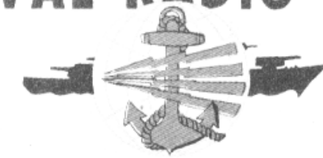
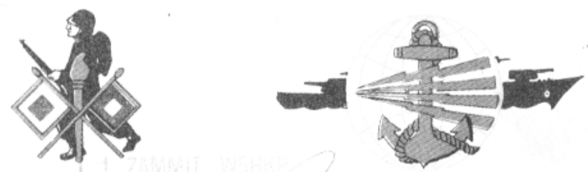
RTTY

U. S. NAVAL RADIO STATION



ARMED FORCES DAY 16 MAY 1959



CONFIRMED J. J. ZAMMIT, W8HAB
Commander, U.S. Navy

NAVAL COMMUNICATIONS DIVISION

W3PYW
OPERATOR

ARMED FORCES DAY 21 MAY 1960

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NEWS OF AMATEUR RTTY

MAY, 1960
25 Cents
Vol. 8, No. 5

HORSE TRADES

This page of the Bulletin is for use of amateurs who have RTTY EQUIPMENT FOR SALE OR TRADE and those looking for equipment to buy or trade. It is a free service and may be the means of getting someone on the air.

RTTY, Inc.
372 WEST WARREN WAY
Arcadia, California
Return Postage Guaranteed

FOR SALE: Model 15 w/kybd and table W9SKF

WANTED: Tape gear W2OKO

FOR SALE: Trans/recvr distributor for tape transmission, and alternate selection of mark and space biased signal generation Uses sync motor and M/K trans dist. ... W3PYW

FOR SALE: Toroids, uncased, 88 mhy¢ $1.00 each W6CQK

FOR SALE: 11/16 inch chadless tape splicers, new in factory cartons @ $3.50 .... K9CNG

FOR SALE: Yellow paper tape 11/16" 8" OD oiled, sealed boxes of 40 rolls $10.00
Selectronics, 1206 S. Napa St. Phila. 46, Pa.

FOR SALE: QSTs, all 1931, Sept., Oct. '41, all but Jan., July '46 all 1947 to 1959 @ 20¢ ea or $2.00 per yr, W6BWG

Parts and Service: W2ZKV, W6EV, W9GRW

Service and Repairs: K4SRU, K7ABB.

TERMINAL UNITS

W6AEE de W6ZH

Dear Merrill:

A month or so ago, while visiting at your house, we got started on one of our favorite topics of discussion — terminal units. Later on, when thinking it over, it came as something of a shock to realize that these conversations had been going on at intervals for over twelve years — ever since we acquired our first Model 12 printers in 1947. How time does fly!

But returning to terminal units. We compared notes and found that each of us were using essentially the same circuit configuration. It was one that we had worked on together during 1950 and 1951, and that you subsequently described in RTTY. (1) Just to keep the record straight, as we go along, the general schematic is shown in Figure 1 herewith.

There have probably been a good many of these terminal units built by other amateurs, no doubt with various modifications and improvements, and some excellent results have been achieved. The last three stages in particular, namely the A.F. rectifier, D.C. amplifier and keyer, came into more or less widespread use.

A perusal of the literature since 1953 indicates that a number of additional modifications may be made to advantage. In fact, the more I dug into the subject, the more dis-enchanted I became with the old unit. A long over-due re-vamping seemed in order.

As early as 1957 W4EHU pointed out the disadvantage of placing the printer magnets in the cathode circuit of the keyer tube. (2) Although several alternative circuit arrangements were suggested by W4EHU and others whereby the printer magnets could be kept at ground potential and still have them appear in the plate circuit alone, most of them seemed to involve separate plate supplies for the keyer tube or other complications.

An examination of the keyer tube and plate supply components showed that the circuit elements, with the addition of a relatively few parts, could be re-arranged as in Figure 2.

By placing the cathode of the keyer tube at negative potential above ground, it becomes possible to ground one side of the printer magnets and still have them appear purely as a plate circuit load. Furthermore, by grounding the screen grid and thereby taking it out of the load circuit, the additional voltage generated in the plate circuit by the back e.m.f. of the printer magnets will have a minimum effect on the control-grid cut-off point.

The plate current curves of a 6V6 indicate that at zero bias and 90 volts on the plate, the static plate current will be about 25-30 ma. By using a VR-90 to keep the cathode potential constant during keying, no provision for adjustment of grid bias or screen voltage to limit the maximum plate current becomes necessary. Plate current cut-off is reached with a negative control grid bias of about 12 to 14 volts.

About the only disadvantage of this arrangement is that the grid circuit of the keyer tube is substantially above ground potential and may introduce complications in coupling from preceding circuits. This can be overcome in several ways, as will be shown later.

Referring back to Figure 2, you will note that the 0.5 Meg. grid resistor of the keyer tube has been replaced by a potentiometer of the same value in order to reduce the grid-swing. This is necessary because plate current cut-off of the keyer is now reached with only about -14 volts on the grid. Under the old arrangement the degenerative effect of the bias resistor and the printer magnets in the cathode circuit (including the back-emf of the magnets) required a grid swing of many times this amount to reach effective cut-off. In fact, as W4EHU pointed out, only by providing such an "over-swing" can the cathode system be made to operate with any reliability at all. The d.c. amplifier shown in Figure 2 has a plate swing of about 150 volts at full output.

The terminal unit was operated essentially as shown in Figure 2 for several weeks. The results seemed to be substantially bet-

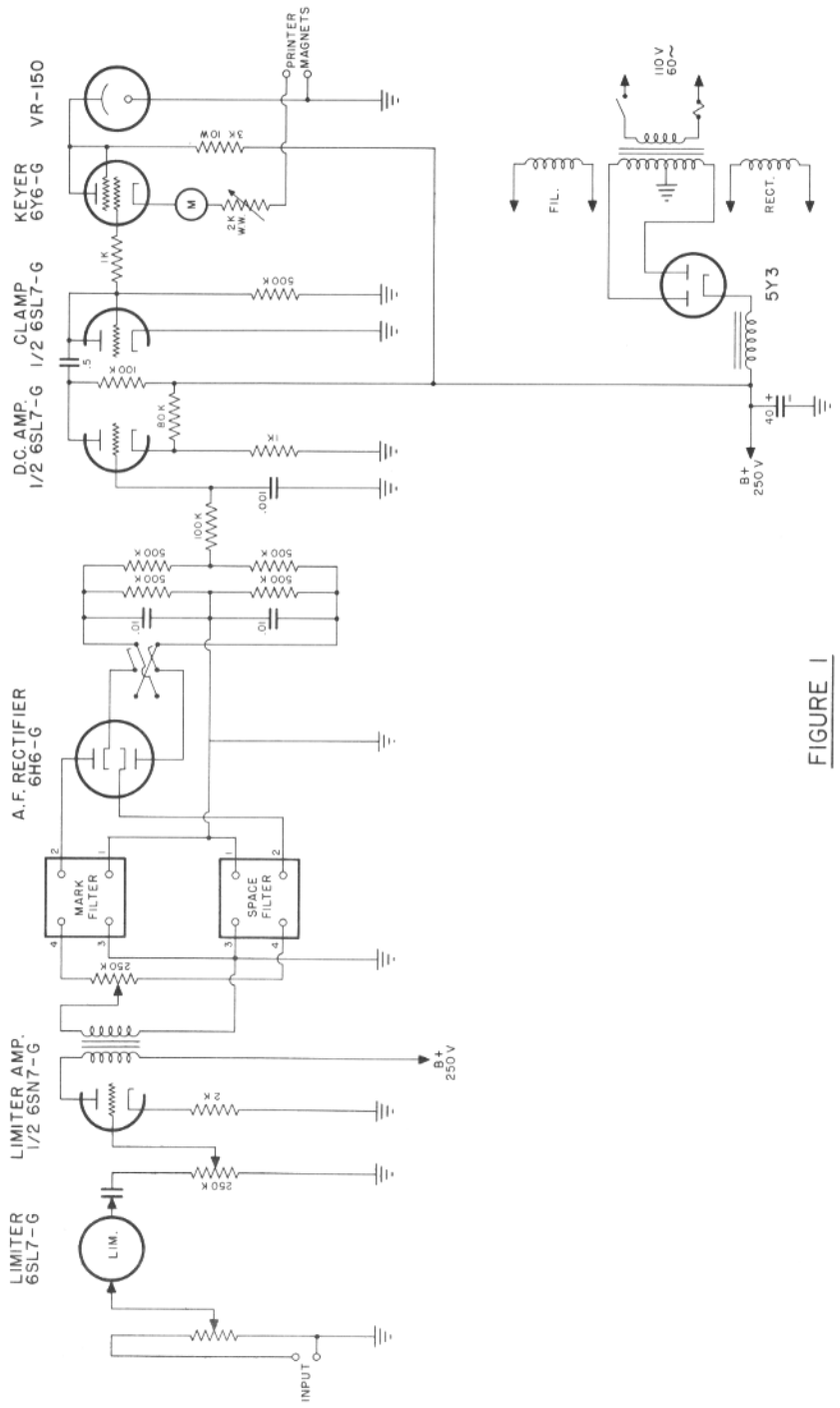


FIGURE 1

ter than obtained previously for the following reasons:

1. Under receiving conditions of noise, fading and interference appreciably better copy, with fewer mis-prints, was obtained.
2. Two or more printers could be operated in series simultaneously without any deterioration in copy or readjustment of the terminal unit — something that could not be done with the old arrangement.
3. Adjustment of the printer magnets and range controls was less critical than before.

* * *

While substantial progress was made by the changes outlined in the keyer circuit, there still appeared room for considerable over-all improvement—especially under receiving conditions of noise, fading and interference. A check of the limiter and filter portions of the unit showed they were performing reasonably well and that, at least for the time being, further effort could be expended elsewhere to better advantage. Work was concentrated on the rectifier and d.c. amplifier circuits.

The new keyer tube circuit, with its grid-swing requirement of only 12 to 14 volts, made it possible to try a full-wave rectifier system that had been in contemplation for some time. The schematic circuit is shown in Figure 3. The idea was to reproduce the envelope-form of the transmitted signal as faithfully as possible in the form of D.C. pulses directly at the grid of the final keyer tube. Pulse-shapers, D.C. clippers, trigger tubes or other methods of altering or "restoring" the envelope character were deliberately avoided in this experiment. Experience had seemed to indicate — qualitatively at least — that copy from weak signals in the presence of noise, fading or interferences could be harmed a good deal more than helped by some of these devices. On strong, steady signals such measures are unnecessary. The practical test is how well they behave under marginal conditions.

A general similarity will be noted to the rectifier system used in the Western Electric AN/FGC-1. The varistar shown in Figure 3 can be made up with 1N38 diodes, or — as in this instance — a complete varister unit sealed in a small case was lifted from a surplus BC-733-D Localizer Receiver. This is the surplus item, incidentally, from which many of the original mark-space filter units were fabricated. The terminal connections of the varistar are shown in Figure 4. In removing the unit from a surplus receiver, the original connecting leads to the varsitar should be left intact to avoid applying soldering-iron heat to the lugs later — and thereby possibly damaging the rectifier elements.

Transformers T-1, T-2 and T-3 are small-size replacement components for plate-to-grid service with a one-to-one primary to secondary turns ratio. Primary inductance is not important.

As had been hoped, the rectified pulses of mark and space signals were considerably cleaner with full-wave rectification than with the old system, and the rise and decay times at the beginning and end of each impulse were substantially faster due to the lower time constant of the filter network. For actual operation the circuit of Figure 3 was adjusted as follows:

1. The adjustable bias control (R-3) of the keyer tube was tapped across the bleeder resistor so that, with no signal input, the keyer grid voltage could be varied from zero to about -15 volts, or slightly behond plate current cut-off. Normal operating bias appeared to be optimum when there was just enough plate current (approximately 12 to 15 ma.) to keep the printer magnets closed and prevent the machine from running indiscriminately.

2. In final operation the Limiter Gain Control R-1 was adjusted so that a steady space signal would just reduce the keyer plate current to zero, while a mark signal would increase it to about 25 to 30 ma. The adjustment was not critical. It was rechecked after a little monitoring on the air and when the optimum value was located it was left at a permanent setting.

Some additional checks on over-all performance were also made as follows:

3. A high-impedance or vacuum-tube voltmeter was connected across test points "TP-1" and "TP-2." A steady mark tone was applied to the input of the terminal unit of sufficient amplitude to be attenuated by the limiter. The Limiter Gain Control R-1 was adjusted so that exactly 2 volts d.c. was measured across the test points.

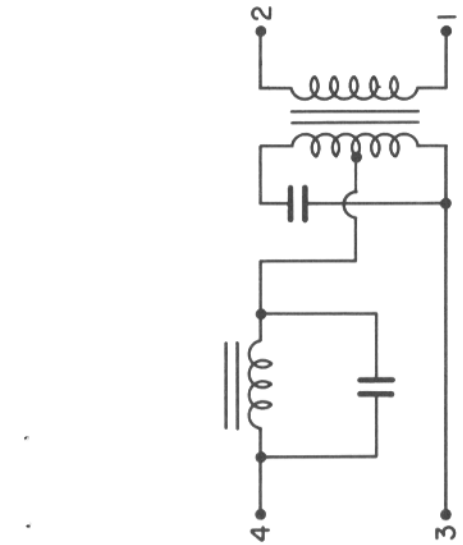
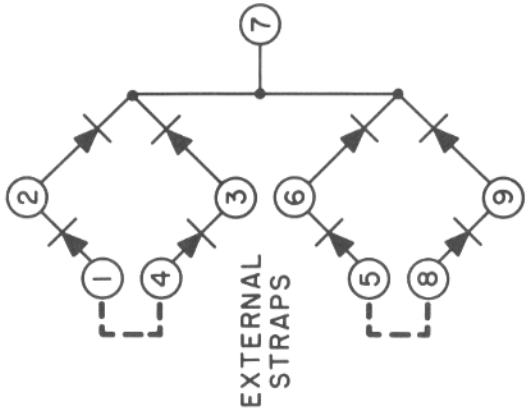
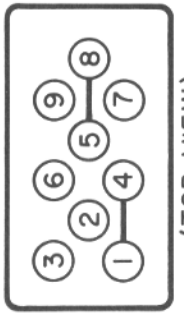


FIGURE 6





W.E.CO. VARISTOR CONNECTIONS
BC-733-D LOCALIZER RECEIVER

FIGURE 4

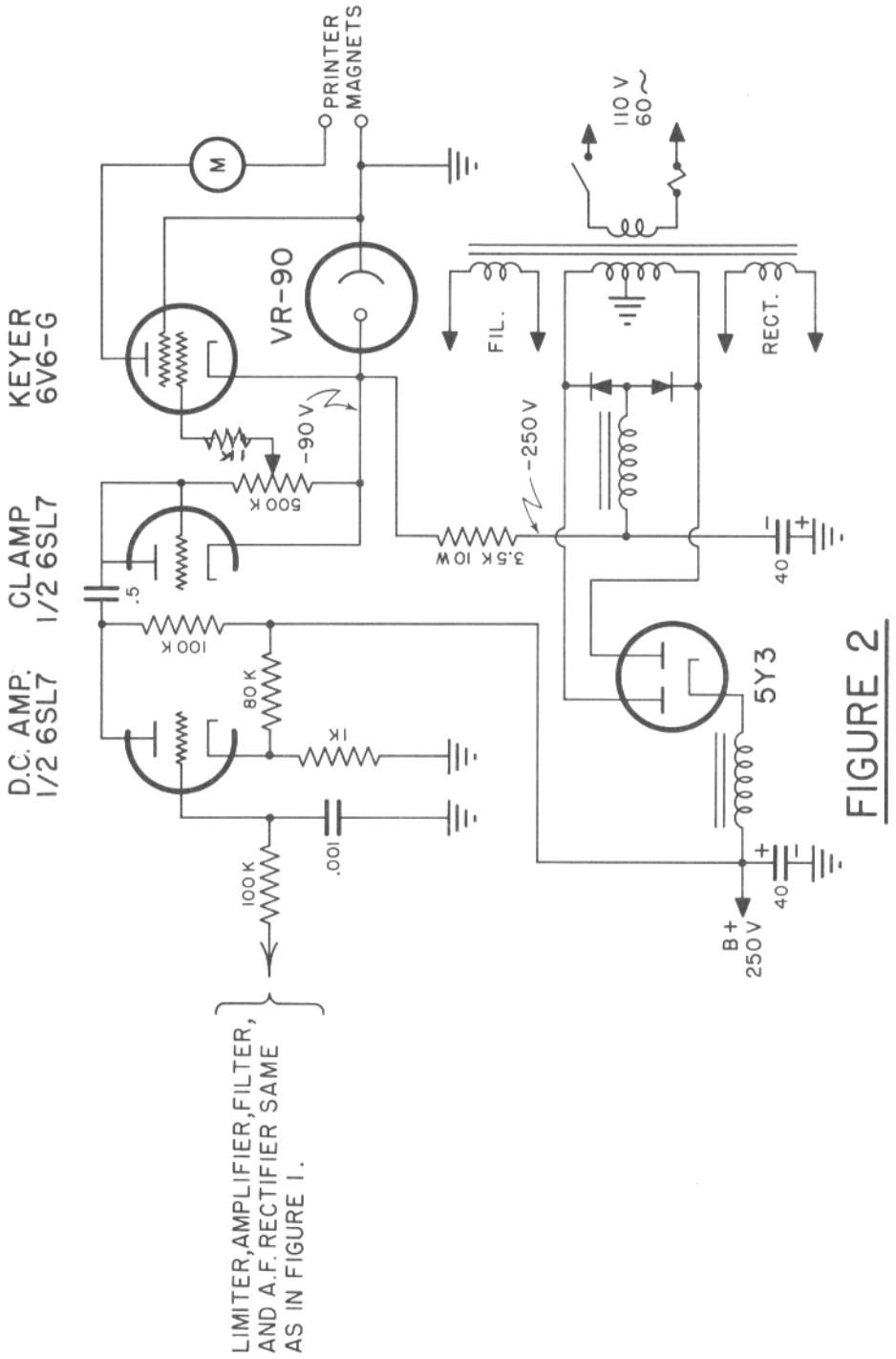


FIGURE 2

The input signal was then changed to a space tone of corresponding amplitude and the polarity of the voltmeter was reversed. The filter equalizing adjustment R-2 was then adjusted so that exactly 2 volts, of the opposite polarity, was measured across the test points. The procedure was repeated, first on mark and then on space, until equal outputs were achieved. A value of 2 volts, while less than the normal operating level of 6 to 8 volts, was arbitrarily chosen to avoid the possibility of driving the grid of the keyer tube positive and thereby giving false readings.

4. As a cross-check in balancing the outputs of the mark and space channels, the antenna was removed from the receiver and the gain controls were advanced to the point where receiver noise caused limiter action to take place. Under this circumstance the d.c. voltages from the two channels should essentially cancel out across the test points. At normal operating levels the measured output should flicker around a value of not more than about 0.1 volts. An imbalance of appreciably more than this amount should be avoided. It may result, however, from a wide variety of causes, including such things as the relative bandwidth of the mark and space filters, the filter damping characteristics, the audio response of the receiver, and whether the B.F.O. is properly centered with respect to the I.F. pass-band. Such a test becomes an excellent over-all check of the system.

The operating results were most encouraging, and while only a qualitative check could be made, the new circuit was unquestionably a considerable improvement over the old one. Not only were fewer misprints noticed on weak, noisy and fading signals, but some additional advantages showed up that had not been anticipated. The range control and printer magnet adjustment of the local machines became even more tolerant than was the case when the new keyer tube circuit was installed. Furthermore the unit was more tolerant of misadjustments at the transmitting end, such as improper bias or keying peculiarities.

° ° °

In the course of working on the keyer and rectifier circuits described here, a still further improvement suggested itself. As outlined in your 1953 RTTY article, one object of the original condenser-clamp-tube coupling system shown in Figure 1 was to obtain a "semi-diversity" effect between the mark and space channels. Fading on the higher frequencies is often of the so-called "selective" variety, and it can be observed that the mark and space signals, while only 850 cycles apart, tend to fade in and out independently of each other. The idea was to have the terminal unit print equally well on either mark or space signals alone, or in any combination with each other. Then, when there is rapid switching between mark and space signals such as in tape transmission, it was reasoned that diversity reception between the two channels would give more dependable copy.

The original system provided considerable diversity effect, but it suffered from a handicap that was inherent in the cathode-biased keyer-tube that followed. As pointed out earlier, reliable operation of this keyer required the grid to swing far beyond the normal cut-off point. Without going into a detailed explanation of the way the coupling circuit functioned, there were periods when the grid would be driven far beyond cut-off and, in the presence of a rapidly fluctuating signal, it sometimes remained beyond cut-off for an appreciable length of time due to the time constant of the coupling circuit. In such instances distortion and mis-prints occurred.

With the improved keyer circuit a double-clamp coupling system could be installed, as shown in Figure 5, so that the grid swing was always restricted within the normal operating limits of the keyer tube. To function properly, the circuit of Figure 5 requires about twice as much D.C. drive as the circuit of Figure 3, and the Limiter Gain Control R1 should be adjusted to give approximately 15 volts across the test points on steady mark or space signals.

The action of the circuit is such that either a mark or a space signal, respectively, will charge the coupling condenser C-1 positive or negative due to the presence of the appropriate clamping diode. When the pulse ceases, the grid of the keyer tube swings in the opposite direction due to the charge accumulated across the condenser. The circuit will copy on either mark or space signals alone, or in any combination

with each other, and a considerable amount of diversity effect can be realized in practice.

The time constant of the coupling condenser C-1 and grid resistor R-4 is about 1/5 second, or approximately the length of time required to transmit one character at the rate of 60 words per minute. If no signal or noise pulse occurs within this period of time the grid returns to bias point setting of R-3. In other words, it is a mark-hold circuit.

A switch SW-1, as shown in Figure 5, was arranged so that the condenser-clamp-tube configuration could be cut in or out of the circuit for comparison purposes. Under operating conditions it was found that, depending upon individual circumstances of signal strength, noise and fading, each circuit seemed to have its particular advantages. One fact became evident, however, and that was that the circuit of Figure 3 worked best when heavy clipping was used, while the circuit of Figure 6 thrived on a small amount of clipping together with greater dependence on the AVC action of the receiver. This may suggest a new line of attack on the problem.

That's enough for now. How about borrowing the unit and letting me know what you think about it? 73's —Herb

(1) RTTY Aug. 1953 "W6AEE Converter" CQ, Dec. 1952 .

(2) RTTY, July 1957, W4EHU, Don Wiggins

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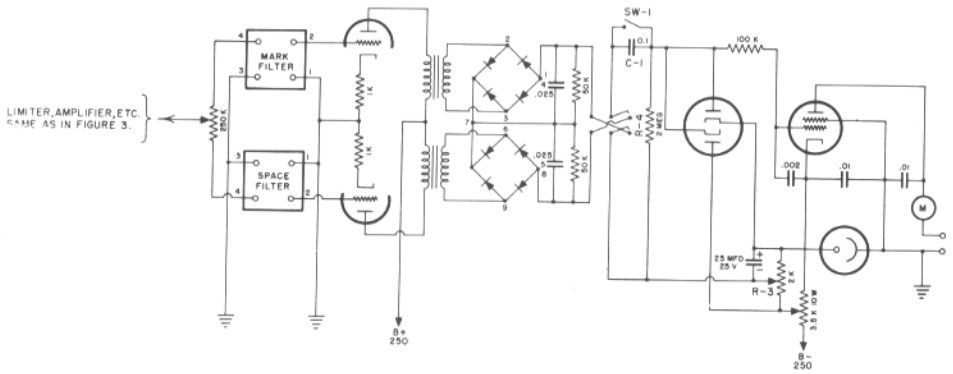

FIGURE 5

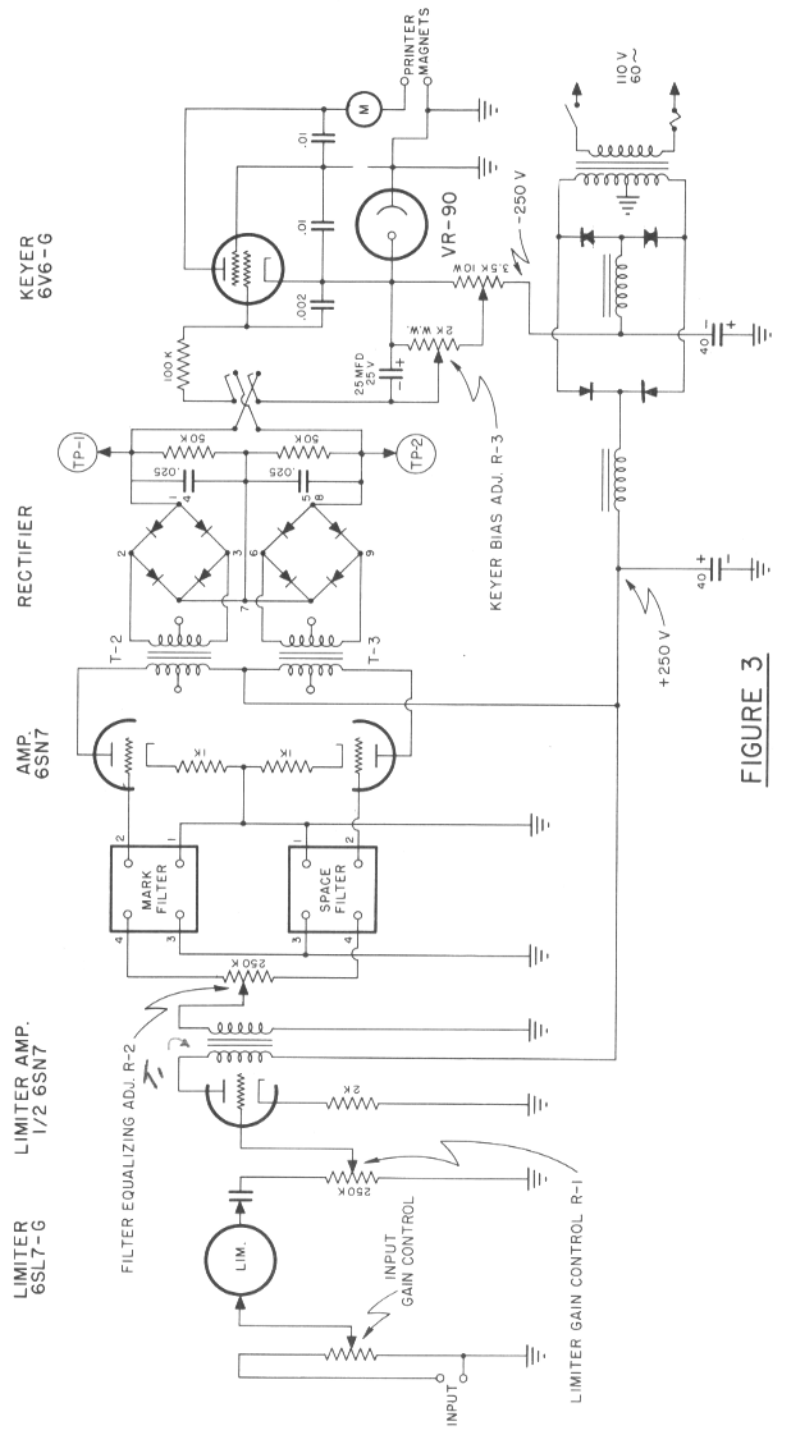

FIGURE 3

RTTY - DX

By BUD SCHULTZ, W6CG

5226 N. Willmonte Ave., Temple City, Calif.

In spite of the big Sun spot blackout during part of the past month DX activity on RTTY continued to increase, both in quantity and quality. Reports from all parts of the World indicate that the RTTY DX "Snowball" is at last starting to roll under its own inertia. By the time this is in print the YASME III should be under way with a full complement of RTTY gear aboard. This should be a tremendous incentive for all you DX minded typers to get in there and pitch. The FSK set-up on The YASME includes a Collins UR390 receiver, a TMC 750 transmitter, a Kleinschmidt TT-4/TG printer, Hallicrafters 0-5B/FR exciter, and a Northern Radio Converter. Quite an impressive layout, to say the least! ! This DXpedition will visit a great many rare spots in both hemispheres and will cause some of the biggest pile ups in the history of Ham radio! ! Here's a quote from Danny Weil, VP2VB, the chief Op on the YASME III: "Although I have spent many years with DX work I know practically nothing of what goes on in this 'world' of letter bashing but Dave, ZL1AV, is a competent teletypist both in operation and maintenance and it was with this knowledge I finally decided to fit the TTY gear aboard." Keep your ears open for the DXpedition and QSL via KV4AA. A contribution of one dollar with your card will merit an Airmail direct return, however, this is not required and all cards received will be answered through normal QSL channels. Contrary to recent rumors, the dollar is not required for a confirmation. The money received through this source is used to help defray the cost of the DXpedition, and if you feel you can afford it as part of your DX activities, it will help to keep things rolling. In any event, you will receive a confirmation, whether you contribute or not. Because of the great number of stations seeking contacts with Danny et al the time allotted for each QSO will be very short so keep 'em brief and to the point.

After ten days of nightly testing and yards of "RY's" Bill Scarborough, ZK1BS, finally broke the ice and is now ready and eager to give RTTY contacts from Rarotonga in the Cook Islands! In the early morning hours of March 28th, after four hours of frustrating testing, this tired old DXer was really "shaken" to read the following copy from ZK1BS: "Success, Bud and Alec, printed 95 per cent for the first Cook Island RTTY QSO fb fb Bud stop pse QSL with a gold edged card hi." The "Alec" referred, of course, to ZL3HJ who was also in this same melee. Bill quickly followed this first break-thru with contacts to ZL1WB, K6-OWQ, ZL3HJ and W7LPM and reports making solid print on W3CRO and W7-SMB/6 but unable to break for a QSO. Bill still has some TU problems but Bill Gates (of the Gates TU and Filter fame) volunteered to build him a new converter and Dick, W7LPM, is furnishing a new series motor for the 26 so ZK1BS should be a solid citizen in the RTTY community from here on in. Look for him on 14,095 Kcs whenever the band is open to the South Pacific. He is also available on 21Mcs.

Bruce, ZL1WB, and Alec, ZL3HJ, are both regular customers on both 21 and 14 Mcs. with tremendous signals and fine FSK. Bruce has completed working all W call areas and is looking toward WAS now! Alec says he will be on very regularly now so if any of you want to flex your muscles on a ZL contact it should be no problem with the likes of these two stalwarts to hold down the far end. Eric, VK3KF, still shows up on 21,084 with his usual "pipe-line" signal and hints that he has a surprise in the offing for his RTTY friends. Look for him week-ends around 0100 GMT. From ZK1-BS and WA6EXT comes word that K6-CQV/KS6 in Pago Pago is ready to try FSK from American Samoa. This should cause a bit of drooling from you DX hounds.

And speaking of drooling—Bill Brennan, G3CQE, comes up with the info that VQ6-GM (British Somaliland) is equipped with RTTY gear, has already made some air tests, and is just waiting for official sanction to get under way on FSK. This is some more "Exotic" material for you Dxers to scrap over and also if you need Africa for WAC-RTTY, this will be your big chance to kill two birds with one keyboard. A VQ6 isn't easy on phone or CW so if you manage it on FSK you really have a good one under your belt.

No further word on ZS1FD or ZS6KD but we still have hopes and expectations of a break-thru from this part of the world shortly.

Bill, G3CQE, continues to pound through on both fifteen and twenty and by now has reached the point where he has problems trying to separate the "breakers" during a session on the bands. Bill has been working his skeds with ZL3HJ, VK3KF, PAØFB, VE7KX and others when time and Band conditions permit. Without Bill's help this column would indeed be a brief interlude! ! Doc, G2UK, writes that RTTY activity in Europe has caught on rapidly in spite of the lack of support from the RSGB. He reports working PAØFB on March 18 for the first G/PA RTTY two way QSO. Doc says that Jan, PAØFB, has worked several W stations during the past week as well as TG9AD and TG9PS. PAØFB makes very good copy here on the West Coast on 21,090. Doc also reports that DL1GP has a bit of RTTY activity going in West Germany that promises a good future source of European QSO's.

The South and Central American group continue to keep the channels busy with lots of activities. As noted above, both Bob-TG9AD and Pete-TG9PS worked PAØFB on twenty plus lots of contacts with the Stateside group. Here's a quote right off the printer from Pete, TG9PS, during a recent rag chew: "Bud you were responsible for getting Bob and myself on RTTY and if you were here now I would – kick you right in the pants! ! It's the most frustrating thing I have ever seen but I like it better than SSB or CW." Cheer up, Pete, I feel the same way – You have lots of company. OA-5G, George and Keith, continue to dish out South American contacts to any who need 'em for their WAC-RTTY Award. Speaking of the WAC-RTTY Award – the Certificates are at the printer now and are a thing of beauty so a word to the wise should be sufficient. In a last minute note from GM8FM, Shank reports he expects to be active shortly on 14, 21 and 28 MCs with a Creed type 3 printer and will be looking for anyone needing Scotland for a new country (And who doesn't need it!).

The DX question of the month is as follows: If you print ZK1BS, VQ6GM, PAØ-FB, and G3CQE all calling CQ at the same time on approximately the same frequency, what procedure should you follow? (After you recover from blowing your stack, of course). For the best answer to this one we will send a steel engraving of George Washington (in color). Please write on one side of the paper and enclose a ten dollar bill to cover cost of handling and mailing. CU next month – and please (!) send in your news. 73 – Bud W6CG.

CQ
Radio Amateurs' Journal

Dear OM:

Don't usually do this cuz there are so many surveys coming in but have to tell you that the RTTY column is back to a monthly basis and the Citizens Band column will appear for the last time in the May issue . . .

Very 73 es tnks for the survy.

A. Trossman W2DTJ

Subscription Rate $2.75 Per Year

RTTY is the Official Publication of the

RTTY Society of Southern California

and is published for the benefit of all RTTY Amateurs and Experimenters

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W6SCQ – Lewis Rogerson

For Traffic Net Information:
W6FLW W6IZJ

For "RTTY" Information:
W6DEO W6CG W6AEE

THE DM-430 DIVERSE ADAPTOR

WOAJL

Here is complete information on the Decimeter Diverse Adaptor engineered by the former owner — Rod Bliss.

I bought out the Decimeter Factory several years ago but there were only about 100 of these little jewels in the inventory and they have long since been sold out by us.

This little gadget can be easily constructed by anyone interested in RTTY and certainly makes a whale of a difference in copy under marginal signals plagued with QSB. The satisfaction gained in better copy is certainly worth the effort of construction.

Some of the fellows are using 6AH6's instead of the 6AC7's and 12AX7's instead of the 6SC7's. If those are used it is necessary to use tube shields to prevent trouble from inter-coupling, etc.

DIVERSITY RECEPTION

One of the most annoying characteristics of short wave reception is the fading encountered on weak and distant signals. By some diabolical design the signal always fades out at the moment the choice bit of DX is giving such important information as his call, his QTH, or your report. This fading is caused not only by fluctuation of signal amplitude at the receiving antenna, but also by change of polarization of the radio wave.

The obvious way to minimize the fading encountered on any one antenna is to use two or more antennas located a few wave lengths apart or of different characteristics. Sufficiently different characteristics may be obtained by using one vertical and one horizontal antenna, two horizontals at right angles to each other, or a beam and a long wire antenna. The two antennas cannot be simply connected in parallel and attached to the receiver, as under some conditions the two signals might be actually of good strength but out of phase, causing cancellation of the signal and apparent fade-out. In commercial receiving centers, several receivers are used, each connected to its own antenna, with a common audio output system and often a common a-v-c system. The receiver with the strongest signal always supplies most of the output, and fading is thereby held to a minimum. Receivers with dual r-f and i-f channels have been made for diversity reception. Although their performance is undoubtedly good, the cost of such an arrangement is out of the reach of most amateurs.

The alternative to using duplicate receivers is to switch the receiver from one antenna to the other as the signal fades. This cannot be done manually with any satisfaction because of the delay in the human nervous system and the requirement of a third hand to operate it.

The Diverse-Adaptor is a combination of an electronic switch and broadband amplifier designed to do diversity switching without any attention from the operator. This circuit automatically switches the two antennas back and forth, searching intently for a signal. As soon as the receiver finds one on either antenna, it keeps the switch thrown to that antenna as long as the signal is of satisfactory strength. If the signal fades, it switches instantaneously to the other antenna, which in most cases will restore the signal to normal strength again. As the receiver tunes in various signals in the band, the Diverse-Adaptor always chooses the antenna with the greatest signal strength.

PUTTING INTO OPERATION

The Diverse-Adaptor may be tested for proper operation with only the tubes in place and the power leads connected. Turn the sensitivity control (R-14) to the counter-clockwise end and set the balance control (R 7) near the middle of its range. Turn on the power and watch the neon bulbs as the set warms up. One bulb should be on and one off. Turn up the sensitivity control until a regular flicking is noticed in the neon bulbs. If the balance control is properly set, the bulbs will light alternately, showing the switching is taking place. If they do not alternate properly, but only sit and flicker, adjust the balance control. The best setting of the sensitivity control is where the neon bulbs blink on and off two or three times a second. When the unit appears to be working properly connect the antennas, receiver input, and A.V.C. lead.

The a-v-c bus in the receiver can be most easily located beneath the i-f transformers. The transformer lead connecting to the a.v.c. is usually black, or white with black tracer. It is bypassed with at least a .01 mfd. condenser to ground and connects through a 50,000 ohm or higher resistor to a line running back from the second detector. It may be positively identified by measuring its d-c potential to ground with a high-impedance voltmeter when the receiver is operating normally and a signal is tuned in. A wire connected to any point in the a-v-c system and brought out to proper post on the Diverse-Adaptor will work. Shielding of this wire is seldom necessary. When all connections have been made, the power may be turned on, and the sensitivity control readjusted for best operation.

ON THE AIR

One use of the Diverse-Adaptor is apparent as soon as it is turned on. The two antenna systems are compared directly several times a second. At one end of the band one antenna may sound "hotter" than the other. At the other end of the band conditions may be just the opposite.

Quite apart from fading, some signals may be nearly inaudiable because they come from a direction which lies in a null of one antenna. By using two different antennas on the Diverse-Adaptor the nulls are wiped out.

The r-f input circuit of the Diverse Adaptor is untuned and allows all signals from the antenna to be present on the control grids of the 6AC7 amplifiers. If a high-power transmitter is operating in the vicinity, enough r-f voltage from it can appear on the 6AC7 grids to modulate other signals. The coil L, shown in the circuit diagram, severely attenuates signals from the broadcast stations, and largely eliminates any trouble from that source. If one or two local short wave transmitters cause cross-modulation, a series tuned trap for each station across each of the terminals ANT and A will reduce their strength sufficiently to remove interference.

An alternative arrangement is to connect a parallel tuned circuit across the same terminals with A grounded, and couple it inductively to the antenna feed lines. This affords maximum antenna selectivity and provides some increase of gain and signal-noise ratio. Suitable tuned input circuits for amateur use can be found in "The Radio Amateur's Handbook," and other amateur publications.

Since the action of the Diverse Adaptor depends upon developing a-v-c voltage, it is not suitable for straight CW reception. Frequency-shift keying and AM or FM phone work nicely, however.

POWER SUPPLY

The filament circuit requires 6.3v a.c. at 1.5 amperes. The plate supply may be any voltage between 200 and 300v. d.c., and draws about 15 ma. The 6SC7 tubes draw very little current. Most of the 15 ma. is used in the conducting 6AC7. The plate and filament power can usually be drawn from the communications receiver, unless it is a small economy model, or runs with power transformer pretty hot.

"L" is 50 turns of #30 enameled wire double spaced on a 1/2" form making a 20 microhenry inductance with low distributed capacity.

NOTE: Connect balanced antenna feed lines to "ANT" and "A." Connect unbalanced antennas to "ANT" and ground "A."

Donald McNicol, Chairman of the Board, American Institute of Electrical Engineers, submitted to the Board of Directors, AIEE, for publication in the 1919 Transactions of the American Institute of Electrical Engineers, January to June 24, the following, in excerpt:

PRINTING TELEGRAPHS

On the lines of the Western Union Telegraph Company the use of multiplex printer system has been considerably extended. About 80 per cent of this company's wire traffic is now handled by means of the Multiplex and the Morkrum printer duplex systems. The Postal Telegraph-Cable Company on the other hand, which has experimented with three different printing telegraph systems during the past twelve years, discontinued on April 1, 1919, the use of printing telegraphs on all its lines, reverting exclusively to the Morse manual system.

J. A. Chumley W4FEE/6
24540 E. Little 3rd St
San Bernardino

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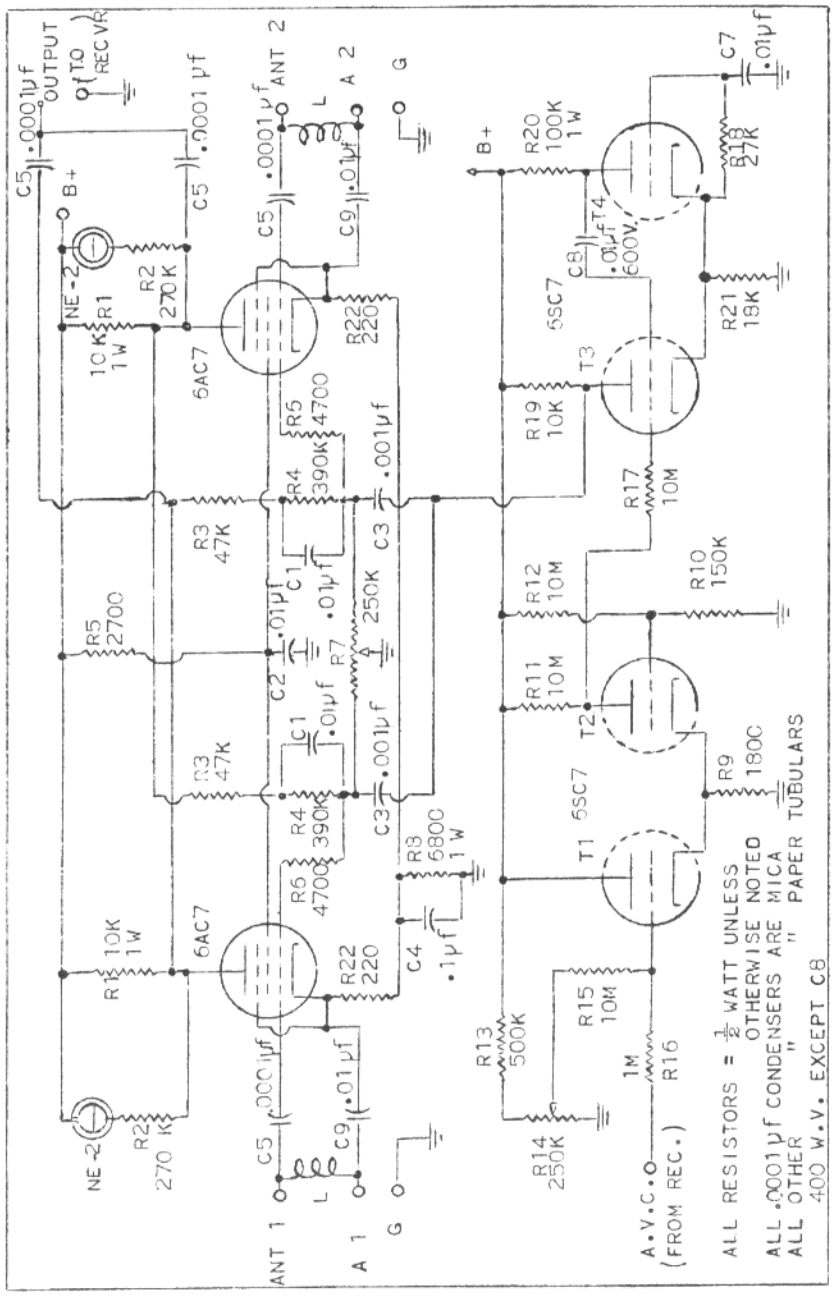


The article by WA6GGR on improving the accuracy of audio frequency measurements interested me very much. I too needed accuracy in my audio frequency measurments, and it dawned on me that a Hammond organ was the ideal accurate frequency source. As the tones generated in a Hammond organ are as accurate as the commercial power frequency, little is left to be desired in the accuracy. I suggest that your readers take their band-spreaded audio generators to the nearest Hammond dealer. A scope and a 6' steel pocket tape are of help also. Ask the dealer to pull only the fundamental drawbar on the upper manual and show you where the third "A" above middle "C" is. By pressing this key an accurate frequency of 1760.000 cps will sound from the speaker. If your finger gets tired, set the steel pocket tape on the key and it will enable you to adjust the scope, generator, etc., without the dealers help. Now by simply going right up the keyboard, one key at a time (don't forget the black keys) the following frequencies will be available.

Third "A" above middle "C"	1760.000 cps
A#	1864.348
B	1974.857
C	2092.307
C#	2216.585
D	2349.589
D#	2488.888
E	2636.417
F	2792.727
F#	2960.000
G	3136.000
G#	3321.081
Fourth "A" above middle "C"	3520.000

"Vibrato" off; "Percussion" off; Do not use Chord Organ. Spinet model Hammond Organ suitable.

The above keys should cover the frequencies we are interested in, however, by multiplying or dividing the frequencies by 2 we can find the key by moving up one octave or down one octave.

One word of caution, do not let yourself become exposed for any great length of time to the Hammond organ dealer. I am now the proud owner of one of the most accurate audio generators in town and the harmonic has one of the most expensive code practice oscillators in town!

I didn't think it would take this much space to wind this up but guess you can condense it to fit RTTY if you think the fellows would be interested.

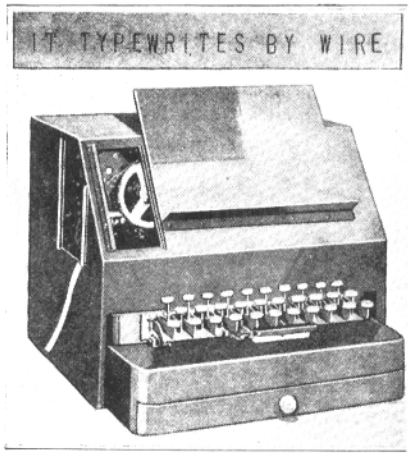
Incidently, the speaker voice coil in the Spinet model is a convenient place to hook up the scope, and I believe any of the Hammond dealers will be very happy to help out, but like I said, be careful of over-exposure.

73,

Ted Hildebrand, W7YZQ
1426 Avenue "E"
Billings, Montana.

SIMPLE PRINTING TELEGRAPH COVERS NEW FIELD OF USE

A simplified printing telegraph suitable for inter-department communication in large plants, as well as main-line traf-



Combined Receiving and Sending Unit: The Receiving Tape Protrudes from the Left Side. A Full-Size Section of Tape is Shown Above

fic, is now on the market. The simplicity is obtained by printing on a tape in place of a sheet, so that much complicated mechanism is done away with. A transmitter, with a keyboard similar to that of a typewriter, is mounted with a printer to form a single unit. This unit is operated on either direct or alternating current, of 110 volts, by a ¼o-hp. motor. The keys control a camshaft, which revolves, opening and closing the line. The maximum speed is 45 words a minute, a safety device preventing too rapid operation.