While you're working on the 30 meter transceiver described by the author last month, keep this handy companion in mind. This matching amplifier makes a nice project by itself or an even better addition to your homebrew station.

How To Build A 30 Meter 100 Watt Amplifier

BY RICHARD W. STROUD*, W9SR

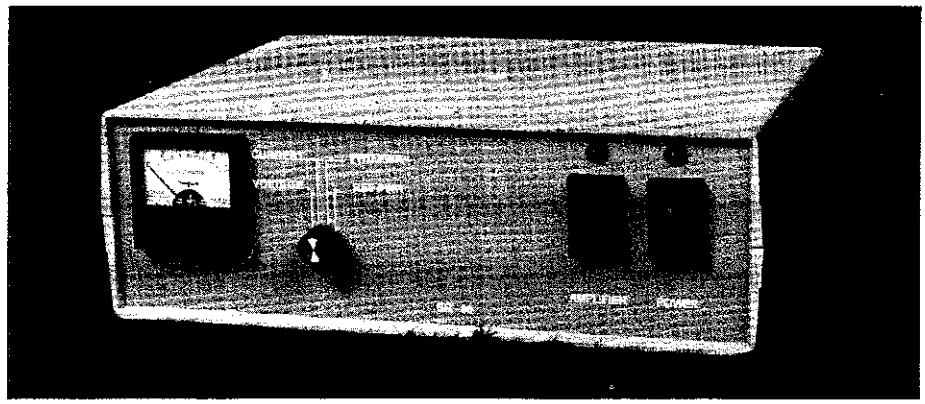
A while after I built and used the QRP rig described in the January 1998 issue, I decided that a nice addition would be an amplifier to give me a little more operating time when the band started to die out. This amplifier uses a Motorola MRF 172 FET and has a gain of 14 dB, developing 100 watts when driven from any 4 watt QRP transceiver. It, like the transceiver described earlier, is built in a 7 1/2" × 10" × 3 1/4" plastic cabinet (Dick Smith H-2507) presently available from surplus outlets.

If following this layout directly, plan carefully before any holes are drilled, as there is very little clearance between components, panel controls, etc. Hole patterns are drilled in the top cover above the fan for air intake, and exhaust air holes are drilled in the side and rear panels. Do not overtighten the four fan mounting screws, as the cabinet can easily craze under pressure.

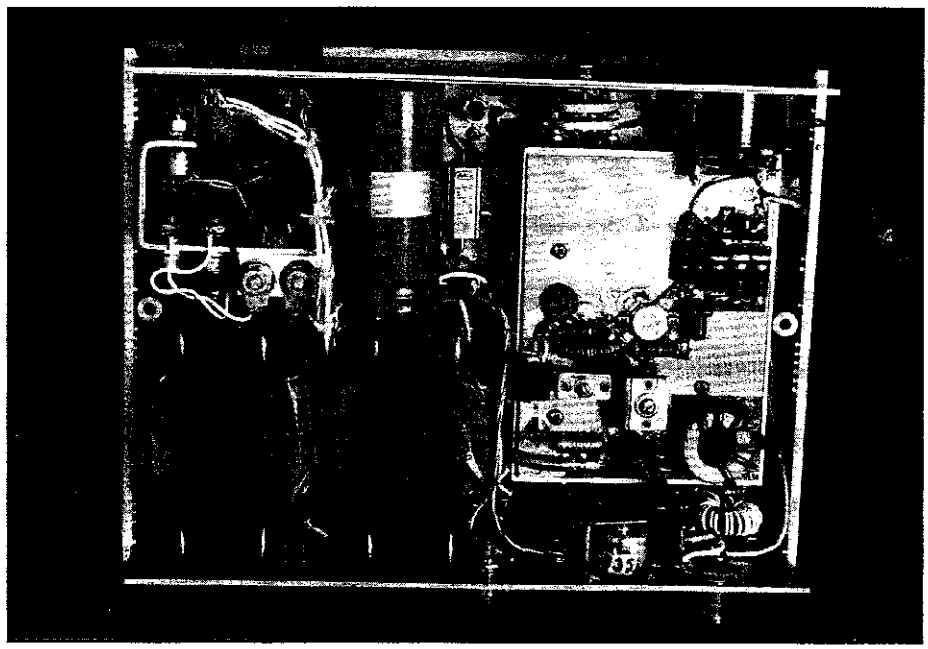
Plastic mounting bosses are built into the cabinet bottom, and these are used for mounting the copper board. Mounting screws are supplied with the cabinet. The bosses can easily be cut away in the area of the transformers and the regulator heat sink assembly to allow mounting of these parts directly on the cabinet base.

The original plastic panels are discarded and the back panel is replaced with a .087 thick aluminum panel. The front is replaced by a sheet of .032 aluminum covered by the engraved plastic panel, giving a total thickness of about .090 inches. These panels fit in the original groove around the front and rear perimeters of the cabinet. Engraved panels are available from L & C Engraving.[1]

A copper-clad board houses the bias



The front view of the completed 30 meter amplifier. It would make a handsome addition to any shack.



The top view shows the parts density of this project. The cooling fan is mounted to the top cover.

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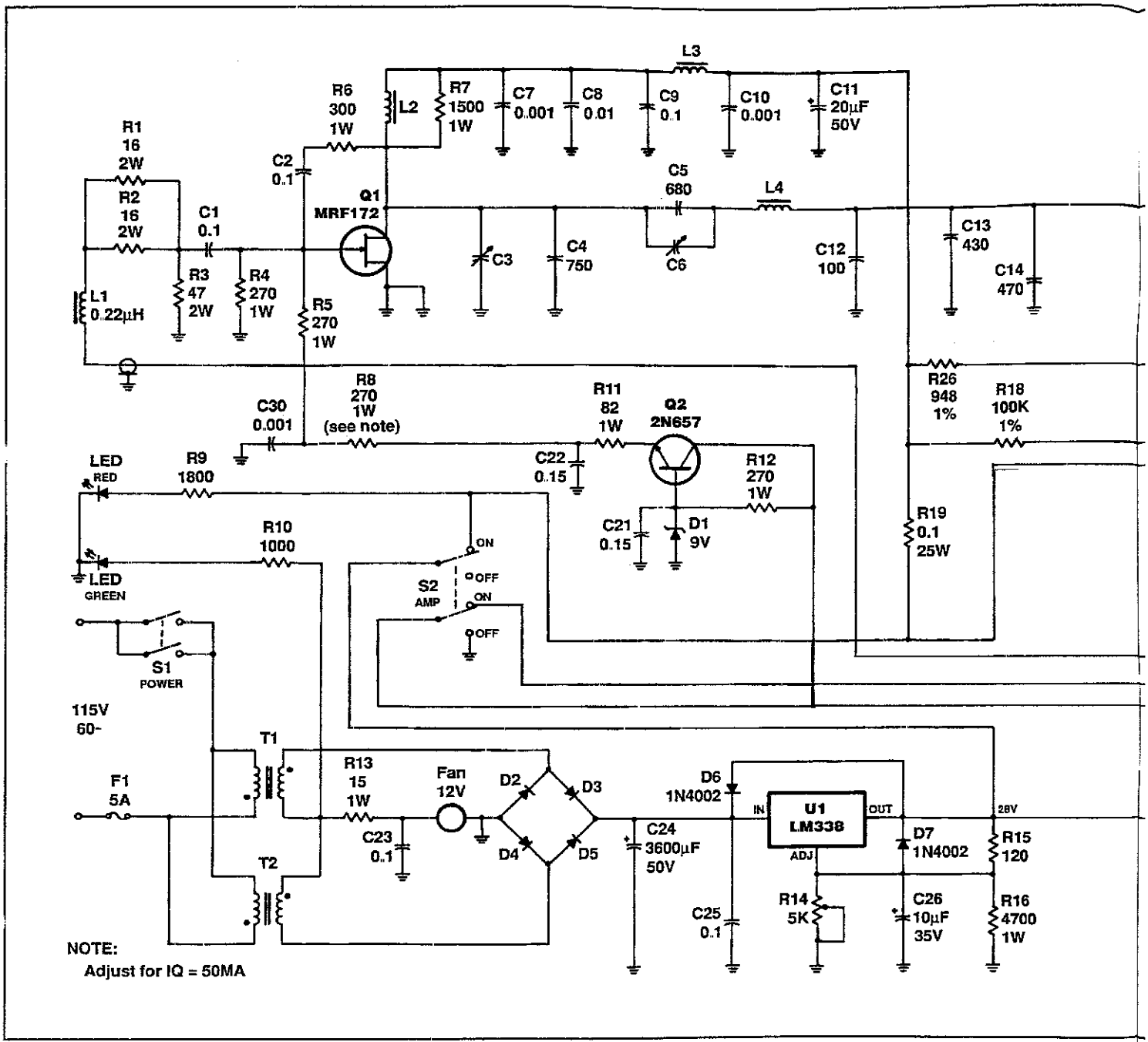


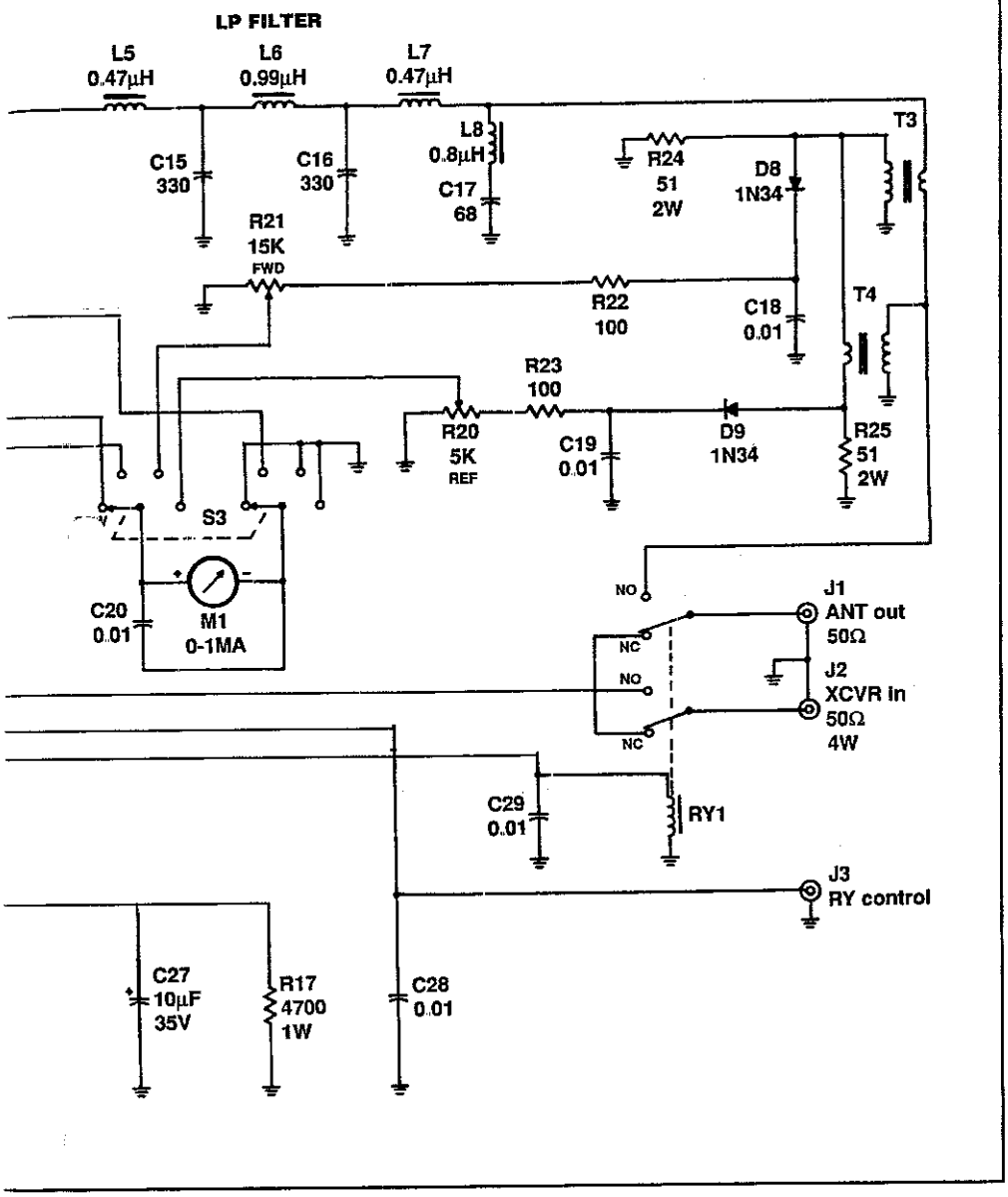
Fig. 1– The schematic diagram for the 100 watt 30 meter RF amplifier as described in the text. This is a companion amplifier to the 30 meter QRP project described last month.

regulator circuitry, low-pass filter, and directional coupler. Also the amplifier heat sink assembly is bolted to this board with the board area below the heat sink fins cut away to allow air flow.

The RF amplifier is built on a copper-clad board which is bolted to the 3 3/4" × 4 7/8" aluminum heat sink. The flat surface of the heat sink is drilled and tapped for mounting the board and transistor. The board is cut through so the transistor can be bolted (with heat-sink compound applied) to the top of the aluminum heat sink. The copper is also removed below the large inductor, L4, and under the meter terminal area. Air from the fan is blown over the transistor, down through the heat-sink fins, and out the side and rear of the cabinet.

Winding L4 with the large wire is somewhat of a challenge. Do not put excessive pressure on the powdered-iron core, as it can break. Use soft copper and form the wire slowly. It does not need to conform closely to the form. This coil was originally made using No. 16 wire. By going to No. 10, with the same inductance, the output increased by nearly 5 watts. Silver plating of the wire was not examined, but this would probably improve the efficiency still further.

Lead length in the RF circuits should be minimal. Pad areas were cut into the copper board for component junction points as necessary. After the unit is operational, the inductance of L8 should be adjusted



Component List (for fig. 1)

R1, R2: 16 ohm, 2 watt carbon
R3: 47 ohm, 2 watt carbon
R4, R5, R12: 270 ohm, 1 watt carbon
R6: 300 ohm, 1 watt carbon
R7: 1500 ohm, 1 watt carbon
R8: 510 ohm, 1 watt
R9: 1800 ohm, 1/4 watt
R10: 1000 ohm, 1/4 watt
R11: 82 ohm, 1 watt
R13: 15 ohm, 1 watt
R14: 5K potentiometer
R15: 120 ohm, 1/4 watt
R16, R17: 4700 ohm, 1 watt
R18: 100K, 1%
R19: .1 ohm, 3%, 25 watt, Dale RH25
R20: 5K potentiometer, 10 turn
R21: 15K potentiometer, 10 turn
R22, R23: 100 ohm, 1/4 watt
R24, R25: 51 ohm, 2 watt carbon
R26: 948 ohm 1% (parallel 1K 1% and 18.2K 1%)

C1, C9, C23, C25: .1 mF ceramic, 100V
C2: .1 mF ceramic, 250V
C3: variable mica, 250 pF, Arco 427
C4: 750 pF mica 500V
C5: 680 pF mica, 500V
C6: variable mica, 470 pF, 43-3517
C7, C10, C30: .001 mF standoff Allen Bradley FB
C8, C18, C19, C20, C28, C29: .01 mF ceramic, 100V
C11: 20 mF, 50 volt tantalum
C12: 100 pF 500V mica
C13: 430 pF 500V mica
C14: 470 pF, 500V mica
C15, C16: 330 pF 500V mica
C17: 68 pF, 500V mica
C21, C22: .15 mF, 100V ceramic
C24: 3600 mF, 50V computer-type Sprague 36D
C26, C27: 10 mF, 35 volt tantalum

U1: LM338 IC regulator
Q1: MRF-172 FET, Motorola
Q2: 2N657 transistor

D1: zener diode 9.1V, RadioShack 276-562
D2, D3, D4, D5: diode, 12 amp 100V PIV IN200A
D6, D7: diode IN4002
D8, D9: diode IN34

RY1: relay DPDT, 12V 135 ohms

M1: meter 0–1 mA Simpson 1-3/4', 43 ohms

F: fan 12V, 3" Panflo FBK-08A

S1, S2: switch DPDT RadioShack 275-691A

T1, T2: power transformer 15V 6 amp (see text)

T3: 30 turns #28E, closewound F50-61 core primary 1/2 turn #18 teflon
T4: 26 turns #22 teflon, closewound F82-61 core sec 1/2 turn #20 teflon
L1: .22 µH 5t #26E, closewound T37-6 core
L2: 2.5 µH, 21t #22E on T68-6 core space 3/4 of form
L3: 2-1/2 turns #20 teflon thru 1/2" ferrite binocular core
L4: .6 µH, 6t #10 soft copper on T106-6 core space over 5/8 of form
L5, L7: .47 µH 5t #18E on T94-6 core, space wire dia
L6: .99µH 9t #18E on T94-6 core space wire dia.
L8: .8µH 12t #20E on T50-6 core, space wire dia

with an insulated tool for a minimum second harmonic signal. This can be done by monitoring with a communications receiver while a very low drive signal is applied to the amplifier.

The primary winding of T3 is a half-turn loop of hookup wire through the core and between two isolated copper pads in the filter output line. T3 is mounted below the copper board and T4 is mounted above to give isolation between the directional coupler inductors.

Because of space constrictions, two 15 volt, 6 amp transformers are connected in series to develop the voltage required by the FET. The transformers used are marked "19A134324P1." There are probably others that will do the job. These and the plastic cabinets are available from Pembleton Electronics.[2] The transformers are bolted directly to the bottom of the cabinet as is the heat sink which houses the LM338 regulator and the rectifier diodes. The stud-mounted diodes are attached to

the heat sink with an aluminum bracket. R14, the regulator voltage set potentiometer, is also mounted on this bracket.

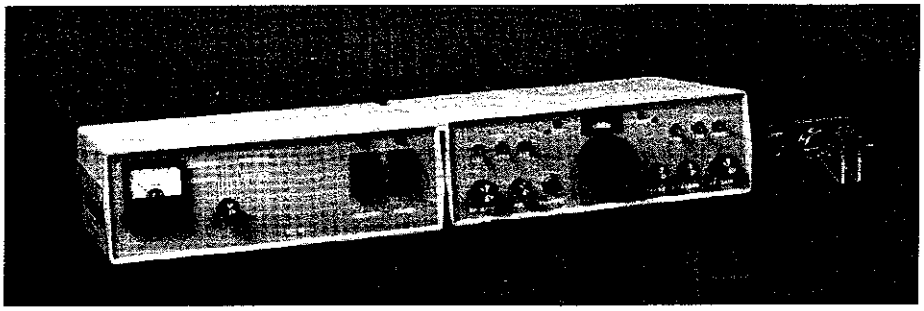
Heat-sink compound should be used under the mica insulators of the regulator and diodes.

Capacitor C24 is held in place by a formed aluminum strap that is bolted to the heat sink.

The LED indicators are RadioShack 276-208 (red) and 276-022A (green) mounted in 276-079 holders. A dot of RTV sealant on the rear holds the LEDs in place.

The change-over relay is mounted on the rear panel near the two coaxial connectors such that the input and output leads to the relay are short. Relay control from the transceiver is routed through an RCA-type panel connector, RadioShack p/n 274-346. When the amplifier is in the off position, the transceiver output is routed directly to the antenna.

R14 is adjusted for a supply voltage of 28 volts. With a 50 ohm load on the amplifier and no drive, adjust the value of R8 if necessary for a Q1 idling current of about 50 milliamperes. With drive applied, adjust C3 and C6 for maximum output, which should be 100 watts with an input of 4 watts. Do not exceed 5 watts input. Normal operating current is about 4.5 amps.



If you've been as careful and exacting as the author, when you complete the amplifier and the exciter you can be as proud of your handiwork as we're sure he is.

The over-current function of the regulator will shut down the supply if the current exceeds approximately 5 amps. This can occur if the SWR is high or the amplifier is over-driven.

The panel meter monitors the supply voltage (100 volts full scale), FET current (10 amps full scale), relative forward power (100 watts full scale), and relative reflected power (10 watts full scale). The forward and reflected power levels are set by R21 and R20.

No problems were experienced in building this amplifier other than trying to crowd it into the small space. Although the unit is not shielded, no problems have been encountered during operation over several months in a residential area.

Results have been gratifying with good reports received from DX stations on a regular basis. By changing the appropriate output components, the amplifier could be modified for other HF bands ■

Footnotes

1. L & C Engraving, 111 W. Mill Street, Ossian, IN 46777.

2. Pembleton Electronics, Inc., 1222 Progress Rd., Ft. Wayne, IN 46808-1262.