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Title: Add-Ons For Greater Dipper Versatility
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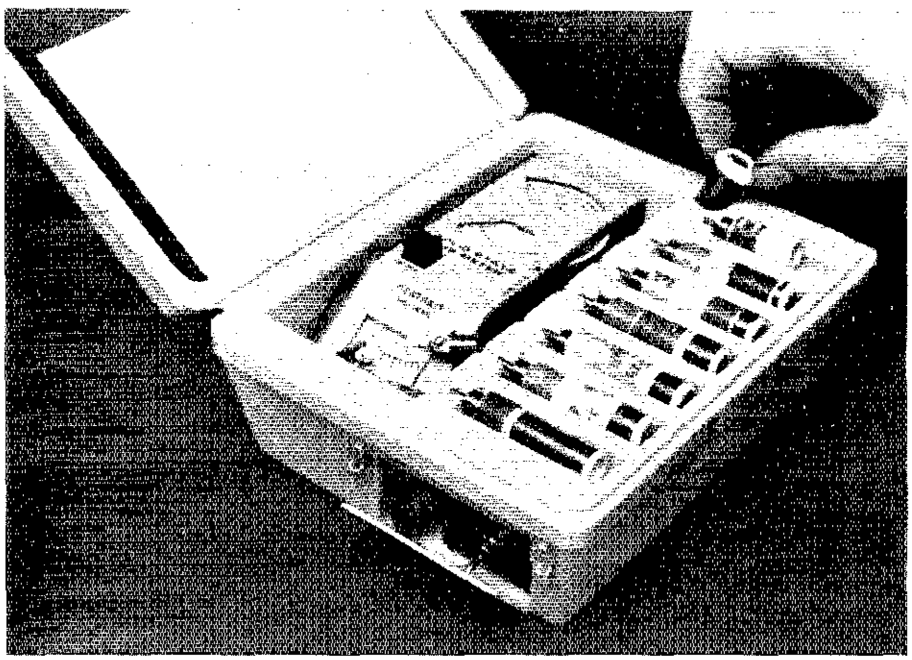
Add-Ons for Greater Dipper Versatility

Your dip oscillator may be in for a new ball game! These simple gimmicks and gadgets extend its usefulness and improve dial accuracy.

By Robert H. Johns,* W3JIP

Simple accessories can be added to your dip oscillator for increased usefulness. They do not require any modification of the basic instrument. All are "outboard additions" that complement the original equipment by providing improved dial accuracy and a means for capacitance coupling to inaccessible circuits. Furthermore, the add-ons make tuning easier by slowing the dipper tuning rate, an advantage when the device is performing as a signal generator. Another benefit is provision of convenient connections and components for measuring inductance and capacitance.

The accessories described apply directly to the Heathkit HD-1250 dip meter. The ideas, however, may be applied to other models, too.



The case of the Heath HD-1250 dip meter has plenty of extra space for accessories that belong with the dipper. A photocopy of the *Handbook* "L and C vs. frequency" graph is taped to the lid. Loose wire additions such as the capacitance probe and the phono jack are tucked in the instrument compartment. The door cut in the side permits access to the space under the coil tray for the plastic box and other coils. Solder lugs held by small hardware hold the door closed. The 5-μH standard coil has a plastic hat, white silicone rubber caulking compound, which prevents it from slipping through the mounting hole to the right of the dipper coils.

Accuracy

I found the dial calibration surprisingly accurate, especially for a kit. Dipper scales are never exact, and no one expects them to be. As I prepared a chart of how many kilohertz to add or subtract from the dial indication, I noticed that each amateur band required the use of a different coil except for 15 and 20 meters. The thought came to mind, "Why not adjust each coil so that it is 'right on' for the bands where the dipper is used most?" Not wishing to modify the coils themselves (they are nicely encased in plastic), I trimmed the inductance of each by the addition of tiny amounts of core material, either powdered ferrite or chips of copper.

First, I listened to the dipper on a calibrated receiver to determine the correction needed. If the dipper indicated 6.9 MHz when the receiver is getting the signal at 7.0 MHz, the coil is too small (too much C needed to resonate it at 7.0 MHz). This means a little more inductance needs to be added, which can be done by inserting pieces of ferrite from a junk-box coil. See Fig. 1. Use a hammer or pliers to break up the ferrite. Before adding the ferrite powder, plug the coil with some sort of plastic that will harden. Fill to a depth of 10 mm (0.4 inch) inside the coil form. Silicone rubber caulking or bathtub sealant has good electrical properties. Either makes a good embedding medium for the ferrite and can be dug out of the coil form if you later decide to remove it. As you add powder and little bits of ferrite, they stick in the silicone. You can follow the frequency change with your receiver and add inductance until both read the same frequency. Make sure that the dipper coil is plugged all the way into its socket since the capacitance involved at this point is part of the tuned oscillating circuit. Otherwise, a little slip will throw off the exact calibration you are aiming for.

Should the coil be too large (the dial

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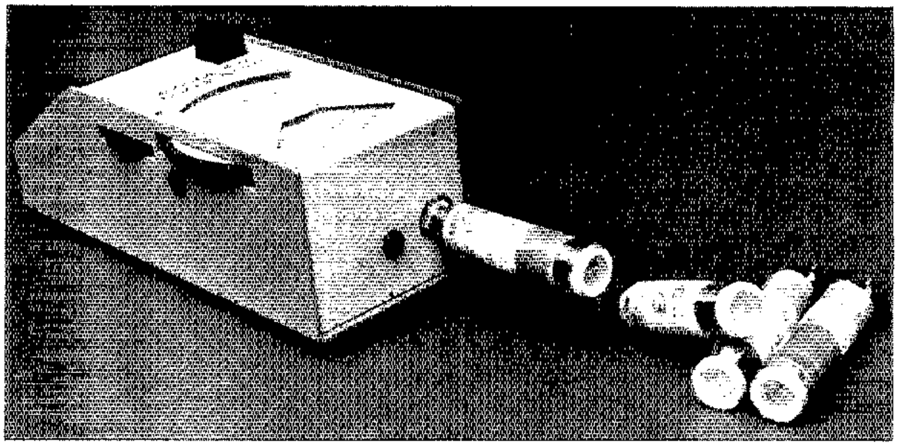

Fig. 1 — The Heath dip meter with plug-in coils. The silicone rubber that may be seen inside the coil has ferrite dust or copper chips embedded in it to trim the coil's inductance so that the dipper reads correct frequencies on amateur bands.

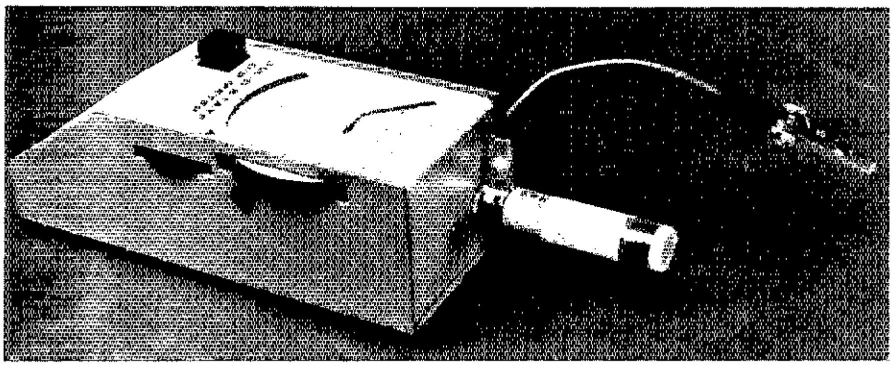

Fig. 2 — The capacitance coupling probe. The clip lead is connected to the circuit under test and is coupled to the dip meter through the small capacitance between the insulated collar and the phono plug of the coil.

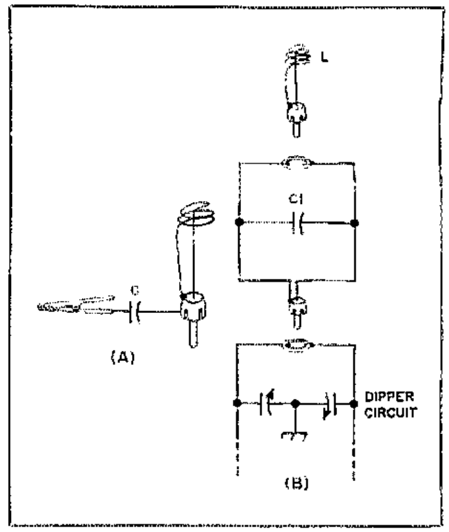

Fig. 3 — At A is shown the coupling capacitor, C, connected between the clip and the coil. Actually, this capacitor is simply the capacitance between the phono plug outer sleeve and the aluminum collar that fits around it but doesn't touch it. At B, a 150-pF or 100-pF capacitor, C1, is connected in parallel with the plug-in coil, L, and also the balanced tuning capacitors inside the dip meter. The capacitors are mounted in a plastic box and connections made by plugging the box in between the coil and the dipper.

indicating 7.1 MHz when the receiver is set at 7.0 MHz), the inductance may be decreased by placing small chips of copper in the coil. Each one acts as a shorted turn of a transformer secondary where the dipper coil is the primary. Cut pieces about a millimeter (0.04 inch) long from heavy copper wire and add them a few at a time to the silicone plug in the coil form. When enough core material has been added to a coil, squeeze some additional silicone into the coil form to cover and secure it. The silicone will set overnight and is easier to trim with a sharp knife than by trying to smooth out the uncured sticky stuff.

There is a little compromise concerning the 15/20-meter coil. That compromise in calibration amounts to the width of a calibration line. In other words, the calibration is about 1 mm (0.04 inch) off. That's very good, however.

Capacitance Coupling

After reading the recent article by Fred Brown, W6HPH,[1] I thought that I would try capacitance coupling to an unknown circuit as he describes. I agree with his conclusion that it works very well. I'm sorry that I did not know about this years ago! With capacitance coupling, you can dip an unknown circuit without having to place the dipper physically next to it so that the coils couple magnetically. The unknown can be a toroid or an LC circuit below a chassis or in a tight place. A single wire is clipped to the unknown and then lightly coupled (a few picofarads) to one side of the dipper tank circuit. A "no-holes" modification for the Heath dipper is accomplished by wrapping a turn or two of the insulated single wire around the outer surface of the phono plug of the dipper coil. This outer surface of the phono connector is not a ground. Rather, it is one side of the balanced oscillator circuit.

A more stable capacitance probe is shown in Fig. 2. An aluminum ring is bent and shaped to be a snug slip fit around the phono plug. The single wire is connected and black electrical tape wrapped around the ring for insulation. The capacitance between this ring and the phono plug is enough to couple the unknown circuit to the dipper so that a nice dip is observed at resonance. The ring may be cut and bent from aluminum sheeting, but I made the one shown from aluminum tape of the type sold in automotive stores. It can be cut with scissors, works easily and can be folded into layers to become as thick as desired. There are many uses for it in the ham shack.

This capacitance probe also provides uniform coupling to a circuit when measuring its Q, as suggested in the Heath manual. In brief, one measures the rf voltage across the test circuit and notes the change in frequency between the 3-dB-down points, where the voltage falls to 0.707 times the peak voltage. The Q of the unknown circuit is equal to the center frequency divided by the bandwidth. This measurement of Q with a dipper was new to me. It works out very well, provided that the coupling between the dipper and the unknown circuit is kept constant. The bandspread provided by the next circuit addition is also a help in measuring the 3-dB bandwidth since these frequencies are quite close together for high-Q circuits in the hf range.

Signal Generator

Although use of a dip meter as a signal source for an impedance bridge or as a signal generator in receiver work is common, the fast tuning rate is a handicap. It is tricky to get a dipper to stop in the passband of a receiver. Since the amateur bands are at the low end of the tuning ranges of the Heath dipper, a simple way to slow down the tuning rate is to add a capacitor in parallel with the tuning capacitor in the dip oscillator as shown in Fig. 3. No change need be made to either the dipper or the coil if the capacitor is placed between them. Placement must allow the coil to be plugged into the capacitor box and the capacitor box plugged into the instrument. With the 150-pF

[1] Brown "A 1980 Dipper," *QST*, March 1980, p. 11.

padder in the circuit, the normal tuning range of the dipper from about 15 pF to 70 pF becomes about 165 to 220 pF. Accordingly, the frequency of the oscillator is both lower for a given coil and does not change over such a wide range. The green coil of the Heath dipper, which tunes from 12.5 to 26 MHz, oscillates from 6.7 to 7.7 MHz with the 150-pF capacitor in parallel with it. This capacitor serves to spread out the bands, 160 through 10 meters. The 50-pF capacitor gives 15- and 17-meter coverage with one coil and 30-meter coverage with another.

Capacitors, phono plugs and jacks are mounted in a small plastic box with the bandspread calibrations shown on the outside (Fig. 4). The calibrations are marked on colored tapes (Radio Shack 64-2340) that correspond to the colors of the coils. Which way to plug the box in is taken care of by the calibration scales; when you read the 40-meter scale, the box is plugged in with the proper capacitor connected.

The oscillator stalls at the high ends of the 160- and 80-meter ranges, probably from lack of feedback. This is easy to recognize, for the meter drops to zero and restricts the ranges only a little.

With the modification indicated, the dipper signal is easy to tune in on a receiver. Also, the Δf for Q measurements in or near the ham bands is easier to estimate from the bandspread scales, despite the inaccuracies in reading the calibration through the logging-scale. The measurement of the rf voltage across the unknown circuit is made easier by using a digital voltmeter and a simple probe. The

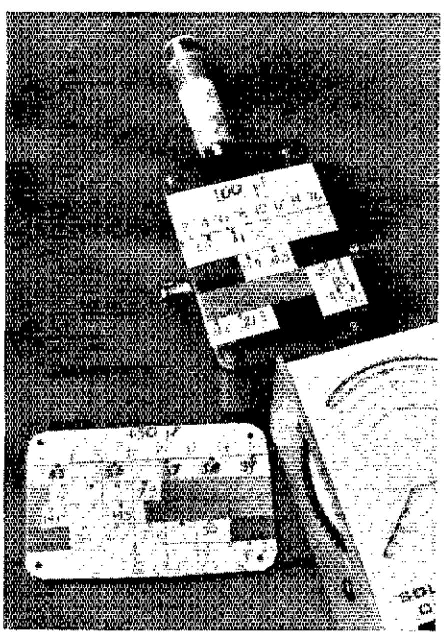

Fig. 4 — The 100-pF bandspread capacitor is connected between the coil and the dipper and the bandspread scales are taped on the plastic box. To use the 150-pF capacitor, the box is turned over and rotated 90°, and the other set of phono connectors is used.

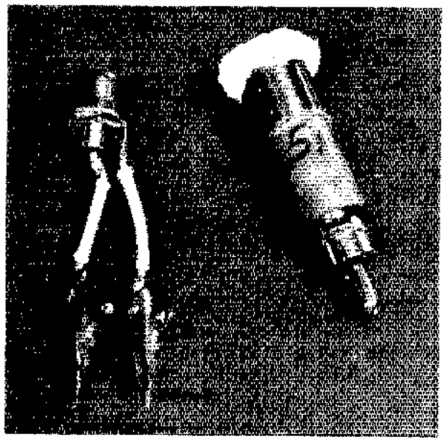

Fig. 5 — Accessories for measuring inductance and capacitance. The phono jack with clip leads will connect to the 100-pF standard in the plastic box and clip onto the unknown inductance. After locating the resonant frequency with the dipper, the value of the unknown coil may be read from charts in the ARRL *Handbook*. The standard 5-μH coil is about the same size as the dipper coils and can be plugged into the phono jack for connection to an unknown capacitor.

0.1 millivolt sensitivity of these instruments makes this job a snap!

Measuring Unknown Coils and Capacitors

The box with a 50-pF capacitor inside fits right in with the graphs and the methods outlined in the measurements chapter in the ARRL *Handbook*. Unknown coils may be measured by connecting them to the 50-pF capacitor in the box via a phono jack equipped with short clip leads as in Fig. 5 and the resonant frequency of the combination found with a dipper. The graph of inductance vs. frequency for this capacitor will furnish the inductance of the unknown coil with no calculation.

Any of the dipper coils can be used as a standard in finding the capacitance of unknown capacitors; their inductance is given in the manual. This can get confusing, since the standard coil that is plugged into the phono jack and connected to the unknown capacitor is sometimes needed in the dipper to scan for the resonant frequency. I prefer to make up a small 5-μH standard that can be stored in the plastic dipper box along with other accessories. It could have been put in the plastic box, but I was afraid of stray coupling and false resonance. The small coil in Fig. 5 is wound on a length of half-inch PVC tubing which is obtainable from the plumbing department of many hardware stores. A good phono plug (Radio Shack no. 274-339) fits snugly in this tubing.

It should be clear that any of these additions to your dip meter could be made independently of the others and according to your interests and needs. The dipper is one of the most useful devices in the shack and it can become even more versatile! QST

Strays

TA PROFILES

☐ We are pleased to have Jim Stewart, WA4MVI on our team of ARRL Technical Advisors, serving as our radio propagation/predictions and EME specialist. In 1978 Jim had a book published on this subject, entitled *VHF Radio Propagation.*

First licensed at age 15, Jim presently has an Extra Class license, and is the proud holder of a WAS certificate on 6 and 2 meters, plus a WAC certificate on 2 meters. His principal interests in Amateur Radio include EME, vhf/uhf, propagation, radio astronomy and OSCAR programs. He is also involved in flying, skiing and sports cars.

As a chemistry major, Jim received his BS degree from Lander College. He resides in Hendersonville, North Carolina, and is employed in air traffic control and as a commercial pilot. — *Marion Anderson, WB1FSB*

TA Jim Stewart, WA4MVI

HAPPY BIRTHDAY AMSAT-OSCAR 8!

☐ March 5 marks the completion of three years of successful operation for AMSAT-OSCAR 8. The satellite will have provided flawless service to Amateur Radio operators, students and science teachers worldwide during 15,280 orbits.

To commemorate this anniversary, ARRL will issue a special QSL card. During the period March 1 through 7, send a signal-reception report to AMSAT-OSCAR 8 Third Anniversary, ARRL Club and Training Dept., 225 Main St., Newington, CT 06111. Provide as much information as possible, including calls heard, telemetry and frequency. Check the OSCAR Operating Schedule elsewhere in this issue or write ARRL Hq. for details on how to listen for AMSAT-OSCAR 8. — *Bernie Glassmeyer, W9KDR, ARRL Satellite Coordinator*