RTTY

NEWS OF AMATEUR RTTY

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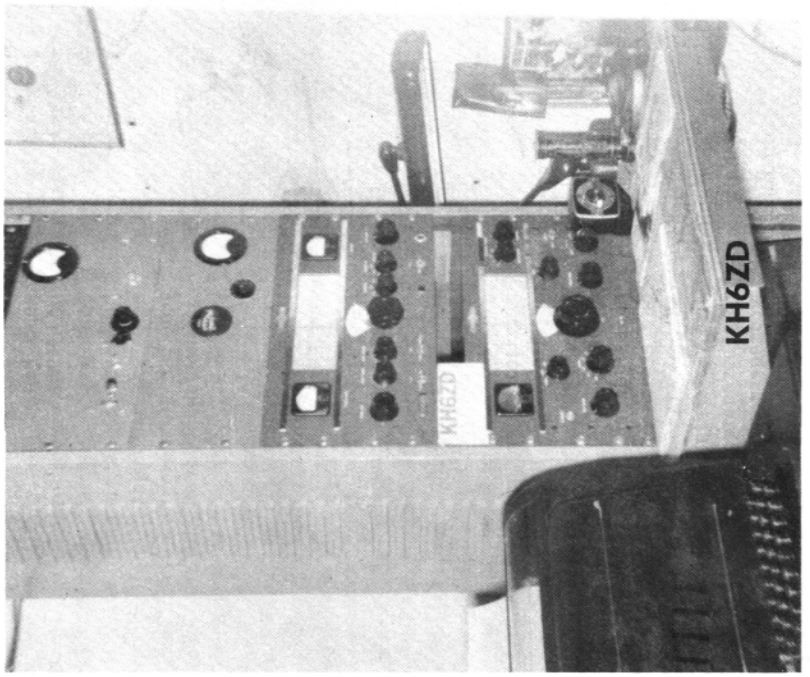

HORSE TRADES

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.

For Sale—Model 12 with table and cover, less keyboard, Model 15 keyboard with AC motor in one unit, Also Model 21-A printer W9HKA

For Sale—12 ohm, 57,000 turns RBM 110 volt DC DPDT Telephone Type Relays W1AFN

Wanted—Model 14 type equipment ..... WØHFU & WØLFI

For Sale—Model MDX (mux td) Manuals W6NCO

For Sale—Model 15 Complete, Model 12 Complete with Sync Motor—Terminal Units W1AFN

For Sale—Model 12 Typing Perforator, set Vacuum tube

For Sale—Model 26's w/tables W6SCQ-W6VPC-W9GRW

For Sale—Bound Volume No. 3 RTTY (1955) $5.00 .... RTTY

For Sale—Tape perforators with end of line indicator, FRA Converters W2ZKV

For Sale—Model 0-73/URT FSK Exciter - manual .. W6PZV

WANTED—Your attendance at National ARRL Convention at San Francisco, July 6, 7, 8, 1956 for Social RTTY events ..... RTTY

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THE MINNESOTA MULTIPLIER

By BOYD "BEEP" PHELPS, WØBP, W9BP

The Third Anniversary Sweepstakes contest is history but the memory will linger on with scores of us, pun intended. Signals roared back and forth across Minnesota for thirty hectic hours. 6's unshifted the RST reports from 2's and 3's caused a choice California section name to look like a stock market report from Athens — heighly Hellenic, no pun intended, just Greek.

In December RTTY I oversold Minnesota as the ideal listening spot. Folks from VE7KX to W1BGW openly expressed envy at my QTH. But like being ten feet tall, sometimes its good, sometimes bad. Signals piled in many layers deep from four directions at once. Occasionally the average was definitely "mark," then quite solid on the "space" side of the polar relay contacts, but usually an incoherent chatter between the contacts. I prayed for a nice quiet ocean on one side like the fellers have on either coast, but on this night even the good Lord seemed to be getting garbles. He promptly lengthened the 20 meter skip so no east coast stations could be heard. Fine and thanks, but then the 6's and 7's were really having a field day working the east coast and I couldn't raise anyone! I didn't even know who down east was jamming me out west!

Usually I make sixth or seventh place nationally from Illinois or Minnesota. This time, in spite of dire predictions on sun spots, I made elaborate preparations. I typed up large cards, one per district, with alphabetical listing of some 160 previously worked RTTY stations, blanks for additional calls and band checkoffs, ruled up cards with messages numbered in advance (ten per card) with columns for the usual RST lies, checked all tubes, recalibrated the receiver, sharpened pencils, and tabulated the transmitter pointer settings and ham handles to quickly refreshen my micro-second memory. Back in the twenties when we had 14-16 mc somebody gave me a big tube two feet long which has been used ever since at W2-9-Ø-BP but not on 20 meters. A good spare has been standing by the last twenty years but underloading a (20 KW) tube prolongs life tho its kilowatt filament (RTTY, Aug. '53) and inability to work 20 caused concern. Early February listening on 20 produced meagre but loud and enthusiastic stations, so with a single 833-A cookie jar I broke 30 years of silence on this band the day before the contest started. A single hundred foot slant wire was used on a fifty foot city lot running east and west for all bands.

WØBP picked up a dozen contacts on 20 at the start before the skip got long, knowing 40 had jammers and figuring 80 could wait. On 80 the band seemed profitable all night and 40 was only used the next afternoon.

As the contest wore on the multiplier complex became more apparent. Suppose I had worked 50 stations and for simplicity say they were all in one ARRL Section, my score would be 100 on the msgs exchanged each way. One station in a new Section would make my score 204. No matter how many Sections I worked, a new one was worth at least a hundred points, probably more in the final computation, and appeared easier than wrangling with a hundred messages. Around these parts each Section is a whole State and the States run larger than down east where they are not only smaller but run two or three Sections in some States. Bayside, N. Y. is neither East nor West New York Section. The State that cops the prize is California with SEVEN ARRL Sections! Is that

W6 calling CQ in all embracing L. A., or the Bay area, or one of the three Valleys? The multiplier monger in addition to being operator; engineer; lawyer; sten, now becomes geographer, but no text book correlates the call book with page 6 of QST. I listened thirty minutes for one pair to struggle thru repeats on CK and time, the unshift on space producing "TOO" for "599" on every repeat. One was in a choice Section for me and seemed worth waiting for, but after they said "Good Luck and 73" for two more rounds, WHAM, a nearby CQ from a friend (?) worked earlier covered them up and I never did work that section. Others had the same experiences and will probably be just crazy enough to tackle the next contest.

When talking to old friends you do not give them a bum's rush along with your roger, and I think we all did a bit of rag chewing, for even a contest should have some decency and enjoyment. Some of the two meter boys invaded our DC bands, and Bud, W6CG must have been talking to one of them when I saw him say "See you next contest." I told an eastern two meter man I was glad to see he had gotten off the local mail route and had decided to tour the country. About a half hundred machines had just been distributed in the Central and Great Lakes areas and many of these were on the air for the first time during the contest. April, 1954 RTTY likened my unprepared getting into a contest to the poor sparrow that flew into a badminton game, and several newcomers had my same experience for they were pounced upon for a message and batted back and forth by us players. But here again, if he never heard about signing with CW we took time to explain this, checked his shift, and answered questions doggone important to him. Most of these beginners seem to be wearing boxing gloves, some possibly blindfolded in addition, none have back space or erase keys, so the wild confusion ran rampant.

Frank, W3PYW, several times National Champion, is a smart operator and always in the thick of every band. About midnight Ed Handy W1BDI and I both answered his CQ. Frank immediately sent his msg Nr. 26 to Ed and 27 to me, single rapid fire and turned it over to Ed, who being no newcomer to ham traffic promptly rogered for Nr. 26, sent Nr. 19 to Frank and 20 to me, then dumped it on me to roger two messages and send my Nr. 25 and Nr. 26! Bulk traffic of six messages in less than six minutes! And so the rat race raged on. I was breathing down the neck of the Champion, being only one message behind him, and he knew it!

Then something peculiar seemed to happen at WØBP after finishing out a sheet with msg nr 39 to W6MXJ before daybreak. The interference faded out and KH6ZD was calling me and we had a wonderful RTTY contact(regular landline printing, local metallic, if you please. After a while Bogota called and said they had closed down their So. American circuits in the 3600 kc band due to interference from our contest but instead of going home the ops decided to use their amateur calls on the commercial equipment already on frequency and join us. All the stations down there were worked in turn with their usual strength and they were printing me fine too. Then all was quiet except for the buzz of hot transformer laminations and the swish of the 3/4 ton window air-conditioner sucking in sub-zero air for the hot room. Then the rattle of a tray of dishes, the feel of hands shaking my shoulders and raising my face out of the printer. In an instant I was wide awake, back into the contest, grabbed a new pre-numbered message tally sheet and sent Nr. 50 to W9ZBK. And so the race went on, shifting between 20-40-80 meters. By early evening my numbers were in the sixties and I seemed to be leading the pack by a slight margin! Competition was becoming more cut-throat and ruthless. If two stations had cleared their

messages and said good luck and 73 for two additional rounds they could expect somebody to zero on them and break them up, especially if one was in a rare multiplier section. When called from an active Section I almost begrudged giving a roger, a msg, and probably a Minnesota multiplier, if his score was near mine. RTTY bauds per kilocycle reached a new high Saturday evening and few new contacts could be made in the congested confusion. Practicing what I preached in my "Band Survey" (RTTY, Dec. CQ, March) I made numerous unsuccessful calls on 7115 and 7090, but listener tuning habits around 7140 had not changed, so the gang continued to battle the broadcasters, jammers and themselves.

For three hours after the contest closed for the better informed I was printing messages being exchanged by 2's and 8's, but I didn't fire up the tired transmitter to spoil their fun. Took 3 sleeping pills and so to bed.

Now, several days later, I am unable to find any log entries or any printer copy covering the Saturday morning period between about 6 a. m. and noon! And I'll offer a reward for the apprehension of any stations receiving my msgs numbered 40-49 with extracts of logs, FCC included! Did I fall asleep and only dream of those fine interference free contacts with Hawaii and So. America? Must have, according to the written evidence. And my msgs nrs. from 50 to 70 that spurred others on to greater efforts, must have been ten numbers too high. Can't correct all their logs now. Sure hope my frequency shift and harmonics were OK during these somnambulent QSO's.

I am sure others had parallel experiences of thrills and spills but will agree it was the best contest ever. Thanks fellers for the many fine contacts and especial appreciation is acknowledged to Teletype Corp. They asked W9OCV to come to his office Saturday morning at the button factory. (Burt nosed me out of fifth position in the previous contest). tough luck Burt, but others had to work too, or sleep like I apparently did.

* * * *

RESULTS OF THE THIRD ANNIVERSARY RTTY SWEEPSTAKES

As reported by WØBP above, the RTTY SS this year was an active one, however not too many logs were sent in for one reason or another. A few of our better known SS RTTYers did not show up this time, and as a result a few areas were not represented. The final scores are as follows, with Top Honors going to Jim Hepburn, VE7KX:

Many other stations took part, but failed to report results.

W1AW	377	13	W2TBD	360	12
W1BDI	1026	18	W2TKO	1748	23
W1BGW	208	8	W6AEE	1672	22
W1FGL	520	13	W6CG	292	12
W1WEW	630	15	W6MTJ	2420	20
W3MHD	468	12	W6MXJ	84	6
W3NQC	140	7	W6OWP	2376	22
W3PYW	3744	26	W6VPC	72	4
W7CSC	468	12	W9OCV	2400	24
WØBP	3240	27	W9OKS	176	8
WØWRO	1092	16	W9TCJ	1848	21
W2JAV	2475	25	W9ZBK	330	11
W2PAT	234	9	VE3BD	260	10
W2PBG	3402	27	VE7KX	3968	32
W2RTW	1160	20			

THE LITTLE MONSTER

BY TED SWIFT, W6CMQ

They say there is nothing new under the sun and I guess that goes for radio Teletype too, judging by the age of the number twelve machine that made the first radio Teletype contact from W6CMQ with W6FGS back in 1946. Since that time, several terminal units that drove a variety of machines have come and gone, but the Little Monster herein described is basically the same as the terminal unit that first copied Virg's signals ten short years ago. However, terminal units are always good for a three hour discussion in any gathering of Teletype hams and considerable interest has been shown in the Little Monster, so here's the dope.

Instead of starting with the complete schematic and instead of thinking about the Little Monster as a complete unit, let us realize that any terminal unit is a composite of several individual, basic, building blocks, each with their own circuits. Since many of these basic pieces are thoroughly familiar to all Teletype hams and since most of them are already functioning in your own terminal unit a minimum of detail is required for their explanation. Lets talk about the pieces one at a time, so that you can concentrate on the hunks of particular interest to you. Lets start with a block diagram of the Little Monster to serve as an index to the discussion.

The first item is an amplifieir. The Little Monster uses a two stage, resistance coupled arrangement. The two tubes are in one bottle, a 6567. The amplifier serves to raise the signal voltage delivered by the receiver, whether from a phone or from the low impedance (hence low voltage) windings of the speaker output transformer, to a level that will knock the pants off of the limiter stage which follows.

The limiter is a two tube (single bottle, 6SL7) device that delivers a constant output voltage regardless of the signal level at its input terminals. This assumes that the input signal level is high enough to saturate the limiter. The limiter messes up the wave form of the signal and makes square waves out of perfectly good sine waves but this is no problem. As we all know, square waves are the equivalent of a sine wave of the same fundamental frequency plus a flock of harmonics. The filters that separate the mark from the space signal can also be counted on to filter out the harmonics generated by the limiter and pass only the fundamental frequency.

The block diagram shows the Coupling Amplifier is next. Its called a coupling amplifier only because it serves to couple the limiter to the mark and space filters. Perhaps it should have been called a decoupling amplifier because its main function is to decouple or isolate the mark filter from the space filter. This amplifier prevents the coils and condensers of one filter from detuning the other filter. Incidentally, it boosts the signal level a bit and thats all to the good.

The band pass filters are perfectly conventional. Each filter consists of wto parallel tuned circuits overcoupled by a small condenser to pass about a fifty cycle band, centered about the mark (2125) cycles) and space (2975 cycles) frequencies. These filters are sharper than most Teletypers are used to, but now that most of the gang have learned to adjust their frequency shift (or set their audio tones) on the money the sharp filters pay off in greatly improved copy under conditions of interference. Toroid coils are used. They are reasonated by a handful of condensers chosen by cut and try to tune each parallel

reasonant circuit to the desired frequency (either 2125 or 2975 cycles). The coupling condensers are selected, also by cut-and-try, to give the desired band pass. Your coupling condensers and tuning condensers should be selected to match the coils available from your own junk box and if the value happens to bear any remote resemblance to the values shown on the complete schematic diagram its purely coincidental.

The filters are followed by another amplifier. This raises the signal level again, but thats not why the stage is present. The filters like to work into an open circuit, or at least into a very high impedance circuit like the grid of a Class A stage. If the filters were terminated directly into the rectifiers, the low impedance of the rectifiers would louse up the filter characteristics, but good. The tuned circuits in the Plate circuit of each of these amplifiers help to discriminate against signals outside the pass band, but mainly they are provided instead of coupling resistances to insure high gain of the amplifier stage at the desired frequency (either 2125 or 2975 cycles) and at the same time provide a low impedance direct current path for the following rectifier stage. The coils used in the tuned circuits can be any old coil that can be conveniently tuned to the Mark or Space frequency and do not need to be high-Q coils.

The rectifier stages serve only to convert the Mark and Space signals to D.C. The two rectifiers are connected back to back so that their combined output is Negative DC voltage on Mark and Positive DC voltage on Space. A balancing potentiometer is provided in the rectifier output circuit to set the DC voltage to the proper RATIO (not necessarily equal) to insure proper keying of the printer.

The trigger stage is the little dilly of the whole terminal unit. Its strictly a YES or NO device. When a negative voltage is applied to its grid, it triggers its plate circuit to an Open condition and no plate current flows. As a result, the plate voltage is high since there is no drop in the plate load resistor. When a positive voltage is applied to its grid the stage triggers to a Closed condition and plate current flows like mad, resulting in a high voltage drop in the plate load resistor and a low plate voltage. The voltage existing at an instant at the plate of the trigger tube is measured by two small neon tubes connected in series to give about 150 volt breakdown condition. If the trigger tube plate voltage is high (negative grid, mark condition) the neon tubes light and connect the B plus voltage to the grid of the following keyer tube. If the trigger plate voltage is low (positive grid, space condition) the neon tubes go out and leave the grid of the keyer tube connected to a highly negative bias supply.

The keyer tube is about the end of things. As explained above, the grid of the keyer tube is either very positive (mark condition) or very negative (space condition), as determined by whether the neon tubes are fired or out. The strength of the incoming signal has little or nothing to do with the values of grid voltage on the grid of the keyer tube. The only thing that governs the keyer tube grid is whether the neon tubes are fired or out. The cathode current of the keyer tube flows through the printer magnet and operates the machine. The amount of keyer tube current under Mark conditions is controlled by adjusting the screen voltage of the keyer tube with a potentiometer.

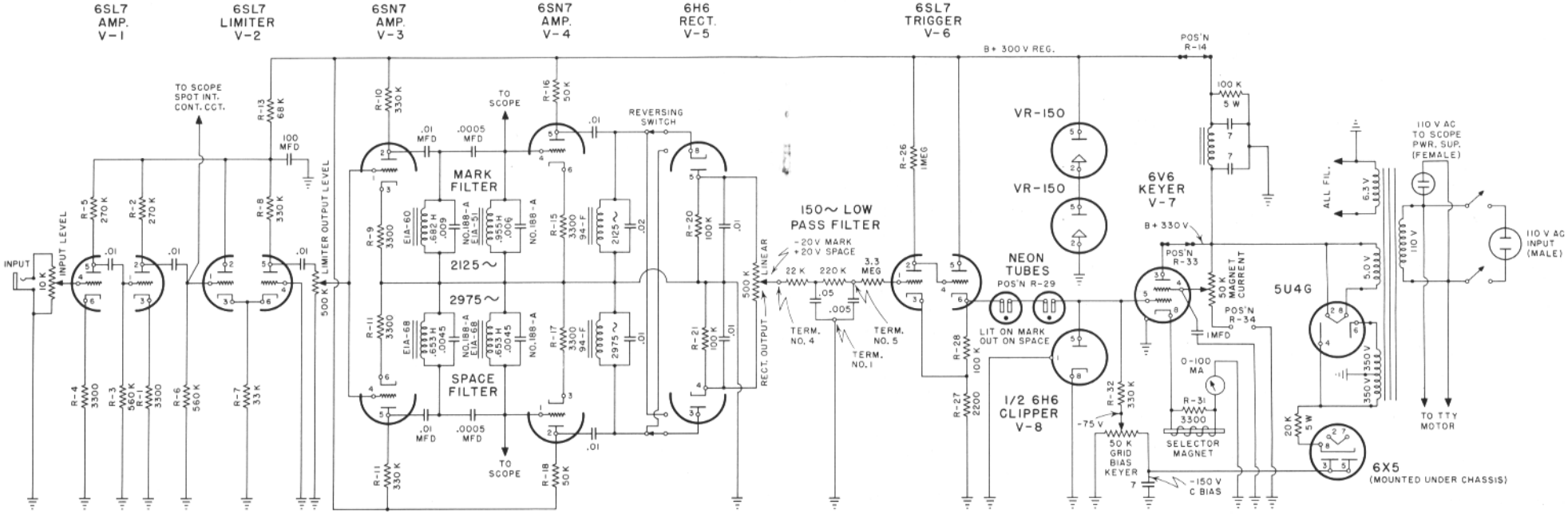
The block diagram shows an oscilloscope connected as a tuning indicator. If you looked closely, you will notice four input circuits to the scope instead of the usual two. Like most RTTY tuning and indicator scopes, signals feed out of the Mark and Space filters to the deflection plates to draw a cross when a Teletype signal is properly tuned in. BUT there the similarity to the conventional tuning indicator scope ends.

he cathode ray tube in the tuning indicator of the Little Monster is a DOUBLE GUN tube. There are two electron guns and two sets of deflection plates all in one bottle. If you dont have a double gun tube, two single gun tubes can be used instead. The second gun (or second tube) is the very interesting one.

Lets discuss the second picture presented on the tuning indicator by starting with the 425 cycle oscillator (see block diagram) This oscillator can be any available audio frequency oscillator such as a Heath Kit audio signal generator or the home brew equivalent. Its nice if the frequency can be varied from about 475 cycles by a dial with lots of band spread but this is not necessary for the tuning indications used in FSK work. It is however, very handy when measuring the exact frequency of the audio tones used in AFSK work. The output of the audio oscillator is fed to a load consisting of a condenser in series with a resistor. The junction between the condenser and resistor is grounded. Neither terminal of the oscillator output can be grounded as this would short circuit either the condenser of the resistor. If your oscillator has one output terminal grounded as most of them do, it will be necessary to connect an old audio transformer between the oscillator and the condenser-resistor load to dry out the circuit. (That means get rid of the ground on the output terminal). The condenser and resistor load are chosen so that they look something like a matched load for the oscillator as seen through any transformer that you may be forced to use, but the exact values are far from critical. For example, suppose your oscillator has an output impedance of 500 ohms. Also suppose you use an old plate to grid audio transformer with a 3 to 1 voltage step up ratio and that you connect the primary winding (low side) toward the oscillator, the secondary winding (high side) toward the load. Since the impedance ratio of the transformer is supposed to be the square of the turns ratio, the load should look like 9 times 500 or 4500 ohms. The reactance of the load condenser should be approximately equal to the load resistor, and both in series should add to about 4500 ohms. Since the condenser reactance adds to the resistor at right angles, each should have a value about equal to .707 times 4500 ohms or 3000 ohms (round numbers). At 425 cycles this calls for a condenser somewhere around 0.3 or 0.4 mfd. The The resistor should be in the neighborhood of 3000 ohms (give or take a thousand). You figure the values to fit your own set-up.

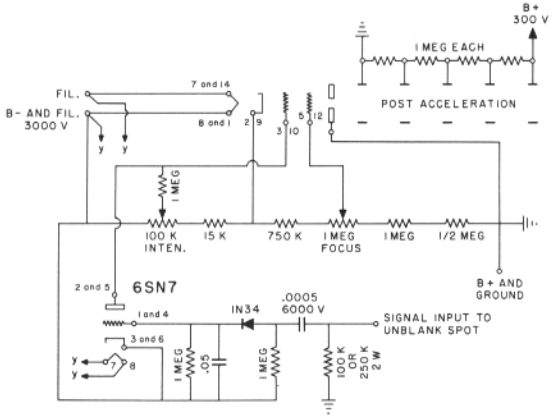
If the Vertical input circuit of a conventional oscilloscope is connected across the resistor (ground side toward the grounded junction between the resistor and condenser) and the horizontal input circuit is connected the condenser (watch the grounds again) then the gain controls on the scope can be adjusted to draw a circle on the cafe of the tube. This circle is traced by the beam spot buzzing around at the rate of 425 turns per second. Now, if the Z axis of the scope (intensity grid) is modulated by the audio tones from the radio receiver, the mark signal will turn the beam from bright to off five times for every revolution of the beam spot, producing a circle made up of five bright and five dark segments. (This is because 2125 divided by 425 equals 5). When a space signal is received the circle will have seven segments. (2975 divided by 425 equals 7). Now lets see what good these fancy circles will be.

Lets assume your a bug on RTTY and that means you want to tune your receiver so the Teletype signal centers squarely in the band pass of the I. F. amplifier. This is important with any receiver but it becomes a MUST if you use a Q-5er, a crystal filter, a sharp bandpass I. F. amplifier such as the better modern receivers have, or a mechanical filter such as the fancy



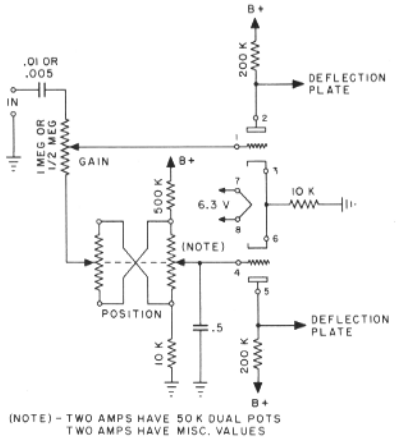
TELETYPE TERMINAL UNIT FOR NO. 26 MACHINE

F.T. SWIFT W6CMQ



CATHODE RAY TUBE GUNS AND SPOT BRILLIANCE CONTROL

(TWO INSTALLED)



(NOTE) - TWO AMPS HAVE 50 K DUAL POTS
TWO AMPS HAVE MISC. VALUES

DEFLECTION AMPLIFIERS

(FOUR INSTALLED)

Collins jobs are equipped with. To use the tuning indicator circles proceed as follows:

STEP ONE: Tune in a steady carrier signal someplace around your operating frequency Your own VFO will do nicely or the crystal calibrator in your receiver is even better. Lacking these sources, tune in any steady carrier you can find on the air, a broadcast harmonic of a Foreign Broadcast station will do. Tune the receiver until your S Meter (or ear) says the signal is centered in the receiver's pass band.

STEP TWO: Adjust the BFO dial on your receiver until the audio output frequency is about half way between 2125 and 2975 cycles as indicated by the cross pattern on the scope laying over at about 45 degrees. Now watch the circle and trim the BFO dial until you have a SIX segment circle and the segments are standing still. Since Six is half way between the five segments for mark and the seven segments for space, a Teletype signal will be centered in the receiver's pass band with the mark frequency near one edge, the space frequency near the other edge of the pass band. Leave the BFO knob alone from here on out, unless the BFO drifts and readjustments are necessary.

STEP THREE: Tune in a Teletype signal. Rough tuning can most easily be done by watching the cross and tuning for clean horizontal and vertical lines. Fine tuning is then done by watching the circle and trimming the tuning until five segments appear and stand still on mark signals. This is all done with the tuning dial, leave the BFO alone. All this can be done with a little practice in far less time than it takes to read these instructions.

Now lets suppose the signal you tuned in is calling CQ and that you want to answer him. You want to transmit on his operating frequency and you want to adjust your shift to exactly 850 cycles.

STEP ONE: Turn your VFO on Tune or whatever you turn it to, to get a signal in your receiver without the signal being on the air. Tune the VFO until the mark line of the cross pattern appears on the tuning indicator. Trim the tuning until the circle has five stationary segments.

STEP TWO: Push the Break button on the Teletype machine or do whatever it is you do to get a steady space condition. Adjust the Shift control on the VFO until a space line appears on the tuning indicator and trim the adjustment until the circle has seven stationary segments. Now your in business on his frequency with standard shift.

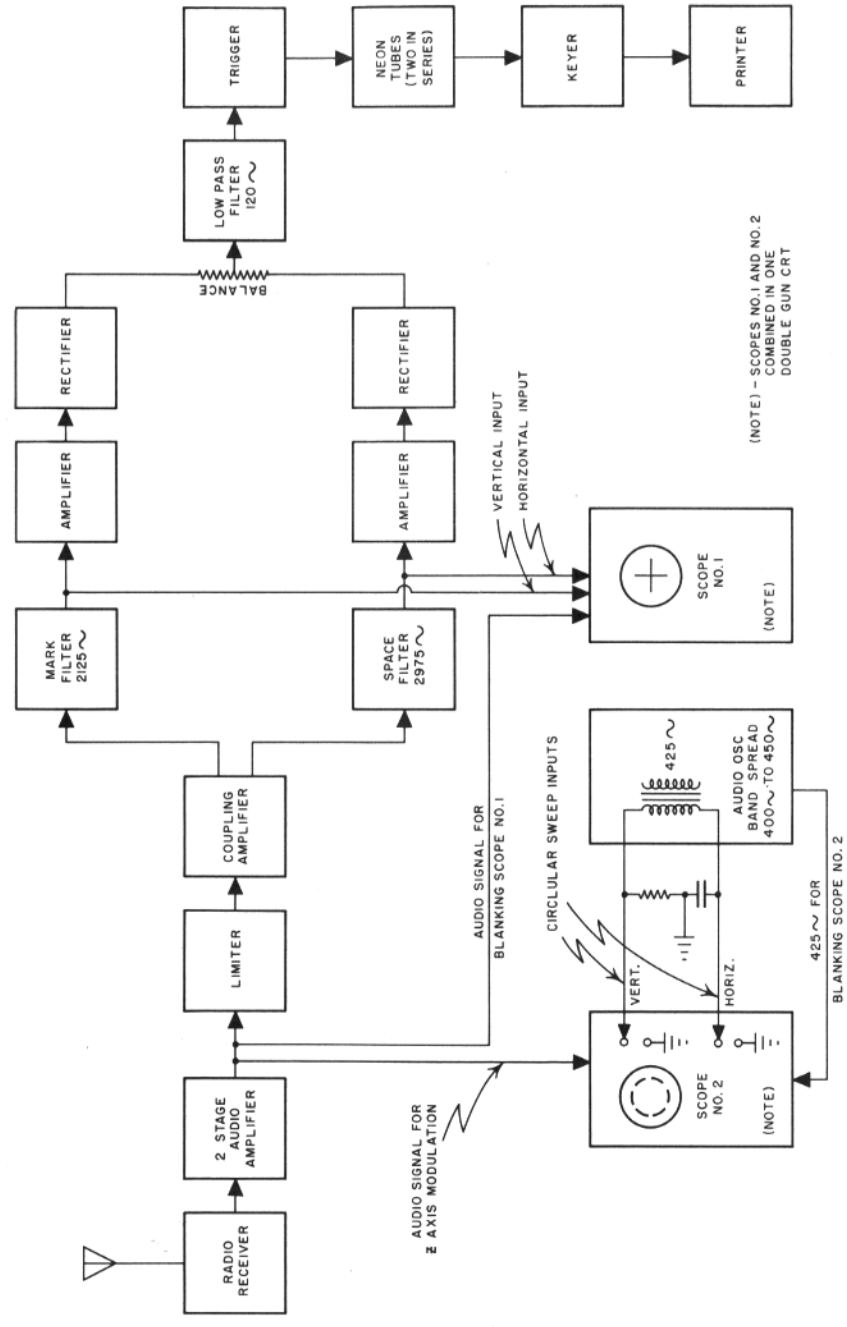
Lets assume you raise the lad and during the contact he finds you have a Little Monster, so he asks you to check his frequency shift. (He just knows it is exactly 850 cycles but he wants you to tell him his shift is perfect just to match that R-9 plus plus report you gave him).

STEP ONE: Have him send a steady mark signal. Tune your receiver for five stationary segments on the indicator.

STEP TWO: Have him send a steady space signal. Adjust your AUDIO OSCILLATOR until seven stationary segments appear on the indicator.

STEP THREE: Read the Audio Oscillator frequency. It should be close to 425 cycles. Multiply the Oscillator frequency by seven and subtract 2125. The answer is his frequency shift in cycles per second. The accuracy of this check is usually based only on the accuracy of your Audio Oscillator and how closely you can read its dial calibration.

All of the above proceedures assume you are interested in 850 cycle shift. To use the tuning indicator on narrow shift, readjust the Audio Oscillator to a frequency which will divide exactly into both the mark and space frequencies for which the filters in your terminal unit are adjusted. The number of segments you will see on the circles will be the



BLOCK DIAGRAM - "THE LITTLE MONSTER"

F.T. SWIFT W6CMQ

number of times the audio oscillator frequency divides into the mark and space frequencies and may be something other than five and seven. You figure it out.

All of the above description concerning the care and feeding of the tuning indicator applies to FSK work. If you operate only on the VHF bands with AFSK, you might as well leave the circular pattern feature out of your unit since receiver tuning has nothing to do with the frequency of the audio tones being received. However, if either now or later you plan to use FSK or if you want to be an audio frequency measuring station for your own and the other fellow's tones, then add the junk necessary to draw the circles. The bandspread calibrated dial on the audio oscillator referred to earlier now becomes a must. To measure either a mark or space tone, adjust the audio oscillator until the five or seven segment circle on the scope stands still. Multiply the frequency read on the audio oscillator dial by five or by seven and thats the answer. If you want to be fancy, you can provide two calibrations on the audio oscillator band spread dial; one five times and the other seven times the actual oscillator frequency. Mark and space tone frequencies can then be read directly from the audio oscillator dial.

A word of explanation is in order about the tube marked BLANKING on the schematic diagram. The circuits are arranged to turn the spot intensity of the cathode ray tube (or tubes) down to the vanishing point when no signal is being received. This prevents drilling a hole in the center of the face of the tube when no signal is being received. The circuit is arranged to bias the intensity grid of the cathode ray tube to cut-off from the electron gun DC power supply. When a signal is tuned in, a portion of it is rectified by a crystal diode. The resulting DC controls the grid bias on the BLANKING control tube. The plate current of the BLANKING control tube then acts like a variable resistance in the electron gun high voltage bleeder circuit and does the same thing as turning up the conventional INTENSITY control of the garden variety oscilloscope diagram, very little equipment is required to provide the Blanking feature. A word of CAUTION! The coupling condensers between the signal sources and the Blanking amplifers must withstand the full very high voltage of the cathode ray tube's DC supply. The input resistors ahead of these coupling condensers are a safety feature only, designed to short the high voltage supply should the condenser fail. Therefore they should be rated at 5 watts or more. (TV doorknob filter condensers are used in this circuit in the "Little Monster.")

The complete schematic diagram of the Little Monster is included in this description with the thought that it will answer many of the questions that may arise and that are not covered in words. Most of the values shown were chosen because that what was available in the junk box, NOT because they were the optimum values. This is particularly true of the band pass filters. The only cash spent on the Little Monster was a couple of bucks for the surplus double gun cathode ray tube. If you want to build something like the Little Monster, use the terminal unit you now have as a base and do your own thinking about how and what to add to it. Thats why no pictures or layouts are given. (Or perhaps thats because we used an old BC-1068 receiver chassis for the TU and quarter inch masonite for the tuing indicator mount).

As was said above, this is not a construction type article. Its written only with the hope that it may give someone an idea or two to think about. If you have questions, shoot them in by mail or RTTY, but pleeze dont ask why we used 2150 ohms instead of 3200 or what kind of toroids make the best filter.

de TED SWIFT, W6CMQ
2330 Melville Drive
San Marino 9, Calif.

MEMORANDUM REPORT ON AIR TESTS ON NARROW SHIFT

By BOYD "BEEP" PHELPS, WØBP, W9BP

Upon the effective date of narrow shift authorization for U. S. Amateurs, contact was immediately established between WØBP and Joe, VE3BAD, of Toronto. As Canadians had rights to use any shift not to exceed 900 cycles for some while, contact had been accomplished several months previous with VE3BAD transmitting with 160 cycle shift and reception at WØBP was with the unit described in December "CQ." More recently a new variable frequency receiving converter has been used at WØBP in which the acceptable shift could be easily varied by one calibrated knob from zero to 1,000 cycles and the band widths also flexible, but that is another story.

Joe is a Telephone Engineer who builds his own ham gear and has had many years experience with Teletype equipment during the war and since, and numerous conversations with him indicate he has much more than average "savy" on RTTY problems. He built the tone quadrupler or "double doubler" conceived by W9TCJ and WØBP and an experimental model was built by W9TCJ and demonstrated at the Chi-RTTY meeting last October and described in November RTTY. Tests by Joe in the lab confirmed the ability of the circuit to frequency multiply and produce signals shifting 850 cycles from input FSK of 212.5 cycle shift; that is, receiver output tones of 531 and 744 cycles would be doubled twice to produce 2125 and 2975 cycle tones acceptable to current converters.

However on air tests on 3630 kcs. over the 700 mile path from WØBP to VE3BAD it worked miserably. Considerable checking of equipment at both ends disclosed no mis-adjustments. A shift of about 200 or 225 cps produced practically no printing, so return was made to 212 cps FSK. At best, printing was very inferior to customary 850 cycle FSK printing between these two stations. Substantially sine waves without limiting were used. Joe reported the "mark" frequency was most erratic and it acted like it faded violently while the "space" was more normal. It is difficult to reconcile this with any propagation theory, but he checked his receiver tuning, etc. and everything seemed normal. Reception at WØBP included both Coasts tho fading was quite bad and Joe was printed well after the terminal unit was adjusted to match his shift.

The current issue of "Tele-Tech" contains an article that is very informative on RTTY band widths and radio distortion of RTTY by J. B. Moore of RCA Communications, Inc. He makes numerous mentions of "Multi-Path Propagation" and that pulse elongations are often six milliseconds. This results in the mark and space frequencies both being present in the receiver and terminal equipment at the same time! Thus an audio tone is produced equal to the shift frequency, and this as well as harmonics of this frequency are to be avoided in terminal equipment. For example, it will be recalled that the choice of 2125 and 2975 cycles for filter units was made to avoid the second, third and

fourth harmonics of standard 850 cycle shift for this reason, and other related reasons such as ringing or tails on the decay of energy in tuned circuits.

Scrutiny of the harmonic tone multiplier or double-doubler with the above in mind reveals it to be a direct violation of this principal. Thus while the high distortion frequency multiplier is generating a fourth harmonic of 212.5 cycles to produce 850 cycle shift, it is also generating many other even harmonics, and the tenth harmonic is 2125 and the fourteenth harmonic is 2975 cycles which exactly matches the mark and space filters! It might be expected the lower order harmonic to be the stronger, accounting for the trouble Joe had with the mark. Unfortunately early tests before air use of narrow FSK was authorized were of necessity confined to the test bench and lacked the effects of multi-path propagation vagarities which cause both mark and space frequencies to co-exist at the same time to produce an undesired tone rich in harmonics. Joe also observed that while he occasionally got perfect printing for a time and the customary pattern of a cross on his scope connected across the filters, when printing went out he got a circular pattern.

It may be premature to condemn the circuit on such short tests. Much more practical data should be accumulated on its use over various air transmission paths of different lengths, at different frequencies, and the Diurnal variation between two stations having steady ground wave daytime communication as compared with the addition of night time sky wave reflections added, as well as long hauls under severe fading conditions and numerous layer reflections.

In passing, it is noted that the local monitor receiver on 20 meters produces normal 850 cycle shift signals from harmonics of the 80 meter transmitter operating on 212.5 cycle FSK, which may suggest frequency multiplication at radio rather than audio frequencies in order to reject any stray audio beats present.

LAWRENCE K C. CHING
KH6ZD, Honolulu, Hawaii

The cover photograph is that of Lawrence Ching, KH6ZD. He writes, "Here is a snapshot of my so-called 'ham shack.' Hi. Rather tight, especially when I have to get behind the 7-foot rack. (Standing room only").

The equipment is as follows from top to bottom: W2PAT converter. Extra panel with AC meter. 0-50 Ma. meter in series with 26 printer selector magnet. 32-V-2 transmitter (modified with WØ JRQ's FSK circuit. 75-A-1 receiver. Not shown is the 522 transmitter for two meters, two meter crystal controlled converter back of the speaker below.

CORRECTION!

In the Circuit diagram of the W6OWP Single Filter Terminal Unit described in the March Issue of RTTY, the screen of the keyer tube should be connected to the Plate instead of the B plus. The grid of the Eye Tube should go to the junction of the resistor and condenser to the left of the tube as shown on diagram on pages 8 and 9.

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Traffic Net News

By EMILE DUVAL, W6FLW

The RTTY Society of Southern California Net operates every Tuesday evening at 8:00 p. m. on 147.85 mc.

ACTIVITY FOR THE MONTH OF FEBRUARY, 1956

W6CZ—NET CONTROL

February 7—24 Checkins

W6ADD	W6IZJ
W6AFX	W6JAU
W6BPG	W6KMT
K6BTK	W6NWM
K6CHU	W6OJF
W6CKS	W6RCM
W6CMQ	W6RL
W6CZ	W6SCK
W6EV	W6SCQ
W6FLW	W6VAD
W6FNW	W6WYH
W6ICS	W6ZBV

February 14—27 Checkins

W6ADD	W6JAU
W6AEE	W6KMT
W6AFX	W6LDG
W6BPG	W6NCP
K6BTK	W6NWM
W6BWG	W6OJF
W6CMQ	W6ORF
W6CZ	W6RL
W6DYB	W6SCK
W6EV	W6SCQ
W6FLW	W6SQM
W6ICS	W6WYH
W6IHG	W6ZBV
W6IZJ	

February 21—32 Checkins

W6ADD	W6IZJ
W6AEE	W6JAU
W6AFX	W6KMT
W6BPG	W6LDG
K6BPI	W6NWM
K6BTK	W6OJF
W6BWG	W6OQI
K6CHU	W6ORF
W6CKS	W6RCM
W6CMQ	W6RL
W6CZ	W6SCK
W6EV	W6SCQ
W6FLW	W6SQM
W6FNW	W6WYH
W6ICS	W6ZBV
W6IHG	W6ZVO

February 28—28 Checkins

W6AFX	W6JAU
W6BPG	W6LDG
K6BPI	W6NWM
K6BTK	W6OJF
W6BWG	W6OQI
K6BWJ	W6ORF
K6CHU	W6RCM
W6CKS	W6RL
W6CMQ	W6SCQ
W6CZ	W6SQM
W6EV	W6VAD
W6FLW	W6WYH
W6IHG	W6ZBV
W6IZJ	W6ZVO

ACTIVITY FOR THE MONTH OF MARCH, 1956

W6ICS—NET CONTROL

March 6—20 Checkins

W6AFX	W6ICS
W6BPG	W6IZJ
K6BWJ	W6JAU
W6CK	K6KHS
W6CKS	W6LDG
W6CMQ	W6LFK
W6CZ	W6LLA
W6DYB	W6OJF
W6EV	W6SCQ
W6FLW	W6SQM

March 13—30 Checkins

W6AEE	W6ICS
W6AFX	K6IHG
W6BPG	W6IZJ
K6BPI	W6KMT
K6BTK	W6LDG
W6BWG	W6LLA
K6BWJ	W6NCP
W6CK	W6NWM
W6CKS	W6OJF
W6CMQ	W6OQI
W6CZ	W6ORF
W6CYR	W6PSW
W6EV	W6SCQ
W6FLW	W6SQM
W6FNW	W6ZBV

March 20—30 Checkins

W6ADD	W6ICS
W6AEE	W6IZJ
W6AFX	W6JAU
W6BPG	K6KHS
K6BTK	W6KMT
W6BWG	W6LDG
K6CHU	W6LLA
W6CKS	W6NWM
W6CL	W6OJF
W6CMQ	W6OQI
W6CZ	W6ORF
W6DYB	W6RCM
W6EV	W6SCQ
W6FLW	W6SQM
W6FNW	W6ZBV

March 27—36 Checkins

W6ADD	W6IHG
W6AEE	W6IZJ
W6AFX	W6JAU
W6BPG	K6KHS
K6BPI	W6KMT
K6BTK	W6LDG
K6BWJ	W6LLA
K6CHU	W6NWM
W6CK	W6OJF
W6CL	W6OQI
W6CMQ	W6ORF
W6CYR	W6RCM
W6CZ	W6SCK
W6EGZ	W6SCQ
W6EV	W6SQM
W6FLW	W6TRX
W6FNW	W6TZA
W6ICS	W6ZBV