Some Notes on the Clapp Oscillator

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THE following notes on the Clapp series-tuned oscillator are a result of the author's experience in building a VFO using this circuit. It is hoped that they will be useful to others.

The circuit used is shown in Fig. 1. Values are conventional, but only high-quality components were used.

Greatly-improved isolation between the oscillator and succeeding buffers may be accomplished with the circuit as shown. One half of a double triode (12AU7 or 6SN7) is used as the oscillator and the other section operates as a cathode follower. The low output impedance of the cathode follower makes the voltage and frequency less sensitive to load changes. W2FBA has used a cathode follower to isolate other VFOs, but the Clapp oscillator lends itself very simply to this circuit. If the oscillator is not keyed, the follower grid may be directly coupled to the oscillator cathode, since little or no d.c. voltage exists at this point. If the oscillator is keyed in the cathode circuit, capacity coupling should be used to prevent the open-circuit cathode voltage from appearing on the follower grid.

It was found that an r.f. choke in the cathode circuit of the follower improved the output. The output is somewhat less than that from the oscillator alone, although neither is very large. In this installation about 3 volts output was obtained, enough to drive a 6AC7 Class A. The 6AC7 was found to be superior to the 6AG7 in cases where the grid drive is small. This is to be expected from the high perveance of the 6AC7. In addition, it was desired to keep power dissipation to a minimum, and the 6AC7 gives more output at lower current. A 2E26 may be driven to full output with the 6AC7 operating Class A from the cathode follower.

The mechanical construction used with this type of oscillator must be considerably more rugged than with the usual high-*C* VFO. The junction between the tuning capacitor and the coil is very hot and any change in stray capacitance at this point will spoil the stability. The coil and condenser should be mounted so that no relative motion can occur between these components or between them and the shield.

Available ceramic coil forms did not give *Q*s which came up to expectations. An air-wound coil similar to the B&W type having a length about equal to its diameter was selected as having the best *Q*. The coil was clamped on one side in a polystyrene bracket. The *Q* of this coil without a shield was measured as 275 at 3.5 Mc. It should be realized that placing a shield around a coil will reduce its *Q*. The coil should be spaced from all sides of the shield by a distance at least equal to the coil diameter to lessen the reduction in *Q* by the shield.

The usual precautions as to condenser bearings should be observed. The small amount of tuning capacitance used in this circuit makes the frequency more dependent upon strays and minimum capacitance of the condenser. Condensers in which spacing can be changed with longitudinal pressure on the shaft should be avoided, since they can cause errors in setting the frequency.

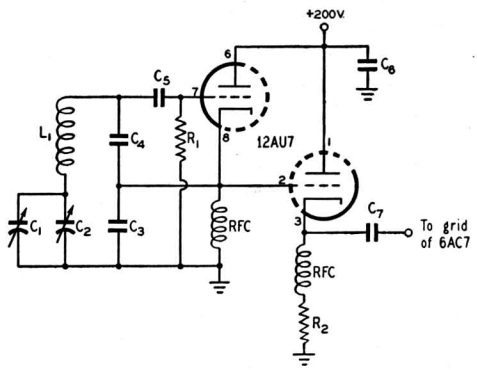

Fig. 1 — Series-tuned oscillator with cathode follower.
C_1 — 50-$\mu\mu$fd. variable.
C_2 — 15-$\mu\mu$fd. variable.
C_3, C_4 — 0.001-μfd. silver mica.
C_5, C_7 — 100-$\mu\mu$fd. mica.
C_6 — 0.01-μfd. mica.
R_1 — 0.1 megohm, ½ watt.
R_2 — 15,000 ohms, ½ watt.
L_1 — 45 turns No. 18, 2¼-inch diam., 2¼ inches long. (See text.)
RFC — 2.5-mh. choke.

The keying properties of the circuit were investigated only as a matter of academic interest. A barely-discernible chirp seems to be present with the usual filter arrangements. Previous experience with the critical tastes of the FCC in the matter of key clicks made it desirable to eliminate them from this unit. In any keyed oscillator the frequency will change as the applied voltage builds up; the Clapp oscillator is no exception, although it is considerably better than others. If the rise in the keyed voltage is sharp the chirp will appear as a click, and many cases of clicks may be traced to this effect. Wishing to

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"kilowatt boys." If you have a crystal on your neighbor's frequency, he may even be able to cut you in on the net that he is a part of, and when you have all of the big boys listening for you instead of competing with you, shucks, it's easy! So, get on the air, whether it be from your car, or from your country cabin, or from your home station. You'll be surprised at what you can do with 20 or 30 watts, especially if you've been used to using much more than that. I was, and you'll be, too!

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have none of these difficulties, it was decided to allow the oscillator to run continuously and to take advantage of the mechanical construction to accomplish the necessary shielding. This proved to be a practical solution; no trace of the oscillator can be heard on anything but the fundamental (3.5 Mc.) and this is not objectionable. The unit is keyed in the Class A 6AC7 following the oscillator.

No measurements have been taken on the stability of the VFO. After a warm-up period of 15 to 20 minutes the oscillator will stay in zero beat with a 100-kc. crystal for long periods of time. The main source of drift seems to be the expansion of the inductance. This could be compensated by negative temperature-coefficient capacitance but was not thought worth while for the desired results.

The Clapp oscillator is most certainly superior to previously-used types. It is not a cure-all for VFO troubles, though, and considerable care must be used in construction to realize its capabilities.

50 Mc.

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Up in the Boston area W1OOP and W1PRZ have been working crossband, 144 to 445 Mc., with W1PRZ running an 8012 grounded-grid doubler, driven by his 220-Mc. 829 amplifier. Modulation is applied to both these stages. W1OOP has a revamped BC-645, using a push-pull 6J6 mixer, 955 oscillator and three stages of 7H7 i.f.

Not all the 420-Mc. activity is in metropolitan areas. It takes only two interested hams to make a communications circuit, and there have been that many in Regina, Sask. for more than a year. VE5JK and VE5BL work almost nightly at 7 P.M., with converted BC-645s.

Here's one fellow who is about two bands ahead of most of us. As soon as the 420-Mc. band was released, W1BBM, North Harwich, Mass., was in there, seeing what could be done. Then, almost before others got interested in 420, he was up on 1215 Mc.; then 2400 Mc., and now 3300 Mc. He finds that, with suitable cavities, ordinary lighthouse tubes will operate satisfactorily as high as 3500 Mc., and he would like to hear from other interested workers. He suggests that the i.f. for microwave work be standardized at 30 Mc., making it simpler for all who build for duplex to coördinate their efforts.