MAY
1952

CQ RADIO AMATEURS!

W7KT

Special Mobile Issue



35c

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20 tubes, including rectifier, voltage regulation and ballast tubes.

Dual conversion, 455 kc and 6 Mc crystal controlled.

Receiver type: Single superheterodyne in tuning ranges of 540 kc to 7.0 Mc and dual conversion on tuning ranges from 7.0 to 54.0 Mc.

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FRONT VIEW, SX-73

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In stop-and-go driving, keep r-f output steady with

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GL-OA3	75 v
*GL-OB2	108 v
GL-OB3	90 v
GL-OC3	108 v
GL-OD3	153 v
GL-874	90 v

*7-pin miniature type.

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166-186

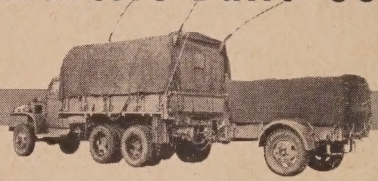
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CQ RADIO AMATEURS' JOURNAL

VOL. 8, NO. 5
MAY, 1952

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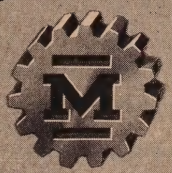
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Feenix, Ariz.

Deer Hon. Ed:

A cupple of weeks ago I got to thinking about putting a reel mobile rig in my car. Not one of these little ten-whatters, but a reel sooper-dooper power job. After all, Scratchi having grate reputashon to uphold, and can't affording to be having week signal on ether, even if operating mobile. Now usually when I am faced with situashon of this sort, I going ahead willy-nilly and ending up with some horribul mess that can't possibly working, or else I getting sumthing that blowing up in Hon. Face. This time, I saying to myself, will be different. This time I sitting down and figuring hole thing out ahead of time so not pulling any bone-head stunt.

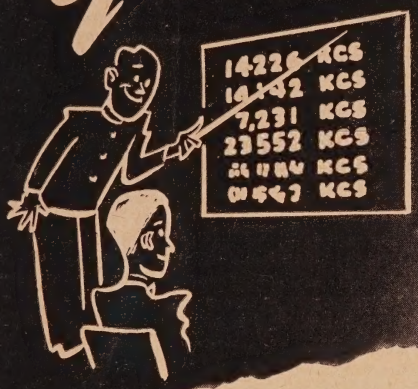
So, supposing I want hundred-what rig. That taking total of maybe cupple hundred whats of power, so at six volts, that being around 35 amperes. That meaning have to get extra heavy-duty battery. Well, that not so bad, but what can you do with hundred-what rig? No, that hardly Scratchi-style power. How's about 600 what rig in car? If going to two batteries, and getting 12 volts, using about 100 amperes. Wowie!! One hundred amperes! Let's see. I could using about eleventeen strands of number ten wire to carrying that current, and maybe getting extra-special big dynamotor. Golly, I could doing it, but then all I'd have is 600 what transmitter. Most hams have bigger rigs at home than that.

Supposing I trying to run cool kilowhat, with maybe 2000 volts at one ampere to final. This taking total power of maybe five kilowhats, counting in modulator and various dial lights. At 12 volts I needing about 420 amperes. Hmmm. Maybe having to go higher than 12 volts. Say, why not using gas generator in trunk of car and getting 115 volts from it? No, come to thinking, a five kilowhat generator is a slite bit too big for trunk of car. Maybe could fitting car in trunk of generator. . . . Haw Haw, Hon. Ed.,

What I could doing is putting generator on trailer, and pulling it along. As a matter of factly, could even put the rig in the trailer, and just having antenna on car. The more I thinking about that, the more I like it except why put antenna on car. Can putting antenna on trailer, then everything be in trailer. Of course, trailer will be kinda large, and hard to pull with my old car. What I needing is to put motor in trailer, so can driving trailer without car. That's it, Hon. Ed. Sure, I'll buy a truck, and mount generator in back, putting transmitter in covered part of back, and operating from the cab. Yes indeedy, all I needing is money.

(ontinued on page 110)

...Spots Before Your Eyes





Oh me! Oh me! What will my frequency be? Do you have spots before your eyes and kilocycles on the brain? The best cure for instability—sometimes known as "where-am-I-hope-it's-in-the-band"—is positive CRYSTAL CONTROL WITH PRs! Yes, PR Precision CRYSTALS give you peace of mind, because when you have a PR in your rig you KNOW WHERE YOU ARE . . . and your friends do, too! You can get PRs at your jobber's for the exact frequency you want (integral kilocycle) within amateur bands at no extra cost! Tens of thousands of amateurs all over the world use and boost PR Precision CRYSTALS for accuracy, stability, low cost, dependability and activity. They're unconditionally guaranteed.

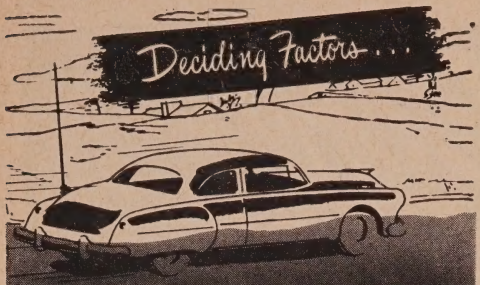
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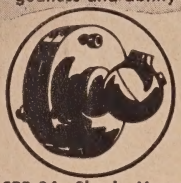
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Broad Band . . .

TVI Disputes

Editor, CQ:

TVI wars being what they are, there are times when the amateur can really use the assistance of a well equipped attorney. Here in Cleveland, for example, one amateur was evicted from his home because of trumped-up TVI charges (there wasn't any TVI) and another amateur found it necessary to fire a gun to convince his neighbors that tearing down his antenna two nights in succession was enough. In addition, countless amateurs all over the country have been plagued by the nuisance phone call routine.

As all amateurs know, every TVI dispute is caused basically by false accusations of the amateur by the TVeyer or non-cooperation, or both, and the squabble is often aggravated by an unscrupulous serviceman, or a gossipping neighbor and shortened tempers on both sides.

Usually, the local Interference Committee (if one exists) can do a lot to correct the situation, but there are times when the dispute does not reach the Committee and even times when the Committee takes the abuse usually reserved for the amateur.

The attorney is an "offensive weapon" as opposed to the "defensive weapon" Interference Committee and we successfully used an attorney to stop the abuse coming from a neighbor who admitted he had no genuine complaint (he had not called the Committee) but nevertheless used each TVI incident in the neighborhood to stir up more difficulties for us. The threat of legal action combined with the knowledge on the part of the trouble-maker that he was in the wrong from the beginning stopped the trouble.

A major problem in using an attorney is the fact that the average attorney knows no more about TVI than the average TVeyer. He must therefore be trained and equipped regarding the facts of interference. This requires time and effort, and if the training and equipping is skimped, a case may be mishandled and the conditions may be worsened instead of bettered.

In the process of correcting our difficulties, we have trained and equipped an attorney who can expeditiously handle almost any legal problem the amateur may have, including zoning. Amateurs in the Cleveland area with legal difficulties will find that attorney Frank R. Uible, located in the National City Bank Building requires a minimum of explanation of the situation to handle these cases.

Individual amateurs, Clubs, and Interference Committees outside of the Cleveland area will probably find that our bulletin, "The Use of an Attorney in TVI Disputes" will save much time and effort (remember that sometimes time is vital) in training and equipping an attorney for your area. We will be glad to supply this if we receive a self-addressed envelope stamped with six cents postage.

James B. Bamburg, W8OPX

Cleveland, Ohio

re "Favorable Publicity"

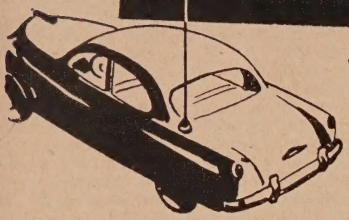
Editor, CQ:

Your editorial in the March 1952 CQ was well stated and forthright. The threat of local ordinances is spreading and they may soon add another reason why so many amateurs leave the air due to TVI. With the upcoming tremendous increase in the number of TV stations, this threat will be dangerous striking at each operating amateur.

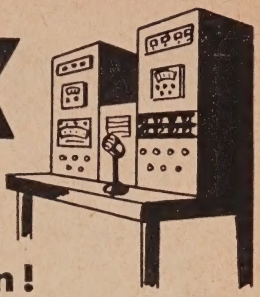
In the last two paragraphs of your editorial is the question "what is this appalling ignorance of amateur radio?" Further on the editorial charges that national publicity has failed to materialize, due to the lack of such publicity and education at the level of the TV service man and radio repairman.

(Continued on page 8)

BUD Condensers



Won't *Guarantee* TOPS in Mobile Operation!



We don't claim that putting condensers in a rig that is inefficient will magically change your results to top quality. We do assure you that the high quality of workmanship and materials that are a part of all BUD products will aid in building efficiency. High Q and low inductance are the natural results of this quality product. All things being equal, BUD condensers will lead the way to better and more enjoyable mobile work.

THREE-GANG TINY MITE CONDENSERS

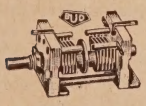
Hams, Radio Constructors and Experimenters can find many uses for these compact, three-gang condensers. Designed particularly for high frequency use, they are adaptable for use in converters, preselectors and receivers covering the Amateur, Television and F.M. bands. Well constructed with soldered brass plates and ceramic brackets. Rotor shaft extended ¼" at rear. Height 1 5/16" Width 1 3/16". Length behind panel 3 3/8". Mounting holes 2 3/16" apart.



Catalog Number	Cap. Per Section Max.	Min.	No. of Plates Per Section	Amateur Net
LC-1845	11	5	3	$3.81
LC-1846	17	5	4	4.32
LC-1847	25	6	5	4.71

TINY MITE DUAL CONDENSERS

The construction of these units is similar to the regular Tiny Mite Tuning Condensers. The two end pieces are held together firmly with two tie-rods. A separate round plate is soldered on rotor rod to shield the two stator sections. Large surface front and rear sleeve bearings, provide smooth rotation.



Catalog Number	CAP. PER SECTION Max. MMFD.	Min. MMFD.	Air Gap	No. Plates Per Section	Over-all Length	Amateur Net
LC-1659	8	2.5	.017"	3	1 15/16"	$2.64
LC-1660	15	3	.017"	5	2 1/16"	2.94
LC-1661	25	4	.017"	9	2 11/16"	3.24
LC-1662	50	6	.017"	19	2 1/16"	3.30
LC-1663	100	9	.017"	37	4 1/4"	3.66
LC-1664	10	4	.037"	7	2 15/16"	2.94
LC-1665	15	5	.037"	11	2 15/16"	3.24
LC-1666	25	5.5	.037"	17	3 7/8"	3.57
LC-1667	35	6	.037"	21	4"	3.93

TINY MITE TUNING CONDENSER SINGLE SECTION



This series of condensers has been designed for applications where space or weight are limiting factors and for tuning of ultra-high frequency circuits. Rigid construction, close fitting bearing, positive rotor contact and Steatite insulation are the outstanding features. Cadmium plated, soldered, brass plates and rods insure high frequency efficiency

Catalog Number	Max. Cap. MMFD.	Min. Cap. MMFD.	Air Gap	No. of Plates	Amateur Net
LC-1640	8	2.5	.017"	3	$1.35
LC-1641	15	3	.017"	5	1.47
LC-1642	25	4	.017"	9	1.53
LC-1643	35	5	.017"	13	1.77
LC-1644	50	6	.017"	19	1.86
LC-1645	75	7	.017"	29	2.01
LC-1646	100	9	.017"	37	2.19
LC-1648	10	4	.037"	7	1.50
LC-1649	15	5	.037"	11	1.62
LC-1650	25	5.5	.037"	17	1.92
LC-1651	35	6	.037"	21	2.10
LC-1652*	50	8	.037"	35	2.64
LC-1653	6	3.5	.073"	5	1.59
LC-1654	15	5.5	.073"	15	1.92
LC-1655*	25	9	.073"	27	2.61

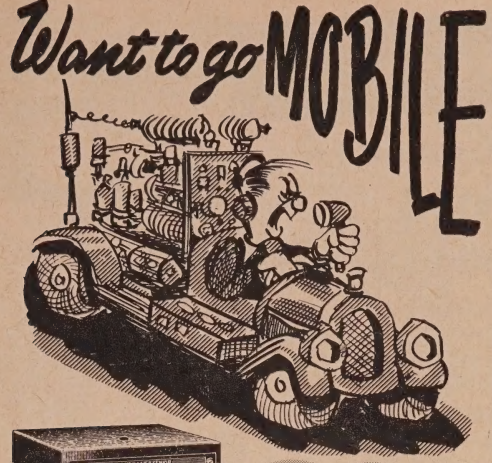
*Denotes double bearing.

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(from page 6)

A motion was introduced at the 1951 ARRL Board meeting that would have done much to build up the strength of the amateur's resistance to the TVI menace, and furthermore it would have provided a bulwark of morale-building spirit in the belief that the amateur's organization, the ARRL, was genuinely upholding the amateur in his fight for survival.

This motion, item 22 on page 28 of July 1951 QST, states "that the ARRL, through its Headquarters staff, establish and publicize a policy on TVI by means of a nation-wide educational program directed at TV manufacturers, TV installers, servicemen and repairmen, and TV set users; such a program to be implemented by suitable printed literature for wide distribution to these groups, together with TV films, radio scripts, newspaper publicity, and other media that will assist said program to be carried to all TV users and builders, with a view at reducing TVI complaints against radio amateurs."

After several weakening amendments were offered a resolution was drafted and adopted. This resolution took cognizance of the widespread misunderstanding of the television viewing public and approved the work heretofore performed by the Headquarters staff and directed them to expand and extend its program in an aggressive and cooperative manner.

This resolution, instead of strengthing the original motion, completely reversed its positive intent, emasulated its potential power, and "whitewashed" those who have been charged with defending the amateur and his rights!

The writer believes that in the introduction of this weakening amendment those responsible killed a movement that might have stopped or at least curtailed the events that caused the localities to take the drastic steps mentioned in your editorial. These and similar happenings have cost Amateur Radio still more casualities in the TVI battle.

It will be noted that while the resolution was "unanimously adopted," the writer, a member of that Board, voted for the resolution **only** after it was obvious that the original motion was completely and irreparably lost for the 1951 session.

Had the original TVI-policy motion been passed and carried out to the "spirit" as well as the "letter" of its detailed intentions, Amateur Radio would not be faced with another deadly foe on the TVI front.

A. David Middelton, W5CA

Tijeras, N. M.

re "Rothman System"

Editor, CQ:

The Rothman modulation system, described by the inventor in the April issue of CQ, appears to be an effective and practical method of obtaining screen-grid modulation. Several of the author's claims for the method, however, are not in accord with amplitude modulation theory and are not substantiated by evidence given in the article. So that readers may not mistakenly conclude that the system is capable of performance exceeding that of other controlled-carrier grid modulation systems, some explanation is necessary.

The theory of screen-grid modulation is covered in two previous references (1,2) that should be helpful to anyone attempting to use any of the recently popular grid modulation circuits. The fundamental principle involved here is that in order to obtain linear (and therefore distortionless) modulation of a radio-frequency carrier, both plate current and efficiency of the modulated stage must be linear functions of the modulating voltage applied to the grid, be it suppressor, screen, or control grid. The author's claims, then, that "screen modulation may be achieved without appreciable 'efficiency modulation'" and that "with proper choice of impedance ratios, 'efficiency modulation' in the **Rothman System** is reduced to a secondary factor" are not correct.

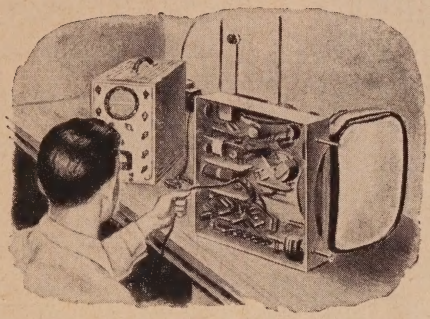
The author's efficiency calculations likewise seem to be in error. It can be shown mathematically that with 100

(Continued on page 10)

(1) **Grammer, Design Limits for "High-Output" Grid Modulation, QST, February 1951, p. 40**

(2) **Grammer, Some Aspects of Screen Modulation, QST, November 1951, p. 41**

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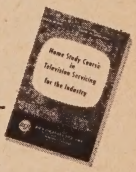
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(from page 8)

per cent sinusoidal modulation, the average efficiency of a screen-modulated stage is exactly 75 per cent of the efficiency at the peak of the modulation cycle. (This peak efficiency is the efficiency that would be obtained under key-down c.w. conditions with an input equal to the peak modulation input.) The author's figure of 70.5 per cent average efficiency thus corresponds to a peak efficiency of 94.0 percent. If tank circuit losses and the radio-frequency power consumed by the modulator had been allowed for, the peak efficiency figure for the output tubes alone would be even higher. It is doubted that such efficiencies can be achieved with any tubes now available.

The author's claim for an economical advantage of screen modulation over conventional high-level plate modulation in terms of total power consumption for a given peak power output is not disputed. For a given size of output tube, however, this advantage results from the use of controlled carrier and intermittent voice modulation rather than from the use of screen modulation as such. For sustained high-percentage modulation (such as may result with pre-modulation speech clipping), and for a given power output, screen modulation requires larger output tubes than does plate modulation because of the greater average plate dissipation produced at lower efficiency. The economical advantage is therefore reduced and, in high power equipment, may even disappear.

G. Franklin Montgomery, W3FQB

Bethesda, Md.

The 29.64 Mc Calling Frequency

Editor, CQ:

This is a statement by the Egyptian Radio Club regarding their sentiments on the 29,640 KC question, since it seems to be causing considerable comment across the country.

This frequency was selected by the A.R.R.L. without consulting emergency ten meter nets or the emergency coordinators. These are the men who actually use ten meters for emergency work.

The Egyptian Radio Club was one of the first in the country to organize a mobile emergency net on ten meters. 29,640 KC was chosen as an operating net frequency. This net includes mobiles in the entire St. Louis area. Actual drills were held regularly on this frequency, or monitored same for contacts with other mobiles in area in case the band was not open.

By building up interest in this frequency operation we found that when disaster struck we were able to be on the scene of action within a matter of minutes. In actual use we have had very little interference from other stations. If a distant station came on the frequency, a call to them would clear them and, in most cases, they even stood by on the frequency to help us keep the net clear of interference. You can get this kind of cooperation on ten meters, but try to get it on 75 meters without a lot of persuasion and even threats. Most active stations throughout the country are aware of our mobile emergency net operation on 29,640 and they come up to the high end of the band to work mobiles. They enjoy working the mobiles and they know where to find them.

We are very much opposed to 29,640 KC being proposed or attempted use as strictly a calling frequency. We feel there are other frequencies in band for such use for those who feel they need a calling frequency.

The experiences in actual emergencies by the Mobile Emergency Corps sponsored by the Egyptian Radio Club, W9AIU of Granite City, Illinois, have proven, beyond any doubt, that the only way to have a group of amateurs trained and ready for immediate action is to have that group active day in and day out with equipment that is functioning and all working on a common frequency and not trying to jump all around the band in confusion. When a disaster strikes there is enough confusion; let's not have the emergency minded amateur and coordinators in this category.

Several cities use auto calls with a series of keyed calls necessary to operate them. In these instances other locations should cause no trouble with these systems. The only time trouble is caused is when these co-called emergency auto calls are actually used for regular chewing and are activated by the skip stations for this purpose.

(Continued on page 12)

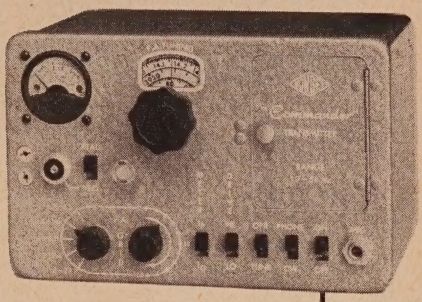
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MODULATOR: Class AB_2 beam tetrodes and integral high level speech clipping (requires no adjustment).

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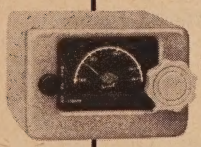
ANTENNA FEED: All conventional feed lines including COAX, RIBBON, and OPEN LINE, or DIRECT to MARCONI ANTENNA.

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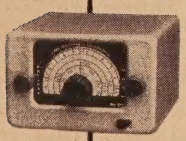
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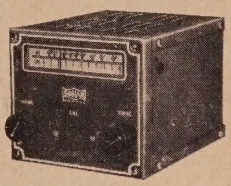
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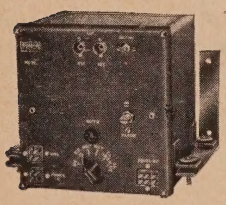
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(from page 10)

We do not believe that 29,640 KC is a frequency that is intended to be used for long haul traffic, as the lower frequencies are far more consistent and should be used for this purpose.

Many mobiles have moved off this frequency because they were continually bawled out by the so-called "Emergency" nets, but who actually were ordinary round table rag chewing groups. These mobiles have dropped out of most emergency operations, not only in this area but all over the country.

If there is any question regarding the disaster activities in the St. Louis area you might check with the Midwestern area office of the A. R. C. and the Civil Defense authorities of this section of the country regarding amateur participation in all phases of "actual" disaster work by the mobiles on 29.640.

Again, we repeat that too many people think of 29,640 KC as a national long haul frequency rather than a local ground wave frequency.

In view of the above statements, it is hereby RESOLVED The Egyptian Radio Club., Inc., W9AIU, Granite City, Illinois, is opposed to using frequency 29,640 KC for a "calling" frequency only and urges all emergency corps in various cities throughout the United States to continue present use of this frequency as a local net operating frequency and to contact their directors and insist that A. R. R. L. discontinue proposal of a national calling frequency only on 29,640 KC.

H. H. Jansen, W9DJG

Alton, Illinois

Present and Prophetic

San Fernando Valley Amateur Hamfest

The Third Annual Picnic of the Los Angeles Council of Radio Clubs will be held on Sunday, May 25th at Verdugo Park, Glendale. The picnic, sponsored by the San Fernando Valley Radio Club, will be a lively affair with door prizes, games for the children, transmitter hunts on 75, 10 and 2 meters, and a mobile radio installation judging. Bring your own lunch—they'll supply the coffee.

"DOWN EASTER'S" Hamfest

Those of you in the Maine area will want to remember the Fourth Annual Down East Hamfest sponsored by the Portland Amateur Wireless Association. It will be held this year at the Eastland Hotel in Portland on Saturday, July 26th.

Rocky Mountain Convention

Another Rocky Mountain Division ARRL Convention is to be held this year at Estes Park, Colorado on June 14-15, with headquarters at Elkhorn Lodge. The convention is being sponsored by the Denver Radio Club. Address convention correspondence to the Secretary, Walter M. Reed, WØWRO, 1355 East Amherst Avenue, Denver, Colorado.

Emergency Net Convention

TVI will be the main topic of discussion at the South Texas Emergency Net Convention to be held in Kerrville, Texas, on May 9th, 10th and 11th. The program of lectures, transmitter hunts, and prizes will be topped off by a special banquet. Make your arrangements through Cedrig Toler at the Blue Bonnet Hotel in Kerrville. Fee, $2.50.

Wisconsin Hamfest

The Wisconsin Valley Radio Association claims a wonderful meal, a good speaker, and a real get together is in store for those who attend their All Day Hamfest at the Youth Buildings, Marathon Park, Wausau, on Saturday, April 26th. Send registration $3.00 (per plate) in advance to Lawrence Lapinski, W9EWN, P. O. Box 179, Wausau, Wisconsin.

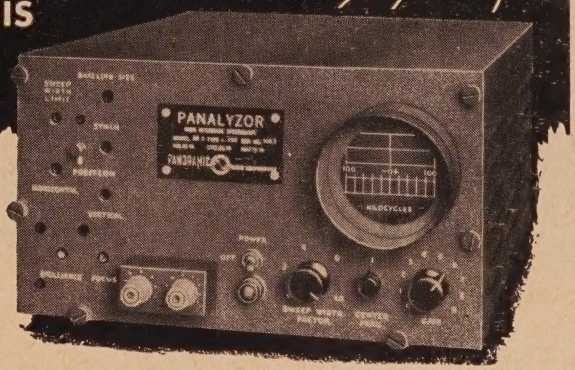
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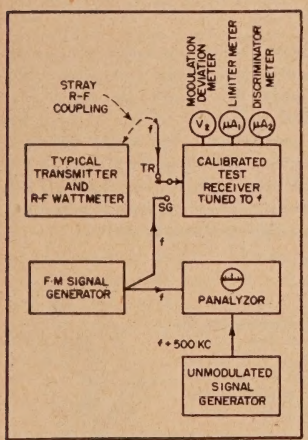
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By instant heating the 4-65A does away with stand-by periods and eliminates costly battery drain. It is excellent for power amplifier and modulator service in fixed as well as mobile rigs. The 4-65A operates over a plate voltage range from 600 to 3000 volts with output powers ranging from 50 to 280 watts. Upper operating frequency under normal conditions is 220 mc.

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ZERO BIAS

EDITORIAL

"SPECIAL MOBILE ISSUE"

As we make the last paste-up and are just about ready to "o.k." the few remaining page proofs, your Editor can sit back and reflect on the progress in radio amateur operation that necessitated this issue. —This issue that is being printed in a greater quantity than any previous issue of CQ—this issue that contains the most pages and text material—this issue that's just plain "biggest" (and we hope "best").

"Mobile" has within the past three years become one of the most important facets of ham life. Conservative estimates show that over 20% of all active amateurs either have, or are building, mobile equipment. At the present rate of phenomenal expansion over one-third of the "actives" will be working mobile within the next eighteen months. Probably with the growing incentive of CD communications, this figure will be exceeded. In some areas mobile activity both on the air and in the clubs over shadows fixed operation by a wide margin.

Originally the impetus for mobile operation was that of an "escapist" from the spectre of TVI. Only by going mobile could many amateurs get on the air. Gradually the so-called "adventuresome" aspect of mobile operation caught on and many fellows began looking wistfully at the old family chariot. What with the importance of CD it didn't take too much talking to convince the XYL that it wouldn't damage the car—too much.

Today mobile operation is being integrated into ham life—no fuss and no bother. There is a certain amount of unwise and hasty regimentation. But it is early and these problems will be easily solved. The future is bright. The slump in activity is behind us and although the sunspots have cut down on the usefulness of 10 and 20 meters, the prospect of 15 meters—and maybe 40—look inviting.

Policy

It is natural to expect that when a new editorial staff assumes control of a publication that there may be some political ramifications. For the past three or four months the CQ Editorial Office has been examining with great interest those letters that have attempted to "second guess" what this policy will be. Many have advocated affiliation—others have stressed the establishment of a "second front" to protect this or that underdog. Fortunately, many have been able to read between the lines (what few there were) and see that CQ is still "independent."

Being "independent" does not relieve us of a certain responsibility—not only to the amateurs themselves but to the government which in the face of tremendous odds continues to provide freedom of amateur operation with a minimum of interference. Recently an ex-Director of the ARRL told me that in his opinion the amateur was, in polite terminology, being played for a "sucker." In other words, the FCC by continuous, and unnecessary, legislation was seeking to build its "empire" to a new height. Eventually the props would be pulled out from under this set up and amateur radio which, according to this genteleman has few friends in high places, would suffer.

Does such a case exist? The answer can be an unequivocal—no!

Now how does this tie into CQ? Obviously, there are at least two sides to every problem incident to amateur radio. Past experiences indicate that there is negligible freedom of action in our "contemporrary" for presenting unbiased facts before the average amateur, in say Dry Gulch, Arizona, where he can only act on what he reads or hears over the air—the latter being far from an unbiased media.

Hence the past five months have repeatedly demonstrated the need for "independent" reporting. This is the work cut out for CQ—this is the job we shall do.

o. p. t.

WHAT DO YOU THINK?

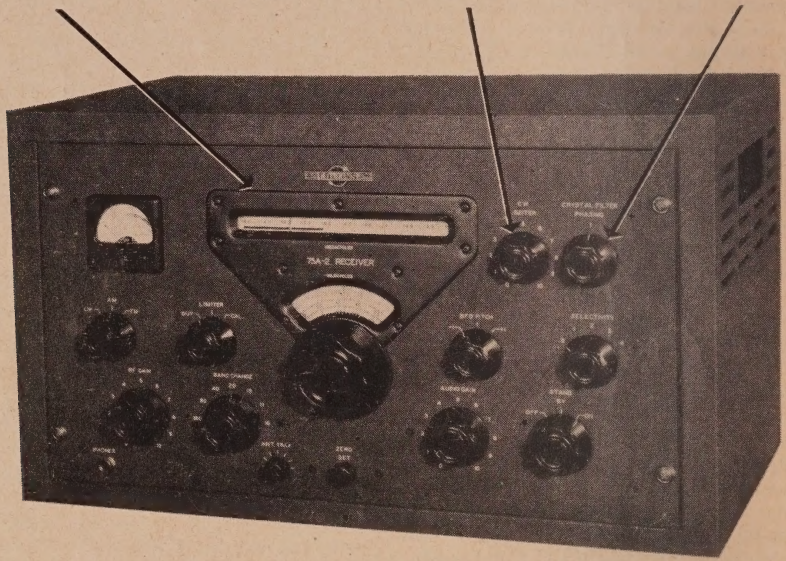
A question foremost in our minds, during the preparation of this issue was—how will the average reader react? Naturally, there are a large number of readers who hold little interest, if any, in mobile operation. On the other hand a "special issue" of this type is of tremendous value to the fellow who is interested in mobile—to him it can become a "handbook." The same idea of "special issues" could be easily carried into fields of particular amateur activity. Would you as a reader like to see more issues like this?

exceptional features of the 75A-2

LINEAR CALIBRATION DIAL:
All divisions are same width. On the 160, 80, 40, 20 and 15 meter bands, each division equals 1 kc. The dial is accurate within 1 kc to 21.8 mc, and 2 kc between 26 and 30 mc after calibration. This all adds up to exceptional band spread and accurate dial setting.

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CRYSTAL FILTER:
Factory adjusted. Selectivity is variable in five steps from 4 kc at 6 db down to about 12 kc at 60 db down with selectivity knob at zero — crystal filter out. With selectivity knob at 4, bandwidth is approximately 200 cps at 6 db down and 6.5 kc at 60 db down.



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For cw reception, highly stable BFO injection and an effective crystal filter give pinpoint selectivity with only slight loss in gain. Linear dial calibration, exclusive in the 75A-2, provides easy "resetability." These satisfying features have been designed with the respected Collins skill, and form part of the receiver that has friends throughout the world.

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Getting The Most From Your Mobile

HERB BRIER, W9EGQ*

and

W. M. SCHERER, W2AEF**

Getting started is often just as big a problem as how to keep things moving. Getting this issue under way has been left to two of our staff favorites—"Herb" Brier and "Bill" Scherer. You'll hear more from them later on, but leading off the issue is this general summation of mobile operation. —Editor.

Amateur mobile stations are fun to operate and can be invaluable in communication emergencies—and they offer many amateurs their only opportunity to enjoy their hobby. Among these amateurs are those whose work keeps them away from home much of the time, while others cannot have a fixed station, either because of lack of antenna facilities or landlord trouble.

This article will discuss in general terms the problems involved installing an effective mobile station, with special emphasis on installations not requiring modification of the automobile's six-volt system, leaving the concluding paragraphs for a discussion of higher-power mobiles.

Power Supplies

Practically speaking, there are two types of power supplies suitable for low-power mobiles—vibrator supplies and dynamotors. The former are available in ratings up to sixty watts in two types, either 300 volts at 200 milliamperes or 400 volts at 150 milliamperes, and are about seventy per cent efficient. The latter deliver up to 600 volts or more and up to 300 milliamperes and are fifty to sixty per cent efficient.

Their comparatively low first cost and high efficiency make vibrator supplies attractive in their power range, although "war surplus" has given some excellent dynamotor bargains. Intelligently used, either a sixty-watt dynamotor or vibrator supply will not overload the average automobile battery system. The problem that then arises is how to convert the greatest percentage of the power supply output into an intelligible signal at the remote receiver.

*Department Editor, CQ

**Contributing Editor, CQ

Modulation

Mobile operation and phone usually go hand-in-hand. Those interested in c.w. mobile operation—and there are a few—can skip the next few paragraphs and cut power requirements for a given carrier in half.

At first glance, the simple circuitry of clamp-tube modulation and its facility of adjustment so that amplifier plate current drops to a very low level without modulation makes it appear ideal for a



If you don't mind the loss of leg room you can mount a commercial transmitter right under the dashboard similar to the W9CWB installation.

mobile modulator. Unfortunately, insufficient conclusive tests have been made using either clamp tube or the Rothman System[1] to warrant extensive appraisal. Some properly adjusted clamp tube systems have only thirty-five percent efficiency and as a result lose some of their apparent advantages. When all factors are considered the difference is not great and a choice between the two can be made on the basis of the elimination of the modulation transformer with its weight and size. Gaining on the other hand a few somewhat critical adjust-

[1] M. I. Rothman, "Rothman System of Modulation," CQ, April, 1952, page 21.

ments. Speaking of adjustments, the reduced screen voltage used in clamp-tube modulation decreases the amount of plate current that can be drawn, making a high-voltage low-current supply desirable.

About half of the available plate current can be allocated to the final amplifier with class AB or B modulation and about three-quarters of it with clamp-tube (or screen grid) modulation. With a sixty watt supply, this will give a fifteen or twenty watt carrier.[2]

A class A modulator is quite wasteful of precious plate milliamperes, but the arrangement of *Fig. 1* is capable of 90% modulation of twelve watts input with a 300 volt supply and twenty-five watts with a 500 volt supply. Proper adjustment of the cathode-bias resistor and overdriving the 6L6 grid causes self clipping of both positive and negative modulation peaks, producing high average modulation, even though the peaks do not exceed ninety percent. The clipping introduces high-frequency distortion; so the low-pass filter is necessary to reduce side-band splatter.[3] A pair of 6AQ5's or 6V6's in parallel may be substituted for the 6L6 for 300 volt operation. Total plate current for a typical mobile transmitter using this type of modulation at the inputs mentioned will be approximately 130 to 150 ma.

Circuits

Two stages, an oscillator/frequency multiplier and a power amplifier are usually sufficient for crystal-controlled r.f. sections for powers up to at least fifty watts and frequencies of 30 or 54 megacycles. A 144 mc transmitter will probably require two more stages, and a v.f.o. will add another tube or two to the minimum requirements, but more about that later. Pentodes and tetrodes, chosen for the input desired and the frequency of proposed operation, are standard in mobiles, because of ease of drive and lack of neutralizing complications.

Besides conserving plate current, eliminating extra tubes conserves filament power, especially important because the filaments often draw current the entire time the station is in operation, while the plate supply is on only during actual transmissions. Therefore, each filament is the equivalent of another five or ten watts input as far as battery drain is concerned.

Using as few tubes as possible in the speech amplifier means, in effect, using a single button carbon microphone, because other types require additional amplification. Those who believe that this is synonymous with poor quality might listen to their telephone. Naturally, it is false economy to eliminate a speech tube at the cost of having to shout into the microphone in order to modulate the carrier. The same is true of skimping in the modulator; run no more input than you can modulate.

Which Band?

The following information may help you decide which is the best mobile band for you—

The 75 meter band is the easiest on which to eliminate man-made noise, but the hardest one on which to obtain an efficient antenna.[4] The daytime

2 NBFM is not discussed in this article because experience indicates that its disadvantages outweigh its advantages in mobile amateur service.

3 n.b., W. M. Scherer, "The W2AEF Mobile Special," this issue, page 24.

4 n.b., W. Wagener, "Measurements on a 75 meter Mobile Antenna," this issue, page 41.



There are only one or two places for conveniently mounting your converter. Some operators prefer to strap it to the steering wheel while others like W9WBA mount them under the dashboard.

range is up to 100 miles, with an occasional more-distant contact possible. Evening range (5:00 PM to midnight) is often only a few miles, because of extremely heavy QRM, with the useful range gradually increasing as the interference thins out after midnight. A good band for the amateur who does daytime driving and likes to talk to hams in the area where he is travelling.

On 20 and 10 meters contacts between 600 and 1,000 miles are often easy to make, but 28-mc "skip" contacts are only possible when the band is open, which under present ionospheric conditions, may not occur for days at a time. Sporadic E. "short skip" contacts are also often possible in the summer on 28 mc.

DX may be worked by mobiles on either band when conditions are favorable, and several low-power mobiles have worked all continents and upwards of 100 countries. Ground-wave range is approximately the same on either band, normally out to twenty-five miles and to 100 miles under abnormally good conditions.

Many operators rate 14 mc as the best all-around mobile band, because of the variety of contacts possible, but it is the poorest of all for emergency work. 28 mc is good for emergency ground wave networks, although there is always the possibility of outside signals disrupting a local net.

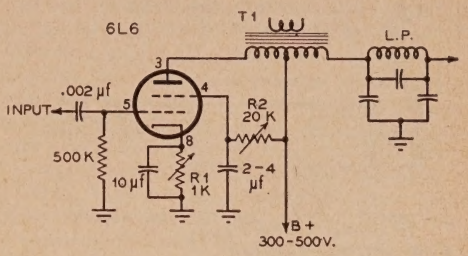
6 and 2 meters are excellent for emergency nets, because of the lack of skywave interference. In addition, 145-147 mc are the only frequencies on which Novice operators may operate phone, almost a necessity for efficient mobile operation. The slightly greater average range of the 50-54 mc band, combined with the possibility of using simpler equipment, make it slightly more desirable; however, a choice between the two is often made on the basis of which has the most local activity. Six meters also offers the opportunity for a few "short skip" contacts during the summer months.

Mobile Antennas

Rear bumper mounted whips about eight feet long, with loading coils to increase their electrical length to one-quarter wave on the lower frequencies are almost the standard mobile antenna. The coils are at once one of the strongest and weakest links in mobile installations. They improve the radiating efficiency of the whips; yet most of the power is dissipated in the coil, especially on 4 mc.[5]

Large diameter coils of heavy wire at the top of the whip are the most effective, but because of constructional difficulties, most installations use a coil of moderate size in the center or at the bottom of the whip at the cost of somewhat reduced efficiency. Loading is not required with an eight-foot whip above 27 mc, and shorter ones may be used on 50 and 144 mc, although they should be mounted high on the automobile body for best results. One about twenty inches long mounted on the center of the automobile roof becomes effectively a "ground-plane" vertical on 144 mc.

5 G. Brown, "High Efficiency Loading Coil," CQ, January, 1951, page 20.



T1 = CENTER TAPPED OUTPUT TRANSFORMER 10,000 Ω PLATE TO PLATE-SECONDARY NOT USED.

L.P. = LOW PASS FILTER.

USE 'SCOPE TO ADJUST R1 FOR EQUAL CLIPPING OF BOTH NEG. & POS. PEAKS -USE HIGHEST RESISTANCE SETTING POSSIBLE.

ADJUST R2, SCREEN RESISTOR FOR 250 VOLTS POTENTIAL ON SCREEN.

Fig. 1. This modulator will clip on the positive peaks to provide 90% modulation at 12 watts input. A low-pass filter is necessary in order to cut down sideband splatter.

Resonating the antenna to the operating frequency is extremely important, especially when a loading coil is used. Grounding the base of the whip to the car body with the shortest possible lead and coupling a grid-dip oscillator to the base while adjusting antenna length or turns in the coil for resonance is one way of doing it. Another is to place a sensitive field strength-meter *(see Fig. 2)* nearby and adjust for maximum radiated signal.

The latter method also permits one to find quickly the optimum adjustments for the antenna coupling network, which may be either a *pi* network or a few link turns coupled to the final amplifier tank coil, with a condenser in series or parallel with it in order to tune out line reactance. Properly adjusted, there is little to choose between the two, although the *pi* network will match into a wider range of impedances.

Multi-Band Operation

Multi-band transmitters and receivers for frequencies up to 54 mc are reasonable to design[6], but an efficient multi-band mobile antenna is something else. The Q of a loaded antenna is so high that attempts to change the coil or short turns in it by means of a switch often results in excessive losses. And operating the antenna without a coil reduces efficiency still more on 4 and 14 mc. As a result, most operators of multi-band mobiles substitute appropriate coils or complete antennas for the different bands. Extending coverage to 144 mc in a band-switching unit also involves complications. Undoubtedly the best solution is to switch in a completely separate r.f. section for that band.

Mobile VFO's

A VFO will result in more contacts per number of calls made, but will slightly increase battery drain, because it usually requires a voltage regulator and at least one more tube. Accurate calibration and

6 n.b., J.Y. Nakamura, "Triple-Band controlled", this issue, page 65.

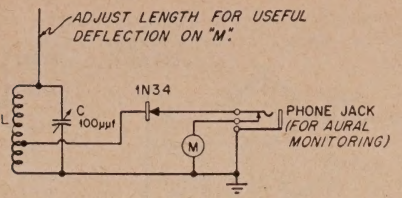


Fig. 2. This gadget is useful if you want to be sure you are actually on the air.

stability are of prime importance, because of the skimpy frequency-measuring equipment of most mobile stations.

Another factor to be considered is that the Q of a 4 mc loaded whip is so high that a shift of only a few kilocycles causes a serious loss of efficiency,[7] therefore a couple of crystals a few kcs apart may be as useful as a v.f.o. on this band. On 14 and 28 mc, however, it is an entirely different situation and many operators have found that a mobile v.f.o. is indispensable.

If a v.f.o. is used, be sure to arrange the control circuits; so that zero beat operation may be set up with the transmitter output stage off.

Receivers

The majority of mobiles for reception, depend on the regular automobile receivers plus a converter and a simple diode noise limiter. The combination leaves something to be desired in selectivity and flexibility, therefore some of the more serious workers build complete receivers, which outperform many home communications receivers.[8]

Most mobiles can hear far more stations than they can possibly work, and it may seem foolish to spend much effort in order to achieve the ultimate in receiving sensitivity, but it pays off, especially when working other mobiles. The following suggestions will help to get the most out of the receiver-converter combination.

Figures 3a, 3b, and *3c* are three common coupling methods between the r.f. stage and mixer. *Figure 3a* gives the highest gain, but is sometimes awkward to switch in multi-band converters. *Figure 3b* is superior to *Fig. 3c,* but requires insulating the variable condenser from the chassis.

In some converters that have a low impedance output it may become necessary to discard the link coupling and tap the 1500 kc output directly from the mixer plate through a small condenser. In extreme cases, an added stage at the converter output frequency is necessary to overcome hiss generated in the automobile receiver. Naturally, the receiver should be carefully peaked to the converter output frequency. One of the push-button positions may be used for the purpose.

Matching the antenna to the converter is especially important, as the signal available is not too strong under the best of conditions. Some commercial multi-band converters are designed to be used with a fairly long length of coaxial cable between them and the antenna. Attempts to use a shorter length are sure to give inferior results on one or more bands. On the other hand, it reduces losses to use the shortest possible length between the antenna and transmitter. A good solution is to mount the antenna relay at the transmitter and insert the additional cable between the relay and the receiver, winding the excess length in fairly large loops and hanging it out of the way.

Single-band converters frequently use a coil of a few turns for the antenna coil. Varying the number of turns and their spacing from the r.f. stage grid coil often improves signal transfer. *Figure 4* shows an alternate system. With it, it is quite simple to obtain an almost perfect match between line and converter. Those using 3 to 6 mc "Command" receivers as a mobile receiver for 4 mc may get a pleasant surprise at the improved results obtained when using this circuit.

Just as important as sensitivity is stability, both mechanical and electrical. Rugged construction of

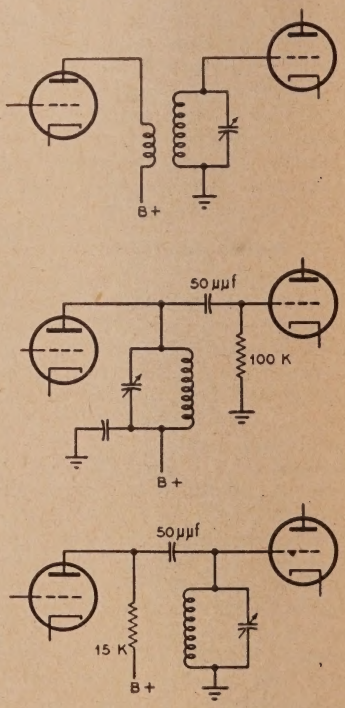


Fig. 3. From top (a) to bottom (c) several methods of r.f. stage to mixer coupling. Circuit (a) provides the highest gain but is difficult to switch in multi-band receivers.

7 n.b., A. J. Uryniak, "The Center Loaded Antenna," this issue, page 63.

8 W. M. Scherer, "Another Standard of Comparison," CQ, November, 1951, page 11.

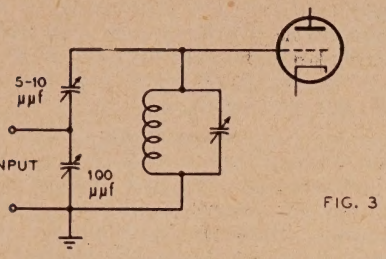


Fig. 4. The well-known R9-er circuit provides a good match to the usual mobile receiving antenna.

the oscillator, using highest quality parts helps, as does regulation of the oscillator plate voltage. In new construction, a high C oscillator with ceramic coil forms and variable condensers insulated with the same material and zero-drift fixed condensers will reduce thermal drift to a minimum. In existing equipment, a negative-coefficient condenser across the oscillator tuned circuit will often help. Its capacity can best be determined by experiment.

Crystal control of the h.f. oscillator gives the ultimate in stability.[9] Tuning is then accomplished by tuning the broadcast receiver and "broad banding" the converter input stages.

Noise Reduction

Noise reduction in mobile installations is not as difficult as some amateurs imagine. The process is roughly similar to deTVI'ing a transmitter. Shielding, filtering and decoupling noise-radiating components are the main ingredients. And, as in a deTVI'ing program, it is difficult to predict just how many preventative measures will be required in a given installation. However, noise can be reduced to the point where that radiated by passing vehicles determines the receiver noise level.

The first step is installing a noise limiter in the receiver. There are several excellent limiters described in *handbooks* and contemporary literature and available commercially. An effective one is diagrammed in *Fig. 5*. Exactly how it should be connected in the automobile receiver varies from model to model. The easiest way is disconnect the output leads of the last i.f. transformer, the a.v.c. lead and the "hot" side of the volume control, and connect them as indicated in *Fig. 5*.

Place the limiter as close to the original second detector as possible. Shield long leads, especially those to the switch, which may be mounted where convenient on the receiver.

Next bond the receiver and converter chassis together and to the automobile firewall. Shield all conductors between the converter and receiver. In addition, bypass and filter power leads if necessary. When these steps have been completed, it should be impossible to hear any ignition noise with the noise limiter off and the antenna disconnected.

[9] n.b., E. M. Brown, "Adapting the Tri-Band Converter to Two Meters," this issue, page 30.

Install spark suppressors at each spark plug and at the distributor.[10] The carbon-resistor type seem somewhat more effective than the wire-wound type, but have a tendency to change in value. Before installing them check their resistance to assure a matched set. Both types should be checked periodically in service to detect openings and large changes in value. Spark plugs with built-in suppressors are effective, but some users sometimes report that additional suppression is necessary.

Generator noise can be attacked by two methods, either singly or in combination. A trap of heavy wire tuned to the operating frequency in the field lead right at the generator is quite effective. Also occasionally effective is the shielding of armature and field leads and the bypassing of the armature lead. *Do not* bypass the field lead.

Regulator noise may be sometimes reduced by complete shielding of it and its leads. In severe cases a complete cure can be accomplished by disconnecting the regulator during receiving periods.

Leads passing through the firewall should be bypassed, preferably right at the firewall, although at the dashboard is usually sufficient. Ground all controls passing through the firewall.

Bonding the various sections of the automobile together with wide flexible braid or strap is an important part of minimizing noises. Clean the points to be joined and either solder connections or use a heavy bolt, lockwasher and nut, then carefully repaint to prevent corrosion.

Bond the following points: Fenders to chassis (some fenders are in two pieces; bond both) motor to chassis, motor to firewall, firewall to chassis, motor hood to firewall, steering column to firewall. Also bumper and bumper splash pan to chassis, radiator to motor or chassis, dashboard to firewall. Also bond the muffler and exhaust pipe to the chassis at several points, particularly near the end of the pipe; the pipe may otherwise act as beautiful

[10] n.b., H. Goffe, "The Problem of Ignition Radiation," this issue, page 51.

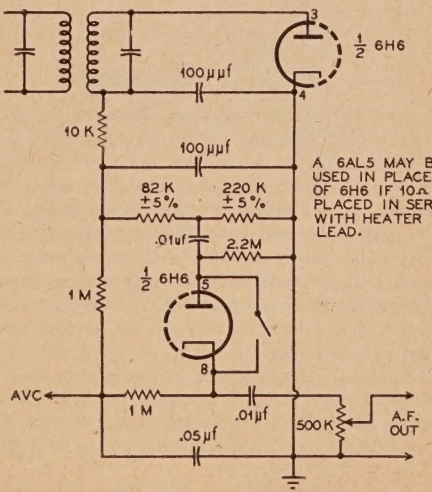


Fig. 5. A useful noise limiter circuit.

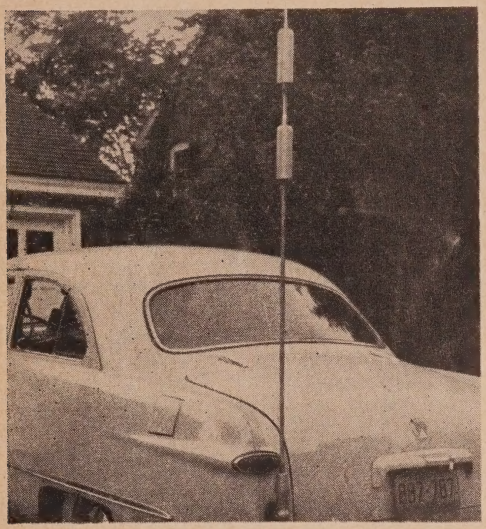
antenna for radiating noise, especially at 28 mc.

Coil springs to mount inside the hub caps and tire powder to put inside the inner tubes are available and will eliminate wheel static and tire "popping."

Naturally, such an intensive campaign is only necessary when you wish to eliminate every trace of noise from your own automobile.

TVI

As stated earlier, one reason some amateurs have gone mobile is to escape TVI. Unfortunately, some bring it with them wherever they go. Fortunately, most mobile transmitters are fairly well shielded, and a properly installed low-pass filter in the coax to the antenna, possibly plus some elementary power lead filtering and bypassing, should eliminate TVI.[11]



Multi-band operation requires the use of two loading coils—one for 20 meters and one for 75 meters. This is the installation of WØEMM who describes a transmitter elsewhere in this issue.

Conserving Battery Current

As we said, filament current is as important as power input in determining battery drain. One way of reducing it is to use quick-heating tubes that need be on only while actually transmitting. Another way is to use fixed bias on the modulator tubes. It eliminates the loss in effective plate voltage caused by cathode bias and may increase modulator output up to ten per cent. In addition, it can result in a considerable decrease in average modulator plate current.

With fixed bias, the bias on tetrode modulators can be increased to about ten per cent of the screen voltage, appreciably decreasing the no-signal plate current. The extra bias does require a little more audio grid voltage for maximum output, which usually means no more than turning up the gain control a trifle. The bias battery is no problem, as it should last its full shelf life. Don't forget to shut off the receiver power supply while transmitting; some amateurs neglect to.

Higher Power

Not everyone cares to hold his power input to the comparatively low level required to avoid modifying the automobile's six volt system. One reasonably satisfactory expedient for obtaining greater power inputs involves installing another battery, increasing the generator charging rate to maximum, and balancing operating and non-operating time to keep the batteries charged. A 115-volt charger may be used periodically to supplement the car generator. A more satisfactory policy is to replace the regular generator with a special "police" alternator. One of them will furnish up to eighty amperes of charging current, and is capable of keeping a battery charged even under severe loads.

It is difficult to say just how much input these expedients permit, because of the many variables involved, but inputs of fifty to seventy-five watts are not uncommon. For still higher power, a few amateurs have installed *surplus* ART-13 transmitters, complete with 28-volt battery and generator system in their automobiles for inputs up to 200 watts. Others have converted large *surplus* dynamotors to be driven from the fan belt for powers approaching a kilowatt with reasonable success. Probably, though, the most satisfactory power source for high power mobile operation is a small gasoline-motor driven 115-volt a.c. generator.

One such installation is that of Bert Wilson, W9DTB, well-known Chicago sports announcer. His push-button started generator is mounted in the car trunk and powers a 32V-2. His biggest trouble with the installation is a common one among those running fairly high power on 4 mc; he has burned out a number of antenna loading coils.

Installation

While the receiver or converter and control switches must naturally be mounted where they are easily accessible from the driver's position, the location of the transmitter and its power supply is a question of space as well as preference. Trunk mounting reduces the length of the antenna lead, but increases the length of battery and control cables. Mounting the transmitter on or under the dash or in the glove compartment and the power supply on the engine bulkhead reduces the length of all but the antenna leads.

Whenever the transmitter is mounted, it is a tremendous advantage to be able to shift frequency from the operating position, even if it is only a few kilocycles. Inability to do so often spoils the effectiveness of special calling frequencies e.g., 29,640 kc., the national mobile calling frequency) simply because it is too much trouble for some stations to shift frequency after establishing contact.[12]

11 n.b., R. D. Zucker, "Low Pass Mobile TVI Filter," this issue, page 43.

12 n.b., G. Snyder, "Mobile Crystal Switching," this issue, page 23.

Another important consideration is to have both hands free for driving. More and more communities are taking a dim view of installations requiring a hand being removed from the steering wheel to operate.[13] Luckily, it is not difficult to mount the microphone so that it need not be held in the hand and to put a push-to-talk button on the steering wheel for single-finger control without removing it from the wheel.

A third frequently-neglected but desirable feature is a visual signal that indicates that the transmitter is actually on the air. A two-volt pilot light or small neon bulb coupled to the output tank so it glows dimly when the transmitter is on is usually satisfactory when the transmitter is mounted where it can be seen. Almost a necessity for trunk installations, is a field strength meter. See *Fig. 2.*

It is probably unnecessary to mention the severe strain that the vibrations and bumps suffered by a mobile installation puts on the equipment. Using a lock washer under every nut and fastening every part firmly to the chassis are elementary precautions. Shaft locks, tube clamps, and shock mounting the units are also often desirable.

Wiring and Control Circuits

The extremely heavy currents drawn from the automobile battery make it very important that conductors in all six-volt circuits be more than adequate for the job. All connections, especially to the battery itself must be large and tight to prevent overheating and excessive voltage drop. Voltage drop, in fact, is often more important than possible conductor heating in determining minimum conductor size that may be used. Automobile generator cable is generally suitable for six volt leads to the B supply, and about number 12 gauge is satisfactory for the filament circuits. Use flexible stranded wire in preference to solid wire.

Heavy duty switches or relays with plenty of contact area are necessary to handle the heavy current safely, with relays a definite necessity for push-to-talk. In normal operation, the receiver power supply should go off as the transmitter is turned on, but unless some other means is provided for checking transmitter frequency, a switch should be provided so that the transmitter oscillator and the receiver can be on simultaneously for frequency checking and zero beating.

Fuse the battery circuit adequately, otherwise a short is likely to ruin the battery and cause an expensive fire.

Results

What can be expected of a mobile station depends on so many variables that it is impossible to do more than guess at it before starting your installation. On the average, however, range on 75 meters is somewhat less than with the same input to a full-size antenna. The same is probably true on the other bands, but many 14 and 28 mc operators insist that they get out better mobile than with the same transmitter from their home.

[13] n.b., M. Hindin, "The Mobileer and the Law," this issue, page 35.

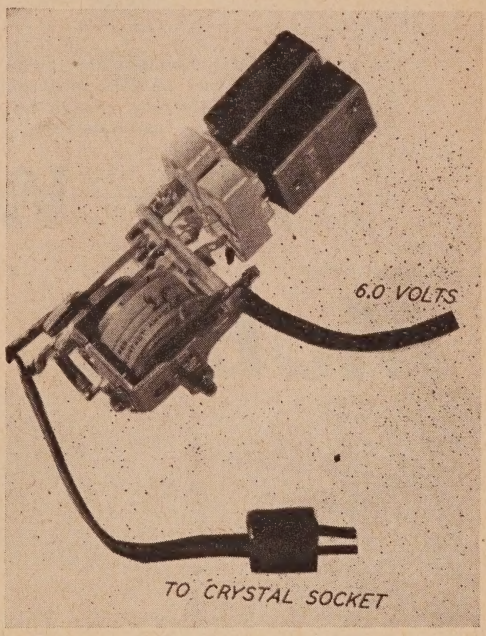
Mobile Crystal Switching

CLARENCE SYNDER, W3PYF*

This is an idea that enabled W3PYF to facilitate the changing of frequency from 29,640 kc (the calling frequency of the Delaware-Lehigh Amateur Radio Club Civil Defense Net) to the QSO frequency of 29,600 kc.

It is simple and after constant use of approximately two months it is still fool-proof. The flick of a switch on the dashboard actuates the relay, and immediate QSY is achieved.

The relay may be anything similar to the Advance 300-ohm KI6ORF, 6 volt d.c. relay with two



Millen crystal sockets mounted directly on the contact points of the relay. The arm of the relay is connected to a short piece of 300-ohm ribbon (as short as possible) and is terminated in an older crystal holder or a 300-ohm Millen plug which is a perfect fit for the FT-243 holders found in most amateur gear.

Although the current drain of this relay is small, it is well to remember to connect the QSY switch to the transmitter filament switch so that when the filaments are turned off the relay coil is disconnected.

*717 Porter Street, Easton, Pa.



All necessary controls from the front panel. At the lower left is the v.f.o. bandswitch, lower right is the final amplifier bandswitch, center right is antenna loading, upper right is final amplifier tuning, and at the upper left is the trimmer for 28 mc grid drive. The switch is for "spot-transmit".

The W2AEF Mobile Special

W. M. SCHERER, W2AEF*

Part One of Two Parts

This is another in the series of exceptionally useful pieces of equipment designed and built by "Bill" Scherer. VFO controlled on the three principal mobile phone bands it is the ultimate in mobile operation. —Editor.

The VFO controlled transmitter has an important operational characteristic which makes it superior to the simpler crystal controlled unit; i.e., the facility with which the transmitter frequency may be spotted at relatively QRM-free sections of the band. VFO operation is more efficient, results in more contacts and 100% QSO's vs. calls made, and materially adds to operating pleasure.

The VFO unit also facilitates multi-band operation. Short or long distance QSO's may more readily be had at will by selecting the appropriate band, and when conditions change or the band goes dead, contacts on another may usually be made.

VFO controlled units are of even greater benefit to the *mobile* operator for dodging QRM, or for raising stations, since the power and antenna limitations of the mobile setup ordinarily make it difficult to compete with higher powered fixed transmitters and beam antennas. The limited periods of time during which one often engages in mobile operation is also a factor in favor of the multi-band arrangement.

Most of the mobile VFO controlled transmitters seen thus far have several drawbacks. Either both the VFO and the transmitter are mounted in the trunk, or the VFO is mounted in the front of the car and the rest of the installation located in the trunk or in some inconvenient and inaccessible

*Contributing Editor, CQ.

place making rapid adjustments difficult. This definitely limits the advantages normally realized with the VFO controlled unit. In the former case the VFO cannot be quickly spotted to a certain frequency, and in the latter case, the final amplifier cannot be kept tuned to peak efficiency over a wide bandwidth. Trunk mounted transmitters are also difficult to quickly and conveniently load and tune properly; raising the trunk cover for accessibility to the tuning controls generally detunes the antenna.

Another disadvantage of the ordinary run of VFO controlled mobile units is that they are too large to mount at a convenient operating location in the front of the car, which is a requisite for efficient and effective performance. Other desirable characteristics consist of full modulation capabilities with selective frequency response and a high average audio level in order to transmit the most intelligible and readable signal under adverse conditions.

The *Mobile Special* has been designed with the above points in view. Its features include the following: (1), frequency control by electrically and mechanically stable VFO; (2), bandswitched r.f. circuits covering the 28, 14 and 4 mc phone bands; (3), VFO bandspread over almost entire dial scale for each band; (4), provision for "spotting" VFO; (5), Pi-network output system providing readily adjustable antenna coupling; (6), grid and plate metering of final amplifier; (7), provision for receiver muting and antenna relay control; (8), zero bias class B modulator; (9), high level speech clipping, (10), high level negative peak clipping; (11), low pass splatter suppressor filter; (12), high gain speech amplifier, and (13), all necessary operating controls are on the front panel with operation possible using push-to-talk button on microphone. Any plate potential between 300 and 500 volts may be used, resulting in plate inputs of from 15 to 35 watts. Using 500 volts and at full input the plate current drain is only 130 ma during unmodulated periods. With full modulation and no clipping, the current rises to 155 ma during the audio peaks, while with heavy clipping it rises to 175 ma. The heater drain is 2.3 A.

The size of the main unit is only 4¼" high, by 6¼" wide, by 6½" deep, permitting mounting at the operating position on the steering wheel or at the dashboard. The small size is made possible by including only the r.f. portion in the main unit. The speech amplifier, modulator and control relays are mounted on a separate chassis which may be placed in some inconspicuous spot such as on the firewall, under the seat, or in the trunk. This arrangement also prevents excessive heat in the r.f. section, which would otherwise occur from the inclusion of the audio tubes and power resistors in the same cabinet. At the same time a degree of flexibility of the entire setup is attained, since any type of modulator (other than that described herein) furnishing adequate audio power may be used as desired, and in accordance with available components.

Tube Lineup

The tube lineup of the r.f. section is a 6AU6 VFO, 6AK6 buffer-doubler, and a 2E26 final amplifier. A Colpitts circuit is used for the VFO. It will be noted that this appears similar to the Clapp circuit, from which the latter was derived, except that the tuning capacitor is connected across the oscillator inductor rather than in series with it. For CW operation the series tuned Clapp arrangement would offer an advantage in the way of



The audio chassis. In the rear are T2 and T3. In front of these are C30, C38, R12 and R22. The tubes, reading from left to right are V4, V8, V7, V6 and V5.

frequency stability with instantaneous changes in plate potential during keying cycles; however, for phone operation, the plate potential is maintained constant under steady carrier conditions, in which case no increased stability would be attained over the parallel tuned circuit used herein. A severe disadvantage of the Clapp oscillator for use in a mobile bandswitched VFO, confined within definite space limitations, is that it is almost impossible to mechanically construct it without experiencing some sort of instability resulting in microphonic noises when the unit is subject to vibration.

Silver mica and temperature compensated type capacitors are used wherever required in the VFO. Ceramic forms are used for the inductors. Although the tuning capacitor should be a heavy solid unit with the rotor mounted in ball bearings, the *Millen* #21000 series type of capacitor is used, since it is a small available unit. Its sleeve type bearings are excellent for this service, and the small soldered plates are stable under vibration. A voltage regulator tube, mounted in the modulator section, is included for maintaining a constant plate potential on the oscillator.

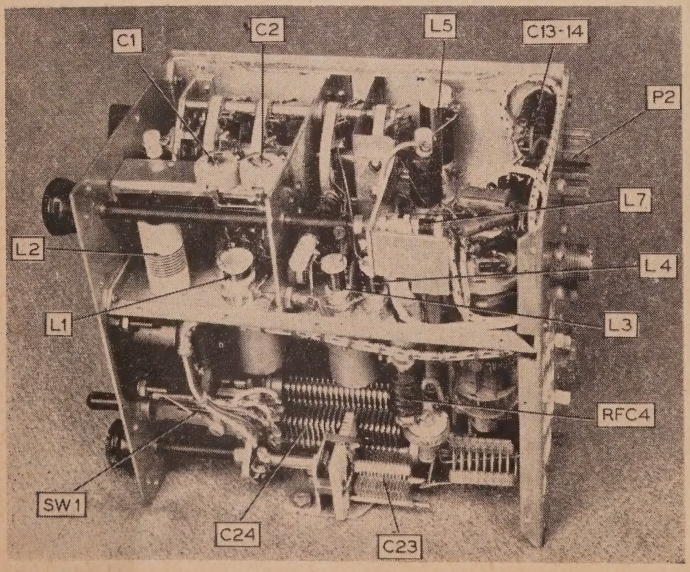
For 3.8 to 4 mc operation, the VFO operates at a frequency of from 1.9 to 2 mc which is spread over the entire range of the dial. Coil *L1* is the oscillator inductor for this range. Bandsetting is attained by adjusting the inductor's iron slug. The oscillator plate circuit is untuned, and is capacitively coupled to the 6AK6 doubler-driver which is tuned to the center of the 4 mc phone band. This provides uniform grid drive over the band. For 14.2 to 14.3 operation, the VFO operates from 7.1 to 7.15 mc. The 6AU6 plate circuit is tuned to 14 mc, and the 6AK6 is used as an amplifier tuned to the center of the 14 mc phone band. For 28.5 to 29.7 mc the VFO tunes from 7.125 to 7.425 mc, bandspread over the entire dial, the oscillator plate is tuned to 14 mc, and the 6AK6 is used as a doubler tuned to 28 mc.

No retuning for proper grid drive is required over the 14 and 4 mc bands. Retuning on 10 meters is necessary only when shifting from one end of the band to the other. This is easily accomplished by adjusting the *L7* slug which is controlled from the front of the panel. From the schematic diagram, *Fig. 1,* it will be noted that load resistors, *R5* and *R6,* are connected across the 6AK6 14 and 4 mc circuits. The purpose of these resistors is not that of broad-banding, as it may appear, but, rather it is a convenient means of cutting down the excessive drive, available on these two bands, without the requirement of an extra control.

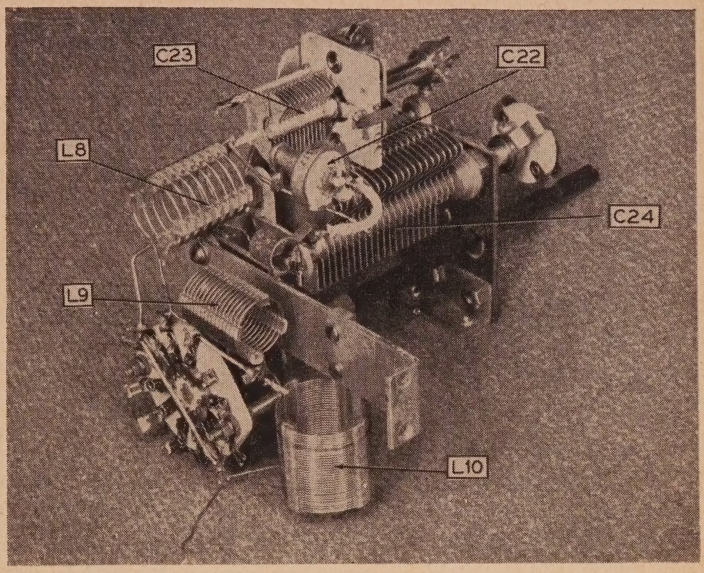
The Final

The driver stage is capacitively coupled to the 2E26 final amplifier. The 2E26 plate tank and output circuit embodies the familiar Pi-network coupling system ,which provides a convenient means for adjusting the coupling from the front panel. It also provides a degree of harmonic attenuation. Capacitors *C23* and *C24,* together with the size of the inductors, have been chosen for optimum performance commensurate with the limited space available.

The final amplifier plate inductors are bandswitched. Although separate inductors are set up for each band, it will be noted that one is added to another as the frequency band is lowered. In addition, the inductors are mounted at right angles to each other to minimize coupling between them. This makes it possible to short out the unused inductors in a simple manner, and it does not lower the Q, as would be the case if one continuous inductor were tapped with the unused sections short circuited out.



The transmitter standing on its right side. Upper portion is the v.f.o. and buffer-doubler section. Lower portion is the final amplifier section.



A view of the pi-network assembly.

In some mobile installations, the loading of the final amplifier may not be sufficiently decreased over the range of the variable loading capacitor. This may be experienced on both 14 and 4 mc, so two sets of banana jacks, one for each band, are mounted on the rear panel to permit the insertion of fixed capacitors which will then be automatically connected across the variable loading capacitor *C24* as the bandswitch is set for the desired band. The approximate amount of loading capacitance is thus obtainable for each individual installation with fine loading adjustable with *C24*. Parallel plate potential feed is used through *RFC4*. On 28 mc, a slight increase in output is obtainable by using a specially wound choke, but the improvement is too slight to warrant its inclusion due to rearrangements which would then be needed for low frequency operation.

Although tubes such as the 2E26 can often be operated satisfactorily without neutralization, the writer has always made it a practice to use some sort of neutralization when using tetrodes or pentodes. This precludes special precautions in the mechanical layout or circuitry to obtain maximum stability.

Neutralization of the *pi* coupled amplifier is easily accomplished through the utilization of the capacitance bridge method.

Control Circuits

The control relays and metering circuits are set up by the "spot-transmit" switch, *SW1*. The center position is neutral, and the transmitter is de-energized. When the switch is in the down, or "spot" position, relay *RLY1*, is energized. This then starts the generator through its own *start* relay, and applies the high voltage to the VFO and buffer-doubler stage. *R13* is also switched into the circuit to assimilate the load normally drawn by the final amplifier and audio system, so that the generator load equals that found during transmitting periods. No plate potential is applied to the final amplifier, but the VFO signal may be heard in the receiver, making it possible to spot the VFO or set it to zero beat with another signal. At the same time, a meter is placed across the 2E26 cathode resistor (*R8*) and indicates the amount of grid current, full scale reading being 5 ma. For 28 mc use, the grid current may be properly adjusted by the panel control for *L7*.

When the switch (*SW1*) is placed in the up, or "transmit" position, relay *RLY2* is energized, the generator starts, high voltage is applied to the entire transmitter, and the circuits are completed for energizing the antenna and receiver disabling relays. *R10* is also switched in series with the meter, making its full scale range 100 ma. The total cathode current may now be read to ascertain the sum of the screen and plate currents when the final amplifier is tuned to resonance. Push-to-talk operation at the microphone is available through the microphone jack when the switch is in the neutral position.

Power leads are bypassed at the Jones power plug for the reduction of direct TVI harmonic radiation. With the transmitter set right next to a TV set and with a dummy load connected through several feet of coax, only very slight cross hatching can be noted on channel 2 when the transmitter is tuned across the 28 mc band. With the unit installed in the car and with the antenna connected, cross hatching on channel 2 is slightly noticeable only when the car is within 100 feet of the TV antenna. In fringe areas, the cross hatching may increase somewhat, in which case a low pass filter may be used.*

* An installation similar to that described by K2CR on on page 43 of this issue would prove effective if mounted externally.

COIL DATA

L1—25 turns #38 enamel on Millen #69042 iron slug tuned form
L2—8 turns #24 enamel space wound on Millen #45500 ceramic form
L3—36 turns #32 enamel on Millen #69048 iron slug tuned form
L4—30 turns #32 enamel on Millen #69048 iron slug tuned form
L5v—100 turns #32 enamel on Millen #69045 copper slug tuned form
L6—30 turns #32 enamel on Millen #69047 copper slug tuned form
L7—11 turns #24 enamel on Millen #69048 iron slug tuned form
L8—8¼ turns, B & W Miniductor #3010
L9—16 turns, B & W Miniductor #3007
L10—34 turns, B & W Miniductor #3016

The Modulator

The modulator tube is a type 1635 which is similar to the 6N7, but it requires less plate and heater current. It may be operated at higher plate potentials with more audio output. In the *Special* it operates as a class B amplifier with zero bias driven by a 6AK6, which in turn is preceded by a two stage speech amplifier consisting of a single 12AT7 dual triode. More than enough gain is available for a high impedance dynamic or crystal microphone. A carbon microphone may be used as described later in the text.

For 500 volt operation, plate potential is applied to the 1635 through a 1000 ohm resistor *R23*. During unmodulated periods the static current drawn by the modulator tube is only 13 ma and the plate potential is just slightly lower than that of the supply source. The total plate dissipation is only a little above the manufacturer's rating of 6 watts. During modulation peaks, when the plate current rises, the voltage drop across *R23* also increases, and the potential applied to the modulator drops. The value of *R23* has been chosen so that the drop across the resistor during modulation peaks limits the modulation capabilities to just under 100%. Any further increase in audio level beyond that required to produce this degree of modulation, just simply squares off the audio peaks and produces high level speech clipping. This results in high average audio level and effectively increases the power of the modulated signal without overmodulating the carrier.

A high level low-pass filter, *T1, C27, C28, C29*, is included to cut off frequencies above 3500 cycles for the prevention of sideband splatter which may otherwise be caused by the high frequency har-

(Continued on page 112)

Parts List (substitutions are possible if the physical sizes are identical)

C1, -C2—3-12 μμf NPO
C1A—47 μμf — zero temp, ceramic
C3—33 μμf—zero temp, ceramic
C4—Millen #21075, remove 2 rotor plates
C5, C6—.001 μμf, silver mica
C7—100 μμf, silver mica
C8, C20A—.002 μf, ceramicon
C9, C17—100 μμf, ceramic
C10, C11, C12, C15, C16A—.002 μf disc ceramic
C13, C14, C16, C19, C20—.001 ceramic
C18—National #NC600
C21—500 μμf, mica
C22—.001 or .002 μf, 1000 v., Button or equivalent
C23—100 μμf, Millen #20100
C24—325 μμf, Millen #19325
C25, C25A—See text
C26—.001 μf, ceramicon
C27—.004 μf, 600 volt, paper
C28, C29—.005 μf, 1500 volt, paper or oil
C30, C38—2 μf, 600 volt, paper or oil
C31—.01 μf, 400 volt, paper
C32, C35—500 μμf, ceramic or mica
C33, C37—8 μf, 450 volt, electrolytic
C34, C36—10 μf, 25 volt, electrolytic
R1—27000 ohms, ½ watt
R1A—6800 ohms, ½ watt
R2, R15—100,000 ohms, ½ watt
R3—560 ohms, ½ watt
R4—4700 ohms, ½ watt
R7—20,000 ohms, 1 watt
R8—20 ohms, ½ watt, carbon, see text
R9, R9A—56,000 ohms, 1 watt
R10—2500 ohms, ½ watt
R11—3000 ohms, 2 watt
R12—15,000 ohms, 10 watt
R13—5000 ohms, 50 watt
R14, R20—1 megohm, ½ watt
R16—500,000 ohms, potentiometer
R17—10,000 ohms, ½ watt
R18—500 ohms, ½ watt
R19—47,000 ohms, ½ watt
R21—680 ohms, 1 watt
R22—15,000 ohms, 10 watt
R23—1000 ohms, 10 watt
FT#1, FT#2—feedthru bushing, see text
FT#3—feedthrough bushing, Millen #32100
J1—2 circuit jack, tip open, ring closed circuit
J2, J3, J4, J5—banana jack
P1—Coax chassis receptacle
P2, P5—Jones plug, #P-310-AB
P3, P4, P4A—Jones socket, #S-310-AB
RFC1, RFC3, RFC4—2.5 m.h., Millen #34102
RFC2—same as above and see text
RLY-1, RLY-2—6 volt d.c. relay, D.P.D.T.
M—0-1 milliameter, 100 ohms d.c. resistance, 1½" square, see text.
SW-A, B, D, F, H—Centralab ceramic 4 deck switch, 2 circuits, 5 positions each deck made up from 4 type RR ceramic wafers and K122 or K123 index. See text.
SW-Y, Z—1 deck ceramic switch, 2 circuits, 5 position, Centralab #2505 or Mallory #173C.
SW-1—Switchcraft Lev-r Switch #3036L—3 position, D.P.D.T.
SW-2—Toggle, D.P.D.T.
V1—6AU6 **V5**—12AT7
V2—6AK6 **V6**—6AK6
V3—2E26 **V7**—1635
V4—VR150 **V8**—OZ4
T1—.39 henries, Thordarson Splatter Choke T20C62
T2—Kenyon Universal driver transformer T264, use ratio primary to ½ secondary, 2.6:1
T3—Kenyon Universal modulation transformer 40W, use 14,000 ohms to 7000 ohm taps.
XS-9 #1, XS-9 #2—National Feedthrough bushing #XS-9

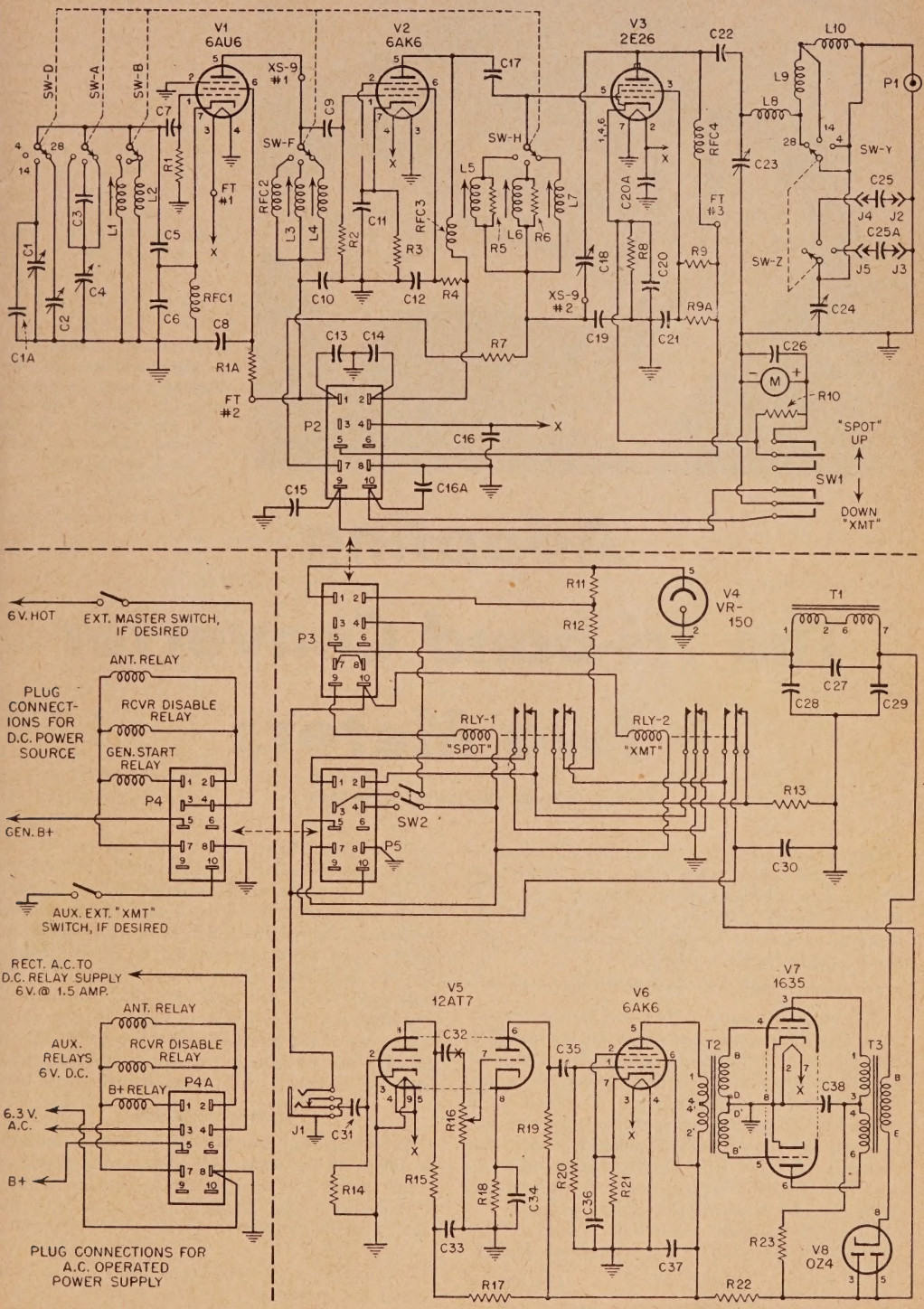
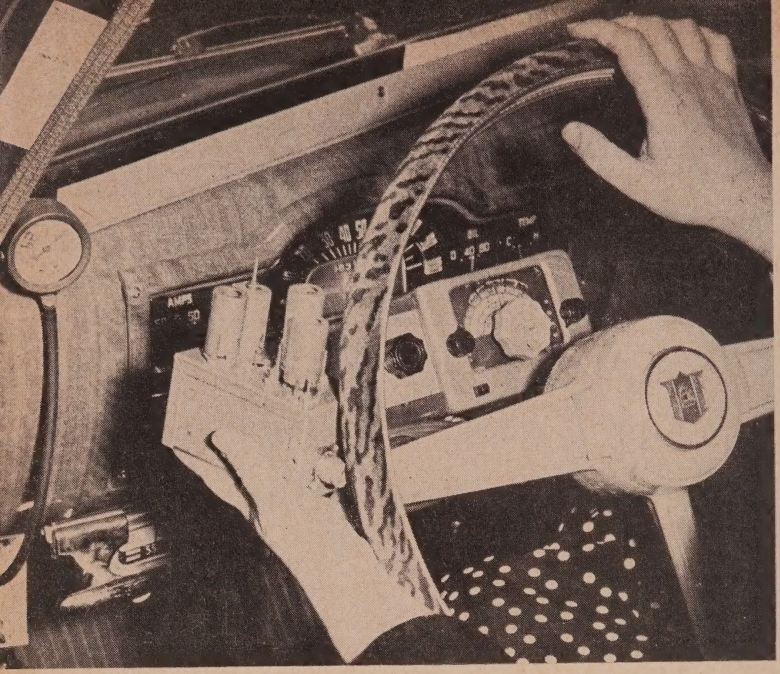


Fig. 1. Wiring schematic of the complete "Mobile Special."



The 144-mc converter is crystal controlled and the Gonset is used as a tuneable i.f. channel. This permits the converter to be mounted below the dash and out of sight.

Adapting The Tri-band Converter to Two Meters

E. MILES BROWN, W2PAU*

Oddly enough this 2-meter mobile converter is easier to build and operate than most home station converters doing the same job. Although designed to work primarily with the Gonset Tri-Band the identical idea could be applied to almost any 10-meter mobile converter. —Editor.

This story started at a Hudson Division Convention. Our luck was good that Sunday morning. The direction finding equipment did its work well, and the hidden transmitter didn't stay hidden long. First prize—one shiny new *Gonset Tri-Band* mobile converter! No doubt the jealous on-lookers deemed it a pity to donate such a versatile device to a character who had long since graduated from the long-wave bands to the exclusive territory above 50 mc, but the prize was gratefully accepted.

The next historical event was a new car and when it was delivered said converter was immediately installed. Next came a BC receiver—one of the simplest and least selective models (incidentally, one of the cheapest!) available. When the gang in the local two-meter CD net saw this trend they must have figured that another brother had given up the good fight and reverted to the d.c. bands. But the best was yet to come. Through the installation** of a little grey box that collection of low-frequency receiving gear began to give forth with some of the nicest sounding two-meter signals anyone'd care to hear. In case you're still interested, here is the story of what went into the little box.

Oscillator Design

Experience had shown that the local oscillator in any v.h.f. converter has to be pretty stable to permit using a typical broadcast receiver as part of the i.f. system. Though some may have the talent and the patience to develop a self-controlled

*Technical Editor, CQ.

***Installation—! To this day it hangs by its leads behind the dashboard . . . Mrs. W2PAU*

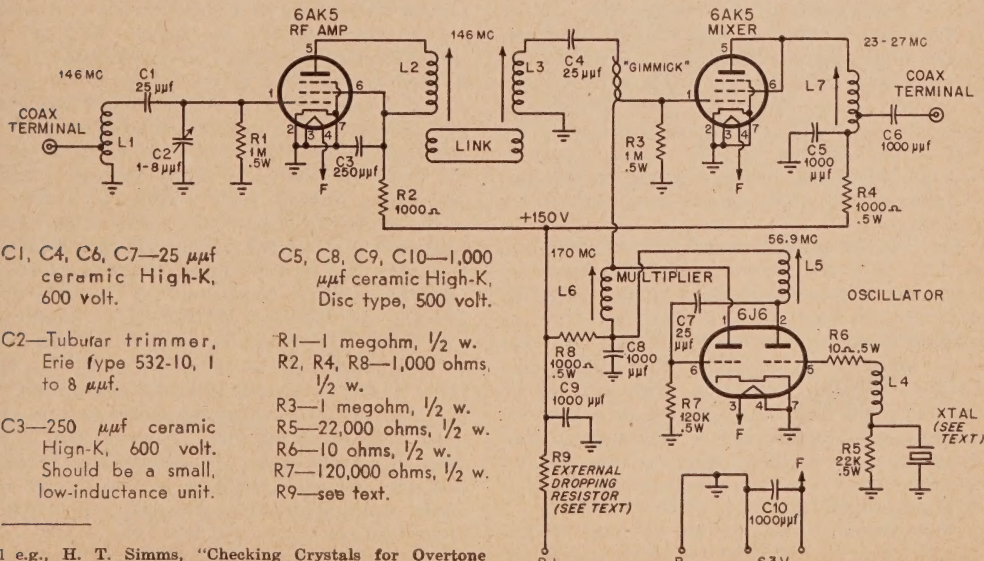
oscillator with adequate stability, the problems involved were too formidable for W2PAU. That settled the question—the front-end conversion oscillator would be crystal-controlled. We've never regretted that decision. It's really something to be able to step out of the house on a cold winter's morning, flip on the mobile receiver and have a solid QSO on the way to work without having to touch up the tuning—while the frost is melting off the equipment! Full credit for this sort of performance should go to the fellow who designed the low-frequency converter—the quartz crystal in the v.h.f. section is stable through Nature's handiwork!

The choice of crystal frequency was a matter of much concern. Again, experience had demonstrated that use of a low-frequency crystal oscillator and a string of frequency multipliers is a bad deal—every harmonic present in the system can produce i.f. beat signals. If, for example, one were to start with a 10-mc crystal oscillator, there would be signals at 130, 140, 150, 160 and every other multiple of 10 megacycles. Each of these could produce a set of responses. Sharp tuning helps, but does not eliminate the problem. Therefore, it was essential that the starting frequency be as high as possible.

After thoroughly canvassing all potential sources, a crystal labelled "56.94 mc" was obtained. Several companies produce such crystals. Some will complain that the cost of a v.h.f. crystal is excessive, or deliveries are poor, but this is insufficient reason for giving up the idea. It is a pretty good bet that the *56.94* mc crystal was nothing more than an 8134 kc quartz plate especially selected for its ability to oscillate on its 7th overtone mode. Several articles have been written regarding the use of low-frequency crystals in overtone circuits[1]. It might be worth spending some time with your collection of 8, 12 and 24 mc rocks to see whether one might do a job in the 60 mc range. The oscillator circuit selected for this converter will make a piece of glass oscillate if the grid coil is made large enough!

Why did we pick 56.94 mc? Mainly because that was the first v.h.f. crystal we could lay hands on! But it turned out to be a lucky choice. By tripling the oscillator signal to 170.82 mc and using "high side" conversion the i-f band corresponding to 144 to 148 is roughly 23 to 27 mc. This range can be covered on the top band of the *Gonset Tri-Band* converter (despite its generous mechanical bandspread) by making use of its "image" response. (The antenna trimmer permits peaking on the image.) How about v.h.f. images? Well, in Philadelphia, TV channel 10 is very definitely occupied by WCAU-TV. The image band corresponding to 144 to 148 mc is 197.65 to 193.65 mc. WCAU's sound carrier, on 197.75 falls outside the low end of the two-meter band response and their picture carrier, on 193.25 mc is outside the high end. Picture components may slop over into the high end of the band a bit, but this effect is usually not objectionable unless we're working in the shadow of the TV tower.

This isn't intended to state that our choice of crystal-frequency was the only reasonable one. There are a tremendous number of possibilities which might give suitable results. Our calculations are detailed here only to demonstrate some of the problems which must be considered in such a design. Despite the care taken to "dodge" images, there are still a few unexplained birdies which are only too apparent when tuning a typically active two-meter band. And in a radiation-saturated area such as the center of Philadelphia there are opportunities for



C1, C4, C6, C7—25 μμf ceramic High-K, 600 volt.

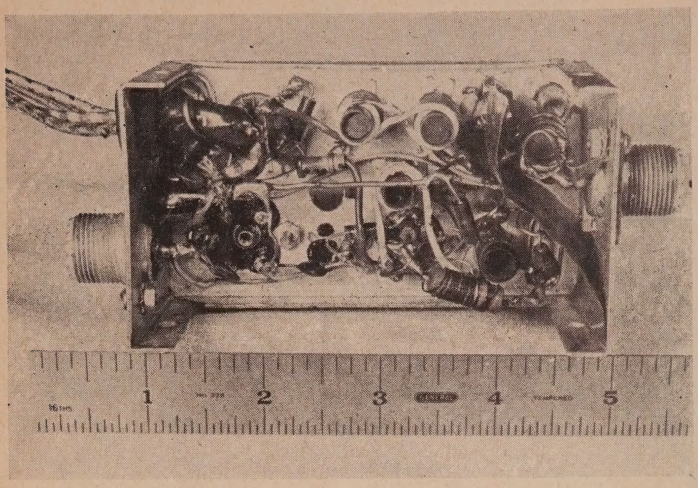
C2—Tubular trimmer, Erie type 532-10, 1 to 8 μμf.

C3—250 μμf ceramic High-K, 600 volt. Should be a small, low-inductance unit.

C5, C8, C9, C10—1,000 μμf ceramic High-K, Disc type, 500 volt.

R1—1 megohm, ½ w.
R2, R4, R8—1,000 ohms, ½ w.
R3—1 megohm, ½ w.
R5—22,000 ohms, ½ w.
R6—10 ohms, ½ w.
R7—120,000 ohms, ½ w.
R9—see text.

1 e.g., H. T. Simms, "Checking Crystals for Overtone Activity," QST, Sept., 1951, p. 59.



Wiring below the deck is in the usual W2PAU fashion—made to work. In the top center the coupled coils L2 and L3 are visible. A thin copper shield isolates the 6AK5 r.f. stage input and output circuits.

listening in on FM broadcast stations, police and taxi signals, etc. etc. But, honestly, these spurious responses have not been the cause of losing a single two-meter QSO to date. A slight twist of the BC set dial will usually move 'em over enough to eliminate any audible interference. Nope, I wouldn't put up with these responses in a home-station receiver, either! But some compromises are acceptable in a mobile job.

The R.F. Design

There isn't much to the rest of the converter. The r-f stage was chosen mainly because of its simplicity. The noise figure of the 6AK5 pentode is good enough to permit excellent reception of all kinds of man-made noise in the typical mobile location. Tests made with a noise generator indicate that we might pick up a db or two in signal-to thermal noise ratio by going to a triode front end, but it wasn't deemed worthwhile. The use of emission bias on the r.f. stage is not customary, though it is a common trick at audio frequencies. Seems to work OK here, too, and it saves a couple of cathode bypass condensers. Some shielding is required in the 6AK5 r.f. stage to cut down the chances of oscillation—a small strap of copper soldered across the grounded socket terminals is adequate to hold things down, even without the antenna load.

The triode-connected mixer was selected since its low plate resistance hanging across the i.f. output coil tends to produce uniform gain across the 4-mc wide i-f band. There is a chance of r.f. oscillation in this sort of mixer, but our model has shown no rebellious tendencies. If it had, a small resistor (100 ohms or so) in series with the i.f. coil lead would have tamed it down. It is true that a simple single-tuned-circuit i.f. output system cannot show truly flat gain characteristics, but the antenna trimmer on the low-frequency converter helps a lot in pulling the peak across the band.

The mixer was coupled to the r.f. stage by link-coupled tuned circuits. This was done in an effort to flatten the gain characteristics and also to provide extra selectivity against v.h.f. images. It is quite likely that a single-tuned-circuit with capacity coupling would have done a less acceptable job.

The crystal oscillator, as mentioned before, was selected because it can force even a reluctant crystal to take off. If the oscillator drifts off on its own (with the crystal in place) the number of turns on the grid coil should be reduced. However, there is often a region where crystal control of the oscillator frequency can be obtained despite a tendency to oscillate uncontrolled at other settings of the plate tuning adjustment. My advice in this case is to take the chance of future drifting and leave things set where crystal control exists! After all, this job is not a transmitter. If it does jump out of lock you won't get a pink ticket. And it normally runs continuously, so warm-up and starting effects are not so important. Any other oscillator circuit suitable for exciting overtone operation in a crystal can be substituted with the author's blessing!

The frequency multiplier is conventional. It can be used as a doubler or quadrupler to suit other crystal frequencies if so desired, and it has more than adequate output to drive the mixer. A piece of insulated hookup wire about 1" long, connected to the multiplier plate and draped near the mixer grid wiring provides sufficient injection voltage.

The photographs show the general layout of the converter. No detailed mechanical drawings are provided, since in these times one must expect to substitute available components for those specified. The unit was built in a 2" X 2" X 4" "Minibox." The relative placement of parts is not especially critical, except that the plate coil of the r.f. amplifier should be located somewhat apart from the grid coil, and the shielding tab should pass between them, obstructing the view from one coil to the other. No crystal socket is used—the crystal-holder pins are soldered directly to the appropriate terminals under the chassis. This was not merely a mechanical short-cut. At first, the crystal was plugged into a socket on the surface of the chassis,

but it was noted that the crystal holder itself was picking up the sound signal from a local channel 6 TV station. The beat between the second harmonic of the crystal oscillator (which shouldn't have been there at all!) and the interfering carrier fell right in the i.f. band! See what I mean about screwy responses? Anyway, locating the crystal under the chassis and thereby shortening its leads cleared up that situation.

The Components

Slug-tuned coils were used except for the antenna coil. (Most of the iron slugs in our collection were of unknown parentage, and we didn't want to take a chance of wrecking the Q of that coil!) Tuning by means of powdered iron cores is just as efficient as any other available means of tuning—if the cores used are selected for good high-frequency performance. Since it is impossible to judge what sort of material went into a given core, except by Q-meter tests, it might be best to buy trade marked coil form assemblies guaranteed for good v.h.f. performance. Tuning with a copper or brass slug will usually produce a coil of lower Q than can be obtained through the use of a proper powdered-iron core. The coils in our model were wound on 9/32-inch diameter forms of thin-walled bakelite tubing. The coil tubes, cores and mounting clips were obtained from a set of antenna-trap coils sold for use with the original 630 TV receiver. Some might be willing to take a chance with coil forms and slugs salvaged from TV i.f. transformers. Don't be misled into using the width-control coil form. That core is practically pure iron! Since small variations in coil forms and winding methods will have a drastic effect on the frequency of v.h.f. coils, coil winding data provided in the parts list should be considered only as a rough guide. Beg or borrow a grid dipper if necessary, and plan to design the coils on the job! Coils should "dip" at the specified frequency with all tubes in place.

It will be noted that the plate voltage dropping resistors shown in the schematic are unusually low in value. This is purposely done to keep the power dissipation under the chassis as small as possible. Using low resistance valves permits the use of ½ watt size resistors, a big help in the limited space available. If the power unit with which this converter is used puts out much over 150 volts, it will be necessary to include an extra external dropping resistance. The converter draws approximately 30 milliamperes with 150 volts on its B+ terminal. Don't forget to figure the power rating required in the dropping resistor—ours took a ten watt wire-wound resistor, which was taped into the power cable assembly.

Operation

Tuning up should be easy once the coils have been pruned to approximate the proper frequencies. It might be a good idea to test out the unit in connection with the fixed-station communications receiver using an a.c. operated power unit—it saves batteries, gasoline, upholstery and stiff necks. A vacuum tube voltmeter is a handy test instrument. Hook a small size 100,000-ohm resistor on the tip of the probe to eliminate probe capacitance. Lacking a VTVM, a d.c. microammeter will do, the 100,000 ohm resistor forming a low capacitance test probe. In this case, the microammeter acts as a voltmeter with a sensitivity of 0.1 volt/ua. Apply plate and filament voltages to the unit, using an external dropping resistor in the B+ lead to hold the voltage at the chassis down to about 150 volts. Hook the output of the converter to the communications receiver input.

First check the crystal oscillator. If it is oscillating, it will develop a negative bias of several volts across the grid leak of the multiplier tube. A normally active crystal will operate similar to any conventional tuned-plate crystal oscillator, i.e., it should slip into oscillation and pop out as the plate circuit is tuned through the crystal frequency. It should be set slightly off the point of maximum output on the safe side to insure reliable starting. If the oscillator shows no signs of oscillating it may be necessary to increase the number of turns on the grid coil, which will probably make it oscillate over a wide range of tuning adjustments. In this case, using the grid dipper as a frequency meter, set the oscillator tuning to put the output signal on approximately the correct frequency.

Next check the multiplier tuning. It should be peaked for maximum negative bias across the mixer

COIL WINDING DATA:

L1—R.F. amplifier grid coil; air-wound, #16 AWG copper, 5/16" ID, 5 turns, spaced to ¾" long, leads approx. ¼" long. Tapped approx. (see text) 1 turn from cold end. Should tune to 146 mc.

L2—R.F. amplifier plate coil; close wound on 9/32" OD thin-walled bakelite tubing with #18 AWG vinyl-insulated "bell wire." 5 turns, leads approx ½" long. Tuned by powdered iron core (see text). Should tune to 146 mc.

L3—Mixer grid coil, same as L2.

Link—Two turns around cold end of L2, same around L3; interconnection leads short as possible.

L4—Crystal osc. grid coil; Wound using a 1 meg 1 watt insulated resistor as a form, approximately ¼" diameter, 13 turns #24 AWG enameled copper wire, spaced to 5/8" winding length. See text.

L5—Crystal oscillator plate coil, wound on coil tube similar to L2, 8 turns #30 double-silk-covered copper wire, close spaced. Tunes to approximately 57 mc.

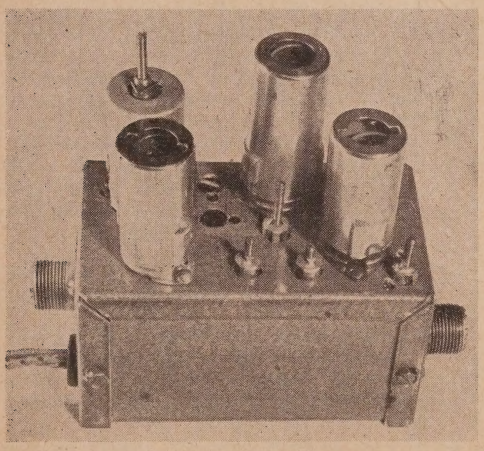
L6—Multiplier plate coil; Similar to L2 except only 3½ turns, with leads approximately 1" long. Tunes to approx. 170 mc.

L7—I.F. output coil; Made from a 21 mc. TV sound i.f. transformer, original windings removed, coil form approx. 9/32" OD, new winding 35 turns close-wound #30 AWG double-silk-covered copper wire, tuned by powdered iron core, tapped 10 turns from cold end. Tunes to 25 mc.

grid leak. The "gimmick" coupling from multiplier to mixer can then be adjusted to produce a reading of about 5 volts.

At this stage of the game a certain amount of extra noise output should be noted when tuning the communications receiver around the 23 to 27 mc band. Set it for 25 mc and peak the i.f. coil of the converter for maximum noise. Tuning the mixer grid and r.f. stage plate coil should also affect the noise level. They should both be peaked for maximum noise, and the coupling between them, likewise. (This coupling should be pretty tight.)

Next hang a two meter antenna on the input of the converter. It should be arranged for 75 ohm or 50 ohm coax termination. It might be well here to enlist the aid of some two meter operator who can pump a good solid signal into your antenna. It's sometimes risky to assume that there must be plentv of loud signals available for test purposes! Knowing the frequency of the two meter signal and the frequency of your converter crystal oscillator. compute the i.f. frequency that should result, and start fishing around that frequency with the communications receiver. If all is well with the crystal oscillator, it shouldn't be hard to find the signal. And it should sound "solid as a rock", giving a T-9 beat note against the receiver BFO. In that case it's just a matter of touching up all the tuning adjustments for best reception. A purist might want to use a diode noise generator to locate the tap setting on *L1* at the optimum point. That's about the only sure way to hit the right spot.



The converter may be easily built into a Bud "Minibox." The input and output coupling go through coax connectors at the right and left, respectively.

If the signal is not located near where it should be, or if it sounds rough and unstable, chances are that the crystal oscillator is operating self-controlled. Tuning the crystal oscillator will probably move the signal around on the i.f. band. If, when it hits the correct i.f. frequency, the signal shows no signs of "going crystal", it was probably a matter of bad luck on the selection of that particular crystal! The article referred in *footnote 1* can be studied for suggestions on what to do next.

When operating normally, the converter produces plenty of noise output to override the noise of the input stage of the *Tri-Band* converter. Thus it controls the sensitivity of the entire receiving system. The usual precautions should be taken to minimize the effects of ignition, generator, regulator; in short, all the usual and most of the unusual types of noises. Two meters is maybe a little tougher than ten in these respects. A good ignition noise limiter on the BC set is a "must."[2]

The converter can be worked into the normal mobile set-up in any of many ways. We added a power supply plug to the back of the *Tri-Band* converter so that its main power controls also act on the v.h.f. converter. The combined drain of the two converters proved too much for the plate power supply of our particular model BC set so it was necessary to get the plate current from the transmitter power supply. An auxiliary antenna switching box was added on the side of the *Tri-Band* converter to facilitate switching its input circuit from the v.h.f. converter to one or two low frequency antennas. Low-cost auto radio coaxial connectors were employed to save space and expense.

The dial problem was easily solved. The slow moving pointer of the *Tri-Band* dial mechanism swings through a generous angle as the converter is tuned from 23 to 27 mc (26 to 30 mc on the normal mode). Five small dots, applied with a fountain pen, serve to indicate the megacycle markers on the two-meter band and show up well at night due to the indirect illumination already provided. The system is too selective to permit precision re-setting to a particular channel, so this crude dial scale is plenty good enough.

That's the whole story. We wouldn't trade this two-meter mobile receiving system for any other we've looked at. And there's another dubious advantage—when two meters begin sounding monotonous, there are three other bands available at the flip of a switch.

2. *See, for example, "Mobile Column," Anderson, "CQ", Jan. 1952*

Another T-17 Conversion

I was interested in the T-17 conversion by W5EHC ("Shack and Workshop," CQ, Feb., 1952, page 50.) as many mobiles are using this arrangement.

I used the plastic model of the T-17 and the cap that goes with the F1 button. Not having a lathe available to turn down the microphone case to the proper diameter, I simply sanded it down with a belt and disc sander, to the point where the telephone cap would not quite fit. Then I cut threads on the case by the simple expedient of forcing the cap on. The cap is tough and the plastic is soft so the threads are quite easily formed.

Ben T. Wade, W4GHB

The Mobileer

and

The Law

MAURICE J. HINDIN, W6EUV*

Mobile operation may easily compound the possibility of the average ham inadvertently running afoul of the law. Judging from the widespread favorable comment on W6EUV's " . . . and the Law" series we could not help but ask him to analyze mobile problems. —Editor.

While previously published articles in *CQ* on legal aspects of amateur radio[1] apply equally to mobile operation insofar as they are applicable, mobile operation involves special considerations with reference to the law.

Since the main purpose of this article is to insure mobile operation free from legal entanglements, the subject matter will be divided into three main divisions as follows:

(1) Difficulties frequently encountered with local and state authorities;
(2) Mobile operation as a basis for negligent driving;
(3) A precautionary check list for mobile operation.

1. Difficulties Frequently Encountered With Local and State Authorities

Although instances of amateur difficulties with local authorities have appeared in a number of different forms, the most frequently reported sources of difficulty are as follows:

A. Mobile Operators have been accused of causing Interference with Police Broadcasts.

This complaint has in some instances, unfortunately, a reasonable foundation in fact. Mobile transmissions have on numerous occasions been heard by patrol cars in the immediate vicinity of the amateur's automobile on police channels. This will invariably cause severe annoyance to the mobile police operator. On-the-spot orders to cease operation are frequently given, with a trip to the police station being the amateur's only alternative. Remedy for this difficulty lies principally in cleaning up the mobile transmitter so that the harmonics and spurious radiation are reduced to a point that such interference can be eliminated. While legally the amateur has as much right to operate his transmitter as the police, practical wisdom suggests avoidance of trouble as a preferable alternative to costly litigation to test this particular case.

B. Local and State Laws affecting Mobile Operation.

The second source of difficulty involves conflicts with authorities because of local and state laws relating to the installation and use of short wave radio equipment in automobiles.

Several states and municipalities, including, for example, the State of New York, have from time to time enacted state laws and municipal ordinances prohibiting interfering with police radio broadcasts, or even prohibiting the equipping of automobiles with radios capable of receiving them. The purpose of such laws is obvious. Police officials do not appreciate having motorists arrive at the scene of a police call ahead of, or simultaneously with, the attending officers, to say nothing of illegal use of the knowledge that may be gained from such police calls. Since the respective state and municipal ordinances each vary somewhat in content, no attempt is made here to analyze each such enactment. The amateur should have no trouble securing a copy of his state's applicable law.

Many such laws require that the owner of an auto so equipped must register the same with the local police department or secure a permit for it from some designated local authority. Where such laws and ordinances have been enacted, permits may be secured by licensed amateurs simply by making an application therefore. Many amateurs have found themselves in temporary difficulty by not registering when so required. In some instances, such laws have been amended to expressly exclude amateurs, as for example the applicable law of the State of New York.[2] In other cases, when the amateur's position has been called to the attention of the prop-

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1. Hindin: "Certain Legal Aspects of Amateur Radio," September 1947 CQ, page 25. Hindin: "Skywire And The Law," December 1951 CQ, page 40.

er authorities, the offending ordinances have been entirely repealed or modified.[3]

While it is doubtful that a state or city could legally prohibit the use of mobile equipment by an amateur entirely,[4] it has not yet been determined by the courts whether or not a state or municipality



". . . officials do not appreciate having motorist arrive at the scene of a police call ahead of the attending officers . . ."

can validly require notification to proper police officials of mobile transmission or mobile transmitting equipment. Until the courts finally pass upon such a proposition, it would be well to assume that where state or municipal ordinances require notification to the police department, such regulations are valid and should be complied with. This is true for the reason that it is generally recognized as a legal proposition that the right to use public highways is not an absolute one, and the state can properly regulate the equipment and conduct of vehicles on state highways.[5]

C. Lack of Adequate Personal Identification.

Several instances have been reported where automobiles have been stopped by state or local police for minor traffic violations. When questioned by the police regarding their mobile equipment, amateurs have failed to have with them a valid radio operator's license. Widespread misunderstanding exists as to the validity of a photostatic copy of an amateur's license. Unless a photostatic copy is certified by the FCC, it is of no legal force or effect. A photostatic copy of an FCC license has no more legal effect than a photograph of the license on the wall of the shack. The mobile operator should at all times have on his person or in his car the original of his FCC license or a certified copy of it, not merely a photostatic copy. The possession of the original of the license would have saved several of the fellows a trip to the local police station and detention until the original license could be produced.

2. Mobile Operation as a Basis for Negligent Driving:

Most states have enacted laws making it a crime to drive an automobile in a reckless or grossly negligent manner. Likewise, negligent operation of a motor vehicle imposes civil liability upon the owner or operator of a vehicle. To the author's knowledge no cases have reached a court of last resort where the operation of a mobile transmitter, while the auto was in motion, was directly proven responsible and the driver shown to be negligent in an accident. Naturally such conduct constitutes obvious negligence in driving under certain circumstances. This aspect of amateur mobile operation should seriously be contemplated by all mobile operators. Negligent inattention to driving a motor vehicle has long been established as a legal basis for liability.[6] If the negligent inattention to the duties of driving is traceable directly to a driver's preoccupation with his operation of a mobile transmitter, the fact that he holds a license to transmit from his automobile would afford him no

2. Sec. 1916, Penal Law of State of New York, as amended, L. 1948, c. 183, and L. 1948, c. 533, which provides as follows:

"1916. Equipping Automobiles with Radio Receiving Sets Capable of Receiving Signals On The Frequencies Allocated For Police Use.

A person, not a peace officer who equips an automobile with a radio receiving set capable of receiving signals on frequencies allocated for police use or knowingly uses an automobile so equipped or who in any way knowingly interferes with the transmission of radio messages by the police without having first secured a permit so to do from the person authorized to issue such a permit by the local governing body or board of the city, town or village in which such a person resides, or where such person resides outside of a city or village in a county having a county police department by the board of supervisors of such county, is guilty of a misdemeanor, punishable by a fine not exceeding one thousand dollars, or imprisonment not exceeding six months, or both. **Nothing in this section contained shall be construed to apply to any person who holds a valid amateur radio operator's license issued by the Federal Communications Commission and who operates a duly licensed portable mobile transmitter and in connection therewith a receiver or receiving set on frequencies exclusively allocated by the Federal Communications Commission to duly licensed radio amateurs."**

3. As for example, Sec. 52.45 of Ordinance #77,000 of the City of Los Angeles, which required that owners of vehicles licensed to operate mobile short wave transmission stations must advise the chief of police of such use. This ordinance was repealed in 1948.

4. Federal Communications Commission vs. Nelson Bros. Bond & Mortgage Co., 289 U. S. 266; Whitehurst vs. Grimes, 21 Fed. (2d) 787; Dumont Laboratories vs. Carroll, 189 Fed. (2d) 183; Tampa Times vs. Burnett, 45 Fed. Supp. 166.

5. 5 American Jurisprudence, Automobiles, p. 531; 64 A.L.R. 1004

6. 5 American Jurisprudence, Automobiles, p. 637; 86 A.L.R. 1149

defense to the charge of negligence in operation of his auto.

An accident occurring while the operator was engaged in operating his mobile station could well be blamed upon his amateur radio activity. The amateur's license to operate a mobile radio transmitter does not give him license to endanger property or life by his careless or negligent operation of his automobile. Traffic conditions, weather, conditions of the highway, and other variable factors well known to every motorist may well require the reasonably prudent amateur to desist from operating his transmitter while actually driving his automobile. The potential criminal and civil liability which might well follow an accident should give the thoughtful amateur pause for serious concern.

Two obvious solutions to this problem present themselves: the first is, the amateur should park his autmobile while operating his mobile radio equipment; the second is, if he desires to operate his equipment while the vehicle is in motion, someone else should drive the automobile for him while he operates the rig. Although neither of these solutions may be to the amateur's liking, the legal consequences of an accident while the amateur is engaged in mobile radio operation can be of such serious consequence as to render the suggested precautions the lesser of the two evils.

3. Precautionary Check List for Mobile Operation

The following steps will help translate the foregoing observations into a practical check list:

(1) Write to the state department of motor vehicles of your state and get a copy of any state statutes relating to licensing or notification requirements for automobile transmitters and receivers.

(2) Write to the city clerk of the city or town in which you live and ascertain if there are any ordinances requiring notification to the police where transmitting equipment is installed in automobiles.

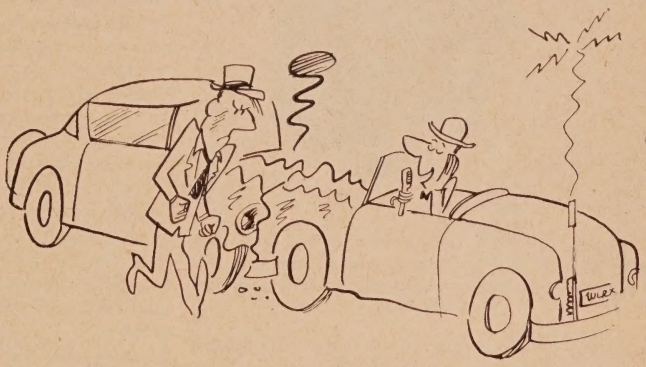
(3) Run an actual interference test in the vicinity of a radio equipped police car in your community. Most police patrol units will be glad to cooperate. If your mobile signal can be heard on the police channel when your car is within several hundred feet from the police radio car, take such steps as are necessary to correct this condition.

(4) Before you start out in your car to operate mobile, be sure that you have on your person or in your car a valid radio operator's license or a certified copy of the license. A mere photostatic copy of the license is not enough.

(5) If you are driving alone, park your car before you begin a transmission, or, if you are accompanied by someone, let them drive while you transmit.

(6) If you are driving alone in your car and feel an urgent need to operate mobile while your car is in motion, carefully evaluate whether or not traffic weather, and road conditions will permit you to safely operate your automobile and your mobile rig simultaneously. Bear in mind that operation of your automobile while operating your radio transmitter could make you liable for negligent operation of your automobile.

"... the amateur's license does not give him license to endanger by his careless driving ..."



ANTENNA TUNING HINT

Shock excitation is an excellent means of tuning a mobile antenna system. Simply disconnect the feedline and insert with very short leads an r.f. ammeter (0-50 ma). Adjust the inductance of base or center loaded systems for maximum deflection of the meter.

Pi-tuned or link coupled systems are equally efficient in transferring power. However, care must be used with the pi-network to insure that you are not "just" tuning the feedline. This results in a loss of radiation due to the fact that part of the antenna system is within the car body or trunk.

When the antenna is not resonated, using the link coupled method arrangement, steps must be taken to tune out the feedline reactive component.

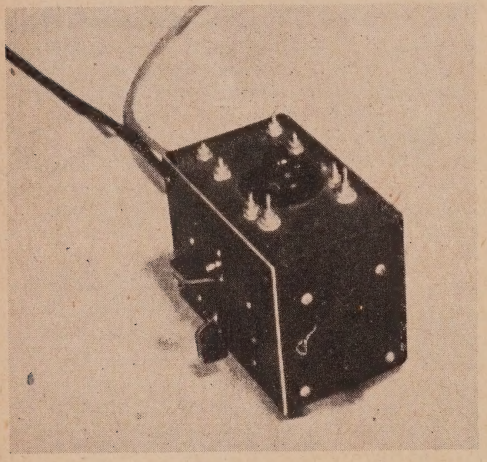
The 4 on 1 Converter

ERIC W. CRUSER, W2DYR*

This converter is designed for the fellow that wants to get off to an experimental start in mobile operation. It would also be useful to the ham who just wants to hear what's on the band from his car.

— Editor.

The mobile converter described here is designed for coverage of the 6, 10, 20 and 75 meter bands. Effort was made to achieve simplicity and to use the minimum of equipment and power consistent with good performance. Due to the 1500-kc intermediate frequency and the inherent selectivity of the usual high Q mobile antenna it has been found possible to dispense with a tuned r.f. stage ahead of the oscillator-mixer without encountering serious image problems.



The "4 on 1" is built into a small utility box. The bandswitch and slug adjusments are on the top. C1 and C2 are on the left and the vernier tuning control is in the front.

A single 6BE6 pentagrid converter is utilized with the usual Hartley circuit for the oscillator portion. A variation of the R9-er input circuit, in which both the coupling and loading condensers, are made variable, is used for matching the antenna to the signal grid of the 6BE6. This is a very efficient, flexible system that eliminates the switching and adjustment of individual antenna coils. To provide a good match to the high impedance input of an automobile receiver a slug tuned broadcast band antenna coil with a high impedance primary is used in reverse. The plate voltage of the 6BE6 is fed through the normal secondary of this coil tuned to 1500 kc and the normal primary is used to couple to the antenna input of the auto receiver.

To avoid mixer instability on 6 meters it is necessary to operate the oscillator on the 25-mc band and use the second harmonic for injection. A tendency toward this same type of instability is eliminated on 10 meters by connecting a 40,000 ohm (*R1*) resistor across *L2*.

A slide switch is conveniently located on the side of the converter to be used as a send/receive switch. It breaks the plate voltage to the converter, operates a relay in the transmitter and as an indicator changes the converter dial light from white to red.

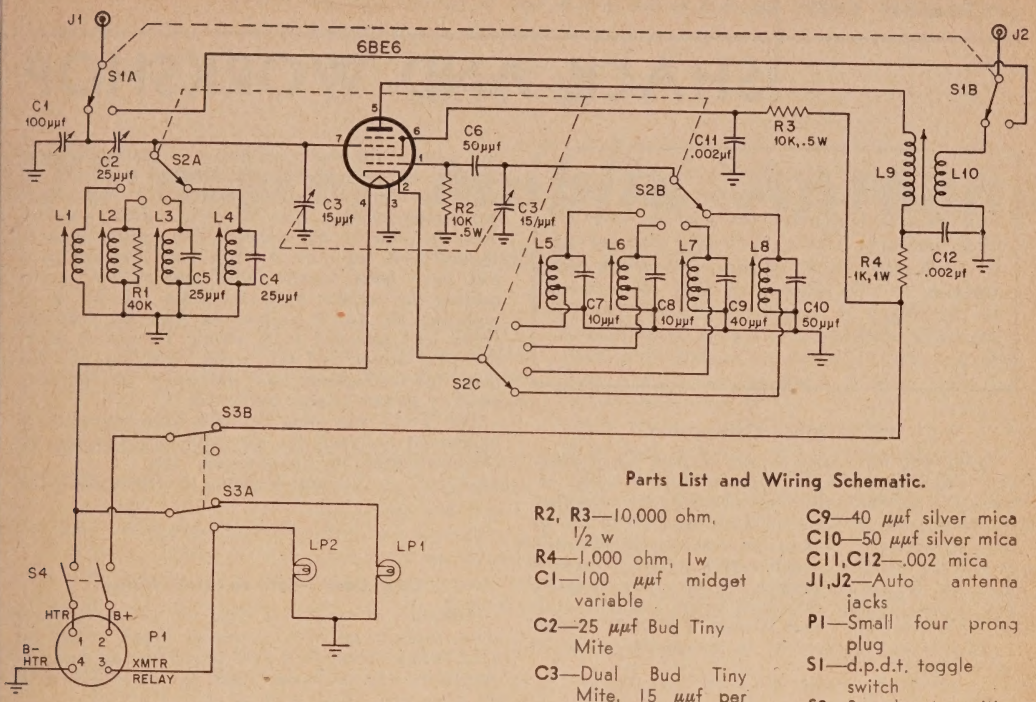
Construction

The converter is housed in a 3" x 4" x 5" utility box with removable sides. All parts are mounted in the main section of this box with the exception of the two switches (*S3, S4*) and the 100 $\mu\mu$f antenna coupling condenser *C1*. These parts are mounted on the left side plate.

The converter is equipped with a small surplus dial using a National AVD mechanism. The dial and vernier mechanism are mounted inside the front of the cabinet by four small metal brackets. A 3/8" hole, as a dial window, is centered and drilled so as to coincide with the dial scale. The tuning condenser *C3* is mounted next. It is attached to the bottom of the box and raised to the proper height with metal spacers. Band switch *S2* is now mounted in the center of the box top. The socket for the 6BE6 is the type with a metal center bushing to which is soldered an 8-32 threaded stud about one inch long. This socket is mounted in an inverted position from the top of the box and to the right of the band switch allowing enough room so that the tube will clear the switch and the side of the cabinet.

Coils *L3, L4, L7, L8* come with an insulated terminal bushing. These bushings are removed to conserve space. After unsoldering the terminal leads, the cement fastening the bushings to the coil forms is usually softened so that the bushings can be twisted off without difficulty. The primaries on coils *L3* and *L4* are not needed and are removed. Terminals are made of #18 wire and secured through small holes drilled in the coil forms and the coil leads are soldered to these. The coils are mounted to the top of the box with the slug adjustment screws outside. The oscillator coils are

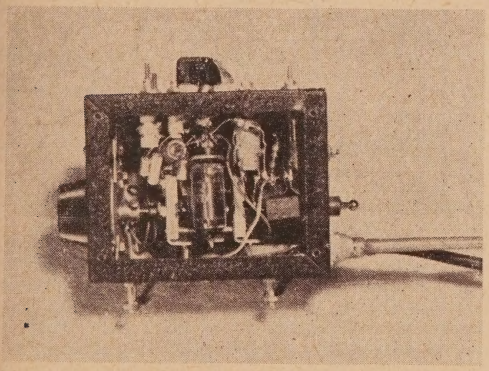
*P.O. Box 316, Lakehurst, N. J.



Parts List and Wiring Schematic.

R2, R3—10,000 ohm, 1/2 w
R4—1,000 ohm, 1w
C1—100 μμf midget variable
C2—25 μμf Bud Tiny Mite
C3—Dual Bud Tiny Mite, 15 μμf per section.
C4,C5—Ceramicon, 25 μμf
C6—50 μμf mica
C7,C8—Ceramicon, 10 μμf
C9—40 μμf silver mica
C10—50 μμf silver mica
C11,C12—.002 mica
J1,J2—Auto antenna jacks
P1—Small four prong plug
S1—d.p.d.t. toggle switch
S2—3 pole, 4 position single section rotary switch
S3—d.p.d.t. slide switch
S4—d.p.s.t. slide switch
Lp1, Lp2—6 volt dial lamps

in a row to the right of the bandswitch and the detector coils similarly mounted on the left. The 75 meter coils (*L4, L8*) are mounted in the rear; next the twenty meter coils (*L3, L7*); then to take advantage of short leads the 6 meter coils (*L1, L5*) are mounted as close to the bandswitch as possible. The ten meter coils (*L2, L6*) are mounted at the front. The output coil, *L9-10,* is mounted with the adjusting screw protruding from the back of the



Looking in with the right side plate removed.

box. It is mounted as near the top as possible, taking care that it clears the other coils. The DPDT toggle switch *S1* is also mounted on the back of the box directly below *L9-10.* The auto antenna jacks *J1* and *J2* are mounted, one at each side of *S1.* A small 4 prong plug (*P1*) is also mounted on the back for the power connections, or if preferred, a hole can be provided to pass a 4 wire power cable. The 25 μμf *Tiny Mite* variable condenser *C2* is mounted by means of the attached right angle bracket to the bottom of the cabinet, on the left side, positioned so that its shaft can protrude through a hole drilled in the left side plate of the box.

COIL DATA

L1—5t. on 1/4" slug tuned form
L2—8t. on 3/8" slug tuned form
L3—5.3-16.5 mc antenna coil (Meissner 14-1064)
L4—1.7-5.3 mc antenna coil (Meissner 14-1061)
L5—15t. on 1/4" slug tuned form—tapped 6th turn
L6—9t. on 3/8" slug tuned form—tapped 3rd turn
L7—5.3-16.5 mc oscillator coil (Meissner 14-1066)
L9, L10—BC antenna coil (Meissner 14-1056)

The 100 μμf midget variable condenser *C1* is mounted on the left side plate of the box in such a position that it will be supported directly above *C2* and taking precaution to see that it will clear

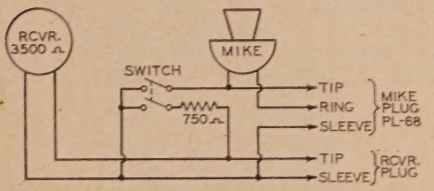
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Inside the SHACK AND WORKSHOP

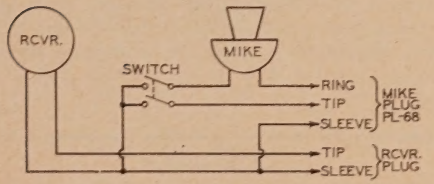
The flow of S & W material continues to pour in and has your S & W Editor under a pile of mail. However, continue to send in your pet ideas and nifty stunts. Each idea that we use is worth either $2.50 in cash or a year's subscription to CQ. Address all S & W material to the Shack & Workshop Editor, c/o CQ Magazine, 67 West 44th Street, New York 36, N. Y.

TS-13 Mike Conversion

Hams who have tried to use surplus TS-13 handsets with "push-to-talk" circuits have usually experienced difficulty with the switching arrangement. As issued, the microphone itself is not effected by the "push-to-talk" switch but remains continuously in the circuit. The switch serves merely to ground one side of the microphone circuit, thus actuating any control circuits connected to it. The other side of the two contact switch is used to place a 750 ohm resistor across the receiver to reduce the possibility of feedback.



(A) ORIGINAL CIRCUIT OF THE TS-13 HANDSET



(B) CIRCUIT OF THE HANDSET AFTER CONVERSION

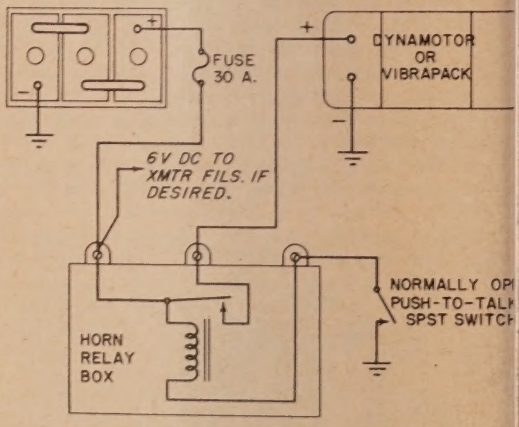
For Ham use it is preferable to modify the microphone circuit to conform with that used in the familiar T-17 or in other single button carbon microphone designed for "push-to-talk" use. The modification itself is quite simple and can be performed with only a screwdriver in about five minutes, if these simple instructions are followed: (1) unscrew the microphone cap and lift the microphone unit out of place. There are no wires soldered or otherwise connected to it. (2) Locate the spring contact which goes to the center of the microphone unit, remove the screw holding it in place, lift away the lug with the green wire attached to it and replace the screw and spring contact. (3) Locate the two screws holding the 750 ohm resistor, unscrew them and remove the resistor. The resistor may be discarded. A lug with a white lead attached to it will have been found under one of the screws holding the resistor in place. Leave this lug as is, replacing the screw to hold it. The lug with the green lead attached to it should be placed under the other screw, and this screw tightened. (4) Replace the microphone unit and screw the cap back on. The circuit is now converted.

The TS-13 may now be used with any piece of equipment designed for use with single button microphones made for "push-to-talk" use.

Capt. Nicholas S. Rahal, W1SDF

Low Cost Push-to-Talk Relay

Amateurs often do not have the necessary heavy duty contacts on their available 6-volt relays for push-to-talk operation. I have found that an excellent substitute can be made from an automobile horn



relay. This relay cost me only 59 cents at our local auto supply store, as compared with several dollars for a commercial relay. Also it is ready for immediate mounting on the firewall of the automobile. This system presently allows me to use a push-to-talk on my 15 watt mobile with complete ease of operation.

J. A. Wisnia, W6KAH

More Shack & Workshop items have been scattered throughout this issue. Look particularly on pages 23, 34, 45 and 64.

Measurements on a 75 meter Mobile Antenna

WIN WAGENER, W6VQD*

This article describes the laboratory type measurements made on a base loaded 75-meter mobile antenna. The author felt that a few accurate facts concerning the electrical characteristics of such an antenna were badly needed. —Editor

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There are respected voices who say little difference should exist between base-loading and center-loading of mobile antennas if both are done equally well. If we really get the power *into the antenna* it will radiate, and a watt's a watt regardless of how we get it out into space (in this particular case).

The antenna measured was a 9 foot whip, without loading, tapering from ⅜" diameter to ¼" diameter, inserted in a flexible mount held just above the rear bumper of a 1950 Ford Sedan. With the mount included, the overall length was 10 feet. Measurements were made at 3900 kc with either a *Boonton Q-Meter* or *General Radio RF Bridge*, Model 916A. The results with both instruments were substantially the same.

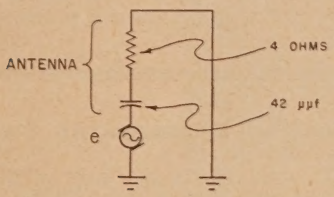


Fig. 1. The electrical analogy.

Looking in at the bottom of the mount we found that the antenna looks like 42 $\mu\mu$f in series with 4 ohms. This is considerably above the 1½ ohm value given by Brown [1] for an 8 foot whip although the measuring conditions were not identical. The capacitance is also somewhat higher than reported but this is probably due in part to the difference in whip lengths. The outstanding difference in resistance values, however, is disturbing and quite important.

Let's say that we want to get 50 watts into the antenna. Now the antenna at the base looks like 4 ohms in series with the capacitance of the antenna back to the body of the car, or ground, as in *Fig. 1*. Since the 50 watts is power, it must be dissipated in the resistance, or $I^2R=50$ watts. Turning the crank we get $I=3.55$ amps. This same current must flow through the antenna capacitance. A value of 42 $\mu\mu$f at 3900 kc has a reactance of 970 ohms. So the voltage at the base of the antenna must be $I(X_c)=(3.55 \times 970)$ or 3450 volts RMS.

We also know that the Q of the antenna alone is equal to X_c/R (970/4) or 240. If the Q is that high, we don't want any more tank circuit in the plate of the output stage, since any extras will just waste

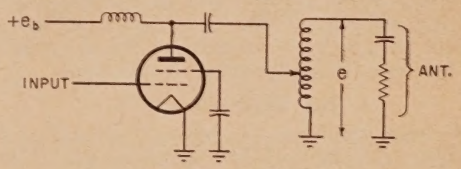


Fig. 2. Because of the relatively high Q of the antenna we need to keep the plate tank circuit at a minimum.

power and make tuning difficult. One needs only to put a coil in parallel with this capacitance to ground and keep the losses in that coil to a very low value, as shown in *Fig. 2*.

We found above that the voltage at the base was 3450 volts RMS. This is 4900 volts peak. If the plate voltage on the final stage is 800 volts we can expect approximately 700 volts peak r.f. voltage between plate and ground when the tube is adjusted correctly. Thus for this case the tap on the coil from the tube plate should be about 1/7th of the way up the coil.

There is no need to make the coil one continuous coil. Breaking it up into sections suited to doing a particular job will make life simpler. It turns out that to tune from 3800 to 4000 kc the total inductance must be adjustable from about 38 μh to 42 μh. We should then want at least 4 μh portion tuneable, and for leeway, say, from about 0 to 8 or 10 μh. Also the low end of the inductance must be a coil capable of having an adjustable tap as this con-

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1 "High Efficiency Loading Coil for Mobile Antennas," George M. Brown, CQ, Jan., 1951, P. 20.

trols the loading on the tube. Since this should be about 1/7th of the total inductance, or 6 μh, another 8 or 10 μh should be assigned to a tapped coil. The balance of the coil, or about 24 μh, should be a series coil with as high a Q as possible. In fact all coils must be high Q as we'll see later. The arrangement now appears as shown in *Fig. 3.*

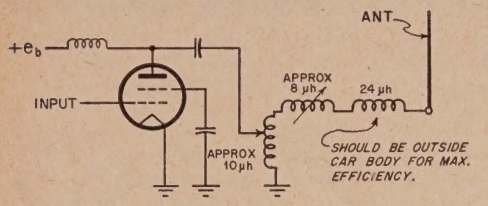


Fig. 3. The antenna loading method pictured above was experimentally derived from these tests.

In order to get the largest portion of the power into the antenna the "Q" of the coil group must be appreciably higher than the Q of the antenna, which we found to be 240. Let's make a table to show the effect of various coil group Q's (see Table I). From this table it appears we should use a coil with a Q of at least 400 and then not shift frequency more than 10 kc either way if we tune up "on the button" (and if the antenna does not move, and hence change the capacity of the car body. But the antenna does move on most installations I've seen).

Lay Back Effects

To study the effect of antenna "lay-back" the antenna was pulled back 30° from the vertical. This reduced the antenna capacitance 0.8 $\mu\mu$f, which is about a 2% change. In this resonant circuit this corresponds to a 1% change in frequency, or a detuning effect of 40 kc. If we tuned up with a partial layback, the change in capacitance could be reduced to $\pm$0.4 $\mu\mu$f and the detuning to $\pm$20 kc. As we saw previously, if the circuit is tuned 10 to 15 kc off resonance (depending on the power lost in the coil) the parallel impedance of the circuit would be cut in half and the power output would be greatly reduced, or the tube overloaded. A stiffer antenna and mount is the simplest answer.[2]

Coil Q	200	400	600	1000
Coil Resistance (approx.)	5	2.5	1.66	1.0
% Radiated Power	45%	62%	70%	80%
Q of Full Circuit	108	150	172	194
Kc off Resonance for 1/2 Tank Impedance	18	13	11	10

Table I

Another interesting effect is that on the 30° layback the antenna radiation resistance rose from 4 ohms to 5 ohms. If one thinks of the antenna "height above ground" as the distance from the antenna to the body of the car, one realizes that the "effective height" is increased on layback and hence the radiation resistance is increased.

I was worried about the apparently high value of antenna resistance of 4 ohms, and especially since one would calculate something less for a simple vertical of the same length above a perfect ground, extending equally in all directions. Of course, the car does not extend in both directions and hence the charging currents in the car can also radiate and so give a high radiation resistance.

Nevertheless, it seemed much of the resistance might be in the steel body surfaces of the car, and not true radiation resistance. So a large aluminum sheet was put over practically all of the car and made to conform quite well to the principal body contours, and tied in to the ground circuit. The antenna resistance was reduced only about a half ohm or 12% of the initial value. This is quite reassuring and leaves one to hope that most of the power can be radiated from a short car antenna.

Many have noted that opening the car trunk detunes things. Measurements showed this to be true, and the change in antenna capacitance when the trunk lid was opened was 1.4 $\mu\mu$f or 3.3%. This corresponds to detuning the circuit 1.65% or 65 kc. Remember 10 to 15 kc is enough to reduce the tank impedance to 50% and with probable bad effects on power developed in the plate circuit. Better build a small boy into the trunk or have an external tuning control if you put the rig in the trunk.

Many of these same conclusions will also apply to the center loaded antenna since the circuit will be loaded by the same total radiation resistance, and the effective antenna capacitances will still act as though in series with this resistance. The center loaded antenna is more difficult to tune to different frequencies and to build into a high Q circuit. Personally, I'm hoping to VFO from the dash and tune the transmitter and antenna to any part of the 75 meter fone band from a dashboard remote control. C U mobile.

Another Dynamotor Use

Some of the Maritime Mobile boys are missing a good bet when they overlook the possibilities of the surplus dynamotors for "B" power aboard ships where they have no a.c.

For about three years I used four DM-33-A's with the primaries connected in series across the ship's 110 d.c. line. It was first necessary to unground the one side from the frame of three of the units. The secondaries were then connected in parallel, and gave a measured output of 600 volts at more than 1 amp. In my case I used the supply (with very little filtering) with my 10 meter transmitter, which was an 829 final modulated by an 829. All of the lower voltages in the exciter and speech amplifier were obtained from the same unit.

The only drawback to using the dynamotors in the above manner is the natural mechanical noise they make. But this was overcome by placing them in an adjoining closet, and using a relay operated by a switch from the operating position. No trouble was ever experienced in the setup.

M. L. WINNER, W3NCV

A Low Pass Mobile TVI Filter

RICHARD D. ZUCKER, K2CR*

You might have known that TVI would get into the picture somehow. —Editor.

I have often wondered how many amateurs that operate mobile are fully aware that they are still legally responsible for all the TVI that they create. Many amateurs have found that it is only a question of time before they have TVI troubles—particularly when mobile on 10 or even 20 meters in a populated area**. If you operate in the wide open spaces, this article is not for you, but if you turn on your carrier any time while parked in a business or residential section or even in your own driveway, it's almost a certainty that you can put a pattern on nearby TV receivers. Frankly, you will have to admit that most mobile transmitters are not designed with the reduction of harmonics in mind.

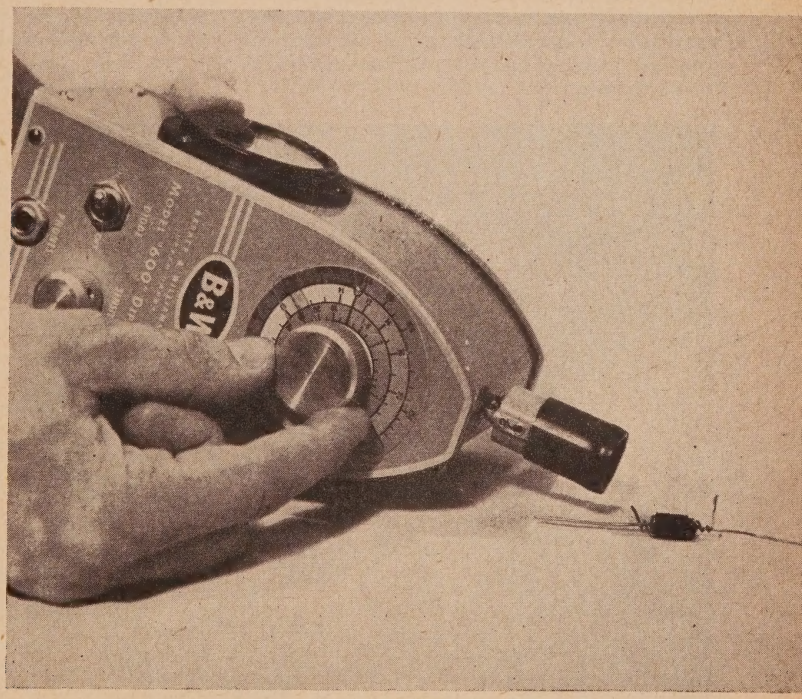
TVI, as a result of your mobile operations, can be just as nasty as TVI from your fixed home station. In fact, it may invite a bent whip antenna or several flat tires as well as the usual unsavory reputation. Let's recognize the situation and accept it but, at the same time, do something constructive about it. The system shown below is easy, quick and inexpensive. With only a few minutes work you can make an astounding reduction in the possibility that your mobile rig will cause TVI.

Low-Pass Filter

Mobile operation does not require as high a degree of harmonic attenuation as fixed station operation.

**You may even have MPI (motion picture interference) as did W2JUC when he parked about 100 yards from a movie house using an obsolete sound system. The audio was picked up and mixed in with the regular movie sound track. Naturally, there is no amateur cure for a situation comparable to this. The solution lies with the movie operators.

*100 E. Palisade Ave., Englewood, N. J.



Each of the tank circuits must be made up and checked for resonance before installation. By the way, this is where the Editor got into the act by bulding one of the units and testing it with the new B & W Model 600 Grip Dipper. This unit will soon be available on a national scale.

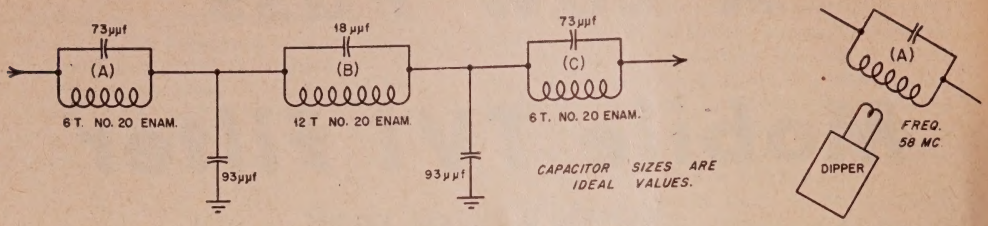


Fig. 1. Circuit for a 52-ohm low-pass filter. Wind the coils directly on ceramicon condensers.

Nevertheless, we should not minimize the amount of harmonic voltage that a small mobile transmitter can radiate.

The values for the particular low-pass filter shown in *Fig. 1* were calculated by Mack Seybold, W2RYI, a very well-known pioneer in TVI research. It is an adaptation of one of his more *powerful* fixed station filters. It was first tried out by W2CVF in mobile operation with excellent results. The author has only made some refinements and put the specifications in a simple and practical form.

The low-pass filter is designed for use with 52-ohm transmission line. It can be installed as a separate external unit as shown in *Fig. 2* as constructed by W2AEF. For optimum performance it should be installed directly in the transmitter itself[1] between the antenna relay and the coax outlet as shown in *Fig. 3*. In either system the filter may introduce some reactance which is easily compensated for by retuning a final amplifier. If a *pi* network is used, the loading condenser will probably have to be increased and if it is not sufficiently high in capacity, a ceramicon or mica padder can be shunted across it.

Construction

The constructer should keep in mind that the type NPO ceramicon has a ± 10% tolerance and a higher Q than the type GP which has ± 20% tolerance. If a capacity checker is available, measure the ceramicons and select closest values. They can be considerably off as purchased. Actually a variation here is not too serious as you are going to combine capacity with inductance to obtain a specific frequency response. For this purpose, the ceramicons which are ¼" diameter, serve also as a coil form. Solder one end of a few feet of No. 20 enameled wire to the ceramicon pigtail and wind according to *Fig. 1*. Solder the other end to make a closed circuit. Then resonate this little tank circuit with the indispensable "Grip Dipper" and either spread or squeeze turns until the frequency is approximately correct. When the 3 tank circuits are completed solder them in series and attach the 93 μμf condensers.

When assembling the complete low-pass filter, it is necessary to keep each tank circuit at right angles to its neighbor to reduce coupling. The installation

1 Philip S. Rand, "The Latest Techniques for the Elimination of Ham TVI", CQ, June, 1950, page 9.

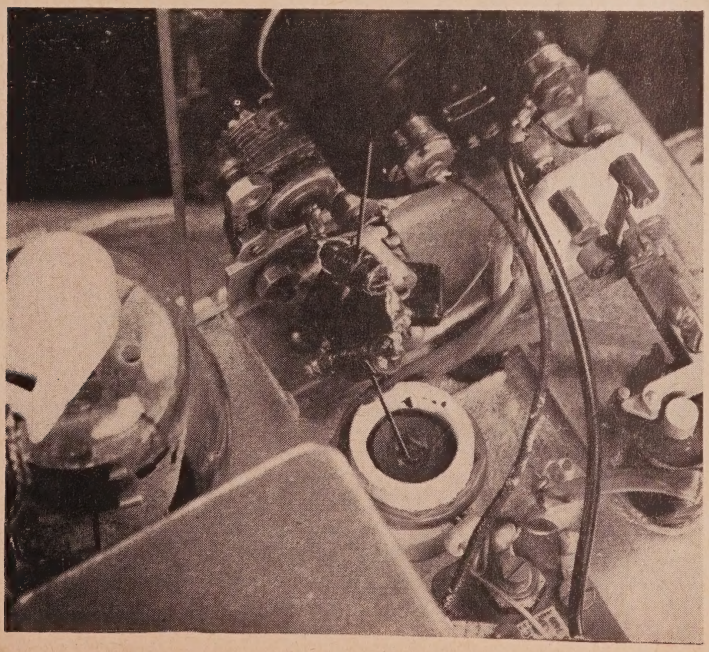


Fig. 3. The low-pass filter installed internally in a mobile transmitter between the antenna relay and the output connector. Only two inductors are visible. The third one is mounted vertically below the one in the foreground. Note the small size of the filter.

shown in *Fig. 2* minimizes coupling by reversing the direction of winding between the two coils.

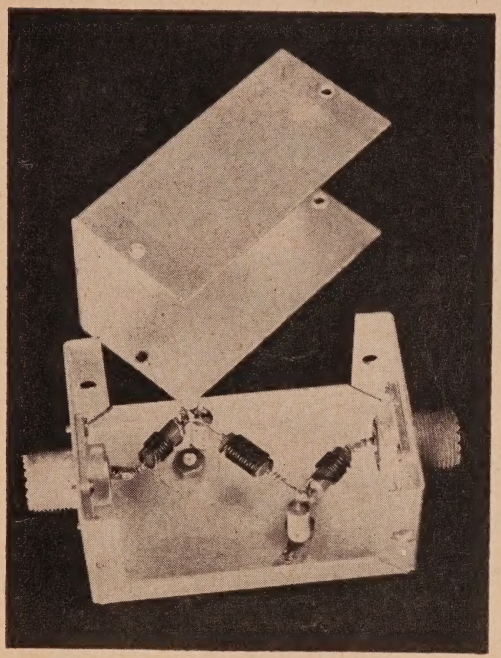


Fig. 2. A low-pass filter n shield box for external installation. The inductors are wound around their corresponding capacitors. Adjacent tanks are at right angles to minimize inter-stage coupling.

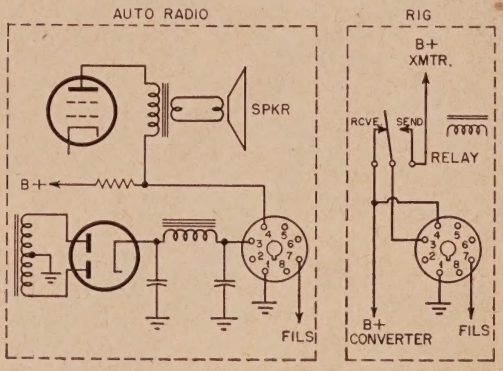
This filter has a cut-off frequency of about 36 mc. This means that harmonics of 10 and 20 meters which would fall in channels 2, 3, 4, 5, 6 or 7 are substantially attenuated. Only your fundamental frequency which is, of course, lower than 36 mc passes through the filter and on to the antenna. In no instance where this filter has been properly constructed has there been any attenuation of the fundamental. You can check this by field strength measurements or a local S-meter reading.

Install one now and start bragging about it in your QSO's. You will soon agree that a low pass filter is a "must" in mobile operation.

SPARE PARTS

Power Supply for Under-the-Dash Mobile

Here's a simple way to get more out of your auto receiver when using it for mobile operation. Since you are going to go into the auto receiver to bring out power for the converter anyway, why not use the auto power supply to power your under-the-dash transmitter? Simply break the main power supply (B+) lead in the auto receiver and connect the hot side to terminal #3 of an octal socket. The other side, the one that feeds power to the auto radio, connects to pin #4. In the rig, install a matching octal socket with pin #3 going to the movable arm of the send-receive relay or switch. One relay contact goes to power the transmitter; the other contact is hooked to pin #4 and also the converter's B+ lead. In the normally closed position a connection is made between pins 3 and 4 which powers the auto receiver and converter. In the transmit position, the connection is broken and the transmitter is powered.

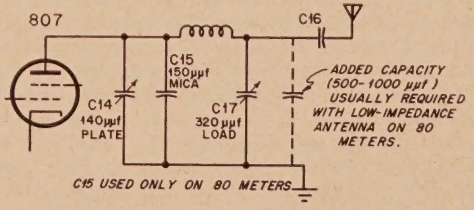


The advantages are that you have automatic receiver silencing and all the auto power supply voltage is available for the transmitter. I used this system to power a small under-the-dash rig with a 6AQ5-6AQ5 modulator combination and found that under load (seven watts input) I had 225 volts on the plate of the final. I used a d.p.d.t. toggle switch and used the other half to switch the antenna from transmit to receive. And believe it or not, on my particular installation (2 tube converter and 3 tube transmitter in the same cabinet) the ammeter showed *less* current drawn from the auto battery in the *transmit* position.

Lynn Stedham, W4HZT

75 METER ANTENNA LOADING

An additional capacity must be connected in parallel with the *load* capacitor in the TBS-50 *pi* network to operate the transmitter on 75 meter phone. The added capacity may exceed .001 μf and



thus make it impossible to resonate in the upper half of the phone band. A solution is to reduce the .00015 μf fixed condenser across the variable input to about .0001 μf.

Herb Brier, W9EGQ

Mobile Teletype

This remarkable mobile unit was recently featured in a television pick-up at the Los Angeles Hobby Show. Last year it won first prize at the ARRL National Convention. —Editor.

The conveyance, a 1952 Chevvy "Carryall" Station Wagon, looked like it had plenty of room at first, but after just a few of the most imperative can't-do-without necessities had been installed, a halt had to be called before it got so crowded that the operator was in danger of getting sucked into the maw of the teletype machine.



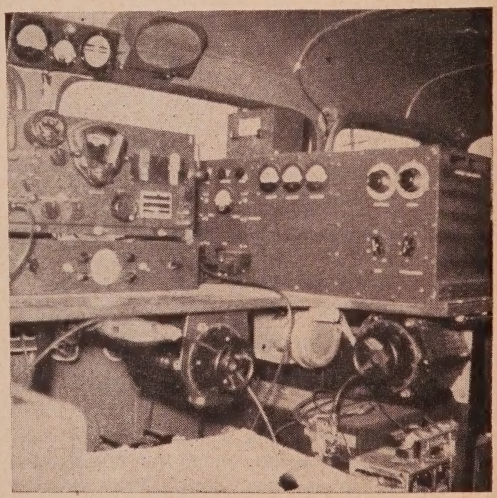
Guided tour: Under the hood (we start at the beginning) is a 1000 watt Kohler automatic 110 volt 60 cycle a.c. light plant which powers the entire mobile station. The frequency of the plant is kept within plus or minus one cycle, a prime factor in the use of mobile teletype equipment . . . teletype synchronization depends upon the action of synchronous motors which must all be running the same speed. This accuracy is kept by means of a governor and a variac.

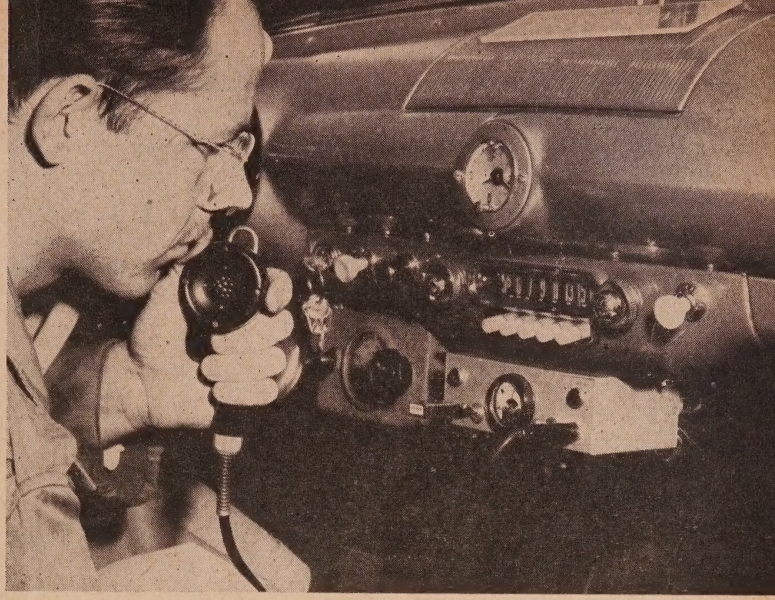
The teletype system works on two and eleven meters using AFSK. On two meters the transmitter is a 522 running about 18 watts, the receiver is also a 522. Phone, as well as RTTY, is used with the change of a plug. The teletype machine is the old faithful Model 12 with a teletype convertor, similar to those in general use out here on the west coast, mounted under it. Since the teletype machine is mounted in the back of the station wagon the only way I can operate in motion is to prop myself well and let the second op, Jimmy, do the driving. Using this unique (if uncomfortable) system I have worked stations in the area (50 miles) while in motion. The old threshing machine copies commercial teletype signals even at 50 miles per hour with solid copy. Under these same conditions I managed a fine contact with Shep, W6LS, at about five miles. The best distance on two meters is San Diego (125 miles). On eleven meters I worked W7VS in Portland, Oregon.



The receiver for eleven meters and below is a BC-348, converted to ten and eleven. The big rig runs 300 watts to an 813 in the final. There is a forty foot whip for 75 meters, shorter whips for the higher bands, and a 19 inch whip in the center of the car top for two meters. On fixed operation a five element beam mounts on part of the forty foot whip. All of the equipment is fed with 52 ohm coax, which seems to be about the best way.

Elwood E. Griggs, W6RI





The perennial question: how small can a mobile transmitter be made? This one is practically hiding under the dash from W6ZUM.

OFFICIAL PHOTOGRAPH U.S. NAVY

The "28-9"

J. ROY SMITH, W6WYA*

Would you go mobile if you had a sinple rig small enough, thin enough, to fit just under the dash of your new super Whiz Liz V-12? Then meet the younger brother of the 28-28 (CQ, Dec., 1951). Here is a three-tube transmitter complete with r.f. driver, 9-watt class C amplifier, fully modulated with 4½ watts of speech power. —Editor.

After the *28-28* was developed, W6FVA and W6ZUM suggested the design of a smaller mobile rig to fit under and flush with the dash. They wanted a rig like the *28-28*, trimmed down and built around the Mallory Vibrapack VP 552. Its crystal socket should be out front readily accessible for a quick change in frequency. Its control panel should be self-contained. That started the development of a new rig which is easy on the automobile battery. Operating at 28 mc with 9 watts, this rig is christened the *28-9*.

Design Considerations

In reducing the plate supply requirements to 300 volts at 100 ma, it was necessary to reduce the class C input and the power to the audio circuit. All the special features of the larger rig had to be retained. These are the r.f. driver, the *pi* network, the control circuits and the audio input system.

The diagram will show the similarity between the *28-28* and this rig. The entire r.f. section is basically the same except for the substitution of the 6AQ5 in the class C modulated stage for the 2E26. Vacuum tube engineers have said that the post war 6AQ5 tube construction has been cheapened to such an extent that it is no longer rugged enough for class C r.f. use. However, this tube did give a minimum of 1½ years rigorous service in this transmitter. The popular 5763 r.f. pentode was tried in this circuit but unexpected difficulties developed. All the troubles vanished when the 5763 was discarded in favor of the 6AQ5. The 6AQ5 grid was also much easier to drive.

The old beam pentode loctal base tube 7C5 would be considered a good tube for the Class C modulated stage. The 7C5 is equivalent in characteristics to the 6AQ5 and preliminary calculations indicate that it is just as easy to drive. It does appear to be rugged as its elements are larger, and will probably last much longer in service. The loctal socket being larger simplifies the mounting of parts directly on the socket as point-to-point wiring is used at every opportunity. Also, its maximum frequency of rated output is higher than 30 mc where other beam power tubes such as the 6V6 fall short. A shield over the 7C5 may not be necessary.

The R. F. Circuit

The r.f. driver uses a 6J6 in a simple circuit that has proven its worth. For complete details of this circuit the reader is referred to the *28-28* article. The grid of the first half of the 6J6 will work from either a 7 mc crystal or a 7 mc VFO.

*Electronics Engineer, USN Electronics Laboratory, San Diego, Calif.

The r.f. choke in the cathode is not critical. It may be either a 2.5 mh standard 4-pie r.f. choke or simply one of the four pies removed and remounted on a wooden dowel, or cemented over and around *C2*, if *C2* is an axial lead type of capacitor.

The class C modulated stage is simplified to the bare minimum of components. The circuit values are the same for either the 7C5 or the 6AQ5 beam pentode. A jack in the cathode is recommended for metering either the grid drive or the total space current (plate current plus screen and grid currents). To measure grid drive, switch *S1* is opened, removing screen voltage which stops all plate current, leaving only the grid current flowing in the meter. Closing the switch restores the screen voltage and the meter reads the total cathode current. This jack is the shorting type which enables the meter to be removed after tune-up. However, the photograph of the W6ZUM installation shows a permanently installed meter in the cathode circuit.

The use of a frequency rated plate choke[1] is important, as its reactance must be as high as possible at the operating frequency. An unsuitable one whose self-resonance (when wired in the circuit) drops below 30 mc, wastes carrier power in heating as part of the tank circuit's resonating currents do circulate through such a choke when its reactance is capacitive.

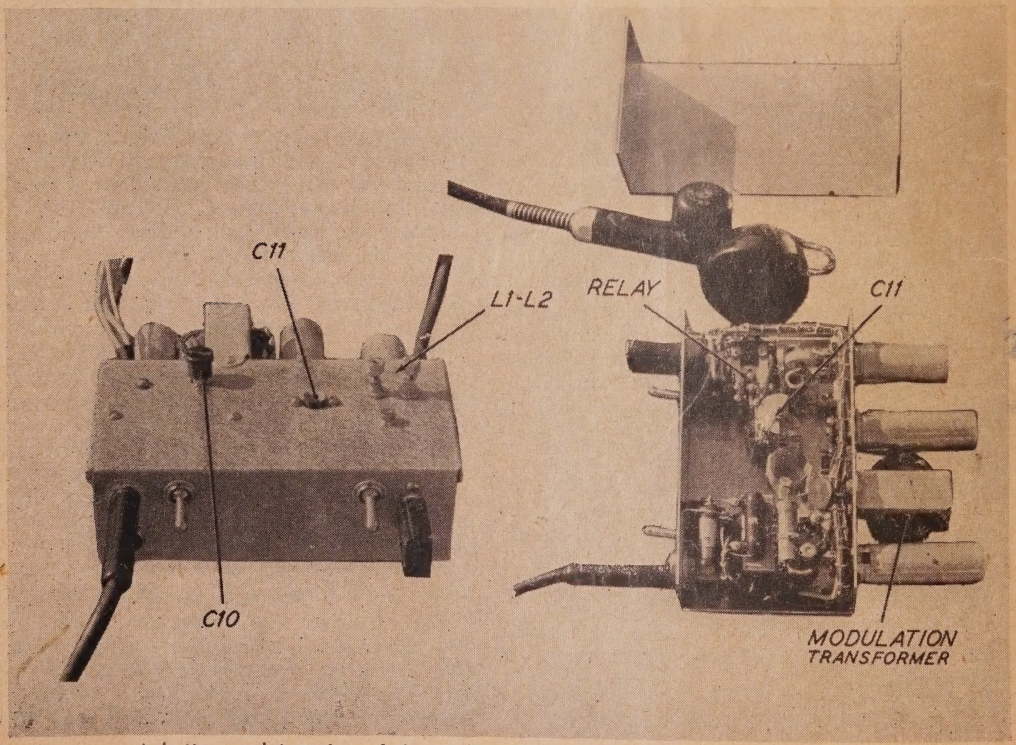
The *pi* network tank circuit is the same as in the *28-28*. It does a good job of helping the reduction of harmonics which cause TVI. It has the added advantage of matching almost any antenna within the impedance range of 50 to 1000 ohms.

The Audio Circuit

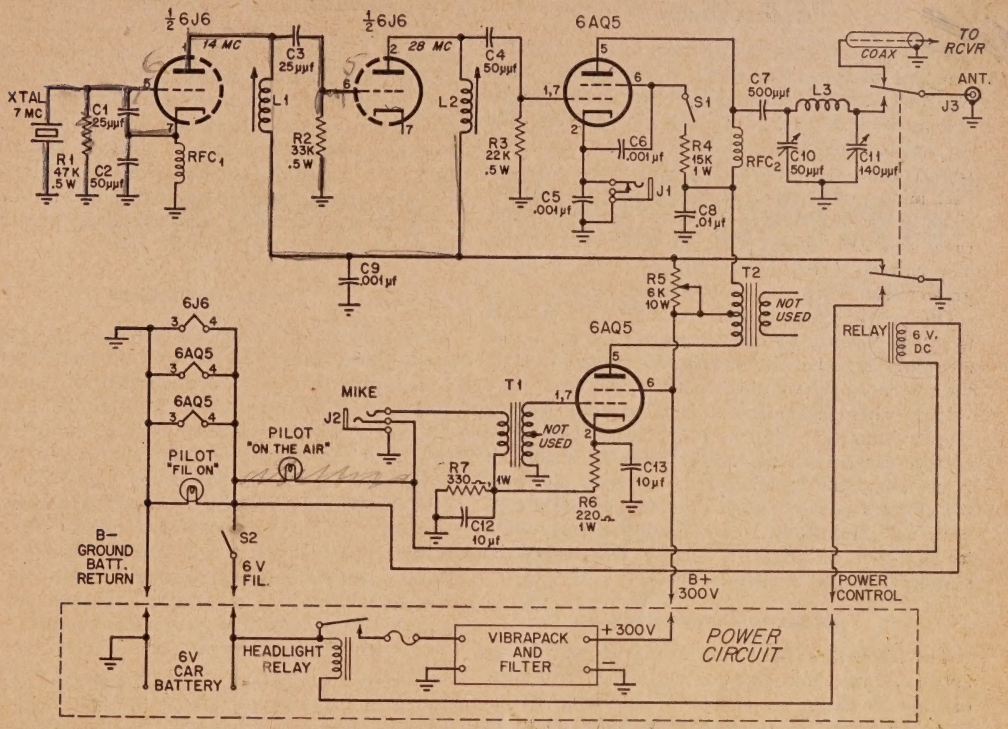
The audio system uses a carbon mike to drive the mike transformer. This transformer is a gem worth all your efforts to obtain. It acts as an effective speech-frequency band pass filter, as its high impedance secondary is in parallel resonance at 1400 cps. (The *Triad Transformer Co.* and the *Peerless Division of Altec Lansing Co.*, both in Los Angeles, make this transformer.) The center tap on the secondary is not used. The entire secondary with its voltage step-up ratio of 1:84 is connected in the grid circuit of the 6AQ5 audio amplifier. To eliminate the usual mike battery some of the 6AQ5 cathode current is fed through the mike by means of the resistor combination *R6* and *R7*. The mike voltage is 4½ volts with the mike switch closed.

In place of the usual modulation transformer, an inexpensive replacement grade push-pull output transformer is used. In this use the output or speaker winding is ignored. Almost any such transformer may be used, but it is wise to select one de-

1 A good 10-meter plate choke can be made by close-winding number 30 enamel wire over the full length of a high value (about 1 megohm) resistor whose body dimensions are ¼ inch O.D. by 1¼ inches long. The wire ends are soldered to the resistor pigtails close in to the resistor body.



A bottom and top view of the "28-9." This model does not have the meter in the center of the front panel.



Wiring Schematic of the "28-9"

R1—47,000 ohm, ½w
R2—33,000 ohm, ½w
R3—22,000 ohm, ½w
R4—15,000 ohm, 1w
R5—6,000 ohm, 10w adjustable
R6—220 ohm, 1w
R7—330 ohm, 1w
C1, C3—25 μμf ceramic
C2, C4—50 μμf ceramic
C5, C6, C9—.001 μf disc capacitor
C7—500 μμf mica
C8—.01 μf disc capacitor
C10—50 μμf midget variable
C11—140 μμf midget variable
C12—10 μf 25v electrolytic
C13—10 μf 25v electrolytic
J1—Closed circuit jack
J2—Signal corps 3 circuit jack
J3—"ANT" Motorola type jack
T1—Mike transformer, 1:84 turns ratio (Triad A-5X or Peerless K-007X)
T2—Replacement output transformer, see text (Chicago RO-304)
Relay—6v d.c. d.p.d.t. (Advance K1604 or Potter-Brumfield KR11O)
RFC1—see text
RFC2—Z-28 Ohmite (see text)
L1—28T #24 enamel (National XR-50 coil form or equal)
L2—13T #18 1⅛" long, ¾" dia. (B&W #3010)
S1, S2—s.p.s.t. toggle switch
Chassis—2⅛ X 3½ X 6½ inches LMB 138 (L.M. Bender Co., Los Angeles; or equivalent)

signed for 14,000 ohm plate-to-plate impedance, capable of 50 ma d.c. and whose primary d.c. resistance is less than 300 ohms. Equally important is that it fit the rear of the chassis. Using a transformer designed for 14,000 ohms plate-to-plate the impedance each side of center tap will be sufficient at the low frequency end (300 cps) for the 6AQ5 to develop full audio power. Since the audio and class C tubes are the same or similar, the "modulation" transformer should have a 1:1 turns ratio, hence the use of ½ of the primary for the audio side and the other half to the class C modulated stage. A Signal Corps type 3—circuit mike jack with its smaller opening is used to prevent confusion with the metering jack and to fit the *T-17b* mike plug.

An additional feature of this audio circuit is its use as a public address system for emergency use or to direct the activities of an outdoor hamfest. Switching the screen switch *S1* off, the class C stage is disabled unloading the modulator. Further, by switching a loud speaker horn to the previously unused speaker winding of the modulation transformer, 4.5 watts of audio is available for public address use.

The .01 μf disc ceramic capacitor *C8* in addition to being an r.f. by-pass capacitor also serves to attenuate the higher audio frequencies not required in speech communication. The overall response of the modulator is within the range of 300 to 3500 cps.

Control Circuits

The control circuit uses a relay actuated by the standard push-to-talk switch in the carbon mike. Since the *28-9* was planned solely for mobile operation in the family car, a d.c. relay is specified. The rig may be made to operate on a.c. or d.c. by merely replacing the d.c. relay with a 6.3 volt a.c. counterpart midget relay, connecting a 4 ohm, 5 watt resistor in series. With the series resistor, the a.c. relay operates equally well on either a.c. or d.c. The battery current drawn in this arrangement is greater than when using a 6 volt d.c. relay.

One set of relay contacts switches the antenna from the receiver to the transmitter during transmission. The other set of contacts is used to start the power supply and short out the r.f. driver plate voltage when the mike switch is released, permitting instantaneous break-in operation. Since the contact current in the midget relay is limited, it is necessary that another relay be used ahead of the vibrator power supply. For this purpose a conventional automobile single headlight relay with its built-in fuse is ideal. The fuse will protect the vibrapack in case of trouble.

Antenna Connections

The *28-9* works best with a quarter wave whip antenna. Since this antenna has a load resistance of only 36 ohms, an impedance matching section is recommended to raise the impedance up to 72 ohms. The matching section consists of a quarter-wave electrical wave length section (67 inches for 10 meters) of 52 ohm coax line with one end connected to the antenna and the other end connected to a 72 ohm coax line of sufficient length to reach the transmitter. Its use affords a better match to the *pi* network. Also, if the little woman objects to the conspicuous quarter wave whip, the automobile's regular BC antenna does a good job as the transmitting antenna. A *Motorola* type antenna plug and jack are used as the antenna connection. A short length of coax line brought out through the chassis connects the antenna to the receiving converter.

Plate Supply

The *28-9* was designed around the *Mallory VP 552* vibrapack which supplies 300 V. at 100 ma. This supply unit does not contain a power filter so one must be built or purchased. There are other vibrator power supplies available which have internal filters. The *VP 552* does a good job and is small enough to be placed almost anywhere on the firewall or under the dash with its filter. The headlight relay with fuse is essential to connect the vibrapack to the battery. The rig and power supply draw about 10 amperes from the car battery including filament and relay currents.

As a note of caution, W6FVA, who has the first-built 28-9, placed his vibrapack under the hood of his '51 Kaiser to isolate vibrator noise. The vibrapack lasted only a short time. The vibrator wafer socket burned out for some mysterious reason. After replacement, the same thing happened again and again. Finally W6FVA observed that the vibrapack would last until it rained, became foggy or until the car was washed. Because of its mounting, moisture collected on the vibrator and ran down into the socket causing a leakage path which eventually burned the socket, disabling the vibrapack. He placed the supply within a plastic bag, like those used to cover vegetables in the kitchen refrigerator, which kept the unit dry. Since then he has had no further trouble.

Tuning Procedures

With the screen switch *S1* open, a meter plugged in the jack reads only the grid current. Using a 7 mc crystal, *L1* and *L2* are adjusted for maximum grid current of 3 to 4 ma. Resistor *R5* may be adjusted to a lower value to increase the 6J6 plate voltage if additional grid drive is required. When switch *S1* is closed, the meter reads the total cathode current. With *C11* set at maximum capacitance, *C10* is adjusted for a current dip or a maximum reading on a field strength meter. If the class C amplifier cathode current is less than 50 ma, capacitance *C11* may be reduced and *C10* readjusted as before. The process is repeated until proper loading is achieved.

In some installations, an additional fixed capacitor of 100 $\mu\mu$f or so, placed in shunt with *C11* may be necessary to reduce loading to 50 ma cathode current.

Conclusions

The *28-9* has several advantages over similar transmitters. The filament and power supply drain upon the car battery is low, eliminating the necessity for a second battery to supply the mobile installation. It has full high-level modulation with speech band-pass quality audio. When signals are weak, a signal report as low as strength *3* is usually accompanied with a readability *5*. All the audio power is concentrated on the speech frequencies necessary in "getting through."

The complete circuit is simple and foolproof. When the leads are kept short, the usual "bugs" just don't appear. The control panel is an integral part of the chassis. The transmitter is small enough to be placed within easy reach beneath the dash of almost any car without sacrificing leg room. The appearance of the neatest car is not affected in any manner. It is easy to change frequency with the crystal socket accessible on the front of the chassis. Besides changing the crystal it is necessary only to readjust *C10*, the plate capacitor, in shifting frequency. In addition the use of the public address feature makes it a versatile mobile accessory.

Four *28-9* transmitters have been built and are doing a fine job. W6FVA has worked eleven foreign countries with his mobile installation. Maybe when you build one you can do better.

The Problem of Ignition Radiation

J. HOWELL GOFFE, W2BGF*

For the first time in any Ham publication CQ takes great pleasure in presenting some down to earth information on ignition noise and interference. We have always held the opinion that to solve a problem it should be thoroughly understood. Mr. Goffe's treatment of the subject is exceptionally readable and interspersed with good advice. —Editor.

It has oft been said of the weather, "Everyone talks about it, but no one does anything." In many ways this is also true of mobile radio noise suppression in the amateur fraternity. In the radio clubs, ham shacks, on fone and CW, the pros and cons of various noise suppression methods have been discussed, ballyhooed, and promoted. Seldom, however, has one of us succeeded in performing the necessary operations to our jalopies to turn the trick.

This is due, at least in part, to the lack of understanding of the phenomena of ignition, the part played by the several electrical components of an automotive ignition system, and the real source of ignition noise. It is the purpose of this article to outline the ignition system, the function of its parts, and to discuss the voltage curves produced, with an eye to discovering the sources of radio noise.

Let it be said at the outset that complete elimination of radio noise cannot be expected as the very nature of the ignition system is such that high frequencies must be produced else no ignition will result. There is ample experience in both the aircraft and the military vehicular field to demonstrate that the high frequency components causing noise cannot be eliminated without eliminating or deteriorating the ignition spark itself. Complete noise suppression is just that — suppression by shielding — rather than elimination. Compromise, however, may be struck between elimination and suppression. For the average ham's jalopie, sufficient elimination can usually be obtained to reduce noise, at least to a tolerable level, without the rigors of complete electrical shielding.

Where's the Noise?

From the noise generating point of view, the automotive electrical system may be divided into two sections; first, the generator/regulator system, and second, the ignition system. Radio noise may emanate from either or both of these systems. A quick test, however, will invariably indicate the guilty system. Operate the car at medium speed with your receiver on the frequency most affected by noise. Close the throttle and turn off key allowing car to coast in gear with clutch engaged. If noise continues, you're lucky, the trouble is in the generator/regulator system. If noise continues but with diminished volume, you're really in trouble, as both the ignition and generator regulator systems need attention.

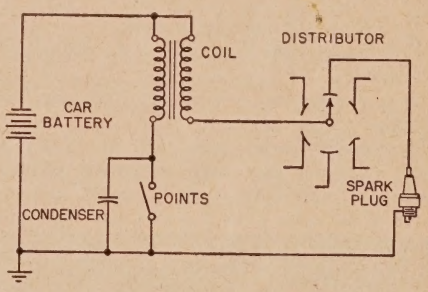


Fig. 1. The typical ignition system

A second test may also be made as follows. Disconnect the wire on the voltage regulator labeled "F," leaving it an open circuit. Again check car on the road as before. If the noise stops completely when key is turned off, you need not worry about "rolling" static. In the author's experience this has been a very rare source of noise and can usually be neglected.

Examining first the generator/regulator system, noise may emanate from either of these units. Generator noise is a result of sparking at the generator commutator and is distinguished by its characteristic sound. Its interference is denoted by a sound resembling a buzzing that increases in pitch with engine speed. Such interference can invariably be eliminated by a small condenser between the "A" (armature) terminal of the generator and ground.

*R.D. #3, Sewell, N. J.

Depending upon conditions, capacitance values from 0.05 to 0.5 μf usually suffice. Several cases of commutator noise may be due to dirty or rough commutator segments and/or poor fitting brushes. Maintenance by qualified people can clear up such difficulties.

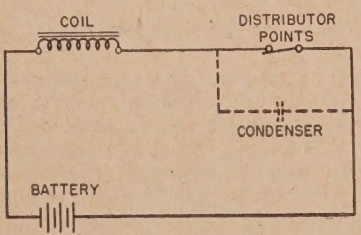
Your Regulator

Regulator noise can be identified as a regular crackling sound of even loudness. If in doubt as to identity, remove regulator cover and manually hold voltage coil relay contacts in the closed position. (Most regulators contain three relays. The odd, or smallest one; is the cutout relay. The other two are usually of the same type, the one wound with heavy wire is the current limiting relay, and the one wound with small wire is the voltage regulating relay.) Regulator noise should disappear when relays are held closed. Interference from this source can be eliminated by cleaning relay contacts and judicious use of condensers.

In most modern cars, regulators are merely switches in the generator field. In the most prevalent systems, the generator field is internally connected to the high side of the generator output. The other side of the field then goes to ground through the regulator to connect the generator as a self excited shunt machine. Generating rates are established by series resistances in this ground end of the field circuit with three charging rates possible:

1. No charge — cutout relay open.
2. Full charge rate — current and voltage relay closed.
3. Low charge rate — current or voltage relay open.

Intermediate charge rates are in reality the average charging rate with conditions changing between low and high charging rates from one moment to the next. Thus it is seen that the regulator is a switching device in the generator field circuit.

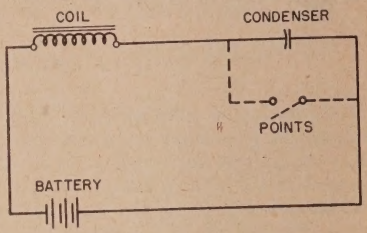


POINTS CLOSED

Fig. 2. Simplified primary circuit.

Noise suppression condensers may be put in the field circuit, if necessary, although two detrimental effects may result. It is possible that such condensers may increase the sparking at the regulator contacts thus requiring more frequent service. Also should the condenser develop a short, the field would go directly to ground producing full charge without the protection of the regulator, thereby subjecting the generator to overload and possible burnout. Should field circuit filtering be required, capacitances of about .002 μf usually suffice.

For really stubborn cases, other tricks may be resorted to. For example, a switch or relay may be used to open circuit the generator field during receive, or a resistance (usually a pot of about 30 ohms, 25 watt) may be connected from field to ground to manually control charging rate. However, such drastic steps are seldom required so you should not need to suffer from regulator noise interference. For the exact generator/regulator system used in your car, consult your service garage and ask to see the Shop Manual for the year and make of the family chariot.



POINTS OPEN

Fig. 3. Another position of the primary circuit.

Your Ignition

Having cleared up any noise from the generator regulator system, we will now turn our attention to the ignition system. In order to understand the problem we face, let us first examine the function of the system and its parts.

It is designed to take energy from the car battery and convert it to a spark of sufficient energy to ignite the fuel-air mixture in the engine cylinder. This is accomplished by magnetizing a piece of soft iron from the battery by d.c. current, then allowing the magnetic field to rapidly decay, thereby generating in a coil of wire of many turns, a very high voltage which jumps the gap of the spark plug igniting the fuel.

A typical ignition system simplified diagram is shown in *Fig. 1.* For the purposes of this discussion, we shall divide the ignition system of *Fig. 1* into primary and secondary circuits, and further, the primary into two circuits representing the two conditions that occur during one ignition cycle. *Figure 2,* then, represents the simplified primary circuit for the "points close" condition. This is the period of crankshaft rotation when the distributor breaker points are a closed circuit due to the position of the cam. This is also the "dwell" period. The angle during which the points are closed is the "cam or dwell angle."

It can be seen from examination of *Fig. 2,* that a simple series circuit is formed so that d.c. current flows thru the coil primary. This primary is a coil of wire wound around a soft iron core thereby forming an electromagnet. During the dwell angle, then, the iron core of the coil becomes highly magnetized.

As the engine crankshaft revolves so also does the distributor cam. Finally an angle is reached when the cam motion opens the distributor breaker points. The primary circuit configuration is then changed to that of *Fig. 3.* Now the condenser, previously shorted out by the points, is placed in series with the coil and battery thus blocking the flow of d.c. to the coil.

Remembering that the coil soft iron core was highly magnetized the split second before the points open, it can be seen that the sharp cut-off of the d.c. current leaves the magnetic field of the core unsupported so a rapid decay and collapse of this magnetic field immediately follows.

Let us now examine the results of the collapse of this field. The coil core is surrounded by two windings, the primary of few turns, and the secondary of many turns. In *each* of these windings a voltage is generated proportional to the number of turns, load, etc. Since the magnetic field is a decaying one, fundamental voltages will be of a fixed polarity and may not change. Transient, oscillatory voltages, however, are superimposed on the d.c. component and may cause a voltage polarity change. Generally accepted connections produce a negative spark (secondary) voltage and a positive primary voltage with respect to the car frame ground.

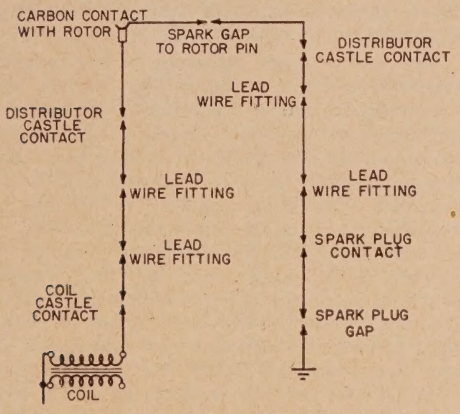


Fig. 5. Simplified secondary circuit.

Checking the effect of transients on the primary side first, examination of *Fig. 4,* a photograph of the primary voltage wave as it appears across the condenser, will indicate that a high frequency transient is established. This transient shown at "A" on the photograph is a highly damped wave with an a.c. component of approximately 100 volts peak value centered about a d.c. component of about 16 volts. This transient is the result of series resonance of the condenser and loaded coil. Radio noise found to be from the ignition system, that exists with antenna disconnected, is usually from this source, brought into the receiver by way of the tube heaters. Power supply filtering and heater by-passing is the cure.

The transient condition shown at "A" *Fig. 4,* continues so long as the spark continues to flow across the spark plug gap. When energy levels are reduced so low that they are unable to continue the spark, the spark current is stopped. This represents a loss of load on the secondary so that the effective value of inductance in the coil primary changes markedly with the result that the series resonance frequency of the coil and condenser is drastically reduced. This new frequency is shown at "B" in *Fig. 4.* It has an a.c. peak value of about 20 volts and is a damped wave centered about a d.c. value of 6 volts. This section of the ignition cycle is believed to be free of interference components.

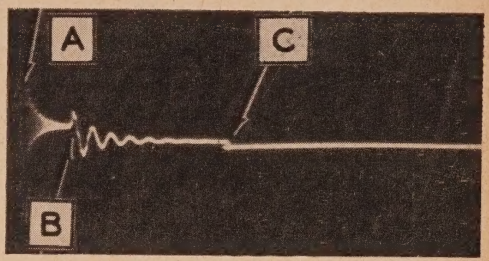


Fig. 4. The primary voltage wave as viewed on an oscilloscope.

As time continues the distributor cam rotates to a point where its action closes the breaker points, thus returning the primary to the circuit of *Fig. 2.* This point is indicated at "C" *Fig. 4.* The balance of the curve to the right of point "C" is the time when the d.c. is flowing in the primary and, therefore, represents the dwell angle.

Last but certainly not least, let us examine the voltage curves of the secondary circuit. The simplified secondary circuit is shown in *Fig. 5.* Since the oscilloscope photograph of *Fig. 6* is not complete in all details, a line drawing of it is given in *Fig. 7.*

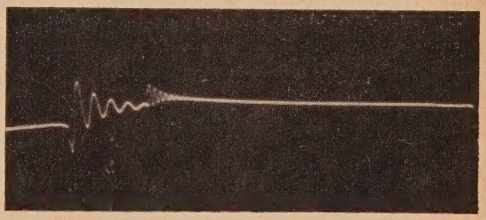


Fig. 6. Oscillogram of the secondary wave.

When the magnetic field of the soft iron core collapses a voltage is also generated in the many-turned secondary. This voltage rises fairly rapidly reaching peak value in about .006 seconds. As this voltage rises from zero towards its maximum open-circuit value, it eventually reaches a value sufficient to break down the insulation between the several sections of the secondary circuit, thereby striking the spark plug arc. The arc striking voltage value may vary from 2000 to 20,000 volts depending on the many variables involved. Once the arc is struck, however, it requires only a small voltage to maintain it, usually about 1500 volts.

It is the inherent quality of electric arcs to act as voltage regulators (VR tubes and the like); so also does the spark plug arc. As a result of this characteristic, the secondary voltage is "pulled down" from the striking voltage to the 1500 volt level. Referring to *Fig. 6*, the plot of secondary voltage vs time can be seen. Since the oscilloscope design precluded the inclusion of the striking voltage, a line drawing of the secondary voltage showing this is given in *Fig. 7*.

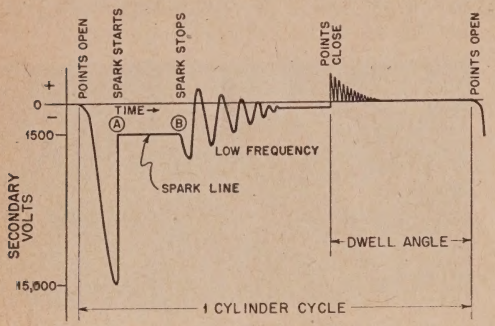


Fig. 7. Analysis of the secondary waveform.

The moment the arc is struck, the secondary voltage is very high, say 15,000 volts. The arc, however, limits the voltage to 1500 volts. Therefore, the secondary voltage curve drops with great rapidity from the 15,000 volt level to the 1500 volt level. The sharp corner made by the curve plot as shown at "A" on *Fig. 7*, results in the generation of a multitude of high frequency components, as those mathemetically inclined will know. HERE is the source of our radio noise.

The arc current continues to flow across the spark plug gap, finally going out at point "B" on *Fig. 7*, about 10° of crankshaft rotation after it started. The low frequency disturbance to the right of "B" is actually the series resonant oscillation of the primary previously discussed, shown in the secondary by transformer action in the coil. The "bump" about center of the curve is the "points close" signal, denoting the time of closing of the distributor breaker points. It can be seen as a transient condition.

The purpose of the coil is also two-fold. First, it converts battery stored energy to magnetic stored energy during the dwell period. Second, it converts the magnetic stored energy to a high voltage sufficient to arc across the plug, thereby creating heat energy to fire the fuel.

The purpose of the condenser can be considered as two-fold. First, it balances the inductive effect of the coil so that the coil-condenser combination appears as a resistive load thereby reducing or eliminating arcing at the breaker points. Second, since it reduces point arcing, it causes a rapid decay of primary current and hence a high rate of decay of magnetic field strength, thereby producing a very high secondary voltage.

Occasionally, due to condition of the spark plugs, engine factors, etc., the spark may actually strike and quench several times during its life. Should this occur high frequency harmonics are generated each and every time the arc re-strikes thereby seriously adding to the noise pattern.

The "Radiation" System

Actual radiation of the generated noise takes place from most components of the secondary system but especially from the arc itself and from the point of generation, the coil. As indicated in *Fig. 5*, there are many connections in the secondary circuit, each of which is a potential source of radiation. Therefore, *Item 1* on the list of "fixes" is the care of the many connections indicated, particularly the distributor *castle* contact and the coil *castle* contact. Experience has shown these to be the two most vulnerable spots for deterioration. It is strongly recommended that all high tension leads be soldered to the fittings, not just clinched in place.

The coil, even though in a metal can, frequently radiates noise. A piece of braid shielding, soldered to the can and securely grounded also helps. Run your power lead ground wire to the engine block rather than to the battery grounded terminal. More careful than usual maintenance of spark plugs will pay dividends in better performance, better mileage and less noise. Clean and file center electrode square so that it has sharp corners, then reset gap to manufacturer's specifications.

The use of series resistance in the secondary circuit is extremely helpful. This has the affect of limiting the rate at which the voltage falls from striking to arc conditions, thereby greatly reducing the high frequencies generated at this point. Usually a nominal 10,000 ohms resistance is used. In general, four methods are employed to introduce this resistance; (1) use of resistive ignition cable, (2) a carbon resistor in the distributor rotor, (3) resistance in the spark plugs, and (4) resistance "suppressors" in the high tension leads. Satisfactory results may usually be obtained by one or more of these methods. It might be well to note at this time that a resistance of 10,000 ohms measured by 6 volts d.c. may look like anything but that at 15,000 volts. Large differences, for example, have been noted using various types of "suppressors" all supposedly 10,000 ohms.

Occasionally, even after all reasonable steps have been taken to eliminate radio noise as outlined, the remaining level is still too high for satisfactory operation. As a last resort, a piece of sheet metal securely grounded by a suitable wire may be moved about the engine compartment over plugs, leads, coils, distributor, and generator as a probe to determine the remaining source of trouble. If found, the metal may be appropriately located to act as a shield to reduce the noise.

In general, noise can be reduced to a tolerable level on 10 meters (the worst frequency for interference), a very low level on 20 and 80 meters, and to zero noise on 2 meters by the methods outlined. Just like eliminating holes in a bucket, every leak must be plugged before final success. Good luck!

Mobile with the ARC-5/SCR-274

LT. PAUL H. LEE, W4RXO*

As the result of many requests for the conversion of war surplus gear. —Editor.

The writer has had the urge to "go mobile" for several years. However, lack of time for construction of homebuilt equipment, plus an unwillingness to spend the amount necessary for commercial gear have combined to prevent such action. However, the "bug" finally bit us very hard and we determined to work out a reasonable compromise. Conversion of the ARC-5/SCR274N series equipments offered an easy, extremely inexpensive, and neat looking installation.

In order to make the installation worthwhile from both the peacetime amateur and the Civilian Defense standpoint, an "all or nothing" approach was adopted, with phone operation on 3.9, 14, and 28 mc, by means of interchangeable units, as the goal. The purchase of three SCR-274N transmitters, three SCR-274N receivers, an MD7/ARC-5 plate modulator, a receiver rack, and a transmitter rack, gave us a good start. Included in the lot were one transmitter and receiver covering the 3.5-4.0 megacycle band, giving us the 3.9-mc phone band without the necessity of modifying the r.f. portions of these units. For the 14 and 28-mc bands, we used 4-5.3 mc transmitters, and 3-6 mc receivers. The latter were chosen because their i.f. frequency of 1415 kc offers a good amount of image rejection without sacrificing too much selectivity. The 4-5.3 mc transmitters were selected because of their lower cost.

The differences between the ARC-5 and SCR-274N transmitters should be noted here. The ARC-5's use shunt plate feed in the p.a. with an r.f. choke, while the SCR-274N's use series feed and no r.f. choke. This makes no difference in actual operation. Also, the size of the original power plugs at the rear of the chassis is different, as are the connections. Most racks on the surplus market fit the SCR-274N's, so if you happen to get an ARC-5 transmitter, it will be necessary to replace the larger power socket with a smaller one from an SCR-274N. These sockets are available on the surplus market. Of course, the best way is to get all ARC-5 equipment, or all SCR-274N equipment and racks to fit, and not attempt to mix the two.

Acquisition of circuit diagrams for these units is a necessity. Readily available sources of such information are the two volumes of the *Surplus Conversion Manuals*, and no attempt will be made to reproduce original circuit diagrams here. In all of the conversions we used as many of the original parts, and left as much of the original wiring undisturbed, as possible.



The author's Chevvy contains a three band installation using only war surplus materials. The antenna is the usual center loaded 75 meter whip.

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Power Source

The next matter for consideration was the source of power. After much careful thought it was decided to use 12 volts for several good reasons. First, the units are already equipped with 12 volt tubes, and require only the paralleling of filaments. Second, the low cost of 12 volt dynamotors outweighs the cost of an extra storage battery, and 12 volt dynamotors are easily obtainable from surplus. Third, use of an extra battery in series with the car battery places only half the drain on the car battery that would result from 6 volt operation. The extra battery can be located up under the hood in many cars. The writer obtained a battery mounting from a junkyard and installed it under the hood of his 1949 Chevrolet, on the left hand side, near the generator. Use of two extra batteries, with one out on charge while the other is in use, provides a reliable power source, and changing batteries has been reduced to a matter of but three or four minutes' time. Someone is sure to suggest the use of a 12 volt automobile generator at this point, but we did not wish to carry matters that far!

Basic Receiver Modifications

Now that the preliminaries are out of the way, let's get down to the actual conversion work. First of all, discard all the 28 volt receiver dynamotors, but save the mounting plates with attached snap fasteners. Mount DM-35 12 volt dynamotors on them, and replace them on the receivers. Then, make a short sleeve, slotted on both ends, out of 1/4" i.d. copper tubing, and use it as a coupling between the splined tuning shaft and a piece of 1/4" shafting to which a tuning knob may be attached. A spinner-type knob is very handy for this purpose. Fill the sleeve with some type of adhesive which dries hard, such as Duco cement, before fitting it snugly over the receiver tuning shaft. It will withstand rough usage without coming loose.

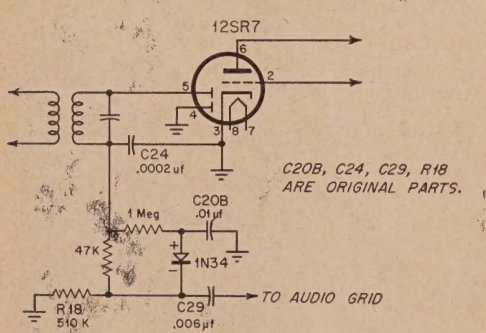


Fig. 1. The noise limiter circuit.

Remove the bottom shield and the front plug-in cover plate from each receiver. The latter may be thrown away, and a new cover plate made of scrap aluminum, for mounting the r.f. gain control and the BFO on-off switch. The r.f. gain control is a 50,000 ohm variable resistor. These two items may be connected to the proper pins of the recessed plug by merely soldering leads to the plug pins. The r.f. gain control should be connected between *pin 1* and *ground*, and the BFO switch between *pin 5* and *ground*. It will also be necessary to solder a jumper between *pins 6* and *7* to complete the filament circuit, as this was formerly accomplished through the plug-in cover that we threw away. Next, using care, clip all the leads from the power socket at the rear of the chassis except the following: *common ground*, *filament*, and *audio*. The red wires which formerly connected to *pin 4* of the old socket and which are the BFO "shut off" circuit, should be tied together and taped up. The remaining wires should be traced back to their origin and clipped out, as they will not be used. Next, trace the filament wiring, and connect the filaments of all tubes in parallel for 12 volt operation. Remove the bottom of r.f. stage grid resistor *R2* from the AVC circuit, and connect it to ground, to permit this stage to run wide open for increased gain. There are certain i.f. circuit differences between the ARC-5 and SCR-274N receivers, but they are of little consequence. In the ARC-5, the 2nd i.f. and a.v.c. tube is a 12SF7 instead of a 12SK7.

A word of caution is here in order. In any of the receivers, do not disturb the wiring between the 12K8 tube and the oscillator coil. In most sets these leads are fastened down with glyptal, and for a very good reason. Shifting these leads will greatly affect the oscillator frequency and stability. Hours of careful work can be ruined by movement of these leads.

A coaxial jack should be installed on the front panel in the place formerly occupied by the old antenna binding post. Merely drill a series of small holes around the circumference of a 5/8" diameter circle, and knock out the center. Use self-tapping screws to secure the jack to the panel.

Replace the 12SK7 r.f. and i.f. tubes with 12SG7's, to give greater sensitivity and gain. If you have an ARC-5, there is no replacement for the 12SF7 2nd i.f. tube, and you will have to be content with it.

At this point, we have completed the basic modifications for all receivers, and they are capable of operation from a d.c. power supply delivering 10-12 volts. Such a source of test voltage is a necessity for testing the receivers and transmitters on the work bench. The 3.9 megacycle receiver should now be tested and put aside.

Use of the station receiver during the conversion of the remaining receiver units is necessary, as it is a very simple matter to listen to the mobile receiver's h.f. oscillator in the station receiver and check its frequency as we make changes. Subtract 1415 from the h.f. oscillator frequency, and you will have the mobile receiver's operating frequency. To bandspread the 14 mc-band, the h.f. oscillator will have limits of 15,415 and 15,815 kc. For the 28 mc band, the limits will be 29,415 and 31,115 kc.

14 MC Receiver Conversion

Let's start on the 14 mc receiver. We have already performed the basic modifications. Remove

the top cover and the shield can over the variable condenser. The receiver may operate without these shields for rough frequency calibration. With a pair of long-nose pliers, carefully remove rotor plates from the variable condenser until only one rotor plate is left in each section. This should be the slotted plate, for tracking adjustment. Now turn on the power, and locate the receiver's h.f. oscillator by listening on the station receiver. The frequency will be much higher than it was originally, but we will have to go still further. Remove the plug-in coil unit from the bottom of the receiver, noting that it is polarized by the pin arrangement of the three coil plugs. Remove the oscillator coil from its shield can, and carefully remove the core from the coil. This should be replaced after rewinding, and its position is not too critical. Remove only the large winding of the oscillator coil, and rewind it with about 10 turns as a start, spacewound. The wire size is not critical. We used number 24 enamelled wire. Put the coil back in its shield, replace the coil unit in the set, and turn on the power. The h.f. oscillator should now be somewhere around 15 mc on the station receiver. Check the bandspread for approximately the correct limits. If you are very "foxy", you can use the original dial markings, with new figures, for the new frequency calibration. Slight adjustment of the number of turns, and the oscillator trimmers and padder, will give proper bandspread.

Tracking may be improved if necessary by bending the slotted sections of the tuning condenser rotor plate. Remember our limits of 15,415 kc (14 mc) and 15,815 kc (14.4 mc). Rewind the mixer and r.f. coils, using about 11 turns on each, spacewound. Rewind the mixer coil primary, using 18 turns of number 30 d.s.c., interwinding part of it with the secondary, to give increased gain. With the coils back in the receiver, and power on, adjustment of the trimmers should now bring in signals, using a short wire antenna. Slight changes in turns may be necessary, and adjustment of the slotted sections of the tuning condenser rotor plates may have to be made, to secure tracking of these two stages. Now replace the shield over the condenser, and fasten the coil unit securely in place.

Install the noise limiter circuit as shown in *Fig. 1*, in the ground return of the 2nd detector diode circuit. Replace the bottom cover. Use the station v.f.o. or frequency meter for final receiver calibration with the shield in place. The top cover may now be replaced, and the 14 mc receiver is ready for use. It is an excellent six-tube superheterodyne, capable of pulling in even weak signals with ease.

28 Mc Receiver Conversion

The conversion of the remaining receiver for 28 mc is performed in a like manner, but with several additional improvements. First, remove the octal r.f. socket, and replace it with a 7 pin miniature socket, for a 6AG5. Replace the 620-ohm cathode resistor *R1* with a 220 ohm resistor. Remove *C6* and connect the small ceramic bypass condensers (as shown in *Fig. 2*) with as short leads as possible. From the coaxial antenna jack on the front panel, run a short length of small coaxial cable to *terminals 1* and *6* of the oscillator coil socket, using *terminal 6* for the shield. Tie *terminal 6* to *terminal 3* to ground the shield. Connect the 6AG5 filament and the mixer stage filament in series and use a 6K8 as the mixer tube. Each tube draws 0.3 amps. filament current.

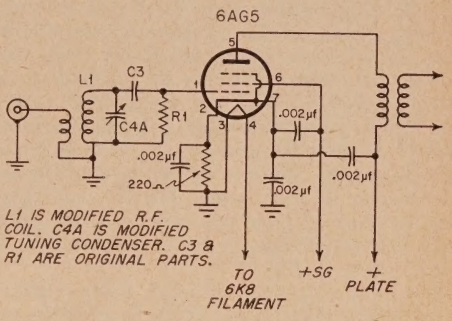


Fig. 2. The new r.f. stage.

Insert a 10,000 ohm 10 watt resistor between *R22* and *R23*, to increase the screen voltage to approximately 140 volts. Connect the filaments of the two i.f. tubes in series, and use two 6AC7's in place of the 12SK7's in these sockets. If you have an ARC-5, you will have to use the existing 12SF7 2nd i.f. with a 12SG7 1st i.f. The gain will be a bit lower than with 2 6AC7's. Install the noise limiter circuit as shown in *Fig. 1* in the ground return of the second detector diode circuit. Now, remove all but one rotor plate in each section of the tuning condenser, and use 6 turns on the r.f. coil, 5 turns on the mixer coil secondary, 9 turns on the interwound mixer primary, and 5 turns on the oscillator coil grid winding, all spacewound. Wind a one-turn link of insulated wire over the ground end of the r.f. coil, and connect it to *terminals 1* and *6* of the coil plug.

Using the station receiver, VFO and frequency meter as before, align the receiver for 28 - 29.7 mc coverage. In this case it will be easier to make a new dial plate than to attempt to make the receiver track to the old markings. As before, the final adjustment should be made with the condenser shield cover, and bottom cover, in place. The preceding paragraphs cover in a few words many hours of work, but the results are well worth the effort. We now have a receiver that is hard to beat for sensitivity and good signal-to-noise ratio on 28 mc.

3.9 Mc Transmitter Conversion

Conversion of the 3-4 mc transmitter for 3.9 mc phone is quite easy. This portion of the work is also the basic conversion for the other two units and it should be done simultaneously in all units.

Remove the top and bottom shield covers, and the oscillator cover. The common ground, filament, p.a. plate, oscillator plate, p.a. screen and antenna relay leads should be connected to the power socket at the rear of the chassis as shown in the diagram, *Fig. 3*.

Remove the old antenna relay, and the feed-thru insulator associated with it, and install two coaxial chassis-type connectors for the antenna connections. From the bottom of the unit, remove the ceramic-insulated keying relay, and by rearrangement and bending of the contacts, make it over into a new s.p.d.t. antenna relay, and mount it in the holes on the front panel where the old one was mounted. Rewinding is not necessary, as it will operate on 12 volts. Now, go back under the chassis and install a closed circuit jack for p.a. plate current measurement in the lower left corner of the front panel. Connect the ungrounded side of this jack to the cathodes of the 1625's, and bypass *both* ends of this lead to ground with 0.001 μf mica condensers. Rewire all tube filaments in parallel, and remove and discard the 126-ohm resistor mounted in clips on the rear of the chassis. The 20-ohm resistor may be removed from the oscillator plate voltage lead. The circuit diagram of the completed 3.9 mc. unit is shown in *Fig. 3.*

One word of caution is in order. Before replacing the oscillator shield in any of the transmitters, take a piece of transformer cloth or other suitable, good, insulating material, and pass it down between the secondary and primary windings of the oscillator coil. Occasionally, one of the primary leads, as it comes thru the coil form and passes down to the terminal block, may rest against the secondary winding and may break down intermittently after the unit heats up. This fault may be recognized by a very rough, off-frequency signal, and it caused the writer much consternation until the trouble was located after several hours of work.

The 3.9 mc unit may now be tested, after replacing the oscillator shield cover and the top and bottom shields. Use a source of 10-12 volts d.c. for the filaments and 250 volts for the plates, with a 5000 ohm dropping resistor for the p.a. screen voltage. If you are lucky enough to have a unit with the calibrating crystal still in it, you may use it and the magic eye tube for calibration. Without the crystal, the station receiver and frequency meter may be used.

The rotating antenna loading coil is left in the circuit, to permit use of the unit with a wire antenna should the occasion ever arise. However, it should be set at *zero* for operation into coaxial feedline.

14 Mc Transmitter Conversion

The conversion of the 4-5.3 mc transmitter for 14 mc is based upon retaining single dial control, using as many of the original parts as possible, and the use of only one doubler stage. The circuit shown in *Fig. 4* is the result.

First, perform all the basic modifications as described under the 3.9 mc portion of the conversion. Then, change the oscillator of this transmitter to bring it to 7 mc, with bandspread, using the existing dial calibration markings with new figures. The outside winding of the oscillator coil should be reduced to 12 turns by removing turns from the top only. The oscillator tuning condenser located under the chassis should have all but 2 rotor plates removed. One of these remaining plates should be the slotted one for tracking adjustment. Now, at the coil terminals under the chassis, move the grid leak tap from the center of the secondary to the bottom end. Disconnect and discard the p.a. neutralizing condenser. Strip out all wiring and small resistors associated with the crystal and 1629 magic eye tube sockets, and remove the 1629 socket.

The doubler coil is wound of 11 turns of number 24 enamelled wire, spaced to occupy ½" length, on a 5/8" diameter slug tuned form. The crystal

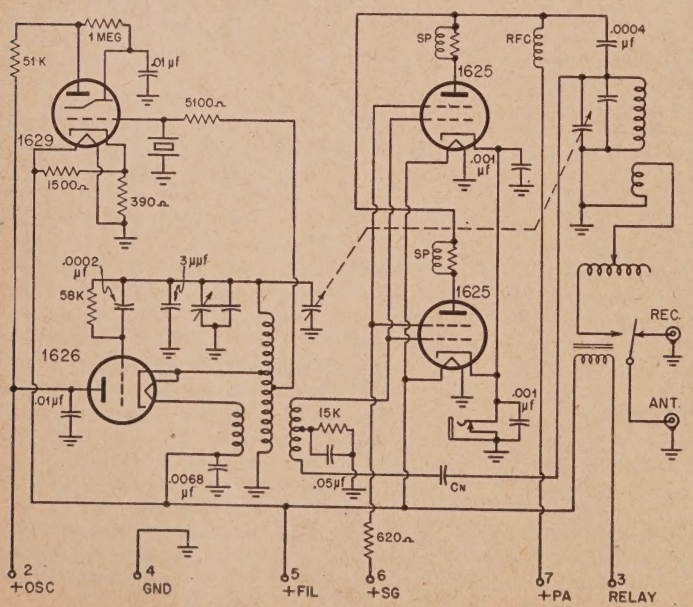


Fig. 3. The 3-4 mc ARC-5 Conversion. This particular transmitter is used on 75 meter phone with considerable success.

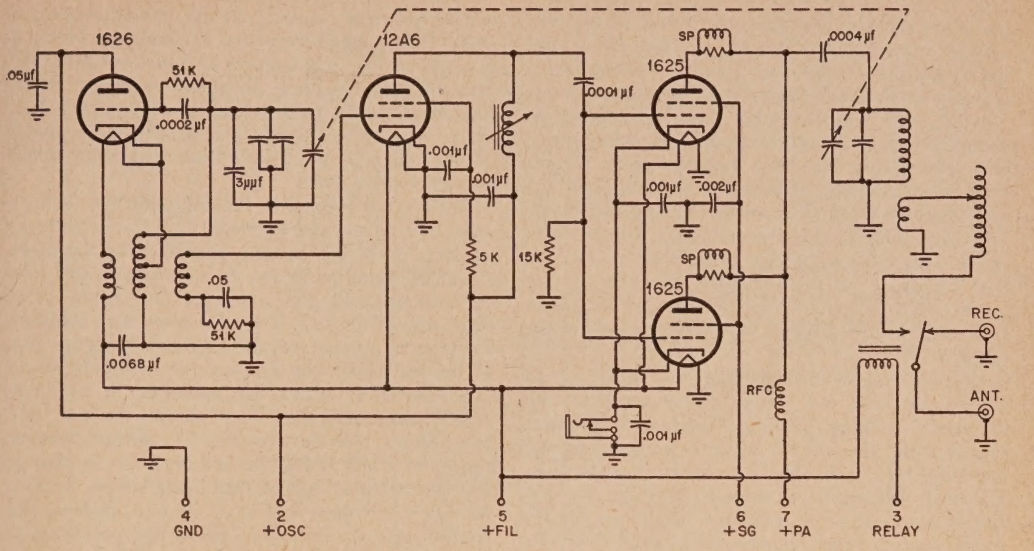


Fig. 4. The circuit of the 14 mc transmitter. The plan here was to use as many of the original parts as possible from a 4-5.3 mc unit.

socket is used for the 12A6 doubler, and the doubler coil is mounted by means of an "L" bracket under the chassis with its adjustment screw sticking up through the vacant socket hole. Wire the doubler stage as shown in the diagram. Now attack the p.a. plate tank circuit, and rewind the coil with its own wire, using only 5½ turns, double-spacing them in the existing grooves. Carefully pull out rotor plates from the p.a. variable tuning condenser until only two are left. Loosen the set screws holding the rotor of the fixed tank condenser, and remove all but two rotor plates. Now the p.a. plate tank on 14 mc will track with the oscillator on 7 mc, giving us our single dial control. The rotary antenna coil may be left in, for use with a wire antenna, or removed, as desired. It should be set at *zero* for coaxial feed, if it is retained.

The transmitter is now ready for test. With plate power applied to the oscillator and doubler only, set the transmitter dial to the desired frequency, say 14 mc, and adjust the fixed oscillator tank condenser under the shield can (it will be necessary to loosen the set screws holding the rotor, and then replace the shield) until the signal is heard in the station receiver on 7 mc. Its harmonic may be heard on 14 mc. Next, check the bandspread, and adjust the slotted rotor plate in the variable condenser under the chassis until proper dial tracking is secured. In the W4RXO transmitter, the new dial markings correspond to the old as follows: 14-4.0, 14.1-4.2, 14.2-4.4, 14.3-4.6, 14.4-4.8. A little painstaking work here will make it possible for you to read frequency directly, and may save you a "pink ticket" from the FCC later on. Slight adjustment of the tuning slug in the oscillator coil may be necessary for proper bandspread or tracking. Once the adjustments have been made, the oscillator should be perfectly stable and should give no trouble.

Now the p.a. may be adjusted. With 250 volts applied to the p.a. plates and the 5000-ohm series dropping resistor supplying the screen voltage, tune the p.a. to resonance by adjustment of the fixed tank condenser under the chassis. Some slight adjustment of the slug in the p.a. coil may be necessary for perfect tracking. Once this condenser is adjusted it may be locked and forgotten, and the p.a. will track with the oscillator over the whole band. Replace the top and bottom shield covers, peak up the doubler coil for maximum drive to the final, and make final frequency adjustments through the holes provided for that purpose. The job is now finished.

28 Mc Transmitter Conversion

This conversion is very similar to the 14 mc job, as may be seen from the diagram, *Fig. 5.* In this case, we bring the oscillator to 14 mc and use one doubler stage to go to 28 mc. For those who may have their doubts, let us state that the oscillator is as stable on 14 mc as it ever was, and also the p.a. operates perfectly on 28 mc, although unneutralized.

Make all the basic modifications as in the 3.9 mc unit. Then remove the 1629 socket, and all parts associated with the crystal calibrating circuit, as in the 14 mc set. The doubler coil in this case consists of 6 turns, spaced to ½" length, on a ⅝" slug tuned form. The doubler coil is mounted as in the 14 mc set, with its adjustment screw sticking up through the vacant socket hole. The oscillator coil is cut down as follows. Remove turns from the top of the coil, leaving 1⅔ turns above the cathode

tap. Then remove turns from the bottom of the coil, leaving 4 turns below the cathode tap. Be careful not to damage the fine-wire filament winding which is interwound. Remove turns from the bottom of this winding, until 4 turns are left. This latter operation should be done by cutting a turn, removing turns, and splicing the wire ends together again, rather than by attempting to pass the wire through the hole in the form and down to the terminal block. It is impossible to take the coil apart without ruining it, so we do it the easy way. Next remove all but 3 plates from the oscillator tuning condenser rotor under the chassis, and all but 7 rotor plates from the fixed oscillator tuning condenser above the chassis.

Remove and discard the p.a. neutralizing condenser and leave the bottom of the oscillator coil secondary winding floating. Wire in the doubler circuit. Note that an r.f. choke is necessary in the p.a. grid leak lead. The p.a. circuit modifications are next. We made no attempt to make the p.a. tuning track with the oscillator, as the p.a. tuning under load is broad enough to give good results within several hundred kilocycles of the operating frequency. If it becomes necessary to retune, this is easily done with a screwdriver. With a little cussing and some carefully applied brute force, remove the gear from the p.a. tuning condenser shaft. Yes, it *can* be done! Remove both rotor and stator plates from the p.a. tuning condenser until a total of 11 plates are left. Then drill a ¼" hole in the side of the chassis so that the shaft may be turned with a screwdriver. The old p.a. fixed tank condenser is left unchanged, and is used as the antenna loading condenser, in series with the link. The small parasitic suppressors should be removed from the old tank coil and reused in the 1625 plate leads.

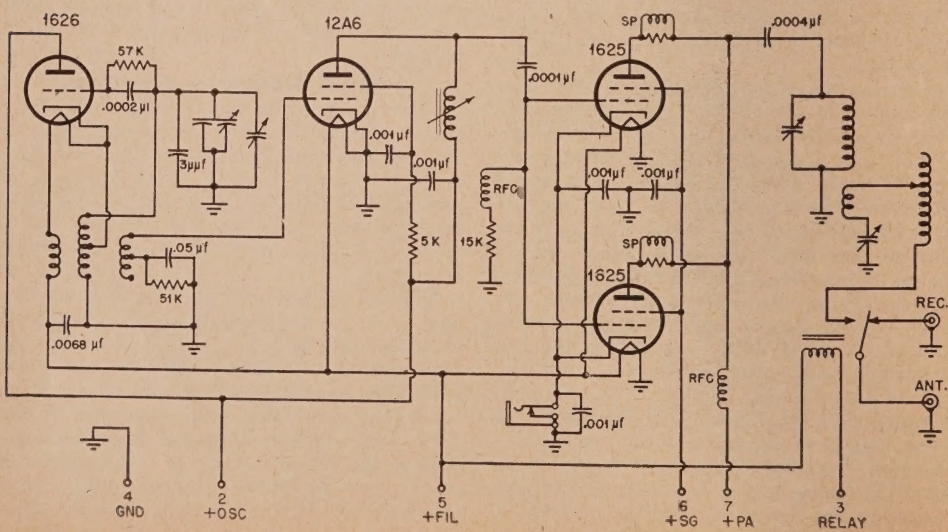
The new tank coil is airwound, consisting of five turns of #12, 1" long, and 1" diameter. The hot end of the coil connects to the tuning condenser stator thru a small feed-thru insulator on which it is mounted. The link consists of 3 turns of #12, ⅞" diameter, and should be mounted on another feed-thru insulator, near the ground end of the tank coil. Once adjusted for proper loading, it may be fixed in position and left alone. Note that shunt plate voltage feed is used.

Apply plate voltage to the oscillator and doubler only, and adjust the oscillator to 14.5 mc in conjunction with the station receiver. Its harmonic should be found on 29 mc. It is simpler in this case to disregard old dial markings and either paint them out, or make a new dial plate and calibrate it, than to attempt to align the oscillator to any of the old markings. Replace the oscillator shield can and again adjust the oscillator to 14.5 mc. Apply plate and screen voltage to the p.a., and tune the p.a. tank to resonance. The antenna loading condenser shaft should be left unlocked so that it may be adjusted in the final installation. Replace the top and bottom shields on the unit, peak up the doubler circuit, and again adjust the oscillator to frequency, and calibrate the tuning dial from 28 to 29.7 mc. The conversion is now complete.

Power Supply and Modulator

The original ARC-5 modulator also has the 575 volt dynamotor mounted on it. This is a 28 volt machine; it is useless to us and may be discarded. Save the mounting plate, however, and mount a DM-34-D 12 volt machine on it. The output of this dynamotor is 625 volts, which is just fine for our purpose. Strip out the tone oscillator, and install a VR-105 in the old 12J5 socket. Replace the two large 15,000-ohm resistors with two 5000-ohm resistors of the same size, and connect these in parallel. Remove all cable sockets except the one with 12 contacts. Cover the vacant holes, and mount a

Fig. 5. The 28 mc conversion is somewhat similar to the 14 mc transmitter.



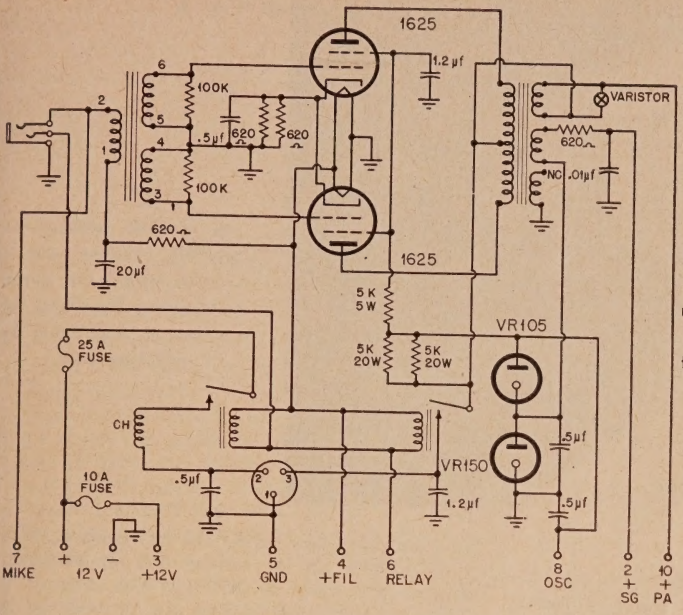


Fig. 6. The final modulator schematic. Note that this unit now supplies the power to the oscillator through the voltage regulator tubes.

heavy terminal block for the 12 volt leads from the battery. Rewire the 12 volt lines to the dynamotor plug with #12 wire. The relays will operate on 12 volts with slight adjustment of the contact springs. The final circuit of the modulator unit is shown in *Fig. 6.* Note that this unit supplies both plate and screen modulated voltage to the power amplifier, as well as unmodulated, regulated voltage to the oscillator. We chose plate and screen modulation rather than simple screen or clamp-tube modulation because we wanted to get the most out of our transmitter. With only 60 watts input, every watt of modulated output counts, especially in mobile operation.

The circuit of the remote control box is shown in *Fig. 7.* It contains the *receiver on-off* switch, which turns on all filaments and the receiver dynamotor, a transmitter *plate on-off* switch, a *phone-speaker* switch, a *volume control,* and a *loudspeaker.* All this is mounted in a metal box about 7" x 5" x 3" deep. The handset plugs into the two jacks. The handset has both microphone and receiver in it, together with a push-button for transmitter control. A loudspeaker silencing relay is also included in the control box, and it is connected so that it silences only the speaker. Thus the handset receiver may be used to monitor one's own signal if desired.

The control circuits are shown in *Fig. 8.* Terminal numbers are shown. It is best to purchase the plugs which fit the various cable sockets on the racks and modulator unit. They are listed here for those who do not have instruction manuals which give this information.

ARC-5 Modulator ——— 9589
SCR-274N Receiver Rack — PL-152, PL-151
SCR-274N Transmitter Rack — PL-154, PL-156

If you are not able to find these plugs, the sockets may be removed and standard octal fittings substituted.

Installation

The W4RXO mobile instalation is in a 1949 Chevrolet sedan, with the modulator unit in the right rear fender cavity in the trunk. This saves most of the usable trunk space. The cables go through a hole behind the rear seat, which is thus concealed, and run under the front edge of the rear seat, under the floor mats alongside the hump in the floor, and up to the front bulkhead under the dashboard. The receiver and transmitter racks are bolted together and are mounted under the dashboard. This makes a very neat mounting and enables a quick change of units when changing bands. The control box mounts under the dashboard, on the driver's side. The handset is hung on the dashboard in a mounting bracket made of copper tubing. The transmitter plate current meter is plug-in, and is used only in tuning up and testing.

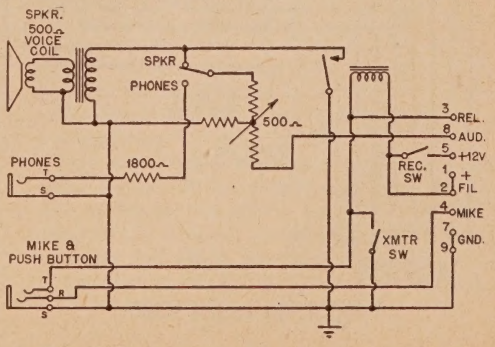
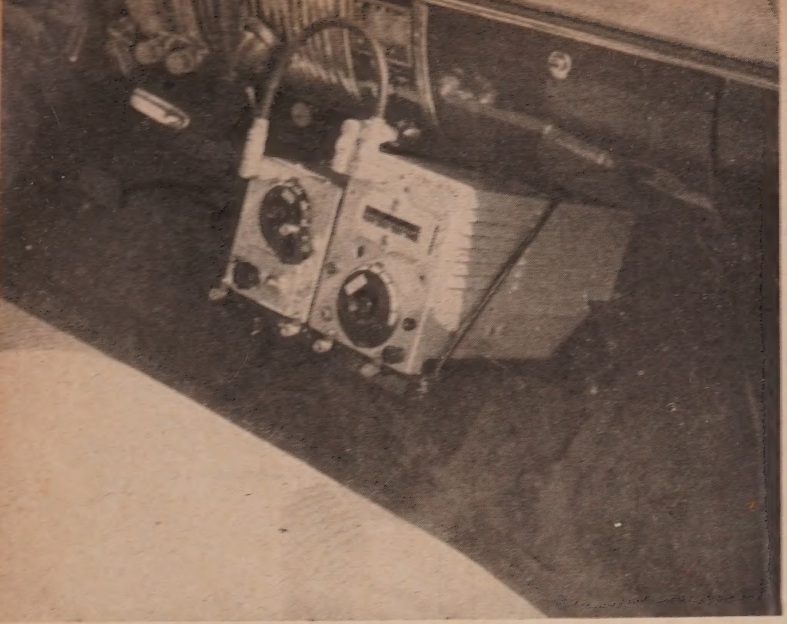


Fig. 7. The control unit is from TCS surplus.



The finished product — a sensitive receiver and a stable moderate power transmitter. Provisions for working on three bands by switching units.

Antenna

The writer decided to use a standard, manufactured, center-loaded whip, with replaceable loading coils, for quick band-change. It is mounted on the left rear fender, as high as possible, and is fed through RG8/U coaxial line with the shield grounded to the car body at the base of the antenna. Once the loading coils are cut to size with the aid of a grid-dip meter, no further adjustment is necessary. We found that removing the coil shield gave a stronger signal on 75 meters. If this is done it will be necessary to rewind the coil with smaller wire, because more turns will be required. Also, on 75 meters, cut the loading coil for maximum transmitter loading at 3970 kc. The drop-off in loading as you QSY to 3800 can be made up by running in about 5 or 6 turns of the variable loading coil in the transmitter. If you cut your antenna coil for 3900 kc, there is no way to make up the large drop in loading which occurs as you QSY to 4000 kc.

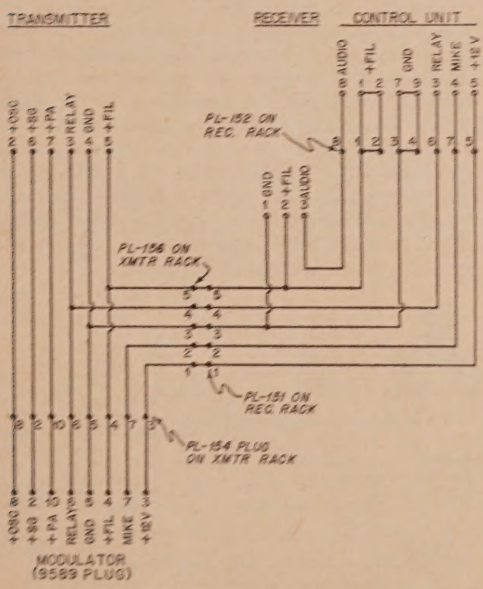


Fig. 8. The control circuits

That completes our mobile installation. One final word of caution—use a heavy lead between the batteries, and from the batteries to the modulator unit, and a short heavy jumper from the modulator unit to the car frame, in order to keep voltage drop in the 12 volt circuit to a minimum. The loss should be no more than a fraction of a volt under full load, and this can be accomplished with sturdy, heavy, leads, plugs, and connectors. Suitable battery cable and connectors may be obtained at any automobile supply store. In our car, the negative terminal of the battery is grounded to the frame. Should your car have the positive grounded, it will merely be necessary to reverse the dynamotor's low-voltage leads. To make the connection to the car battery from the extra battery, drill and tap the positive (or negative, as the case may be) battery post to take a ¼-20 screw, about ½" long. The lug on the jumper cable may thus be securely bolted to the top of the battery post, without disturbing the car wiring in any way.

With the antenna described, each of the transmitters may be easily loaded up to 100 milliamperes plate current, at about 575 volts. A husky, well-modulated signal is put out by this installation, and results are limited only by band conditions and the amount of high-powered QRM that piles up on our frequency. We have worked 1000 miles on 75, and all U. S. districts and several foreign countries on 20 and 10 at the present writing.

The Center Loaded Antenna

A. J. URYNIAK, W2RJL*

This is required reading for anyone that intends to try to tune a center loaded mobile antenna, or would you rather do it the hard way? —Editor.

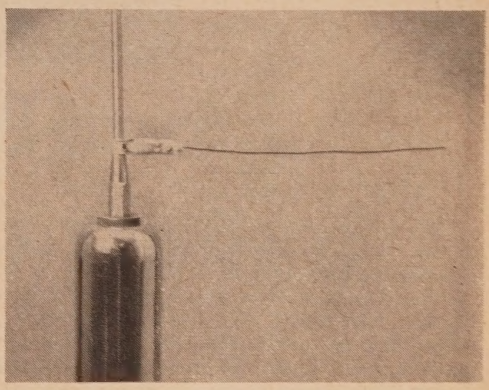
No doubt every owner of a mobile station has given his antenna a critical look and wondered to himself what would happen if he did this, or did that, or maybe took a turn off the loading coil, etc. Sure, we all have that feeling sometime. In even more vulnerable condition is the fellow who has yet to tune his whip. I have been through the mill and I hope that the results of my experience will be as helpful to you as they would have been to me When I started trying to tinker with the *Master Mount mobile* 75 meter center-loaded antenna.

The problem is that of tuning the antenna to a desired frequency of resonance. Just about any change that is made in the antenna results in a change in its resonant frequency. Worse than that, even the feedline and the proximity of other cars will change the resonant frequency (hereby abbreviated f_r).

The first approach to tuning the whip was to prune the loading coil to 3995 kilocycles (New York State Civil Defense frequency) while it was installed on W2QJN's car. Moving the antenna coil to my whip changed the f_r to 3950 kc. Since the antennas were mounted in roughly the same part of the two cars the variation was apparently due to the difference in feeder length: W2QJN, having his transmitter in the trunk of his car only had about 18 inches of feeder, my transmitter is under the dash and has about 21 feet of coaxial feeder.

The center-loading coil will change the f_r if it is turned upside down. The coil should be pruned from the top for the highest frequency desired (3995 kc in my case), then, when it is inverted, the frequency drops 70 to 75 kc. (3920 kc in my case). A second coil, pruned to 3880 kc, resonates at about 3810 kc. when inverted, giving me a wide choice of basic operating frequencies. K2BS happened to be passing through town one day so I pruned his coil to 3958 kc with the alternate falling on 3890 kc, 68 kc lower. The fr of the coil goes up from 15 to 20 kc for each turn removed and seems to be quite linear. When the coil is through being pruned it is wise to use some #33 Scotch tape to hold the turns in place. The tape will stretch so be careful to draw it tight. It is not necessary to tape the entire coil, only the top end few turns where wire has been removed in the pruning process, leaving room for the remainder of the coil to spread out if the end is not taped. This spreading out results in a change of loading from day to day. If you want to hit a specific frequency (by reason of crystal control, net operation, friends, or perversity) all you have to do is prune the coil until you are close to the channel, then spread out the last few turns for fine tuning on the last five or ten kc.

Next a series of tests were made to determine what effect the changing of the length of the whip had on the f_r. The lower half o fthe antenna was made two feet longer by means of a piece of brass pipe; this increased the f_r 20 kc. The two foot section was then changed to the top half of the antenna, resulting in a drop of 305 kc in the f_r. When both the top and bottom sections were extended two feet the resultant f_r was the sum of the two individual changes: plus 20 kc and minus 305 kc, or 285 kc lower. The total extension of four feet did not seem to make much difference in the signal strength at a distance of four miles although W2FJN reported a possible one "S" unit improvement.



Possibly the "simplest" expedient to tune your mobile antenna—clip on a "pig-tail."

Just how does that attractive metal coil shield affect things? It was removed and the frequency shot up 160 kc, that is how it reacts. W2TPM, 200 miles away, reported no change in signal strength when the coil shield was removed. Even the polystyrene disc at the bottom of the coil will raise the fr of the antenna if it is made thicker.

*826 Warren St., Utica 4, N. Y.

Tests with W2UJR, about 250 miles away, indicated that the antenna is quite sharp in frequency response, and should be retuned if the transmitter frequency is changed much over ten kc.

Bridges and tunnels seem to affect the transmitted signal just the same as they do broadcast signals, save your breath when going through them. I don't know what happens to the resonant frequency of the antenna, guess it just goes away. Even a truck near the antenna will upset the tuning.

Pig Tails

So far the tuning of the antenna is all well and good, but not flexible enough. Some simple means of tuning the antenna to other frequencies is desirable. After all, you don't want to have to take the coil apart and change it every time you change crystals. A simple solution to this problem is the clip-on piece of wire, a short piece of #20 enamel wire on a *Mueller #45* clip which is clipped just above the coil on the antenna itself, not on the threaded coupling between the coil and the antenna. Several lengths of wire were tried so that a rough idea of the change in f_r could be correlated with the change in the wire.

Length of Pig-tail	Resonant Frequency	Drop in Frequency
—	3910 kc	—
5"	3895 kc	15 kc
7"	3880 kc	30 kc
8"	3870 kc	40 kc
9"	3860 kc	50 kc
11"	3840 kc	70 kc

Thus you can see that the antenna can be matched to almost any frequency just by using a pair of wire cutters and a grid-dip meter.

While playing with the pig-tail clip several other positions were tested. The five inch pig-tail was clipped in a horizontal plane just above the coil, lowering the f_r from 3910 to 3895 kc. The same clip was then moved to the top of the whip, still in the same plane, lowering the frequency to 3860 kc. When the pig-tail was turned to the vertical plane (extending the height of the antenna five inches) the resonant frequency went still lower, to 3853 kc. Reports from W2FJN, eight miles away, indicated that the pig-tail did not affect the signal strength.

A *Mueller #24A* clip was clipped under the bottom of the coil cover, resulting in a lowering of the f_r of 20 kc. The length of the pig-tail wire on the clip seemed to make very little difference in the frequency. This surprised me for I thought that the frequency would go up when the tail was clipped just as it did when attached above the coil.

Extra Hints

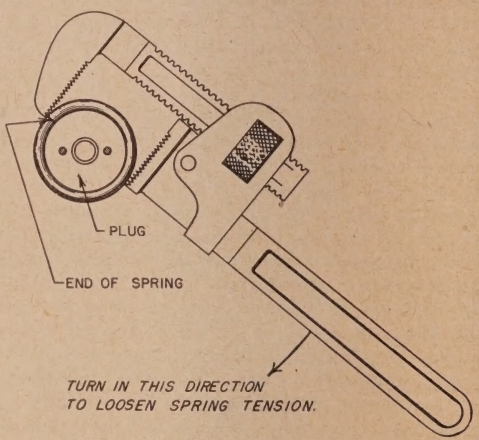
The easiest method of tuning the antenna is to use a grid-dip meter, however, a VFO will usually do the job satisfactorily, providing you don't have an antenna tuning network between it and the antenna. For tuning procedure it is best to couple the antenna directly to the transmitter so that the impedance of the antenna will vary the loading of the rig. In this way the VFO can be swung up and down the band to find the frequency of maximum loading.

The receiver here is a *Gonset Tri-Band* mounted just to the right of the drivers' knee. The rig is a homemade affair using a 6AK6 VFO, a 2E26 final, and a 1635 modulator. The power runs from 20-25 watts input and is supplied by a dual Vibrapack mounted in the engine compartment. The 75 meter *Master Mount* mobile antenna has given me good reports from almost half of the states, and even from Canada.

Spare Parts

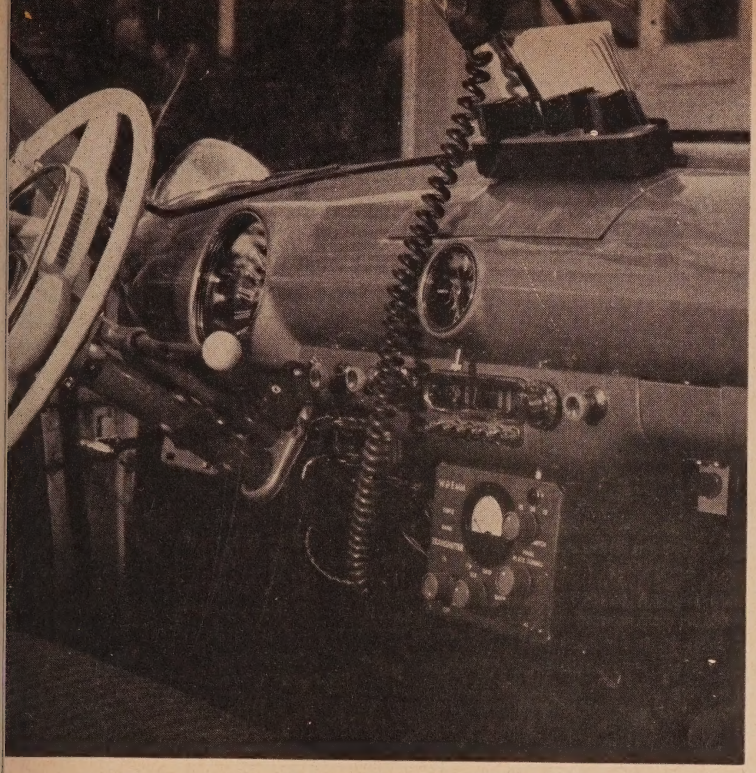
De-Assemblying The Mobile Antenna

Many spring-supported mobile antennas are secured to the mounting bracket by means of a threaded metal plug screwed into the lower end of the spring. Sometimes it becomes necessary to remove the spring from the mount, as when the braid inside the spring breaks. Usually the plug is provided with a couple of holes for a spanner wrench, but these are not of much help unless the spring is loosened in some way. Since the spring itself forms the "threads" into which the plug screws, turning the plug merely wraps the spring more tightly around the plug. If the spring tension can be relieved, the plug can be removed easily by hand.



A simple method of relieving this spring tension employs an ordinary pipe wrench which is usually available in the average household. With the antenna end of the mount secured in a vise, the jaws of the wrench are opened to fit over the spring and the wrench is held in the position which would be used if the plug were to be screwed *into* the spring. The end of the spring is caught with the tip of the fixed jaw on the wrench, while the movable jaw bears on the spring one half turn from its end. Pressure applied to the wrench will now tend to "unwind" the spring and will relieve the tension which normally holds the plug. The plug can then be removed easily, usually without a wrench. A similar procedure can be used to start the plug into the spring, if necessary, when the mount is reassembled.

R. H. Houston, W3MAX



This is a complete 15 watt transmitter with band switching. It is easy to build and a pleasure to operate. Note how the author has a number of crystal mounted in a box on the dash.

Triple-Band Crystal Controlled

DR. JAMES Y. NAKAMURA, WØEMM*

The mobile transmitter poses many special design problems that are not found in the home rig. It should be as small as possible, use as little current from the battery per watt output as possible (efficient), be neat, be easy to remove for servicing, operate on 10, 20, and 75 meters, have bandswitching, be easy to tune, and easy to build. The unit described here easily passes on all these counts. The entire three band transmitter measures only 6¼" x 6¼" x 4¾", slightly larger than the *Gonset* converter. The circuit is simple and straightforward for maximum ease of construction and future servicing.

Design

The modulator consists of a 9001 pre-amplifier which was designed to work with an *Electrovoice* 600C dynamic microphone, but will provide plenty of gain with most any high impedance dynamic microphone or crystal microphone. This is followed by a 6C4 voltage amplifier. The gain control in the 6C4 grid circuit can be replaced by a fixed resistor if desired, thus saving a bit of panel space. This control is seldom used unless there is a change in microphone. *T1* is a midget audio transformer matching a single plate to push-pull grids. The modulator is a 6N7 tube in Class B, but a type 1635 may be substituted if higher plate voltages are available. *T2* can be any 10 watt modulation transformer of small size. The microphone jack is a PL-68 type with three connections so that the push-to-talk relay can be operated by a switch on the mike. The whole audio section occupies a strip 2" wide and 6" long on the chassis. When constructing the rig it is a good idea to wire the modulator first and test it before going on to the r.f.

A shield is placed between the modulator and the r.f. sections of the transmitter both above the chassis and below. A third shield is mounted above the chassis between the oscillator and final r.f. amplifier.

*Deer River Hospital Clinic, Deer River, Minn.

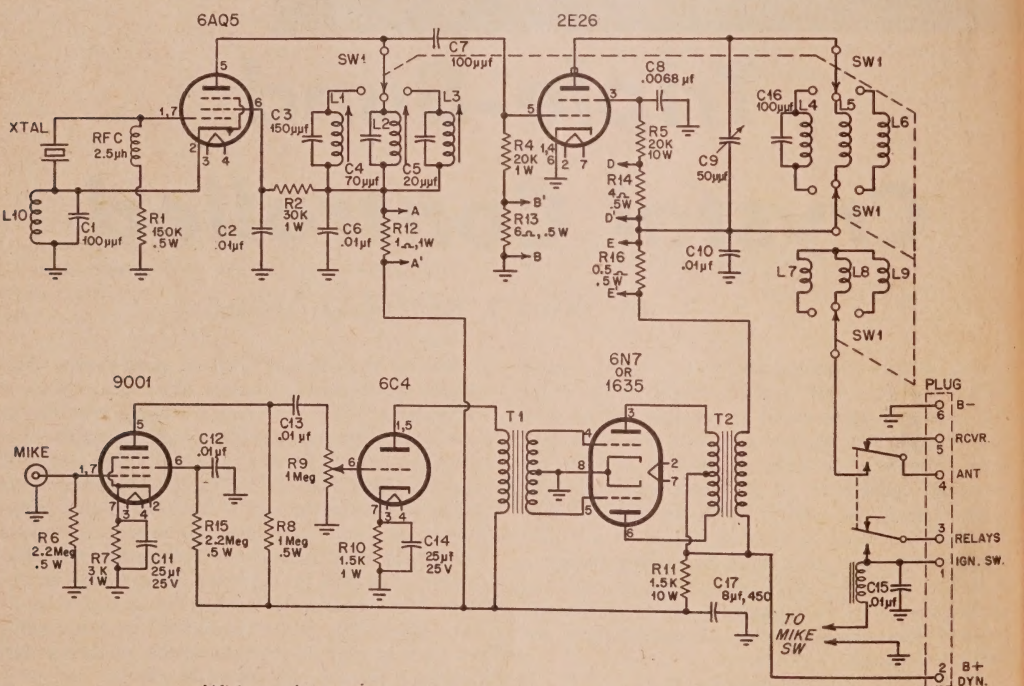
The oscillator is a 6AQ5 in a tritet circuit. This circuit was chosen because its affords sufficient output to drive the 2E26 final, even when doubling. The crystal socket is mounted on the front panel so that the frequency can be changed quickly. A 75 meter crystal will oscillate on its fundamental frequency for operation in the 75 meter band. A 20 meter crystal will oscillate on its fundamental as well as its second harmonic, depending upon which tank circuit is switched into the oscillator plate circuit. Crystals between 14,200 kc and 14,300 kc are used for 20 meter output and crystals above 14,250 kc are used for 10 meter operation.

The oscillator is mounted very close to the crystal socket. The plate coils are wound on standard slug-tuned forms. The coils from the BC733D surplus receiver work fine.[1] Two of these three coils are mounted on the shield between the oscillator and the final. Also mounted on this shield are the final tank condenser and the four-pole-three-throw ceramic wafer band-change switch. The plate coils are broad tuned so that they can be adjusted once and left, eliminating one control from the front panel.

The final amplifier, a 2E26, is mounted in the remaining half of the chassis. A 2E26 was chosen for the final amplifier because it is rugged, small, and very easy to drive. The plate coils are made from "Miniductors" and are mounted between the wafers of the ceramic band-change switch. The antenna coils are wound slightly larger in diameter on the cold ends of the tank coils with #18 wire. A 100 or 125 $\mu\mu$f ceramic condenser is placed inside the 75 meter coil as a padder. About the only deviation from normal design techniques in this stage is the omission of the r.f. choke in the B-plus lead. The 2E26 socket is mounted somewhat below the chassis to keep the tube from sticking up too high.

The meter, an 0-1 ma Triplet meter, is switched to read: (1) Oscillator plate; (2) Final grid; (3) Final screen; and (4) Final plate. The proper multipliers are indicated in the diagram. If another meter is used that has a different internal resist-

1 L1 and L2 were unchanged, L3 needed only a few turns removed to hit ten meters. The values of the ceramic condensers placed across the coils to make them resonate should be close, but a grid-dip meter should be used to check.



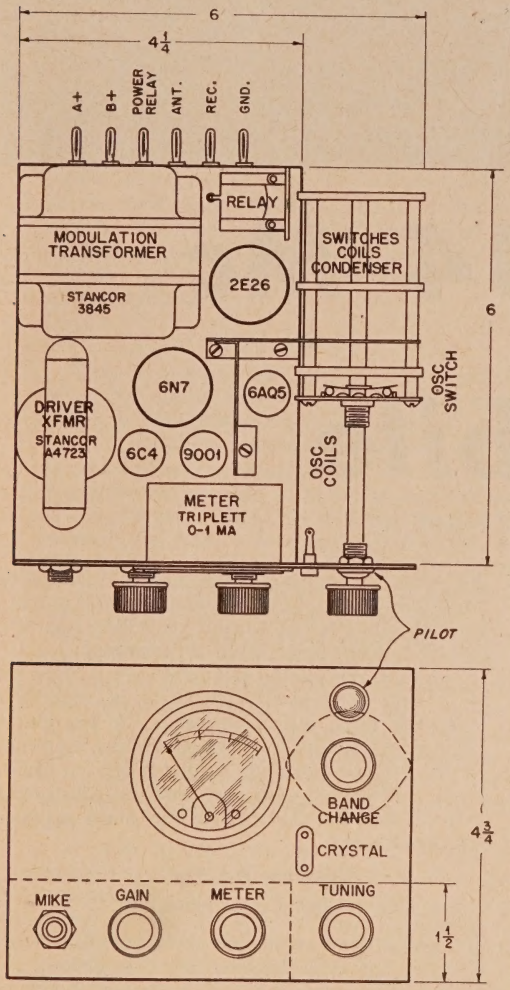
Wiring schematic and parts list of the triple-band transmitter.

R1—150,000 ohm, ½w
R2—30,000 ohm, 1w
R4—20,000 ohm, 1w
R5—20,000 ohm, 10w
R6—2.2 megohm, ½w
R7—3,000 ohm, 1w
R8—1 megohm ½w
R9—1 megohm pot & sw. (optional)
R10—1500 ohm, 1w
R11—1500 ohm, 10w
R12—1 ohm, 1w
R13—6 ohm, ½w
R14—4 ohm, ½w
R15—2.2 megohm ½w
R16—0.5 ohm, ½w
C1, C7, C16—100 $\mu\mu$f tubular ceramic
C2, C6, C10, C12, C13, C15—.01 μf disc.
C3—150 $\mu\mu$f
C4—70 $\mu\mu$f
C5—20 $\mu\mu$f
C8—.0068 μf
C9—50 $\mu\mu$f
C11, C14—25 μf, 25v
C17—8 μf, 450v
RFC—2.5 mh
T1—3:1 Audio (Stancor A4723)
T2—MBF surplus (or Stancor 3845)
SW1—4 p. 4 T. (Centralab Kit)

ance, the multipliers *(R12-13-14-16)* will have to be changed to give the correct readings.

Construction

Unfortunately there doesn't seem to be a stock cabinet that is just the right size for this unit, at least I was unable to find one. The cabinet can be made from sheet metal with much less effort than you expect.



A proposed layout when using all standard parts. Note that the crystal socket has been shifted to allow more room.

Tuning Procedure

The oscillator should be tested before the final is wired to make sure it is functioning correctly. There should be a good dip in the plate current when the plate is tuned to resonance. The 100 $\mu\mu$f coupling condenser *(C7)* loads the oscillator so much that once the final is wired in there will be little observable dip.

When all the wiring is completed plug in a 75 meter crystal and set the bandswitch to 75 meters. Disconnect the power from the final until the plate current of the oscillator is checked, it should read from 20-30 ma or a bit more. Check the final grid current. Next, attach a suitable load to the link and apply power to the final. The plate current should read about 50 ma, the screen from 7-9 ma, and the grid should be less than the previous reading. Check the other two bands the same way.



Other Data

A set of banana jacks are mounted in a junction box in the back of the transmitter cabinet so that the transmitter plugs in, allowing the rig to be removed for servicing in a few moments.

The antenna being used is the new *Master Mount* three band whip using two loading coils, one on top of the other. By shorting the proper coil or coils any of the three bands can be selected.

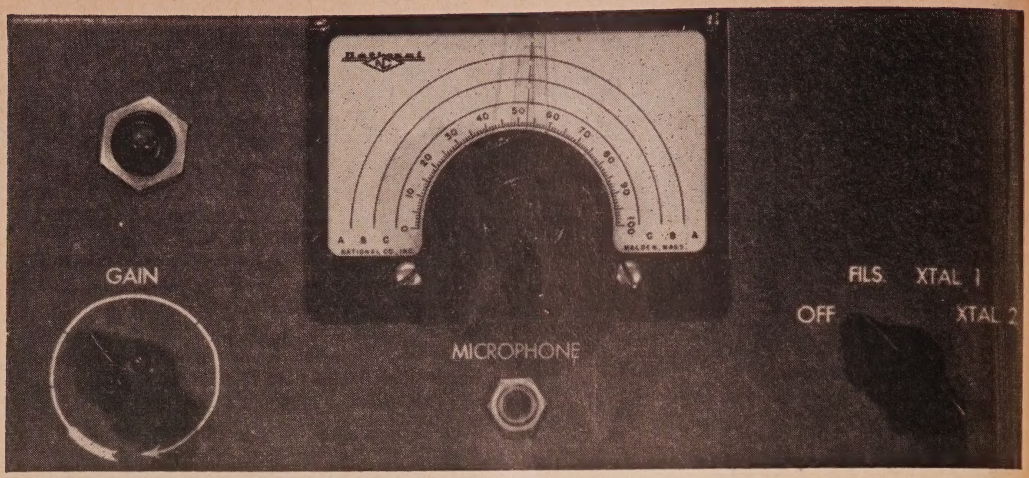
The power input to the 2E26 is about 15 watts. All power is furnished by a dynamotor supplying 340 volts at about 150 ma. This is not critical though and most any power source in this range will work nicely.

There you have it, a simple transmitter that works like a charm. You can QSY with no flurry whatever, being limited only by the number of crystals handy. (I have a holder mounted on the dash that holds a dozen ready for use.) It takes only about half a minute to change bands if you are in a hurry (usual case). The results are amazing on all bands, with R5 the usual report, good enough?

COIL DATA

L1—slug tuned, about 40 turns, #26 enamel
L2—12 turns, #18 enamel
L3—8 turns, #18 enamel
L4—Miniductor, 2 inches of #3004
L5—Miniductor, 1½ inches of #3003 or about twenty turns of #14 enamel
L6—Miniductor, ¾ inch of #3003 or about ten turns #14 enamel
L7—6 turns #18
L8, L9—3 turns #18
L10—11 turns #16

Coils wound on ⅜" isolantite form (CTC slug tuned forms).



CD 144 Mc Mobile

JOHN HECOMOVICH*

This article is an example of conscientious design work. Possibly the same job could have been done with fewer tubes, but certainly it could not have been done as well. —Editor.

The little mobile rig described in this article was the result of my uncomfortable position as Emergency Coordinator. In spite of all efforts the number of two-meter mobiles increased at an alarming snail's pace. As a result a program was initiated through the radio department of the San Mateo Junior College to mass produce a two-meter mobile the tentative goal being set at 25 units.

After an agreement on the approximate price of the units a careful study was undertaken by the author to determine a basically sound design. My findings are outlined below. I hope that they will prove valuable to other EC's faced with the same problem.

Basic Description

This composite unit is housed in a steel case 9" wide, 11" deep and 4" high. This case encloses a 9 tube superheterodyne and a 7 tube transmitter. The high points of the unit are as follows: (1) Approximately 1 microvolt sensitivity. (2) Single dial control. (3) Simple switching. (4) Excellent noise limiting. (5) Adequate selectivity and stability for mobile work. (6) Crystal controlled AM output. (7) Reasonable power requirements.

The cases, panels and sub units were constructed by a local sheet metal concern at an extremely reasonable price, this being due to the fact that a fairly large quantity was desired, making it profitable for the concern to set up the necessary equipment. Undoubtedly this unit may be constructed in a standard size cabinet with only minor mechanical alterations.

Receiver Description

The receiver lineup is as follows:

V1—6J6, push-pull, neutralized, broad band r.f. stage.
V2—6J6, push-pull, cathode modulated mixer.
V3,V4—6AG5 pentode, 5.8 mc i.f. amplifiers with no a.v.c.
V5—9003 pentode, 5.8 mc i.f. amplifiers with optional a.v.c.
V6—6AL5 duo diode, second detector and noise limiter.
V7—6J6, half of the tube utilized as the receiver voltage amplifier.
V8—6AQ5, Class A modulator.
V9—955 triode high frequency oscillator.

Experiments were made with various types of r.f. stages, and it was decided that the push-pull ampli-

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fier had far more attributes than shortcomings, and on the basis of good gain and a reasonably low noise level it was included in the design.

Inasmuch as single dial control was desired, without the necessity for ganged tuning, it was necessary to use loaded tuned circuits to achieve broad-banding. Fairly high values of grid resistors were used in the grid circuit, because the loading of the antenna effectively flattened the response. The plate resistor values were a compromise between proper loading and plate voltage considerations. The band pass of the amplifier is flat across the band to approximately 3 db, when the circuit has been peaked at 146 mc. The components of the amplifier are mounted on a polystyrene sub-assembly which is located in the lower right hand corner of the chassis. This was done primarily to allow working on the main chassis at the same time as the sub-unit was being constructed. Any similar configuration will serve as well. After completion, the sub-assembly was dropped in and wired to the tubes.

The Mixer

After experimentation with a large number of mixer types, using triodes and pentodes with various means of injection, thought was given to cathode injection. Not too much information was available on this subject, so experiments were made using single triodes, pentodes, push-push mixers and finally the push-pull model. The results of the push-pull mixer experiments proved so interesting that further work was performed in that line to determine all its characteristics. The results of the experiments showed that this mixer was superior to all others from the standpoint of signal-to-noise ratio, conversion gain, freedom of pulling, and critical adjustments. The link loading and the high value of grid resistors were sufficient to load the mixer circuit properly. By center tapping the three coils and ganging three midget butterfly capacitors an exceptionally fine amplifier-mixer assembly can be obtained by those who wish to use tunable front ends.

In order to avoid the necessity of altering the primary of the first i.f. transformer to allow push pull connection, the mixer plate circuit was center tapped through a resistor network. Admittedly this broadened the response of the transformer, but this disadvantage was outweighed by the saving of the work necessary to disassemble and rewind the primary and reassemble the transformer. Improved performance will result with a center tapped transformer and the choice will be left to the constructor.

The injection is accomplished by a system which should be more properly called cathode modulation. This is achieved by returning the cathode to ground through a pickup link in the oscillator. The 47-ohm resistor serves simply as a terminating resistance for the injection coax cable. Another important feature of this mixer is that the transconductance of the tube remains higher than it will in other forms of mixing. As a result higher conversion gain results. With this type of injection the high frequency oscillator can be coupled to the mixer even with fairly large separations of between 5 to 10 inches between the oscillator and mixer. This feature makes it possible to mount the front end and i.f. assembly in some convenient place in the car, and then tune by means of the oscillator mounted on the steering column.

Available data on cathode injection indicated that this method required relatively large oscillator power. Our experiments did not indicate this to be true, and it was found that i.f. signal level varied little with input variation in oscillator power. The only point that might be considered at all critical

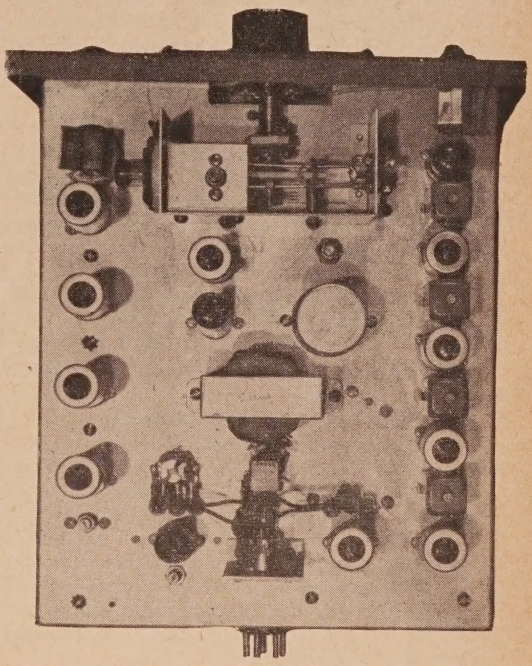


Fig. 1. A topside view showing the receiver i.f. strip at the right and the transmitter on the left.

in this circuit was the value of the mixer plate voltage. This value had marked effect on the signal-to-noise ratio; but very little on the signal level. Experiments with a variable resistor in series with the mixer supply indicated that a finite voltage produced the best signal-to-noise ratio. The plate resistors of this unit were chosen on this basis. If use of a center tapped system other than that shown is contemplated, it will be necessary to experimentally adjust the plate voltage by inserting a potentiometer of approximately 50,000 ohms in series with the center tap. After the optimum value has been determined, the potentiometer can be replaced by a fixed resistor having the same values as the setting of the potentiometer.

In closing this discussion on the mixer, it is pointed out that there is neglible oscillator pulling of mixer grid tuning making this an ideal circuit

for applications where normal circuits would be inadequate.

The IF Amplifier

The i.f. system consists of three stages of 5.8 mc 6AG5 amplifiers, running with fixed bias and no a.v.c. The components can be seen running on a line from the lower right to the lower left of the chassis. These stages operate with fairly high gain and have band pass characteristics of 100 kc. Otherwise no special characteristics distinguish the i.f. amplifier, and only normal construction precautions need be observed. No doubt the absence of a.v.c. will raise a question. Experiments showed that it was difficult to design an a.v.c. system that would do much with fast flutter of mobile operation. Secondly, a large number of 6AG5 tubes, which are not particularly suitable for a.v.c. work were available. Using remote cutoff tubes and the additions shown in the *Fig. 2* the construction may incorporate a.v.c.

Second Detector and Noise Limiter

The second detector utilizes half of a 6AL5 in a conventional diode detector and r.f. filter. The other half of the 6AL5 is used as an automatic series type limiter. It can be said that the noise limiter does a fine job of noise pulse removal.

The first audio section utilizes one half of a 6J6 as a conventional high gain voltage amplifier. The 6AQ5 beam power amplifier is connected in a normal fashion through a push-pull output transformer to a 4 to 8 ohm permanent magnet speaker voice coil.

The High Frequency Oscillator

This section can be seen on the top view at the left center of the chassis. *(Fig. 1)*. The oscillator circuit contains no special circuit innovations, except that it was designed with a high C circuit and heavy inductances to prevent vibrational instability. It is easily recognized as an ultra-audion circuit with resistive decoupling. The LC circuits are arranged so that any desired bandspread can be attained by adjustment of the air padder and tuning capacitor.

The oscillator in this case operates on the low side of the signal frequency. There is no reason why the oscillator could not operate on the high side of the signal except that because of the relatively low i.f. frequency, and broad band r.f. circuits it is desirable to operate on the side which has the least police, taxi and aircraft activity, thus reducing possible image troubles. Any high frequency triode such as the 9002, 6AB4 or 6C4 could be used in place of the 955.

Transmitter Description

The transmitter tube lineup is as follows:

V10—6AG5, Modified Pierce crystal oscillator, tripling or quadrupling to 24 mc depending on choice of 8 or 6 mc crystals.
V11—One section of a 6J6 tripling to 72 mc.
V12—One section of a 6J6 or a 6AB4 doubling to 144 mc.
V13—6AG5, buffer amplifier operating straight through to 144 mc.
V14—6J6, push-pull cross neutralized class C amplifier.
V7—One section of a 6J6 used as a speech amplifier.
V8 —6AQ5, Class A modulator.

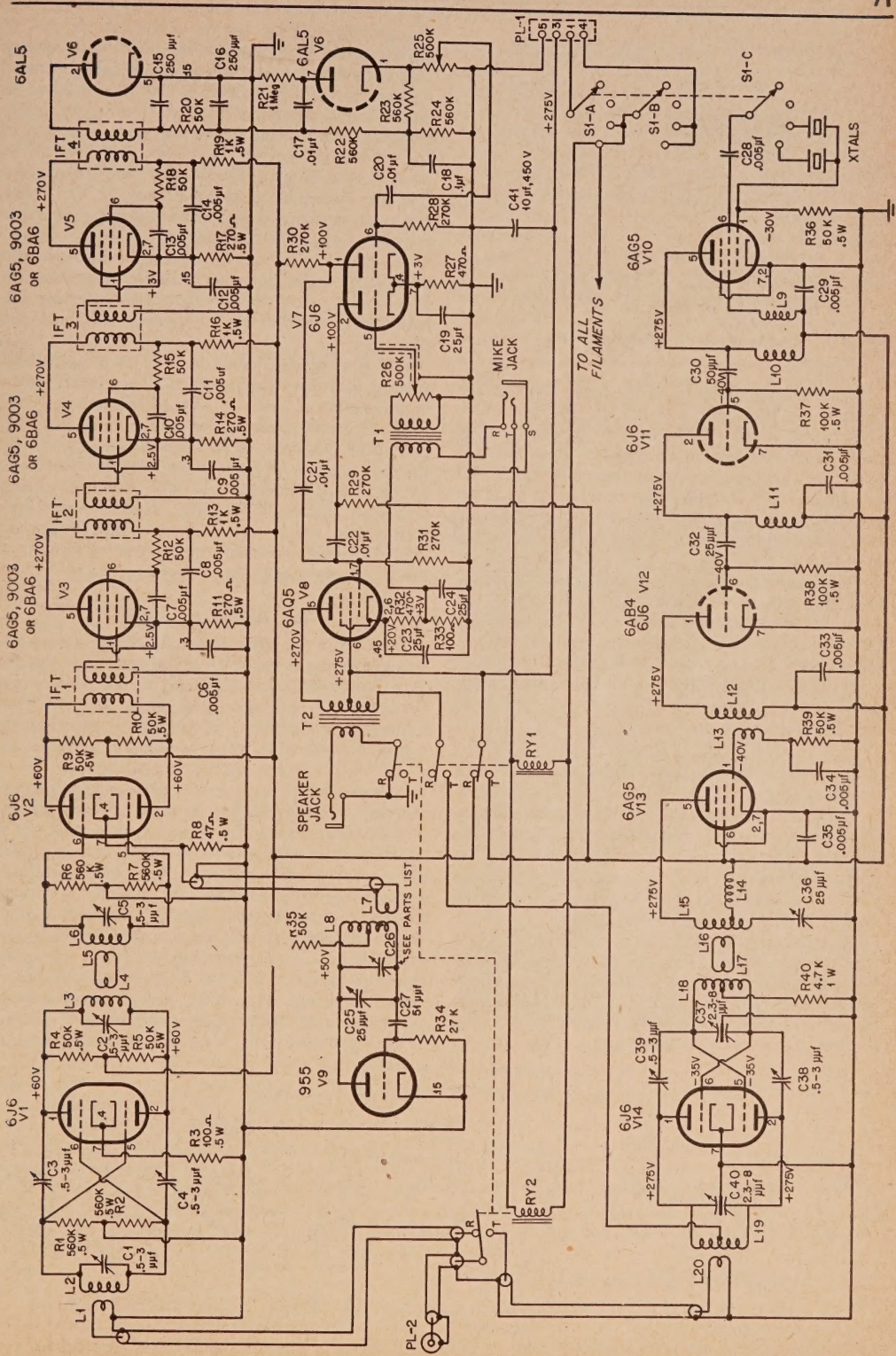
The Oscillator

Several years of experiments with various oscillators furnished convincing proof that when good efficiency, low crystal current and efficient frequency multiplication was desired, the modified Pierce will more than adequately fill the bill. The oscillator used in these units furnished practically equal drive with either 6 or 8 mc crystals and is arranged to give a choice of two crystals by rotation of the control switch *(SW1)*. More crystal selections could be made available by using a more complicated switch but prohibitive size and scarcity precluded this in these units. Added flexibility is possible by using either a directly connected crystal socket located on the front or side of the cabinet, and eliminating crystal switching, or by connecting one set of switch points to the external socket in place of one of the internal sockets.

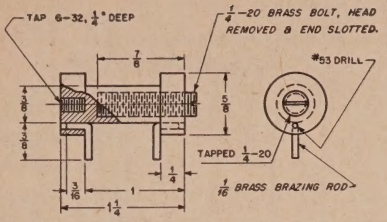
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144 CD Parts List

R1, R2, R6, R7, R22, R23, R24 — 560,000 ohm carbon, 1/2 watt
R4, R5, R9, R10, R12, R15, R18, R20, R35, R36, R39 — 50,000 ohm carbon
R3—100 ohm carbon
R8—47 ohm carbon
R11, R14, R17—270 ohm carbon
R13, R16, R19 — 1,000 ohm carbon
R21—1 megohm carbon
R28, R29, R30, R31 — 270,000 ohm carbon
R27—2,700 ohm carbon, 1/4 w
R32—470 ohm carbon, 1 w
R33—100 ohm carbon, 1w
R34—27,000 ohm carbon
R37, R38—100,000 ohm carbon
R40—4,700 ohm carbon 1 w
R25—500,000 ohm Pot. long shaft, Midget
R26—500,000 ohm Pot. Screw driver adjust, Midget
C1, C2, C3, C4, C5, C38, C39—.5 to 3 μμf trimmers, (Ceramicon)
C6, C7, C8, C9, C10, C11, C12, C13, C14, C28, C29, C31, C33, C34, C35—.005 μf disk caps., (Ceramicon)
C15, C16—250 μμf tubular caps. (Ceramicon)
C17, C20, C21, C22—.01 μf 600 volt
C18—.1 μf 200 volt
C19, C23, C24—25 μf electrolytic, 25 volt
C30—50 μμf tubular cap., (Ceramicon)
C32—25 μμf tubular cap., (Ceramicon)
C27—51 μμf tubular cap. 0., temp. coeff., (Ceramicon)
C41—10 μμf electrolytic, 450 volt
C25, C36—25 μμf air padder, APC
C26—National UM-15. Stripped to 1 rotor and 1 stator.
C37, C40—2.3 to 8 μμf midget butterflies (Johnson)
IFT1, IFT2, IFT3, IFT4—5.3 mc IF transformers, (Alladdin #278-0007)
T1—S. B. carbon mic. to single grid
T2—Universal P. P. output transformer, 10 w
S1A, B,C—3 pole 4 throw rotary switch, (Mallory 3234J)
Ry1, 2—D.P.D.T. relays 6 volt coil
PL-1—Power plug (to suit
PL-2—Antenna Jack, Motorola



Wiring Schematic of the 144 mc CD Mobile



Oscillator plate coil form details

Some objection may be raised because the screen operates at the same potential as the plate. No overheating or ill effects were experienced under these conditions and much greater drive was attained by running the tube in this condition. Proof of cool and non-destructive operation can be given by noting that the combined plate and screen current of the oscillator with a 300 volt supply is only 11 ma.

The plate circuit is tuned to approximately 24 mc by a slug tuned coil. These coils resonate with the stray capacities and form a broadly resonant circuit that does not require retuning with any reasonable change in frequency. These forms incidentally were all custom built and the dimensional drawing is included for the benefit of anyone who wishes to build their own forms.

The Triplers

This circuit utilizes one section of a 6J6, or a 6AB4, tripling from 24 to 72mc. The socket connections are so arranged that either type of tube can be used with approximately equal results. The 6AB4 performs slightly more efficiently and has the added advantage of requiring a 0.25 ampere less filament current. The plate circuit is tuned in the same manner as the oscillator circuit.

The second multiplier uses one section of a 6J6 which doubles from 72 to 144 mc. The socket connections of this stage are arranged so that the opposite section of the 6J6 from that used in the tripler is utilized. It is apparent that the 6J6's used in these circuits can be interchanged, thus utilizing the normally unused section of the tube in case of failure. Long experience with the 6J6 has shown that the most common failure in this tube is caused by grid to cathode shorts. If this should occur in either stage, operation may be restored by interchanging tubes which places the shorted section in the unused portion of the socket. This results in more flexibility and better use of the tubes. This type of operation is possible only if 6J6 tubes are used in these stages. The following alternate courses are open to the builder.

(1) 6AB4 tubes may be used in both stages with consequent reduction in filament requirements. These tubes were difficult to obtain, whereas 6J6 tubes were plentiful so the answer is obvious, in this case.

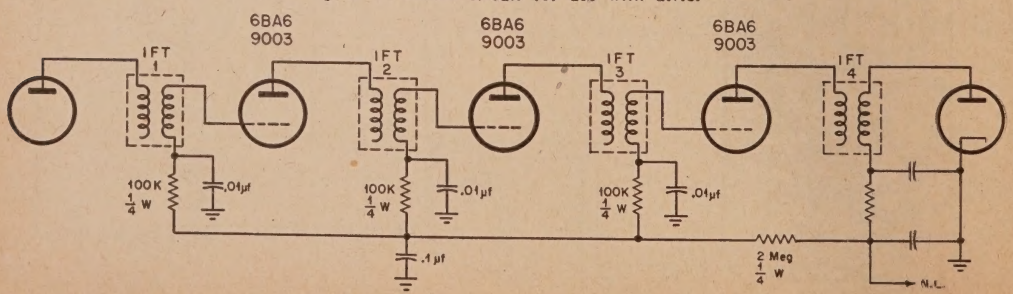
(2) A single 6J6 could be used to perform both tripling and doubling functions. This would result in the saving of one 6J6 tube, filament power and space. It would result, however, in a more awkward placement problem. Also, experience has shown that the cumulative heat of the relatively inefficient multipliers concentrated in one envelope caused premature failure of the tubes. In the writer's prototype unit, which was built some time before the duplicate units, the same multipliers have been in use for nearly three years.

The Buffer Amplifier

The 6AG5 in the buffer amplifier acts as a straight through amplifier at 144 mc. Past experience has shown that this tube is one of the best performers in its class whether it be used as a multiplier or amplifier, providing the screen voltage is approximately equal to the plate voltage. No ill effects have been observed in using this tube in this fashion. Other than the high screen voltage, the only point of interest is the plate tank circuit.

The apparently series tuned tank circuit is in reality a parallel tuned circuit; the tuning capacitor and the plate and stray capacitor combination are actually in series with the net capacity appearing in parallel with the coil. The circuit allows the use of a much higher inductance with considerably higher efficiency. This circuit also permits the constructor to wash out the high tube and circuit capacities found when using pentodes, particularly when capacity coupling is used between stages. With reasonable care in placement of components,

Fig. 2. Alternate circuit for use with a.v.c.



the very low grid and plate capacity of the 6AG5 will not support oscillation so the circuit operates very stably without neutralization.

L1,L4,L5,L16,L17,L20—1 turn #18 hookup wire, 3/8" diameter
L2,L3,L6,—4 turns #14 tinned 3/8 diameter, 1/2" long
L7 —Hairpin loop, 1" long 1/2" wide #14 tinned
L8 —Hairpin loop 4" long 1/2" wide #10 tinned
L9 —2.5 mh. RF choke
L10—28 turns #28 DSC on 3/8" diameter brass slug form closewound
L11—12 turns #28 DSC on same type form as L10 closewound
L12—4 turns #14 tinned on same type form as L10 3/4" long
L13—2 turns #18 hookup wire on cold end of L12
L14—30 turns #28 DSC closewound on 1 meg. 1/2 watt resistor
L15—10 turns #14 tinned 3/8" diameter, tapped 3 turns from condenser end
L18—6 turns 3/8" diameter 3/4" long center tapped
L19—4 turns #14 3/8" diameter 3/4" long center tapped

Final Amplifier and Modulator

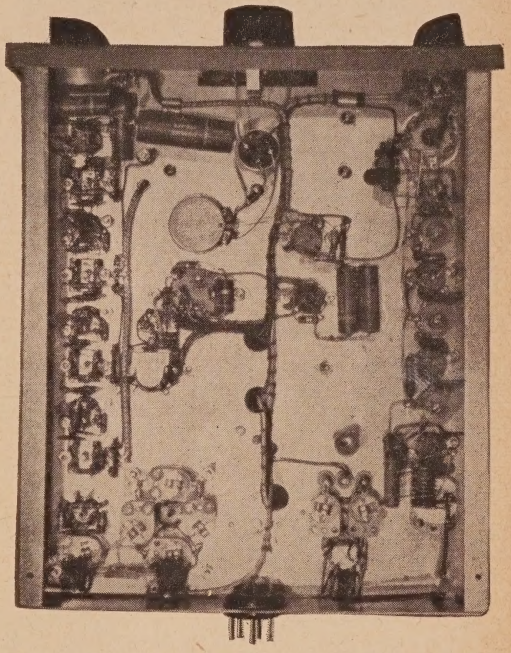
The 6J6 in the final, operates as a conventional push-pull, cross neutralized straight through amplifier at 144 mc. Several 6J6 finals have been checked for efficiency, and the top efficiency was 63% with an average between 55 and 60%. With an input of 5 watts, an output of 3 watts can be obtained. This, coupled into a good antenna, will give a good account of itself as has been amply proven by the units being described.

The speech amplifier was designed for use with a carbon microphone of the F-1 type. The second half of the 6J6 used as receiver audio is used as a resistance coupled amplifier with ample gain available for driving the 6AQ5 which serves as a Class A modulator. The microphone voltage is obtained through the use of a tapped and decoupled cathode circuit in the 6AQ5 stage. There is nothing critical about the speech except that the microphone and 6J6 grid lead should be shielded to prevent pickup. In some cases it will be necessary to reverse the grid winding leads of the microphone transformer to prevent feedbacks.

The modulator consists of a single 6AQ5, used with a push-pull output transformer working as a 1:1 modulation transformer. This mode of operation is advantageous because the opposing d.c. currents in the two halves of the transformer reduce core saturation. This allows the use of smaller transformers with saving in space, weight and cost. The 6AQ5 is overbiased to cut down the plate and screen currents. This admittedly should cause more distortion, but all reports indicate good quality.

Switching and Push-To-Talk

The switching of this unit was designed with economy of power as a major factor. Simplicity and the prevention of high load voltages on the components were other factors. In order to produce single knob control, the crystal switching was incorporated in the same switch. There are many instances where standby conditions are desirable particularly from the standpoint of battery life. The control sequence has been arranged as follows: *Position 1;* Off. *Position 2;* All filaments on with B supply starting relay not energized. *Position 3;* Supply relay energized, receiver operating, crystal No. 1 switched in. *Position 4;* Same condition as *position 3* with crystal No. 2 switched in. It can be seen that by allowing the filaments to be preheated before the plate voltage is applied, the application of high no load plate voltage is prevented with consequent lessening of possibilities of damage to components. The push-to-talk is conventional, with the send-receive switching being done by two six-volt relays. All the functions of the two relays could be incorporated in one, but the relays used were very inexpensive so the reason for utilizing them is obvious.



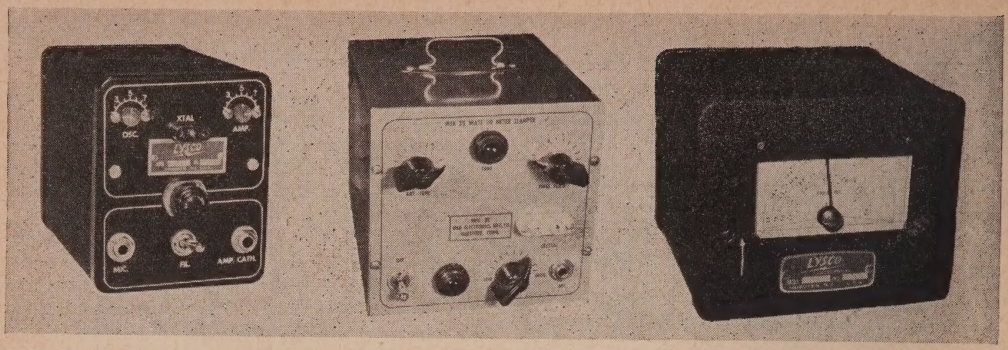
Because these units were produced on an "assembly" line basis they have a clean appearance under the chassis.

Any supply of a dynamotor or vibrapak type, which can deliver 250-300 volts at 90-100 ma. properly filtered, will be suitable for this unit. If single knob operation of the type described previously is desired, installation of a control relay will be necessary.

Receiver Aligning and Tuning

Before applying voltages to the unit, a check should be made with an ohmmeter to make certain that no plate voltage shorts exist. After checking

(Continued on page 112)



(Left) Lysco, (Center) Web "Junior," (Right) Lysco VFO.

YOUR MOBILE CATALOG

Transmitters

Quick to interpret the importance of mobile operation to amateur radio, the manufacturers supplying the field have made available a wide variety of components and completed units. The comprehensive technical articles and features on mobile technique in this special issue refer constantly to them by specific reference or by general specification. On the advertising pages are more complete details of most of the outstanding manufacturers serving the mobile communications field. In addition, reviewed in this article are highlights of certain pieces of equipment, not selected for any particular quality other than their application to mobile operation, and primarily to permit the reader to evaluate in one place the scope of the commercial coverage available.

Why Commercial Equipment

Logically, the amateur planning for mobile operation should ask, "What units should I purchase and which should I build?" As in the case of fixed-station operation, economy frequently dictates the choice. Similarly, scope of operation must be a determining factor. If single-band operation is contemplated, a multi-band converter is poor economy . . . If all-band operation is planned, an adequate antenna installation with extreme flexibility is a necessity, etc.

For the fortunate amateur who has the inclination to operate mobile and the necessary capital to go completely commercial, the obvious advantage is equipment incorporating hundreds of hours of engineering time and production facilities unmatched by the average amateur. Under any circumstances, certain specific components cannot be produced with economy in the home workshop. These products run the gamut from the base spring of a whip antenna, to such essential accessories as the special mobile microphone. In substance, judicious allocation of the mobile budget will determine what percentage of your installation will be commercial and home-constructed, within the limits prescribed by the essential components which cannot be duplicated in the home workshop, and therefore, must be purchased from a manufacturer through one of his authorized distributors.

Single-Band Mobile Transmitters manufactured by Lysco Manufacturing Company, Inc.

Economy and compactness are possible by building these compact transmitters for single-band operation only. Separate models covering all amateur bands and the CAP frequencies are available. The crystal plugs into the front panel. Tuning controls are screw-driver adjusted. While there are slight variations in the circuitry of the various models, essentially they consist of either 6AQs or 6V6s employed as oscillator and separate power amplifier and modulator. Clamp tube modulation is employed and the carbon microphone should incorporate a push-to-talk circuit to control the transmitter. Antenna change-over relay is built in. The antenna circuit is designed to work into a 50-ohm coaxial line. Variable link coupling of the output stage is provided to permit optimum adjustments when making the original installation. A jack is provided for external metering of the PA cathode current.

Single-Band Mobile Transmitters manufactured by Web Electronics Mfg., Co.

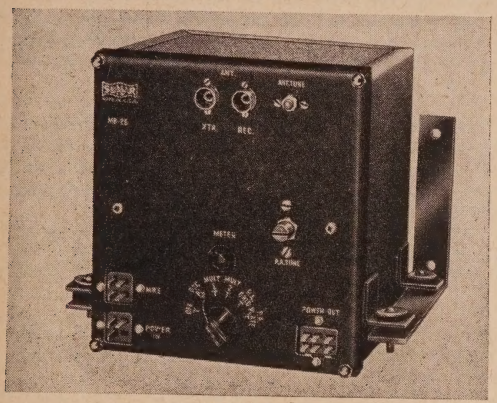
The Web "Junior" is particularly designed with a thought towards practical emergency operation. Since it is delivered sans power supply it may be used as either a mobile transmitter or in a portable station. The "Junior" operates primarily on 10 meters but may be put on 6 meters if desired. The circuit is a 6V6 tritet and a 2E26 output. Modulation is obtained through another 6V6 operating as a "clamp tube". The manufacturer claims a peak output of from 30 to 50 watts. The transmitter also has good possibilities of loading any of the various types of mobile antennas.

Mobile Variable Frequency Oscillator manufactured by Lysco Manufacturing Company, Inc.

For tremendous increased effectiveness in operating mobile, particularly on the crowded low frequencies, a v. f. o. is a desirable accessory. The Lysco Model 381 is an extremely compact unit measuring 4½" x 4" x 5". The r.f. output may be obtained at the front panel in one model or at the end of a 15' length of coaxial cable in an alternate model. Controls are a bandswitch providing selection of output on 80 or 40, and the main tuning knob. Power requirements are 6.3 volts at 1.3 amp. and 200 volts at 30 ma. The v.f.o. uses three 6AK5's. The main tuning dial is calibrated for 80, 40, 20, and 10 meters. The tuning dial is fully illuminated. When the v.f.o. is being operated on 80, the filaments of the 40-meter buffer are automatically turned off with resulting power economy. For use with crystal control transmitters, the Lysco Model 381 can be plugged directly into the crystal socket.

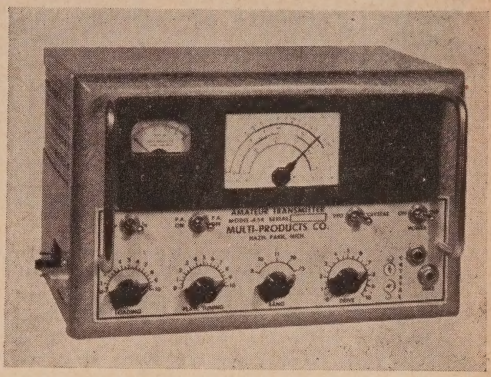
Single-Band Mobile Transmitters manufactured by Brooklyn Mobile Equipment Company

Bromeco CD10X and 2OX are designed for operation on either 28 or 14 mc with a maximum input of 50 watts. 6AG7 crystal oscillator-doubler stage drives class C 6BQ6. The speech amplifier consists of a 6SH7 class A amplifier driving a 6AU5 class AB, modulating the 6BQ6 plate and screen. Link-coupled output goes through an integral change-over relay. Meter is illuminated for easy night vision and may be switched to read either grid current or plate current. Jones plugs provided for easy installation or removal. Brown hammertone cabinet measures 5" high x 5½" wide x 7" deep, sufficiently small for dash mounting. Antenna coax connector.



Single-Band Mobile Transmitter manufactured by Sonar Radio Corporation

This series of single-band transmitters is available for 2, 6, and 10 meters, and the commercial AM and FM bands between 30 mc and 163 mc. Everything is built into the Sonar MB-26 series, the push-to-talk switch on any standard microphone is the only control required. Just 6½" high x 7" wide x 5⅞" deep, the transmitter comes furnished with shock mounts bolted to the metal housing. Can be mounted under hood, dashboard, seat, truck, etc. Tuning controls are screw-driver adjusted making them relatively tamperproof. Tube complement is 6J6 oscillator/tripler; 6J6 doubler; push-pull parallel 6J6 output delivering 6 watts. 12AU7 speech amplifier driving 6AQ5. Power required 225-300 v. at 100/150 ma; 6 v. at 2.5 amp. Controls are power amplifier tuning and antenna control. Six-position meter switch provided metering for all circuits with external meter. Antenna coax connector.



Multi-Band Transmitter Mfd. by Multi-Products Co.

This transmitter is a complete packaged unit with provisions for either direct crystal control or VFO operation. It is bandswitching from 10 to 75 meters and has optional 6 meter coverage. It is shipped minus power supply, but may be operated from a surplus PE-103 with power to spare. Two models available with provisions for either carbon or hi-impedance mikes.

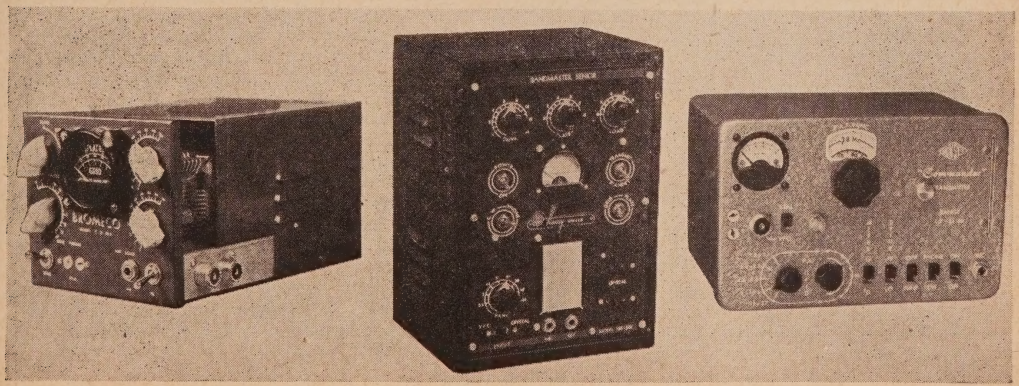
Multi-Band Transmitter manufactured by Harvey-Wells Electronics, Inc.

This transmitter is currently being produced in three different models. One for CW operation and two for phone. All of them use two 6AQ5's in the frequency multiplier stages and an 807 output into a pi network antenna coupler. The speech equipment varies in the two phone models. Because of the relatively wide frequency coverage (2 to 75 meters) this unit has proven to be very practical in mobile, portable and fixed station use.

Crystal Controlled Multi-band Transmitter manufactured by Gonset Company

This brand new transmitter was designed around the dual vibrapack so that it would not be dependent on "surplus" dynamotors, etc. As such it will operate very nicely at 35 watts input. Coils and crystals are obtainable for any of the amateur mobile bands up to and including 50 mc. The modulator has built-in high level speech clipping. Any standard carbon or mobile type dynamic may be used. The "Commander" uses a 6AG7 and 6146 in the r.f. lineup and a 12AT7 and two 6AQ5's in the speech and modulator. May be used as a portable station due to convenient antenna loading arrangement.

SPECIAL: A VFO "attachment" will soon be available at a small extra cost to all "Commander" users. This "attachment" will be simply plugged into the present transmitter and will automatically provide VFO coverage on any of the mobile bands.



(Left) Bromeco CD 10X, (Center) Harvey-Wells "Senior", (Right) Gonset "Commander".

Ionospheric Propagation Conditions

Forecasts by George Jacobs, W2PAJ*

Sorry! No Prediction Tables This Month. Had to Make Room for the Mobile Material.

As the apparent travels of the sun continues northward into the northern hemisphere, the seasonal trend of lower daytime maximum usable frequencies (MUFs) and higher nighttime MUFs continues. Only a very few north-south circuits will have usable frequencies above 28 mc, and not much 10 meter activity is expected until next October. Twenty meters should be the best DX band for all circuits, with the band open almost around the clock for many circuits. Forty meters is expected to be fairly good for DX on many "all dark" circuits, but 80 meters will probably be too noisy for anything but occasional DX.

The fact that the Zurich relative sunspot number for February 1952 was only 21.6 is a sign of the poor propagation conditions that are with us. This is the lowest relative sunspot number recorded since March, 1945. These relative sunspot numbers, when averaged out for a 12 month period, are a direct indication of solar activity and associated ionospheric propagation conditions. We have not yet reached the bottom of the present cycle. The minimum of a cycle is usually indicated by monthly relative sunspot readings of below 10.

Solar activity must still decrease considerably before reaching the values usually associated with sunspot minimum. The minimum is expected late in 1954 or early 1955. As a point of interest, the relative sunspot number for February 1947 (peak of present sunspot cycle) was 132.3.*

In May there is usually noticed a considerable increase in sporadic E activity. More frequent short skip openings (up to 1000 miles) should be noticed on ten meters, and some six meter openings between the southern section of the USA and Central America may be possible, especially between 8:00 AM to 1:00 PM local standard time.

General Propagation Conditions—May, 1952

Europe

No ten meter activity until late next fall. Good conditions are expected on twenty, with the band open until after 0000 GMT. Circuits should be possible from all areas of Europe to all sections of the USA.

Some good 40 meter dark hour circuits are expected, but the band will be noticeably noisy.

Eighty meters will be quite noisy and not many openings are expected except possibly to Northern New England and the Canadian Maritime Provinces.

South America

Some 10 meter activity expected during daylight hours, but considerably less than during the winter and early spring months. Twenty meters should remain open almost around the clock, with strong signal intensities during the dark hours.

Fair to good conditions are expected on forty, and only fair conditions to Central America countries on eighty meters.

Africa

No ten meter openings expected this month, but conditions are fairly good for twenty meters during certain hours.

Some 40 meter openings are expected but not much on 80. Openings on these bands will only occur when the path is completely in darkness.

Oceania

(Australia and New Zealand): Fairly good ten meter activity expected from the West Coast, with the possibility of very infrequent opening to the central and eastern areas of the USA. Fairly good conditions are expected for 20, with openings of varying reliability expected for a period of over 18 hours each day.

Since it's winter time down under, conditions on 40 are fairly good, and rather frequent openings are expected.

Not too much expected on 80 because of higher noise levels at the USA receiving end.

Asia

Near East circuit characteristics are quite similar to European except signals are somewhat weaker because of the increased absorption on the longer circuits. No 10 meter openings, fair to good 20 meter openings, very erratic 40 meter activity, and not much possibility for 80.

Very infrequent 10 meter openings are possible from Pacific Coast USA to the Far East. Two distinct fair-to-good periods expected on 20 to the Far East and India: one occurring just after dawn, local time, and another just after sunset. Not too much expected for 40, except from the Pacific Coast to Japan. High noise levels and absorption make DX possibilities for 80 meters poor on these circuits.

All circuits from an easterly direction favor east and central USA. QTH's while circuits arriving from a westerly direction favor Pacific Coast QTH's.

A monthly department. Address correspondence to 3620 Bedford Ave., Brooklyn 10, N. Y.

Ionospheric disturbances especially affecting North Atlantic night circuits are expected May 1-5, 14-19, 24-28, and 30-31.



Gathered by DICK SPENCELEY, KV4AA*

There is no new WAZ member this month but we extend our welcome to the following station as a newcomer to the Honor Roll:

W1DPJ 35-127

The Editor apologizes for the absence of the DX Honor Roll. This was unfortunately necessitated by the unexpected length of some of the feature mobile articles.

It will appear in a new form next month.

"'Twas better that no QSO befell
a DX station who didn't QSL."
Anon.

With that opening gem we wish to say a few words on the tender subject of QSLing. This practice of confirming radio contacts by card must be considered an integral and important part of ham radio. The thrill of receiving a rare DX card is only exceeded by the actual contact itself (with considerable anxiety between). Here we have actual proof of the QSO, a necessity with DXCC and WAZ, and a nifty piece of wallpaper to display to our visitors and envious brethren. Unfortunately there are a few DX stations in rather rare locations who are, we say somewhat charitably, sluggish with the pasteboards. For such stations QSLing is an admittedly expensive and time consuming business but we believe a solution exists in the fact that there are several W hams ready and willing to take over their QSL problems upon receiving a copy of their logs from month to month. This has worked out nicely in such combinations as W4TO/AP5B, W6UZX/PK4DA, W1NWO/9S4AX, W4AZK/FM8AD and WØYXO/ZK2AA, to mention a few. Surely with this minimum effort on the part of DX there seems little excuse for not participating in the courtesy of that much wanted QSL card. DX stations wishing help in this manner and W stations willing to donate their services are invited to drop me a line. . . .

Now that the hoot and holler occasioned by the recent DX brawl is fading into a pleasant (or unpleasant) memory for most of us, we will get down to the routine DX reporting which, due to lack of any startling developments, is a rather tough job. . . .

**A monthly department. Address all correspondence to Mr. R. C. Spenceley, Box 403, St. Thomas, Virgin Islands. U. S. Air Mail rates prevail.*

Happy Divorce VS1 vs. VS2

SINGAPORE AND MALAYA WILL NOW BE CONSIDERED SEPARATE COUNTRIES. As these two locations are under separate provincial governments the ARRL, RSGB and CQ have reached agreement on the above. Retroactive credit on QSOs has not, as yet, been decided.

WØELA's projected jaunt to VS4/VS5 will probably take place this month. Clyde anticipates better conditions will be prevalent during May/June.

VS1's have advised W7OY that VU5AB has now left the Nicobars but plans further operation at some future date.

The ZD9AA who showed up on 3509 Feb. 22nd. with an S8 signal is apparently NG as the real ZD9AA, 14147, tells us, via TI2TG, that he is not active on 3.5 mc at present.



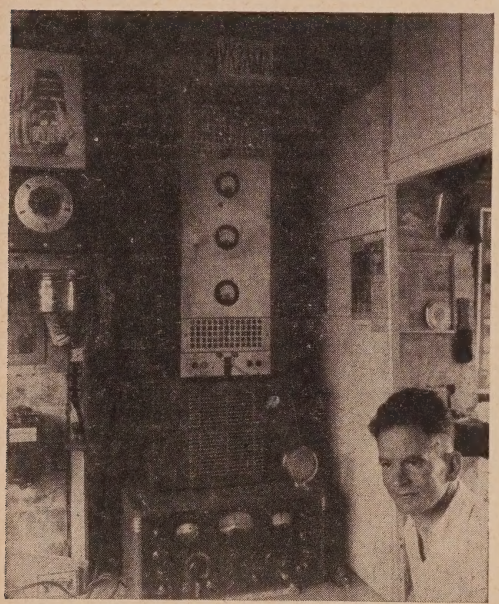
This is the layout of Alex Desmeules, VE2AFC. Alex runs 300 watts into PP 812s and holds WAC, WAS and WAVE.

Deeds and Doings

VK3XO added VP8AJ and VQ3BM to reach 151. . . . **GM3CSM** nabbed ZD6HN for No. 179 and welcomes QSLs from LZ1KAB, GD3UB and YN3AG. . . .**W7OY** reaches 200 with KH6QY/KC6, ZS2MI, OY3IGO, VQ3BM, ZD6HN and EA9AP. Eddie ponders one ZC2AD QSO'd 0400z 2/23. . . .**WØELA** jumps to 40-200 with an overdue list of 18 new ones including LZ1KAB, LB8CH and PX1AR. . . .**W6EPZ** adds VP5BH, FB8BB and CR4AL for 199.

. . .**W4VE** goes to 174 with FD8AB, EAØAB and EA9AP. Doc is due in JA land in April and hopes to be on soon. . . .**VK2ACX** makes it 214 with VP8AJ, EAØAB and FB8XX. . . .**W5BZT** hooked ZB1BS, VP8AT and GD3UB. . . .**W6AM** welcomed that FB8XX QSL. Don has 232 for 233!!!. . . .**W6EAE** went to 152 with ZD2GAJ, EAØAB, VK1BS and VQ4HJP. . . .**F8BS** is now 39-223 with VK9XK and PX1YR. . . .**VK3CP** nabbed LB4VB (Antarticia), ZE3JP, 4UAK and VP7NT. . . .**W2WZ** finally nipped FD8AB, making A1 39-220.

Between college studies **W1RAN** QSO'd SU1GO, VP2AF, EAØAB and EL2R. . . .**W5KUJ** comes through with VQ1RF, HC8GI, ZK2AA and HE9LAA, this raises Bob to 38-175. . . .**OE1FF** adds FI8YB and becomes the **OE** stalemate. Frank still needs crds from W7LEE and W7GWD '49 for WAS. . . .**KP4KD** swooped to 39-190 with MP4BBD, VP5BH, EAØAC, VK1BS and VP8AP. We understand VR4AB operated from shipboard Ev. . . . **W4RBQ** phoned HI6EC, VP2DB and KJ6AP for 39-183. . . .**W2GRV** A3 nabbed ZS7S, FP8AW, ZD6HJ, FG7XA and HE9LAA for 35-141. . . .**W6EFM** reached 40-208 with EAØAB. . . .**W1NWO** A3'd with ZD9AA and VP5BP for 39-189 phone only. . . .**W4DKA** hooked ST2GL, ZS7C and VP5BH. . . .**W4KE** reports DX slow but did snag OE13GB. . . .**VK3CX** grabbed VP2MD and further informs us that the boat has left for Heard Island. We trust this will soon result in a swarm of VK1 **QSLs!!!**



Twenty-five years ago the six masted barkentine "E.R. Sterling," bound from Australia to England limped into St. Thomas after being buffeted by a hurricane off the Cape Verde Islands. On board was Maury Anderson and his ham rig. This started a friendship that was recently renewed through his station VK3AMA, the "Sterling" is pictured upper left.

W2PRN advises VP5BP is operated by VE3CJ/VE3HC. Dan also hooked LU2ZA, CT4AL and VP8AJ. . . .**W7BD** holds forth with VP8AJ sked O115z and advises that VP8AJ can furnish A3 QSOs to those that need 'em. . . . **W7BTH**, off since June is now resuming his search for Zone 34. . . .**W4OPM** nabbed LU4ZI, Deception Is. . . . **W4EXO** advises that ZD9EH, last July, was Earl Hartwell, ex-**W4TOC**, who visited Gough Island at that time. . . .**G2FSR**, now active in G is old VS6JH/VS4JH. . . . **W3PGB** pulled in EK1RR. . . .**VK3YP** reports QSO with TT1CW, Yam, 012 T8/9 VFO QRS, Beam right direction. . . .**W2VIA** and **KP4JE** dropped in on KV4AA. . . . **KV4AU** nabbed EL2A. . . .**W6UHA** advises the OM, W6TS, finally nailed FD8AB. Maxine expects possible visit from FF8AC this fall and adds that LX1BT intends to reside permanently in LA while old **PK6HA**, Gus, now lives in Oakland. . . . .**VK3ANP** reached 100 with HC2OS, Ken also keyed with KP4CU, KG4AF and YI3BZL. . . .From **ZD4BF** via **W5MPG** and the West Gulf Bulletin we hear that ZD1SW soon leaves for Switzerland, ZD2DCP and ZD2GAJ are active A1/A3 and that there is one ZD3D active on 14 CW, could use. . . .**W7PZ** had nice visit with W7AH ex W1CH. Ben is looking for an OQ5 sked. . . . Latest QSLs at **W5AWT** are VP8AU and KB6AT, the latter is stateside now.

SV1SMX has been active of late he is an /MM, SS Spiro, off SA east coast. . . .**CE3AG** and **CE3DZ**, via W5FXN, state there is a possibility of an Easter Island station in '53. . . A letter from J. Kelkboom, Curacao, N.W.I. advises 11 out of 16 passed the ham examinations given in PJ land Feb. 21/22nd. all await licenses and new calls. The lucky eleven were: L.D.McBurney, D.W. Kurtz, J.M. Kelkboom, H. Oduber, R.C. Abendanon, Sj. Heeringa, J. Ooms, H.A. Crawford, A. Kooiker, S.C. Chapman, and J.M. van Eyck. PJ's will be limited to 150 watts A1/A3 and the following freqs: 3520/3635, 3685/3800, 7020/7280, 14020/14330, 21020/21430, and 28020/29680. 160 meter operation is not allowed. Thus, don't look for PJs, or whatever prefix appears, on the low end. New calls will be printed when received.

An article from the Miami Herald reads, in part: "CUPID TIED UP AMERICAS SHORTWAVE AIRWAYS SUNDAY AFTERNOON WHILE A MIAMI RADIO OPERATOR RECEIVED A LEAPYEAR PROPOSAL OF MARRIAGE FROM THE WIFE HE WAS DIVORCED FROM 31 YEARS AGO." This Lothario was none other than Buck, W4RBQ, who, when contacting W4CIM, Covington, Ky. casually mentioned that his ex-XYL lived in the area. A phone patch did the rest and we now wish Edna and Buck all the luck in the world on their second try.

Here and There

KP4UW recd the No. 1 Extra Class Ticket issued in Porto Rico while KP4KD followed closely behind with No. 2. KD also recd WAA certif. No. 50 which Ev says is well worth going after . . . **W2SAI** was heard knocking 'em off in the contest with his new stacked beam. Beams are located at the 100 ft., 70 ft. and 40 ft. levels of the 100 ft mast which rotates with prop pitch motor. . . . **W3MSK** and **W4OSU** arrived in KP4 for a temporary stay. Ed and Larry participated in DX contest 1st half from W3MSK and spent 2nd half on the other side of the fence at W4OSU/KP4. They may be heard on 3.5. . . .We hear from **G3AAM** that **MP4KAE** is now QRT. . . . **W2FA** finally rounded out WAC on 3.5 with 4X4BX. Nice going Bill. . . .**W8BTV** say **W8BKP** is a man to watch on the DX lists with his nice work with QRP 50 watts. . . . **TI2TG** reports KM6AW/KS6 is now KS6AA and seems to concentrate of tfc to KH6 and is stingy with other QSOs. That's right Howie we've tried hard too. . . .**W1BTE** who has operated from HP1BR and YN4CP now shows up from W5JK. Irv continues on to Miami after a spell. . . .**W7BD** reports ZC2WN 043. Here's hoping El !!!. . . .**W8HGW** welcomed QSL from 4UAJ.

W4TO reports AP5B stopped off at MP4 on way back to England. Buck has logs and cards if any AP5B QSLs are missing. VR6AC, 020, 1230z was heard testing at **W4TO**. . . . **WØTKX** ponders the UA situation. Do they QSO W's or not. KH6WAB says yes. DL4's say the UA's etc. won't QSL DL4s . . . **WIDSF** recd old timer certificate and snagged CX4AD, FF8AC and CR7AD. . . .Three stations report beam casualties due to high winds. **W1ADM**, beam down, tower OK, will rebuild in summer. **W5KC**'s came down on contest eve, oh-oh!!. . . .**W8DDS** has his back up now. . . .**W7GUI** reports VR1A back on again (Tawara). . . .**W1DPJ** advises that GM8VS is now headed for MP4K-land. GM8VS ex VS7SV has been in 43 countries in the past 15 years. DPJ also welcomes prompt QSL from DU1GT. . . .**W5AVF** nabbed three new ones in contest: KX6AL, EA8BF and CT3AA, atta boy Fred. . . .From FOC (First Class Operators Club, G-land) Bulletin No. 55 we note that **G5US** has departed for VK7 and will be on as soon as settled. **VQ3SS** has

returned to East Africa and will probably turn up with aVQ4 call. Peggy G3HUD, is off to VS1 land where her first aim will be to get that ticket.

160 Meters

Conditions seemed very good during last half DX contest. *KV4AA* rounded out all W dists by snagging W7JU, W6KIP, W6AM and W6YRA. *WØNWX* was heard QSO ZL1BY whose signals were copied here RST 249 at the time. KV4AA was heard at ZL1BY and KH6IJ. . . .*KG4AF* was frequently heard during last half on 1998 and 1901. . . .*W6KIP* on the band after an absence of 30 years QSO'd KH6IJ, KH6MG and KH6AEX in test . . .Thus, DX activity on this band is picking up for contests and we suggest more W's look around this band for a few extra multipliers in the contest next year. . . .We have recd a resume on this year's 160 tests from W1BB with the general conclusion that, while a lot of fun was had by all and notable results accomplished, things were not as good as were anticipated. From *W2EQS* we hear that Loran stations at Fire Island, Sandy Hook and Cape Hatteras have increased power, during the past year, from 85,000 to 1,000,000 watts, this will give accurate bearings, to within 100 feet, to ships 750 miles away in daytime and 1400 miles at night, but, of course, increases QRM on the band. W1BB stresses more vertical component be used in 160 antennas for better results. This is borne out by listening to balloon raised antennas such as VE2WW and others. . . . It is the writer's opinion that the 160 tests should be extended to cover the month of March and possibly April next year.

W.A.B.

The L.A.B.R.E., P.O. Box 2353 Rio de Janeiro, Brazil, puts out a very nice WAB (Worked all Brazil) certificate with the following requirements: This award is open to any amateur station submitting QSLs confirming contacts with the "Districto Federal" (Rio de Janeiro city) and Brazils' 20 states. A special ribbon is added for contacts with Brazils' four "Territories". QSLs shall bear a minimum readibility report of 3 and a tone of 8. A list of states and territories follows:

1. Alagoas PY7
2. Amazonas PY8
3. Bahia PY6
4. Ceara PY7
5. Espirito Santo PY1
6. Goias PY2
7. Maranhao PY8
8. Mato Grosso PY9
9. Minas Gerais PY4
10. Para PY8
11. Paraiba PY7
12. Parana PY5
13. Pernambuco PY7
14. Piaui PY8
15. Rio de Janeiro PY1
16. Rio Grande do Norte PY7
17. Rio Grande do Sul PY3
18. Santa Catarina PY5
19. Sao Paulo PY2
20. Sergipe PY6

Districto Federal - PY1

Territories

Acre PY8
Amapa PY8
Guapore PY8
Rio Branco PY8

With deep regret we record the passing of two well known hams. Ed Miller, W2ZJ, on Feb. 19th and Eddie Niespo, W7OY, on March 15th. Their loss will be keenly felt by all that knew them over the years. Both succumbed to heart ailments.

Another Certificate has been made available by "THE ASOCIACION DE RADIO AFICIONADES DE LAS VILLAS, ARALV, Apartado Num. 136. Santa Clara, Cuba. This is the WACO (Worked all CO) award which will be given to those amateur stations submitting confirmations for radio contacts with 7 of Cuba's 8 districts. There is presently no activity in CO4/CM4, the Isle of Pines, so this has not been counted. QSLs need not be sent in. Applican can obtain statement of possession from the Secretary of his local radio club. Districts are as follows:

CO/CM1 Prov. of Pinar del Rio
CO/CM2 City of Havana
CO/CM3 Prov. of Havana
CO/CM4 Isle of Pines
CO/CM5 Prov. of Matanzas
CO/CM6 Prov. of Las Villas
CO/CM7 Prov. of Camaguey
CO/CM8 Prov. of Oriente
CO/CM9 is special call of experimental stations only.

Incidentally—the prefix CO denotes Class 'A' Cuban License for operation of phone and CW on all bands. The CM prefix denotes Class 'B' license for CW on all bands and phone on 7mc only.

ANNOUNCING DANISH JUBILEE CONTEST CELEBRATING 25th ANNIVERSARY OF E.D.R.

TIME: 2100 GMT May 3rd to 2100 GMT May 4th, 1952
RULES: Phone to Phone or CW to CW. Last three numerals. Start at 001 denoting number of QSO's. Each contact on 3.5, 7, 14, and 28 mc counts one point. Contacts on 144 mc count two points.
MULTIPLIER: There are 25 Danish districts including OX and OY. Letters from A to Z and AE to OE will follow the call sign denoting the Danish district. Results should be sent to E.D.R. c/o Borge Petersen, Himmerlandsgade, 1,3, Aalborg, Denmark. All hams are cordially invited to participate.

FCC 50-1494

As a result of correspondence between Jim Price, W5FXN, Senator Johnson, the FCC and the Dept. of State regarding status of amateur radio banned as per the FCC notice of Dec. 21, 1950, We quote the following letter as it appeared in the West Gulf DX Bulletin No. 55:

From the Dept. of State, Washn. D.C. Feb. 14th, 1952

My Dear Mr. Slowie,

The Department has now been informed of the status of amateur operations in six of the nine countries listed in the Commissions Public Notice as follows:

1. Indonesia: Amateur radio communications still forbidden and no indication that this restriction will be lifted in the foreseeable future.

2. Japan: Amateur radio communications by Japanese nationals still forbidden. Some illegal operations have occurred. Japanese regulatory Commission has apprehended and closed down nine illegal stations owned by Japanese nationals and is continuing enforcement activities. Japanese Government is studying matter of amateur radio operations in Japan.

3. Indochina; (a) Vietnam; Amateur radio still forbidden. Any such operations that have been observed are illegal. (b) Cambodia; Status not yet reported. (c) Laos; Status not yet reported.

4. Iran; Status not yet reported.

5. Lebanon; In the near future the Govt of Lebanon plans to notify the International Telecommunication Union that it will authorize a limited number of amateur licenses. The conditions imposed on such operations will be forwarded to the Commission when they are received. Present status amateur international operations, "Still forbidden."

6.Netherlands Antilles: The Govt. of Netherlands Antilles transmitted a notification to the Sec. General of the LT.U. on Jan. 16th, 1952, "That radio amateur stations are now allowed in the Netherland Antilles."

7. Thailand: Amateur radio stations are forbidden by law. There are indications that the law is not strictly enforced and that responsible authorities apparently permit clandestine operation in certain instances which are not officially divulged. The Commission should presume that amateur radio operations are officially forbidden.

8. Australia (???): Status not yet reported.

9. Austria: Status not yet reported.

The Commission will be informed on the status of amateur operations in Iran, Australia, Austria and the states of Cambodia and Laos as soon as the Dept. receives the official reports from the U.S. foreign missions involved.

Sincerely yours,
Francis Colt de Wolf
Chief Telecommunications Policy Staff.

AR8AB	095	1830	VQ3BM	060	1505
CP1BK	075	2335	VP2MD	042	1130
CR4AC	020	0055	VP3TY	080	1130
CT3AA	052	1325	VQ5CK	035	2140
CP5EZ	070	0050	VS6CG	070	1115
CR5AD	138	2115	YI3BZL	032	1820
DU1GT	093	1330	YO3RF	078	1350
DU1MB	085	1350	YK1UN	040	1630
EA9AP	085	1800	YU1AQ	037	2030
EK1FM	080	1355	YU3AT	093	1420
EA8AE	043	2040	ZP2AC	110	2300
EQ3FM	048	1450	ZD6HN	138	1910
EAØAD	085	2400	ZD4BH	017	2035
EL2B	050	2330	ZB2I	050	2025
FY7YB	020	1800	ZD2GAJ	063	2255
FD8AB	023	2305	ZD9AA	146	2125
F9QV/FC	072	2125	ZS3K	060	1945
FI8YB	082	1250	ZS7D	084	1830
FQ8AE	084	2030	ZC4CC	7015	0345
FO8AC	058	1645	ZC4DT	052	0705
FB8XX	040	1900	3V8AJ	050	1400
FM7WF	073	1700	4UAJ	083	1300
FL8BC	076	1755	4X4RE	100	1425
FB8BB	028	1740	3V8AJ	040	1535
FK8AL	080	1850	5A2TU	058	1455
GD3FBS	005	1405	5A2TU/AM	056	1410
GC2FZC	040	1845			
HE9LAA	045	1705			
HA2KQ	017	1800		PHONE	
HA2TU	066	1935			
HZ1AB	028	1555	CT1SQ	370	1525
IS1FIC	038	1500	CN8EJ	320	2255
JA7EN	014	0045	CP6AL	164	2025
KS6AA	048	0320	CR6BX	28432	1845
LX1JW	038	1415	DU1AP	187	1430
LU4ZI	013	0130	EA8AW	392	1915
LZ1KAB	057	1920	EA9AR	310	2150
MP4BBD	083	1430	EQ3FM	351	1445
MI3US	063	1450	FR7ZA	315	0900
OQ5VN	090	2155	HZ1TA	326	1420
OE13HL	050	1110	HC8MM	365	0535
MI3VG	038	1725	F3WV/FF8	316	1840
SP3CM	025	1635	KM6AY	282	0320
SU1PA	017	1415	LU4ZI	198	0145
SP9KKA	087	1555	MP4KAC	290	1335
ST2HL	068	2135	MI3NA	318	2255
SU1AD	083	1405	MF2AA	350	1625
SVØWP	079	1335	OX3BD	348	2257
TF3SG	048	2235	TA2EFA	370	1815
TA2EFA	105	1845	VQ5AU	056	2100
TF5SV	001	2250	VR2AP	245	0530
VP8AJ	130	0200	VR2CG	175	1420
VP5BH	7001	0220	YN1AA	3780	0310
VU2BC	022	1405	ZD4BF	120	1915
VQ5AU	015	2205	ZD9AA	146	1945
VP8AP	042	0130	TG9AD	3792	0555
VK9DB	078	1345	KC6DX	305	1400
VU2NB	040	1415	ZS8A	360	1845
VQ8CB	100	1305	ZD4BL	155	0630
UI8KAA	045	1305	ZD9AA	205	2300
UM8KAA	110	1330	ZP4BB	28432	1750
VU2MD	083	1350	ZS7C	355	1535
VQ4JHP	7020	0350	ZK2AA	180	0500
VS6BA	078	1335	5A2TP	305	1835

Our Cover

Milwaukee's Mobile Unit

W9HRM/M is housed in a new one and one-half ton International Metro Truck. The roof is insulated with spun-glass, the floor with two inches of cork and the space between the inner and outer walls is filled with cork. A gasoline burning heater supplied from the fuel tank of the truck supplies heat for all-weather operation.

A rigid "T" shaped table along one wall provides two operating positions. The first position consists of a Collins 32V-2 and a HRO-7. The second position consists of a Harvey-Wells Band Master and a National NC-57B headed by a RME-152. The Harvey Wells transmitter is supplied with both a.c. and dynamotor power supplies so that it can be used for mobile operation from the storage battery in the truck. For such mobile operation



while in motion a second receiver is provided consisting of a Gonset Tri-Band feeding a Motorola P-69 i.f. strip. All equipment is rigidly mounted in place.

An additional Motorola P-69 Receiver is provided, this one xtal controlled on the Milwaukee Police Department Station KSA-596.

All power wiring is installed in rigid conduct, with circuit breakers and standard outlet receptacles. When commercial a.c. power is not available it is supplied from a PE-75 2½ kw., gas driven generator carried in the 2-wheel stake-type trailer. An advantage of the trailer mounted generator is that it can be placed at a distance from the truck and the noise thus greatly reduced.

A bench seven feet long runs along part of the wall opposite to the one occupied by the operating table. This bench serves as a resting place for extra operators and messengers, and under its hinged top are bins for storing cables, antennas, tools and spare parts.

Two stainless-steel collapsable 40-foot antenna masts are provided. A folding ten-meter ground-plane antenna is also available. All antenna leads are in co-ax with co-ax antenna relays. The roof mounts four antennas, one each 2, 10, 75-meter and one for the police receiver. Co-ax feed-thrus are provided for feeding the external antennas, when used.

A Leece-Neveile a.c. type generator provides extra battery charging power when the truck engine is in operation. A trickle charger built into the truck is used to insure a full battery for the start of any operation.

H. Charles Kaetel, W9SNK
Director of Mobile Activities
MILWAUKEE RADIO AMATEURS' CLUB



A Monthly Department Edited by LOUISA SANDO, W5RZJ*

Salute to the mobiles! So many of the YLs operate mobile these days, and after this issue of CQ we'll warrant there'll be many many more. Mobile operating is especially appreciated by husband/wife ham teams, and with many of them the OM's call is used for the "big rig" and the XYL's call for the mobile station.

A suggestion for some of you YLs who are too busy with jr. ops to get much operating in during the day on the home rig—go mobile! While the OM drives, and the kiddies look out the windows, you can rag-chew. That's what W9IES, Nelda, does. "Now that we're mobile," she says, "I find I have more contacts than on the big rig, for that's limited to roundtables with locals after the youngsters are in bed. When we're driving around town I just pick up the mike and start shouting. It's not a very powerful little job, only runs 4½ watts, has a 2E26 in the final, but it has gotten us out to Spokane, Wash., for a very nice QSO."

YL Get-Together

A reminder to the Chicago area YLs. Don't forget the YL get-together scheduled for May 23-24-25, 1952, at the Hotel President, 2054 N. Lincoln Ave., Chicago, Ill. That's the QTH of W9GME, Grace, who is chairman of the gathering. If you're mobile, she'll guide you in! Full details appeared in this column last month. Write W9GME at the above QTH for reservations.

Hawaiian YLs Start Club

Congratulations to the KH6 YLs on their newly organized club! This is the first YL club in Hawaii and it's off to a good start with a membership of 18 XYLs. The first official meeting was held Feb. 28th, and hereafter meetings will be held the last Thursday of each month.

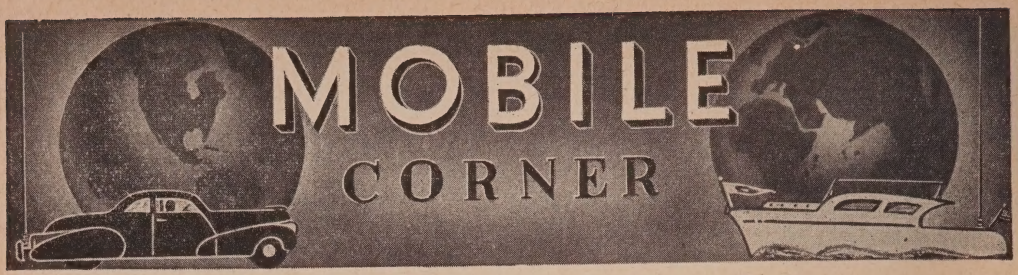
Temporary officers were elected until such time as there are enough licensed operators to vote, date set as June 31, 1952. At that time they hope to have at least ten licensed operators. At the present time there are seven and it looks as though some of the gals will have tickets very soon. Officers at this time: President, KH6AFN, Jeanette De Long; secretary and publicity director, KH6TI, Ardelle Johnson; treasurer, KH6AFC, Hazel Keefer. Other licensed members: KH6AFL, Louisa Bostwick (who is doing an FB job of sending code practice on 40 meters three nights a week for beginners); KH6AJD, Alice May Drury; Lee Lally, XYL of KH6AKV, and

(Continued on page 116)



This is Lillian Cruz-Uribe, W9MMO who is chief-op while in W-land with this mobile setup on 10 meters. In Mexico she is 2nd-op to OM XE1BT where they also operate on 40-meter phone.

Address all letters and correspondence to 959C-24th Street, Los Alamos, New Mexico.



Edited by R. V. "Andy" Anderson, W3NL*

With the advent of a "mobile" issue of CQ, perhaps it would be well to look back somewhat on just what has been accomplished. For all practical purposes, the end of World War II can be taken as the start of mobile activity. It is true that there was considerable mobile activity prior to Pearl Harbor, but certainly in no great quantity. It will be recalled that only the frequencies from 28 mc up could be used for mobile. The hams preponderantly used the ten meter band, primarily because of the ease of operation that it affords, and also because (at this time) the band offered considerable opportunity for DX. Many mobiles WAC'd while Ol' Sol was parading its spots favorably. Also a number of the gang worked all states. Them was the days!

Within a few years, the FCC gave the nod to lower frequency operation. That did the trick insofar as mobile activity was concerned. While ten was still acceptable, twenty offered DX and seventy-five could be depended upon (at least in the daytime) to furnish contacts reliably up to a few hundred miles. Now that ten has flopped except for occasional DX (and I mean occasional) a great many of the fellows are working twenty and seventy-five.

While we're at it, though, let's not forget two meters, where many of the gang are operating quite satisfactorily. A number of cities have excellent representation on two by the mobile boys.

The situation thus presented is that of a great many (possibly a majority) of mobiles working the lower frequencies. This is good in some ways and bad in others, especially since some of the gang on the lower frequencies have made no provision for working ten.

Once a ham goes mobile, he acquires a civic responsibility quite apart from those of the usual fixed station for he now possesses a radio station which is independent of local power and which can conveniently be moved about. This is a commodity of extreme importance to himself and his fellow citizens in time of emergency. He therefore must insure that he is capable o putting the equipment to the greatest possible use where it will operate most efficiently. He must concern himself not only with the mobile installation but also with his operating ability and knowledge of local communication plans.

RACES, which will become effective with the advent of a national emergency, provides no frequencies for mobiles below the ten-meter band, except for a few kc on 75. No one is gullible enough to believe that these few kc would permit operation of any extent. Those mobile clubs which do not provide for regular Civil Defense activities on frequencies of ten and higher are not fulfilling their civic duties. Those mobiles who cannot regularly work these frequencies will be found wanting when the time comes for Civil Defense activities. This is basically true because continuation of operation under RACES presupposes certain activity under RACES regulations. The license for RACES operations is not exclusively an FCC function any more, since the application must be endorsed by a Civil Defense office. It is therefore reasonable that all mobiles should regularly get into activities of a group nature, on frequencies of ten and higher, so that prompt action can be taken in case of an emergency.

A Bi-monthly department. Address all correspondence to 2509 32nd Street, S.E., Washington 20, D.C.

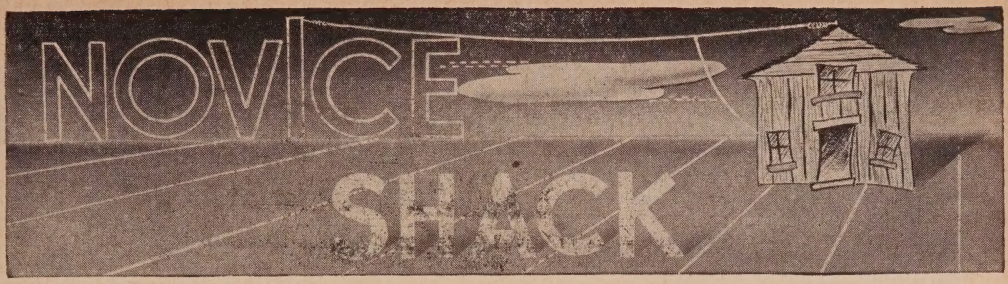
Auto Call Locations

The Auto Call is a device which permits a station to call a fixed station at any time with the ease of dialing a telephone. All that is necessary is to transmit on a frequency of 29.640, the national emergency and calling frequency, and whistle once, then twice, then three times and finally four times. The pause between the series of whistles (and after the last) should be about ½ second or more. 24 hour service is given in the following cities:

Baltimore, Md.	W3NKY/PJL, W3JE, W3RFA, W3NAE
Chicago, Ill.	W9DEP, Oak Lawn W9GQY
Dayton, Ohio	W8DPW
Ft. Worth, Texas	W5RHW
Hampton, Va.	W4OIM
Hartford, Conn.	WINEM
Jacksonville, Fla.	W4UHY
Memphis, Tenn.	W4BAQ
Minneapolis, Minn.	WØPZT
St. Paul, Minn.	WØHKF, WØTOF, WØSMT
Washington, D. C.	W3KBE, W3MAX/OQF, W3PTS/RXJ, W3RIC, W3NL
Arlington, Va.	W4BF
Falls Church, Va.	W4GEB/JKX

Once the contact has been established, you must QSY. This is an infallible rule, since transmission on 29.640 blocks the Auto Call, rendering it useless for further calls from weak signals. All hams should remember that when skip is open, transmissions on 29.640, the national emergency and calling frequency, of a purely personal nature such as ordinary QSO's cannot help but block certain units of this emergency calling system.

(Continued on page 104)



A Monthly Department Edited by HERB BRIER, W9EGQ*

You have probably already discovered that this issue of *CQ* is devoted to mobile operation. Your reaction upon seeing the pictures and circuit diagrams accompanying some of the feature articles may be that a mobile station is too expensive and complicated for most Novice operators. And there is no denying that one can be both, but it does not have to be. If you already have a fixed station, you can probably "go mobile" for a very reasonable cost. Before telling you how, a few words about mobile operation in the Novice bands may be in order.

Most mobile operation is on phone, but this does not automatically limit Novice mobile work to the 145-147 mc band. I was inclined to think it did, until investigation proved that mobile CW operation is not the rarity I had believed. Naturally, different procedures are used with it than are used on phone. Probably the most important difference is that most operators feel that driving a car and simultaneously manipulating a telegraph key is more than they care to try. The standard CW procedure, therefore, is park the car while making contacts, unless someone besides the operator does the driving.

As a matter of interest, last fall, I worked a CW mobile station in motion, the operator driving while transmitting. He reported that he often did it. My reaction was less one of admiration of his skill than of hope that when he killed himself, he did it by running into a post, rather than into an automobile driven by someone so unskilled that he had to use two hands. I would like to see the expression on the face of a traffic policeman observing this ambidextrous feat of mobile operation.

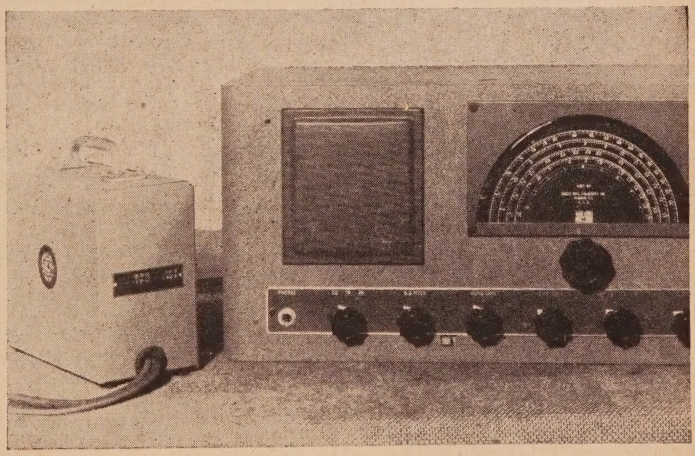
The big advantage of CW over phone is its greatly increased range per watt of power, combined with greatly reduced battery drain for the same output power. Parking while making contacts eliminates the necessity of suppressing noises generated by the automobile ignition system, also a big advantage.

The conventional mobile installation, consisting of converter or receiver, transmitter, power supply, and antenna permanently mounted, is fine for those who can afford it. On the other hand, easily removable installations also have much to recommend them. Instead of being permanently mounted in the automobile, the equipment may be mounted on a drawing board and placed on the seat while being used. When not in use, it may be removed, and in emergencies, set up within a matter of minutes wherever it, and a storage battery can be carried. The nicest part of it is that fixed-station equipment can do double duty as mobile equipment.

Power Supplies

With the exception of a few AC/DC receivers and transmitters, most communications receivers and low-powered transmitters use tubes with six-volt filaments. They can be heated directly from a six-volt storage battery. A vibrator power supply or a small dyna-

**Address all letters and correspondence to 385 Johnson St., Gary, Ind.*



Many typical communication receivers can be operated from a standard inverter and a six volt battery.

motor may then be used to furnsh plate power. As receiver and transmitter are on alternately, one power supply can serve for both. *Figure 1* illustrates how it is done.

A standard 300 volt, 100 milliampere, vibrator supply will permit upwards of 25 watts on CW, depending, in multi-stage transmitters, on how much power is required by the exciter stages.

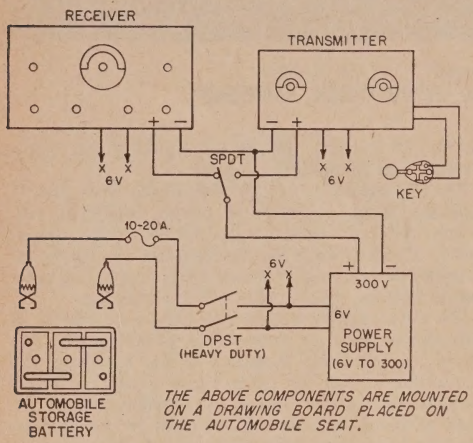


Fig. 1. Operating fixed station equipment from a six-volt battery.

Such a supply is also adequate for almost any communications receiver. There are few who will deny that a communications receiver, with its BFO., high selectivity, crystal filter, noise limiter, wide frequency coverage, and similar features, will far overshadow the average mobile converter-broadcast receiver arrangement.

Most communications receivers have provisions for operation from an auxiliary power source in the form of a socket mounted on the back of the chassis. Normally, a dummy plug with a jumper between two pins completes the filament circuit. Removing the plug permits using the connector from an auxiliary supply. This feature can be added to existing equipment as diagrammed in *Fig. 2*. Notice that the "B" voltage is connected ahead of the built-in power supply filter to augment any filter in the external supply.

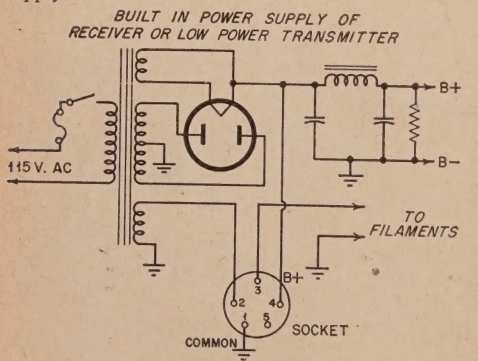


Fig. 2. Many communication receivers already have this auxiliary power socket wired in place. Normally the equipment operates with a plug and jumper between pins 2 and 3. To use an external supply the

A 300 volt, 100 milliampere, vibrator supply sells for about $15.00 (without d.c. filter) but including hash filters, or to $25.00 for models complete with all filters. *Lysco* also offers an eighty milliampere model, designed as a companion unit for their series of mobile transmitters, with a built-in changeover relay for $33.00. A combination six volt d.c., 115 volt a.c., 300-volt, 100-ma vibrator supply is also available from several manufacturers for $38.00 to $40.00.

Inverters

Another method of operating 115 volt equipment from a storage battery is through an inverter. It changes the battery output to "a.c." and steps it up to 115 volts. Although the resulting waveform is far from a duplicate of regular house current sine waves, it performs very much like it when connected to the 115 volt input terminals of a receiver or transmitter. Because filament as well as plate power flows through the inverter, the overall efficiency with one is not as high as when the filaments are connected directly to the battery. The inverter's greatest utility is in operating AC/DC equipment, which could not otherwise be operated from a storage battery.

Inverters are available in a variety of ratings. The forty, forty-five and seventy-five watt ones appear the most useful to the Novice. A receiver, like the NC-54 or S-38B, consumes about thirty-five watts, which drops to twenty or twenty-five watts on "standby". The power consumption of the AC/DC transmitters being offered to the Novice by various manufacturers also runs about the same—approximately twenty-five watts with the key up and thirty-five to forty watts with it down.

Filaments of both receiver and transmitter must be on simultaneously, but plate power need be applied to each alternately; therefore power drain on the inverter should not exceed sixty-five watts with typical AC/DC equipment. A seventy-five watt inverter will handle the load easily. Oddly enough, while a seventy-five watt inverter costs around $33.00, forty and forty-five watt ones sell for approximately $9.00 and $11.00, respectively, making it cheaper to purchase two of the smaller ones, instead of one larger one.

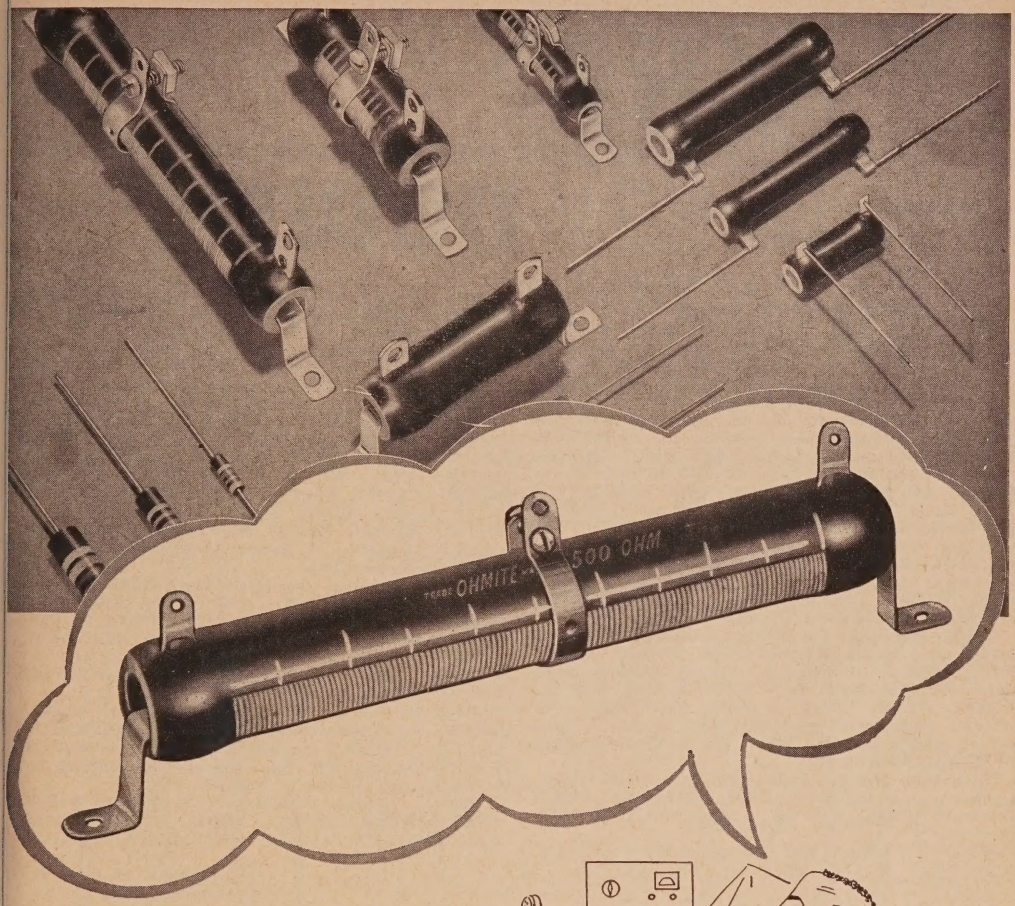
An inverter may be used to operate equipment with transformer type power supplies from a storage battery, but, besides the lessened efficiency mentioned above, it may be more expensive. At least a seventy-five watt inverter is required to power the average communication receiver, many of which, to minimize drift, are designed to consume practically as much power in "stand by" as in "receive", consequently, another inverter will be needed to power the transmitter.

145 mc phone

Your 145 mc equipment may also serve the dual-purpose role of mobile and fixed-station equipment, although there are very few 145 mc phone transmitters that can be operated from a 100 milliampere power supply. Most of them will operate on a 300 volt, 200 ma supply, although a war surplus "522" will draw over 200 ma, unless the plate voltage is held under 250 volts. The "522", in addition, will need the 832 filaments rewired and the other twelve volt tubes replaced with six volt tubes for six volt operation.

A fairly intensive search for a 145 mc phone transmitter that could be operated from a 100 ma supply located one in the January-February, 1952, issue of

(Continued on page 120)





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the VHF news

A Monthly Department edited by Bill McNatt.

February-March Aurora DX

As mentioned briefly in the last column, auroral DX on 2 was excellent on the night of February 23. Later, early in March, another less-extensive opening occurred.

According to **Montana VHF** published by W7MBV, the night of February 23 was wonderful for both visual observation of the aurora and its propagation characteristics. "Three stations were heard on two by W7MBV, Geraldine, between 2130 and 2220MST, with a very fast flutter and garbled very badly. One of the stations was W2N??, who was transmitting on the frequency of 145.52 mc at 2145 to 2200. Several calls were given the W2, but he was never heard on again. The calls of the other two stations could not be made out."

W9WOK, Bensenville, Illinois, reports a brief aurora observed at about 1800CST, March 22. W8BFQ was heard calling W1HDQ; also, W3NKM was heard briefly before the band closed at about 1830CST.

W2NLY missed the 23d DX, but caught the March 5th aurora and worked W8RMH, FRN, W9UCH, W4AO, W1IZY, W2UXP, W2TBD and W2ORI. Stations heard were: W9EHX, W2OWF, W1GJO, W1HDQ, W2UHI, W2QHZ, W2AZL, W2UK, W2WHJ, and W3MRQ. Jim expected a recurrence on March 21st; as yet, we have had no reports, although WWV was heard transmitting Ws during the evening.

Ted Fabian, W3RUE, Pittsburgh, renewed auroral DX acquaintances on the 23rd by working W9PK and W9EHX. Ted heard W8LPD, W8WRN, W8TBS, W8DX, W1HDQ, W2ORI, W2RPO, W2PAU, W2UTH, W9LF, W9UCH, W9BPV, W9MAL, W4AO, W4PCT and W4JDN. On March 3, W8BFQ was heard via aurora.

W2SFK was worked on aurora on March 4th. W3RUE now has a new 6-over-6 beam 65 feet high on 2, using wide-space Yagis. The final is an AX-9903.

W4AO, Falls Church, Virginia, thawed himself out nicely from the recent Alaskan trip by exercising his fist on the 23rd aurora. Ross worked W1GJO, W2SFK, W2PV, W2ORI, W2TBD, W2UTH, W3PMG, W3KWL, W4PCT, W8DX, W8GNN, W8TBS, W8RMH, W8GJF, W8FKC, W8FRN, W8BFQ, W9BPV, W9EHX, W9MAL, W9LF, W9SUV, W9PK, WØKYF and VE3AIB. Heard: W2PAU, W8GHV, W9UCH, W8WJC. Ross observed the auroral propagation to begin at about 2000EST and end at 0004, February 24th.

In Columbus, Ohio, Ken Myers heard W9EHX, W8DX, W4AO, W9BPV, W8TBS, W8GJF, W8FRN, W2ORI, W8GNN, W2PAU, W9PK, W8PTF, W8BFQ, W2RPO, W9SUV, W9MAL (worked), W3KWL, W9UCH, W9LJ, W8ZUR, W8RMH, WØKYF, W3RUE and the "old boy" himself, W4JDN! The last two stations heard at W8WRN were W4AO and W8DX at 0005, February 24.

March 5th aurora produced signals from W9FAN, W9EHX, "On The Ball Red," W8FMW, W8RMH, W2NLY, W8ANR(?), W9BPV and W2UTH. Ken worked W9FAN, W9EHX and W8RMH, the contacts with W9FAN and W8RMH being the first at W8WRN.

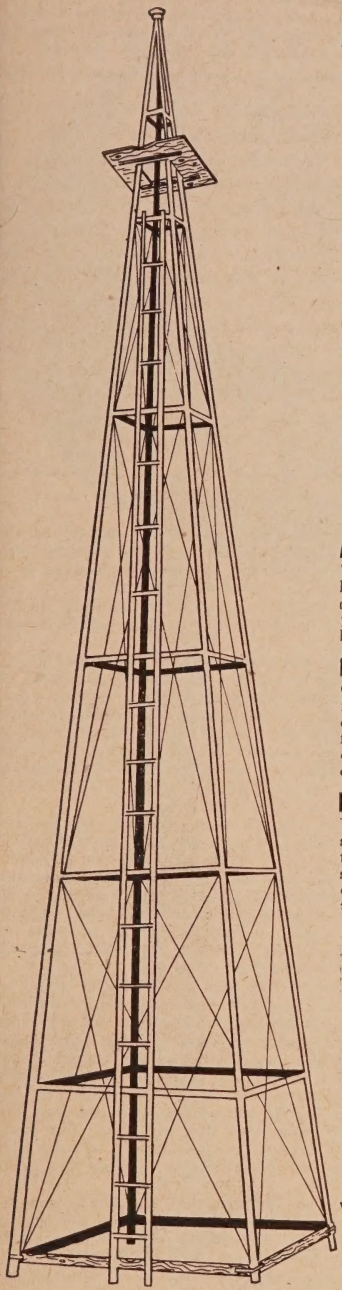
W9EHX, McLean, Illinois, worked W4AO, W4PCT, W8GNN, W8RMS, W8GJF, W8DX, W8FRN, W8PTF, W8LPD, W8RMH, W8CLL, W9SUV, W3KWL, W3RUE,

(Continued on page 88)

Address all letters and correspondence to 2433 Elder Lane, Franklin Park, Ill.



Twenty-six VHF mobile operators and their friends attended the first general meeting of the 147.5 mc. FM "Medical Communications Net" on March 16th. About fifteen other mobile operators could not attend. Pictured above (not in order) are: W9FQU, W9UZ, W9IGH, W9BWM, W9PSP, W9QBH, W9PXW, W9ZOX, W9ZNX, W9HPJ, W9NFK, W9UDT, W9CYT, W9IWE, W9LSY, W9QKH, W9ZYF, W9RPU, W9QOW, W9QGG, W9SAK, W9KLB, W9MDO, W9CPF.



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One man can do it! Your tower arrives in compact bundles. No heavy crates. Parts fit perfectly. Just dig four holes for anchor posts — then erect a piece at a time. Complete, easy-to-follow directions.

PERMANENT!
Vesto towers are made from heavy steel protected against rust by a thick layer of galvanizing. They should last a lifetime—yet they are easy to dismount and move should this become necessary.

SAFE!
A strong steel ladder is securely bolted in place. Reaches from ground to platform at top. You can make any adjustment necessary without danger of swaying or structure failure. Platform will hold as much weight as you can crowd on it, with perfect safety.

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Better balanced — sturdier — more anchorage, more support. This extra strong design has been proved for years — in thousands of towers!

Withstands Heavy Winds!
No Vesto Tower has ever blown down! They have stood through hurricanes and gales with winds in excess of 100 miles per hour. Every Vesto Tower is stressed for winds of 87 mph.

AVAILABLE IN 8 SIZES!

Vesto prices have not gone up one cent since January 5, 1951! Towers are shipped to your home knocked down, FOB Kansas City, Mo. 4th Class freight. Prices subject to change so order now. Send check or money order.

22′—$ 94.75	33′—$135.75	44′—$178.75
28′—$115.75	39′—$157.75	50′—$217.75
61′—$279.75	100′—$1060.00	

Easy Terms—1/3 Down—12 Months To Pay

VESTO "TILT-TOP" $34.50
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WRITE TODAY FOR DETAILED INFORMATION!

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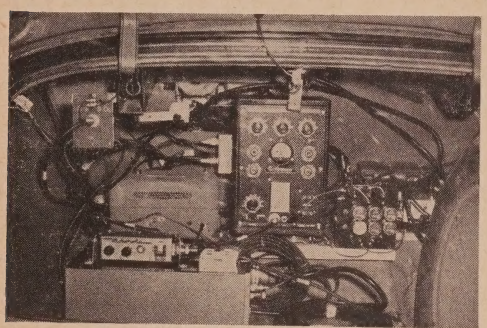
(from page 86)

WØEMS and W2PAU between 1920 and 2220CST on February 23. Stations heard were: W9BPV, W9LF, W9PK, W9LMJ, W9BOV, W9MAL, W9UCH, W9FAN, WØKYF, W8TBS, K8FQK, W8GAB, W8ZUR, W8EWE(?), and many unidentified carriers . . . W9BPV, Armington, Illinois, also enjoyed the 23rd aurora but spent his time fishing out a new state, not mentioned, rather than running up a lot of contacts.

WØMNQ, Kansas City, Missouri, observed the opening began on the 21st, peaked on the 23rd and was still noticeable on the 25th. Jim says the Illinois gang, as always, was heard but the stations they were working didn't come through. The Kansas City gang heard W9EHX, W9MAL, W9LF, W8BPV, W9PK, W9UCH and WØKYF.

On Six Meters, WØTKX observed the aurora on the 23rd. Bob says the earlier aurora in February was celebrated at WØURQ's by a QSO with W9VZP while WØANU, WØGPQ, WØOMC and WØRAJ—the entire ham population of Hutchinson, Minnesota—visited at WØURQ's with WØQIN and WØTKX.

On March 3 and 4, Hod, W9ALU, Metamora, Illinois, worked W9VZP, W9OCA and W4RBK on aurora. Hod reports that out of the band signals serve as good indicators for propagation. . . W7JPA reports that the February 23rd aurora was the first observed in Washington since last December 31. It was so intense that only c.w. could be used. W7JPA worked VE7DU, W7BYK, W7KGQ, and W7FLQ. Arch is still looking for Vermont, Georgia, Rhode Island, Kentucky, W. Virginia, and Arkansas for WAS. That's an invitation for schedules, fellers!



Pictured above is the trunk compartment of W9FQU's car, showing the Harvey Wells TBS-50C, Motorola P69-18ARS AM receiver and the "Dispatcher" transmitter-receiver, fixed-tuned on 147.5 mc. The Harvey Wells transmitter provides operation on the three bands, 3.9 mc, 14.2 and 28.5 mc. The bank of six crystals is mounted just to the right of the TBS unit. Any one crystal may be selected automatically by a rotary type relay controlled by a selector switch mounted on the dash of the car.

At the driver's position, only one mike and one speaker are used for the entire installation. In the control head, there are two switches and three pilot lights. One switch controls the 147.5 mc FM unit and a relay system for transferal of the mike and speaker. The second switch, integral with a volume control, operates the Gon-Set Tri-Band converter and the Motorola P69-18ARS receiver. Going on the air on any of the bands requires the operation of only one switch and pressing the mike button.

The 147.5 mc antenna is a ground-plane type, roof mounted. The antenna for the lower bands is a spring-base mounted 90-inch whip. Base loading coils are used for 3.9 mc and 14.2 mc. Retuning the TBS and antenna for band-charge requires only a few minutes of time. The 147.5 mc FM rig is used for rag-chews and civil defense operations, which is very good communications in the entire metropolitan Chicago area.

There's never a dull moment during W9FQU's hours of driving in the Chicago area.

The VHF bands are not carrying the load they should, particularly at this time when low-frequency DX depends more on 40 and 80. We should be shifting more of the short-haul work to the VHF bands in order to leave the lower frequencies open for DX work. I believe there is good activity on two in some eastern areas, but for the most part our VHF bands are making a pretty sad showing. I work Six exclusively, although at one time I was on Two. Out here, there is not too much to brag about on either band, and—so far as I can see—we are losing ground instead of gaining. —"A Reminder"

The 420 Mc Band

According to information released in February by the National Bureau of Standards, a radio message was transmitted for the first time by lunar reflection as a part of an experiment conducted on 418 Mc. by the Bureau's Central Radio Propagation Laboratory in cooperation with the Collins Radio Company on November 8, 1951.

Radio waves have been reflected from the moon, before, but they were usually received at or near the point of origin.* In the NBS-Collins experiment, on the other hand, the signals were transmitted via moon reflection to a point 775 miles from Cedar Rapids, Iowa. Now, if you're interested in attempting the experiment, it's of interest to know that the transmitter used **20 kilowatts** output! So, when you push up the power to the 4X150As or the AX-9903, don't forget the bias!

The transmitting antenna used at Cedar Rapids was a fixed array consisting of a 10-foot aluminum "throat" feeding a "chicken wire" horn supported by telephone poles. The tilt angle was about 7°. Therefore, transmissions had to be made while the disk of the moon was in the aperture of the horn antenna. The receiving antenna was a half-wave dipole and plane reflector mounted at the focal point of a **31-foot diameter** paraboloid, rotatable in azimuth and elevation, at Sterling.

Reflection of the 418 Mc. signals apparently began as the leading edge of the moon intercepted the transmitted signals. As the moon continued to move across the radio beam, the received signal increased. During this period the receiving antenna was positioned for maximum received signal. About 10 minutes after the initial contact, the signal attained its highest strength. At that time, the operator in Cedar Rapids transmitted in Morse code the historic message, **"What hath God wrought!"** The maximum signal level existed for another ten minutes and then decreased as the moon passed through the radio beam.

As a verification of the fact that the signal was reflected by the moon, the actual transmission delay time was compared with the theoretical value. This was determined from the geometry of the experiment—the relative positions of the transmitter, the moon, and the receiver—and the known velocity of propagation.

*D. D. Grieg, S. Metzger, and R. Waer, "Considerations of Moon-Relay Communication," **Proc I.R.E.**, 36, pp. 652-663: May, 1948. J.H. DeWitt, Jr., and E. K. Stodola, "Detection of Radio Signals reflected from the Moon," **Proc. I.R.E.**, 37, pp. 229-242; March, 1949. F. J. Kerr and C. A. Shain, "Moon Echoes and Transmission Through The Ionosphere," **Proc. I.R.E.**, 39, pp. 230-242; Mar., 1951.

(Continued on page 90)

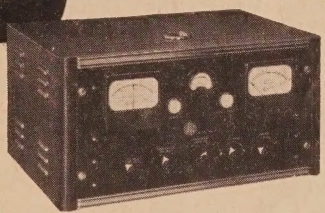
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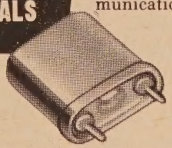


When used for different bands, plug-in type antenna coils provided. Crystal accuracy guaranteed to be ± .0015% over range of 15° to 50° C. Meets or exceeds FCC requirements.

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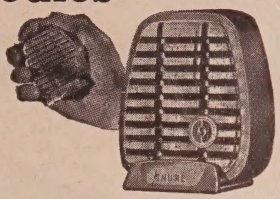
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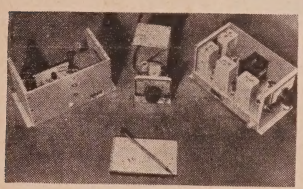
NEWCOMER'S BUYWAY

"The Hercules"



In amateur radio, just like lots of other hobbies, there are all kinds of gadgets and accessories which one acquires in time as a matter of course. However, probably the first item a radio amateur requires, after obtaining his basic receiver and transmitter, is a dependable microphone, so voice "contacts" can be made. Regardless of whether you are a new-comer or an old-timer in amateur radio, the new Controlled Reluctance mike, the "Hercules" (manufactured by Shure Brothers, Inc., 225 W. Huron St., Chicago, Ill.) warrants your consideration. It is a hand-held magnetic unit that provides clear reproduction, high speech intelligibility, high output and ruggedness at an amazingly low price. Being magnetic, this mike is practically immune to varying conditions of heat or humidity. The "Hercules" can be used indoors or outdoors, fits snugly in the hand, sits firmly on a desk or can be placed on a stand. There are two models with an output level of 52.5 db below 1 volt per microbar. Model 510C "Hercules" lists at $15.00 while the Model 510S, which has a built-in switch, lists for only $17.00. The "Hercules" has a die-cast case, with a Metallic Green finish, See the "Hercules" at your Distributor or write Shure Brothers for further details.

Eldico's MR-2 & MT-2



Eldico's two-meter transmitters and receivers are *first choice* for Mobile or Fixed Station operation for Civilian Defense — whether it be amateur communication service, Civil Air Patrol, Coast Guard Auxiliary, Auxiliary Fire or Police Departments, or other C.D. usage. Combine this with the added joys of "Fb" operation on the amateur band and you come up with the reasons for the tremendous demand for Eldico's MR-2 and MT-2.

Eldico has supplied the Federal Government, various states, cities, towns, and villages with complete Civilian Defense communication equipment (from the antennas to microphones, Mobile or Fixed). See your distributor or write to Eldico for your copy of "*Eldico's Plan For Civil Defense.*"

Many Civilian Defense groups are now in the process of training C.D. personnel for operating their Eldico communication equipment through radio classes using the Eldico Novice Radio Course. ELDICO of N. Y., Inc., Douglaston, L. I.

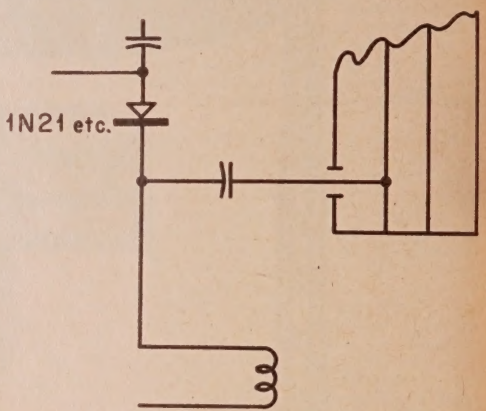
VHF NEWS

(from page 88)

Quoting **Proceedings of the IRE, March** 1952, Sulzer, Montgomery and Gerks state: "The estimated performance of the system is specified in the following parameters: Frequency, 418.0 mc. Transmitter output power, 20 kw. Transmitting antenna gain referred to an isotropic radiator, 21 db. Receiving antenna gain referred to an isotropic radiator, 30 db. Receiver noise figure, 4 db. Receiver bandwidth, 1 kc." Calculations show that the received power corresponds to a signal-to-noise ratio of 8.6 db; the measured signal was in good agreement with that figure, although—according to the **Proceedings** report—severe fading was observed. It is believed, as a result of the experiment, that a 10 to 20 db increase in system gain would produce a satisfactory hand-keyed circuit. Ross Bateman, W4AO, of the CRPL, participated in the tests.

W9MBI 420 Mc Converter

Reference page 42, "CQ", April, 1952, Clare Reynolds, W9MBI, offers recent improvements in his converter circuit. "I have been doing work on the converter, getting better results with the injection voltage for the crystal mixer connected on the i.f. side," says Clare. The revision is shown in the partial circuit drawing.



The grid resistor shown in the April issue circuit **should be 33,000 ohms** instead of 330,000 ohms, as shown.

The circuit revision given by W9MBI minimizes the loading effect of the 378 mc tripler on the antenna circuit and also improves the Q of the mixer coaxial line.

The W2QED 420 Mc Report

Not much to report, this month, according to Ken. 420 mc activity attained a new low; weather on the east coast was foul.

W3RKQ now has a 420 mc beam, but W2QED is afraid that it's too heavy for the support. Accordingly, Harvey plans to correct the situation. W2QED is using a new converter which replaces the ASB7 and its broad, noisy i.f. system.

"I use a 955 tube in a tunable line oscillator, a coaxial crystal-mixer and 6J4 r.f. stage. The output (i.f.) stage is in the 2-meter band; the 2-meter receiver is used for an i.f. strip. It works so well that Ken can hear some of the 420 mc stations that are unable to copy him. Last year, the situation was reversed, according to Ken . . . 420 mc contacts at W2QED, Seabrook, N.J., during February included W3RKQ, W3OWW, W2HEK, W2BLV, W2EH. and W3BSV.

Ted Fabian, W3RUE, has an AX-9903 final on 144 and hopes to get it working on 420 mc, soon. W8WRN reports that three of the Columbus, Ohio, gang are trying to activate 420 but W8HMM says none has heard the other . . . WN8IPJ/W8IPJ writes, "I get the impression from your column that 420 mc is very sparsely populated.

(Continued on page 94)

50 WATTS *with the* NEW BROMECO

50 INPUT ON

10 mtrs MODEL CD-10X

OR

20 mtrs MODEL CD-20X



5" H x 5½" W x 7" D

These amazing xmtrs have become so popular for mobile and fixed station use, we are now enlarging the territory of distribution. Combining the well founded standard circuits with new design applications, the CD 10X and CD 20X are a compact, solidly built mobile unit tried and tested under many rugged conditions. To prove this we have sold most of our transmitters by "contacts-on-the-air." They deliver a fine crisp, clear, distortion-free signal with plenty of Audio and r.f. sock. High gain speech amplification requires no close-talking. We are now in production to fill orders *immediately*. Compare our specifications and we know you'll buy. Never before has so much been packed into so little.

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- Crystal controlled - 14 mc xtal for CD-10X, 7 mc xtal for CD-20X, 6AG7 OSC.
- Class C final; straight thru amp. 6BQ6 plate and Screen modulated. Link coupled.
- Audio; 6SH7 high gain Class A amp. pushing a 6AU5 Class AB modulator.
- Antenna change over relay, internal.
- Illuminated 2" Meter - grid and plate ranges.
- Standard Co-ax r.f. fittings.
- Jones plug supplied.
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- 5" high x 5½" wide x 7" deep. Front removal by unlocking one thumb screw.
- Brown hammertone finish.
- Power; 400-500 VDC, 100-150 ma.
- Mike; any single Button carbon mike with switch.

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VOA NEEDS OPERATORS AND TECHNICIANS

The Congress of the United States has strengthened the Voice of America and authorized a broad-scale technical-facilities construction program. The new facilities are now approaching completion. Substantial numbers of technical personnel are needed.

The Voice is presently broadcasting in 45 foreign languages plus English. Extensive studio, recording and master control facilities are operated in New York. A number of high-power standard broadcast and short-wave overseas bases are in operation.

A typical overseas base includes: a transmitting plant with at least one very high-power (more than 300KW) medium or short-wave transmitter, at least two high-power short-wave transmitters, communication transmitters, associated high-gain antenna systems and power generating equipment, and a receiving plant with a number of the most modern triple diversity receiving units.

There are a number of vacancies in the radio engineering and operating staffs, both in New York and overseas. The salaries for the vacancies in New York range $4,207 to $7,040 per year, depending upon individual applicant's qualifications. The salaries for the overseas positions range from $4,719 to $9,230 per year plus quarters and post allowances ranging from $600 to $5,300, depending upon the size of family and household effects is furnished to overseas posts.

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Both models utilize dual conversion for high stability and are vibration tested at 10 G's. No babies, these! They can take all the rough handling mobile equipment is subjected to. In order to announce these models in this mobile issue, the time factor prevented our taking photos for you. However, we are in production on these items and by the time you read this we will have built up *limited* stock piles for immediate delivery. Listed below are some of the outstanding features. For more complete information write for catalog supplement MCC or, if you do not yet have our new catalog ask for the whole works.

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- Two meters and C.A.P. frequencies
- 6BQ7 P.P. grounded grid r.f. stage
- Dual conversion, all tuning done at 14-18 MC.
- Compact, only 4" x 5" x 6", with universal mounting supplied
- Sensitivity better than 1 Mv.

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- 3 Bands, 10-20-75 meters
- 6AK5 preselector
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NET PRICE: EITHER MODEL, COMPLETE: ONLY $59.50

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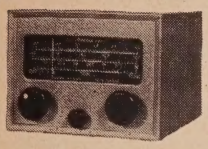
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The LN series converters are identical to the standard 2BR and 3BR converters, less the noise limiters.

NEW SONAR MOBILE Rcvr. Model MR-3

Complete coverage for 10-11-20-75 meters. 8 tubes, 4.5 watts audio output

Uses: 12AT7 RF stage and B.F.O.
12AT7 oscillator mixer
(2) 6BQ6 I.F. stages
6AL5 2nd detector and noise limiter
6AT6 1st audio
6AQ5 audio output
OB2 voltage regulator

1 Microvolt signal produces 0.5 Watt audio output. A.N.L. and B.F.O. are push-button operated.

Requires 250 Volts at 60 to 80 mils. Size: 4-9/16" x 5-3/16" x 5-11/16"

Complete with tubes . . . less power supply and speaker....**$89.95**

SONAR MODEL SR-9 Rcvr. $72.45

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STANCOR ST-203A Mobile Xmtr. Kit. Uses 2E26 final push-pull 6V6's modulation. 25-30 Watts RF. **$47.50** less tubes

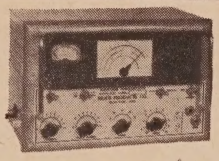
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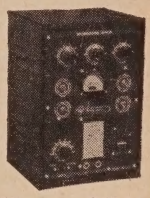
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132	Universal Body Mount	$8.75
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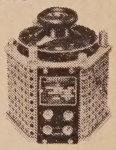
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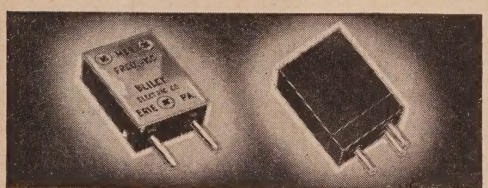
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1.0 - 10.0 mc
Supplied per Mil type CR-5; CR-6; CR-8; CR-10 when specified.

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CRYSTALS

BLILEY ELECTRIC COMPANY
UNION STATION BUILDING
ERIE, PENNSYLVANIA

(from page 90)

I have a home-made 7-watt transmitter using a WE-316. But, before I build a converter, I would like to know if there is anyone in Detroit working this frequency." You can contact him by writing John K. Dixon, 17569 Greenview, Detroit, Michigan.

Two Meters

WN4TKE reports from St. Petersburg Florida, that W4JZ, W4GFE and WN4TKE are active; W4LAW and W4HAD still keep Tampa represented; W4GAC/4 is on at Largo; W4CCR and W4OER are active in Sarasota, and W4AYX is back on 2 in Clearwater. He runs about 150 watts to a pair of 24Gs and has a beam 97 feet in the air. . . . According to Walter, WN4TKE, W4KQR, WN4TLX, and WN4TMB are all good prospects for the 2-meter band in St. Petersburg. WN4TME, Sarasota, came on in March, while W4SIZ, Dunedin, is expected to join the gang, soon. WN4TKE uses a VHF-152A and has a 16-element beam scheduled to go 45 feet high.

Jim Kmosko, **W2NLY**, is still looking for Wisconsin and Missouri contacts in spite of the February 23 aurora. He would like to hear from active aurora DX hounds in those states. **(WØKYF and W9FAN are the only ones reported, so far.—VHF Ed.)**

W2WHJ is raising a 30-element "W2NLY" beam, and is even using W2NLY's old tower—so, it should work! **W2AZL** is putting up a new 20-element array; **W2QQF** also has a new 20-element beam. "All are on horizontal!" W2NLY reports. . . . Via **W2PAU**, a letter from **PAØALO**, Renkum, Holland, informs us that he is using a "Brownie" Twin Five, a la **CQ**, April, 1951, on horizontal. "The results really were outstanding," says PAØALO, "With 24 watts in the final 832 I was able to work G, ON, OZ, F, DL and PA. The signal reports I got and still get are excellent."

Two Meters Topics in Texas

W5CVW "airborne" over Bristol, Tennessee reports that "Cowtown" (Ft. Worth) activity is quite good. W5HD, W5RCH, W5AYC, WN5TYA, W5SZF and WN5UXP populate the band, as does Bill when he's home. Congratulations to WN5UXP, who recently got his general class ticket.

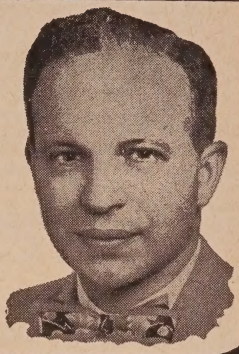
"The Wind-Jammer Society," according to **W3PBR** —the original "Mr. X" (See **CQ**, March, 1952, p. 46) —held its annual banquet on Saturday night, March 22, at the Engineers' Club, Philadelphia. Members and XYLs present were: W3BV (Pete and Marie); W2VX (Charlie and Anna); W3PBR (Mason and Adaline); W3GYB (Reds and Helen); W3EPO (Clyde and Evelyn); W3SCS (Burt and Florence); W3NWQ (Cliff and Catherine); W3NAP (Ted and Dorothy); W3CQF (Perry and Ruth); W3DQE (Ed and Ethel); and, W3NXT (Buck and Jean). The whole group enjoyed a wonderful repast and a good time. It was agreed that all stations would try to get on the air each Monday night at 10:00 PM in an effort to stir up some activity. Also, it was agreed that "Mr. X", who was selected in secret, as previously, would not send out membership certificates as in the past, but rather will spur activity in any way he may see fit. As usual, the identity of "Mr. X" will not be revealed until the next banquet. The next get-together will be held at the summer home of W3NWQ, date to be announced, later. This is to be a basket picnic, and the "harmonics" are always welcome. Come on, "Wind Jammmers," let's make the 2 meter band alive as it used to be—especially on Monday nights.

W5HD says he will have his new p.p. 4-65A final on the air sometime in April, thus giving the boys another strong signal to beam on. . . . **W5AIT** and **W5SAC**, Hamilton, are heard quite often. W5SAC uses an 829B with 100 watts input, now, which improved matters quite a bit. . . . **W5HAA**, Little Rock, Arkansas, reported that the band was wide open to the east during the first week of March. W4DIX and W4HHK, in the Memphis area, were heard nightly as was W5RCI, Marks, Mississippi, and W5JTI, Jackson. . . . **W5MWW**, New Boston, says he has worked into Dallas, recently. . . . The good conditions have not, however, extended to Ft.

(Continued on page 96)

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Leo I. Meyerson, WØGFQ



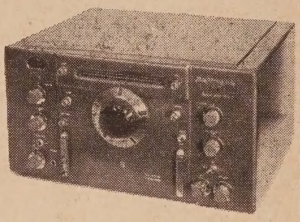
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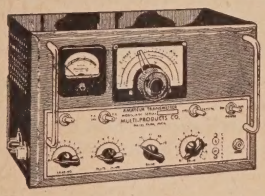
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Built-in power supply on separate chassis. Front panel oscillator compensation control. 20 to 1 precision gear drive. Provisions for NBFM adapter. Push-pull audio output. Speaker matching transformer built into receiver with 8 and 500/600 ohm output terminals.

$383.50

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LOW DOWN PAYMENT

10" PM Speaker matching cabinet **$16.00**



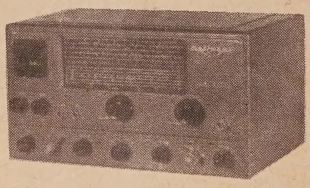
NEW ELMAC-A54

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VFO or Crystal control. Direct-reading. VFO on all bands—75, 20, 11, 10. • Plate modulation • Completely band-switching, fone or CW. • 50 Watts max. input. Power required: 300-500 V.D.C. at 250 ma., 6.3 V AC or DC at 4.5A. • Uses 3-6AG5, 6AR5, 6C4, 12AU7, 2-6L6G, 807, (included). • Only 7½" x 7½" x 12", 14½ lbs.

For carbon mike input **$139.00**
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Power Supply, 110 Volt AC **$ 39.50**

NC-125 RECEIVER



Covers 560 kcs to 35 mc in 4 bands. Voice or CW. National Select-O-Ject built-in. Includes AVC, automatic noise limiter, antenna trimmer, variable CW pitch control, separate R. F. and audio gain controls, jack for phone or NFM-73B adapter, volt rg, stabilized oscillator.

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- ☐ NC-125 Info
- ☐ Used Equipment List

Name_____

Address_____

City_____ State_____

(from page 94)

Worth, according to W5CVW. The March 3 tornado in Ft. Worth left the 2-meter arrays intact, but sure cleaned up the TV antenna. . . . **W5POG**, Sherman, Texas, is heard almost nightly. W5CVW is on the band every night that he isn't flying, calling CQ on c.w. at 144.1 mc and shifting to phone after making contact.

WN5TFW, Port Neches, Texas, says that long-haul conditions weren't too good in early February but that 100 to 200 mile range contacts were made. **WN5UJP**, Lake Charles, Louisiana, is now active with an 829B final. The night work schedule keeps WN5TFW's activity down, but John says that W5DSB, W5QME, W5QIO, W5JBW, W5AOA and W5STP keep the band alive in the Sabine area.

W5 VHF Awards

W5CA, Tijeras, New Mexico, reports that a VHF club has been organized in Albuquerque and has had several meetings. W5VWU, W5LZD and W5RFF more or less head the thing up, although it has no officers, no dues or other entanglements, and the group meets at the members' homes. Mid says that the questionnaires are out for the West Gulf Division VHF awards and it is hoped that each state of the division will be represented. Judges are W1HDQ, W5CA and W9NFK. The present plan is to award the plaques at the Corpus Christi convention in June.

In The State Of Washington

Glenn Ritchey, **W3FSO/7**, now signs "CDR" on the Naval roster: it was official in January! Activity is really increasing in the northwest, according to Glenn, who says that stations all around the Pudget Sound area can be heard every night. This is very gratifying in view of some of the many "silent nights" during the winter. W3FSO/7 is compiling a VHF directory of stations in northwestern Washington, so—if you're on 6, 2 or higher—send a postcard to him giving your name, address, telephone number, bands of operation, frequencies, etc.

W7DNG, Cecil Brickley, Bremerton, is now on the 2000PST schedule. An old-timer on 2, Cecil returned to the band recently after having been inactivated for 20 months by a night-shift.

W7JPA writes that 2-meters used to be very active in Toppenish, but now there is "absolutely no one on." Arch even took down his 18-element beam! "After four years on two, I have no record of anyone in this district having worked any real DX. We just don't seem to be favored with tropospheric conditions that produce long haul stuff. However, W7HEA and yours truly are going to reactivate two, this summer, with **horizontal** beams. So, if the skip gets very short on Six, we will be calling on Two."

"Montana VHF"

From the **Montana VHF** published by **W7MBV**: W7GCS doesn't seem to be as active as he used to be . . . W7NZJ soon to be heard from a new QTH in Great Falls . . . W7MM is on with a 522 transmitter and a vertical dipole. W7HQT blew up his transmitter in February but is again active. Joe now has the ten element beam up.

In The Midwest

W9EWO, Lebanon, Indiana, felt that spring arrived on March 15 when he heard WN9OGJ, W9LIR, W9SUV, W9KLR, W9UMG, W9HKQ, W9JGA, W9NW, W9EQC, WN9OVL, W9AFT, WN9PPZ, W9LEF, WN9OKR and W9WWT.

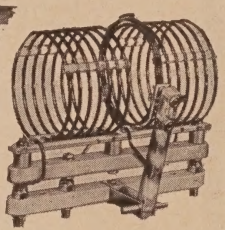
"**The Weatherman**" on TV and the 2-meter hams: What is probably one of the best public-relations deals for the radio amateur—and most certainly for the two-meter ham—occurred in early March when Clint Youle, "The Weatherman" of WNBQ, Chicago, (Channel 5) arranged with W9NW, Ken Caldwell, to collect last-minute weather reports from other hams on two-meters in a radius of 100 miles. The suggestion for the idea was made by W9MGP, Ed Lindgren, Maple Park, Illinois, in a letter to Clint Youle who contacted W9NW. Ken, of course readily obtained cooperation from W9HKQ.

(Continued on page 98)

LOADING PROBLEMS?

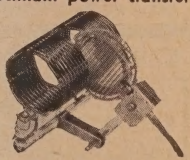
then use

JOHNSON ham inductors

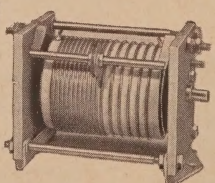


Swinging link inductors for amateur bands 160 thru 6 meters; 150, 500 and 1000 watt sizes. Two inductance values for each band permits choice of appropriate L/C ratio dictated by amplifier plate voltage and plate current. Polystyrene insulation, Steatite bases and heavier wire sizes insure highest efficiency.

Plug-in links originated by JOHNSON. Select the link to match your line, coupler or output filter for optimum power transfer.

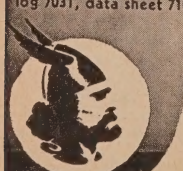


Faraday Shields to minimize capacitively coupled spurious output. Designed for JOHNSON plug-in links, equally effective and readily installed on other links including non-plug-in types. Screen is copper plating on polystyrene. Grounded hood and copper braid complete shielding.



229-201 variable inductor for antenna loading, "pi" and "L" networks. Inductance 10 microhenries, winding #14 copper wire with variable pitch, insulation is Steatite.

* For further information about JOHNSON inductors, see your distributor; write for catalog 703T, data sheet 710.



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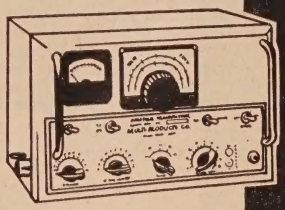
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- Frequency within operating range to your specification.
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HT-22-LDS	150-174 Mc.	½ Watt	Dry Battery	324.95*
HT-22-LWS	150-174 Mc.	½ Watt	Wet Battery	349.95*
HT-22-HWS	150-174 Mc.	1 Watt	Wet Battery	399.95*

*Plus Federal Excise Tax

S-81 115V AC/DC 152 to 174 Mc. FM receiver $49.50
S-82 115V AC/DC 30 to 50 Mc. FM receiver 49.50

ELMAC 50 Watt XMTR

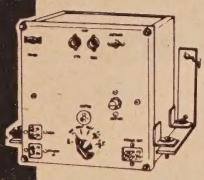


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A-54 for carbon mike . . .	$139.00	6 VDC dynamotor supply . . .	$87.50
A-54H for hi-Imp. mike . .	149.00	Electro-voice 210 carbon mike .	16.50
110 VAC power supply . . .	39.50	Electro-voice 600D dynamic mike	23.10

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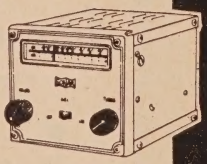
MOBILE TRANSMITTERS MB-26



2, 6 or 10 meter models; 6 watts, power filter network, low power consumption. Crystal controlled output. 6 tubes, built-in relay, compact. **72.45**

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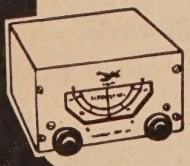
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Both with the RAYTHEON output tube →
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- Complete Kit with tubes . . 244.92
- Completely wired with tubes and air tested . . . 298.50

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(from page 96)

DeMotte, Indiana, W9CEW, Geneva, Illinois; W9GDM, Wheaton; W9IMQ, Dundee; W9EQC, Aurora; W9ODT, Lockport, W9FVE/9, Ft. Sheridan; WØBBJ/9, Kenilworth, and W9BUM, Hammond, Indiana.

The originator of the idea, W9MGP, also reports whenever propagation permits; his idea served as a stimulant to his own 2-meter activity!

The amateur-radio weather reports are collected three times weekly, Sunday, Tuesday and Thursday. Clint Youle has repeatedly credited the hams for their cooperation but does not recite the call-list because—obviously—the viewers are interested in the weather and not in ham call signs. Word of the unusual tie-in between two phases of VHF—TV and Two Meters—passed amongst the ham fraternity like wild-fire and, even though NBC and Clint Youle may not realize it, his viewing audience increases appreciably at 2200CST on the nights when the "ham reports" are given. Even the 147.5 mc FM circuit goes nearly dead! So, thanks to W9MGP's idea and W9NW's dependable cooperation, the VHF radio amateur is rendering another public service and is receiving recognition that money could not possibly buy.

W9NW reports new stations worked include **W9AGM**, Chicago; **WØBBJ/9**, Kenilworth, **W9CVQ**, Wilmette; **W9MUN/9**, Lake Forest; **W9QOW**, Northfield; **WN9QHK**, Northbrook; and **WN9PPA**, Oak Park . . . Apparently the south-side of Chicago is coming to life on 2-meters after a long hibernation. **W9ENK, CUY,** and **JYR** are active. To be active, by the time you read this, are **W9MDO, W9UDT,** and **W9CYT**—graduating from the 147.5 mc FM net; CYT, of course, is a former 2-meter man from 6 years ago.

A new Indiana station is **W9KLR**, Rensselaer, Indiana, worked by W9NW for the first time . . . **W9LXK**, Robby—now in Highland Park, Illinois, is back on two after an absence of about 5 years. But, then, Robby did tell us he'd be back! . . **W9ODT**, Lockport, is again active as is **W9CZZ**, Wheaton; these guys come and go!

WN9REM, Downers Grove, received good traffic relay from W9CEW on AM/FM through W9HPJ/9, Illinois State Police, to the Arkansas tornado emergency . . . Little was heard from the Milwaukee area at W9NW during the month, except for W9TQ. Wha' even hoppen to that Milwaukee gang, which used to be so supreme?

Chicago stations: please send your "STAPERMO" scores to Ken Caldwell, W9NW, 562 Arlington Place, Chicago, Illinois. Ken was "elected" scorekeeper for 1952; it's not too late to start, now. Just send in your monthly totals for **different** stations worked, not total contacts, and please list calls. . . **W9EQC**, Aurora, now has company in the form of W9BFY (wotta form), using a Millen transmitter with 90 watts input to a 3E29. The antenna is a 12-element array 45 feet high! . . .

WN9REM, Downers Grove, puts in a walloping signal with a 522 and 5-element beam.

WØEMS, Adair, Iowa, has been working into central Illinois every morning and evening, according to W9EQC. W9MAL, W9EHX, W9BPV and W9LF are all very active in the Peoria; even Russ, W9RGH, is heard more frequently. W9KPS is active in Taylorville; W9KQX and W9ERC represent Springfield, and W9LMJ is on in Bloomington.

On Sunday, March 16, about 35 operators of the Medical Communications Net (the civil defense function of the "Party Line" Net on 147.5 mc FM) met at the Chicago Health Department for a general information meeting regarding medical defense communications. The group was addressed by Gen. (ret.) Homer, assistant Civil Defense Director for the state of Illinois, Dr. Earl Blair, Chicago Civil Defense Corps medical service, Harry Harrison, W9LLX, chairman, medical communications net, and Al Witt, W9KLB, chairman of the training committee. Net drills are conducted on Sunday mornings at 10:00 and on Monday evenings at 9:00. Amateurs who are interested in participating in the medical communications net are **not** required to have a station on the frequency.

(Continued on page 100)

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50-AB 50 W., 815 Final, AB/2 Modulated . $79.50
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LYSCO MOBILE XMTRS
CHOICE OF 10-20-80 METERS

A-114 25 W., 6AQ5 Final,
A-129 Clamp Modulated . . $33.55
A-175

B-114 25 W., 6V6GT Final,
B-129 Clamp Modulated . . 33.55
B-175

All include tubes.

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(80 Thru 2 Meters - Fixed or Mobile)

TBS 50C 35-50 W. 807 Final, for Carbon Mike $111.50
TBS 50D 35-50 W. 807 Final, for Xtal Mike . 137.50

SONAR XMTR
CHOICE 2-6-10 METERS

MB-26 6 Watts Output . . $72.45

MOBILE RECEIVERS
SONAR

SR-9 Complete 2, 6 or 10 Mtrs., Less Pow. Sup. & Spkr. $72.45

POLICE ALARM

AR-3 118-149 Mc: 110 V. AC-DC. in Plastic Cabinet 49.50

SONAR MR-3
THREE BAND

Complete RCVR BFO - Push Button. Full Electrical Band Spread, on all Bands 80-75, 20, 10-11. 1 Microvolt Sensitivity. . . . . $89.95 Net

MOBILE CONVERTERS

GON-SET Tri-Band 10-11, 20 & 75 . . . . . $47.60
GON-SET 2 Meters with Super-Imposition Tuning 44.60
LYSCO 130 for 10-11 Mtrs 39.00
LYSCO 132 for 20 Mtrs . 39.00
LYSCO 133 for 75 Mtrs . 39.00
MALLARD Choice 10, 20 or 75 Mtrs. 39.95

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LYSCO-4 300 Ohm Lead, 40 or 80 Mtr Output-All Band Calibration . . $26.95
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LYSCO All Bands with Tube & Remote Switch 6.95

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WARD 2 Meter ½ Wave or 6 Meter ¼ Wave Cowel Mounted Whip 4.26
PREMAX 10 Meter Whip ¼ Wave Chrome-Silicon Steel 6.24
PREMAX 10 Mtr. Whip ¼ Wave High Tensile-Stainless Steel 7.28
PREMAX Universal (Any Angle) Mount & Spring 11.40

6 MOBILE POWER SUPPLIES

PE-103 Used - Excel. 500 V.D.C. Up to 350 ma. (Rated 160 MA) . . . $29.95
HARVEY-WELLS DPS-50 300 V. 250 MA. . . 87.50
KRECO PS-400 — 400 V. 375 MA. Relays, Filter on Base 66.50
KRECO PS-580 580 V. 250 MA. (For Clamp Mod. Xmtrs) 79.50
NIAGARA'S SPECIAL - Vibrator Supply 6 V.D.C. or 115 V.A.C. in. Output-6.3 V.D.C. at 4A. and 300 V.D.C., 100 MA. 39.50
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All items ordered must meet with full approval or your money back.

(from page 98)

The net is sufficiently extensive throughout the Chicago area that volunteer assistants can participate by visiting the nearest active station. For particulars, write to W9KLB, Al Witt, 3038 W. 55th Street Chicago,

Six Meters

W5RKE, Albuquerque, New Mexico, plans to be active of 6 and 2 meters this spring and summer, and is eyeing the Sandia Mountains as a portable location at 10,500 feet! Lewis wants the best opportunity to work DX. . . **W7OPV, QAK, IWI** and **CVQ** are thinking of getting on 6. W7LHK lined up the converter after getting a grid-dip meter.



Shown above are Paul Wilson, W4HHK; "Bud" Beck, W5FSC; and, Charles Hoffman, W9ZHL, "Three Stalwarts of VHF" at the Turkey Run VHF Meeting, last summer. This is to remind you to plan for this year's Turkey Run conclave, now. Details, later, from W9ZHL.

Yak-Yak (Published by the Yakima Amateur Radio Club, W7AQ.) from Arch MacArthur, **W7JPA**, Yakima, Washington, is to the effect that W7HEA, W7FIV and W7JPA are still active on 6; **W7BOC** is building a new rig and is expected to be on, later. Arch says "it" isn't like it used to be—very few contacts on openings this past year.

"Our hat is off to the guys who stay with the band during these poorer seasons," W7JPA comments. His 50 mc. VHF Scoreboard total is: 42 states, 5 countries, W, VE, XE, LU and KH.

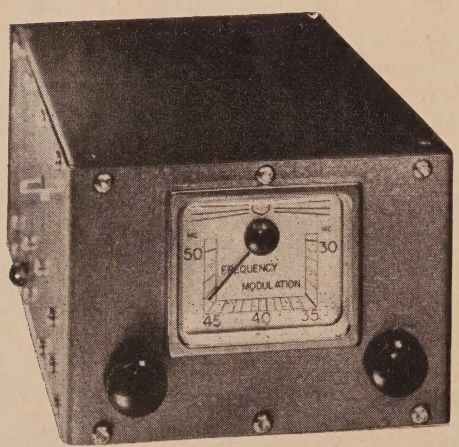
W7HEA, Toppenish, adds to Arch's comments that W7 FIV, JPA and HEA all use panoramic reception and automatic band monitoring so that if "anything" comes along, they're sure to know about it.

"I am still sweating out a Vermont contact for WAS," says Bish. "It looks like a long sweat, too! Sure hated to see **RASO** fold, as it did a lot to keep the gang active. Maybe some kind of a contest might be rigged to take its place. It would have to be on a basis other than contacts, though, to be of any interest to us. Unless the band is open . . . four locals doesn't add up to much of a score. Contacts beyond 500 miles might be more interesting.

"When Vince (WØZJB) had the column, we used to get together on the low end of 11 on Sundays and swap lies. I have seen as many as fifteen or twenty 6-meter operators there at one time. I would like to see something like that revived. How about a suggested frequency in a few of the LF bands where we can look for guys afflicted with VHF-itis? I schedule W2PAU every Sunday at 0900 and 1000 PST on 27 mc." **(VHF Ed. Note:** Well, there's an idea for you fellows; if you're in the west, write your ideas to W7HEA, C. O. Bishop, 207 East Toppenish Ave., Toppenish, Washington. Middle-west and eastern stations, write to W2PAU, E. M. Brown, 88 Emerald Ave., Westmont, N.J.)

(Continued on page 102)

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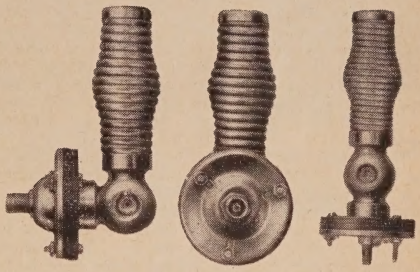
NET PRICE

BODY MOUNTS *(Regular)*

No. 132 Double tapered spring.....$8.75
No. 132C Coaxial double tapered spring..... 8.75

BODY MOUNTS *(Heavy Duty)*

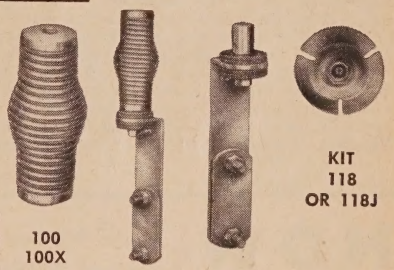
No. 132X Double tapered spring.....$9.85
No. 132XC Coaxial double tapered spring..... 9.85



132C 132XC | 132C 132XC | 132X or 132

BUMPER MOUNTS

No. 140 Double tapered spring.....$6.55
No. 142 Less spring, with insulator..... 3.25
No. 100 D. T. Spring only..... 4.50
No. 100X Heavy Duty D. T. spring only..... 5.50



100 100X | 140 | 142 | KIT 118 OR 118J

JUNIOR MODELS

No. 132J-D. T. spring without coaxial fitting.....$4.17
No. 132JC-D. T. spring with coaxial fitting..... 5.17
No. 140J with Double Tapered Spring..... 4.17

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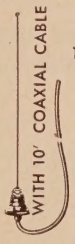
No. 118 Master Coaxial Conversion Kit.....$1.00
No. 118J—Jr. coaxial conversion kit..... .90
(No 118 Fits 132 Models & 118J Fits 132J Models)

EXTENSIONS For Model 106 Antennas

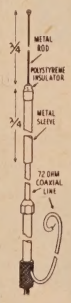
No. 90 — 26" extension $3.25
No. 92 — 18¼" extension 3.25
No. 94 — 36¼" extension 4.25

TWO METER ANTENNAS

No. 113 Roof top 2 meter 140MC to 165MC.....$3.96
No. 114 Coaxial VHF complete with cable..... 9.95
No. 117 Extra antennas for Nos. 113, 114..... .97



113



114 (COAXIAL TYPE)

ALL BAND MASTER MOBILE ANTENNAS

AB/W20, 40 or 75 meter coils, complete with any coil less spring.....$8.75
Extra coils 3.30

CIVIL AIR PATROL

MASTER CIVIL AIR PATROL ANTENNA 2374KC..$9.95
Extra C.A.P. coil..... 3.60
Extra C.A.P. shield..... 1.75

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Suggested for all Band Operation

STAINLESS STEEL WHIP ANTENNAS

Fits All Master Mounts
SERIES 100 with ⅜, 24 Thread Studs

Model No.	Length	Net Price
100-60S	60"	$4.95
100-72S	72"	4.95
100-78S	78"	5.00
100-86S	86"	5.15
100-90S	90"	5.20
100-96S	96"	5.25

Series 106 Without Studs, Fits Model 92 Extension.

Model No.	Length	Net Price
106-60S	60"	$4.15
106-72S	72"	4.15
106-78S	78"	4.20
106-86S	86"	4.35
106-90S	90"	4.40
106-96S	96"	4.50

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(from page 100)

WØMEK, Pisek, North Dakota, comments on PU1TKX's article, "The PU Expedition," CQ, March, 1952, p. 18. "At the time Bob, WØTKX, claimed to be on Torpos Island, he was sitting cozily at home in Minneapolis. I know—I was down to see him on November 22! But, rather than to embarrass the fibber, I won't tell a soul!"

Referring to this column for February, 1952, Emil says, ". . . . you said you'd like to see someone on 6 meters in North Dakota next summer. (**VHF Ed Note:** Please read it again!) Well, doggone it, here I've been on 6-meters since April, 1950, and have done a lot of checking and listening and some calling on the band at all seasons of the year. In 1950 . . . I worked 28 states and three VE3s last summer was terrible . . . I had a few QSOs that last week in May, a few in June, and then not another squeak came through. I have practically worn out the converter, tuning the band . . . sunspots, or something; 6 just never came through, here, last summer.

"The 6-meter rig is an 807, 35 watts input, on 50.1 mc. The beam is a 4-element array, 31 feet high. The receiver is a VHF-152A into an HQ-129X."

Bob Schoening, **WØTKX**, advises that WØRAJ—on Cyprus Island for a couple of seasons—is again leaving for Europe, soon. . . **WØQIN** has been having good luck on 6 and 2 from his new hill-top home, and is looking forward to Illinois contacts on 2, any opening, now.

For the first time since 1939, the Twin Cities, Minneapolis - St. Paul, Minnesota, radio amateurs will hold a big Mid-American and Dakota division convention on Labor Day week-end, September 5, 6 and 7, at the Nicollet Hotel, Minneapolis. "Our local VHF population is small, but active," says WØTKY, "so, we want the VHF gang to attend the events being planned. We guarantee the 6 and 2-meter men will not be neglected."—**Bob Schoening, WØTKX, Program Committee, Mid-American Convention.**

Bill Chambers, W7BYK, challenges, "What about the Faithful Few On Six? If any award is needed, this is the one! In the Seattle area, W7DYD, W7KGQ, W7KO and W7BYK are the main supporters of six-meter activity. W7MIG, W7FIM, W7FAW and W7GFM do show up occasionally, however." (Bill, you precipitated an idea that has been in the back of my mind—but hadn't jelled, of itself. Instead of the band-confining "Faithful Few On Two" designation, I'll make it **The Faithful Few On VHF.** Thanks for triggering the idea.—**VHF Ed.**)

W7BYK adds that most of the gang have gear on 2-meters, but that they prefer 6-meter operation. "There is lots of activity on 2 in Seattle, Tacoma and Olympia, but I am not familiar with exact details. I have some gear . . . to be used on 420 mc if for nothing more than getting multipliers on contests."

W7CZY, the local SCM, has 2 and 10 meter mobile. W7BYK has a 6-meter walkie-talkie unit that works well over a limited range. . . Normal operating hours at W7BYK are 1815 until 1900 or, sometimes, later. The rig is a 6AG7 VFO and an 832 final, 25 watts. The receiver is a Wallman cascode into a Super-Pro. The beam is a 2-element, but a 4-element array is scheduled to replace it , soon. The mobile rig consists of a bandswitching arrangement, pretuned so that 6, 10 and 75 can be selected readily. The 6-meter net frequency is pretty well established at 50.4 mc. The receiver at the home station is equipped with a 200 kc sweep circuit for checking the low-end of 6 meters.

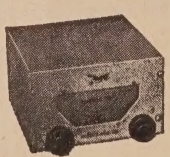
"Dear VHF Gang"

You fellows have buried me in mail! Now, that doesn't mean that I don't want mail, at all. But, circumstances have been such—for the past five months—that I just haven't been able to catch up on your many letters. My "to be answered" file is about 1-inch thick; I hope you won't lose patience with me—I plan to answer all specific inquiries, eventually. You do compliment me, so! Please, f'gosh sakes, don't condemn me for being slow on the reply as the gag goes, "Don't get excited: it's only a hobby!"

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The new Mallard three band converter and three band transmitter.

3-BAND VFO CONVERTER



FEATURES: ● Plugs into any xtal socket of any transmitter ● Voltage regulated-temperature compensated ● Nylon gear drive dial accurately calibrated in Kcs ● Ample band spread ● Glare free illuminated dial ● Power supply, available as optional equipment, supplies sufficient power for converter.

For more mobile QSO's - easier QSY while in motion get the new three band Mallard.

Amateur Net **$59.95**

MALLARD HI-Q 20 COIL



● Heavily plated 1/8" solid copper wire. ● Heavy flexible copper strap permits exact inductance adjustment. ● Sturdy, weatherproof housing of 1/8" thick plexiglas ● Removable threaded plastic nylon end-caps ● All metal parts of brass heavily nickel-plated.
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● Two pie-wound coils for greatest efficiency. ● Powdered iron-core slug. ● High Q throughout inductance range. ● Easily adjusted to exact inductance. ● Heavy insulated copper wire treated with Insulex to resist moisture and fungus growth and to maintain high Q. ● Completely weather-proof housing of 1/8" thick plexiglas. ● Threaded plastic nylon end — insulators. ● Easy installation — quick adjustment. ● Metal parts of heavily nickel-plated brass. ● Sturdy.
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3-BAND VFO TRANSMITTER



High efficiency, top quality components, skilled engineering - these characteristics best describe The New Mallard three band transmitter.

SPECIFICATIONS: ● 40 watts input on the three bands using the new RCA 6146 in the final ● 2 xtal sockets with selector switch ● ECO socket ● Hi-level AM modulation 100% - Built in speech clipper ● Antenna relay for push-to-talk ● Low impedance co-ax output.

TUBE LINE-UP: ● 6AV6 Oscillator or Buffer ● 6AQ5 Doubler ● 6146 Final with 12AU7, 12AU7, PP 6V6's.
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a tremendous performer

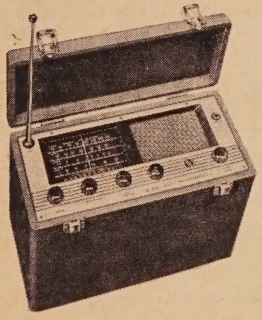
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THE HIGHLIGHTS: Frequency range, 540 kc to 54 mc in 6 continuous bands. Six crystal controlled channels in frequency range from 1.5 to 29.7 mc. Single superhet from 540 kc to 7.0 mc and dual conversion from 7.0 to 54.0 mc. IF's, 455 kc and 6 mc. For reception of AM, CW, MCW, ICW, and Carrier Shift Tele-typewriter. Six-position band change turret, with readily interchangeable coils. Dial calibration and precision gear train eliminate need for separate electrical bandspread; for example, from 350-550° of bandspread are provided on ham bands from 80 to 10 meters. Has extreme frequency stability and amazing resetability. Calibration accuracy, within ±0.2% or less at all frequencies.

Sensitivity is 2 mv or less for 10 db signal-to-noise ratio. Six steps of selectivity available. Audio fidelity, ±1.5 db from 200 to 4000 cps. AGC, ±6 db from 2 mv to 1 volt input. Image rejection, not less than 80 db at any frequency; IF rejection not less than 100 db. IF output, at 70 ohm socket, 200 millivolts (455 kc) with 2 mv antenna input. Carrier level indicators calibrated −30 to +70 db; zero db = 50 mv. Panel controls: RF gain, AC on/off; bfo pitch; audio gain; crystal phasing; selectivity; VFO/Crystal; crystal vernier; band selector; frequency; receive/send; CW/modulation; AGC/manual; ANL/off; antenna adjust. All components are built to JAN specs. Complete with 17 tubes, plus rectifier, voltage regulator and current regulator. Panel for standard relay pack is 10½" x 19"; depth behind panel, 16¾". Shpg. wt., 75 lbs.

97-553. Hallicrafters SX-73 Receiver. *Net* **$975.00**
$146.25 down, $73.21 monthly for 12 months.

97-787. R-46 Speaker for above receiver. *Net* **$19.95**



S-72 4-BAND PORTABLE

For powerful all-wave reception: 540-1600 kc, 1500-4400 kc, 4.3-13 mc, 12-31 mc. Two built-in antennas, loop for AM, 60" whip for SW. Has tuned RF stage, AVC, BFO, full electrical bandspread. Handsome carrying case, 14 x 12¼ x 7¼". For 105-125 volts DC, 50-60 cycles AC, or self-contained batteries. With tubes, less battery pack. Shpg. wt., 16 lbs.

97-505. S-72 Portable. *Only*.....**$109.95**
80-585. Battery Pack. *Only*..... **$4.17**
Model S-72L. As above, but with 175-400 kc band in place of 12-31 mc band. Ideal for marine and aviation service.
97-507. *Only*.....**$119.95**

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97-506. SX-71 Receiver.....**$199.50**
97-746. S-76 Receiver..... **169.50**
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97-540. SX-62 Receiver..... **289.50**
97-508. S-38B Receiver..... **49.50**
97-529. S-81 Receiver..... **49.50**
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- Available with matching stub & full directions for stacking two units one full wavelength for super-gain.
- Matches 300 ohm line, either singly or stacked.
- Rigid all-metal construction
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FEATURES:

- Only high stability crystal controlled mobile converter ever developed.
- 6BQ7 push-pull grounded grid RF amplifier
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- Four tubes used, works from automobile radio power supply, low current drain.
- Compact only 4" x 5" x 6" — weighs 3 lbs.
- Universal mounting, steering post or under dash.
- Vibration tested at 10 G's. Will withstand rough going.
- 21.667 mc crystal used — no image response
- Tuning range includes C.A.P. frequencies
- Price complete with all necessary tubes, crystal and instruction manual - ONLY **$59.50** Amateur Net

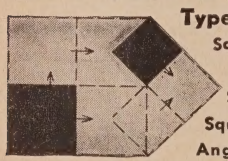
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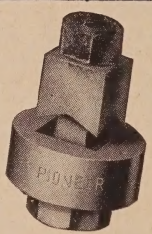
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Type "CS"
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3/4	$3.50				
7/8	$3.85				
1	$3.95	1	$2.15		
● KEYED		1 1/16, 1 1/8, 1 5/32	$2.30	1 3/8	$2.60
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MOBILE CORNER

(from page 74)

Check List

A check list is invaluable for prompting the memory when getting ready for a trip, exercise, etc. The following list is compiled from various sources, and as such, may include certain articles not considered necessary by some operators. It should serve, however, as a means of making up one's own check list:

Automobile and Equipment

1. Full tank of gasoline
2. Oil level checked
3. Battery recently checked
4. Spare tire in usable condition
5. Jack and lug-wrench
6. Extra can of gasoline and funnel

Radio Equipment

1. Crystals of net frequencies
2. Spare fuses (for car also)
3. Spare vibrators
4. Spare tubes
5. Spare panel lamps (for car also)
6. 10 meter folded dipole
7. 75 meter folded dipole
8. Loading coil.

Operating

1. Paper and message blanks
2. Log book and license
3. Pencils
4. Clip board
5. Pillow

Accessories

1. Extension cord and lamp
2. Flashlights
3. Tools—pliers, screwdrivers, pocket knife, wire, solder and iron
4. Multimeter
5. Neon-bulbs and wave-meter

Personal

1. Drinking water
2. Blankets
3. Extra Clothing
4. Card tables and chairs
5. Tarpaulin
6. Ropes
7. Ground stakes
8. First-aid kit

Power

1. Extension battery leads
2. Extra 6-volt battery
3. Extra vibrapack or dynamotor
4. Gas-engine generator

Remote Control

A recent requirement for remote control of a mobile unit demonstrated how complex an utterly simple application can be. If you think it's simple try building a unit of these specifications: 1) The extension is a telephone handset with switch. 2) The handset switch will control the transmitter or alternatively turn on a lamp which signals the car operator to turn on the transmitter. 3) The handset mike works directly into the transmitter or alternatively the car operator can use the local mike 4) whichever operator is transmitting, the other can monitor the transmission or

(Continued on page 106)

Mobile Catalog!

GONSET

Two meter converter	$47.80
Triband converter	47.60
10 meter converter	44.74
3-30 meter converter	44.74
Noise clipper	9.24

SONAR

MB-26 Transmitter available in 2, 6 or 10 meters and commercial freq.	$72.45
SR-9 Transmitters available in 2, 6 or 10 meters and all commercial AM & FM freq.	72.45

HARVEY-WELLS

Bandmaster, Sr.	$111.50
Bandmaster, Deluxe	137.50
APS50 AC power supply	39.50
DPS50 DC power supply 6V	87.50

ELMAC

A-54 Transmitter	$139.00
A-54H Transmitter	149.00
PSA500 Power Supply	39.50

CORNELL DUBILLIER

Converters					
6R10	6 VDC	to 110 AC	100 Watt..		$41.07
6R5	6 VDC	to 110 AC	50 Watt..		28.95
12R8	12 VDC	to 110 AC	80 Watt..		28.95
12RU15	12 VDC	to 110 AC	150 Watt..		54.48
Travelectric					
6-1160	6 VDC	to 110 VAC	35 Watt..		10.63

ELDICO

Two meter superhet receiver wired & tested	$94.95
Two meter superhet receiver Kit complete	59.95
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All band mobile antenna center loaded with coil for either 20, 40, or 75 meter - specify freq. coil desired	$ 8.75
For ten meters short out coil in use, extra coils	3.25
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Model 94 36" Extension	4.25
Model 126 Universal Mount	8.75
Model 126X " "	9.40
Model 132 " "	8.75
Model 132X " "	9.85
Model 132XS " " Stainless steel	40.75
Model 138 Bumper mount	6.55
Model 113 two meter roof mount	3.96
Model 114 two meter Universal mount	9.95

We also carry Premax, Ward and Radelco mobile antennae and mounts. And all top nationally advertised lines of Parts, Receivers and Transmitters.

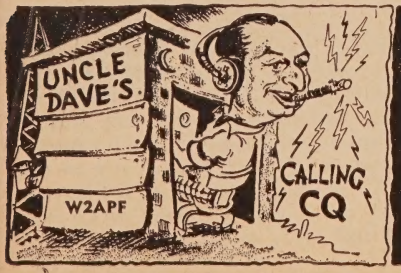
MALLORY VIBRAPACKS

Cat. #	Nominal Oper. Voltage	Nominal Output Voltage	Max. output current	Type	
VP540	6.3	250	60 MA	Self-rectifying	$19.80
VP551	6.3	125,150,175,200	100 MA	Self-rectifying	14.52
VP552	6.3	225,250,275,300	100 MA	Self-rectifying	17.34
VP553	6.3	125,150,175,200	100 MA	Tube rectifier	16.17
VP555H	6.3	300	200 MA	Tube rectifier	34.32
VP554H	6.3	225,250,275,300	100 MA	Tube rectifier	18.99
VP557	6.3	400	150 MA	Tube Rectifier	34.32
VPG556	12.6	225,250,275,300	100 MA	Self Rectifier	18.99
VPF558	32	225,250,275,300	100 MA	Tube Rectifier	20.64

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MAS320	6	300 V.	@ 200 MA	Magmotor	43.31
MVS415	5.5	400 V.	@ 150 MA	Magmotor	45.29
420A	6.0	400 V.	@ 200 MA	Generator	45.29
450AS	6.0	400 V.	@ 250 MA	Generator	45.68

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$25. deposit with order — balance C.O.D.

Coils for 80, 20 and 10 meters $2.91 per set. Coils for 160 meters $3.60. Equipped for CAP 4585 kc. **$83.50.**

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14 V. DC	375 V. 150 MA.	DM-375	8.95
14 V. DC	330 V. 135 MA.	DM-330	7.95
14 V. DC	500 V. 500 MA.	PE-59	14.95
12 or 24 V. DC	275 V. 110 MA.	USA/0516	3.95

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MOBILE CORNER

(from page 104)

both can talk without switching. 5) The car operator can talk to the remote operator without the transmitter operating. After this has been worked out, then try running in another mobile, and adapting the unit to it in a few seconds. We would appreciate hearing from any of the fellows who have worked out such a unit.

Odds and Ends

W5TCV reports a Houston, Texas "Atom Bomb attack" on February 29th. Mobiles drove around the disaster area and reported to the NCS, W5STK, who relayed to the main control center by field telephone. Participating were W5's STK, TCV, ADZ, RSJ, MK, QJS, IRP, TFA, TGA, UMD, NHB, ON, LLT, UFH and HPG . . . . Presumably everyone has caught the error of listing a 6AX7 instead of a 12AX7 in the Noise Limitor in the January issue. Fortunately there "ain't no" 6AX7 making the error obvious. Pin connections shown are those of 6SL7, not the 12AX7. . . . . This writer is still concerned at the number of mobiles using modulation systems other than plate which are badly out of adjustment. These operators don't seem to care what the signal sounds like so long as they can work someone, even though they are told on each QSO that the signal is violating practically every requirement in the book. Keep it up boys; one day you may find that mobiles are regulated down to the last screw and washer. . . . . For those fellows that wish to work ten and the little lady doesn't wish a standard whip on the car, the abbreviated whip with matching stub should be investigated. This antenna looks like an ordinary receiving antenna but the slip-joints won't slip . . the whip is solid. Tests have shown this antenna assembly is only about 2 db less efficient than a full sized 10 meter whip. A relay should be installed to open the stub if the antenna is to be used on the broadcast receiver. This antenna is made by one of the leading antenna manufacturers and is very reasonably priced. . . . The 6BQ7 is appearing in a number of rigs. You can get more watts per volt if the power supply will stand the mils.

4 ON 1 CONVERTER

(from page 39)

the coils and *C3* when the side to which it is attached is put in place. Send/receive switch *S3* is mounted near the front of this side plate and the on/off switch *S4* is mounted in a similar manner near the back of the side plate. This completes the assembly.

Wiring

The band switch and coils are wired first. The switch being positioned to obtain the shortest possible leads to the 6 meter coils. The socket connections are wired next and the socket mounting stud is used as a common ground point. The condensers used across coils *L3, L4, L5, L6, L7,* and *L8* are next installed. The output coil *L9-10,* the antenna jacks and *S1* are wired. The pilot lamps *Lp1* (white) and *Lp2* (red) are held in position (so

(Continued on page 108)

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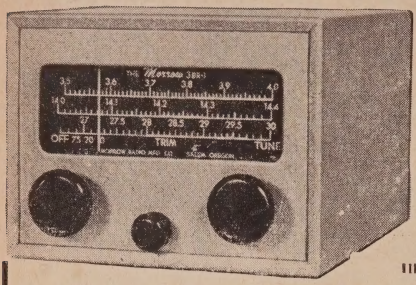
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4 ON 1 CONVERTER

(from page 106)

they will light the dial face) by stiff wire soldered to the socket shells and made fast to one of the dial mounting bolts. Flexible leads are soldered to the tip connections of the dial lights and brought out for connection to *S3*. The power wiring is next and flexible leads are brought out the left side of the box for connection to *S3* and *S4*. The components on the left side plate are wired in with flexible leads made as short as practical. After completing this wiring the side plate can be fastened to the box. The converter is mounted on an aluminum base plate with four small shock mounts. This base plate is provided with a clamp for attachment to the automobile steering column.

Operation

If a grid dip meter is available it will greatly facilitate alignment. The output circuit *L9-10* is tuned to 1500 kc. With *C3* set near maximum capacity and with the band switch set for the proper bands the following oscillator frequencies should be set up by adjusting the coil slugs as follows: *L5*—25,750 kc; *L6*—28460 kc; *L7*—15,500 kc; *L8*—5,200 kc. With *C3* in the same position as before and with *C1* and *C2* set at mid-point the coils in the detector circuit should be adjusted as follows: *L1*—50,000 kc; *L2*—26,960 kc; *L3*—14,000 kc; *L4*—3700 kc. If a grid dip meter is not available the oscillator frequencies can be set up by applying power to the converter and listening on a receiver; however, it will be necessary to put the converter in operation and peak the detector circuits by actual signals or noise background. The antenna network condensers *C1* and *C2* are adjusted for best operation with the particular antenna in use at any time. *C2* can be very effectively used as an antenna trimming condenser although ordinarily when it is properly adjusted for mid-band operation further peaking is not required. It is also used to advantage as an attenuator when receiving strong local signals to prevent receiver blocking.

The band spread on the 75 meter phone band is approximately 45 dial divisions. Tuning from 14,000 to 14,400 kc occupies about 20 dial divisions and if the inductance slug is adjusted so that 14,000 kc is received with the tuning condenser *C3* at near maximum capacity the 15-mc short wave broadcast band can be covered. If desired, additional band spread for the 20-meter band may be obtained by padding the 20 meter oscillator inductance with additional capacity and operating the oscillator on the low side of the signal frequency. The spread on 10 meters is approximately 30 dial divisions and the 11 meter band can be covered without slug re-adjustment. The six meter band is spread over about 40 dial divisions.

This little converter has produced very satisfactory results on all four bands and it can be truthfully said that the performance has exceeded expectations.

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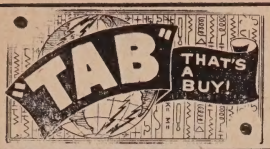
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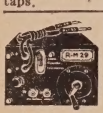


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SCRATCHI

(from page 4)

I'm sorry I mentioned that money stuff. At moment Scratchi are flatter than piece of ham in drug-store samwich. As soon as I get through paying my bill at Joe's Triple-Dip Hunky-Dory Ice Cream and Used Magazine Parlor I won't having enuf money to buying slitely used soddering lug. Oh well, all I having with that truck and transmitter is a big moving house. House!! That's it, Hon. Ed. A house!! Are there any rules in ham radio which saying that mobile rig have to be moving? Not by a jugfull. Oh boy, I reely got idea now.

I drive car up to window of shack. Not having any rig in car, but are having nice new mobile antenna on car I trading out of local ham for cupple gallons of cacktus jooce. Now, all I having to do is feed power from main rig into car antenna, and having nice mobile setup. No sense in letting my ten kilowhat rig go to waste. Just feed car antenna with it and Scratchi will having mobile signal what are reely producing results.

I quick-like dragging length of coax cable from junk-box, making link for final tank, and running coax to whip antenna on car. To making sure having good connection I soddering everything reel peechy. Next I reducing power on final down to cupple hundred whats, and tuning up antenna. Boy oh boy, I can pulling nice two inch arc off the top of antenna. I going into shack, turning on receiver, raising power to full ten kilowhats, and calling seek-you mobile. First cracker out of the box I raising a VK, and having nice chat. He telling me that I must be pulling his leg when I saying that I using ten kilowhats mobile. He thinking that a grate joke. Hee, hee, how little he knowing, Hon. Ed!!

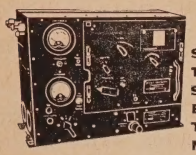
Next fellow I hooking are in Sumatra. He telling me he living on rubber plantation. I going back and tell him reception is reely good that nite, on acct. I can almost smell rubber burning when listening to him. In fact, even after signing with him I smell rubber burning, and it seem to be coming from direction of window. I rushing outside to car, but can't finding anything. Maybe it rubber grommet around antenna. I going back to shack and throwing rig on air, then going back to car. Hokendoke Hackensake!!! What a sight! Hon. Ed., the rear wheels look like forth-of-July pinwheels! Arcs are going from car body to axles to wheel, and the rear tires are smoking. As I watching, the hole rear of the car seem to change color. Next thing I knowing the trunk cover is getting red hot, and I running away like sixty, when WHAMMM!! Big explosion knocking me off my feet, and when I getting up and turning around, the hole car are on fire.

Brother Itchi come running out of house with fire exstingwhisher and soon getting fire under control. Golly, was he mad. Hon. Ed., he so mad he hitting the ceiling. Not that this is bad, but he hitting the ceiling with me. Oh my aching back.

Well, you can having this mobile stuff. I'm off it. I'm content to sitting in nice comfortable chair in shack and working with my home rig. That is, I'll be content to do same as soon as Hon. Brother Itchi are letting me in radio room. At moment he putting padlock on door and throwing away the key.

Respectively yours,
Hashafisti Scratchi

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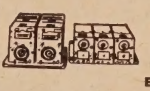


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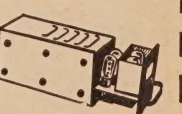
RECEIVERS

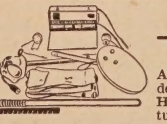
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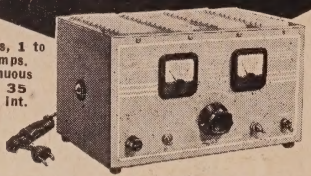
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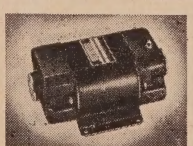
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MOBILE SPECIAL

(from page 28)

monics created by the clipping in the modulator stage.

An added feature is the inclusion of a high level negative peak clipper to prevent possible breakup of the carrier should any transients on the negative peaks extend beyond 100% modulation. An OZ4 cold cathode tube is used for this purpose, since it requires no heater potential. Comparative tests have indicated no difference in its operation, for this service, over that using the customary hot cathode rectifier tubes, except that it is not advisable to use it where the plate supply potential is less than about 325 volts, since it requires at least 300 volts to fire the OZ4.

Small coupling capacitors are used in the speech amplifier stages to drop off the low frequency response, so that the clipping of these frequencies, which contribute little to intelligibility, will be less, with little production of harmonic distortion being created within the pass band of the modulation system.

End of Part one. Part Two will appear in June.

(The Editor feels that a few words of explanation are in order on the division of this article. As many of our readers are aware, W2AEF is an outstanding author and well-known for his extremely thorough step-by-step construction texts. During the preparation of this article it became obvious that the drawings and texts on the construction (now Part Two) would consume another seven or eight pages. Thus in the interests of "rounding" out this issue we have regrettably divided this feature into two sections.)

CD MOBILE

(from page 73)

to see if all the filaments light properly, the 6J6 r.f. amplifier tube should be removed from its socket. Connect an r.f. generator which is audio modulated between the first i.f. amplifier grid and ground. Set the generator to the i.f. frequency desired, which in this case is 5.8 mc. With the speaker or resistor load plugged in and an a.c. voltmeter connected between the 6AQ5 plate and ground, adjust. Tune i.f. transformers for maximum reading on the meter. Keep the output level of the generator low enough so that the most sensitive scale of the voltmeter can be used. This practice prevents receiver overload and subsequent false alignment. Remove signal generator and bring the load from a 144 mc generator near the mixer grid circuit. Due to the peculiarities of this type of mixer, aligning the first i.f. transformer with a 5.8 mc signal injected into the grid of the mixer will result in faulty alignment of the first i.f. Adjust the pad on the generator until the signal is heard in the

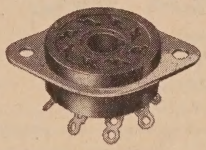
receiver. This is a temporary setup. With the signal tuned in, peak up the adjustments of *IFT1* for maximum. It will be noted that this transformer tunes in a noticeably different manner than the others. What is meant by this is that the maximum obtained by injecting a 5.8 mc signal into the grid of the mixer and the maximum obtained by this method will not coincide. The second method is obviously correct.

At this point it will be necessary to set the oscillator tuning range. With the oscillator tuning capacitor fully meshed and a signal frequency of 143.9 mc injected into the mixer grid cirucit, *slowly* rotate the oscillator pad until the signal is tuned in. Inasmuch as the rotor of the pad is at both d.c. and r.f. potential a non-metallic aligning tool must be used. There will be two settings of the oscillator pad which will tune in the signal. The higher capacity setting will place the oscillator on the low side of the incoming signal and the lower capacity setting will give high side operation. The choice of the two will be dictated by conditions previously described. Set the signal generator at 148.1 mc. Rotate the oscillator tuning capacitor towards minimum capacity. If sufficient bandspread results, bend the rotor plate away from the stator plate slightly, reset the 143.9 pad adjustment and repeat the process. By repeated adjustment of the pad at the low end and bending of the plates, full bandspread will be obtained. The bandspread in these units has been set at 70-80 divisions. Set the signal generator to 146 mc, tune in and adjust mixer pad for maximum output. Plug in the r.f. amplifier tube and allow a warm up of about 10 minutes. More than likely a loud and unpleasant squawk will result. Connect a vacuum tube voltmeter with a 50,000 ohm carbon resistor in series with the negative lead between one of the amplifier grids and ground. A negative reading will more than likely result, indicating oscillation. Adjust the neutralizing capacitors in equal steps until the grid voltage falls to zero. Adjust the amplifier grid and plate tuning to resonance at 146 mc. Unless you are lucky, negative voltage will again appear during this step. Repeat these adjustments until no negative voltage appears at any settings of the trimmers. Remove meter and repeak amplifier grid, plate and mixer grid circuits to 146 mc. If the neutralization is properly done, no regeneration or oscillation will be experienced, even with the antenna disconnected. With the generator set at 146 mc, touch up all the trimmers for maximum. Move the coupling link of the oscillator in and out. You will probably notice that very little change in level will occur. Use as light a coupling as is possible. After the alignment has been completed the antenna may be connected. Trim the amplifier grid circuit to 146 mc, tune the receiver and get yourself a pleasant surprise. The sensitivity, stability and signal to noise ratio of the receiver will be found to be excellent. As a final check, remove the r.f. amplifier tube with the antenna connected and notice the drop in noise level. If the set is operating properly the

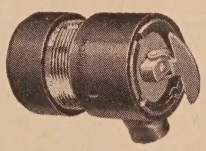


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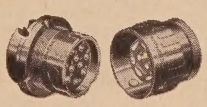
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noise will drop to negligible proportions. This indicates that the antenna and r.f. tube noise effectively masks the mixer noise, which characteristic is absolutely necessary in a properly designed VHF receiver.

Transmitter Alignment

Remove the doubler, buffer and final tubes from their sockets. Plug in crystals into socket and set selector switch on *position 3*. Clip a voltage of about 150 volts between the exciter B+ buss and ground. Connect a VTVM or 20,000 ohms/volt meter in series with a 50,000 ohm carbon resistor between tripler grid and ground. Adjust slug of *L10* for maximum reading on meter. Switch selector to *position 4*. Unless the crystals are widely separated relatively little change in tripler grid voltage will occur. Cut the plate voltage, plug in doubler, move meter to doubler grid, turn on supply and repeat previous steps by adjusting slug of *L11*. Plug in 6AG5 buffer and repeat, adjusting slug of *L12*. Plug in final amplifier, connect meter between grid center tap and ground. Adjust *C36* and *C37* for maximum final grid current. Adjust link coupling for maximum voltage. Resonate plate circuit of final amplifier. A sharp dip in grid voltage will undoubtedly result. Adjust neutralizing capacitors in small steps, keeping *C37* resonated for maximum drive, and rocking plate tuning capacitor. Continue this adjustment until no grid voltage variation occurs at any setting of *C40*. Reset *C36* and *C37* for maximum drive. Switching crystals should produce relatively little change in grid voltage. Touch up slugs of *L10, L11* and *L12* for maximum grid voltage. Increase exciter plate voltage to 275 volts. At this voltage the various grid voltages should be approximately the same as shown on the diagram. The exciter is now tuned and the final is neutralized. Temporarily insert a 0-50 d.c. milliammeter in series with the B+ lead to the final. The plate supply voltage should now be connected in its normal fashion. With the microphone plugged in, press the push to talk button. The plate current of the final will probably be near 50 ma. Quickly resonate *C40* until plate current dips. The final should dip to approximately 10 to 12 ma with no load. Connect a blue bead pilot lamp dummy load to the output coaxial jack. Press button, resonate final and adjust output coupling until plate current reads between 20 and 30 ma. A good average is about 25 ma. At this point the lamp will be close to burning out, if not actually burnt out. Talking across the mike at a distance of 3 to 4 inches, adjust the setting of *R26* until a marked increase in the intensity of the lamp load results. Doubling the intensity will be approximately correct. The normal scope method for adjusting 100% modulation may be used if desired. Remove meter and reconnect B+ lead. You are ready for installation and adjustment.

The problem of ignition noise, locations of supplies and cable types have been adequately covered by others so no time will be spent on these subjects

(Continued on page 116)

HARRISON HAS MOBILE EQUIPMENT

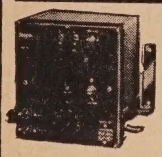


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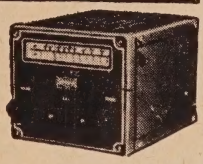
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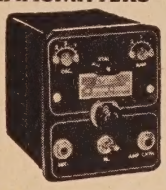
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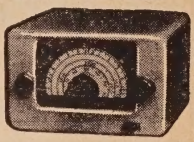


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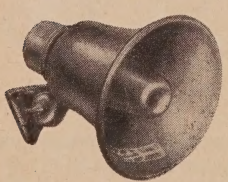
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(from page 114)

here. Needless to say, the final operating characteristics of the receiver will depend a great deal on the normal noise problems.

The final adjustment of the receiver and transmitter is performed in the car with the antenna connected. Tune in a signal and adjust the antenna coupling to the receiver for maximum. The receiver is now complete. Set a field strength meter in a position where you can observe its reading. Press button and *quickly* adjust *C40* through hole in bottom of case for maximum field strength. The rig is now complete and ready for operation.

In closing a few pointed statements are in order:

(1) Do not attempt to use supply voltages higher than 300 v. A good compromise is 275 volts.

(2) Do not try to run more than 8 watts input. Remember what kind of a tube you are using in the final.

(3) In adjusting final, do not hold button down for long periods unless you are sure the final is resonated.

(4) Carry a field strength meter in the car along with spare tubes.

If these precautions are observed you will be rewarded with long periods of trouble free operation and many enjoyable QSO's. In closing the writer wishes to say that any questions regarding this unit will be gladly answered on receipt of a stamped, self-addressed envelope.

YL'S FREQUENCY

(from page 81)

M'Lou Hill, XYL of KH6AID, who passed their Novice exams and are waiting for their tickets. Other XYLs now studying for their tickets include Eileen Davis, XYL of KH6ALH; Gladys Thrasher, XYL of W8CIV; Marie Lam, XYL of KH6GG; Linda Vittum, XYL of KH6AO; Billie Wolford, XYL of KH6AGR; Evelyn Arnett, XYL of KH6ZZ; Marie Martin, XYL of KH6PA; Hazel Manner, XYL of KH6TY; Jeane Grube, XYL of KH6ALK; Caroline Mercer, XYL of KH6EZ, and Alma Falk.

Dell says all credit goes to KH6AFN, Jeanette, for starting the ball rolling and getting the club organized. It definitely has stirred up a lot of interest and one of Hawaii's leading newspapers, *The Honolulu Advertiser*, sent a photographer and reporter to the meeting and a story on the club was featured in the Sunday paper.

Best wishes on the success of your club. It's especially encouraging to see so many XYLs going after their tickets!

Los Angeles YLRL

Cold and rain (in California!) didn't deter a goodly number of YLs from attending the March meeting, and two new members were enrolled in the club. Add their calls, W6LNP and W6LMQ, to the list of club members you may work for the *Lad 'N Lassie* certificate. Incidentally, these YLs were recruited from a list obtained from the local FCC by secretary AVF and president CEE, who received permission to go through the FCC list of local calls

to look for likely YL names. Then the YLs were sent invitations to club meetings. An idea for clubs in other cities. Club plans include a picnic to look over a proposed Field Day site in the San Bernardino Mtns. They also will have several members as operators at the ham booth at the Los Angeles Hobby Show the end of March.

Here and There

Aren't there *any* YLs active in Utah? The State of Utah is badly needed for WAS/YL. If there is any YL in Utah active, on any band, or who will make a sked — or if anyone else knows of such a gal — please drop a note to this column editor. Tnx!

A note from W6FEA, Gertie, District Chairman for California, says she is happy to see all the news of the Los Angeles and San Diego YLs, but how about a little news from the rest of the state. And she sent along the following:

W6GQZ, Iva, won the Dr. Wing 2-meter activity trophy for the San Joaquin section. The third time for permanent possession . . . W6KNJ, Betty, belongs to CAP and So. Alameda CD net and handles traffic for boys in the Pacific area . . . W6PJF, Rosemary, is NCS for the YL net at 1300 PST on Wednesdays on 3910 kc. Checking in: W6DCL, EWV, FEA, HHD, HTS, HRO, NLM, WRT. Other YLs are welcome . . . W6FKY, Aileen, is building a modulator for her OM's 80-meter CW rig so she can go on 75 when her Advance Class ticket arrives . . . W6YLT, Mabel, is most active on 20 meters for skeds with JA stations and their families in the area . . . W6ZKD, Betty, QRL in high school. Teaches code in the Naval Reserve and also works in a radio store after school and Saturdays . . . W6FEA,



W5IZL, Ruth Brown, finds operating mobile a necessity. Between homemaking and helping her OM run their newspaper about her only time for QSOs is en route between home and office.

(Continued on page 118)

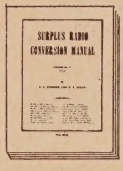
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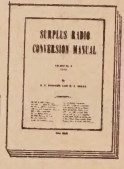
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CQ Magazine

67 West 44th Street, New York 36, N. Y.

Gertie, is active in the American Legion net on 3975 kc which distributes traffic from overseas. Tnx for the news, Gertie!

Your column editor has just received one of those handsome certificates of membership in the Military Amateur Radio System. (It's worth joining just to get one, gals—hi!) Now to get cranked up on 4025 and join the other YLs around N.M. in MARS.

YL of the Month

Some time ago we received this interesting letter: "I am XE1BT and W9MMO is my wife, and she, therefore, is the chief op here in West De Pere, Wisconsin. She is the first W to take XE1BT, equipment with operator and all—hi! When we go to Mexico City she is considered a full citizen and is able to operate XE1BT without any restrictions on all bands. So I think as to date she is the only American citizen who has these privileges. We have several Americans operating in Mexico, but they are restricted to 10 meters, as you know, and Lillian has no such restrictions."

Of course, we had to know more, and a note to Lillian, herself, brought these details. This was after the National Convention at Seattle. XE1BT had been appointed Mexican Delegate to the convention so they packed up their four little harmonics and went to Seattle, with a lot of sightseeing along the way—Glacier National Park, Grand Coulee Dam, Yellowstone and the Black Hills.

"And we met other hams sightseeing at every place," says Lill, "You just can't miss those mobile aerials! We had an FB time in Seattle. It's the first ARRL convention I have attended. Three years ago I attended the Mexican convention in Merida, Yucatan, but I wasn't a ham then; I have had my license only since February, 1951.

"I never heard of ham radio until I started going with the OM. He has been XE1BT for 26 years, and his League has made it possible for him to keep his call in force though he has been residing in the USA for 14 years. He was my Spanish instructor at the University of Wisconsin Extension Division. We were married about 2½ years later. I studied code off and on for several years before I first went to Chicago to take my test. Needless to say I didn't pass! In between studying I had two boys and a girl. Last December I made the supreme effort and took the test again. My license came through the middle of February and on March 6th my third boy was born. The junior ops range from 1 to 5 years!"

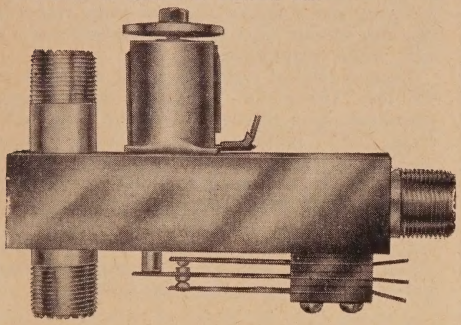
W9MMO's home rig is a Motorola transmitter, about 200 watts input, remotely controlled, with a 3-element wide-spaced beam. She also uses a Meissner signal shifter and her receiver is an HQ129X. For 40 CW she uses a homemade 35-watt transmitter. So far she is operating only on 10 phone and 40 CW, but hopes to go on 20 soon.

"As you could probably tell from the picture W9MMO/M is a 3-band Karadio and a Gonset converter to operate a fixed frequency Motorola receiver, using the speaker of the Karadio for both receivers. The transmitter is a Motorola Model T-69 20A which originally was a police transmitter and which the OM converted. Presently it is on 10, but in Mexico we operate it on 40-meter phone. Incidentally, when in Mexico I operate as second operator under the OM's call, XE1BT. Which means that I can operate in two different countries under two different calls!"

33, and see you next month. *W5RZJ.*

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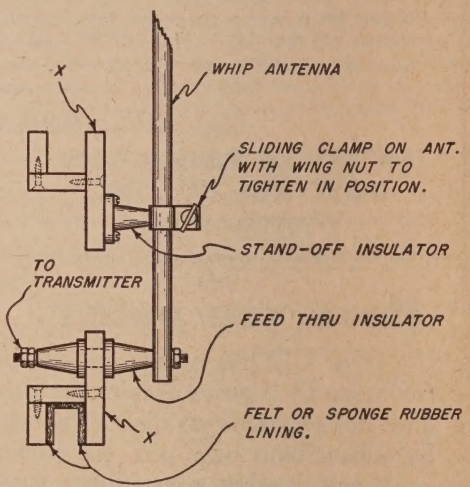
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NOVICE SHACK

(from page 84)

the *RCA Ham Tips*. Called the "Twomobile" by its designer, W2OQN, the unit is a complete 145 mc transceiver, (*Transceiver*: *Trans*mitter-re*ceiver*) so called because parts of the circuit are used both for receiving and transmitting. The audio stages feed a two inch speaker when receiving and serve as a modulator while transmitting.

Using a total of eight tubes and a voltage regulator, the "Twomobile" features a superregenerative/superheterodyne receiver, consisting of a 6AK5 r.f. stage, 12AT7 oscillator/mixer, voltage regulated by an OA2, 6C4 superregenerative second detector feeding the 6AU6-6AQ5 audio amplifier/modulator stages. The three tube transmitter circuit consists of a 6AK6 oscillator/doubler, 6AK6 doubler, and 5763 doubler output stage, and has an output of a watt and a half, which has been sufficient for many mobile-to-fixed-station contacts up to thirty-five miles.



X -- MADE OF WOOD -- MAKE 2 -- DIMENSION OF OPENING TO FIT OVER TOP & BOTTOM SILLS OF CAR WINDOW -- GLASS COMPLETELY OPEN.

Fig. 3. An easily removable car window mount for mobile antennas. A piece of plywood, slightly smaller than the glass in the car door, with the insulators mounted on it may be substituted for the brackets. Lower the glass and insert the top and one edge of the plywood in the slot remaining. Then raise the glass to hold plywood in place. Naturally, this is not recommended for very heavy antennas, etc.

More information on the "Twomobile" may be obtained from the January-February, 1952, edition of *RCA Ham Tips*, available from your dealer or from: Tube Department, RCA, Harrison, N. J.

Mobile Antennas

It takes a lot of courage or perseverance to drill holes in an automobile body to mount a mobile antenna—especially if it is your father's car. Bumper mounts can be installed without drilling; therefore one can be mounted permanently, and the antenna itself, plus a length of coax connected between it

and the transmitter through a slightly opened window, added whenever desired. *Figure 3* also shows how temporary window mounts may be used.

An efficient all-band mobile antenna is very difficult to design, but the one sketched in *Fig. 4* has possibilities in covering the three Novice bands. As a quarter-wave "Marconi" antenna for the 27 mc band is about 103 inches, the whip length should be that long. It so happens that a "Marconi" antenna may be any number of quarter waves long, and the 145 mc band is approximately five times twenty-seven mc; so the 103 inch length will work quite well as a five-quarter wave antenna on 145 mc.

An eight foot whip is a poor radiator on the 3.7 mc band under any circumstances; however, its efficiency can be improved greatly by the addition of a loading coil. The easiest place to put it is between the base of the whip, but the nearer the top of the whip it is placed, the more effective it is. Remembering that the whip will work on 145 mc when it is any number of quarter waves long, the whip can be cut at either twenty or sixty inches and the coil inserted. Then the loading coil and the rest of the whip can be used for 3.7 mc, and the coil shorted out or removed for 27 mc. Other articles in this issue will give details on adjusting the loading coil for best results.

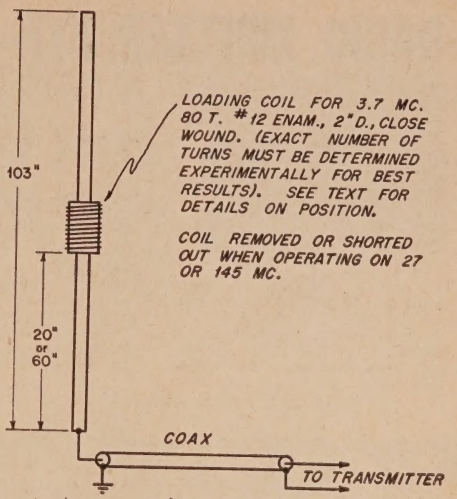


Fig. 4. A suggested novice band mobile antenna.

Miscellaneous

Donald G. Colley, Santa Monica, California, poses a problem that has probably worried almost every person who has recently applied for an amateur license. He writes: ". . . went to the F.C.C. examining point in Los Angeles a couple of weeks ago, took the Novice examination, passed it, and then found out that it would take the F.C.C. *from three to six months* before they would get around to issuing me a license!

"Is there anything that can be done to speed up the extremely slow processes of the F.C.C.? They certainly can dampen the enthusiasm of a beginner in ham radio."

(Continued on page 122)

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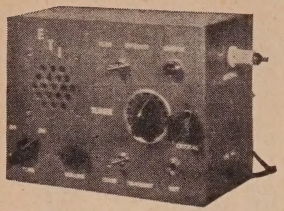
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All that can intelligently be said about the F.C.C. log jam is that they are doing their best to break it, even to relaxing rules applying to renewals—which does the new applicant absolutely no good. Writing to F.C.C. does not help either, since processing query letters takes time that might otherwise be used in processing license applications.

Because the F.C.C. is so slow, Novices applying for General Class licenses should not wait until just before their Novice license expires to do so, unless they want to be off the air for several weeks waiting for a license. Obtaining a Technician Class license as soon as you feel you can pass the technical examination, even though your code speed is not yet high enough to pass the thirteen-wpm code test is another good idea. Holding a Technician Class license, as soon as you pass the code test, your license is immediately endorsed for General Class privileges by the F.C.C. examiner.

Bob, WN1UPX, makes an excellent suggestion. "I don't see why QSL's can't be sent in envelopes. If you receive a card on a rainy day, chances are 99 to 1 that it will be all wet and the ink smudged. Now that it costs two cents to send a card, why not add one cent and make sure your card doesn't arrive all wet or with cancellation marks all over it? Don't you think it is worth the extra cent?"

Bob has a very handsome card, and it happened to be a wet dreary day when it came. Being protected by its envelope, it arrived undamaged, but I am glad a certain WNZ didn't see the condition of his.

Jim, WN9PRJ, who previously reported on his experiments on improving the stability of his S-19R in the *Novice Shack*, says that feeding the i.f. output of the BC-454 into the S-19R and its i.f. output, in turn, into a BC-453 did not work so well; therefore he keeps the BC-454 as a standby receiver. He is now busily building an all-band transmitter, using a 6AG7 driving an 807, preparing for the day he knocks the *N* out of his call.

Ira, WN2HMR, one of the *Novice Shack's* regular contributors, writes another of his newsy letters. He and his Novice friends are all members of the Queens ARC emergency networks on 145 and 3.7 mc. Spence has obtained his General Class license. WN2MAI's name is George, and Ira, himself, hopes to have his code speed up enough to take his General Class examination before next month.

Help! Help! Joe Wilkerson, P. O. Box 715, Thomasville, Alabama, would like help from someone on his code; so that he can get a Novice ticket. He sends fairly well, but "can't receive worth a flip."

Just to prove that the *Novice Shack* gets around, this month's mail included letters from the California State Prison at Folsom, Represa, and from The Island of Barbados, B. W. I. Both wanted information—about radio, not on my record.

George, W4PJU, told me that WN4TED, Macon, Georgia, has worked all states (WAS), has the cards and has obtained his General Class license, apparently making him eligible for one of the S-76 receivers offered as a prize in the *Hallicrafters* Novice WAS contest.

Do you remember the item in last month's column about Dick France memorizing the code while flying at 10,000 feet in an aeroplane operating on instruments. I have talked to Dick personally about it since then. Not only were they using oxygen equipment, but they were flying completely "blind" and Dick was doing the navigating! Maybe memorizing the code isn't so difficult after all.

Equipment

Adding to our roundup of transmitters designed for the Novice, are two kits offered by John K. Dixon, WN8IPJ, 17569 Greenview Ave., Detroit 19, Mich. The first kit, using a 6L6, is rated at 25 watts input, and sells for $35.00. The second, 6F6, 807, 807, is rated at 75 watts input, and sells for $49.95. John reports that both kits are complete with tubes, power supply, crystal, key and all parts, and they can be operated on both 3.7 and 27 mc.

Some of you who purchased the *Eldico* "Private Tutor" Novice Course may have suffered some inconvenience because of delay in the arrival of the printed lessons. The difficulty has now been corrected, and all lessons should arrive with the code records.

Questions From the Novices

Q. Can the pi-output network of a small transmitter be link coupled to the grid circuit of a push-pull 807 amplifier?

A. Yes. Connect the pi-network to center link of the grid coil through low-impedance twisted pair line or coaxial cable. The pi-network is tuned in the normal manner to vary excitation. Of course, the 807 grid circuit must be tuned to resonance with the excitation frequency.

Q. What tube should I use to drive 807's?

A. Any of the small pentodes and beam-power tubes such as a 6V6, 6AQ5, 7C5, 6AG7, etc., in a crystal oscillator circuit will drive 807's on the 3.7 mc band. The 6AG7 puts the least strain on the crystal and is to be preferred on that score. A 6L6 will deliver more output power than any of the above tubes, but is hardest on crystals.

On 27 mc, a stage between the oscillator and 807's is recommended. Here again, any of the tubes mentioned above may be used, although all of them with the exception of the 6AG7 or 807, will have to be neutralized for maximum stability. A 2E26 will also make good intermediate "buffer" amplifier, and will not require neutralization.

A good way to build such a transmitter is in steps. Build the oscillator, use it on the air until you are thoroughly familiar with its operation, add the buffer, then the final amplifier. A 300 to 400 volt, 100 ma power supply will handle the first two stages, and a 500 volt, 150 ma supply will allow the maximum input to the 807's permitted to the Novice. Later, when you get your General Class license, voltage and current may be increased to 750 volts and 200 ma for 150 watts input. Use plug-in coils, and you will have a transmitter for all amateur bands between 3.5 and 29.7 mc, by plugging in appropriate coils and crystal.

Q. Why is it impossible to raise WN stations unless you are very close to their frequency?

A. I would also like to know, because I am one of those who know how difficult it is. Several times lately I have spent an hour or more just below 3,700 kcs, calling CQ and WN stations without success. Even calling from within the Novice band does not give much better results if the station called is more than a few kilocycles from the calling frequency. It is natural to listen on your own frequency first after calling a CQ, but if you do not hear anyone calling you there, it might be wise to tune around a little for other calls.

See you all next month. News about you and your equipment, including pictures, are interesting to other Novices as items about them are to you.



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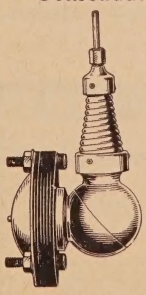
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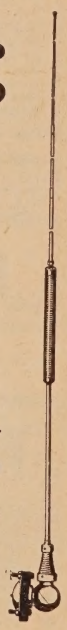
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381	396	413	427	484	495	512	448	462	477
383	398	414	429	485	496	514	450	463	479
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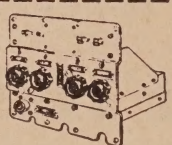


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FOR SALE: SCR522 receiver-transmitter. Used on six meters. Receiver is tunable. Less power supply. $30.00 both. W5NUN, Tucumcari, New Mexico.

Wanted: APR-4, other "APR-", "APS-", APT-"; ARC-1, ARC-3, ART-13, BC-348, BC-221, etc.; TS-12, 13, 35, 120, 146, 155, 174, 175, other "TS-", particularly microwave equipment, spectrum analyzers; G-R, Ferris, etc. units; 723A/B, 3C22, all tubes; manuals, meters, parts, cable. Quick cash, or trade TV, astronomical telescope etc. Littell, Farhills Box 26C, Dayton 9, Ohio.

FOR SALE- Power supply 1250 volts 250 ma. shown in 12th edition "Radio Handbook" page 217 all UTC components, $75.00. All band 30 watt exciter unit with vfo, $65.00. W6ZMA, 127 McMillan, Oxnard, Calif.

WANTED: Pierson KP-81 receiver in good operating or repairable condition. Cash or trade. Eugene A. Wille, W9EKU, 3435 North 47th Street, Milwaukee 16, Wisconsin.

WANTED: Top prices paid—Navy selsyns 1F, 1G, 1CT, 5F. 5G, 5CT and BC348, BC-221, AN/ART-13, AN/ARC-1, AN/ARC-3, RTA-1B. Lectronic Research, 719 Arch St., Philadelphia.

"BC 610E with speech amplifier, coils 10 through 40, $450.00. HT-9, coils 10 through 80, $190.00. Both complete and in good operating condition. Plate power transformer and modulation transformer for BC 610. Will take 250 watt class B modulator and good receiver as part trade. All inquiries answered. Charles Strunk, W5JZP, Rt 3, Box 351, Yuma, Arizona."

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FOR SALE: Amphenol connectors. New. Cheap. Palmer, W2TMI, 112 Lake, Blasdell, New York.

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GOING FISHING? Contact Hams Haven, the rendezvous of Northwestern Ontario. Write Jack B. Connor, VE3AFH, Eagle River, Ontario, Canada.

FOR SALE: R.C.A. Wire recorder, perfect condition. First $40.00 gets. W8ZAI, 6894 State Park Blvd., RFD #5, Pontiac, Mich.

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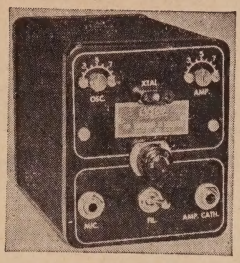
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WANT: SCR-694, BC1306, PE-237, Dynamotors DY-17; ATC, ART-13 war surplus test equipment, technical manuals, radar equipment, tubes. Sell: 1 h.p. 3 phase motor, $35. TBY technical manuals, $2. T. Clark Howard, W-1-AFN, 46 Mt. Vernon St., Boston 8, Mass.



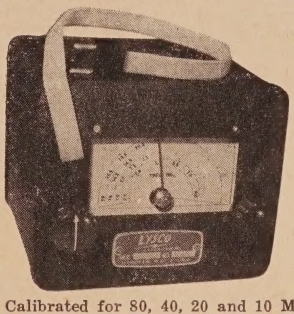
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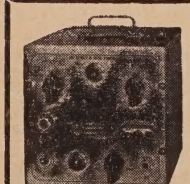
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BARGAINS: New and used, Collins, Hallicrafters. Hammarlund. National, RME, Gonset, Lysco, Mallard, etc. Write Dossett, W9BHV, 855 Burlington, Frankfort, Indiana.

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WANTED: Dynamotors: DY-12, DY-17, PE-103A, Transmitters: ART-13, ATC, TCS, BC-610, Collins, receivers: BC-348, BC-342, BC-312, Collins, National; hand generators: any type; vibrator power supplies; PE-237, PE-104A; rectifiers: RA-34, RA-62, RA-20; technical manuals, tubes; war surplus test equipment. Arrow Appliance Company, 25 Harrison Court, Lynn, Mass.

VHF-152, 2-6-10 meters $69.50. DB-22A Pre-selector $59.50. Meissner signal calibrator 10-50-100 KC model 9-1006 $29.50. All units like new. Color: St. James Gray. WØCVU, P.O. Box 224, Cedar Rapids, Iowa.



To those of you who are ready to buy (or even to sell), these Reports will give you the latest price changes as well as the new and discontinued products. This monthly summary of the market is supplied by RADIO'S MASTER, The Industry's OFFICIAL Buying Guide, published by United Catalog Publishers, Inc., New York City. A complete description of each product is found in RADIO'S MASTER 16th Edition, available at local Radio Parts Distributors.

ANTENNAS & ACCESSORIES—TV, FM, AM

Amphenol—Resumed production on 300 Ohm Tubular Twin-Lead #14-271.
Trio Mfg. Co.—Rotator #TR-2M decreased to $26.97 net.

RECORDING EQUIPMENT, SPEAKERS, AMPLIFIERS, NEEDLES, TAPE, ETC. . . .

British Industries—Introduced new Speaker, Super 5 at $20.95 net.
Masco—Added MA-77, Amplifier . . . MA-77R, Remote Control Amplifier . . . MCO-77, Outdoor System . . . MB-77, Booster Amplifier and MB-77P, Booster Amplifier with Panel.
Pickering & Co.—Withdrew #161L and 161M, 78 RPM Pick-ups and #165L, Equalizer pre-amplifier unit.
Wilcox-Gay—Withdrew their series of Recordio Tape.

BOOKS AND MANUALS

Rider, John—Increased prices on Catalogs 135, "Receiving Tube Substitution Guide Book" to $3.00 . . . Catalog 131 "TV Installation Techniques" to $4.50 . . . Catalog 134, "TV and other Receiving Antennas" to $6.60. Rider's Television Manual series, Volume 9, now in production available in April.

TOOLS AND HARDWARE

Drake Electric—Decreased price of #900 "Instant Heat" Solder Gun to $9.00 net.
Minnesota Mining—Withdrew "Scotch" No. 24 Electrical Tape with Neoprene backing.
Plymouth Rubber Co.—Decreased prices on their Slipknot Friction Tapes, Double Rubber Tape and their Splicing Compounds . . . also Slipknot Friction in Display Cartons.
Utica Drop Forge—Added 2 new compound-leverage, parallel-action pliers #402-6½" (with cutter) and #400-6½" (without cutter) . . . added new Plier-Snip #101-4½".
Van Cleef Bros.—Reduced prices on Dutch Brand Friction Tapes . . . Dutch Brand Rubber Insulating Tape and Dutch Brand "Hippo" Shop package Rubber Tape.

MISCELLANEOUS

Radio Mfg. Eng.—Added new Mobile Converter for 2, 6, and 10-11 meters at $66.60 net . . . withdrew Model NBF-4, Ratio Detector.
Simpson Elec. Co.—Added series 45, 47 and 49 of rectifier type Voltmeters, Microammeters and Milliammeters.

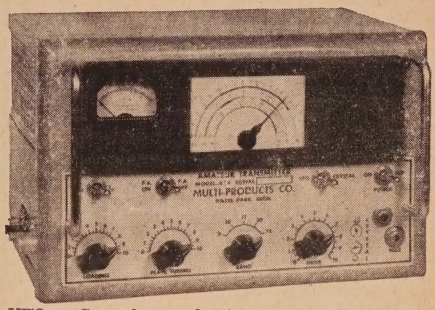
TUBES—RECEIVING, TELEVISION, SPECIAL PURPOSE, ETC. . . .

Eitel-McCullough—Added 3 new Vacuum tubes: 3W5000A3, 3W5000F3, and 3X3000A1 all at $198.00 net each.
National Electronics—NL-249C, Half-wave Rectifier added at $12.75 net . . . added Ignitron Type #NL-1001 at $37.50 net.
R.C.A.—Increased price of 4E27A/5-125B to $35.75 Sugg'd user.
Tung-Sol Electric—Increased price of Receiving tube 12K7GT to $2.20 list.
Taylor Tubes—Added 8013A at $10.30 list . . . and 8020 at $22.00 list.
Raytheon—Increased price of Special Purpose Tube type CK 1006 to $5.85 sugg'd user . . . added Receiving tubes 6BK7, a twin-triode at $3.20 list and 6V3, a nine pin miniature at $3.90 list.

LOOK

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Under-dash Mobile Xmtr.



VFO or Crystal control. Direct-reading VFO on all bands—75, 20, 11, 10. ● Plate modulation ● Completely band-switching, fone or CW. ● 50 Watts max. input. Power required: 300-500 V.D.C. at 250 ma., 6.3 V AC or DC at 4.5A. ● Uses 3-6AG5, 6AR5, 6C4, 12AU7, 2-6L6G, 807, (included). ● Only 7½" x 7½" x 12", 14½ lbs.

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ELECTRO-VOICE 210 Mobile Carbon Mike $ 17.10
ELECTRO-VOICE 600D Mobile Dynamc Mike 23.10

MORROW 3-BAND CONVERTER



- No Images or Birdies
- Automatic Noise Limiter—Built In
- 1-Microvolt Sensitivity —All Bands
- Antenna Trimmer on Front Panel
- Beautiful Grey Hammertone Finish

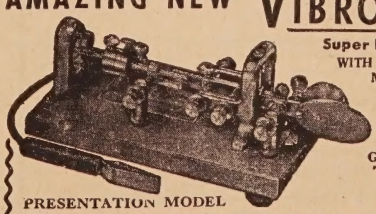
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- Drift-free, Pre-calibrated Oscillator
- Full Width Dial — Calibration Accuracy 1%
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- I.F. Amp. with 4 Tuned Circuits, Output 1525 Kc.
- Complete with Mounting Hardware, Manual
- Case—Height 4", Width 5½", Length 6½"

Steinbergs

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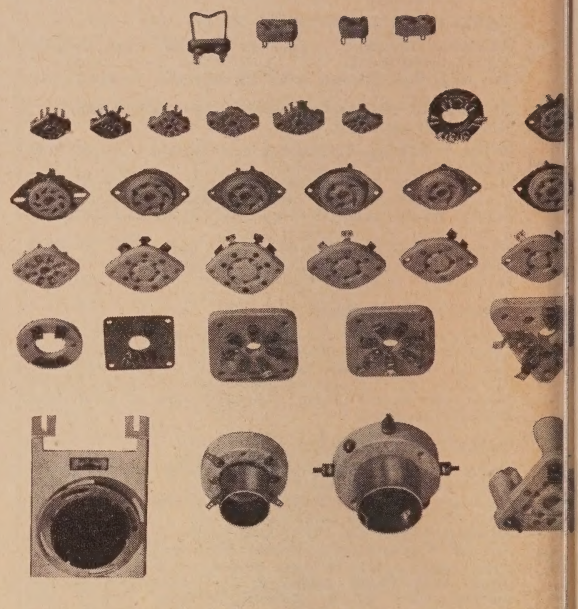
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The HFS is the *only* moderate-priced receiver covering the entire VHF spectrum from 27 mcs. to 250 mcs. in 6 bands. Receives AM, FM and CW with exceptional selectivity and sensitivity. Can be used as either fixed or portable receiver, operating from a standard power supply, 6-volt vibrator-type supply or a combination of "B" and storage batteries.

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These rugged, RCA-developed *VHF* beam power tubes have no equals for mobile or emergency rigs. Because of their high efficiency and high power gain, they require less drive and deliver more output at lower plate voltage, than any other similar types of comparable price range. Translate these advantages into practical results and they spell *power economy, more watts per dollar, and compact transmitter design.*

The RCA 5763 *miniature* beam power tube is ideal as the final in a low-power rig, as a frequency multiplier, and as the driver for an RCA-2E26 or 6146. As a final it will handle 17 watts input on cw and 15 watts on phone with a simple 300-volt power supply.

The RCA-2E26 beam power tube will handle a full 40 watts input on cw and 27 watts on phone . . . and can be modulated with a 6N7 Class B operated. It also makes an excellent driver for the new RCA-6146.

The RCA-6146—the tube that's tailor-made for "2"—will take 64 watts on cw and 48 watts on phone at 150 Mc . . . yet it's only a trifle larger than a 2E26!

Ask your RCA Tube Distributor for the full story on these VHF beam power tubes . . . or write RCA, Commercial Engineering, Section EM38, Harrison, N. J.



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