you'll just damage your little amplifier by proceeding any further. Best bet is to stay away from tube sets, which probably don't need



PARTS LIST	
TRANSISTOR:	RESISTORS:
Q1—2N109	R1—7.5K pot
CAPACITOR:	R2—220K
C1—.02 mfd	R3—4.7K
	BATTERY:
	B1—1 1/2v penlite cell

further audio amplification anyhow. It does a fine job on those small $2.97 Japanese receivers some of the discount houses are selling.

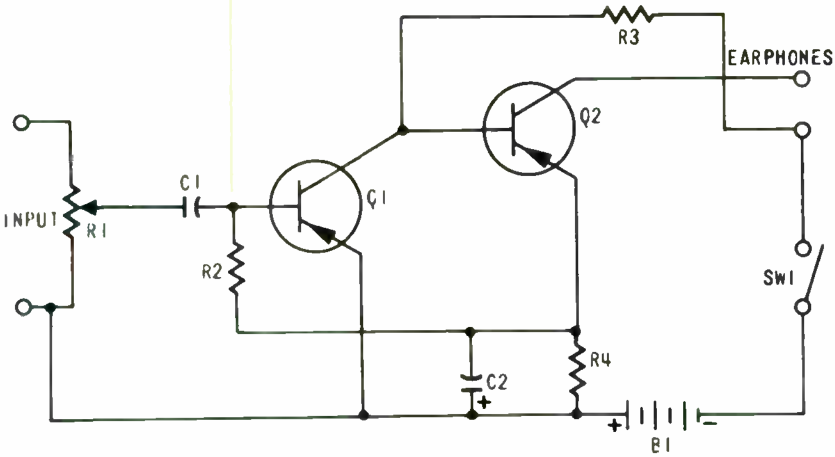
Construction is best left to your own requirements, although we found it convenient to build it into a pillbox for versatility's sake. Using the amplifier as a basis, you can come up with any number of ideas, not excluding shortwave reception! Simply check your catalogs for the frequency response specifications of germanium diode types, pick one that is rated fairly well at a high frequency (like 20 MHz), grid-dip an LC combination at the desired band, and you're in business. As long as your antenna is adequate and you have developed enough Q in your souped-up crystal detector, you should be pleased at the variety of stations that will come popping through the amplifier!

9

Crystal Set Audio Amplifier

Everybody at one time or another has built a crystal set. They are dandy little gadgets too irresistible to pass up, particularly for the youngsters. But each one lacks good sensitivity, a factor of dire importance if you happen to live more than 75 miles from a 50,000-watt AM broadcast station. This circuit will enable you to effectively soup-up your dormant IN34A crystal receiver to a point where you'll be outperforming some of those commercial TR radios that Japan is famous for. Construction is basic; it can be thrown together in just about any fashion—provided you watch for shorts and solid solder connections—and the results will surprise you.

Any number of conventional hobby-type PNP transistors can be substituted for Q1 and Q2. Check the reference listing at the rear of the book, however, before plugging them into their sockets. Also, the resistance value of the 75K potentiometer is not too critical. Actually, you can get away with a 1 or 2 megohm control quite satisfactorily.



PARTS LIST

TRANSISTORS:
Q1, 2—2N105
CAPACITORS:
C1—8 mfd, 10 WVDC electrolytic
C2—20 mfd, 10 WVDC electrolytic
RESISTORS:
R1—75K pot.
R2—15
R3—10K
R4—270
BATTERY:
B1—9v DC
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.

Warning: Take care that none of the 9-volt current reaches the crystal diode in such a manner as to cause breakdown. Throw a capacitor across the output of the crystal set if you feel your particular configuration may be prone to this kind of thing. Best bet, though, is to go ahead and try it "as is." If you lose (odds are in your favor), you are out one diode. Next time reverse the polarity and use NPNs.

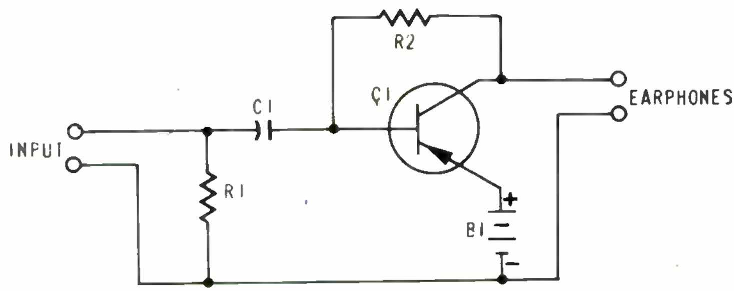
10

Powerful Headset Booster

Do you own a pair of magnetic headphones? Those old, reliable earpinchers seem to endure just about all the abuse you can dish out and still come back for more. The only problem, however, is that the vast majority (with impedances from 500-2000 ohms) lack something in sensitivity. Which is why many SWLs and amateurs use the compatible speaker on their receivers.

This dandy little booster, however, can solve all of that once and for all. Simply plug it in between the earphones and your receiver, recorder, CPO, or what-have-you, and you'll have more volume than you'll know what to do with. Particularly if you plan on using your magnetics in some of the two- and three-transistor projects in this book, you'll find that this oomph-box will do an amazing job in adding overall sensitivity to the system. In many applications you can crank the gain (on your receiver) up and place the headset on the table, using it both as a speaker and earphone! This is particularly helpful to amateur contest enthusiasts who simply don't have the time to bother with switches, cables, plugs, etc., while they're chasing DX. They simply crank up the gain, and "copy" by amplified earphone when they get tired of the physical closeness inherent with headset arrangements. Caution: You can't do this if you're using a crystal earpiece, or you'll quickly ruin the sensitive crystal element.

Quickie note: Looking for a quick modulator? Just reverse the input and output connections in the schematic, and you've got a dandy little modulator, for low-power transmitters, that allows you to use the magnetic earphone as a sensitive microphone!



PARTS LIST

TRANSISTOR:	RESISTORS:
Q1—2N105	R1—1.2K
CAPACITOR:	R2—68K
C1—.1 mfd	BATTERY:
	B1—9v DC

11

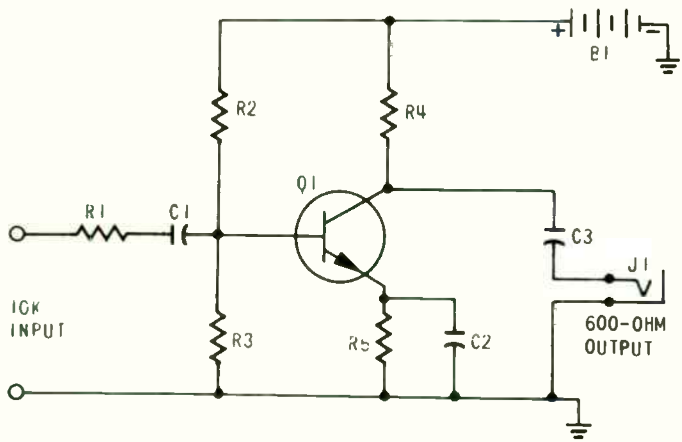
Low-to-High Z Headphone Adapter

Frequently we are faced with the problem of trying to run headphones from a high impedance source (in the area of 10K). Other than being well stocked on headphones in all impedances, we thought that it might be nice (and inexpensive) to be able to use the same set of phones for all equipment via an adapter or matching device. The result was a device that did the job but caused some signal loss.

An improved version did the job but included amplification to boost the signal enough to overcome the insertion loss. This is the version shown here. Build it on a 1" by 2" piece of Vector board, keeping wiring as direct as possible. A plug at the input and jack at the output will enable you to use the matcher without any grief.

PARTS LIST

TRANSISTOR:
Q1—2N1605A
CAPACITORS:
C1, C3—6 mfd
C2—50 mfd
RESISTORS:
R1, R2—100K
R3—11K
R4—5.1K
R5—1K
BATTERY:
B1—22 to 25 volts
MISCELLANEOUS:
J1—suitable jack



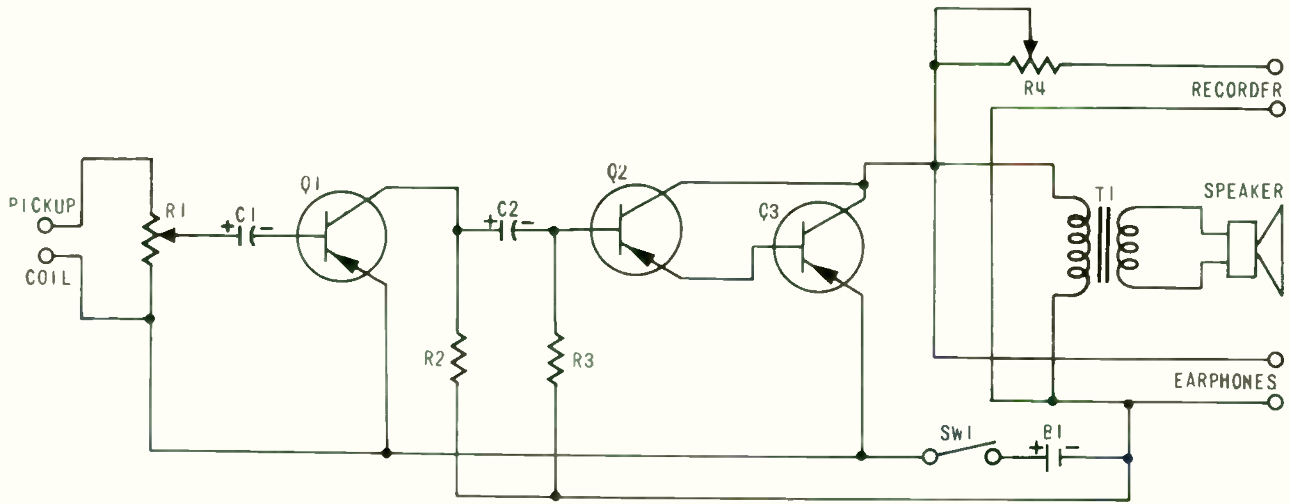
12

High-Gain Telephone Pickup

Ever wish you had facilities for amplifying a telephone conversation so that others in the room could hear what is being said? This high-gain transistorized preamplifier is especially designed with a telephone pickup in mind. It has more than enough amplification to provide room-filling sound, and it is non-permanent in that it utilizes a conventional coil-design pickup rather than a direct-line capacitively-coupled "tap." Consequently, it has no adverse effect whatever on normal telephone use, and it can be energized at the flick of a switch for full amplification of both sides of the conversation.

If you feel up to reworking the circuit installation, you can soup-up our design for reverse action. While it sounds complicated, it really isn't. What you do is hook a voice-actuator (available at amateur radio supply centers) to the input circuit, simply switch in at the plus (hot) side of C1 and the plus side of B1. Place the high-gain telephone amplifier nearer the phone than you, but pointing the speaker in such a way as not to induce annoying feedback. Under this arrangement your remote (VOX) mike now actuates the system thusly: When the other party is speaking, you hear his voice amplified at room volume. When you wish to speak, you talk into the pushbutton-operated VOX mike which then amplifies your voice in the same manner. The telephone mouthpiece "hears" the speaker, and you can relax as much as 30 feet across the room, knowing that your friend "hears" you at full normal volume.

This system, while expensive to the extent that the VOX investment is required, gives you a definite edge over just about


PICKUP
COIL
R1
C1
Q1
C2
Q2
Q3
R2
R3
R4
RECORDER
T1
SPEAKER
EARPHONES
SW1
B1

anything commercially manufactured for less than $125. Even without the refinements, however, this phone pickup amplifier provides top-quality performance. The pickup coil can be had from several suppliers (Consolidated Acoustics, Superex, Philmore, etc.) for anywhere from $.88 to $2.95. You can omit the AF transformer if you like, but there will be a noticeable decline in volume to your PM speaker if you do.

PARTS LIST

TRANSISTORS:
- Q1, Q2—2N105
- Q3—2N331

CAPACITORS:
- C1, C2—10 mfd electrolytic

RESISTORS:
- R1—75K pot.
- R2—10K
- R3—220K
- R4—1 meg pot.

BATTERY:
- B1—9v DC

MISCELLANEOUS:
- T1—Lafayette SK-96
- SW1—SPST. Oak type 200 or equiv.
- Speaker—Miniature (2 1/2") PM pickup coil—See text.

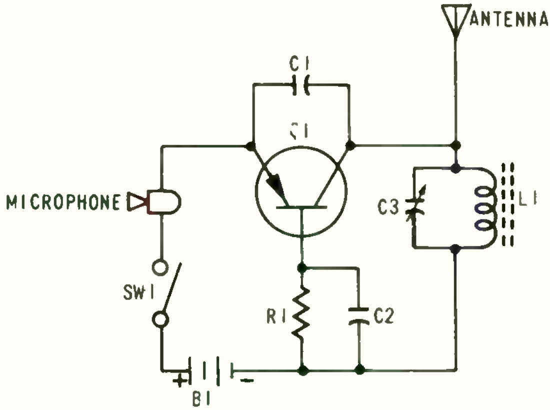
13

Wireless Mike

Whether used as an electronic baby sitter or as an experimental project, this miniature radio transmitter will fill the house with radio waves—for at least 50 feet! I think you'll find that if you select your components carefully—searching out the smallest parts available for the values indicated—you'll be able to put this together in a rather small case. I used an empty tuna fish can which worked out just fine.

To keep things as tiny as possible, you can use a subminiature iron core coil for "L" in the circuit. J. W. Miller has a coil with the part number 70F254AI which should fill the bill nicely. For the 365-pfd variable, you'll find that Lafayette has a nice little job in their catalog.

With all of the parts assembled, attach a 10-foot length of wire to the set as the antenna. Now, turn it on and place it with the antenna lying near a receiver tuned to a vacant spot on the dial. Place the microphone near the receiver's loud-speaker and tune the transmitter's variable capacitor slowly until you hear audio feedback. This will indicate that the transmitter and receiver are tuned up on the same frequency. Distance can be increased by using a good receiving antenna.



PARTS LIST

TRANSISTOR:
Q1—GE-9

CAPACITORS:
C1—100 pfd
C2—0.02 mfd
C3—365 pfd, variable

RESISTOR:
R1—51K

BATTERY:
B1—14v (Eveready 239)

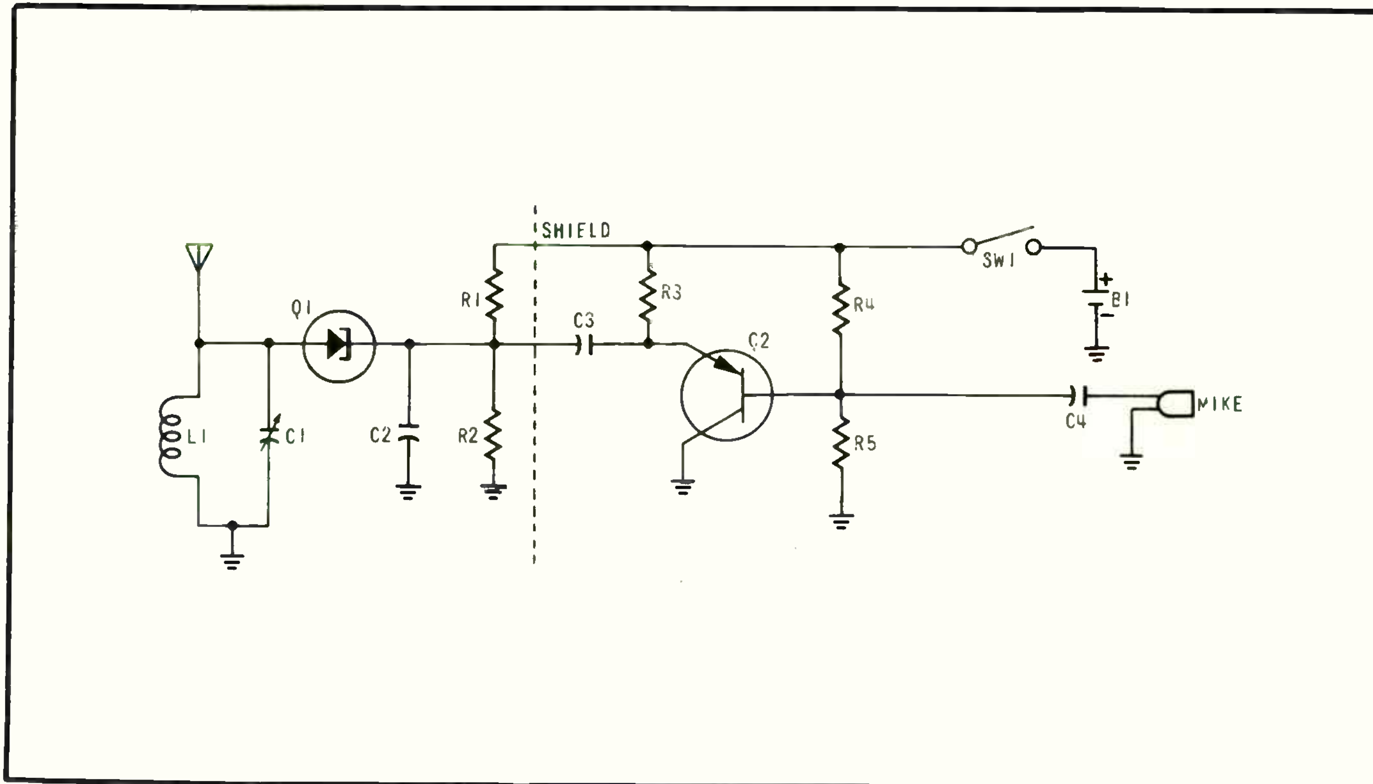
MISCELLANEOUS:
L1—250 µh coil (see text)
SW1—SPST. Oak type 200 or equiv.

14

Tunnel Diode FM Room Bug

Here's another FM wireless microphone circuit, but this one has a new twist—a tunnel diode oscillator. Actually, this is identical to one of those professional eavesdropping devices illustrated in "The Electronic Invasion," the book that exposed the snooping industry and the tactics employed. In actual operation, however, this "bug" makes a dandy electronic babysitter, room transmitter, one-way paging device, or what-have-you. The essential difference between this one and the usual one-transistor circuits, though, is its excellent modulation qualities and good output power.

The circuit shown here is designed to be built into a small metal case, similar to a walkie-talkie arrangement. The shielding indicated in the diagram is important, since it separates the oscillator section from the modulator and provides for good frequency stability. You can make this shield/divider by simply adding a sheet of cut aluminum, bent at one edge into a lip for mounting purposes, and inserting it halfway (in the middle) across the depth of the box. Then you can begin construction. There is nothing really tricky to worry about, providing you make all leads extremely short and to the point. The battery, a single penlite cell, should be mounted on a battery-clip holder and affixed to the inside wall of the


SHIELD
Q1
R1
R2
R3
R4
R5
C1
C2
C3
C4
L1
Q2
SW1
B1
MIKE

modulator section. The antenna (any piece of stiff hookup wire will do) should be about 4-3/4" long, although you might want to start with a piece about 5-1/4" long, snipping a 1/16th of an inch for maximum power transfer while you watch the receiver "S" meter or field strength meter.

Tuneup is a dream. Just find a clear spot on the 88-108 MHz band, and adjust C1 until you hear yourself through the FM microphone. Simple as that. Note: Do not use multiples of the antenna length indicated, or increase the DC voltage to the circuit, or you will cause your room "bug" to put out more signal strength than the FCC allows under Part 15 of the Rules and Regulations.

PARTS LIST

TRANSISTORS:
- Q1—1N2939 tunnel diode
- Q2—2N241A

CAPACITORS:
- C1—1.5 to 5 pfd variable
- C2—0.001 mfd
- C3—50 mfd
- C4—5 mfd

RESISTORS:
- R1—330
- R2—27
- R3—470
- R4—10K
- R5—12K

BATTERY:
- B1—1.5v penlite cell

MISCELLANEOUS:
- L1—6 turns of #16 wire, wound on a 3/8" open-air form
- SW1—SPST. Oak type 200 or equiv.

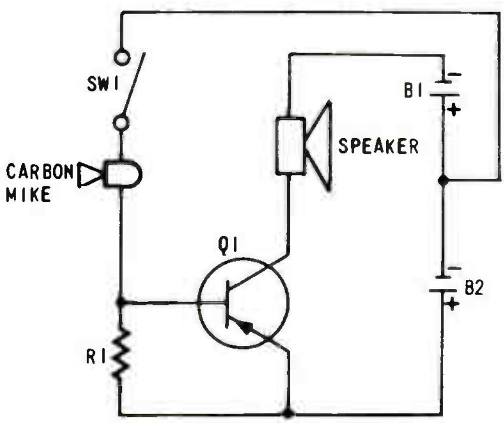
15

Low-Cost Megaphone

This little cheapie won't allow you to blast over three football fields, but surprisingly it will develop over 1/3 of a watt from just four batteries, an under-$1.00 transistor (if you shop around, you might turn one up for about 38¢), a 10¢ resistor, and a war surplus carbon microphone, which you can get anywhere for about 75¢. Amazing, yes, but don't expect miracles. Yet, a 3-ohm speaker can be put through its paces to the astonishment of friends, and you've got a circuit that will last.

The best part about carbon microphones is that they last just about forever. Fidelity they do not have one heck of a lot of, but for oomph, you can't beat them. And they'll withstand severe cold, mositure, hot sun, and harsh winds better than any mike ever developed, making them a necessity for a megaphone that can be used under all conditions.

If you like, you can use this circuit as a PA system, drawing power from your automobile. To do so, however, you'll have to resistively reduce automobile battery voltage so as not to damage either the mike or transistor. This can quite easily be accomplished with several 10-watt resistors connected across your ignition circuitry. For test purposes, grab a few high-wattage potentiometers and haul your multimeter out to the car. Run the largest pot across the plus and minus terminals of your battery and check the resultant voltage at various settings. Once you've gotten around 3 volts, transfer your lashup to the underside of the dashboard and try the same thing from the ignition switch to ground. Only this time, race the engine to see how high the voltage might go when the generator/alternator is pumping juice to the circuit. In most instances the setting difference between this hookup and that measured across the battery is no more than about 10%. Regardless, set the pot at a point approximately 3/4 of the distance between the battery test point and the ignition setting. Now switch to the ohmmeter to determine what value fixed resistor will be needed to do the same job. Once this



PARTS LIST

TRANSISTOR:
Q1—2N301
RESISTOR:
R1—12

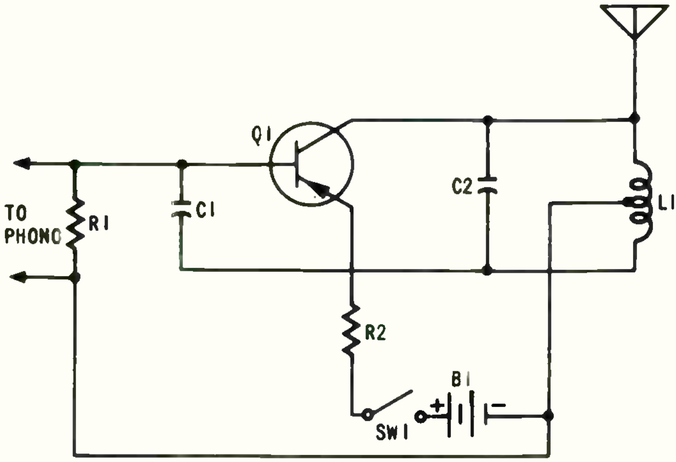
BATTERY:
B1, B2—3 volts (four pen-lite cells). For auto operation, see text.
MISCELLANEOUS:
SW1—SPST. For auto
Speaker—3 ohm

has been determined, you can mount the resistor near the microphone across the incoming plus and minus leads, switching it in and out when required on the same switch (a DPST) you use for the battery pack when the device is going to be employed as a megaphone. Even if you don't elect to keep it handy in the trunk of the car for versatile use, you'll be pleasantly surprised at the amount of power this extremely simple circuit provides. As an inexpensive megaphone, it can't be beat.

16

Wireless Phono Broadcaster

With this little demon on the job, you can be a big-time DJ, spinning platters which can be heard on all AM radios throughout the house. The few components involved can be wired together right in the base of your favorite phonograph, with a 10-foot wire antenna extending along the floor in back of the unit. Except for keeping the leads short, there are no special problems to be concerned about. The operating frequency is determined by L1, and the unit should work well with any ceramic phono pickup.



PARTS LIST

TRANSISTOR:
Q1—2N374

CAPACITORS:
C1—390 pfd
C2—365 pfd

RESISTORS:
R1—390K
R2—47K

BATTERY:
B1—9v DC

MISCELLANEOUS:
L1—Tapped variable loop-stick (Miller 2002)
SW1—SPST. Oak type 200 or equiv.

17

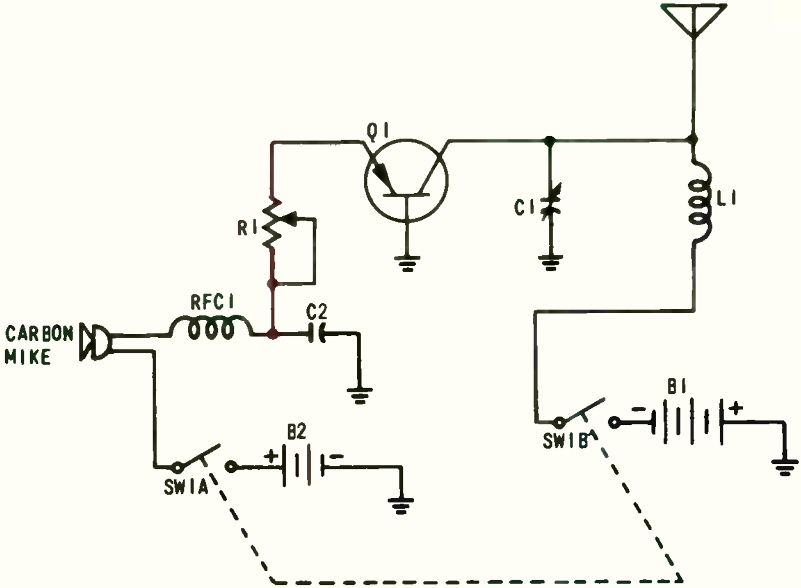
20-Minute AM Wireless Mike

Believe it or not, you can construct this simple AM wireless broadcaster in 20 minutes. It's perhaps one of the most basic circuits going, yet dependable and inexpensive to put together.

You can build it in just about any kind of chassis...from a small minibox to an ordinary plastic box which nuts and bolts come in. Nothing is particularly critical except the antenna: Keep it under 4 feet in length so as not to violate FCC Rules and Regulations, Part 15. (See introduction).

Notice that a carbon microphone (or simple carbon mike button) is used in the input. A 1-1/2v DC battery must be rigged into the circuit in order for this to properly modulate the transmitter. To tune, merely adjust C1 until you hear your signal "plop" onto an unused frequency in the AM broadcast band. Once achieved, adjust R1 for best modulation.

Presto! You're on the air!



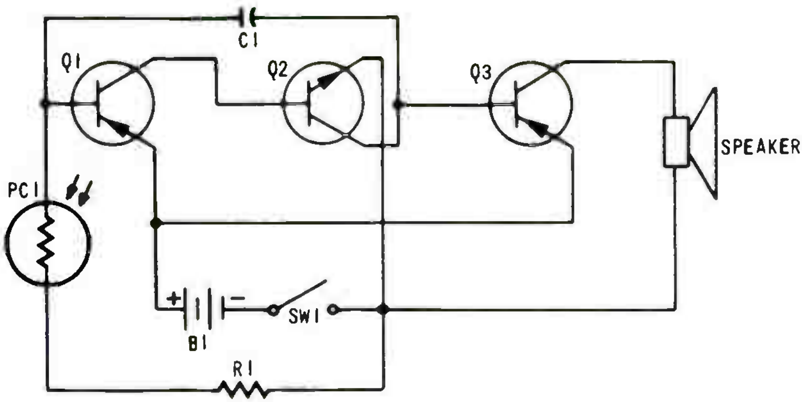
PARTS LIST

TRANSISTOR:
Q1—GE-2
CAPACITORS:
C1—375 pfd, variable
C2—.22 mfd
RESISTOR:
R1—5K pot.
BATTERIES:
B1—22 1/2v DC
B2—1 1/2v DC
MISCELLANEOUS:
L1—Standard-type ferrite loopstick. Or use J. W. Miller #70F254AI.
RFC1—2.5 mh RF choke. National R-100.
SW1A, B—DPST. Oak type 200 or equiv.

18

Light-Activated Audio Oscillator

Interested in electronic music? Would you believe a transistorized rooster? Or a gadget—perish the thought—that'll wake up the missus automatically as you silently glide into the driveway at 2 AM? Well, this dandy circuit can do all of these questionable things, and then some. Basically, it's nothing more than a photoelectric cell hooked into a CPO-variety audio oscillator. Since the TR oscillator depends upon applied voltage for tone frequency control, the amount of light that hits the photocell will noticeably alter the resultant audio pitch. As a simple music-maker, it can't be beat.



PARTS LIST

TRANSISTORS:
Q1—2N105
Q2—SK3011
Q3—2N1359
PHOTOCELL:
PC1—International Rectifier CS-120-M6
CAPACITOR:
C1—.15 mfd
RESISTOR:
R1—10
BATTERY:
B1—6v DC, 4 penlite cells.
MISCELLANEOUS:
SW1—SPST
Speaker—4-8 ohms

You simply move your light around, occasionally hitting the photocell square on the head. Other variations on the musical theme can include a battery of lamps of different wattages. All you do is switch them on in the sequence you desire. One piano player we know rigged up a keyboard from a child's chord organ with microswitches and then fed these to lamps which varied in intensity with each note by 2-1/2 watts. Sure didn't sound like Radio City, but it carried a tune amazingly well!

For the rooster bit, simply mount the photocell remotely out-of-doors; for example, just outside the bedroom window or on a rooftop, carefully insulating the connections so rain doesn't short-circuit them. Run the wires down to the audio oscillator, and you've got an alarm clock that will always get you up at the crack of dawn. (Watch out for cloudy days!)

If you are that foolish (or perhaps your wife has already read this page) the same "remote installation" technique can be employed at the garage door where it will respond to auto headlights. Just run the wires to the house where the oscillator is located. Note: If these outside jobs are planned, rig a cutoff switch at the 6-volt supply battery so it won't go on screeching all day!

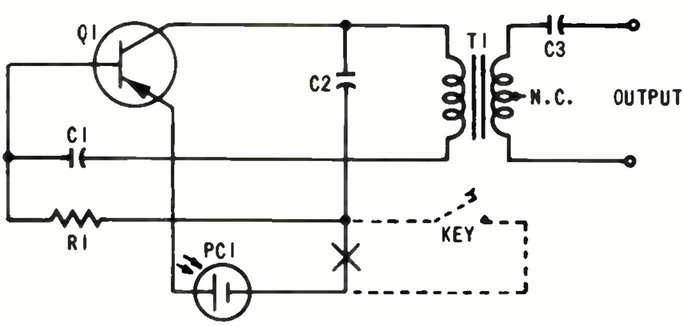
Construction is quite simple. You can even substitute a different capacitor value for C1 if you like, providing it's fairly close to .15 mfd. If too much light hits the photocell, the circuit won't function. In that case, raise the value of R1. If long distances must exist between PC1 and the rest of the circuit, you may find that removing R1 altogether improves response.

19

Light-Powered Oscillator

Another dandy circuit for just about everybody, this little gem can be adapted for a number of various operations. Using a photocell for activation, it can serve as a light-alert that will sound off as darkness approaches (great for remembering to call the kids in during the summer), as a pocket novelty, or, perhaps most usefully, as a batteryless code practice oscillator. Particularly for those studying for Novice exams, this CPO is extremely useful. It can be built for almost nothing, compared with going prices for commercial code oscillators, and requires no battery replacement—ever. It will theoretically run forever, providing the photocell isn't cracked by accidental dropping.

Due to the new technology in photoelectric cell development, the inexpensive S3M will provide output anywhere from .2 to



PARTS LIST

TRANSISTOR:
Q1—2N527
PHOTOCELL:
PC1—International Rectifier S3M
CAPACITORS:
C1—.05 mfd
C2—.1 mfd
C3—.05 mfd
RESISTOR:
R1—12K
MISCELLANEOUS
T1—Argonne AR-162 transformer

1 full volt, depending upon proximity to light. Also, this factor governs pitch, which will be anywhere from 500 to 2000 Hz accordingly. But the best thing about it is that normal room lighting will activate the oscillator, allowing for portability, school project displays, and what-have-you. For science fairs, try rigging up several different light intensities, for example, using a room dimmer (any hardware store has them for about $7). Often differences in lamp wattage the human eye can barely detect will strongly affect oscillator pitch—great for "magic" effects.

Wiring isn't critical, except that the further away the photocell is from the circuit, the less response can be expected at extremely low light levels. This is due to inherent resistance in the wire. If you want to employ the circuit as a code practice oscillator, insert your key at "X" in the schematic, breaking the existing wire.

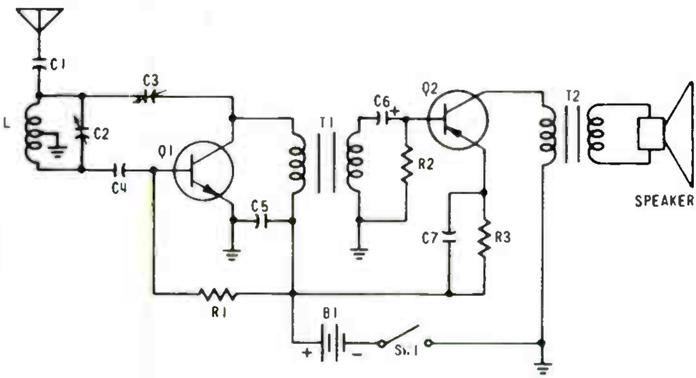
20

AM/SW Receiver

This little receiver is a real winner, despite its simplicity. Utilizing three coils, the receiver will cover the standard broadcast band, 1.6 to 4 MHz, 4 to 12 MHz, or even the entire range of 550 kHz through 12 MHz, and it will do a pretty good job, too. A regenerative-type receiver, it may be constructed on any chassis material you have on hand. The one thing to remember is to keep all leads short and neat.

The coils are wound on 1/2-inch forms from #30 enameled or single silk-covered wire. The broadcast band coil (550 kHz to 1.6 MHz) consists of 450 close-wound turns (about 5 inches); the 1.6 to 4-MHz coil is 70 turns (about 1/2 inch), and the high-frequency coil is 25 turns (about 1/4 inch). Each coil is tapped a few turns from the base end of the windings, and each tap is chassis-grounded. When constructing the circuit, the coils can be made up to be plugged temporarily into the circuit so that full frequency coverage may be achieved. If only one band is desired, simply solder the particular coil into the circuit.

Being a regenerative set, it will be necessary to adjust the regeneration to keep the set working. To do this, tinker with C3 until the set goes into oscillation (it will cut off sharply) and then backtrack slightly to the point where the set starts operating again. The frequency is varied by adjusting C2. Use a 50-foot length of wire as an antenna.



PARTS LIST

TRANSISTORS:
- Q1—2N849
- Q2—2N217

CAPACITORS:
- C1—100 pfd
- C2—365 pfd, variable
- C3—100 pfd, variable
- C4—0.01 mfd
- C5—0.05 mfd
- C6, C7—10 mfd, 10-volt electrolytic

RESISTORS:
- R1—1.6 meg
- R2—110K
- R3—91

BATTERY:
- B1— 9v

MISCELLANEOUS:
- T1—Driver transformer, 10K pri, 2K CT sec, 1.5 ma
- T2—Output transformer, 500-ohm CT pri, 8-ohm sec, 5 ma
- L—See text
- S1—SPST
- Speaker—8-ohm miniature

21

Sensitive Broadcast Receiver

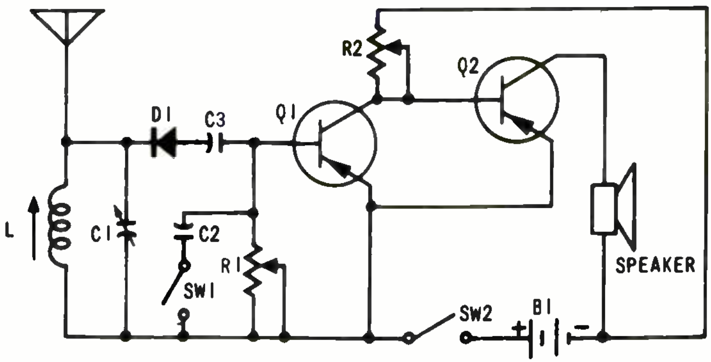
Although a relatively simple and direct circuit, this broadcast receiver will really pull 'em in when connected to nothing more complicated to a 100-foot hunk of wire. It builds beautifully on a hunk of Vector board with no particular problems to be on the lookout for.

PARTS LIST

TRANSISTOR:
Q1—2 - 2N374
DIODE:
D1—1N34A
CAPACITORS:
C1—365 pfd variable
C2, 3—.05 mfd
RESISTORS:
R1, 2—50K pot.

BATTERY:
B1—9v
MISCELLANEOUS:
L—Loopstick (Miller 6300)
SW1—2 SPST. Oak type 200 or equiv.
Speaker—8 ohms

When you get the receiver put together, you'll notice it has it's fair share of switches and knobs for such a little set, but they all play their part in making this set different and better than many other similar units. The combination of C2 and S1 perform the duties of a base/treble control, C1 is the station selector, and R1 is the volume control; R2 also controls output (do not set at maximum resistance).



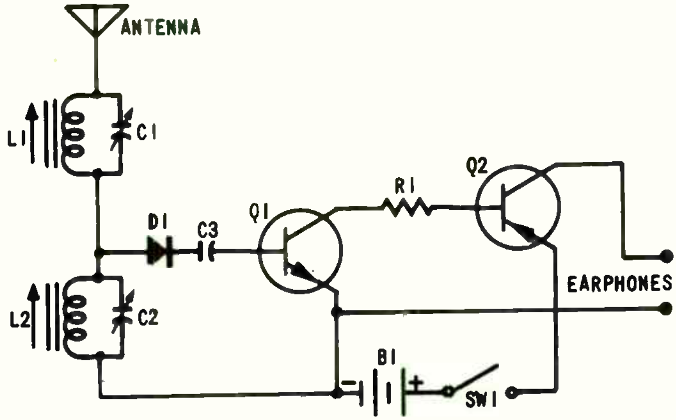
22

High Selectivity AM Receiver

The primary fault of most simple-to-construct AM broadcast transistor receivers is their inherent lack of selectivity. Several we've constructed didn't act much better than a conventional 1N34A crystal set as far as strong station rejection goes. This souped-up 2-transistor set, though, has a unique added feature: An extra stage of selectivity guaranteed to do the job. And the best part is that the whole thing can be thrown together for about $3.25 (as little as $2 if you know where to hunt for components).

The heart of this gem is the second LC combination, designated as L2/C2 in the schematic layout. In operation, you have two separate and distinct tuning circuits working together for optimum selectivity. Operation is simple. Just adjust C2 to tune in the desired AM station, and tune C1 to reject any strong unwanted signals that tend to interfere. Simple? In use, you may find better results by tuning L1 and C2 together at first to arrive at the best permanent position of L1's slug. Suggestion: Open capacitor C1 halfway, then tune L1 until a signal about midway up the AM band is tuned in. Leaving L1 at this setting should permit your catching the entire band with C1.

The entire project can be built into a good-size pillbox or even a cigarette-pack-sized commercial plastic container. The only construction precaution is to make certain that L1 and L2 are far enough apart to insure against coupling. For best results, place them at right angles to each other.



PARTS LIST

TRANSISTORS:
- Q1—GE-5
- Q2—2N105

DIODE:
- D1—1N38B

CAPACITORS:
- C1, 2—Miniature 365 pfd
- C3—.02 mfd

RESISTOR:
- R1—1200

BATTERY:
- B1—9v

MISCELLANEOUS:
- L1, 2—Lafayette 34C 8705 ferrite loopsticks
- SW1—SPST

23

High-Gain Broadcast Receiver

Disappointed with the performance of your homebrew transistor AM receiver projects? Well, we don't blame you one bit. Many aren't more than souped-up crystal radios, and they work every bit as well. This circuit, though, is for the experimenter who's tried them all. A quick glance at the circuit will confirm its uniqueness.

No claim is made that this little gem is going to blow a 10" PM speaker to smithereens, but we will guarantee some really fine RF gain, something lacking in most 3-transistor configurations. With this receiver, you should be able to pick up just about every AM broadcast signal on the band. And if you're pleased with its sensitivity (and you will be), you might even entertain the thought of souping up its "front end" by tacking on the lower LC configuration shown at the left of the schematic in the "High Selectivity Receiver" project a few pages back. This combination (selectivity/sensitivity) will be hard to beat.

Construction is simple, although precaution should be taken to insure against transistor leakage. Particularly in direct-coupled designs such as this one, it pays to try substitutions of identical-type transistors, since nearly all factory-fresh products exhibit some leakage. By narrowing it down to the lowest possible figure, you'll be amazed at how well this little demon will perform. Additionally, it won't hurt to tinker a bit with the value of C4. Try a .001-mfd ceramic to begin with. If you detect unwanted oscillation, lower this value to .0005. Keep reducing the value of C4 in this manner until oscillation disappears.

PARTS LIST

TRANSISTORS:
- Q1, 3—GE-7
- Q2—2N105

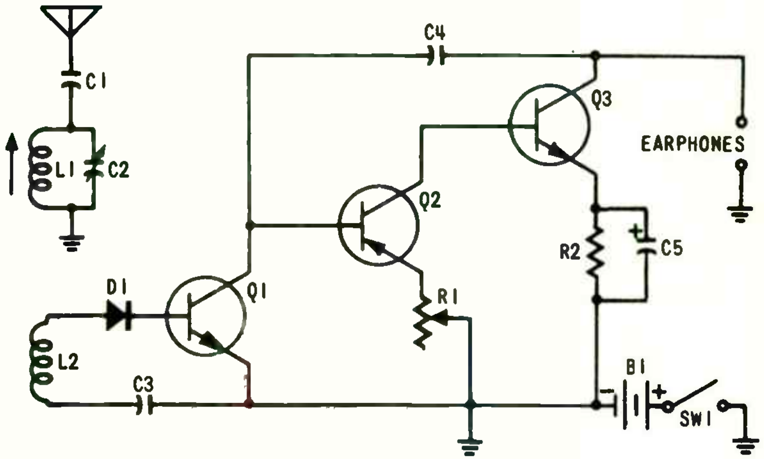
DIODE:
- D1—1N34A

CAPACITORS:
- C1—50 pfd
- C2—365 pfd miniature variable
- C3—.5 mfd
- C4—.001 mfd or smaller. See text.
- C5—10 mfd, 10 WVDC electrolytic

RESISTORS:
- R1—75K pot.
- R2—1.5K

BATTERY:
- B1—Four 6v, penlite cells

MISCELLANEOUS:
- L1—Standard ferrite loopstick
- L2—4 turns #25 cotton-covered wire wound in same direction as L1 turns. Wind around L1.
- SW1—SPST. Oak type 200 or equiv.



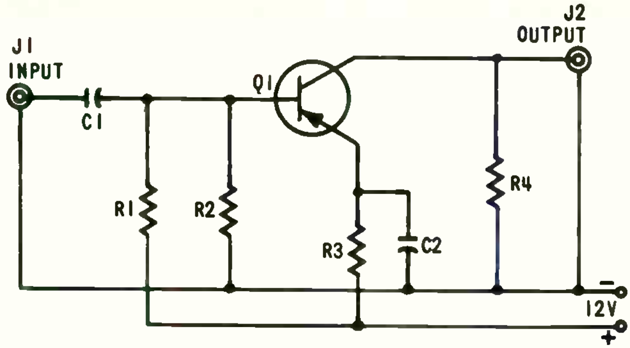
24

AM Radio Reception Booster

Designed primarily to soup up sagging reception in an ancient household radio, this little gadget worked out so well that it was tried as a booster for a communications receiver (on broadcast band frequencies) and became a permanent part of several DX receiving stations hereabouts.

You can build the booster into a small plastic or aluminum box, using a piece of Vector board or cardboard for the chassis. The handful of parts required can be arranged to suit the size of the chassis/container, but keep the input and output of the booster on opposite sides of the unit.

The booster was designed to receive its power from a 12-volt source within the receiver (the filament pin of a 12-volt tube in the audio section was handy), which enabled the booster to be turned on and off with the receiver. The negative contact in the booster connects to the receiver's chassis, but if the receiver is an AC/DC set, use a battery for the booster power rather than the tube-pin/chassis lash-up. The battery is connected to the circuit (observing polarity) as shown at the "12v" point on the schematic.



PARTS LIST

TRANSISTOR:
Q1—2N269
CAPACITORS
C1—0.01 mfd
C2—0.1 mfd, 1000 WVDC mylar

RESISTORS:
R1—3.4K
R2—113K
R3—100
R4—2.3K
MISCELLANEOUS:
J1, J2—Standard phono jack

25

Borrowed-Power AM Receiver

A speaker-driven transistor radio that requires no batteries? A few years ago this would have quickly been dubbed "impossible" and let go at that. However, as you can see in this circuit, it is not only possible, but indeed practical! This unique receiver configuration will tune the entire 550-1600 kHz AM broadcast band. The "battery"—actually a 1N38B germanium diode—picks up the strongest signal on the air (even though it may not be the one you are listening to) and "steals" a few microvolts of RF, converts it to DC, and uses it to power the receiver. This is the identical system now being engineered for air-powered eavesdropping devices and minature transmitters that can be permanently installed, without regard to battery failure or replacement.

Construction of this project is fairly straightforward, but it should be borne in mind that in order to develop enough power to satisfactorily drive a PM speaker you'll have to supply one heck of an input. Which brings us to the antenna-ground system. Ideally, your antenna wire should be high in the air (as much height as you can muster) and at least 75 feet long. Pre-

PARTS LIST

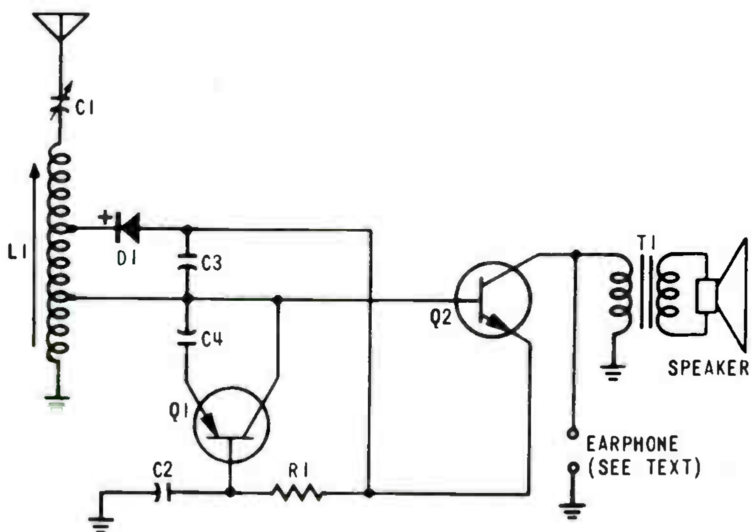
TRANSISTORS:
- Q1—2N105
- Q2—GE-5

DIODE:
- D1—1N38B

CAPACITORS:
- C1—365 pfd variable
- C2—.5 mfd
- C3—500 pfd
- C4—.002 mfd

RESISTOR:
- R1—270K

MISCELLANEOUS:
- L1—Ferrite loopstick with taps at the 6th and 30th turns.
- T1—Lafayette SK-96
- Speaker—4 - 8 ohms



cautions should be taken that adequate insulation is provided along the line. A ground wire should be used also—#14 (or #12) solid-conductor copper wire running from the receiver to a steel post driven at least four feet into the ground, preferably in a location where the ground is usually moist. (Near a downspout is a good spot for most installations of this nature). If you are willing to forego the speaker for a crystal-type earphone or headset, you may find that you won't need quite as elaborate a system, although some form of "long wire" antenna is still required.

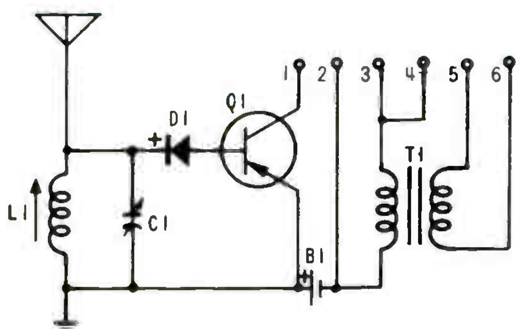
Naturally, the closer you are to a 50,000-watt AM broadcast station, the better your receiver will function, since it will be able to "steal" proportionately more voltage to drive the transistors. On the other hand, if you are quite far away from such a station, yet remarkably close to a high-power TV station, you can separate the diode from the loopstick, employ a fixed-tuned LC grid-dipped to the proper VHF frequency, and substitute a high-frequency diode for the 1N38B. Surplus 1N21s are worth a try.

26

Universal Output AM Receiver

Almost everyone has at one time or another built a one-transistor, one-diode AM receiver, only to find out later that hooking up a conventional earphone just didn't seem to work out. The reason is that the transistor inherently has a high-impedance output, thereby making it only suitable for use in conjunction with high-impedance magnetic-type headsets. Redesigning the output as shown in the schematic, however, will solve this problem once and for all. Actually, what you are doing is adding a host of output combinations, including several with a matched output audio transformer. This little component can make all the difference in the world, though the magazines would lead you to believe otherwise. All you have to do is rig up your new radio in a small box and install either six Fahnestock clips or six suitable binding posts. From then on, sit back and enjoy the dividends of your project.

In operation, your combination of connections depends entirely on what type of headset you intend to use. For example, if you have a pair of 600-ohm Army surplus magnetic phones, connect it to clips numbers 1 and 2. Do the same with high-impedance magnetics. For crystal phones, run a jumper from clip 1 to clip 3 and connect the phones to clips 2 and 4. For low-impedance dynamic earphones, connect the phones to clip 5 and 6 and run your jumper wire from clip 1 to clip 3.



PARTS LIST

TRANSISTOR:
Q1—GE-2
DIODE:
D1—1N38B
CAPACITOR:
C1—365 pfd miniature variable

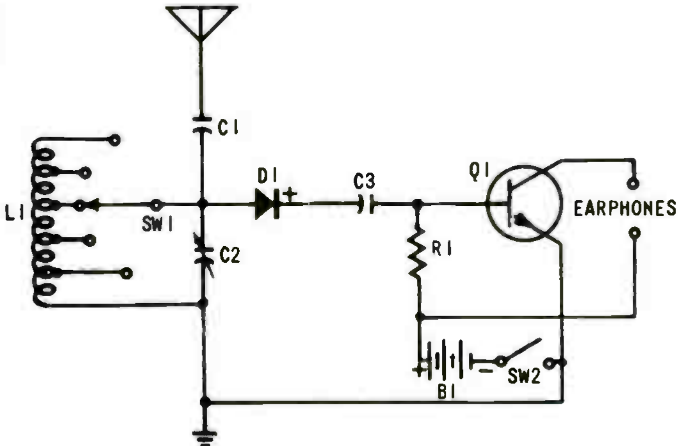
BATTERY:
B1—1 1/2v penlite cell
MISCELLANEOUS:
L1—Ferrite loopstick
T1—Audio output transformer; 300-ohm primary, 6-ohm secondary.

27

Variable-Selectivity Receiver

If you are not "in" with the advante garde of the crystal-set bunch, chances are your front end isn't up to date. Here's a circuit that combines the most popular crystal/transistor configuration with a sophisticated tapped coil-capacitor design that will really bring you up to date. The idea is to combine the versatility of C2, which is variable, with a choice of coil lengths, provided conveniently here by tapping a homebrew 175-turn version at appropriate steps. The result is that once a station has been tuned in with C2, it can be brought out of the noise by simply switching SW1 until maximum signal level is received. By so adding Q to the circuit, you'll have a dandy receiver that will outperform them all (at least in its class).

Care should be taken during the tapping procedure to insure that the coil is not broken at any point along the line. Particularly when working with fine wire (such as the #28 called for in this circuit) extreme care must be exercised during soldering. Also, check to insure against insulation-burn, which could easily short out turns and consequently lower overall Q. A good junkbox should yield most of the parts necessary for construction, although if you are willing to part with a few dollars, you can subminiaturize the whole thing and pack it nicely into a pillbox. If you like, you can use a higher voltage than that shown, using a 1 meg potentiometer between the plus side of B1 and ground to adjust for optimum performance. Don't exceed six volts, however, or you'll lose your transistor!



PARTS LIST

TRANSISTOR:
Q1—GE-5
DIODE:
D1—1N38B
CAPACITORS:
C1—.005 mfd
C2—365 pfd variable
C3—.05 mfd
RESISTOR:
R1—10K

BATTERY:
B1—3v, two penlite cells. (see text).
MISCELLANEOUS:
L1—175 turns of #28 insulated wire, close-wound on a 3/8" form and tapped at 50, 100, 125, and 150 turns.
SW1—5-position rotary
SW2—SPST

28

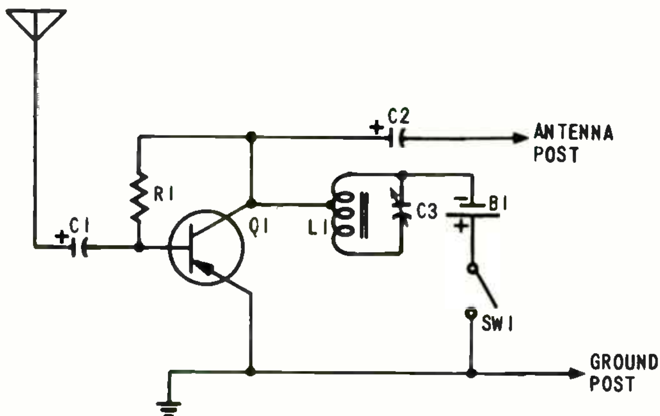
BC Band Booster/Preselector

Whether you are a crystal-set addict or an out-and-out broadcast band DXer, this powerful preselector/booster will add considerable performance to your receiving setup by preamplifying the signals before they get to your receiver! Just as the hams and CBers use RF preamps, this inexpensive gadget will boost the distant stations you've been trying to pull through the noise, in addition to adding another selectivity stage to the existing front end of your set.

If you plan to use this on a conventional tube-type radio, just run the wire from C2 to the antenna post on the radio. If none is visible, and it becomes evident that some kind of self-contained antenna is being employed, locate it by looking for a loop or ferrite core. Disconnect the inside antenna, replacing it with the antenna wire of C2. Run the inside antenna core wire to the antenna input (shown at the left of the schematic) of the booster/preselector. Ground the booster to the receiver chassis, after checking first to make sure the chassis isn't "hot" (some of the older AC/DC sets are). If you want to add pazazz to your crystal set receiver, just connect the output leads on the booster to the antenna and ground posts of the crystal set. Simple as that.

Operating (tuning) is a pleasure. Just tune in the station you are going to listen to on the master receiver. Then tune C3 until you hear a marked increase in signal strength. Actually, what is happening is that all the Q from the preselector is being tuned to that frequency, eliminating the chance of adjacent-channel interference, or at least minimizing it considerably. Use this double-tune method whenever you're looking for those rare ones.

NOTE: If you construct L1 exactly as described, your preselector will be so sharp that simple tuning at one end of the band on the receiver, while the booster is tuned to the other, may let you in for a surprise: You may actually lose stations! This is only superficial (due to the extremely high Q of the circuit), and can be quickly remedied by adjusting C3 for maximum.



PARTS LIST

TRANSISTOR:
Q1—2N501

CAPACITORS:
C1, 2—.02 mfd, 200 volts
C3—409 pfd variable (do not substitute a 365 pfd)

RESISTOR:
R1—39K

BATTERY:
B1—1 1/2v penlite cell

MISCELLANEOUS:
L1—70 turns slightly spaced on a 4" long, 3/8" diameter ferrite core. At the 70th turn, draw off a tap (which goes to Q1) and then wind another 10 turns close together. At the 80th (and last) turn, run the wire to the side of C3 that is connected to the minus side of B1.
SW1—SPST. Oak type 200 or equiv.

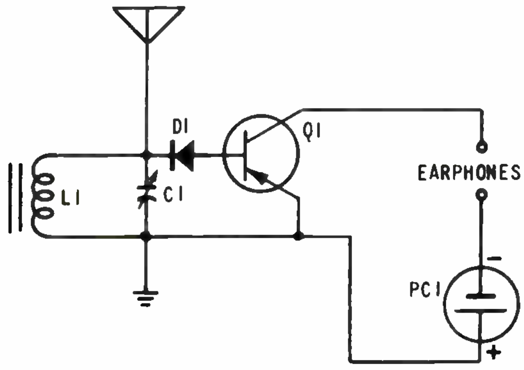
29

Solar-Powered Receiver

The ever-popular photoelectric sun batteries have found a variety of uses in space vehicles, amateur transmitters, science projects, etc. In this circuit, an International Rectifier type S1M is used to power a simple, one-transistor broadcast band receiver. During the day, the photocell can be activated extremely well by placing it so that it catches the direct rays from the sun. At night, close proximity to any bright household lamp will also turn on the music. There are no batteries to wear out, and the dandy little receiver will virtually play forever, with no maintenance or parts replacement required.

The loopstick antenna coil can be just about any standard type normally found in junkboxes full of parts stolen from old crystal sets, TR radios, etc. If not, all the major suppliers have them and they're quite reasonable. Ignore the center tap usually found on the J.W. Miller Type 2001 coil; it isn't needed here.

You can build this set in practically any kind of container you wish, although the sun battery does have to be externally mounted and located not too far from the receiver. The reason for this is that long lengths of wire between the photocell and receiver will add resistance along the line, lowering the voltage.



PARTS LIST

TRANSISTOR:
Q1—2N105
DIODE:
D1—1N38B
PHOTOCELL:
PC1—S1M
CAPACITOR:
C1—365 pfd miniature variable
MISCELLANEOUS:
L1—Loopstick antenna coil (see text)

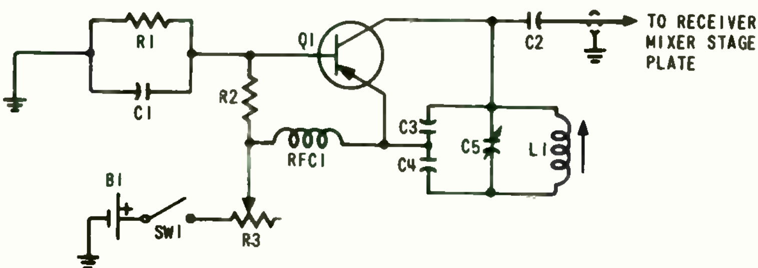
30

Q Multiplier 1400-kHz IFs

Everyone knows the value of having a Q-multiplier on the receiver, but just try to get one that will work on anything but 455 kHz IFs! Although a host of commercially-made multipliers and magazine project circuits exist which can be adapted for other IFs, a great deal of work is required and impedance matching becomes a significant problem. The schematic shows a dandy Q-multiplier that will really add pazazz to your

1400-kHz IF shortwave receiver and requires no elaborate matching devices.

The Q-multiplier can be designed as an outboard peaking device (similar to the Heathkit arrangement), or you can build it right into your receiver, bringing the shaft of C5 through the panel, permitting external tuning. Likewise, you can also put knobs on R3 and L1 for the ultimate in Q-multiplier versatility and performance.



PARTS LIST

TRANSISTOR:
Q1—2N1742. See text.

CAPACITORS:
C1—1 mfd
C2—1-3 pfd
C3—100 pfd
C4—2 mfd
C5—10 pfd variable

RESISTORS:
R1—150K
R2—5K

BATTERY:
B1—1 1/2v penlite cell

MISCELLANEOUS:
L1—Iron core, 1400-1450 kHz coil, 120-130 MH.
RFC1—1 mh RF choke
SW1—SPST. Oak type 200 or equiv.

The lead to the plate of the mixer stage in the receiver should be shielded. The coil (L1) should have a high Q and for 1400-1450 kHz should be an iron core unit having a value of 120 to 130 microhenries. You can substitute an RCA 2N544 or Amperex OC-170 transistor for Q1, but you should allow for a change of resistance in R2. If you elect to make the substitution, use a potentiometer that will permit your trying 3K to 40K ohms on for size. Once determined, you can substitute a permanent 1/2-watt resistor, and you're in business.

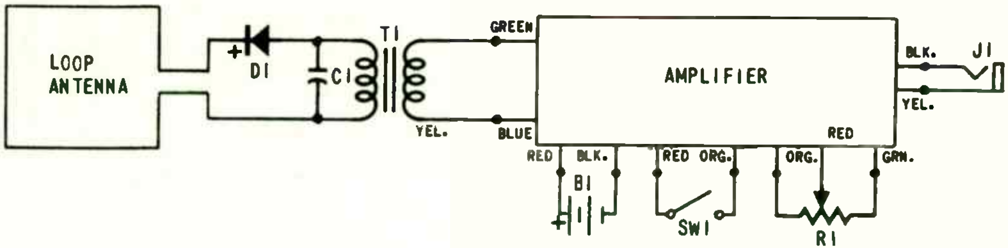
31

VHF Aircraft Receiver

Just about anyone who flies today has a normal curiousity about the "private" conversations between the pilot and ground station operator. The problem has been, however, that both FCC and FAA regulations specifically prohibit in-flight use of receivers by passengers, for fear that the receiver itself might interfere with transmissions under certain conditions. The regulation applies not only to superregenerative receivers but to the "quiet" (as far as oscillator circuit is concerned) superheterodynes, which leaves our curious airborne friend without a receiver of any kind capable of tuning the VGF spectrum.

This circuit, then, is a compromise and has been used on numerous occasions during flights of commercial jet airlines. It can be built about the size of a cigarette pack (or slightly larger) and will enable you to intercept pilot-to-ground transmissions without violating FAA regulations. The reason is that it has no oscillator circuit at all! Instead we've employed a germanium diode to do the detecting, and a standard printed-circuit board Lafayette amplifier to accomplish the amplification.

The key to successful snooping is the loop antenna, which can normally be built into the frame (or rim) of a plastic case lid designed to house the crystal receiver. By simply twisting the entire unit about (near the window), you should be able to obtain excellent reception. If you detect a hum (internal power



PARTS LIST

AMPLIFIER:
Lafayette PK-522

DIODE:
D1—1N38B

CAPACITOR:
C1—.002 mfd

RESISTOR:
R1—5K pot.

BATTERY:
B1—9v

MISCELLANEOUS:
T1—Lafayette TR-120
J1—Phone jack
SW1—SPST. Oak type 200 or equiv.
Antenna—Homemade 4 3/4 x 2 3/4" loop

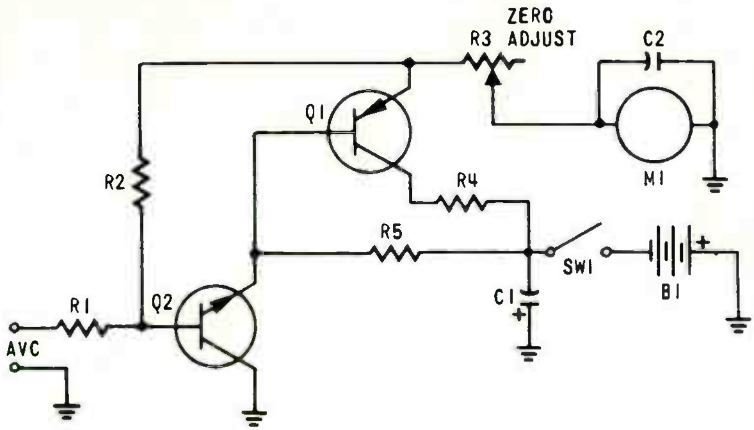
lines in the plane), merely reorient the loop in such a way as to null out the hum while retaining good reception of aircraft transmissions. Naturally, you won't be able to hear the ground control station's signals except during takeoff and landing, but it sure makes interesting listening anyhow. By using a standard dynamic or crystal earpiece, other passengers will assume you're using a hearing aid.

32

"S" Meter

With this neat schematic you can add an "S" meter to just about any receiver you might happen to have around that has built-in AVC circuitry. It can be built into the receiver itself or as an outboard add-on for versatility. It uses a miniature 0-1 milliameter as the meter readout, and R3 serves as the zero-adjust control. Two commonly-available transistors, a 2N438A and 2N416, are used to amplify the signal.

The "S" meter can be built into a small minibox and easily coupled to any ham transceiver, CB rig, shortwave receiver, or what have you, although R1 may have to be adjusted somewhat, depending on incoming AVC voltage. If decibel referencing is used, bear in mind that approximately 6 db equals one "S" unit. If direct readings are to be interpreted, three-quarters of the meter scale should represent S9, while the furthest possible indication (needle all the way to the right) is about 60 db over S9.



PARTS LIST

TRANSISTORS:
- Q1—2N416
- Q2—2N438A

CAPACITORS:
- C1—500 mfd, 12 WVDC electrolytic
- C2—.01 mfd

RESISTORS:
- R1—1 meg
- R2—56K
- R3—15K
- R4—1K
- R5—470K

BATTERY:
- B1—9v

MISCELLANEOUS:
- M1—0-1 milliammeter
- SW1—SPST. Oak type 200 or equiv.

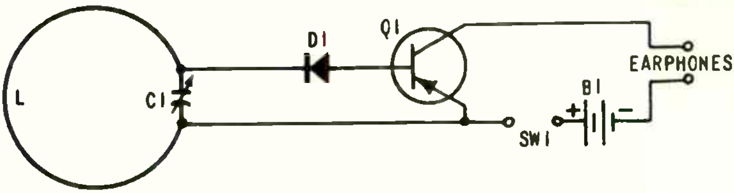
33

Simple FM Receiver

This easy-to-build receiver will allow you to hear nearby FM broadcast stations or the sound channel of TV stations, providing they are not too distant. No, it doesn't have a great deal of selectivity or sensitivity, but it's ideal for those living in metropolitan areas or those close to transmitting towers. Heart of this gadget is the loop antenna, bent from a 16" length of #12 copper wire and soldered directly to the stator and rotor lugs of C1, a 20-pfd midget variable capacitor.

In operation, you might want to try reversing the polarity of the 1N34A diode to see in what position you get best results. It is imperative that you use Hi-Z (high impedance) magnetic earphones with this receiver. Crystal earphones, dynamics, etc., won't match properly and the resultant volume will be too low.

If you'd like to try other frequency ranges, simply enlarge or decrease the diameter of the loop antenna. For the aircraft band, for example, you might want to reduce the antenna's diameter to about 14", while 20" might be just the ticket for 30-50 MHz snooping. Once you've arrived at a listening frequency, rotate the loop for improved performance. Then clip to the loop a 3-foot piece of stiff wire. This additional antenna wire should be alligator-clipped on the loop where best reception is attained.



PARTS LIST

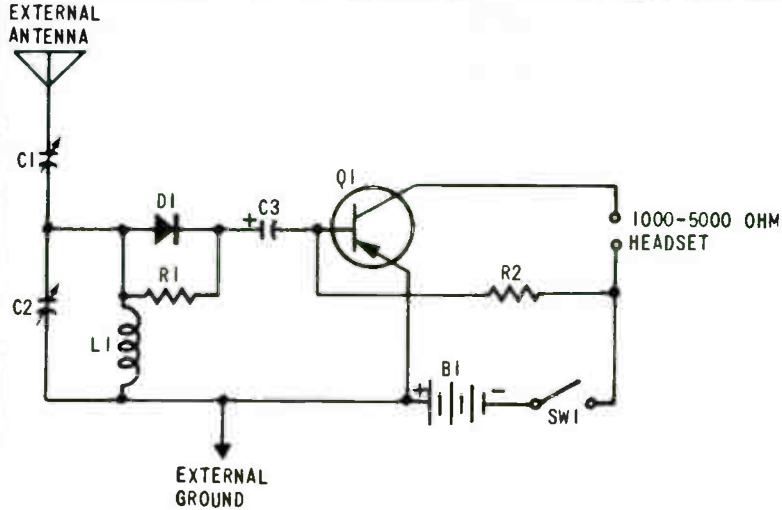
TRANSISTOR:
Q1—2N109
DIODE:
D1—1N34A
CAPACITOR:
C1—20 pfd midget variable

BATTERY:
B1—3v, 2 penlite cells
MISCELLANEOUS:
L—16" loop #12 wire
SW1—SPST. Oak type 200 or equiv.

34

"007" Shortwave Receiver

Though one-diode, one-transistor receiver circuits are becoming quite commonplace these days, it is hard to find anything that covers more than just the conventional AM broadcast band. This unique receiver, however, will permit you to monitor any frequency from 200 kHz to 30 MHz! An extremely tiny unit that can be built using subminiature components, such as those available from Lafayette, it can be made to fit in a metal cigarette case with room to spare. Heart of this little receiver is its plug-in coil arrangement. Made



COIL (L1) TABLE

FREQUENCY	MILLER TYPE	MILLEN TYPE
200- 820 kHz	70F123A1	J300-1200
600-2200 kHz	70F184A1	J300- 180
2 - 5 MHz	70F185A1	J300- 18
4 - 13 MHz	70F476A1	J300- 4.7
8.5 - 30 MHz	70F106A1	—

PARTS LIST

TRANSISTOR:
Q1—2N371
DIODE:
D1—1N34A
CAPACITORS:
C1—180 pfd trimmer
C2—365 pfd variable
C3—10 mfd 12 WVDC electrolytic
RESISTORS:
R1—220K
R2—240K
BATTERY:
B1—9v
MISCELLANEOUS:
L1—See coil table
SW1—SPST. Oak type 200 or equiv.

from inexpensive J.W. Miller or James Millen Company forms, the coils simply drop in for various frequency ranges (see coil table).

It should be noted that R1 is tentative and might be subject to experimentation, although optimum gain should be obtained with values ranging from 100K to 1 megohm. You can ascertain this by inserting a 1 meg potentiometer and adjusting it for maximum headset gain. For us, 240K was the proper figure, but it may vary somewhat from receiver to receiver. NOTE: Do not use crystal earphones—stick to magnetic or dynamic types with impedances ranging from 1000 to 5000 ohms.

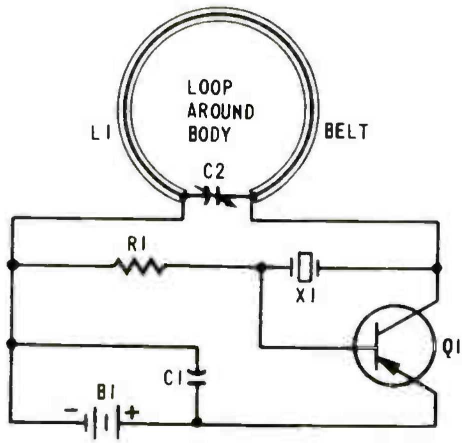
35

"007" Beacon Transmitter

This rather unconventional transmitter circuit is just the thing to have along if you find yourself involved in international espionage cases from time to time. Even if you're not Napolean Solo, you might be able to think up some interesting applications. Designed to be powered by a tiny hearing-aid variety mercury cell (although it will perform admirably from a somewhat more bulky 9-volt TR battery), this subminiature oscillator puts out a steady "beacon" signal in the 27-MHz band. Particularly good for transmitter hunts, it has been so devised as to be worn upon the person, using the belt as an antenna. The transmitter itself can be built into a tiny pillbox and inconspicuously tucked into a pocket.

The trick is in the belt. By using a hank of hookup wire and taping it to the inside of the belt (so as not to be seen), the ends of the wire come together at C2, a subminiature 250 pfd variable that is simply tuned for maximum RF output. C2 can be secreted behind the buckle.

The crystal should be a 27-MHz fundamental, since no frequency multiplication takes place in the transmitter. It is suggested that you choose a CB channel compatible with a hand-held walkie-talkie (perhaps CB channel 9) so that complete versatility is realized with this setup. If you'd rather, you can alter the output arrangement for conventional base station



PARTS LIST

TRANSISTOR:
Q1—GE-3
CAPACITORS:
C1—.01 mfd
C2—250 pfd variable
RESISTOR:
R1—270
BATTERY:
B1—9v mercury cell
MISCELLANEOUS:
L1—Hookup wire inside belt (See text)
X1—27-MHz CB fundamental crystal (See text)

use as a code transmitter (it's legal under Part 15). Simply connect the key between the plus side of B1 and the connection to C1, and hook up the antenna across C2, taking care that the center conductor of the coax is soldered to the connection point on the right of C2 in the schematic. The shielding is attached to the left.

36

Tunnel Diode 50-100 MHz FM Transmitter

Here's a dandy "quickie"—a simple and inexpensive one-transistor transmitter that can put you on the air fast. Using a 1N2941 tunnel diode, this circuit will allow you to tune yourself in on any receiver capable of picking up signals in the 50- to 100-MHz range, including the popular 88-108 MHz FM band. If you are a VHF ham, dust off your grid dip meter and trim up the LC combination for 145-MHz coverage. (Yes, the tunnel diode will hit it!)

We heartily suggest you build this one in a small minibox because of the shielding the handy metal chassis provides. A simple penlite cell holder or clip mounted inside will be just the ticket for B1. A slide switch suffices for SW1, although care should be taken not to accidentally leave it on the "ON" position (a problem we ran into). Do not increase the voltage of the B1 supply, nor extend the antenna length much beyond

3 1/2", or your transmitter will be so powerful it will violate FCC Rules & Regulations, Part 15.

Incidentally, you can zero in nicely on TV Channels 2, 3, and 4 with the circuit shown here. This is always good for some eyebrowing raisings when the gang is over watching a ball game.

PARTS LIST

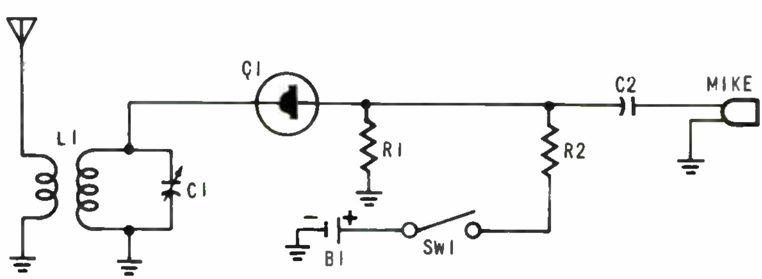
TRANSISTOR:
- Q1—1N2941

CAPACITORS:
- C1—1.5-9.1 pfd variable (E.F. Johnson 189-4)
- C2—.5 mfd

RESISTORS:
- R1—22
- R2—220

BATTERY:
- B1—1.5v penlite cell

MISCELLANEOUS:
- L1—11 turns of B & W 3003 stock, with a 1-turn link on the cold end.
- SW1—SPST. Oak type 200 or equiv.



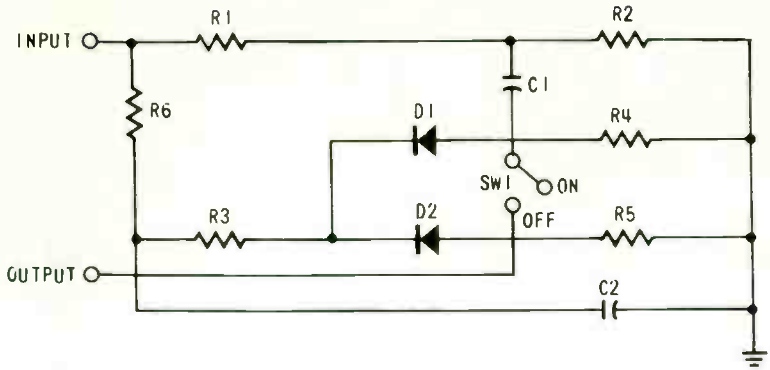
37

No-Transistor Noise Limiter

Although there are volumes of material on how you can eliminate noise problems (electrical noise, ignition noise, etc.) at the source, very few articles tell you how to cut down noise at your receiver. The reason for this is clear: Few people want to alter the appearance or circuitry of their store-bought commercial receivers with anything homebrew. On the other hand, it is quite easy using the circuit shown here to construct a subminiature noise clipper/limiter that can be wired into your receiver with a minimum of cutting and chopping. In fact, you can use the existing "ANL" or "noise" switch!

Although nothing is critical about construction, all leads should be kept short, and if you desire extreme miniaturization, you can use 1/10th to 1/4-watt resistors to help keep space down. The entire assembly can be built into a tiny pill-box or even the inside of a subminiature IF can. But the trick is in keeping all leads as short as possible.

Hookup is not complicated. If there is already a noise limiter in the circuit, simply disconnect it from the audio input and tape the wire so it doesn't come in contact with any components or short out against the chassis. Connect the "input" lead from our noise limiter to the same tie point. Connect the "output" to the audio-output of the existing limiter. Disconnect the wires from the existing off-on switch and use this now as SW1.



PARTS LIST

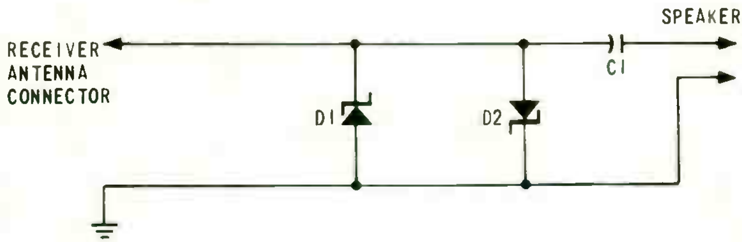
DIODES:
D1, 2—1N464A
CAPACITORS:
C1—.02 mfd
C2—.05 mfd
RESISTORS:
R1—270K
R2—470K
R3—560K
R4—1.2 meg
R5—1 meg
R6—1.2 meg
MISCELLANEOUS:
SW1—See text

38

Automatic Receiver Muter

This exciting little device can be thrown together in less than 20 minutes and is a guaranteed insurance policy for your ear-drums. Particularly when SWL'ing during summer thunder-storms, atmospheric noise can prove brutal, if not deafening. And for hams with low-power transmitters, this gadget will mute the receiver completely whenever the RF switch (or key) is thrown. WARNING: This is not the same as a relay-controlled standby setup; if your transmitter is powerful enough to damage the receiver front end, it will do it also with this device, although you won't hear your tubes sizzling.

It uses the latest zener diode, the Motorola 1N746 (try a Hoffman HB1 if it's easier to obtain), to ground out loud signals automatically before they reach the speaker. If you're now using a separate antenna for receive, you can leave it



PARTS LIST

DIODES:
D1, 2—Motorola 1N746
CAPACITOR:
C1—.02 mfd

hooked up permanently; no need for coaxial antenna switches or relay arrangements.

Construction is unbelieveably simple. Just make sure you've got your zeners properly polarized according to the circuit layout shown. If you've got a lot of stray RF floating around the shack, you might consider building the whole thing in a metallic container or small box, although for most applications it can take any form you like. It also works remarkably well installed just inside a CB transceiver, since it mutes out powerful ignition bursts from passing cars.

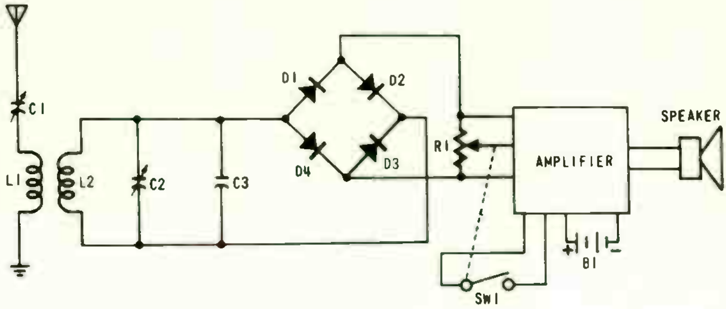
39

Simple CB Receiver

This won't be the hottest receiver you'll find, but it's a sure-fire way to listen in on CB goings-on in your locale without refinancing your house and car to do it. In fact, the most expensive investment will be $3.95 for a Lafayette amplifier breadboard. The other components can be had from the junk-box or for about $3.00 brand new, if you know where to buy. Substitutions can be made, however, without serious problems.

The main complaint you will have about this receiver is not volume (it'll be the loudest crystal set you've ever heard), but the apparent lack of selectivity. Never fear, though. Even those CBers with $300 base stations often have difficulty separating one signal from another. But you'll get a kick out of just how much activity you do hear!

Construction is simple and to the point, although the shorter you make lead lengths—particularly near L1—the better. The antenna can be any 8-foot length of wire, although a cheap CB whip would be just the ticket. Be sure to use a good ground, preferably to an external ground pipe or radiator. The better your ground, the better your reception. Watch polarity of the crystal diodes during wiring. If you reverse any of these, or in any other way deviate from the circuit arrangement, you won't be hearing anything.



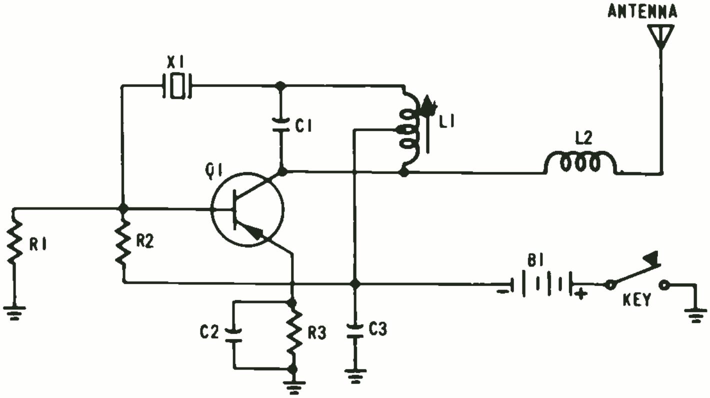
PARTS LIST

AMPLIFIER:
Lafayette PK-543
DIODES:
D1, 2, 3, 4—1N34A
CAPACITORS:
C1—15 pfd trimmer
C2—140 pfd variable
C3—15 pfd
RESISTOR:
R1—50K pot.
BATTERY:
B1—9v
MISCELLANEOUS:
L1—45 turns hookup wire wound over L2
L2—13 turns #20 wire wound on a pencil
SW1—SPST on R1
Speaker—8-ohm, 3 in.

40

CB Code Transmitter

Here's a circuit that will put you on the air for little more than the cost of a 9-volt TR battery and a 59¢ RF transistor! Not a code oscillator but a genuine 27-MHz transmitter that can be used without a license under Part 15 of the FCC rules, this project can be constructed in less than 2 hours. Most of the parts can be scrounged from a good junkbox, although you'll have to get a fundamental frequency 27-MHz crystal from your parts dealer. Order it on a channel that is compatible with your present gear and equip your receiver with a BFO for beating against the code transmitter to produce a crisp tone. If you have a crystal in the transceiver for the same channel



PARTS LIST

TRANSISTOR:
Q1—Lafayette 19 G 4211 PNP "bargain"
CAPACITORS:
C1—15 pfd
C2—.01 mfd
C3—.001 pfd
RESISTORS:
R1—33K
R2—270K
R3—56
BATTERY:
B1—9v
MISCELLANEOUS:
L1—12 turns #22 enameled wire on 1/4 of a slug-tuned form center-tapped
L2—10 turns of hookup wire wound tightly on a pencil, then slipped off
X1—27-MHz fundamental frequency CB crystal

as the code transmitter, you can eliminate the BFO requirement by simply depressing the "spot" switch on the unit while the CW is being received.

This circuit will be good for at least 3 blocks with a simple 1/8-wave whip antenna, and a lot further with a more adequate radiator, although you should check to see whether this might require your licensing it under Part 95. In any case, it is superb for most conventional short-range CW work and ideal for the CBer who'd like to study on-the-air for his Novice ham radio ticket.

Any PNP RF 30-MHz transistor can be used in place of the Lafayette recommended, although it has been our experience that slight circuit modifications might have to be performed if upon insertion the transmitter does not immediately go into oscillation.

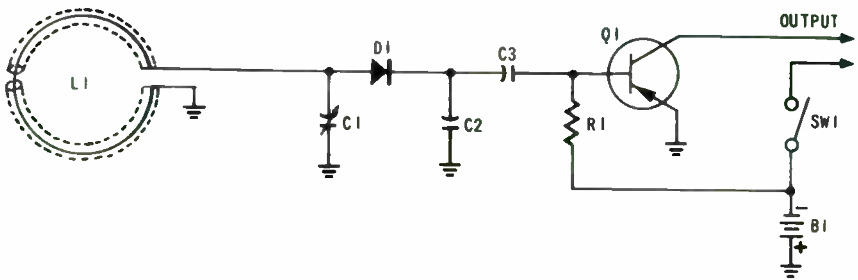
Tuneup is easy. Adjust the slug of coil L1 so that it is about halfway out of the coil. A signal should be evident on the receiver. Separating the transmitter from the CB set, adjust L1 again so that the receiver's "S" meter peaks. This adjustment should be made slowly and carefully, since this "peak" point may be a hard one to find. Every time you change the antenna, readjust L1.

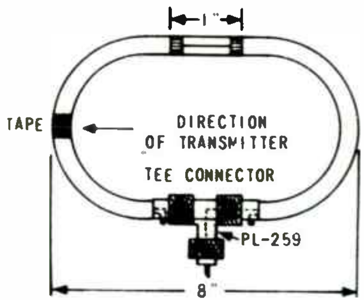
41

Portable CB Direction-Finder

This dandy direction-finding loop set is just the ticket for search and rescue operations, tracking down "mystery" bootleg stations, or even for Part 15 hidden transmitter hunts. It is a completely portable, self-contained CB receiver designed to pinpoint the direction of the intercepted 27-MHz signal. Similar to the FCC's DF which has been in use for years by their Field Engineering & Monitoring Bureau, your CB version can be built into a tiny 4 x 2 1/4 x 2 1/4-inch minibox and powered by just two penlite cells.

Here's how it works: You tune in the mystery signal by adjusting C1 for best reception while listening in on a headset.





DETAIL OF L1
THE ANTENNA LOOP

PARTS LIST

TRANSISTOR:
Q1—2N372

DIODE:
D1—1N34A

CAPACITORS:
C1—35 pfd variable (Hammarlund MAPC-35)
C2—.005 mfd
C3—.1 mfd

RESISTOR:
R1—150K

BATTERY:
B1—3v, two penlite cells

MISCELLANEOUS:
L1—Length of RG-8/U coax. See text and schematic.
SW1—SPST. Oak type 200 or equiv.
Tee connector—PL-259

(You can feed the output into a Lafayette-type audio amplifier if you like; this will give you loudspeaker operation). Then you simply rotate the loop until a distinct "null" is detected. If you've placed a piece of tape on the left side of the loop (see loop detail in diagram) this will indicate exactly what direction the signal is coming from.

The loop itself is made from a length of RG-8/U coax. A 1" swatch of the cable's copper shielding is removed to form a gap at the top of the loop. It is important that no shield connection is present at this point. One side of the loop is grounded to a PL-259 in the conventional manner, while on the other the shield is shorted to the center conductor so that the PL-259 at that end has no connection whatever to the center prong.

42

Field Strength Meter for CB and 6 Meters

Since a substantial number of CBers eventually go on to become Technician Class hams and 6-meter operators, this circuit might be an ideal one-evening project for the newcomer to communications. Heart of the circuit is an inexpensive 7-pfd variable trimmer capacitor which, when coupled to the coil shown, can be "trimmed" to your particular CB channel or your operating frequency on 6 meters. No, it won't handle both at one time without readjustment, but when you do zero in your FSM, you'll have the hottest little tune-up box around. No commercial manufacturer makes a gadget specifically for these frequencies; hence, any application is general, broadband, and usually rather insensitive.

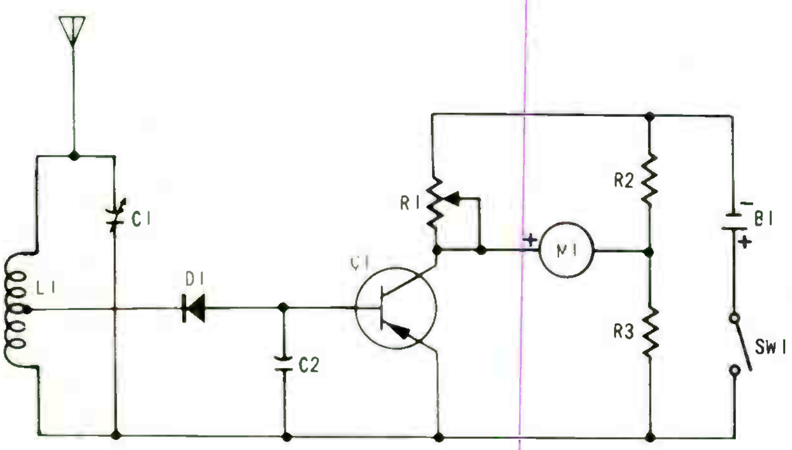
Construction is quite basic and no special hints need be given other than the customary suggestion that you keep lead lengths fairly short. The antenna, for convenience sake, can be a replacement telescoping whip, similar to those found on many FM transistor radios. These whips are available with suitable mounting apparatus from most parts suppliers or mail order houses.

Primary advantage of this souped-up FSM is that it will seldom react to signals other than those on the frequency to which it is tuned. And, since the 1N34A diode is followed by a one-transistor amplifier, this narrow-band selectivity is particularly important. You're safe in placing the FSM as far from the transmitter as you like (so long as you still get a meter indication) without worry over picking up the radiation of a harmonic, local broadcast station, etc. Incidentally, this gadget is great for outdoor bunny hunts or other hidden-transmitter games.

PARTS LIST

TRANSISTOR
Q1—2N1017
DIODE:
D1—1N34A
CAPACITORS:
C1—7 pfd ceramic trimmer
C2—0.01 mfd

RESISTORS:
R1—15K pot.
R2, 3—1.5K
BATTERY:
B1—1 1/2v DC, one penlite cell
MISCELLANEOUS:
L1—12 turns B & W #3015, tapped 3 turns
M1—0-1 milliammeter
SW1—SPST · Oak type 200 or equiv.



43

Ultra-Miniature Code Practice Oscillator

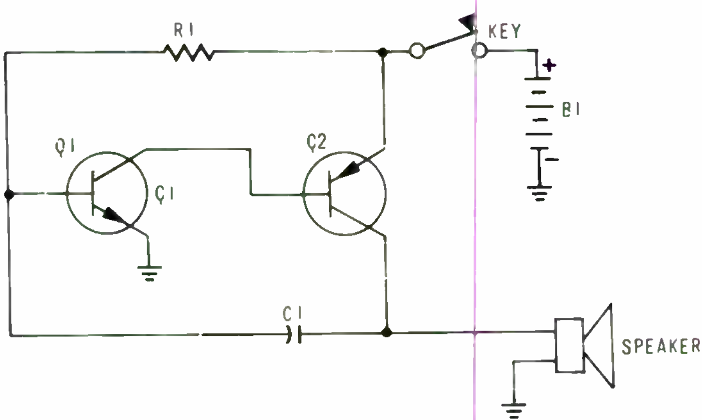
Keeping in line with today's trend in ultra-miniaturization of electronic circuits, here's one which you can build on a tiny square of plastic as the chassis and still have room to spare. The circuit is a 2-transistor code practice oscillator which delivers a rather healthy signal to an 8-ohm speaker.

PARTS LIST

TRANSISTORS:
Q1—GE-5
Q2—GE-2
CAPACITOR:
C1—0.04 mfd
RESISTOR:
R1—58K

BATTERY:
B1—6v
MISCELLANEOUS:
Speaker—8 ohms
Key

Mounting and parts placement isn't critical, and you can either mount the components on one or both sides of the chassis. Parts values aren't even particularly critical. The completed unit can be mounted right on the plate which holds the telegraph key, with the battery and speaker adjacent. One idea might be to build the whole circuit right into the telegraph key plate, thus eliminating the need for a separate chassis.

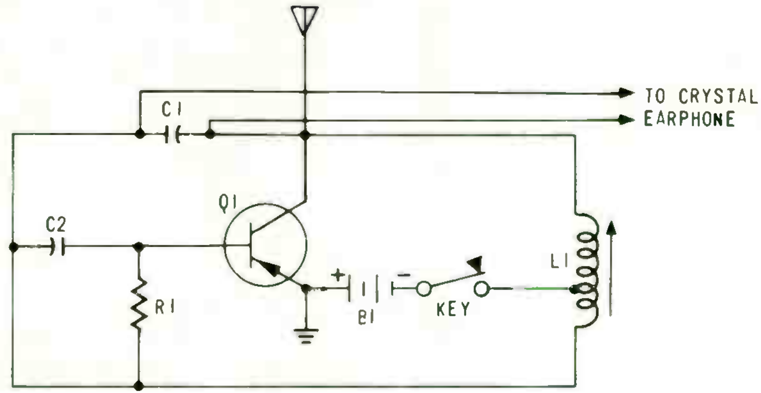


44

Code Practice Oscillator/RF Transmitter

Here's one for everybody interested in Morse code, whether you're a ham or just trying to become one, or just plain want to have fun. This circuit can be a code practice oscillator providing a nice audio note when keyed, a wireless code broadcaster for "hamming" it up, or a combination of both. Note to ham flea-power addicts: You can tune this on 160 meters for millwatt-type operation. Working on the tunable oscillator/VFO basis, you don't even need a crystal.

If you'd really like to add pazazz, use flashlight cells (size D) instead of the 9-volt TR battery. And for range, just make the antenna length as long as you can manage. One low-band



PARTS LIST

TRANSISTOR:
Q1—2N105
CAPACITORS:
C1—220 pfd
C2—.005 mfd
RESISTOR:
R1—1.2 meg
BATTERY:
B1—9v
MISCELLANEOUS:
L1—Lafayette MS-269 (tapped variable loopstick)

ham we know rigged this baby into a 5-mile long antenna (unused telephone line), tuned it up on 160 meters, and worked an unbelieveable 108 miles with it!

Construction is quite simple, since it has only one transistor and a minimum of related components. If you get a tiny Japanese-type radio knob, you can fasten it to the variable loopstick shaft and pretty much dial your own transmitting frequency. Best bet for optimum performance is to tune it to a "dead spot" on the AM broadcast band. For higher frequency operation, carefully remove turns from the loopstick, checking with a GDO as you go along, until you've reached the area you want to operate on. (For 80-40 meter use, use a high-frequency transistor). For code practice use, disconnect the antenna and insert a crystal earphone in parallel with C1 as indicated. To vary pitch, connect a 1 meg potentiometer from the base of the 2N105 to the collector.

45

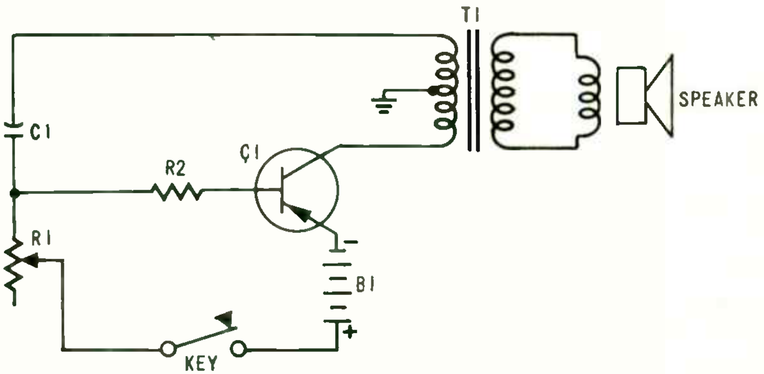
Variable-Tone Code Practice Oscillator

Although there is a virtual multitude of good CPO circuits to be found in the magazines and numerous project books, there are few that permit adjustment of the tone pitch for comfortable listening. This circuit, on the other hand, provides not only the versatility of variable pitch, but also a sufficient amount of audio output to drive a 2 1/2" speaker to adequate room volume for group participation. No external amplifiers are required.

You can build this project in a small plastic box or metal minibox and need only drill a hole for the shaft of R1 (pitch) and a hole for the key connector. This can be a standard phone jack connector. Under normal usage, the 9-volt transistor radio battery will last for three months. If you are practicing for a Novice examination, or contemplate extensive use of the CPO, use six standard penlite cells in series for better battery life. Incidentally, the CPO will operate satisfactorily with as little as 3 volts applied, although R1 will require some readjustment to compensate for slight pitch variation. In use, the more battery voltage supplied, the more audio output, although even 3 volts will drive a small PM speaker with transformer.

PARTS LIST

TRANSISTOR:
Q1—2N1265
CAPACITOR:
C1—.2 mfd
RESISTORS:
R1—5K pot.
R2—1K
BATTERY:
B1—9v See text
MISCELLANEOUS:
T1—Inexpensive push-pull audio output transformer
Speaker—4-8 ohms



46

Self-Powered CW Monitor

This handy circuit is just the trick for insuring against code monitor blow-out from high-voltage shorts. And all sorts of other things, too. It actuates itself by stealing power from your transmitter and using it to kick in the audio tone oscillator. Result? Perfect code monitoring regardless of what band you're operating! You don't touch a thing. Just remember not to let it out of your sight, though. We had one disappear that way.

We pulled all the parts from a junk box which contained what was left of an AM transistor radio after surgery. You can do the same, substitute parts, or buy everything new. It's not a critical design, so you can substitute wherever it is to your advantage. If you haven't a 2N107 handy, you can use any standard audio PNP type. If you want to employ an NPN, just reverse the diode polarity. Other germaniums can be substituted for the 1N34A also. For instance, if you want to monitor your CW transmissions up to 6 or 2 meters, merely work up another LC combination and plunk in a 1N21. (Be sure to grid dip the LC first, though, to check).

Hint: If you don't want your junkbox monitor stolen, you might consider mounting it inside your transmitter. This way you can run an antenna wire over to the antenna coax connector area and wrap a few turns around the transmitter's output wire just as it leaves the rig. This will insure adequate "firing" voltage for Q1, and make a neat installation to boot. If you want a portable monitor, use a good-sized length of hookup wire as your antenna, and get it as close to the transmitter's output as humanly possible without danger of electrical connection. Otherwise, you'll have to have 20 feet or more of pickup antenna. If you desire completely portable operation, using a small telescoping antenna, add a stage of transistor amplification between D1 and R1.

PARTS LIST

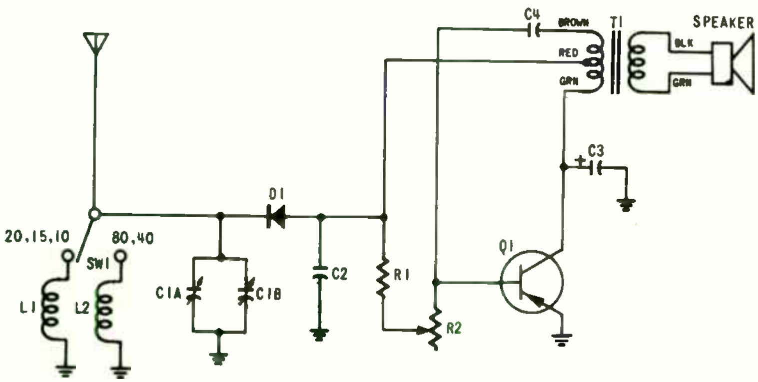
TRANSISTOR:
- Q1—2N107. See text.

DIODE:
- D1—1N34A diode

CAPACITORS:
- C1A, B—365 pfd variable with both sections paralleled
- C2—2 mfd, 15-volt electrolytic
- C3—.02 mfd, 50-volt electrolytic
- C4—.04 mfd, 15-volt electrolytic

RESISTORS:
- R1—22K
- R2—100K pot.

MISCELLANEOUS:
- L1—8 turns #24 enameled wire on 1/2" diameter poly rod.
- L2—40 turns #24 enameled on other end of L1 rod.
- T1—Lafayette TR-99
- SW1—SPST. Oak type 200 or equiv.



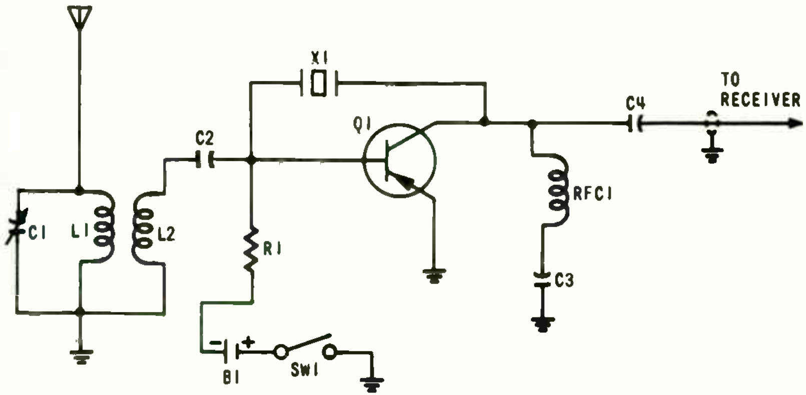
47

Ham Band WWV Converter

With this handy circuit you can get WWV smack dab in the middle of your receiver dial, if you can get 40 meters on your receiver (7000-7300 kHz). So what? Well, at the flick of a switch, you'll be inserting a crystal calibrator noted throughout the world for it's accuracy: The National Bureau of Standard's station WWV. Actually, what you'll be doing is converting it from 5 MHz and inserting it on 40 meters. And you can use these broadcasts to accurately calibrate your receiver so it will read out frequencies as well as any the FCC snoops use. (Well, almost as well).

You can build it in just about any type of chassis you might have available, although the complete enclosure a minibox affords might be your best bet. The only precaution you need to take is to make the interconnecting cable between the receiver and converter a shielded type (like RG-58/U) so it won't pick up signals from the amateur band (40 meters).

X1, the crystal used in the converter, can be any 75-meter phone band type from 3820 to 4000 KHz; a surplus unit is fine.



PARTS LIST

TRANSISTOR:
- Q1—GE-9

CAPACITORS:
- C1—68 pfd variable
- C2, 4—100 pfd
- C3—.05 mfd

RESISTOR:
- R1—4K. See text.

BATTERY:
- B1—1 1/2 or 3v, penlite cell

MISCELLANEOUS:
- L1—25 turns #26 enameled wire wound on a 3/8" slug-tuned form.
- L2—5 turns of #26 enameled wire wound over L1.
- RFC1—2.5 mh RF choke
- X1—Any 75-meter crystal, 3820-4000 kHz. See text.
- SW1—SPST. Oak type 200 or equiv.

Tuning up the converter is a snap: Merely adjust C1 for maximum signal strength. If you have trouble getting the crystal to oscillate, lower the value of R1 somewhat (preferably using a 5K pot) until oscillation begins.

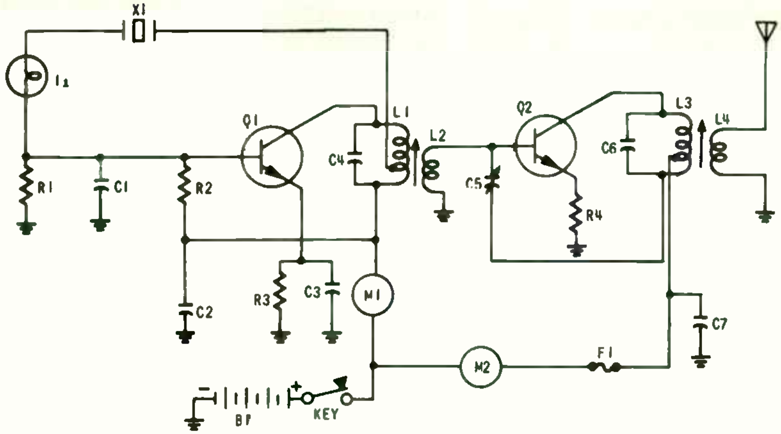
48

3-Watt 40-Meter CW Transmitter

All right, all you skeptics. Here's a self-contained, efficient 7-MHz CW transmitter that will put 1 1/2-2 watts of output power into your antenna. No tubes. No big power supplies. No headaches. Plenty of flea-power 40-meter DX. Attention Novices: This rig now can save you money later on, a simple one-tube linear amplifier capable of 80-100 watts when you get your General Class ticket. Meantime, startle the boys on the band with this amazingly easy-to-build two-transistor rig.

To quell a few qualms, we'll start by getting the most expensive items out in the open right now. The 2N1573s will run you between $1.50 and $2.00 each. Period. Nearly all the other essential components can be scrounged from somebody's basement junkbox.

Construction isn't too critical, except that the transistors must be heat-sinked, the circuit metered to prevent burnout of the semiconductors, and the coils carefully coupled as directed. If you have a grid dip meter, you'll be ahead of the game, although one isn't absolutely essential to get this rig on the air. Since Q1 is being run well below its ratings, you can merely adjust for maximum indication on the pilot bulb.



PARTS LIST

TRANSISTORS:
- Q1, 2—2N1573

CAPACITORS:
- C1—250 pfd
- C2, 7—.05 mfd
- C3—.01 mfd
- C4, 6—1000 pfd
- C5—5-25 pfd miniature variable

RESISTORS:
- R1—27K
- R2—180K
- R3—82
- R4—56

BATTERY:
- B1—45v Burgess U-30, Eveready 415.

MISCELLANEOUS:
- L1—7 turns #22 wire on 1/2" slug-tuned form. Wound 1/2" long; tapped at center.
- L2—2 turns #22 over cold end of L1
- L3—5 turns #14, 1" dia., 1" long, air-wound. Tapped at center.
- L4—6 turns #22 insulated, closewound and loosely coupled to L3. See text.
- X1—40-meter ham band crystal
- F1—1/10th amp fuse. Type 3AG.
- I1—Pink-bead 2-volt, 60-ma pilot bulb.
- M1—0-50 milliammeter
- M2—0-100 milliammeter

However, this technique comes in time. First, you'll want to make your basic preset adjustments.

Adjust L1 until oscillation starts. This can be noted by a drop in the reading of M1 or by monitoring your frequency on a nearby receiver. (Yes, the pilot light will light, but dimly). Meter reading should be about 16 milliamperes. Now, adjust L3 for a dip in the M2 meter. Watching the pilot bulb, adjust L3, noting the change in light. Next tune C5 until a point is reached where no amount of L3 adjustment will change the brilliance of the pilot lamp. This is the neutralizing process.

Next comes antenna coupling. Move the coils of L4 between those of L3, but not entirely intertwined. If you have access to a GDO, adjust C6 so that your reading on the grid dipper at L3-L4 is right for the frequency. If you don't have the GDO, move L4 in and out of L3 until your final amplifier current (on M2) reads between 60 and 70 milliamperes.

Now call CQ.

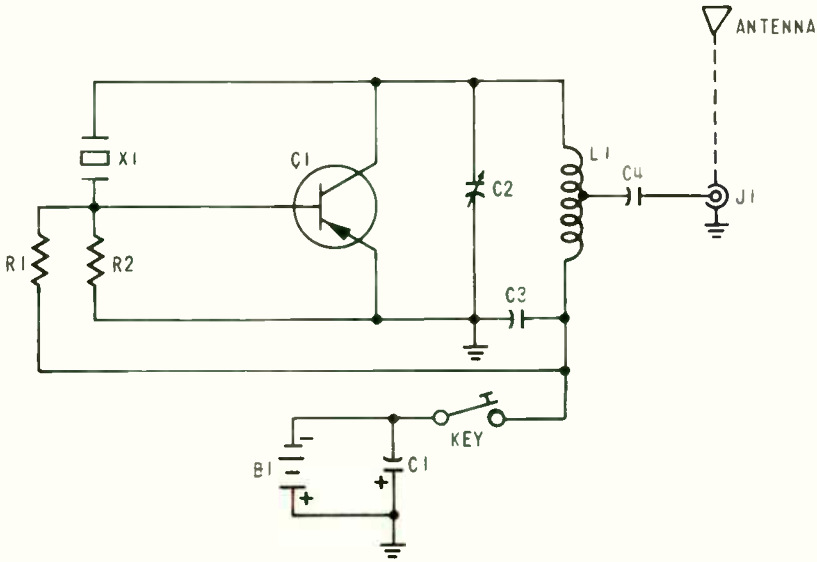
49

40/80 Meter Transmitter

Here's a little transmitter to use on the 40- and 80-meter ham bands, so if you've got a ham ticket (except Technician Class), go to it! It puts out a good, solid, reliable 10 milliwatts, which should "get you out" 3- to 5-miles with a decent antenna. The rig fits easily into a 4 by 6-inch chassis; fiberboard or Vectorboard should do just fine. Nothing to bug you about with the parts layout—there are so few components that they'll just about lay themselves out. Keep the leads as short and direct as possible.

Coil L1 is made from B&W Miniductor 3015; 45 turns for 80 meters or 22 turns for 40 meters. We found that a resonant longwire antenna performed well, but best results were obtained from a dipole cut for the desired band.

To get the thing going on the air, lock the CW key into the "on" position and monitor the signal on a nearby receiver. Peak the output by adjusting C2. Release the key, move the coil tap to another position, press down the key, repeak C2. Keep doing this until the best combination of tap location and C2 is found. It may be necessary for you to back off slightly from the best setting of C2; do this if the set is tempera-



PARTS LIST

TRANSISTOR:
Q1—2N370

CAPACITORS:
C1—100 pfd electrolytic, 25 WVDC
C2—409 pfd variable
C3—0.01 mfd
C4—47 pfd

RESISTORS:
R1—75K
R2—6.2K

BATTERY:
B1—3v

MISCELLANEOUS:
L1—See text
X1—40 or 80 meter crystal
J1—Standard phono jack

mental about going on the air when you press down on the key. Don't operate the set (even for tests) without an antenna or with the tap on the coil—unless you want to tune the set for maximum smoke.

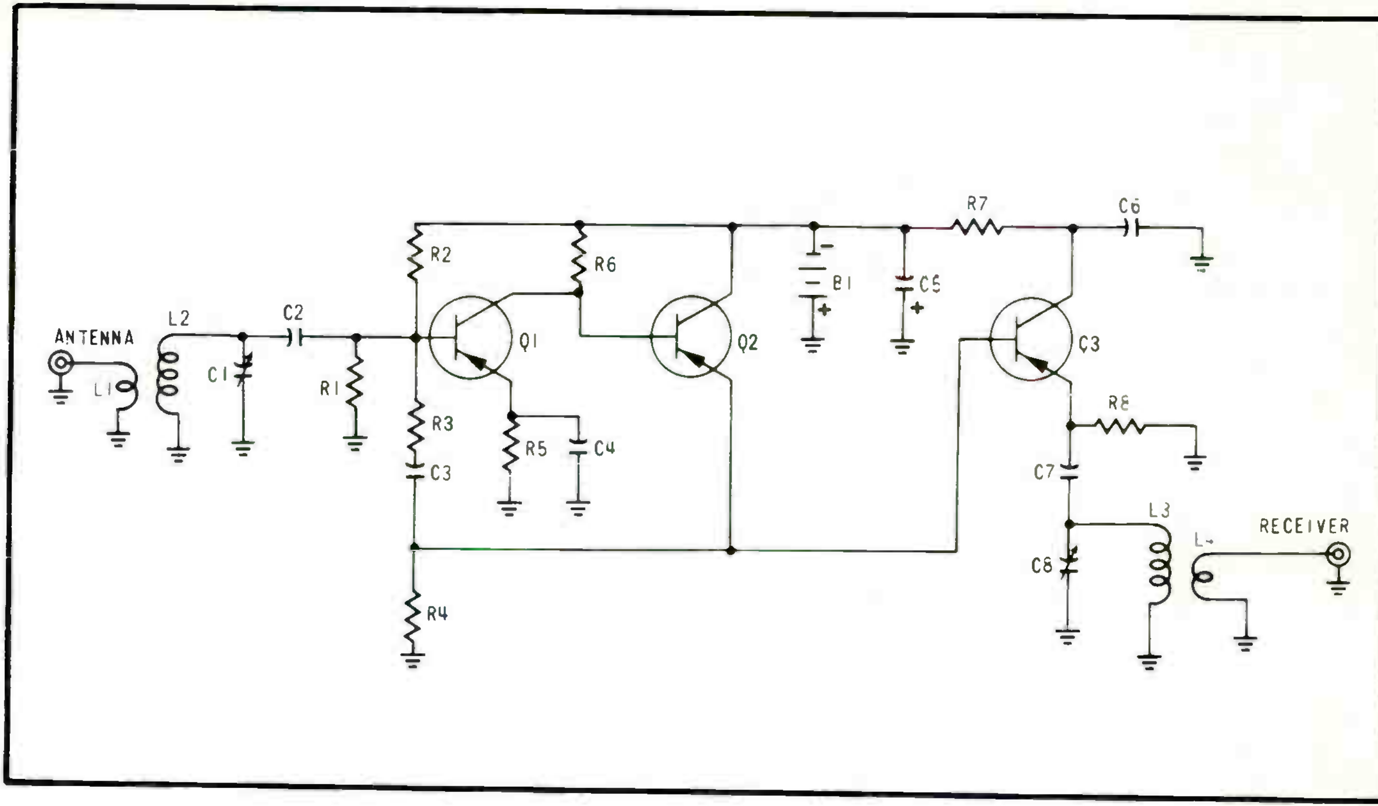
50

Preselector/Booster for 80-11 Meters

This useful circuit is quite easy to construct, yet amazing in its ability to "select" a certain frequency and boost those particular signals. In fact, you'll hear stations that never before existed as far as your reception is concerned. Even on CB (use 10-meter coil instructions), a fantastic increase in received signal level can be realized that will enable you to work your mobile over many more miles than previously available.

For SWLs and DXers, this is your baby. In effect, it adds a $250 front end to your receiver system, yet it will cost you less than $10 to construct. Though a few buddies we know have built their preselector/boosters into their old S-38Ds, we preferred to construct ours in a small minibox to insure maximum versatility and shielding.

Construction is basic, although care should be taken in proper component placement, since this circuit is a wee bit more


ANTENNA
L1
L2
C1
C2
R1
R2
R3
C3
R4
Q1
R5
C4
R6
Q2
B1
C5
R7
C6
Q3
R8
C7
C8
L3
RECEIVER

involved than most we've been dealing with thus far. Keep your wiring short and to the point, a factor in arriving at optimum performance at 10 and 11 meters. By simply substituting a VHF transistor, you can get this "soup-er-up" gadget to do a dandy job on 6 meters, although you'll have to grid-dip your coils (L2, L3) for resonance at 50 MHz before installation is permanently in place. You might try halving

PASTS LIST

TRANSISTORS:
- Q1, 2, 3—2N384

CAPACITORS:
- C1, 8—140 pfd variable
- C2, 7—.05 mfd
- C3—.03 mfd
- C4—.01 mfd
- C5—500 pfd, 12-volt electrolytic
- C6—.04 mfd

RESISTORS:
- R1, 4, 5, 6—5K
- R2—10K
- R3—1K
- R7—500
- R8—2K

BATTERY:
- B1—9v

MISCELLANEOUS:
- L1, 4—2-turn link of #18 cotton covered wire over cold end of L2 & L3. Vary turns for performance.
- L2, 3—B&W 3016. For 80 meter, 36 turns; 40 meters, 23 turns; 20 meters (and 15 meters), 14 turns, 10 meters, 4 turns.

the specifications for 10-meter use as a starter if you don't have a grid dip meter handy.

Battery voltage is not critical, although you'll notice we used 9 volts (which is what we had handy). You might even try varying it a bit between 7 and 12 volts DC for best overall results.

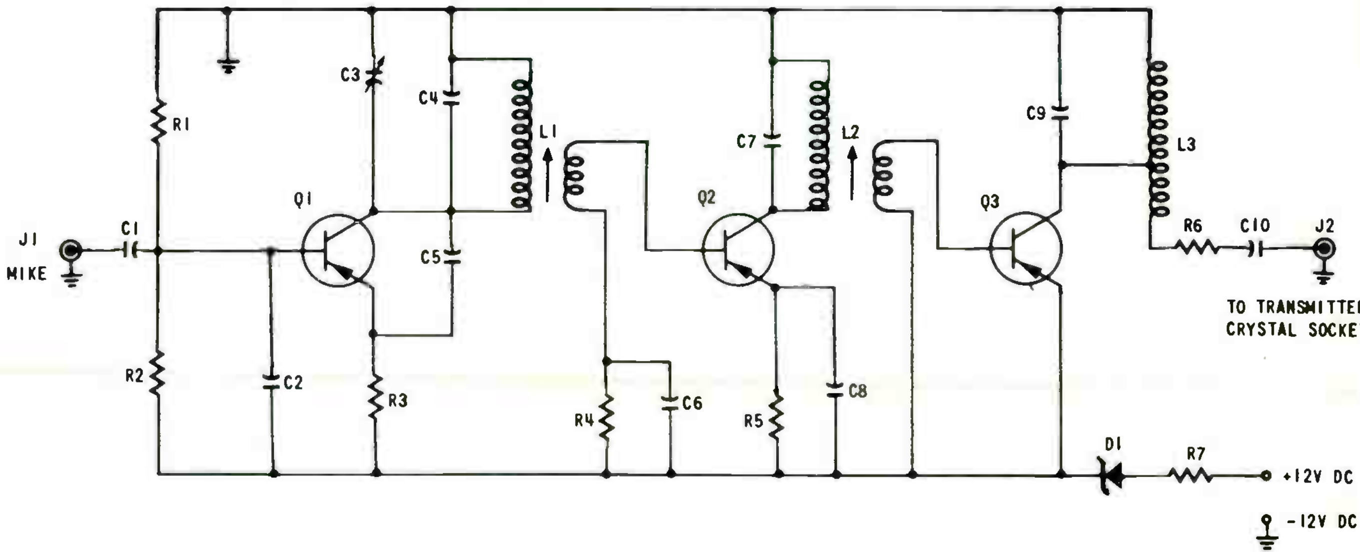
51

NBFM Adapter/VFO for 6 Meters

Are you a gung-ho 6-meter operator compelled to observe self-inflicted "quiet hours" during peak DX periods due to excessive TVI? Well, this handy gadget can fix all of that in a jiffy by providing your rig with narrowband FM modulation. So what's so great about NBFM? Simply that it seldom results in TVI.

Or maybe you are dissatisfied with your present crystal arrangement—spending waking hours dreaming of a commercial VFO? Forget it, OM, here's a variable-frequency oscillator more stable than any you could buy. Why? Because its fundamental frequency is 25 MHz, not 8 MHz, so any error or deviation is not multiplied six times in your rig, leaving you with fears of dropping below 50.1. Instead, this simple solid-state instrument operates from an independent 12-volt source and your transmitter multiplies only by a factor of two (yes it will do it—just readjust the oscillator circuit if drive is down, which it shouldn't be).

So, you've got a device that is either an NBFM adapter or a solid-as-a-rock VFO suitable for CW work at the low end. Or you have a combination of both! If you want regular transmitter operation with VFO control, just disconnect the mike and plate modulate per usual. If you want VFO-driven NBFM operation, simply insert a ceramic or crystal mike into the input jack (disconnecting your regular mike) and you are in business. What you'll get is a 3-kHz frequency swing, ade-


J1
MIKE
C1
R1
R2
C2
Q1
C3
C4
C5
R3
L1
R4
C6
Q2
C7
L2
R5
C8
Q3
C9
L3
R6
C10
J2
TO TRANSMITTER
CRYSTAL SOCKET
D1
R7
+12V DC
-12V DC

quate for narrow-band work. If you find it's a smidgen low (sounds like AM), use a mike preamp, adjusting the output as you go along. If you overdrive the adapter/VFO, you'll be on regular FM, in which case you'd better get up above 51.5 before Frank Charlie Charlie writes you a letter.

Construction is fairly "tight" and VHF techniques should be observed throughout. Use a GDO to check for proper inductance of the coils (25 MHz in the circuit). Make sure the finished device is entirely enclosed for adequate shielding.

PARTS LIST

TRANSISTORS:
- Q1, 2, 3—GE-9

DIODE:
- D1—1N752 Zener

CAPACITORS
- C1—.1 mfd
- C2—0.001 mfd
- C3—5 pfd variable, Johnson 160-102
- C4—50 pfd
- C5—5 pfd
- C6, 8, 10—0.01 mfd
- C7—24 pfd
- C9—100 pfd

RESISTORS:
- R1—47K
- R2—5.6K
- R3—470
- R4—680
- R5—120
- R6—33
- R7—240

MISCELLANEOUS:
- L1—11 turns #34 enamel, closewound on Miller 4500 form w-4 turn link
- L2—12 turns #30 enamel, closewound on Miller 4500 form w-3 turn link
- L3—15 turns #30 enamel, tapped at 5 turns from bottom of coil
- J1, 2—Standard phono jacks

Tuneup is fairly simple. Set C3 so it's completely closed and then adjust L1's slug until an output signal is detected at exactly 50 MHz. Tune L1 for maximum output. Next, listen on 50.6 MHz until (by adjusting C3) you hear the signal. Adjust L2 for maximum. Don't worry about a slight frequency shift at this point.

Reset the receiver to 50 MHz and peak L3 for maximum signal. With the cover on, adjust L1 carefully for maximum signal at 50 MHz with C3 fully meshed. Okay? Now you're ready to make rough dial calibrations with a pointer knob on C3, although you should use a zero-beat from a suitable frequency checker to determine the final on-air frequency.

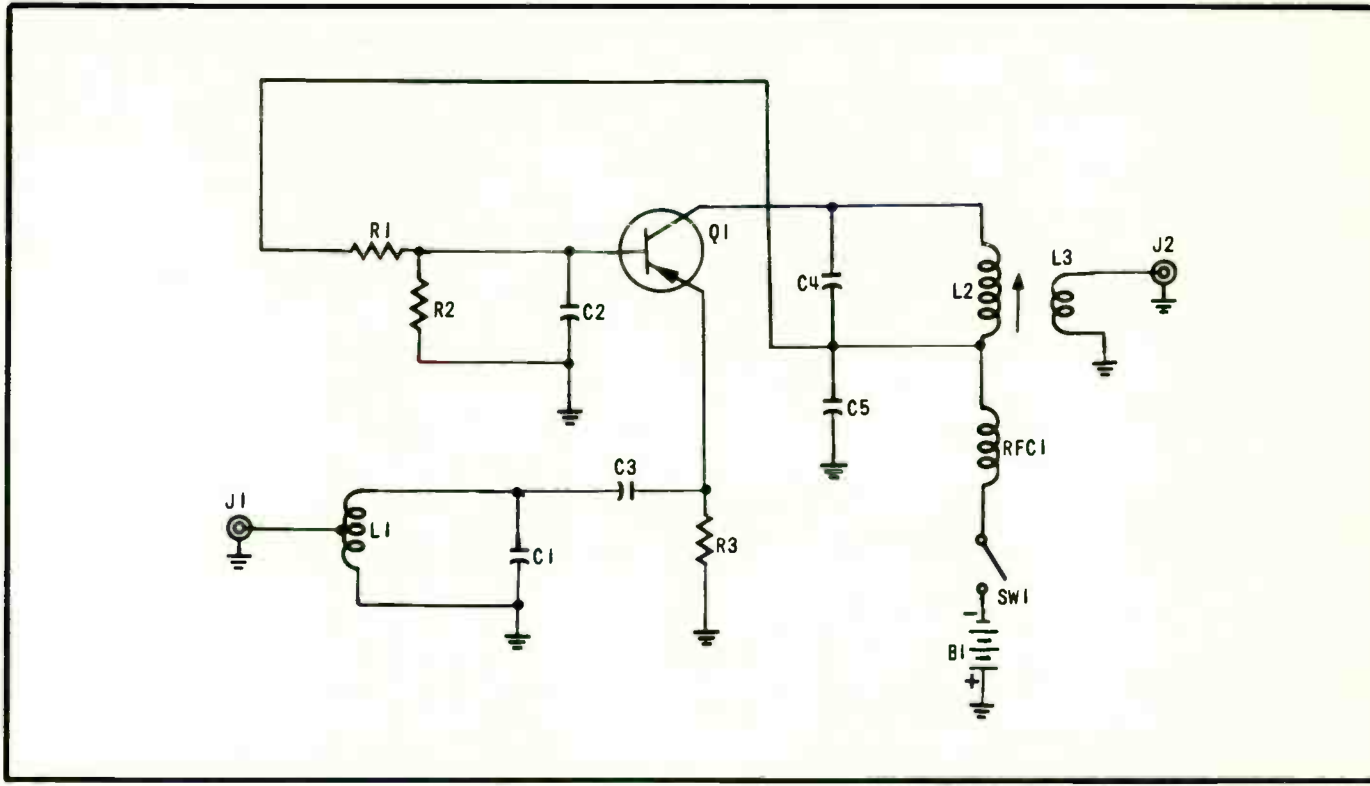
52

Handy 6-Meter Receiver Preamp

Looking for an inexpensive way to add more pazazz to your 50-MHz listening post? This simple preamplifier has a measured 6 db noise figure, meaning that when you hook it between your antenna and receiver it can boost signals by at least 12 to 15 db. Which comes in quite handy if you're a noise-level-type VHF DXer who delights in hearing things the boys across town don't know exist.

Key factor in this preamp is the new 2N2189 low-noise germanium transistor which consistently outperforms tubes in similar circuit configurations due to its inherent quietness in the VHF spectrum. Additionally, it drains only 4 ma from a conventional 9-volt TR battery, meaning you don't have to tear into your converter for supply voltage. When equipped with standard SO-239s, you're all set for optimum boosting. Yes, it's 50 ohms.

Since stray hand capacity can alter circuit efficiency, it is suggested you build this gadget "tight" (short connections wherever possible) and enclose it in some kind of a metallic box, although a minibox is not necessary (an aluminum Sucrets box works just as well). Wherever feasible, don't use wire; use short component leads instead, building close around the 2N2189.


R1
R2
C2
Q1
C4
L2
L3
J2
C5
RFC1
C3
J1
L1
C1
R3
SW1
B1

Input coil L1 should be wound with #14 wire, about 5 turns, inner diameter of 3/8". Stretch L1's length to 1/2" and you've got it. You'll find this mounts nicely without support if you simply connect the center conductor to the "hot" part of your input coax connector. Output coil is arranged with L3 at the cold end of L2, which is simply an 8-turn job wound in the same direction as L3. Both should be wound on the slug-tuned form called for in the parts list.

PARTS LIST

TRANSISTOR:
Q1—2N2189
CAPACITORS:
C1—47 pfd
C2, 3, 5—.001 mfd
C4—18 pfd
RESISTORS:
R1—4.7K
R2, 3—1K
BATTERY:
B1—9v
MISCELLANEOUS:
L1—5 turns of #14, i.d. 3/8", length 1/2"
L2, 3—8 turns and 3 turns, respectively, of #24 wire wound on Cambridge Thermionic slug-tuned form PLST/2C4L/P
RFC1—5.6 μh RF choke (Miller 9330-18 or similar)
J1, 2—SO/PL-239 coax connectors
SW1—SPST. Oak type 200 or equiv.

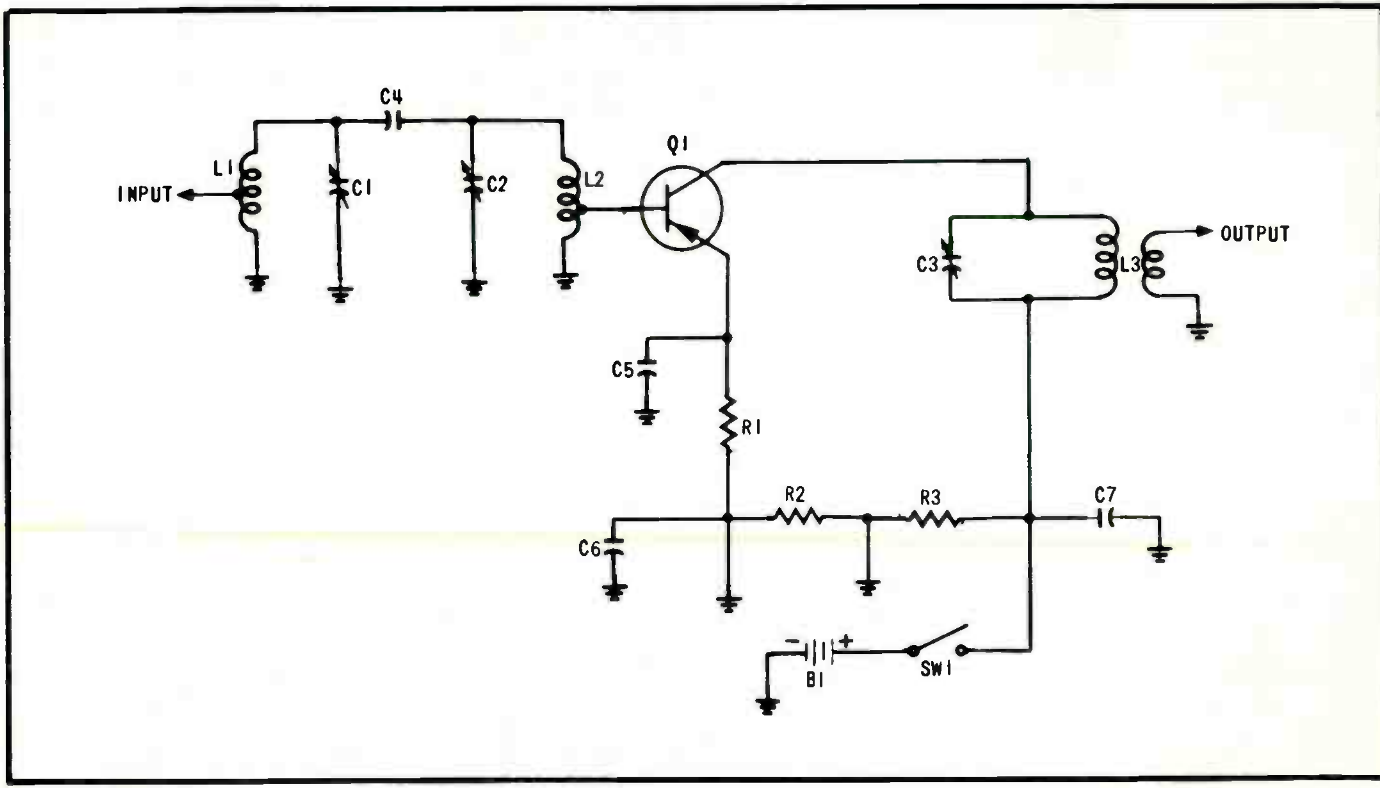
Tuneup is remarkably simple. After checking to make sure you've got your TR battery polarity right, insert the transistor and tune the slug coil for maximum "noise" in that part of the 6-meter band you wish to tune. Adjustment isn't critical, since the little preamp has a 2 1/2-MHz bandwidth, although you can frequently get a bit more hop by squeezing the output coil's turns together or pulling them apart. Parts shouldn't run over $6.50 and construction takes only a couple of hours.

53

432-MHz Receiver Preamp

Good preamplifiers are hard to come by at 3/4 meters, but if careful VHF techniques are practiced during construction of this one, you'll be able to realize an inexpensive preamp that will come within .2 db or better of the noise figure the very best parametric amplifiers provide. Since the semiconductor we're using here is new, it may also be a bit hard to find. If you find this to be the case, look for a Texas Instruments XM101 or an RCA 2N2857. They're direct replacements and will pump out a mighty 12 db gain at 432 MHz. If your converter isn't really hot on this band, build two of these preamps and run them in cascade. The result will outperform the best.

Construction can be tricky, particularly since we're dealing with UHF frequencies where even the smallest amount of excess wire can be made to resonate. Use no hookup wire; short components leads will be more than adequate. Don't begin construction without the aid of a grid dip meter to check coil frequency. L1, L2, and L3 should all register in at 432 MHz, or whatever your exact listening area is. Check these coils again after other components have been mounted. Even the slightest proximity to metal can alter an LC configuration by several megahertz.


C4
Q1
L1
INPUT
C1
C2
L2
C3
L3
OUTPUT
C5
R1
R2
R3
C7
C6
B1
SW1

Tuneup is basic. Simply peak all variable capacitors for maximum signal level on your receiver while maintaining the quietest noise level. If you've followed instructions to the letter, your overall noise figure should be on the order of 3 db, or about 1/2 "S" unit on the meter.

PARTS LIST

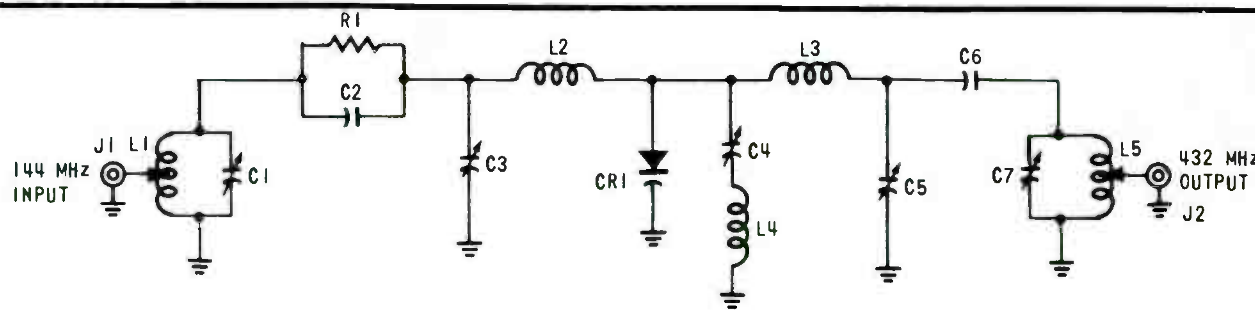
TRANSISTOR:
Q1—2N2998
CAPACITORS:
C1, 2, 3—1-20 pfd piston capacitors (JFD)
C4—Gimmick. Two turns of insulated hookup wire coming together for 3/4"
C5, 6, 7—200 pfd
RESISTORS:
R1—1K
R2—2.7K
R3—6.8K
BATTERY:
B1—9v
MISCELLANEOUS:
L1, 2, 3—1 1/2 x 1/4" copper strap, mounted across piston capacitor, tapped approximately 1/4" from cold end.
SW1—SPST. Oak type 200 or equiv.

54

144-MHz to 432-MHz Tripler

Interested in a simple, easy way to get on 432 MHz? Well, if you've got a 2-meter transmitter handy, you're as good as on with this nifty circuit. Using the latest in solid-state technology, this dandy tripler requires no tubes whatever and will put you on 3/4 meters with a whopping 40 watts!

Operation is a dream. All you do is "spot" your contact by zero-beating him with your 2-meter VFO. You'll clearly hear



PARTS LIST

DIODE:
- CR1—Varactor diode

CAPACITORS:
- C1, 3—25 pfd variable
- C2—5 pfd
- C4—15 pfd variable
- C5—10 pfd glass piston trimmer
- C6—1 pfd
- C7—15 pfd

RESISTOR:
- R1—33K

MISCELLANEOUS:
- L1—4 turns of #18 tinned wire 1/4" diameter. 1/2-inch long. Tapped at 1 1/2 turns from cold end.
- L2—4 turns of #18, tinned, 1/4" diameter, 1/2" long.
- L3—2 turns 1/8" wide copper strap. 3/8" diameter, 1/2" long.
- L4—3 turns #14 tinned. 3/16" diameter, 3/8" long.
- L5—1 1/2" long copper strap across C1.
- J1, 2—Coax connectors

the third harmonic of the 144-MHz frequency as you zero in. Once you've set the frequency, just fire up your varactor tripler and give him a shout. Nothing to it.

Construction of this device is not a dream. You shouldn't even attempt it if you haven't worked with VHF/UHF techniques. Tuneup is not complicated, although it can get exasperating since all controls seem to interact. The important thing is to make sure you are looking at power output on 432 MHz. A coaxial filter before the wattmeter would be a good idea. Then keep tuning everything until you have achieved what you believe to be the maximum output. That's it!

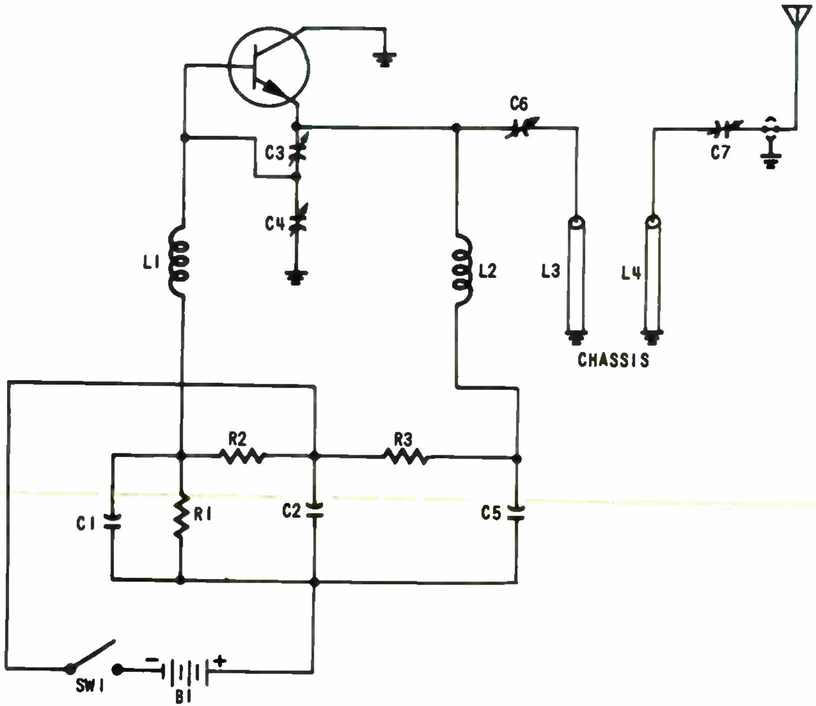
Prices of varactors are plunging right now. Best bet is to shop around, and compromise lower power rating if you like to save money. In 1964 the 40-watters ran about $18. Now, some are down to half that. A quick check in the microwave components section of your parts catalog will give you the latest prices. Regardless of what you wind up with, rest assured it will beat out those old 2C39s in every respect: size, power, efficiency, and pretty soon—price.

55

1-Watt Transmitter for 432 MHz

Here's a dandy rig with real flea-power oomph for the ham who wants to go UHF without investing his life savings. This simple one-transistor configuration offers one-watt output on any single frequency in the 420 to 450-MHz band, complete with its own DC supply (battery). It can be keyed for real UHF DXing.

The transmitter is portable, requiring only an adequate antenna for effective transmitting range. It's ideal for contest



PARTS LIST

TRANSISTOR:
Q1—2N3553

CAPACITORS:
C1—500 pfd
C2—0.01 mfd
C3, 6, 7—Arco 402 variable, 1.5 to 20 pfd
C4—Vitraman No 400 variable, 0.9 to 7 pfd
C5—50 pfd

RESISTORS:
R1—1.8K
R2—75
R3 2.7K

BATTERY:
B1—28v

MISCELLANEOUS:
L1, 2—.22 μh RF chokes, Nytronics No. 60Z189
L3, 4—Parallel brass rods, 1-3/4" long, 3/16" diameter, spaced 3/8" apart. Tunable.
SW1—SPST. Oak type 200 or equiv.

enthusiasts who want added points in ARRL SS bashes for UHF operation, and it's dependable enough to run through many such meets without necessitating battery replacement. Best of all, there's no crystal or associated multiplier stages to worry about. Correctly tuned, it simply resonates at the prescribed frequency whenever the battery voltage is applied.

An ideal UHF club project, this rig has enough "soup" for DX work, provided the listening and antenna gear is up to snuff. Construction is not for tinkerers without prior knowledge of UHF wiring techniques. (For the uninitiated, let us simply state that at such high frequencies there is no such thing as wire. Everything is soldered together, using only component leads, and the leads are kept extremely short with care taken to avoid their resonating at 432 MHz). Additionally, the chassis should be such that its inherent capacity doesn't infringe too much on LC combinations, something that happens all too easily around 500 MHz.

Coils L3 and L4 are tunable, and consist of two parallel brass rods spaced 3/8" apart. Each rod is 1-3/4" in length and 3/16" in diameter. Tuning is accomplished by a simple sliding mechanism which can be fabricated in many ways; each will work. Generally, the shorter the electrically-used portion of the rod, the higher the frequency. Output from L3/L4 is fed to the antenna through very low-loss coax. (Never use anything smaller in diameter than RG/8U, and that only for short feedline runs).

The best way to tune up the rig is to set the usable rod sections at 1-1/4" and resonate the circuit for 500 MHz by varying C3, C4, and C6 for maximum output. Check with your GDO to insure accurate frequency placement. Then slowly work the output frequency down until you are in the 432-MHz ham band. Once you find a good spot (432.15 is popular), set your rig and forget it. There's very little need for VFO-variety operation on 3/4 meters.

56

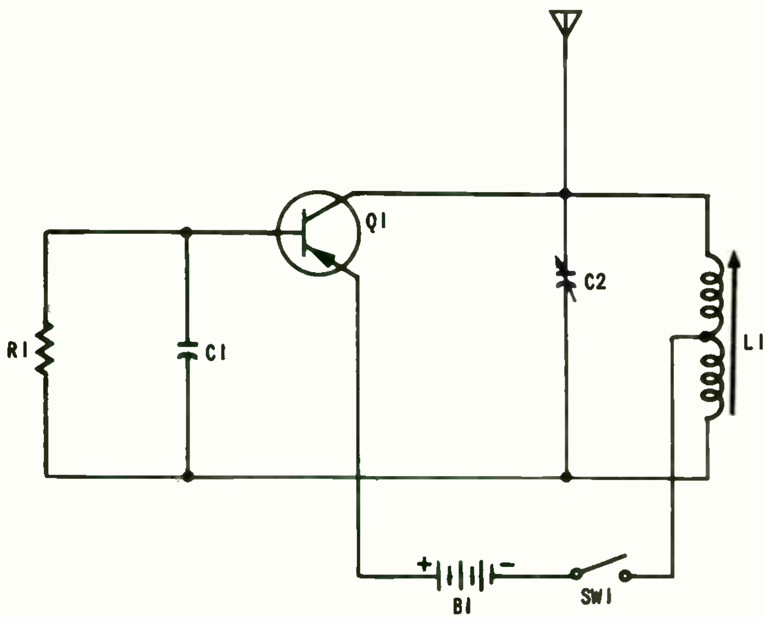
One-Transistor Receiver BFO

At last here's a dandy BFO that'll update those old receivers. A DXers delight, you just install this gadget (with an external switch) inside your receiver and watch the fun begin. Sophisticated SWLs recommend tuning with the BFO, a technique long employed by VHF ham addicts for locating weak signals. The idea is to inject a signal on top of one you would ordinarily pass over. Result is that when you tune, you'll hear a sharp note on each carrier present. Now that you've located it, switch the BFO off, and you're in for some real DX. Construction is amazingly simple. Just keep connections as short as possible all the way.

Hams will find this one transistor marvel particularly useful on Gonset G-50s, Communicators, and what-have-you, that put out excellent signals but lack a good beat-frequency oscillator. By tuning with the BFO, you'll find yourself snagging all kinds of choice DX the boys across town can't even hear. Additionally, those with extra shortwave band coverage on household-variety AC/DCs will now be able to copy CW transmissions with ease. Great for aspiring hams, SWLs, etc. But this circuit will work only with receivers having a 455-kHz IF.

Note to CBers: Installing this device in your transceiver means longer distance contacts between mobile and base. How? Simply by injecting the BFO when the mobile is in a "dead spot" or otherwise gone for the moment; you'll know whether or not he's still transmitting. When you hear the beat note go off, you'll know he's turning the transmission over to you. Simply pick up the ball and call him, notifying him of the problem. Chances are he can hear you and move his car slightly so that passable communications can be resumed. You'd be surprised how many contacts can be "saved" using this technique!

In operation, you will first want to preadjust the BFO for maximum performance. This is accomplished by tuning to an AM broadcast station about midway on the dial and tuning L1 until you hear the characteristic "beat." Then switch to



PARTS LIST

TRANSISTOR:
Q1—2N218
CAPACITORS:
C1—.005 mfd
C2—500 pfd variable
RESISTOR:
R1—330K, 1/2-watt.

BATTERY:
B1—9v
MISCELLANEOUS:
L1—Allied Radio 64 G 401 tapped loopstick
SW1—SPST. Oak type 200 or equiv.

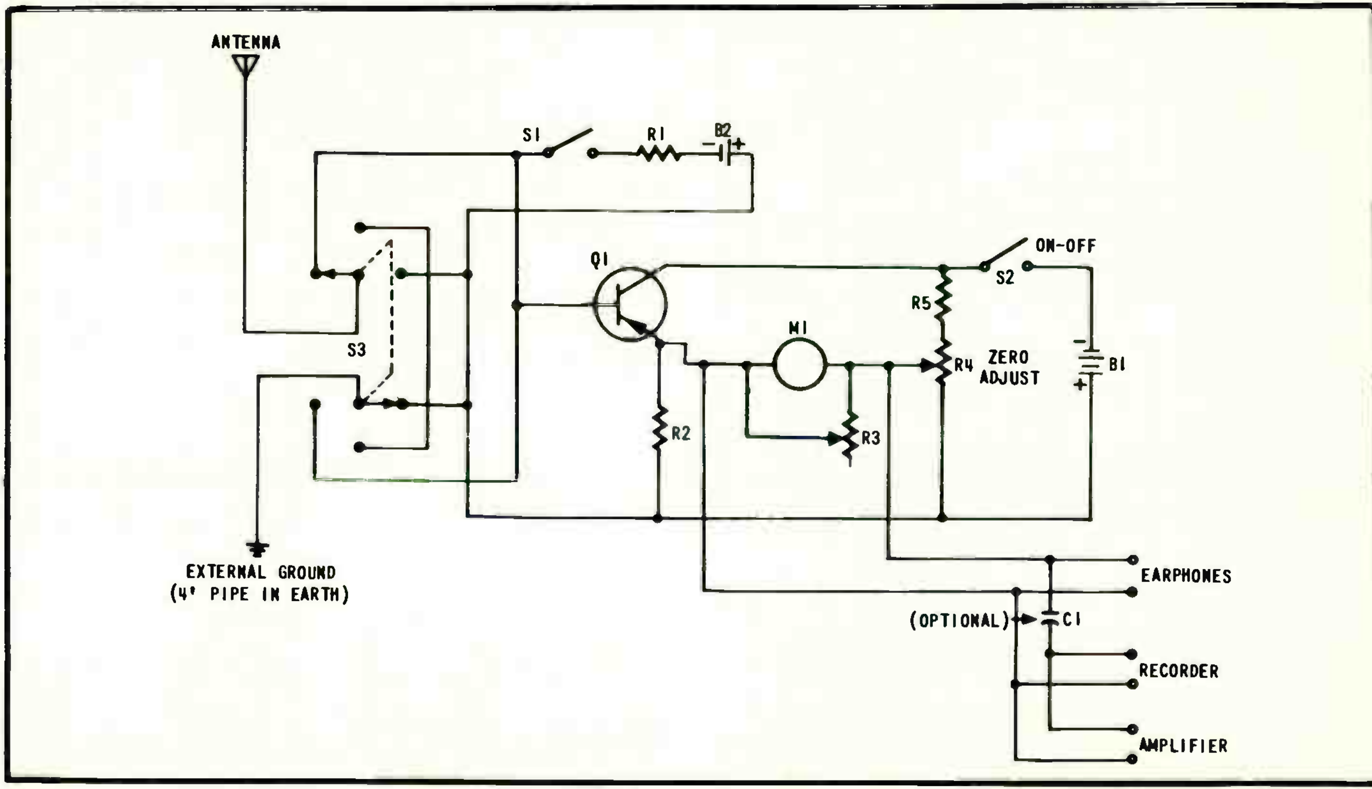
a shortwave CW signal, and adjust L1 again slightly for a note pleasing to the ear. Now install the BFO permanently in the receiver by connecting the "antenna" wire to an unused terminal near the receiver's IF amplifier.

57

Static Electricity Detector

Here's a project bound to catch the imagination of the truly scientifically-inclined: An instrument that can be built for a maximum of $12 (much less if you have a well-stocked junkbox) that will predict weather conditions, measure minute amounts of static electricity in the air at any given moment, warn of impending lightning storms, forecast shortwave band conditions, predict noise level conditions on CB, and win you a top prize in a Science Fair Project Competition. Convinced?

Any time of day or night there are jolts of electricity traveling through the air so small as to make them go unnoticed by the average person, who usually doesn't know what's going on anyway unless he looks up and sees lightning flashes. These tiny currents, though very often low in voltage, may run in current anywhere up to 25,000 amps! And they exist seemingly uncontrolled, sporadic in their intensity, and claiming no place as their home. When these current bursts become more frequent and intense, they adversely affect shortwave radio conditions like an overhead lightning storm, even though the actual disturbance may be as much as 100 miles distant. With the static electricity detector, however, you can "read out" what is happening before it happens in your locale. For example, you may find that you can accurately predict when


ANTENNA
S1
R1
B2
ON-OFF
S2
Q1
R5
M1
S3
R4
ZERO
ADJUST
B1
R2
R3
EXTERNAL GROUND
(4' PIPE IN EARTH)
EARPHONES
(OPTIONAL)
C1
RECORDER
AMPLIFIER

a storm will hit overhead by simply tracing its course as many as 24-36 hours before! After a few days use, you will have a good idea of what the "norm" in electrical bursts is. Any deviation from this "norm" can be noted on a corresponding log sheet, noting meter readings of peak burst intensities and when they are occuring. As they come closer together and increase in intensity, you have the makings of a fine electrical storm, possibly moving your way. By periodically checking the instrument you can easily tell whether it is indeed approaching, or instead turning around, moving away. If you are good at your logkeeping, our bet is you can outpull the Weather Bureau for reliability.

Noise level on practically any high-frequency band is to a certain extent dependent upon electrical discharge in the atmosphere. Whether or not 80 meters, for example, will be in condition for 500-mile DX is consequently dependent upon how low this noise level is at the moment. By beginning each day with a good meter check, you can accurately determine both at-the-moment conditions and what the next few hours hold for communication. The same principle applies in CB work, where low-noise conditions are an absolute "must."

PARTS LIST

TRANSISTOR:
Q1—2N282
CAPACITOR:
C1—.05 mfd disc, optional See text.
RESISTORS:
R1—1.8 meg
R2, 5—2200
R3—10K pot.
R4—500 pot.
BATTERIES:
B1—3v, two "D" cells
B2—1 1/2v penlite cell
MISCELLANEOUS:
M1—Lafayette TM-200, 0-50 microammeter.
S1, 2—SPST. Oak type 200 or equiv.
S3—2-position, triple throw lever.

If you begin to notice a trend toward "quiet" on the meter, you can establish a graphic slope that will tell you just about when the peak of quietness will hit. At that time, make your long-haul groundwave call to unit 1. Chances are if you're on a clear channel you can manage well over 80 miles!

As a science fair exhibit, you can't, of course, haul along your 4-foot ground rod and home monitoring antenna, but you can rig up a temporary system and display the results of your weather (storm) forecasting. Your accuracy (and it will be good if you stick to it) is bound to be noticed by alert judges, anxious to see just how you arrived at your conclusions. So you present your "secret" static electricity detector.

Construction is simple, yet the system is fairly exacting if it is to perform the way you want. First, make certain you use a metal enclosure; a 3 x 4 x 5-inch minibox will do quite well.

The ground employed should be a 4- to 7-foot (yes, feet) length of galvanized steel rod (3/8—1/2" diameter) driven into the earth. It helps to pre-moisten the ground for several days prior to driving the rod, and it is a good idea to keep it watered from time to time afterwards. From the top of the pipe, run a length of guy wire to the antenna mast. (See following paragraph). This step must be accomplished. Midway (or wherever), run a "T" type extension from the ground wire into the room and attach it to the static detector. Solder the tee.

The antenna should not be on the roof, instead it should be placed at least 30 feet from the ground post in an area not prone to electrical disturbances of a man-made nature, such as power lines, phone lines, underground cabling, etc. Cut six or seven 10" lengths of #12 bare copper wire and file to points at the top, soldering them together at the bottom. Fit these to a wooden block or other form of insulation and attach to the antenna mast. Point the rods upward, spreading them apart slightly at the top. Cut a length of #12 insulated wire (lead-in wire), solder to the junction of the antenna wires, and run it down the mast, taping where necessary to hold it place. Connect the lead-in wire to the static device's antenna post. Ground the antenna mast (as indicated above) by running the wire from the ground post underground (at least 6") to the antenna pole and solder the connection. Use a Bernzomatic torch to insure conductivity.

To use the detector, zero the meter with R4 and adjust R3 (after closing the master switch) until you reach a satisfactory level on the meter. Now connect the antenna and ground wires and switch in the antenna. If the meter needle drops below scale, switch to the ground position. This is a polarity problem that will frequently occur; whenever this happens, merely switch from ground to antenna or vice versa.

Warning: Do not situate your antenna in such a manner as to attract lightning—something that must be considered when you have a high radiating element with a good ground. Periodically check the system to make certain the ground is conductively connected to the mast.

58

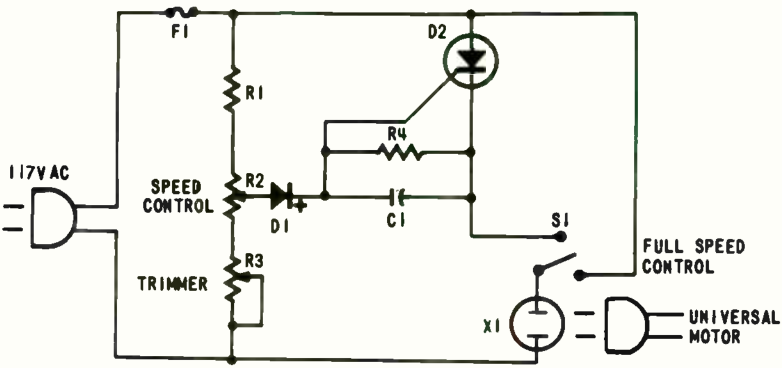
Appliance Speed Control

Ever wish you could soup-up household motor-driven appliances so that you could control their speed? Well, this handy gadget will enable you to do just that with sewing machines, kitchen appliances, vacuum cleaners, hand-type power tools, etc. Matter of fact, just about anything you can name with a 1/8-horsepower (or less) motor can be regulated with this inexpensive device.

In addition to Variac-type control, this circuit includes a trimming potentiometer (R3) which can be set to regulate the full coverage swing of R2, the speed control. By preadjusting R3 in accordance with the requirements demanded by the particular motor-driven device you wish to control, extremely "fine tuning" can be realized by manual adjustment of R2. Additionally, a cut-out switch, S1, provides for straight-through full-speed actuation that bypasses the regulation circuit. Thus, you can enjoy the luxury of reduced-speed control while at the same time not giving up normal top-speed operation. (If desired, R2 and S1 can be combined into one component so that as R2 approaches the top speed it can provide, S1 will kick in).

Construction is best attempted after giving thought to precautions that are conventionally applied to 117v AC devices.

Proper insulation is a must, and nothing should be left in bread-board fashion. The finished SCR control box should be completely enclosed and ruggedly fitted to insure that accidental dropping will not short together any of the components.



PARTS LIST

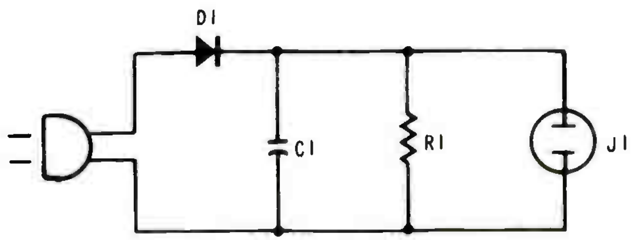
DIODES:
D1—IN1693
D2—GE C15B silicon
CAPACITOR:
C1—2 mfd, 200 WVDC electrolytic
RESISTORS:
R1—4K, 5-watt
R2—500 ohm pot., 2-watt
R3—200 ohm pot., 1-watt
R4—2200, 1-watt
MISCELLANEOUS:
F1—15 amp fuse
SW1—Heavy-duty DPST
X1—Standard AC plug receptacle

59

Electric Shaver Booster

This circuit may add quite a bit of zip to your morning shave, if you're using a standard AC/DC electric shaver. The reason is that most shavers—unless they are expensive top-of-the-line models—seem to run smoother and operate more comfortably from direct current than from household AC. No rattling, banging, or buzzing.

The schematic shows a simple and cheap AC-to-DC converter guaranteed to produce good 117-volt DC for your razor. It should run less than $3.00 to construct, including the metal



PARTS LIST

DIODE:
D1—200 PIV, 750 ma. silicon diode (Allied Radio SD-92A)

CAPACITOR:
C1—20 mfd, 150-volt electrolytic

RESISTOR:
R1—100K, 1/2-watt

MISCELLANEOUS:
J1—Standard AC receptacle

box; and the silicon diode rectifier costs just 68¢. Outside of reminding you to take precautions in construction, due to the comparitively high voltage being handled, there is little more to say on this one. It is sweet, simple, and does an admirable job of reviving those dormant shavers. Be certain to use grommets wherever the AC lines pass through the metal housing and make sure the youngsters can't get inside the chassis.

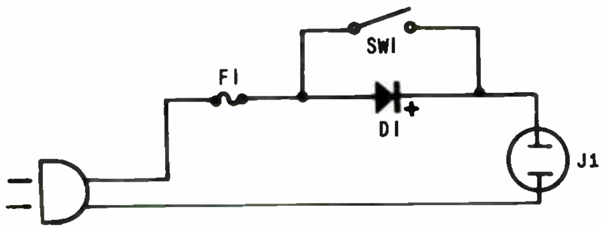
It is advisable to unplug the adapter from the wall after each use, since someone might be tempted to use it on a higher-wattage device. So doing would surely burn out your rectifier, in addition to causing possible damage to the appliance.

60

Electronic Light Dimmer

Here's a dandy silicon power rectifier light dimmer that can be built for way under $2.00. When used in the power line to any household lamp, it will quickly halve the brilliance of the light through its inherent ability to pass only DC and not AC voltage to the bulb. The result is a romantic, soft light of considerable effect in living rooms, dining rooms, etc. In addition, it makes a handy item for a photographer's camera-bag, since any indoor shots can be enhanced by reducing harsh household light to help soften backgrounds. In addition, flash pictures won't look as though the living room lamp were "fighting" with the flashbulb. Once you build this cheap dimmer, you'll wonder how you ever got along without it. We use one in the living room, throwing the switch whenever the TV goes on. It provides a soft light for reading purposes without interfering with the television picture.

Construction should be neat, and the metal enclosure should be equipped with rubber feet to protect tabletops, etc., against scratching. Grommets should be used where the AC line comes in, and extension-cord variety wire should be utilized in the wiring inside. An adequate heat sink should be provided for the silicon rectifier. You can make a satisfactory one by simply stringing a lot of metal washers on the top-hat SCR. The more brilliant the bulb used in the lamp, the more the rectifier will heat, although this shouldn't be a prime concern unless you plan to be regulating 300-watt-and-up bulbs with your dimmer.



PARTS LIST

DIODE:
D1—200 PIV, 12-amp silicon power rectifier. Lafayette 19 C 4207.

MISCELLANEOUS:
F1—15-amp fuse.
J1—Standard AC receptacle
SW1—SPST. Oak type 200 or equiv.

61

Electronic Fence Charger

Although this solid-state charger was designed originally to keep livestock within an enclosed area, we're sure you can think of a number of more practical applications around the home. The output is high voltage, yet not so high as to be fatal. Just enough to provide a good wham. The trick behind this configuration is that the high voltage is not always present. Hence no danger in case of rain, children, etc. Based on an SCR trigger arrangement, the neon bulb (I1) fires when C2 reaches firing voltage. Then the SCR conducts and shocks the victim.

Construction, needless to say, must be undertaken quite meticulously, with more than adequate insulation throughout. Care should be taken to avoid possible shorts, and if desired a 30-amp 117v AC fuse can be inserted in the line on the outside of the 1N1695 rectifier. Rubber grommets should be used wherever wires pass through the chassis sides. Heavy-duty outdoor insulated wire should be used to carry the high voltage from your charger to the fence.

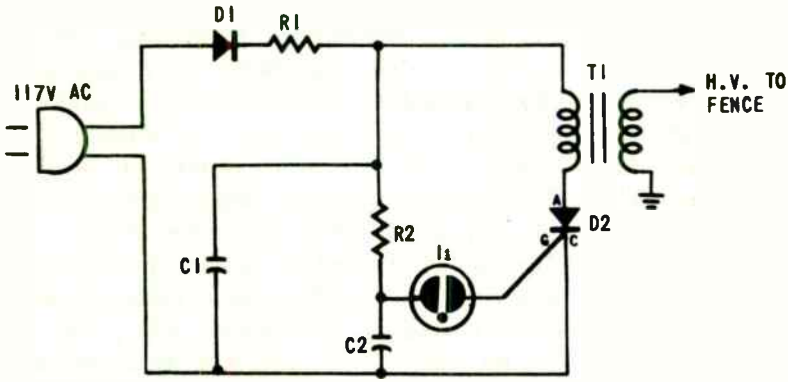
PARTS LIST

DIODES:
- D1—1N1695
- D2—1140A-2

CAPACITORS:
- C1—2 mfd, 200 WVDC electrolytic
- C2—.5 mfd, 200 WVDC electrolytic

RESISTORS:
- R1—1.2K
- R2—12K

MISCELLANEOUS:
- T1—Standard 12-volt auto coil
- I1—NE-2H neon bulb

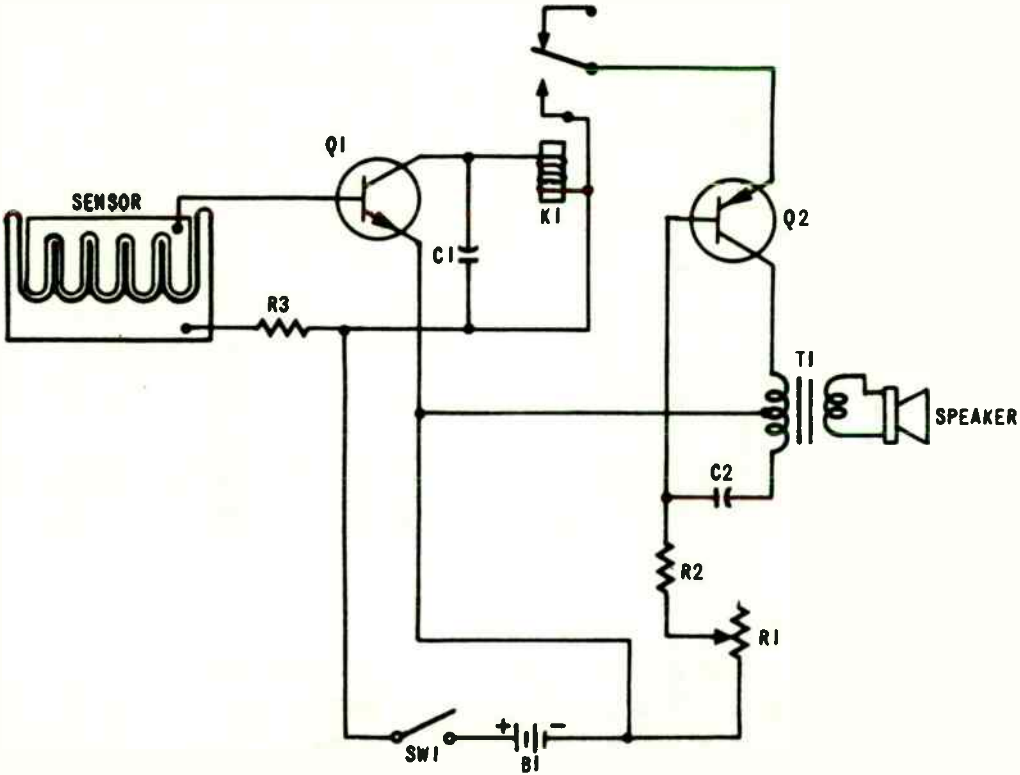


62

Electronic Moisture Alarm

This dandy little unit will scream like a banshee when it rains, drizzles, or is just plain too humid, depending upon how you set its sensitivity. One interesting application is for home-owners: Few builders bother to include a heat vent, radiator, etc., in the basement since they feel enough warmth can be derived from sheer proximity to the heating system. Which is fine as far as they're concerned, but it sure gets damp down there! Experimenters with this problem can save their magazine collections, paint jobs, etc., by simply adding a modified version of this circuit to an electric heater. When severely high dampness prevails, this gadget will trip the heater into action and shut it off when it's job is done.

But the real application of the entire project is simply to set off an alarm when raindrops hit the sensor plate element. This can be a boon to farmers, gardeners, etc., and an electric counter can be added if you also want to record the number of rainfalls in a given period. Additionally, hams and CBers can install their sensor near the transmitting antenna to warn of rain while they're on the air. This can be a significant shack additive, since reception, SWR, and a host of other problems often check back to moisture on the roof.



PARTS LIST

TRANSISTORS:
- Q1—2N170
- Q2—2N107

CAPACITORS:
- C1—100 mfd
- C2—.25 mfd

RESISTORS:
- R1—1.2 meg pot.
- R2—10K
- R3—5.6K

BATTERY:
- B1—9v, six penlite or size C cells.

MISCELLANEOUS:
- T1—Argonne AR-119
- K1—Sigma 4F-1000 S/S1L relay
- Speaker—4-ohm
- SW1—Switch hooked to R1

One housedweller we know of built a huge sensor element and installed it in a troublesome area in his attic where dampness seemed to appear sporadically. Result was that through the downstairs alarm he was able to trace the difficulty to a 3 x 5-inch ceiling spot where, upon a rooftop inspection, he discovered the culprit—a poorly nailed-down shingle. You can probably think of other situations where a permanent-type installation can prove advantageous.

Since we're not dealing with RF, construction is pretty much as you want it. Nothing tricky, except to note correct transistor connections. The sensor can be built to suit your own requirements; it can either become actuated with a heavy rain, light spray, or just dampness, but for the latter, correct and careful construction is a must.

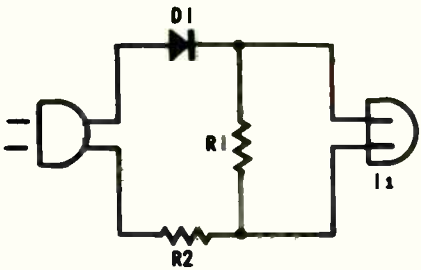
Easiest way is simply to paste a sheet of aluminum foil on a thin piece of wood or bakelite. By cutting zig-zag patterns out of the piece lengthwise, you can electrically separate the aluminum sheet into two halves, which are wired to the alarm. An Xacto knife is a handy item to have when doing a cutting job like this. Simply cut one narrow strip, zig-zagging your way down from the top. For dampness, make the strip as thin as humanly possible without the two sides shorting. (We're talking about perhaps a 1/128 or 1/64 of an inch). Regardless of the sensitivity required, it is best to check it out in the circuit before permanent installation to ascertain if it is shorted.

63

Inexpensive Strobe

Got anything around your house that moves (vibrates or rotates) at 60, 120, or 240 times per second? If so, this strobe will give the illusion of "freezing" the motion. An electric clock motor, a record player motor, and a tape deck motor all will look as if they have come to a dead stop.

Heart of the strobe is the diode, which permits only 1/2 of the 60-cycle AC to pass (regardless of which way the diode is wired into the circuit). Build the unit into a plastic cylinder for convenience. To use the strobe, turn out the room lights and hold the strobe light a few inches away from the motor under examination.



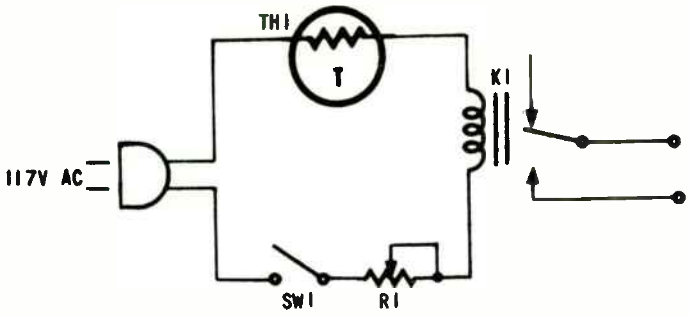
PARTS LIST

DIODE:
D1—1N553 diode
RESISTORS:
R1—110K
R2—16K
MISCELLANEOUS:
I1—GE type NE-2P neon bulb

64

Time-Delay Device

By placing a thermistor and a variable resistor in series with a power supply, a variable time-delay relay can be made. When the switch is closed, current flow is limited by the resistance of the thermistor. When the thermistor heats up, it permits sufficient current flow to close the relay. By decreasing the series resistance, the delay time may be decreased. Such delay circuits are used in many cases where variable or fixed delay is required. This particular circuit gives a range of about 1/2 to 15 seconds.



PARTS LIST

DIODE:
TH1—Fenwal K-600 thermistor

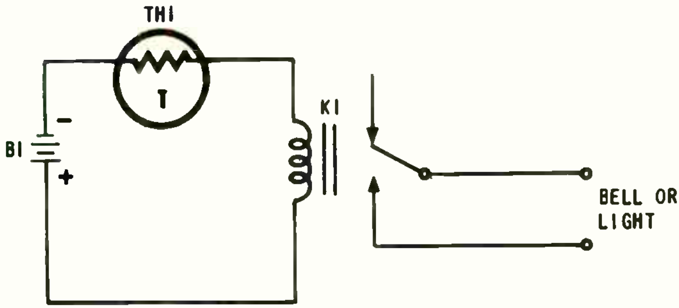
RESISTOR:
R1—5K pot

MISCELLANEOUS:
K1—115v AC, 10-amp relay (Potter & Brumfield KRP11AG) Be sure to specify 115v AC operation
SW1— SPST. Oak type 200 or equiv.

65

Liquid Level Indicator

In this project we will use the thermistor as a fast acting remote liquid level control. The current through the thermistor heats it higher than the surrounding atmosphere; in such a state the thermistor will be at low resistance. When the thermistor becomes submerged in a liquid it cools because of the greater thermal conductivity of the liquid. The thermistor resistance will increase sufficiently to reduce the current and trip the relay. A bell or light, attached to the relay, can serve as the indicator. Such a circuit might have a household application as a flood indicator in your basement.



PARTS LIST

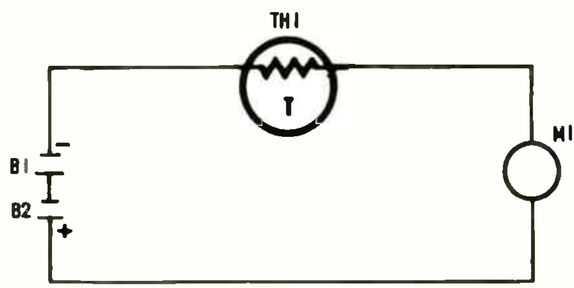
DIODE:
TH1—Fenwal K-600 thermistor (See text)
BATTERY:
B1—70v
MISCELLANEOUS:
K1—2.5K relay, close 9 ma, open 6 ma. (Potter & Brumfield LB5)

66

Electronic Thermometer

A thermistor is a negative-coefficient temperature-sensitive therman resistor in which the absolute resistance is a function of its absolute temperature. As temperature goes up, resistance goes down. The thermistor is one of the most versatile components known to electronic design engineers.

An interesting experimenter's circuit is an accurate and fast acting electronic thermometer using a thermistor. As the temperature changes, the resistance of the thermistor changes, and the current flow through the meter is calibrated in terms of temperature. In this case, the thermistor may be mounted at a great distance from the meter, and ordinary insulated copper wire may be used for connection because of the relatively negligible drop or change in wire resistance compared to the thermistor resistance. This specific circuit has a temperature range of approximately 0 to 115°F full scale. Calibration can be accomplished by exposing the



PARTS LIST

DIODE:
TH1—Fenwal K-600 thermistor (See text)

BATTERIES:
B1, 2—1.34v mercury, batteries

MISCELLANEOUS:
M1—0-to-50 milliammeter 2K resistance

thermistor to known temperatures such as a warm water (not hot), using another thermometer as a comparison.

The thermistor used in this project is a type K-600, an inexpensive experimenter's type made by Fenwal Electronics, 63 Fountain St., Framingham, Mass. If your local shop doesn't carry it and can't obtain it for you, contact Fenwal for the name of the nearest distributor. The K-600 was previously designated the EMC-4 thermistor.

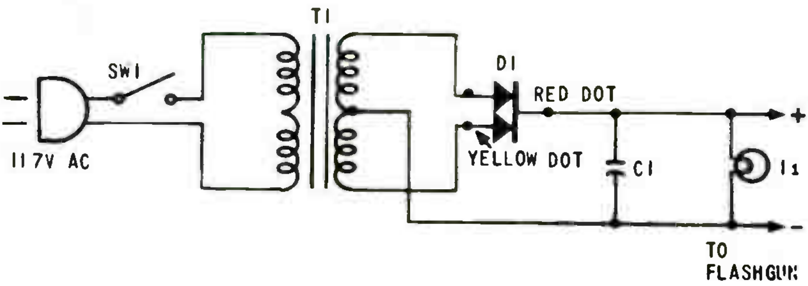
67

Flashgun Battery Eliminator

If you've ever "just missed" that unforgettable pose because the bloomin' flashbulb didn't fire, this little project is for you. It has been our own finding that the often-suspected "bad" flashbulbs more frequently than not are fine—it is just that battery voltage had deteriorated, connections weren't clean, or some such thing. Which is a lot of consolation after you've fired the shot. Particularly since the advent of Instamatics, this problem takes on expensive overtones, since the film advances whether or not the bulb actually went off. One episode with our Kodak Instamatic 104 resulted in only four usable prints, and those were due to the fact that the other eight were taken indoors with a faulty flash. The remaining four were taken outside in the bright sunlight.

The circuit actually is a handy and conventional battery eliminator. It uses a 6.3-volt filament transformer and suitable rectifier to provide 3.5-volts DC to the flashgun. Results? So far no misfires. And you shouldn't have any either.

The trick is in making an adapter so that you can easily plug the 6-foot wire from the eliminator into the flashgun battery holder whenever you want. Though fitted wooden dowels do nicely, we found it more expedient to simply remove the existing battery, tape our connections to it, and plug it back into the flashgun after drilling a tiny hole in the holder so that the eliminator wires can pass through. After a fashion, you'll find that this allows your regular battery to recharge, while at the same time providing fail-proof pictures indoors where there is an AC outlet handy. Of course, when there isn't,



PARTS LIST

DIODE:
D1—International Rectifier J14C1

CAPACITOR:
C1—240 mfd, 6-volt electrolytic

MISCELLANEOUS:
T1—Stancor P6134 filament transformer
I1—GE #47 bulb
SW1—Heavy-duty AC SPST

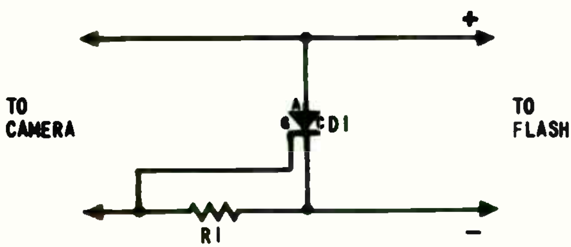
you simply disconnect the eliminator and proceed in taking your pictures with the battery.

Our own use showed that we used the eliminator on 75% of our "flash needed" pictures. The other 25% were taken with the battery supply, which was well charged. Don't leave the eliminator plugged in (or switched on) except when you've got the camera out. You'll ruin the original battery by pouring constant recharge currents into it. Intermittent use, of course, is harmless to the cell.

68

Electronic Flash Life Extender

An electronic photo flash is a dandy thing to have and you can make it even dandier if you can extend it's life. Only two components are required and the whole project is rapidly wired between the camera and the flash unit.



PARTS LIST

DIODE:
D1—2N3228 silicon controlled rectifier
RESISTOR:
R1—102

Heart of the scheme is a silicon controlled rectifier which, in conjunction with a resistor, acts to soften the jolt of voltage and current across the camera contacts. This shouldn't adversely affect the quality of the photographs you're going to get, but it will let you take many more without additional investment in flash gear. The parts for the life extender should cost in the area of $2.

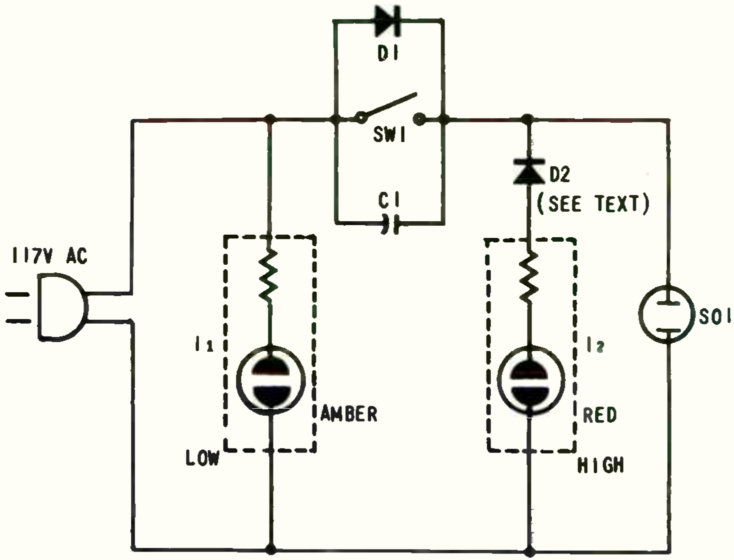
69

Electronic Wattage Reducer

This handy item is just the thing for prolonging life of needed high-wattage units such as a photographer's high-intensity lamps, projector lamp, non-motor driven appliances such as electric heaters (without fans), etc. The idea is simply to be able to half the power going to the device without spending $57 to do it commercially. You can use it to lower iron heat for pressing tricot or nylon items too delicate for conventional ironing, for lowering soldering iron heat for tricky semiconductor construction projects to avoid burning out low-wattage resistors, etc. Matter of fact, it'll work on just about any household or commercial device that normally draws up to 1500 watts. Great for cutting down that electric bill!

The trick in constructing this gem is to properly mount the silicon rectifier (D1) so that it's completely insulated from the chassis. This mount should be an SCR heat sink, available at any parts store. Additionally, it is wise to drill ventilating holes in the case to allow for proper cooling. Normally D1 will run hot, but you don't want to cook it either. Observe proper insulating techniques for high-current 117v AC protection. Fuses aren't a bad idea.

The lights (resistive neons) are for your own convenience and information only. They are not a necessary component



PARTS LIST

DIODES:
- D1—IN1196A and silicon heatsink
- D2—50 ma, 200 PIV silicon

CAPACITOR:
- C1—.01 mfd 1,000-volt

MISCELLANEOUS:
- I1, 2—Resistive NE-2 assemblies, color marked
- SO1—Chassis-mount AC socket
- SW1—Household AC, 15-20 amp.

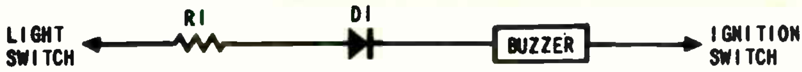
and can be omitted entirely if you so desire, providing your SPST switch is marked clearly "high" and "low." Putting the gadget in the wrong position could very well prove disastrous, particularly if its your nylon shirt the missus is ironing when she mistakenly throws it on "high"!

70

Car Light Buzzer

Ever return to your car only to find that you had left the lights on. Yes, they're off now, but they killed the battery in the process of dying. Seems like such a simple matter to rig up a gadget to let you know when the lights are on with the motor off that it's hard to understand why Detroit can't include this type of thing with your $3,000 monster. The whole trick is a matter of three inexpensive little components which can be wired up in a few minutes, hidden from view, and forgotten about until they automatically swing into action.

Get yourself a buzzer, the kind that they sell for kids to learn code. Remove the cover from the unit and attach the diode and resistor as shown in the schematic. Then, hook the resistor end of the gizmo to the car's light switch and the buzzer end to the ignition switch. For positive ground cars, hook the circuit in backwards, and forget the resistor in cars



PARTS LIST

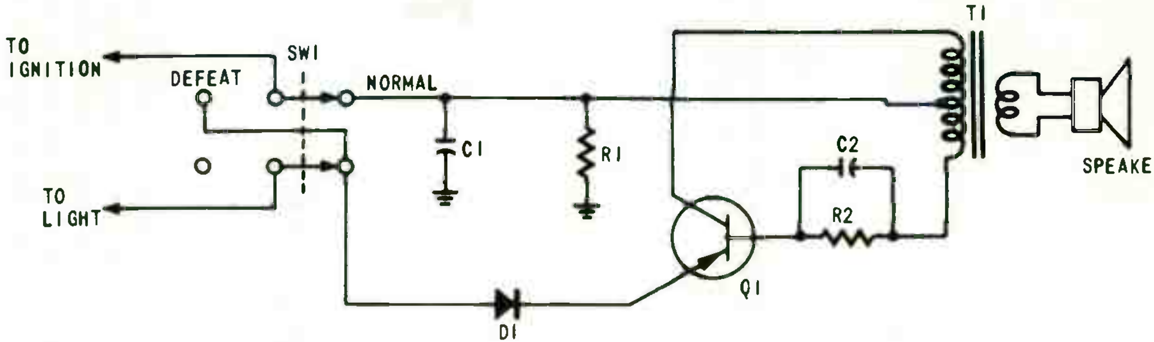
DIODE:
D1—1N2482 diode
RESISTOR:
R1—11 ohms (not required for 6 volt cars)
MISCELLANEOUS:
Buzzer—See text

with 6-volt electrical systems (negative or positive grounds). When the motor is off and the lights are on the buzzer will sound to remind you that you goofed.

71

Automobile Headlight "Minder"

Here's something really different in reminder devices, a gadget that may soon be incorporated as an optional accessory on Detroit's top-of-the-line models. This light-minder circuit sounds a loud alarm if the lights of the car are left on when the ignition is turned off. The alarm stops when the lights are turned off. When the lights are intentionally left on for a period of time, the alarm can be defeated so that no warning sounds. The alarm then sounds when the ignition switch is turned on



PARTS LIST

TRANSISTOR:
Q1—2N217
DIODE:
D1—1N34A
CAPACITORS:
C1—.22 mfd, 25 WVDC electrolytic
C2—30 mfd, 15 WVDC electrolytic

RESISTORS:
R1—15K
R2—680
MISCELLANEOUS:
T1—Lafayette 99 R 6209
SW1—DPDT. Oak type 200 or equiv.

as a reminder that the system has been defeated and the switch should then be returned to the "Normal" position.

If you drive a positive-ground automobile, use an RCA 2N647 instead of the 2N217, reverse the polarity of the 1N34A crystal diode, and reverse the polarity of C1. Switch wiring remains the same, as do all remaining connections and components.

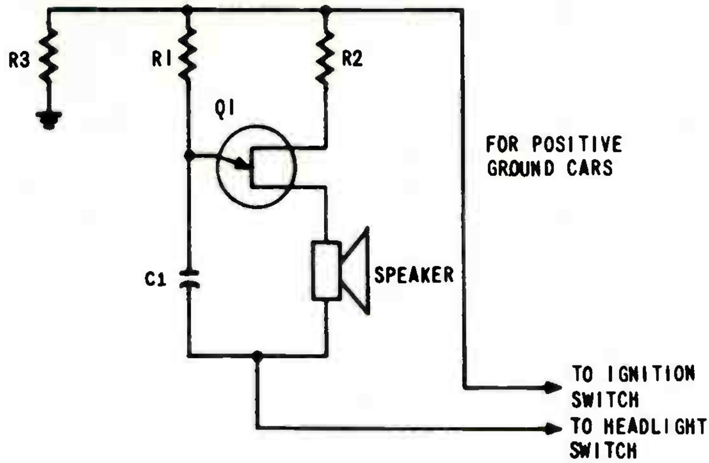
The device can be built into a small plastic box or minibox, providing it is well insulated and care is taken to avoid shorting due to road vibration. All solder joints should be double-checked for this reason. The speaker can be 1 1/2-inch permanent magnet type with a voice coil impedance of approximately 11 ohms. The Lafayette 99 R 6035 works fine.

72

Auto Battery Saver

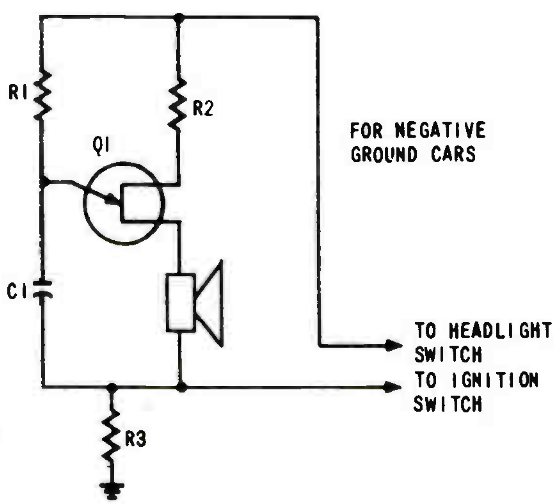
Here's a project that at first glance may seem old hat. But hold it! This inexpensive gadget uses the latest in unijunction semiconductors to provide a state-of-the-art configuration that will be incorporated into several new Detroit cars in the near future. The idea is simple, yet the design will outlast your car and save immeasurably on "forgotten" battery drain. Operating on a computer logic basis, the unijunction transistor saver will squawk horribly every time you turn off the key without killing the headlights.

Don't want another contraption in the car? Put aside your worries; this thing can be built into the tiniest of containers



PARTS LIST

TRANSISTOR:
Q1—2N2160
CAPACITOR:
C1—25 mfd, 50 WVDC electrolytic
RESISTORS:
R1—1.6K
R2—92
R3—271, 5-watt

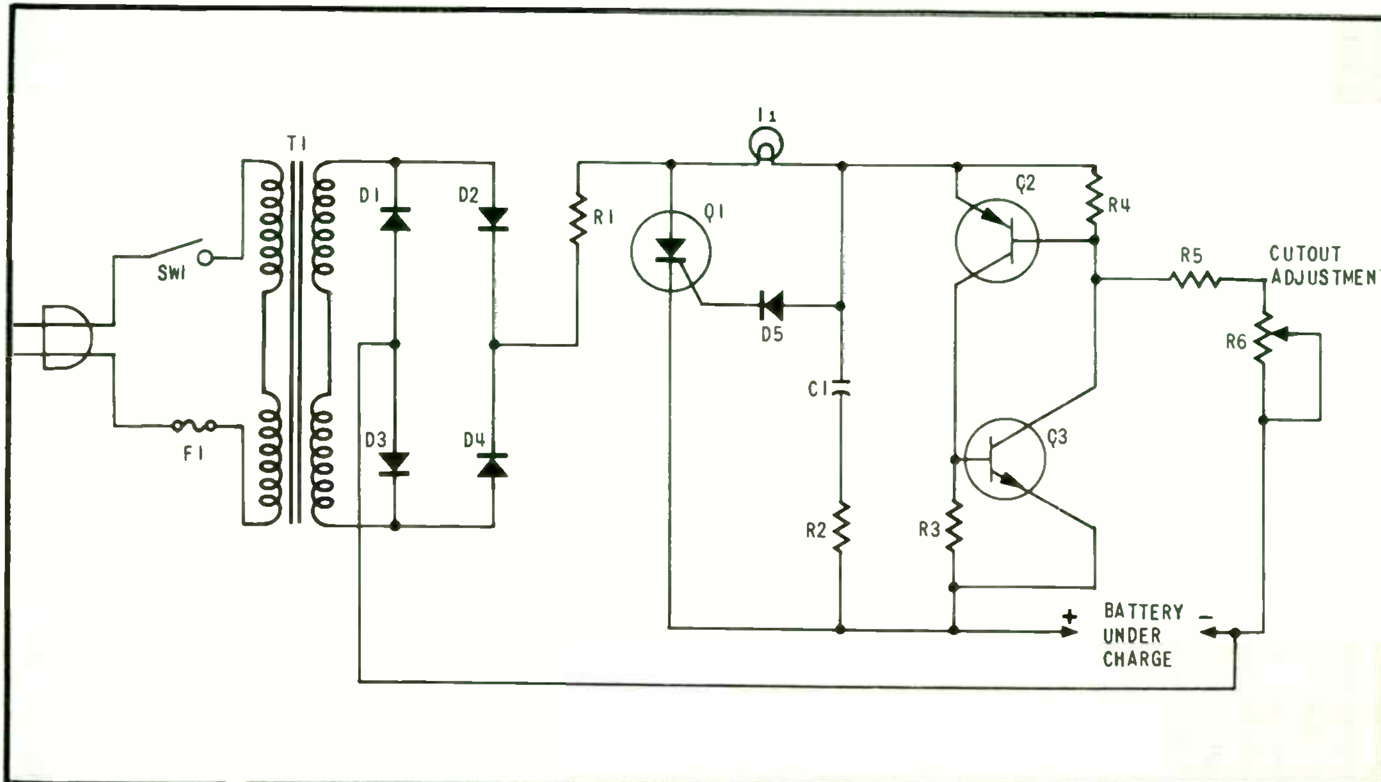


and can be inconspicuously mounted in the rear of your glove compartment. All wires are out of sight. Better still, forget about a separate speaker system. Wire this directly into your car radio speaker, killing two birds with one stone. Build this squawker and you'll wish you'd never heard of headlights. At least until you get in the habit of turning them off before you kill the ignition.

73

12-Volt Battery Charger

Hams and CBers who do a lot of mobile transceiving know what can happen to a good auto battery. Unless you have an alternator/generator in your car and keep the engine running most of the time, sooner or later you're going to have need for a portable battery charger. Not just a trickle charger, this circuit has been designed to handle the standard 6-cell 12-volt lead storage batteries in automobiles and other vehicles without removing them from their original mounting and without the need for constant attention. When the battery is fully charged, the charger circuits automatically switch from high


T1
SW1
F1
D1
D2
D3
D4
R1
Q1
I1
D5
C1
R2
Q2
R4
R3
Q3
R5
CUTOUT
ADJUSTMENT
R6
+
BATTERY
UNDER
CHARGE
–

charging current to "trickle" charge, and an indicator lamp lights to provide visual indication of this condition.

The charging rate is approximately 2 amps, enough to bring any battery up to snuff in a short time. When the cells have reached the fully-charged condition referred to above, the circuit switches to "trickle"—and then provides a constant 150 milliamperes to the battery.

Construction is somewhat tricky, since correct capacitor, diode, and transistor polarities must be strictly adhered to.

PARTS LIST

TRANSISTORS:
- Q1—2N3228
- Q2—2N2614
- Q3—2N3241

DIODES:
- D1, 2, 3, 4—1N2860
- D5—1N3754

CAPACITOR:
- C1—50 mfd, 15 WVDC electrolytic

RESISTORS:
- R1—5 ohms, 20-watt
- R2—33
- R3—470
- R4—150
- R5—1.8K
- R6—10K, 2-watt pot.

MISCELLANEOUS:
- F1—1 amp fuse
- I1—#1488 12-volt pilot lamp
- T1—Stancor RT-202
- SW1—SPST 3-amp, 125-volt

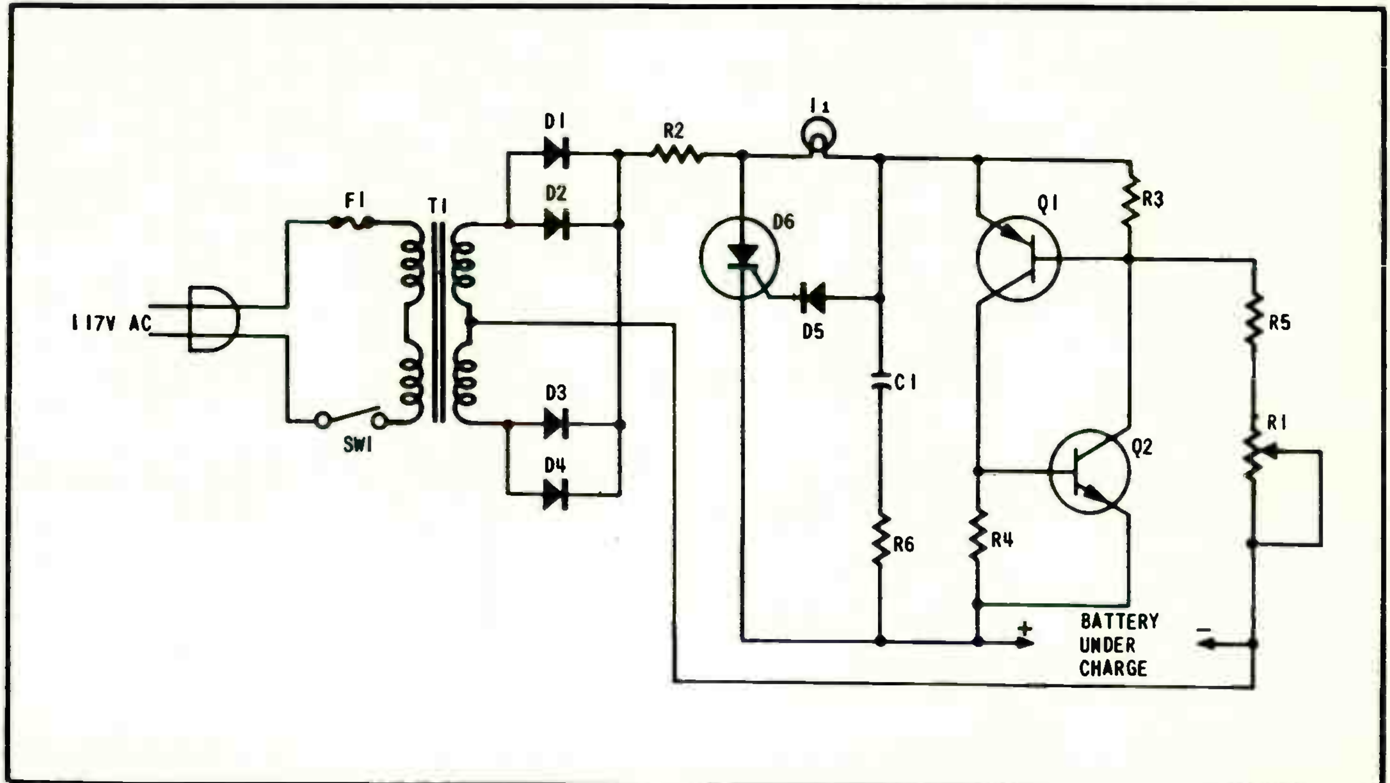
Additionally, adequate ventilation should be afforded the charger without endangering the components. Best answer to this problem is to provide angled vents. Since high voltage is used in the input, fuse F1 is an absolute necessity, as is heavy-duty wiring throughout. All leads should be as short as possible. Also, observe the wattage ratings suggested in the parts list for R1 and R6. Other resistors can be standard 1/2-watt types. Also, see project 74.

74

6-Volt Battery Charger

At last a reliable charger for those with older American and foreign cars that use a 6v DC electrical system! Not only is this charger inexpensive to construct, but it has many times the output of those so-called trickle chargers on the market for $17 and up that take a good 48 hours to do the job. This 3.2-amp charger automatically shuts itself off when the job is done and flashes a light to signal that it's finished. This circuit is especially useful for recharging run-down batteries in automobiles or other vehicles without removing them from their mounting.

A delight for Volkswagen addicts with a host of receivers and transmitters in the power line, this jazzy charger can be adjusted by presetting the automatic "cutoff" provided. Simply set potentiometer R1 so that the indicator lamp just begins to light on a freshly charged battery (which, incidentally should measure 7.15 volts, and not 6). From that point on, every time the circuit senses that the battery is 7.15 volts, the charging will stop, except for a minute 150 ma "trickle."


117V AC
F1
T1
SW1
D1
D2
D3
D4
R2
I1
D6
D5
C1
R6
R4
Q1
Q2
R3
R5
R1
+
BATTERY
UNDER
CHARGE
−

Special care should be taken that the battery connections are clean—really clean. If you don't get a solid hookup, the charger will shut off early, before the battery is charged. And it will stay off until someone rectifies the situation by readjustment or by cleaning the binding posts.

Once again, since we are dealing with 117v AC house current, extreme care should be taken to insure that proper insulation is used throughout the circuit. Also, it is a good

PARTS LIST

TRANSISTORS:
- Q1—RCA 2N2614
- Q2—RCA 2N3241

DIODES:
- D1, 2, 3, 4—RCA 1N2860
- D5— 1N3754
- D6— 2N3228

CAPACITOR:
- C1—50 mfd, 15-volt electrolytic

RESISTORS:
- R1—10K pot., 2-watt
- R2—2, 25-watt
- R3—150
- R4—470
- R5—1.8K
- R6—33

MISCELLANEOUS:
- T1—Stancor RT-202
- F1—1 amp fuse
- I1—#47 bulb
- SW1—3 amp, 125-volt, SPST. Oak toggle

idea to provide ventilating holes in the box so the rectifiers don't overheat. Remember: Your new charger may be exposed to all kinds of weather in actual use. This means that rain and snow can leak into the ventilated chassis if you're not careful. Also, rubber grommets should be used wherever you have wires extending from the charger. Make certain the unit is kept in a clean, dry place when not in use, and you'll realize many long years of dependable service. Also, see project 73.

75

Magic "Buzz-Buzz"

Here's something which has a multitude of uses—as a metronome, as a darkroom timer, or as no more than a curiosity which will amuse your guests and immediately identify you as an owner of something which is most definitely "far out." It's a box which sends out horrible little buzzes at a rate which you can vary in duration.

Build the Buzz-Buzz in any small box—it need only be slightly larger than a miniature speaker. The on/off switch and pot are mounted through the case so that they are easily manipulated. Construction layout is not critical and most of the components can even be attached to a terminal strip. The transformer is the only bulky ingredient and you can bolt that down using a ground lug on the terminal strip.

After turning the unit on, it will take a few seconds before it starts perking. Let it run for a minute or two, and then adjust the timing by using the second-hand on your wristwatch. For accuracy, take a full minute's count (just count the number of pulses heard during a 1-minute period).

PARTS LIST

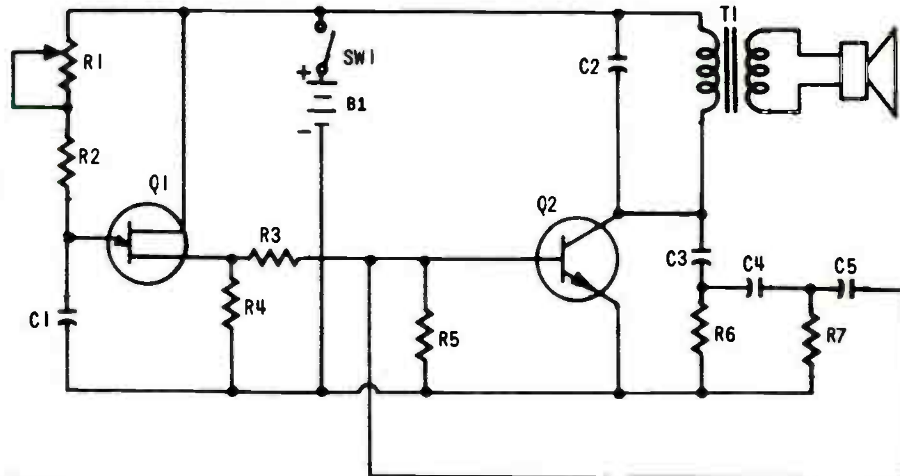
TRANSISTORS:
- Q1—2N1671 unijunction
- Q2—2N3391

CAPACITORS:
- C1—100 mfd, 25 WVDC electrolytic
- C2—0.1 mfd
- C3, 4, 5—.05 mfd

RESISTORS:
- R1—10K pot.
- R2, 3—19.1K
- R4, 6, 7—1K
- R5—13K

BATTERY:
- B1—9v

MISCELLANEOUS:
- T1—Standard-type transistor output transformer
- SW1—SPST. Oak type 200 or equiv.

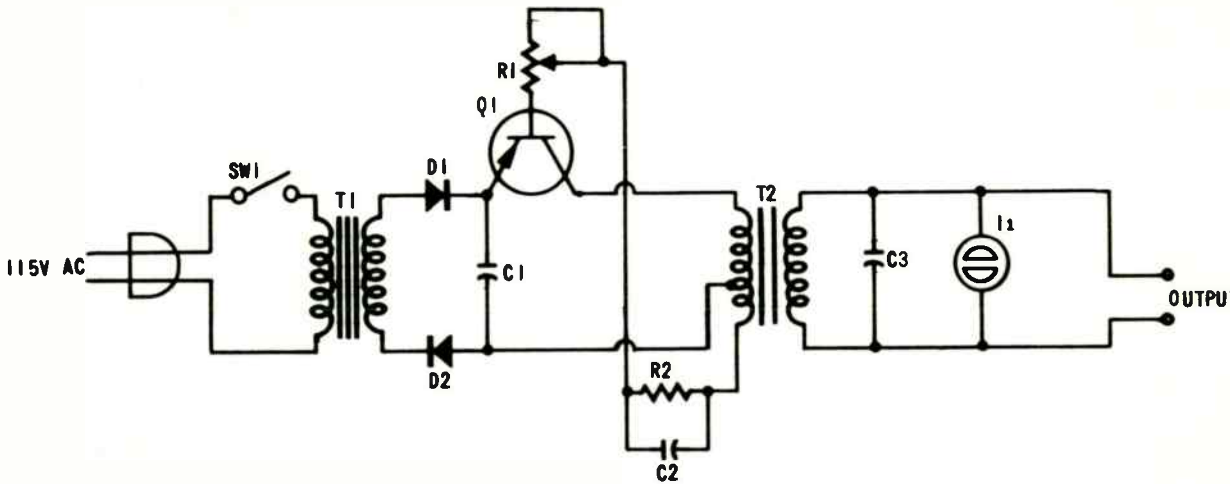


76

"Beeper" Box

This circuit doesn't have a heckuva lot of practical uses but it is an interesting design of a blocking oscillator in a modified Hartley configuration. It will, however, make a dandy night light for the kiddies or an amusing toy. Built into a small chassis, it operates directly from the household power lines. Speed of the pulses is controlled by the setting of the pot.

As the circuit functions, the neon bulb will flash with each pulse; it also acts as a peak limiter. For general experimenting, the output can be fed into binding posts, and from there you're on your own with the disposition of the little pulses. Run them into an oscilloscope or a VTVM—you can even use the pulses as a "shock" device.


R1
Q1
SW1
D1
T1
T2
I1
115V AC
C1
C3
OUTPUT
D2
R2
C2

PARTS LIST

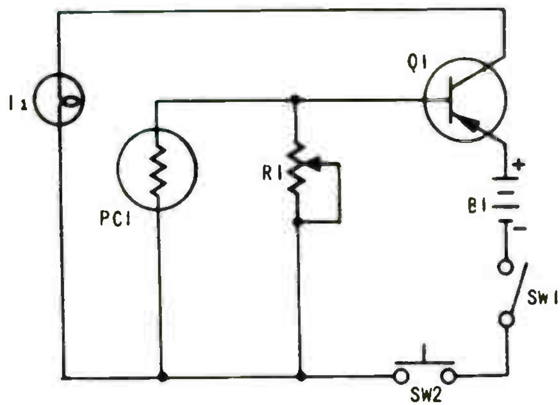
TRANSISTOR:
Q1—GE-3
DIODES:
D1, 2—general purpose silicon rectifiers
CAPACITORS:
C1—1000 mfd, 10 volt electrolytic
C2—500 mfd, 10 volt electrolytic
C3—0.05 mfd
RESISTORS:
R1—1K pot.
R2—36K
MISCELLANEOUS:
T1—6.3 volt filament transformer. Triad F-14X.
T2—Universal audio output transformer
I1—NE-51 neon bulb
SW1—SPST. Oak type 200 or equiv.
equiv.

77

'Magic" Electronic Candle

An instrument like this conjures up all sorts of devious applications—modifying your living-room floor lamp for "magic" activation, using it as a central switch to control all your household lights "automatically," a fool-proof custom lamp for a friend (that won't work until you show him how), etc. You can also surreptiously mount the circuit in a cigarette case and place it close to the table lamp, running wires under a mat, etc. Regardless of whether it's "inboard" or "outboard," it's guaranteed to startle your guests.

So what is it? Simply a photoelectronic gadget that will turn on a lamp with "only the flick of a match." There's no other way to get the lamp to light, outside of traveling about with a bulky flashlight. But the amazing part is that by placing the



PARTS LIST

TRANSISTOR:
Q1—2N1177
PHOTOCELL:
PC1—Standard-type photocell
RESISTOR:
R1—35K pot.
BATTERY:
B1—3v, 2 penlite cells
MISCELLANEOUS:
I1—GE 123 bulb
SW1—SPST. Oak type 200 or equiv.
SW2—Pushbutton

photocell in such a way as to "get hit" with the flood of light the instant the lamp is turned on, it will stay on until you deactivate either the lamp or the photoelectronic device. Great for the upstairs bathroom.

The delight of the circuit is that you can build it more or less to suit whatever form captures your imagination. Construction can be tight or loose; photocell placement can be in the lamp or in the device. For simplicity's sake, the circuit shown is self-contained. That is, with its own light bulb hooked to the supply battery. You can devise a variety of forms with this, and get good lighting by employing the new high-intensity flashlight bulbs (some parts stores have them, or see a good hardware outlet), although a normal 3-volt light can be realized with the GE 123 lamp we used. You can modify the circuit further by using a separate transformer hooked to a 12-volt car bulb like they do with Tensor high-intensity AC lamps, and with suitable relay firing (hook the relay where our GE bulb is now) you'll get a really bright light. Variations on this theme are endless, and they'll all work admirably at the lighting of a match.

Most fun we've had is in bringing folks to the house at night and entering the darkened living room by the flame of our butane lighter. When we get close enough to the "rigged" lamp, the room floods with light and the FM set comes on with background music. Never fails.

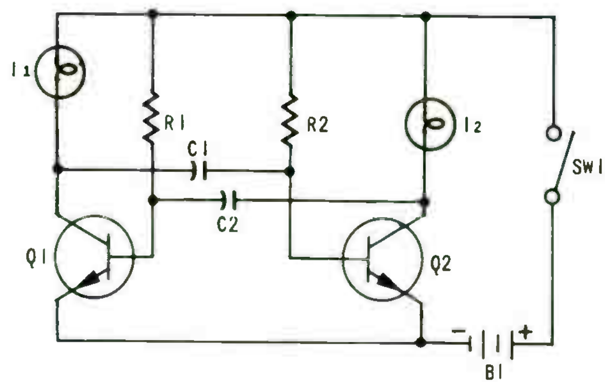
78

Idiot Box

Ever have a hankering to build something guaranteed to confirm your neighbors suspicions about you? Would you believe a circuit that does absolutely nothing? A slow-fire flashlight battery dissipator? You name it, and our idiot box will fit the description admirably. By simply throwing the switch, the transistor control circuitry will flash two #47 bulbs on and off for what seems like an endless period of time, stopping only when the batteries go dead. While it might not sound impressive to you, it is guaranteed to steal the show when your non-electronics type guests happen into a darkened room.

By experimenting with the polarities of C1 and C2 and the resistive values of R1 and R2 (substitute 50-ohm pots if you like), you can come up with countless variations on this winky-blinky theme. A dandy toy for the kiddies (trying putting it in the bedroom if you have trouble getting them off at the right time), it also makes a terrific project for teenagers doing experimental construction with an eye to learning something about RC circuits.

Would you believe a size D battery tester?



PARTS LIST

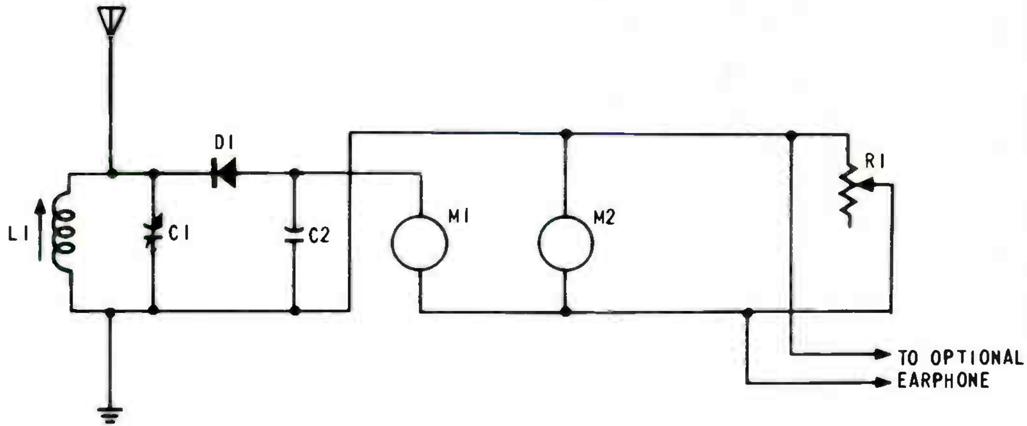
TRANSISTORS:
Q1, 2—2N1304
CAPACITORS:
C1, 2—30 mfd, 6-volt electrolytics
RESISTORS:
R1, 2—12 (see text)
BATTERY:
B1—3v, two "D" cells
MISCELLANEOUS:
I1, 2—#49 bulbs (do not substitute)
SW1—SPST. Oak type 200 or equiv.

79

The Mysterious Power Meters

Here's a dandy Science Fair project that will baffle your friends, amuse your parents, and put up quite a fight for top prize at school. If you're inclined to experiment just for the sake of something different, we guarantee this project will be one of its kind and definitely not something you can go out and buy at the corner parts store. So what is it? What does it do? Actually, it's an unusual "do-nothing box," an electronic assortment of parts guaranteed to do absolutely nothing. And without batteries, yet! But the fun begins when the meters flicker and you reveal the facts: That here's a device busy sucking power, measured in microamps and real honest-to-Betsy volts, twenty-four hours a day. And doing nothing with it!

Actually, what we're doing is accurately measuring the rectified current from a free-power radio receiver tuned to a local broadcast station. To the amazement of your friends, you can permit the curious to "tune the air" using capacitor C1 and see on the meters the various amounts of converted energy your mystery meter box is taking in. Naturally, the effect



PARTS LIST

DIODE:
D1—1N34A
CAPACITORS:
C1—365 pfd miniature variable
C2—10 mfd, 6 WVDC electrolytic
RESISTOR:
R1—1 meg pot.

MISCELLANEOUS:
L1—Loopstick antenna. Allied Radio 91 C 286.
M1—0-50 miniature microammeter. Lafayette 99C 5049
M2—0-3 miniature voltmeter. Lafayette 38 C 3195.

is vastly improved if you build your set in a clear plastic box, so everyone can see that no batteries are being used.

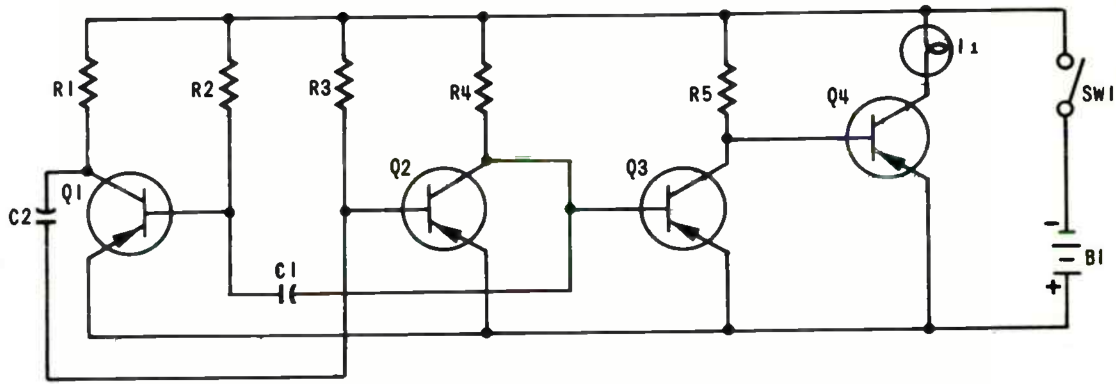
If you live in a metropolitan area close to a high-power (20,000-50,000 watt) station, you can get by with a self-contained coil antenna, the type found in parts catalogs (Philmore makes a dandy). If reception is good enough, you can demonstrate how the voltage increases when someone's hand is placed on the "ground" connection. One professional quack toured the country a few years back with one of these gadgets. The so-called "Dr." would "measure the inherent biological volt/currents present in the human body" before huge audiences. For quite some time he had people convinced they were all human capacitors, charged at various levels and intensities (which depended upon their intellectual compatibility with Martians). In any case, though, the body-ground demonstration is too good a bet to pass up.

You may have to adjust R1 to insure that one of the meters doesn't "pin" in the presence of an unusually strong signal. Additionally, you can hook up a Hi-Z earphone if you like. This will serve as the evidence to convict you of power stealing, in case you run into any nonbelievers.

80

"Flashing Seconds" Electronic Clock

Though this may seem like a rather complicated way to come up with a bulb-type metronome, it represents an interesting application of multivibrator and gate circuitry in addition to providing exact 60-second flashes that will be almost as ac-



PARTS LIST

TRANSISTORS:
- Q1, 2—2N217
- Q3—2N270
- Q4—2N441

CAPACITORS:
- C1—25 mfd, 12 WVDC electrolytic
- C2—100 mfd, 12 WVDC electrolytic

RESISTORS:
- R1, 4—2K
- R2, 3—100K
- R5—120

BATTERY:
- B1—12v DC "B" cell, auto battery, etc. See text.

MISCELLANEOUS:
- I1—12v, 1 amp bulb. See text.
- SW1—SPST. Oak type 200 or equiv.

curate as your electric wall clock. If you must be practical about it, you can use this as an effective and inexpensive flasher for your automobile. You can simply wire your parking lights, tail lights, or what-have-you to the device for emergency use.

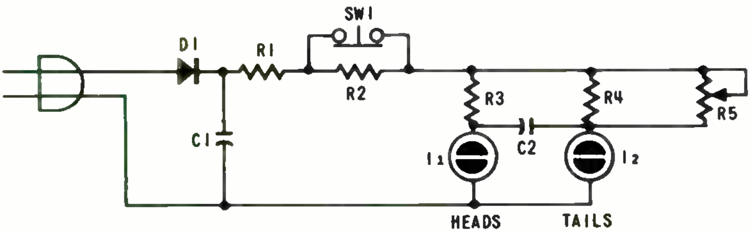
Actually, this electronic-clock configuration can be used to "fire" any 12-volt appliance—including the popular hi-intensity lamps. Additionally, it makes for a lot of interesting results with 12-volt motored appliances. Electric trains take on a striking resemblance to actual chug-chug operation when wired to this gadget.

Construction is not critical. Any box or chassis you have handy will do the job, although care should be taken not to overheat the semiconductors during soldering. Observe proper electrolytic polarities, and you'll have no problems. Incidentally, you can vary the flashing rate by changing the values of C1 and C2.

81

Electronic Heads & Tails

Ever get tired of flipping coins to solve who-gets-what, or who-goes-first? This ingenious circuit can be a game in itself, an adjunct to a conventional yes-no, or high-card/low-card game, or simply as a panic button guaranteed to get laughs at the office. If you're handy with follow-ups, you can



PARTS LIST

DIODE:
D1—1N2070
CAPACITORS:
C1—.22 mfd
C2—.47 mfd
RESISTORS:
R1, 3, 4—150K
R2—1.8 meg (see text)
R5—750K pot.
MISCELLANEOUS:
I1, 2—NE-2 bulbs
SW1—Normally-closed push button

design a suitable board game for the youngsters based on the use of this gadget, making it more complex for the teenagers, more basic for the 6- to 10-year olds.

Close inspection of the circuit configuration reveals a 750K potentiometer hooked into the "tails" NE-2 bulb. This should be mounted entirely within whatever housing you come up with. It is strictly a calibration adjustment device, for accurately settling (once and for all) the odds. (Yes, you can adjust for decisions in your favor!) For best results, experiment for a while with different settings until you feel that a legitimate randomness of flashes has been achieved. Also, experiment a bit with different values for R2. Since neon bulbs by nature are undependable for uniformity, you may need to lower the resistance (to 1.5 or 1.2 megs, for example) or raise it slightly. But first, try it with the value recommended in the schematic.

One chap (a neighbor) had his heads & tails circuit relabeled "Panic Button," and substituted "yes" and "no" for the flipa-coin phrases. He built it into the wall in his office and made sure that certain employees saw him reaching allegedly important business decisions with the gadget. Never failed to start the workers buzzing!

A note on construction: Since we are dealing here with household AC, be sure everything is adequately insulated if you are working with a metal enclosure. Best bet is plastic, if you can locate a suitable case with lid. But if you plan on letting the kids play with it, it's a good idea to seal the plastic lid to the box with the heat of a soldering gun to make sure they don't open it. The only component that should ever necessitate replacement is C1, and that won't be until after many years of pleasureable use.

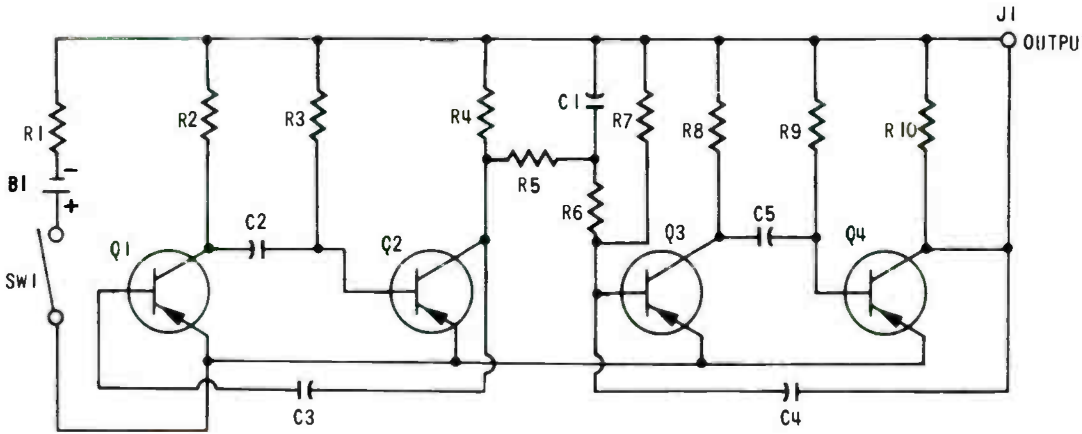
Suggestion: Great gift for the lady of the house who can never make up her mind about what to wear. Narrow it down to two outfits and let her push the button.

82

Siren

A handful of parts and you're a one-man fire house, a police car; or, maybe your house becomes a burglar alarm-equipped screamer in the event that you get an unwelcome midnight visitor. This isn't the whole burglar alarm system, just the noisy part, the siren.

Our siren will work with its own miniature speaker or it can be fed into an amplifier to crack windows on the other side of


J1
OUTPUT
R1
B1
SW1
R2
R3
R4
C1
R5
R6
R7
R8
R9
R10
C2
C5
Q1
Q2
Q3
Q4
C3
C4

the county, its wailing shriek piercing all ears along the way.

The four transistors comprise two separate multivibrator circuits which function at different frequencies. The action of the two circuits cutting in and out of operation causes the wailing.

PARTS LIST

TRANSISTORS:
- Q1, 2, 3, 4—GE-2

CAPACITORS:
- C1, 2—100 mfd, 3 WVDC electrolytic
- C3—25 mfd, 3 WVDC electrolytic
- C4, 5—.025 mfd

RESISTORS:
- R1—25K
- R2, 8—10K
- R3, 7—100K
- R4—1.8K
- R5—16K
- R6, 9—33K
- R10—130

BATTERY:
- B1—1.5v

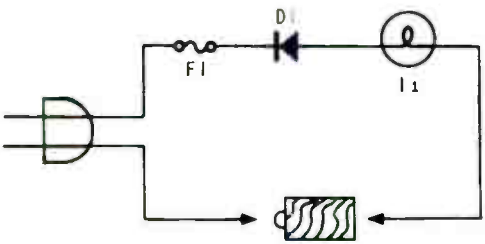
MISCELLANEOUS:
- J1—Standard phono jack
- SW1—SPST. Oak type 200 or equiv.
- Speaker—8-ohm (optional, see text)

83

Flashlight Battery Rejuvenator

This simple circuit will recharge all dry-cell flashlight batteries, penlite cells, and nickel-cadmium batteries, regardless of size or shape. Based on the same principle as the $4.95 "Chargatrons," our version utilizes an easily-available

10-watt household bulb as the current-regulating ballast tube and a low-current silicon power diode as a half-wave rectifier. Regardless of what kind of dry cell you wish to charge, our little rejuvenuator will pump about 32 ma of pulsating DC through the battery. You can hook up as many as four weak cells together (paralleling the batteries to the rejuvenator) or just one without any fear of overcharging or otherwise burning out the cells. It is a proven fact that standard flashlight "D"



PARTS LIST

DIODE:
D1—1N337
MISCELLANEOUS:
I1—10 watt, 117v AC bulb
F1—15-amp fuse

cells can be recharged up to 16 times before they reach the point of no return. Why spend 20¢ each time a cell goes dead?

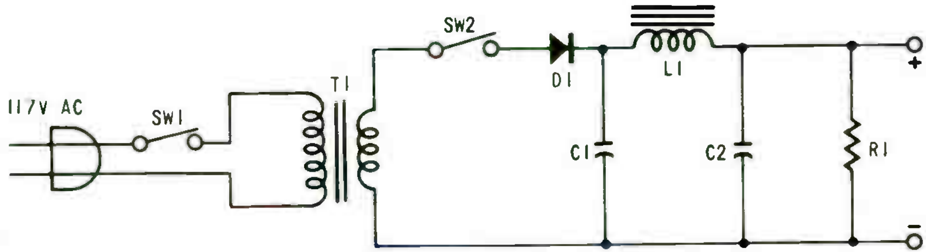
Inspection of many of the so-called dry-cell chargers reveals nothing more than a step-down transformer that reduces 117v AC to approximately 3 1/2 volts. But the problem is that it is still alternating current, which will charge the battery all right, but it also reduces the number of times that battery can be recharged by a significant factor. Additionally, a battery recharged on AC will tend not to hold a charge for as long as one charged with DC. In fact, a 1 1/2-volt flashlight battery will only power a bulb for 4 minutes; then it goes dead. Another overnight recharge in a transformer-type AC charger only restores its 4-minute playing capability. In a DC charger, however, a fully-charged 1 1/2-volt battery will power the flashlight for several hours! Note: Our rejuvenator is designed only for 1 1/2-volt cells. Attempts to charge larger value batteries will prove disappointing.

84

Transistor Battery Eliminator

Buying batteries for your favorite transistor project can be a pain, so here is a battery eliminator especially designed for the experimenter. It will put out either 9 or 12 volts and up to 10 to 12 ma. With R1 in the circuit, as shown, it delivers 9 volts. Build this on a small board, with all components mounted on top. It's an easy arrangement and allows for plenty of ventilation. If you wish, a ventilated cover can be fitted over the chassis. Don't overlook the possibilities of using copper or aluminum screening for this purpose.

The output of the eliminator can be fed to binding posts if you like, but I simply fed mine right into a 9-volt battery clip which, when wired on "backwards," lets me snap the power supply right into the circuit of the set.



PARTS LIST

DIODE:
D1—1N4820

CAPACITORS:
C1—400 mfd, 15 WVDC electrolytic
C2—600 mfd, 15 WVDC electrolytic

RESISTOR:
R1—1.3K (remove to obtain 12 volt output)

MISCELLANEOUS:
L1—Filter choke, 75 mh, 204-ohm (Miller 858 or 959)
T1—6.3-volt filament Transformer, 3 amps.
SW1, 2—SPST. Oak type 200 or equiv.

85

Radio Warmup Eliminator

In these days of Westinghouse "instant-on" TV's, solid-state control devices for household appliances, and no-warmup transistor radio receivers, it seems a bit outdated to just sit back and wait while the old AC/DC receiver's tubes heat up. Yet thousands of these sets are still selling quite well in the $7.95-and-up area and are constant reminders of backwardness in technology. Being an unfortunate (yet not altogether unpleased) owner of such an AM radio, we decided to do something about it. The circuit shown here is the result. Total parts investment: $1.87.

Actually, this circuit can be used on any AC/DC type receiver, including some of the more inexpensive amateur and SWL types which tune the shortwave bands. Particularly if you are an SWL DX addict, this handy gadget is for you. Simply throw SW1 to "standby" when the receiver is not in use, and to "on" when it is. The silicon rectifier can run forever, and it certainly won't reduce tube-life. What it will do, however, is get rid of warmup time and associated preliminary frequency drift. This factor alone is worth the price of the components.

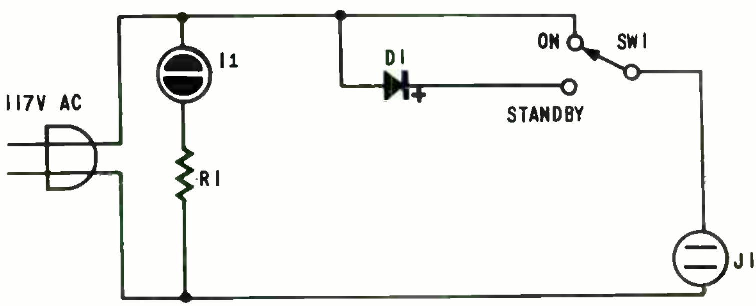
Though the device can be built inside the receiver, we found it more versatile as a plug-in accessory. Regardless of how you decide to house it, you should exercise maximum precautions since we're dealing with relatively high currents (amps as opposed to milliamperes). Use grommets, a well-insulated line cord, and good soldering techniques.

PARTS LIST

DIODE:
- D1—2 amp, 200 PIV silicon rectifier Lafayette 19 C 5005

RESISTOR:
- R1—220K, 1/2-watt

MISCELLANEOUS:
- I1—NE-51 bulb
- J1—AC plug receptacle
- SW1—SPDT heavy-duty type



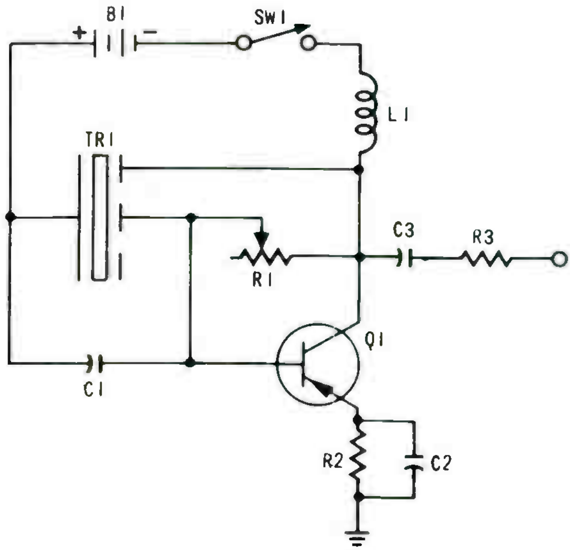
86

Alignment Generator

This project makes use of semiconductors known as Transfilters. These devices, manufactured by the Clevite Corporation, were originally designed as ceramic intermediate-frequency filters. Experimentation has shown that Transfilters can also be put to good use in transistor oscillator circuits. Their small size and low cost makes them well suited for applications such as beat-frequency oscillators or alignment generators. Transfilters do not require shielding and are not affected by external magnetic fields. Their output frequency may be varied by a potentiometer (as compared to a variable capacitor in the case of LC oscillator circuitry). Therefore, the tuning element may be located at a point remote from the oscillator circuitry.

The operating frequency of the circuit shown here is variable over a limited range by adjusting the forward base-bias resistor R1. This effectively varies Q1's internal resistance, hence the impedance is "seen" by the Transfilter electrode. Since this load impedance affects the Transfilter's operating frequency, changing the transistor impedance will shift the oscillator frequency.

The Clevite TO-01 Transfilter oscillates approximately 2 kHz above its nominal resonant frequency. For example, a TO-01A, with a nominal resonant frequency of 455 kHz, will oscillate at approximately 457 kHz. C1 is, therefore, connected from Q1's base to ground to lower the oscillator frequency to the nominal TO-01 frequency. Our circuit will permit approximately 8-kHz frequency shift. Transfilters are available for all of the popular IF frequencies (455, 465, 470, and 500 kHz).



PARTS LIST

TRANSISTOR:
Q1—2N1382
TRANSFILTER:
TR1—Clevite T0-01
CAPACITORS:
C1—0.01 mfd
C2—0.1 mfd
C3—0.05 mfd

RESISTORS:
R1—100K pot.
R2—220
R3—10K
BATTERY:
B1—6v
MISCELLANEOUS:
L1—2.5 mh RF choke
SW1—SPST. Oak type 200 or equiv.

87

Signal Injector/CPO

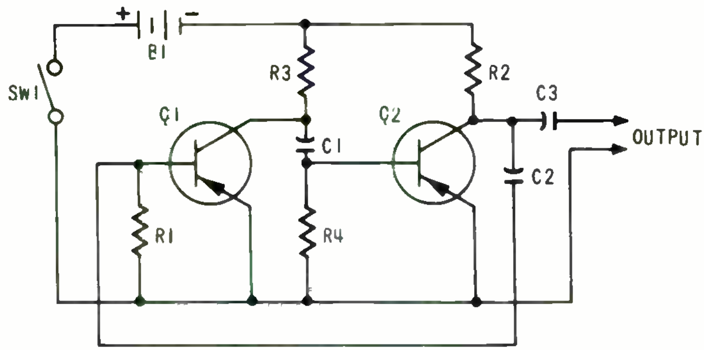
You'll get plenty of harmonics out of this device, which can be put together from a few garden variety components normally found in an experimenters' junk box. The signal it emits

PARTS LIST

TRANSISTORS:
Q1, 2—2N217
CAPACITORS:
C1, C2—0.01 mfd
C3—0.05 mfd
RESISTORS:
R1, R2—11K
R3, R4—10K
BATTERY:
B1—9v
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.

can be used to test CB rigs, receivers, amplifiers, and headphones. It will even generate bars across a TV screen if you connect its output to the TV set's antenna terminals. Connect a telegraph key to the circuit (in place of the switch) and a speaker or headphones to the output and you've got an instant code practice oscillator.

I built one of these on a scrap of cardboard. It looked pretty ridiculous but served the purpose quite well. You can use anything handy—wood, Vector board, plastic, even a shirt cardboard.

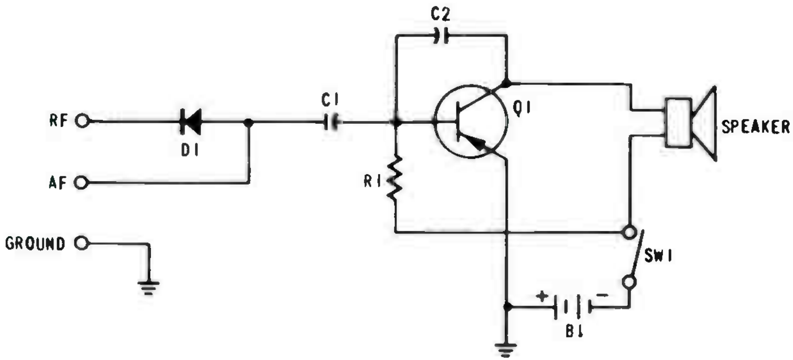


88

RF/AF Signal Tracer

Here's a great little circuit capable of RF and audio signal tracing. Also, it provides for audio "read out" through a small 4-8 ohm PM speaker, allowing you to hear what the circuit being tested is "hearing" at any particular point along the line. Though commercially available in a variety of forms, this handy little TR gadget can be assembled in less than one hour and shouldn't run you more than $4 for parts.

Construction is fairly straightforward and simple. For best results, however, it is suggested you build the signal tracer



PARTS LIST

TRANSISTOR:
Q1—2N301

DIODE:
D1—1N38B

CAPACITORS:
C1—50 mfd, 10 WVDC electrolytic
C2—.02 mfd

RESISTOR:
R1—2.7K, 1-watt

BATTERY:
B1—6v, 4 penlite cells. See Text.

MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.

in a small minibox or similar metal enclosure. Input (see far left of schematic) can be binding posts, Fahnstock clips, or perhaps 3-foot insulated wires with alligator clips at the ends.

Experiment with the supply voltage. You may find you'll realize better results with two penlite cells (3-volts) instead of the four we used. Also R1's value may be a governing factor, depending upon the circuit condition of Q1. If you like, you can use a 3500-ohm potentiometer in place of the recommended 2.7K 1-watt resistor, adjusting for best results. Once proper operation has been achieved, R1 can be left alone. The only time it might have to be tuned again would be if your battery supply has become weak. You should find that this unique instrument will outperform many commercial types, plus having the distinct advantage of being completely portable.

89

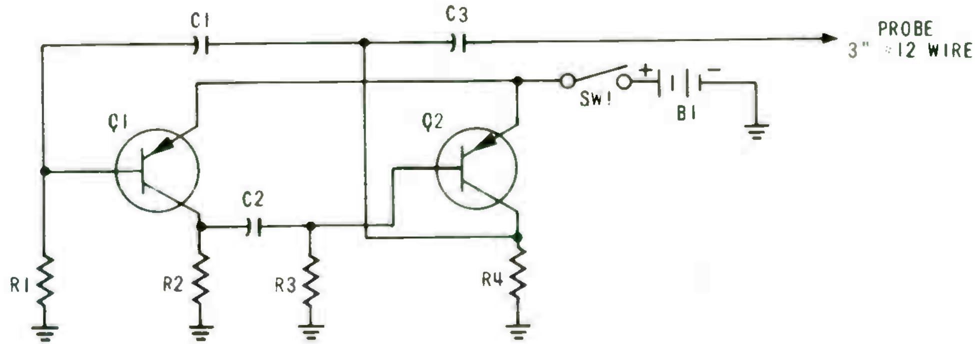
Transformerless Signal Tracer

This dandy little two-transistor signal tracer has an output frequency of approximately 800 cycles (Hz) and is as rich as can be in harmonics (so don't try to put it on the air!). Its 9-volt battery supply will last for months during normal use, and the finished instrument will compete with the best of them in operational performance.

PARTS LIST

TRANSISTORS:
Q1, 2—2N624
CAPACITORS:
C1, 2—.0047 mfd
C3—.01 mfd
RESISTORS:
R1, 3—220K
R2, 4—4.7K
BATTERY:
B1—9v
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.
Probe—3" length #12 wire

The multi-vibrator type circuit can be used for both audio and RF signal tracing, due to the tremendous harmonic output. A single 3" piece of wire serves as the circuit probe, and the whole kit and kaboodle can be neatly built to fit into a can or small plastic box. All wiring should be as short as possible, although shielding is not essential except as protection against shorts.


C1
C3
PROBE
3" #12 WIRE
Q1
SW1
+
−
B1
Q2
C2
R1
R2
R3
R4

90

Foolproof Coil Frequency Finder

Want to eliminate hours of work tinkering with trial-and-error windings on coils to get the correct frequency? Well, this exciting project can do it for you. All you need is a low-power signal source such as a VFO, griddip meter, RF signal generator, etc. Particularly when working with high-frequency or VHF circuits, getting those coils just right can be unbelievably tricky. Often it'll look great on the GDO, but in the circuit you find you're a good 5 MHz off frequency. Alas...

Our FCFF (yes, foolproof coil frequency finder) operates without batteries or other power source, yet provides an in-circuit application for your test-bench coil. If it works here, it'll work in the rig. Additionally, you'll be able to more accurately pinpoint the exact frequency and you can adjust it on-the-spot for any winding deficiencies. Sound like a lot of performance for a $5 investment? You bet it is. But the trick is in proper construction and application.

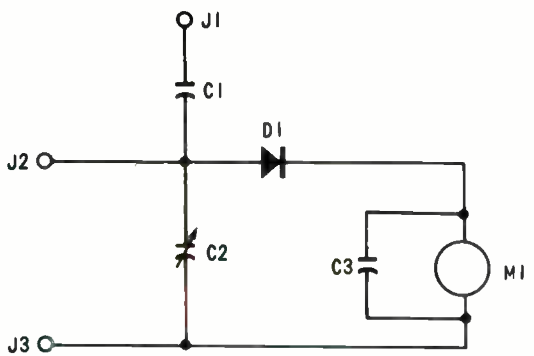
First off, you want to build this in the smallest minibox-type chassis you can manage. Complete all-around shielding like this is the key to accurate readings. Wiring must be point-to-point and "tight," since you'll often be experimenting with VHF circuits, and you're after reliable frequency determination. Use a miniature milliammeter to help keep overall size down. Employ conventional binding posts for external connections, spacing J2 and J3 suitably far apart so that an average size coil can be fitted between. Put a pointer knob on the shaft of C2 and mark the minimum point (capacitor fully open) as "10 pfd" and the maximum point (fully closed) as "150 pfd." From these two points, you should be able to approximate further calibrations, such as "75 pfd" and "100 pfd." These will be rough, at best, but will be sufficiently adequate for this device.

PARTS LIST

DIODE:
- D1—1N38B

CAPACITORS:
- C1—10 pfd
- C2—140 pfd variable
- C3—.001 mfd

MISCELLANEOUS:
- M1—50 μa DC microammeter
- J1, 2, 3—Binding posts

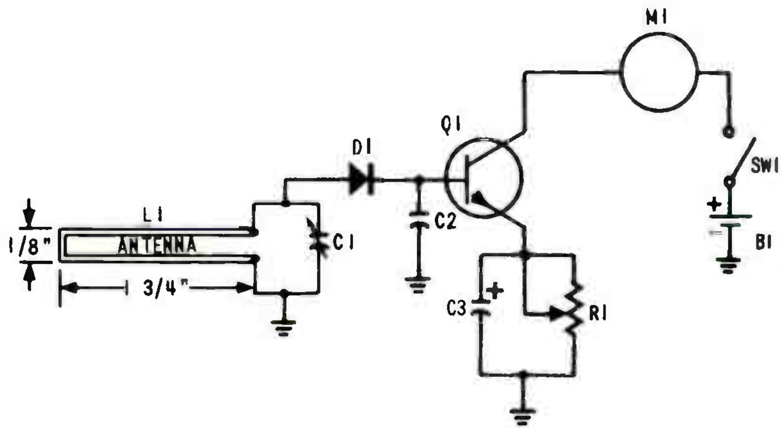


Operation is a delight. Feed the center conductor (ignore the shield) of your RF generator to J1. Connect the unknown coil across J2-J3. If a coil is to be used with a capacitor of any type, set C2 to that value. Then sweep across the frequency range with a signal generator until you hit the maximum meter on M1. The generator calibration will read out the frequency! (Use a VFO the same way). For GDO operation, plug the appropriate coil into the dipper and bring it within an inch of the unknown coil. Adjust dipper tuning for maximum reading on M1. Ignoring the dipper's meter and sensitivity control, simply read out the calibrated frequency. Easy?

91

VHF Man's Field Strength Meter

For the dyed-in-the-wool VHF-UHF ham enthusiast, it is a well-known fact that transmitter tune-up measurements must invariably be taken at the receiver. Occasionally, the more astute operator will plug in his highest meter coil and use the "diode" section of his Heathkit grid dip meter. For the most part, however, there is really no field strength measuring device available for these frequencies, hence the all too-frequent trial-and-error techniques that often wind up with the



PARTS LIST

TRANSISTOR:
Q1—2N229
DIODE:
D1—1N90
CAPACITORS:
C1—5-75 pfd miniature variable
C2—470 pfd
C3—10 mfd, 15 WVDC electrolytic
RESISTOR:
R1—2K pot.
BATTERY:
B1—1 1/2v penlite cell.
MISCELLANEOUS:
L1—Antenna hairpin loop. 5/8" wide strip of copper or brass, folded into coil 1/8" across and 1 3/4" long, hooked directly (with no wire leads) to C1.
M1—0-500 miniature milliammeter
SW1—SPST. Oak type 200 or equiv.

experimenter footing the bill for a blown final tube.

The circuit configuration shown in the diagram, though, will solve these problems once and for all. Our project is a souped-up VHF-UHF field strength meter especially designed for taking transmitter measurements at 144, 220, and 432 MHz. Complete with VHF transistor and high-gain follower amplifier, the device affords maximum flexibility and sensitivity without the close coupling to the transmitter antenna normally encountered in this frequency range. For accurate readings, it is only necessary to preset C1 to the general transmitting range (for example: the low end of two meters). From there on in, you can forget about any adjustments except the meter-zeroing control, R1.

Construction, although simple, is tricky. You should use a minibox which affords complete shielding (otherwise you may be tuning in a harmonic). And wiring simply doesn't exist. All connections are made component-to-component, using the absolute minimum lead length possible. Make sure C1 is firmly locked in place. You can mount L1 (the antenna pickup loop) on a piece of slotted Lucite or a piece from the lid of a plastic box. Complete and secure insulating techniques must be observed when affixing the antenna loop to the device. Allow no lead length from L1 to C1. The connection must be direct, yet taking care that C1's stator/rotor connections do not short against the side of the metal box when the FSM is completed and the lid snapped on.

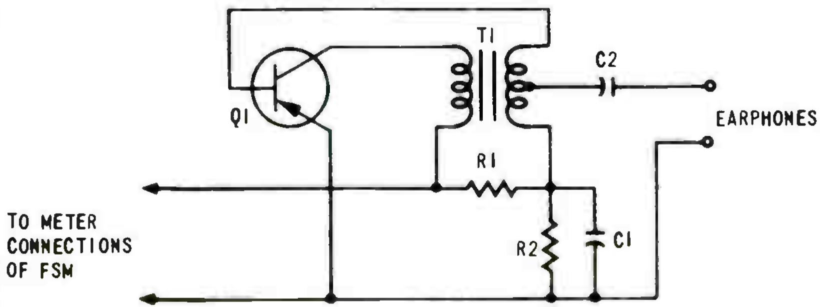
92

Audio Tone Field Strength Meter

Have you ever been working on a mobile rig, trying to adjust the antenna, tune the transmitter, and keep an eye on your FSM all at the same time? Well, if you could use some help on these occasions, build this snazzy FSM add-on. Designed so that it can be built into any conventional absorption-type FSM, it will deliver a clear audible tone in addition to a meter reading to tell you just how well you're doing in power output.

Naturally, the higher-pitched the tone, the more signal is getting to the FSM. One major drawback: The FSM antenna should be placed very close to the transmitter's antenna, since for adequate rectification to take place to drive Q1 a lot of signal should hit the FSM. But this isn't as serious a problem as you might think, since most 5-watt CB transmitters and certainly a lot of amateur equipment deliver a good whallop. Just insure that the FSM is close to the antenna. You can always run extra-long wires down to a remote headset.

Construction is quite simple, since no battery is required to drive the transistor. Hence, permanent installation can be considered inside the field strength meter itself. Just provide a plug for the headsets or earphone.



PARTS LIST

TRANSISTOR:
- Q1—2N107

CAPACITORS:
- C1, 2—.01 mfd

RESISTORS:
- R1—4.7K
- R2—2.7K

MISCELLANEOUS:
- T1—Audio transformer, 10K primary, 2K c.t. secondary.

93

In-Line Transmitter Tune-Up Meter

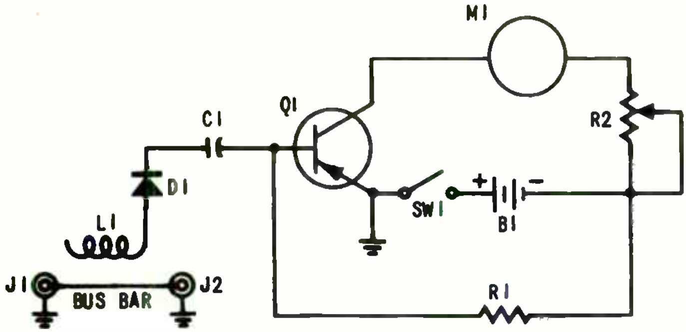
Ever wonder if maybe that scratched-up FSM is really telling you anything about your antenna output? Well, the circuit shown here can put a halt to your fears once and for all—and it'll take you less than an hour to construct. Essentially this gadget is one-half of the famous Heathkit-variety SWR bridge/indicators that adorn some of the more sophisticated CB/ham shacks where the operator is concerned about his radiated power. This device will not read out reflected power, but it will permit you to adjust your transmitter for maximum output where it counts—in the feedline. Additionally, since it is coupled directly to the set, it will not complicate affairs by giving you harmonic readout, something guaranteed to destroy tubes if you don't watch out. One last feature we've noticed: Stray RF from the oscillator/doubler stages doesn't readout on this in-line meter, but it will with an FSM if proper instrument placement is not meticulously observed.

To make sure your meter does all this, build it in a rectangular minibox or something similar which will completely shield the circuit. The only holes you'll need will be for the coax connectors (use the same type now employed with your feedline), the 0-1 milliammeter, and the on-off-adjust pot. You'll find you can do a fair job with the large meter hole by roughing in pencil on the chassis the circular shape (just a 32nd" or so smaller than you actually need) and drilling along the circle with whatever drill bit you have handy. So perforated, you can cut between holes (beginning with a screwdriver cut) to break it open. File for smoothness, and you've got it!

PARTS LIST

TRANSISTOR:
Q1—2N105
DIODE:
D1—1N34A or 1N60
CAPACITOR:
C1—.01 mfd
RESISTORS:
R1—2.7K
R2—500K pot.
BATTERY:
B1—3v, 2 penlite cells.
MISCELLANEOUS:
L1—See text
M1—Miniature 0-1 milliammeter
J1, 2—Coax connectors
SW1—On-off attached to R2.

Mount the coax connectors fairly close together to keep the bus bar between as short as possible. Reason for this is that several manufacturers found they induced high SWR by making the bar unduly long. Wind as few turns (L1) as possible around the bus bar for pickup; you won't need many, since there's a stage of amplification between the diode and meter. Even with two turns, you should be able to get a reasonable indication from a 1/2-watt transmitter; for more powerful rigs, just reduce meter input by adjusting the pot. This dandy device should cost you less than $7 to build and will outperform anything similar at twice the price commercially.

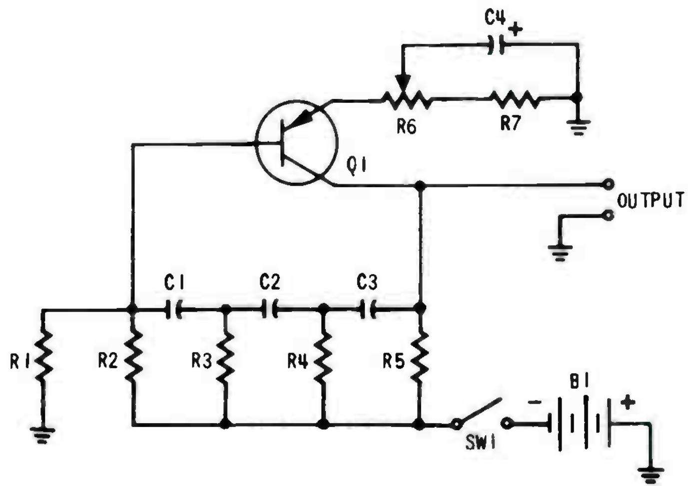


94

800-Hz Oscillator

This extremely simple circuit will provide a solid 800-Hz audio tone usable for CPO operation, signal tracing, receiver audio checks, speaker tests, and a host of other applications. Comparable to tube-types which ran over $15 just a few years back, this useful instrument can be built for little more than the price of the minibox. If you decide to construct it in a plastic case, you can probably get all the parts (with the possible exception of Q1) from your junkbox.

Other transistors can be used, although the realm of possibilities should not include standard replacements normally



PARTS LIST

TRANSISTOR:
Q1—2N633
CAPACITORS:
C1, 2, 3—.01 mfd. See text.
C4—50 mfd, 15 WVDC electrolytic
RESISTORS:
R1—4.7K
R2—56
R3, 4, 5—10
BATTERY:
B1—15v mercury cell
MISCELLANEOUS:
SW1—SPST. Oak type 200 or equiv.

considered in making substitutions, since the circuit is a wee bit critical. Scrounge around for a 2N369, 2SB101, or 2SB102 if you don't have the 2N633 handy. If you'd rather have a higher resultant frequency than 800 Hz, you can decrease the values of C1, C2, and C3 in the ladder network. By uniformly reducing capacitance, the pitch will rise. It is suggested that since a 15-volt supply is required in this circuit, you should spend a little extra for a Mercury cell. It will last much longer and will cut down your cursing frequency when you realize the gadget's dead and you haven't any 15-volt batteries in the shack.

95

1,000-Hz Audio Oscillator

This nifty circuit can be thrown together for about $3.50 and can perform a number of useful functions. In addition to providing a solid 1000-Hz note for such purposes as code practice and audio tracing, it makes a dandy MCW (modulated CW) tone source for injection into the ham AM signal. Particularly of interest to VHF enthusiasts, since a great deal of 2-meter code practice is conducted through the AM transmitter, this little circuit can be connected directly to the microphone jack without any fear of damage to the modulator or Q1.

CBers may also find this tone oscillator helpful in locating other units in the same base-mobile system. By simply equipping all transceivers with a pushbutton "spot"-type switch that injects the 100-Hz note on the carrier, it becomes quite a basic task to locate your mobile's signal among the thousands on Channel 9. Simply work out a coding signal prior to speaking into the microphone. Example: 5 short "blasts" with the audio oscillator should be sufficient. (You'll be surprised just how many fellows clear the channel so they can find out where the mysterious beep is coming from).

You can build this handy gadget in just about any manner you like. Nothing is critical, although leads should always be made as short as possible just to avoid shorting. The oscillator can be built into an existing piece of gear (as suggested above), or made in to an external accessory. It can be built into a pillbox, complete with miniature speaker. Check your latest Lafayette or B/A catalog for subminiature components.

PARTS LIST

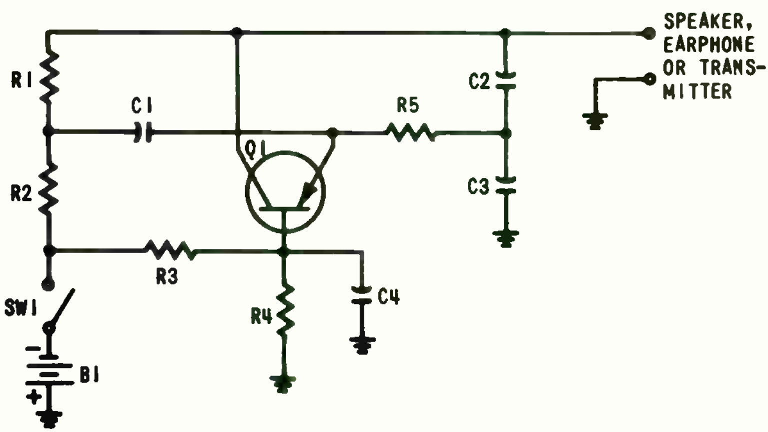
TRANSISTOR:
- Q1—2N109

CAPACITORS:
- C1—.75 mfd
- C2—.05 mfd
- C3—.15 mfd
- C4—5 mfd, 15 WVDC electrolytic

RESISTORS:
- R1, 2—1K
- R3—33K
- R4—18K
- R5—220

BATTERY:
- B1—9v, penlite cell

MISCELLANEOUS:
- SW1—SPST. Oak type 200 or equiv.



96

Four-Way Tone Oscillator

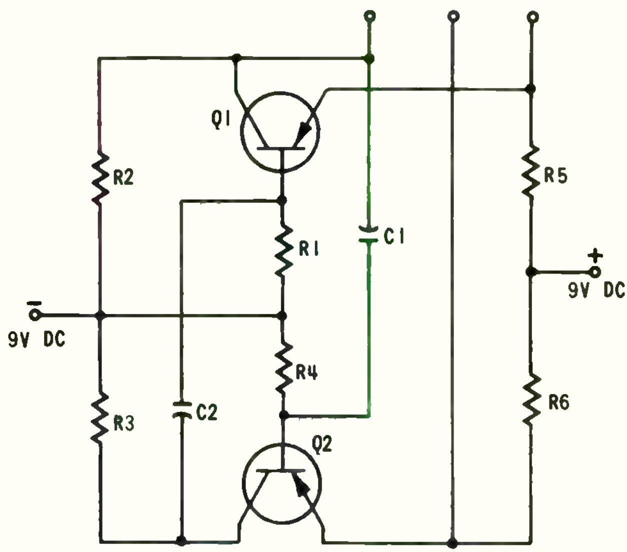
This versatile instrument can serve a multitude of uses for the experimenter and amateur radio enthusiast, including that of a Go No-Go transistor tester, and audio square-wave generator, a grid dip modulator, or even a code practice oscillator. Employing only ten components, the complete circuit can provide audio notes from just about any point in the unit, although the three outputs indicated in the schematic should prove satisfactory for most applications.

As a code practice oscillator, just key the battery supply and take off whatever pitch you find pleasing to the ear from the output terminals. For operation as a transistor tester, simply place any small-signal PNP transistor in one of the 2N107 sockets. If the transistor is good, you'll hear the telltale audio note. For use as an audio square-wave generator, simply run connections from the output to an oscilloscope, sit back, and watch the fun begin. Any number of combinations can be worked with the device. If you're out to modulate your GDO, wire the output into the oscillator's plate circuit and you're in business.

Although a 9-volt TR battery works well, you can get by with less, providing you don't drop below 5 volts. If you'd like to get still more tone variations, substitute a slightly higher value for C1. It should be noted that for your investment (way under $5), you have the equivalent of a $45 commercial instrument—and then some.

PARTS LIST

TRANSISTORS:
Q1, 2—2N107
CAPACITORS:
C1—.0047 mfd (see text)
C2—.25 mfd
RESISTORS:
R1, 4—560K
R2, 3—2.7K
R5, 6—1.2K
BATTERY:
B1—9v
MISCELLANEOUS:
5 binding posts or Fahnstock clips



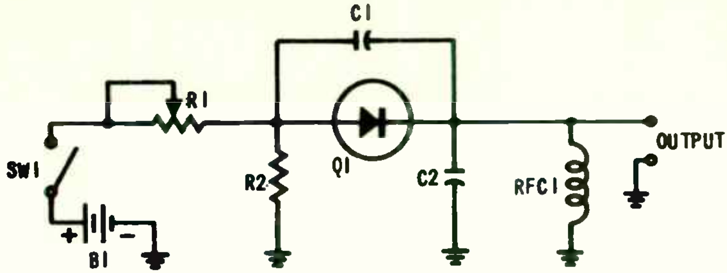
97

Tunnel Diode 100-KHz Sine Wave Generator

This is probably the most unique, inexpensive sine-wave generator circuit ever published, and one reason is the obvious lack of a quartz crystal, a standard item for conventional generators. Instead, a new General Electric ZJ69TD tunnel diode is employed both as oscillator and amplifier.

Comparison checks have confirmed that almost without exception this circuit stacks up to the best of the crystal-types, except that variations in temperature will affect frequency somewhat. For best results, a constant-temperature environment should be provided, although for practical purposes, room temperature is fine. The important thing is to avoid subjecting the oscillator to changes. For this reason the tunnel diode should be allowed to adjust to room temperature, if it has been in the car or any colder environment, before attempting to use it. Aside from this, though, frequency stability is excellent and a perfect sine wave will result.

Construction is not critical. Slight variations can be allowed with C1 and C2, although no more than 80 pfd plus or minus should be considered as a substitute.



PARTS LIST

TRANSISTOR:
Q1—ZJ69TD
CAPACITORS:
C1—680 pfd
C2—660 pfd
RESISTORS:
R1—25K
R2—51
BATTERY:
B1—6v, four penlite cells.
MISCELLANEOUS:
RFC1—1.6 mh choke
SW1—SPST. Oak type 200 or equiv.

98

Transistor Gain Checker

Although there is a multitude of short-type transistor checkers on the market, and circuits galore that will tell you loads of things, this checker will determine just about the most important factor of all—the DC gain of a low-power transistor. You may have to do a bit of calculating, but you'll find it's well worth the effort. And you can use this circuit for checking both PNP and NPN transistors. (For the NPNs, just reverse battery polarity shown in the schematic.)

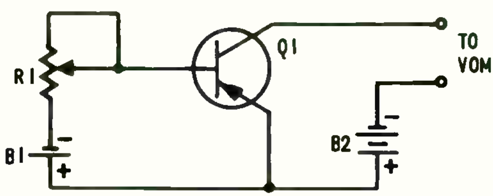
After checking your transistor for shorts, connect it as shown in the diagram. Rig the VOM to read 0-1 ma. Adjust R1 until the transistor's collector current reads out at 500 ma. Disconnect the batteries and read R1's resistance by using the VOM as an ohmmeter. Divide the resistance of R1 into the voltage (1.5 volts) of B1 and record the answer as Ib1.

Next reconnect the circuit and adjust R1 until the VOM reads 1.0 ma. Again disconnect the batteries to check R1's new resistance value. Divide through as outlined in the above paragraph. Record your result as Ib2. Now subtract Ib1 from Ib2 and you've got dIb. Divide dIb into 500 microamps (making certain to express dIb in microamperes, too), and you've got your transistor's gain! Simple?

If you're confused, just bear in mind that the 500 microamperes represents the difference in Ic, or collector current. You'll find this method extremely helpful in determing what gain you can expect from transistors on hand, plus being a big boost to experimenters who just like to "brew their own."

PARTS LIST

TRANSISTOR:
Q1—See text
RESISTOR:
R1—1.5 meg pot.
BATTERIES:
B1—1.5v
B2—3v



99

Diode Tester

Ever get that uneasy feeling that maybe the circuit you built was wired up properly and the reason it still won't work is because a component was faulty? You've probably got access to equipment to check out many of the components, but what about diodes? It's a cinch to give them the once over with this handy-dandy diode checker, which can be whipped together for a few dollars.

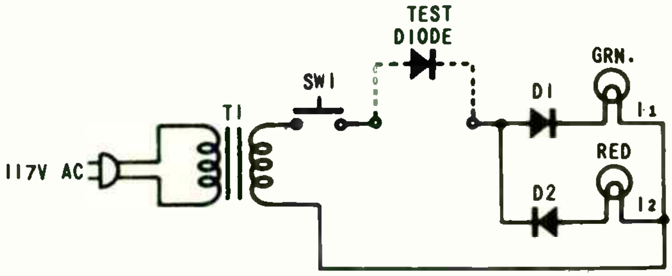
The tester is built in a plastic or metal box, and all you do is insert the diode to be tested and watch the little lights. The diode is held into the circuit by binding posts and then the switch is pushed to get the verdict. If the green light goes on, the diode is working properly. If both the red and green go on, the diode is ready for the scrap heap. If only the red

PARTS LIST

DIODES:
D1, 2—1N2069
MISCELLANEOUS:
T1—6.3v filament transformer. Triad F-14X.
I1, 2—6.5v 2.75-amp lamp
SW1—SPST pushbutton

light goes on, that means you've still got a fighting chance because the diode is reversed in the test circuit.

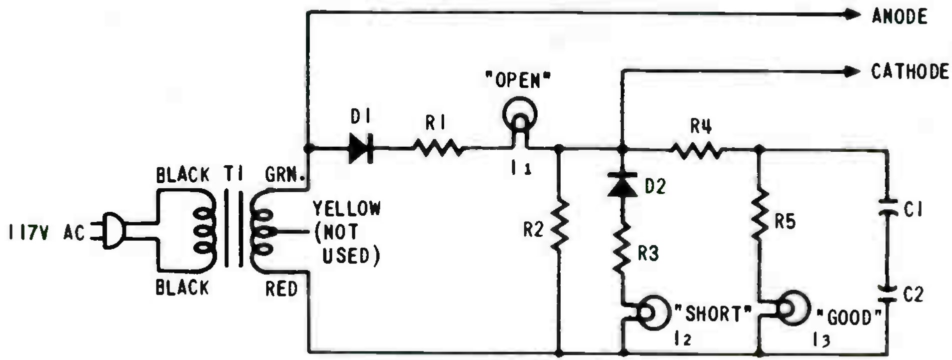
Here's an idea. Color the bulbs green and red with a felt marking pen. Put on a few coats, letting each dry before applying the next.



100

Silicon Rectifier Tester

With the state-of-the-art now getting to a point where silicon power rectifiers are replacing tubes in just about every possible instance, a silicon rectifier test instrument is becoming a necessity. The problem, though, is that no one seems to offer them for sale; and if they do, they are not exactly cheap. This circuit, however, is the essence of just such a handy gadget—a tester that will tell you all you need to know about your SCR: whether it is open, whether it's shorted, and whether it's just plain "good." All you have to do is plug it in and connect the suspected SCR across its test jacks (or alligator clips). Depending on which lamp lights, you'll have your answer. And the checker will test any silicon diode rated at 250 ma or more.



PARTS LIST

DIODES:
D1, 2—GE 1N536

CAPACITORS:
C1, 2—1000 mfd, 15-volt electrolytics

RESISTORS:
R1, 3—33, 1 watt
R2—10, 5 watt
R4, 5—8.2, 5 watt

MISCELLANEOUS:
T1—Stancor P6134, 6.3-volt filament transformer. (Centertap is not used).

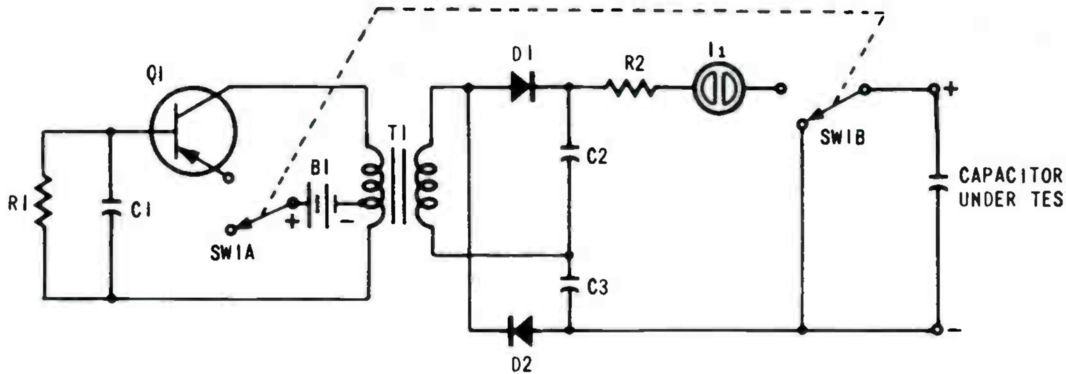
Construction is best attempted in a reasonably large (6 x 3 x 3) minibox, drilled to accommodate all the bulb fixtures. The line cord should pass through a grommet, and heavy-duty wiring should be the vogue throughout. Carefully note diode polarity during component installation, and pay particular attention to which way you wire in the capacitors (C1 and C2). Also, be sure you always use a higher wattage resistor than that called for in the parts list if your junk box doesn't provide the exact duplicates.

The beauty of this little checker is that it requires no on-off switch, since the SCRs don't draw current when not in use. Watch polarity at all times when checking the silicons. If you aren't sure which is cathode and which is anode, check any Allied or Lafayette semiconductor page, or dig out your ARRL Handbook.

101

Portable Capacitor Leak Detector

At last! A handy capacitor leak tester that is completely portable, foolproof to the nth degree, and capable of testing capacitors in the circuit! Sound too good to be true? Well, here it is and you can build it in anything you have handy: a



PARTS LIST

TRANSISTOR:
Q1—GE-3
DIODES:
D1, 2—1N538
CAPACITORS:
C1—.05 mfd
C2, 3—4 mfd, 200-volt electrolytics
RESISTORS:
R1—18K
R2—180K
BATTERY:
B1—3v, two penlite cells
MISCELLANEOUS:
T1—6.3-volt, 1-amp filament transformer. Triad F-14X.
I1—NE-2 neon bulb
SW1A, B—DPDT. Oak type 200 or equiv.

minibox, a cigar box, a shoe box, grandmother's hatbox... you name it. Heart of this beauty is a standard 1-amp, 6.3-volt filament transformer that, when coupled into the unusual circuitry revealed in the schematic, supplies a gigantic 100 volts (and more) from a 3-volt penlite cell power pack! The value of this tester is simply in determining whether or not a suspected capacitor is faulty, and it doesn't have to be completely shorted to show up on the instrument. Hence, for a very small investment, you'll have a professional quality test set which you can carry about without regard to AC line cords or rechargers (total battery investment: 40¢).

To test a capacitor, run a couple of clip leads from the output posts (near SW1B in the schematic) over to a receiver or whatever that is giving you a headache. Then temporarily disconnect one side of the questionable capacitor to electrically lift it out of the circuit. Apply test clips, noting polarity of the leads in relation to the circuit diagram. Close the switch on the tester. If the capacitor is leaky, the NE-2 bulb will light and stay lit as long as the switch is closed. If it is good, the light will flicker for a few moments right after SW1 is thrown, and then peter out and stay out indefinitely. (Note: This flickering takes place more noticeably with large value capacitors than it does with the smaller ones.)

It should be remembered that this tester is primarily designed for the "good-bad" determination of paper, mica, and ceramic capacitors with ratings of 150 volts or more (most frequently-encountered types). Using it for low-rated example: .05 mfd @ 15 working volts, transistor type) capacitors will cause permanent damage to the component.

102

Trickle Charger for Your VTVM

Ever try to check something on a seldom used VTVM, and end up with a reading that is a mile and a quarter from accurate? You were better off before you began. In electronics no answer is better than a wrong one! Opening the VTVM case you are pleasantly surprised to see that the bottom of the case is oozing with corrosive battery juice.

You can avoid all of this by doing two things. First, ditch the flashlight battery that you have been using in the VTVM and replace it with a nickel-cadmium cell (<u>not</u> alkaline or mercury types, please). Next, hook up a trickle charger that will always keep the new battery in top shape. The charger described here will fill this bill nicely and can be left "on" all the time if desired. The battery will not become overcharged with this unit.

PARTS LIST

DIODE:
D1—1N3121
RESISTOR:
R1—127

The charger we suggest is merely some simple additional circuitry wired into the VTVM; it consists of two parts, a diode and a resistor, which draw their power from any 6-volt source within the VTVM. Without disturbing any of the existing circuitry in the VTVM, connect the charger between the 6-volt source and the positive side of the battery holder. When the VTVM is turned on, the charger will function.

103

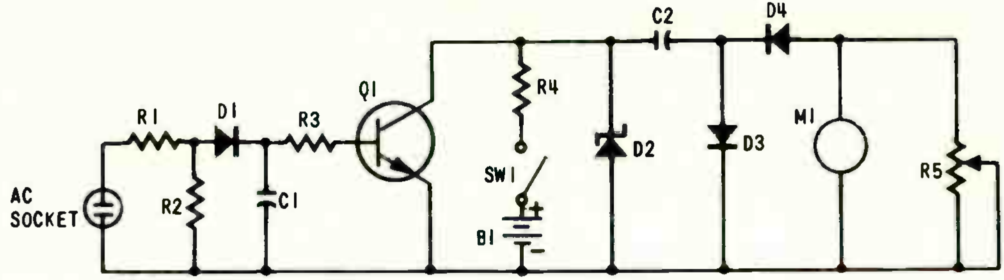
Power Line Frequency Meter

Anyone who has ever used a 110-volt AC power generator in the field is aware of the dangers inherent when the line frequency begins to shift. Most heavy-duty gasoline generators were designed to power electric saws and other outdoor machinery—not two-way radio equipment! Unfortunately, however, emergency use of these generators for CB sets (and Field Day operations for hams) often results in a burned-out power transformer.

It is not enough just to be able to measure the output voltage from the put-puts. Varying voltage can be accommodated by most communications transmitters and receivers. But when the frequency begins to deviate from the 50-60 Hz norm, look out. This handy gadget has been designed to alert you when line frequency shifts begin to take place. And it will do it in time for you to unplug the radios or otherwise we adjust the generator frequency.

The unit can be built in a small metal box, so long as the circuit is well insulated from the chassis. Since the device will be used out of doors, take care to avoid any layouts that might result in shorted components under damp conditions.

Calibration is accomplished by sampling household AC for the reference frequency, which is almost always 60 Hz. Plug



PARTS LIST

TRANSISTOR:
- Q1—2N1059

DIODES:
- D1, 3, 4—1N297 silicon rectifiers
- D2—1N711, 7 1/2-volt zener

CAPACITORS:
- C1—.1 mfd
- C2—3 mfd

RESISTORS:
- R1—150K, 2-watt
- R2—6.8K
- R3—2.7K
- R4—1.2K
- R5—3.5K pot.

BATTERY:
- B1—12v, 8 "D" cells.

MISCELLANEOUS
- M1—0-1 milliammeter
- SW1—SPST heavy-duty

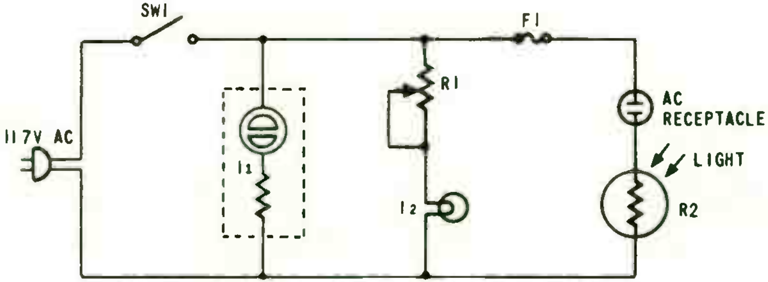
in an AC cable. Then set R5 for zero resistance and turn the meter on. Now adjust R5 so that the meter (M1) reads out 0.6 milliamperes. This corresponds to 60 cycles (Hz) per second; the meter now corresponds to 0-100 Hz across the scale. You'll find that the handy meter responds quite well to all frequency variations and will carry you through a 75- to 150-volt range nicely.

104

Variable 120-Volt Power Supply

Ever wish you had some kind of variac-type power supply with which to regulate small motors, appliances, lamps, etc? Well this tiny supply can do just that for any gadgets you have around the house, providing they do not draw more than 25 watts of power. The essential difference between this circuit and the variable supply presented elsewhere in the book is that it permits you to vary alternating current; it does not rectify the 117 volts. Consequently, your use is not restricted only to AC/DC appliances. But the real beauty is that no hefty transformer is used.

Heart of the regulator is an interesting component known as a cadmium sulfide (CdS) cell, a device which changes its re-



PARTS LIST

RESISTORS:

R1—7.5K, 5-watt pot.

R2—Delco LDR-25 CdS cell. 2 1/2" diameter disc of scrap metal sheeting drilled in center to accept R2. Serving as a heat sink, the ring is suspended 1/2" from the chassis by standoffs. Grommets are used to insure that heat sink is electrically above ground. See text.

MISCELLANEOUS:

F1—3/16-amp fuse. Type 3AG.

I1—Neon bulb and assembly (with built-in resistor).

I2—Type 3S6 3-watt 110-volt bulb.

SW1—Heavy-duty 177v AC.

sistance in proportion to the intensity of light falling on it. For this reason, it is imperative that during construction I2 is placed in such a way as to throw plenty of light on the Delco LDR-25. (Incidentally, you can buy these cells for less than $1.50.) The trick, though, comes in heat-sinking the CdS cell. Best bet is to cut a disc no smaller than 2 1/2" in diameter and suspend it (about 1/2") electrically above the chassis. In this fashion you can mount R2 and it will dissipate 25 watts, even though it may run hot. It is also a good idea to ventilate the box. The bigger the heat sink, the safer R2 is from burnout. Also, insure that R2 is electrically bonded to the heat sink. Warning: Do not hook the power control to any device drawing more than 25 watts. A standard household 25-watt bulb is an excellent tryout load.

Transistor and Diode Substitution Section

The following are standard substitutes for the transistors and diodes shown in this book. These substitutions have not been tested in the circuits and some variance in circuit functioning is to be expected. It may be necessary to experiment with differing component values to achieve maximum results when substituting a transistor or diode. Where no substitute is shown, none is recommended.

DIODE	SUBSTITUTE
1N34A	1N34 1N38B
1N38B	1N38 1N38A
1N60	1N34A 1N54A 1N64A 1N295
1N90	1N34A 1N95 1N116 1N126
1N297	1N67A 1N297A
1N553	1N540
1N1695	1N1763 1N2070
1N2069	1N2071 1N2482
1N2070	1N1695 1N1763 1N2863
1N3121	1N309 1N116 1N117

TRANSISTOR	SUBSTITUTE
2N105	GE-2
2N107	GE-2 2N64 2N105
2N109	GE-2 2N217 2N270
2N111	GE-1 2N112 2N112A
2N170	GE-5 SK-3011 SK-7
2N217	GE-2 2N109 2N466
2N218	2N140 2N219

2N229............2N1198
2N241A 2N320 2N396A
2N269............2N107 2N404 2N582
2N270............2N331 2N395 2N396A

2N301............GE-3 2N301A 2N1534
2N331............GE-2 2N396A 2N414B
2N370............2N371 2N372 GE-9
2N371............GE-9 2N370 2N372

2N372............GE-9 2N370 2N371
2N374............GE-1 SK-3008
2N382............GE-2 2N383 2N1350
2N384............GE-9 SK-3008

2N414............GE-1 2N396A 2N404A 2N427
2N416............GE-1 2N396A 2N145A 2N415
2N438A GE-7 SK-3011 2N439A 2N440A
2N441............GE-4 2N173 2N442

2N442............DS-501
2N501............GE-9 2N846A 2N976 2N979
2N527............GE-2 SK-3004
2N624............GE-1 2N1224 2N1225 2N2495

2N633............GE-2 2N59A 2N59B 2N60A
2N849............2N706A 2N850
2N1017...........GE-9
2N1059...........GE-8 2N1431 2N1699

2N1065A GE-9 SK-3008
2N1177...........GE-9 SK-3006
2N1302...........GE-5 2N635A 2N1304
2N1304...........GE-5 2N635A 2N1306

2N1359...........GE-3 2N1360 2N1535
2N1573...........GE-2 2N597 2N1375 2N1377
2N1742...........GE-9
2N2189...........GE-9 2N2191

2N613............GE-2 2N2614
2N614............GE-2

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