RTTY Demodulator - Con.

CONTINUED FROM PAGE 7

quency of the various bandpass filters. An oscilloscope or other tuning indicator can be connected to either the input filter outputs at J2 or to the channel filter outputs at J3 of Figure 2.

In Figure 3, the channel filter outputs at A and B are applied to the detector/low-pass filter through an inversion switch. The mark signal is applied to a precision full-wave rectifier consisting of A1 and its associated circuitry. When the input to A1 is negative, the output goes positive and diode D1 conducts. As long as the input is negative, the voltage at the cathode of D1 will be a positive voltage equal in magnitude to the input voltage. Because of the high open loop gain of A1, only a very small input voltage (a fraction of a millivolt) is needed to overcome the forward voltage drop of diode D1. When the input voltage to A1 is positive, the output is negative and D2 conducts. When this occurs, D1 is shut off and the cathode of D1 remains at zero volts. The voltage at the cathode of D1 is therefore a half wave rectification (inverted) of the input. Adding twice the rectified and inverted signal to the original input signal at the summing junction of A3 results in a full-wave rectification of the input to A1. The precision full-wave rectifier is capable of rectifying signals in the tens-of-millivolts range, and is primarily limited by the offset voltage of amplifier A1 (which can, of course, be balanced out if desired). Because of this ability to handle small signals, the precision full-wave rectifier allows operation of the demodulator over a rather large dynamic range. The space signal is applied to another precision full-wave rectifier (A2) which produces a dc output of opposite sign with respect to the mark rectifier. The mark and space rectifier outputs are summed at the input of A3, and since they are of opposite sign, the difference of the detected mark and space signals is formed.

Amplifiers A3 and A4 and their associated circuitry form an active 3-pole Butterworth low-pass filter. One pole of the filter is supplied by the feedback network of amplifier A3. The other two poles are supplied by A4 and its associated circuitry. The cutoff frequency of the low-pass filter is about 36 HZ.

CONCLUDED NEXT MONTH

*****

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December 1973
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CONTENTS-

6th GIANT RTTY FLASH CONTEST

RULES

The **cq elettronica** Mugazine of Italy is once again sponsoring the « **Giant** » RTTY Flash Contest.
The purpose of this Contest is to promote increased interest in the RTTY mode of operation as used by Radio Amateurs.
This is a « flash » Contest because the total contest time is limited to 16 hours periods on two successive weeks in January 1974.

1. **CONTEST DATES**
   1st 15,00-23,00 GMT January 19th 1974
   2nd 07,00-15,00 GMT January 27th 1974
2. **BANDS**
   3,5, 7, 14, 21, and 28 MHz Amateurs Bands.
3. **COUNTRY STATUS**
   The ARRL Countries list will be used except that the W Call areas WO to W9 and the VE Call areas from VO to VE7 will be considered as separate Countries.
4. **MESSAGES**
   Messages will consist of:
   a) Call sign
   b) RST
   c) Zone number *(Example I1XXX 599-15)*
5. **EXCHANGE POINTS**
   a) Each two-way RTTY contact with station in one's own zone will receive 2 exchange points.
   b) Each two-way RTTY contact with station outside one's own zone will receive exchange points in accordance with the « exchange points table ».
   Note: stations may not be contacted more than once on any one band but additional contacts may be made with the same station if a different band is used.
6. **LOGS AND SCORE SHEETS**
   Use one log for each Band.
   Logs to contain: Data, Time (GMT), Call signs, Countries, RST and zone numbers sent and received, multipliers Country, Points and final score.
   All Logs must be received by not later than February 28th 1974 in order to qualify.
   Send them to:
   Prof. Franco Fanti
   Via A. Dallolio 19
   40139 Bologna, ITALY
7. **MULTIPLIERS**
   A multipliers is given for each Country worked. A separate multiplier may be claimed for the same Country if a different band is used.
   The operators own Country does not qualify for a multiplier and count zero point.
8. **SCORING**
   Total exchange points times the total number of multiplier times the total number of QSO.
9. **SWL'S**
   This contest is also open to SWL RTTYers. For the SWLs the same scoring rules are valid. A separate results table will be made for these entries.
   The Logs for SWLs must contain: date, time (GMT), Call sign of station heard, RST and Zone number sent by station heard, multipliers Countries, points and final score.
   The same stationis only valid once on each band.
10. **AWARDS, MEDALS & FREE SUBSCRIPTIONS**
    The contest Committee will compile two separate lists.
    a) General classification
    b) Short Wave Listeners
    In each of these two classes the following awards will be made:
    1st: gold medal
    2nd: silver medal
    3rd: bronze medal
    4th to 7th: will receive a 12 month's subscription to the **cq elettronica** magazine.
    8th to 10th: will receive a 6 month's subscription to the **cq elettronica** magazine.
    There will also be awards for all of the operators and SWL's that send logs.
11. **WORLD RTTY CHAMPIONSHIP TABLE FOR 1973.**
    Points and positions achieved will be valid for inclusion in the WORLD RTTY championship table for 1973. The « Giant » is the last Contest for consideration for the Championship for the year 1973.
12. **RULES OF BEHAVIOUR AND PENALISATION.**
    The Logs must be compiled in accordance with the rules listed in (6).
    The contacts must be made by means of the RTTY mode and it is not permitted to use other modes of transmission either before, during or after the exchange of messages by Radio Teletype.
    During the Contest it is expected that Amateurs will observe the fundamental rules of courtesy and good operating during contacts.
    Failure to observe any of the above Rules will result in the exclusion of the entry from the final results and any such Logs received will be considered as check Logs.

All logs received become the property of the Edition CD and will not be returned.
The decision of the organising Committee in any dispute will be final and any subsequent controversy cannot be referred to the Civil Court.

*****

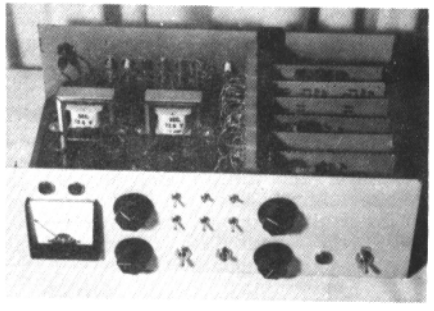
VOLTA RTTY CONTEST- -

STARTING- 1400 GMT- December 1st.
ENDING 2000 GMT December 2nd.-

SEE OCTOBER ISSUE FOR RULES--

*****

RTTY DEMODULATOR WITH GOOD DYNAMIC RANGE.



JIM ABSHIER, W8QOP
1750 South Hill Rd.
MILFORD, MICHIGAN, 48042

Part 1 of 2 parts

Introduction

One of the problems encountered in designing solid state signal processing circuits which employ diodes is that the forward voltage drop of the diode is rather significant when compared with the signal level. A germanium diode, for example, has a forward voltage drop of about 0.3 V. If used as an envelope detector for signals limited to 10 V peak-to peak, the diode drop would represent about 6% of the desired peak rectified output voltage. For a signal level of 1 V peak-to-peak, the diode drop would be 60% of the desired output. The dynamic range of such a circuit would therefore be limited to just slightly over 20 db.

Solid state RTTY demodulators generally employ diodes as envelope detectors and elements in threshold determining circuits. Such demodulators usually employ a limiter which, to a great extent, reduces the dynamic range requirement of the envelope detector. For linear operation of the demodulator, however, the diode circuits leave much to be desired. In this article, an experimental RTTY demodulator is described which works well in both the linear and limited modes of operation. Large dynamic range of the envelope detectors is achieved by using an operational amplifier in conjunction with diodes in a circuit commonly referred to as a precision rectifier. An operational amplifier is also employed in a precision peak detector circuit. Two such peak detectors are used in a circuit which determines the mark space decision threshold. The demodulator was designed as an experimental unit for evaluating the relative merits of different operating modes under various signal and noise conditions. Objectives included experimentally determining the conditions under which linear operation is preferred over limited operation, and to what extent the automatic threshold correction (ATC) circuit improves performance. To date, extensive tests have not been performed using the demodulator so conclusions can not be presented at this time. The description of the demodular is presented with the hope that some of the ideas used will be of value to the amateur RTTY community.

System Description

The basic design concept of the demodulator is the familiar two-channel concept. Bandpass filters separate the mark and space audio signals. These audio signals are then envelope detected, and the detector outputs are subtracted to obtain the teletype keying waveform. In addition to the circuits for performing this basic signal processing, the demodulator employs a limiter for improving (when feasible) input signal-to-noise ratio (SNR), a slicer (limiter) for hard limiting the keying waveform and threshold computing circuitry for determining a suitable switching threshold for the slicer.

Figure 1. is a system diagram of the demodulator. The audio signal from the communication receiver is applied to an input filter. This filter consists of two bandpass filters with outputs summed. One filter is centered on the mark frequency, and the other is centered on the space frequency. The function of this input filter is to pass only signals appearing in the vicinity of the mark and space frequencies, and to reject signals appearing in other parts of the receiver passband. For linear operation of the demodulator this input filtering is not too important, but for limited operation, it is extremely valuable; particularly if the receiver passband is broad.

The output of the input filter is applied to an amplifier which can be operated either as a linear amplifier for

the linear mode of operation or as a limiter. In the linear mode, this amplifier just provides a voltage gain of five. In the limited mode this amplifier (approximately) hard limites the signal from the input filter. In so doing, the limiter generates an output waveform of essentially constant power. Now the input to the limiter consists of desired signal (the mark or space tones) and noise (receiver noise, atmospheric noise, QRM, etc.). Whichever signal is stronger (signal or noise) will tend to "capture" the limiter and suppress the weaker signal. When the SNR at the input of the limiter exceeds a certain threshold value, the output SNR is improved with respect to the input SNR. When the input SNR is below this threshold, however, the output SNR degraded with respect to the input. For this reason the input filter is rather important. The SNR at the input to the limiter should be made as high as possible with the objective of keeping the limiter operating above the SNR improvement threshold. By rejecting noise in the portions of the receiver passband which do not contain desired signal components and passing the desired signal components, the input filter improves the SNR appearing at the input of the limiter with respect to the SNR at the receiver output.

The limiter (or linear amplifier) output is applied to the mark and space channel filters. These bandpass filters separate the mark and space audio tones. The mark and space tones are applied to an inversion switch. This switch, when on, causes the space signal to be interpreted as a space signal. It is desirable to have such a capability because one occasionally encounters an RTTY signal on the air which is inverted.

The mark and space audio tones are detected by precision full wave rectifiers. These rectifiers utilize the high gain of operational amplifiers to rectify signals well below the normal diode cut-in voltage. Details of how the precision fullwave rectifier works are given in a subsequent section on circuit descriptions. The rectified space signal is subtracted from the rectified mark signal and the difference is applied to a low-pass filter. The low-pass filter is a three pole Butterworth active filter with a cut-off frequency of about 36 HZ. The output of the low pass filter is the demodulated teletype keying waveform. To provide an indication of signal strength and a signal for operating squelch circuitry, the rectified mark and space signals are added and the sum is averaged in a simple RC low-pass filter.

The teletype keying waveform from the Butterworth low-pass filter is applied to a circuit which computes a bias voltage to be applied to the keying waveform. This bias voltage is subtracted from the keying waveform to reduce detrimental effects of frequency selective fading. When the mark or space signal fades, the teletype keying waveform is not symetrically distributed about zero. The bias voltage tends to shift the keying waveform so that it is symmetric about zero volts. This shifting of the keying waveform provides better noise immunity under conditions of frequency selective fading. It also allows the demodulator to work either the mark or space signal only. The bias voltage is developed by detecting the positive and negative

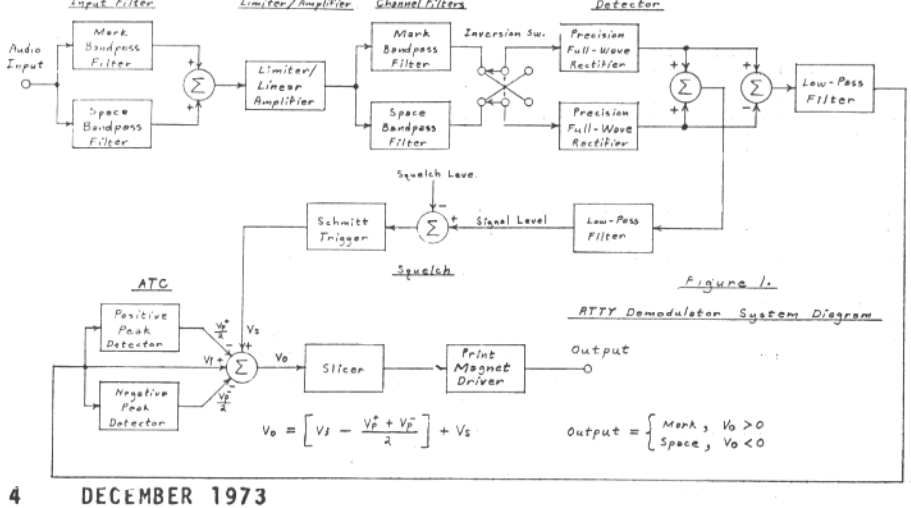


Figure 1.

RTTY Demodulator System Diagram

peaks of the teletype keying waveform. The peak voltages are then summed with the keying waveform to obtain a composite signal VT given by;

$$V_T = \left[V_i - \frac{V_p^+ + V_p^-}{2} \right]$$

In this relationship, Vi is the teletype keying waveform from the low-pass filter, V_p^+ is the positive peak voltage and V_p^- is the negative peak voltage. The peak detectors respond rapidly to increasing peak voltages but decay slowly. This allows quick recovery from the steady mark condition. When a steady mark signal has been received for several character times, the bias voltage becomes the mark voltage divided by two. It is desirable to restore the bias to zero rapidly when a character is received (assuming the space signal is the same amplitude as the mark signal) so that optimum noise immunity is obtained for the first character after a long duration of the steady mark condition. The rise time of the peak detectors is therefore approximately equal to one bit time or 22 milliseconds. The start pulse of the first character after a steady mark condition causes the proper bias voltage to be developed for the character. The decay time of the peak detectors is several characters long to avoid decaying of the bias signal during characters which are mostly mark or space. This decay time is generally a compromise between bias voltage decay or droop and the ability to follow the fading signal. Very rapid fading usually reduces the effectiveness of this circuit.

The corrected teletype keying waveform is applied to a slicer which hard limits the waveform about a threshold of zero volts. The slicer output switches the print magnet driver transistor which keys the teletype machine. A squelch circuit is available for preventing the machine from printing garbage when the incoming signal goes off the air. This circuit is essentially a Schmitt trigger with an adjustable threshold. The rectified and filtered mark-plus-space signal is applied to the squelch circuit. If the signal drops below some (adjustable) threshold level, the Schmitt trigger switches and applies a large offset voltage to the slicer. This large offset holds the print driver on overriding all other input signals to the slicer.

The experimental RTTY demodulator has various controls and switches for altering its operation. It can be switched from limited to linear operation. The bias voltage or threshold computing circuit and the squelch circuit can both be turned on or off. Switches are available for selecting normal or inverted mode and 850 or 170 Hz shift. Either the mark or space (or both)channel can be turned off. Controls are available for attenuating the audio input signal, adjusting the balance between the mark and space channel filters and adjusting the squelch threshold. A meter provides monitoring of the mark-plus-space signal level, the average keying waveform level at the output of the Butterworth low-pass filter, and the bias voltage of the threshold computing circuit.

Circuit Descriptions

The various circuits used in the demodulator are shown in Figures 2, 3, 4, and 5. In these figures, circuits enclosed by solid lines are contained on pluggable circuit cards. Six of these cards are used in the demodulator. Figures 2 through 5 also show interconnections of the circuit cards and circuitry which is not contained on the circuit cards. In this section, the various circuits used in the RTTY demodulator are described.

The input filter shown in Figure 2 consists of two bandpass filters; one for the mark signal and the other for the space signal. Each bandpass filter consists of a 741 operational amplifier with an RLC circuit as the feedback impedance element. The voltage gain at resonance is essentially determined by the ratio of the feed back resistance to the input resistance. The feedback inductance and capacitance provide the bandpass characteristic of the filter. The inductors are 88 mh. torroids readily available as surplus telephone loading coils. The capacitors are good quality mylar capacitors. Ceramic capacitors are not suitable in this application. The mark bandpass filter has two feedback capacitors; one of which can be switched in and out to provide two alternate center frequencies for the bandpass filter. The mark filter normally operates with a center frequency of 2975 Hz. and the space filter operates at 2125 Hz. This provides 850Hz shift operation of the input filter. When the additional capacitor of the mark filter is switched in, the mark center frequency is 2295 Hz. for 170 Hz shift operation. Audio from the communication receiver is applied to the input filter through a 500 ohm potentionmeter which can be used to attenuate the incoming signal to an acceptable level. Switches are provided at the outputs of the bandpass filters so that either the mark or space section of the input filter can be disabled. Effects of interference (QRM) on either the mark or space frequency can be reduced by

switching off the filter section for the frequency being jammed.

Outputs of the input filter are summed at the input of the limiter/linear amplifier (Figure 2). This amplifier circuit operates as either a linear inverting amplifier or as a limiter. For linear operation, the amplifier output is connected to the 51k feedback resistor, and the circuit operates at a voltage gain of 5. For limiter operation, the amplifier output is connected to the diode feedback network. In this mode, the output is limited to approximately 3v peak-to-peak. Limiter or linear operation is selected with the mode switch shown in Figure 2. The two diodes

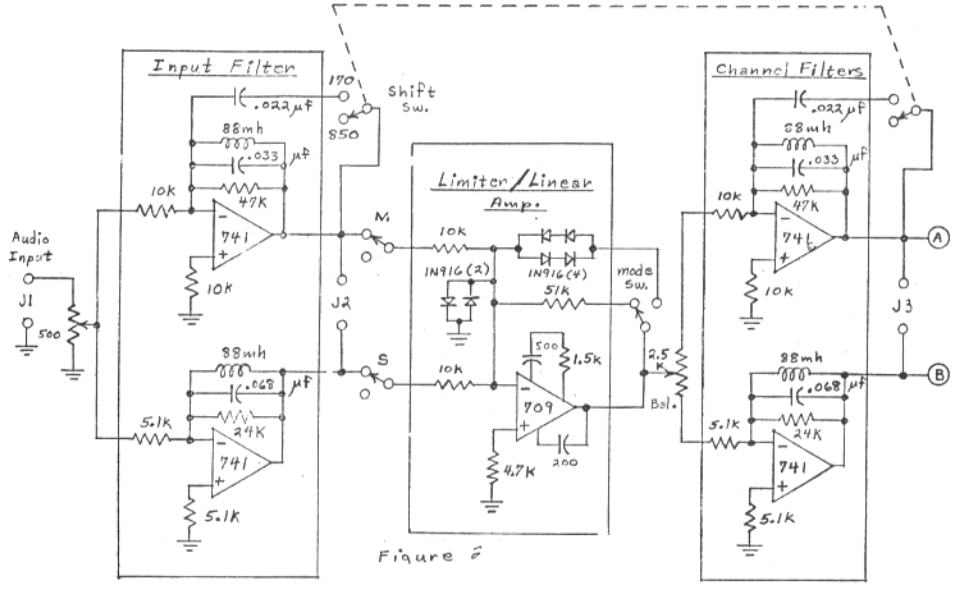


Figure 2

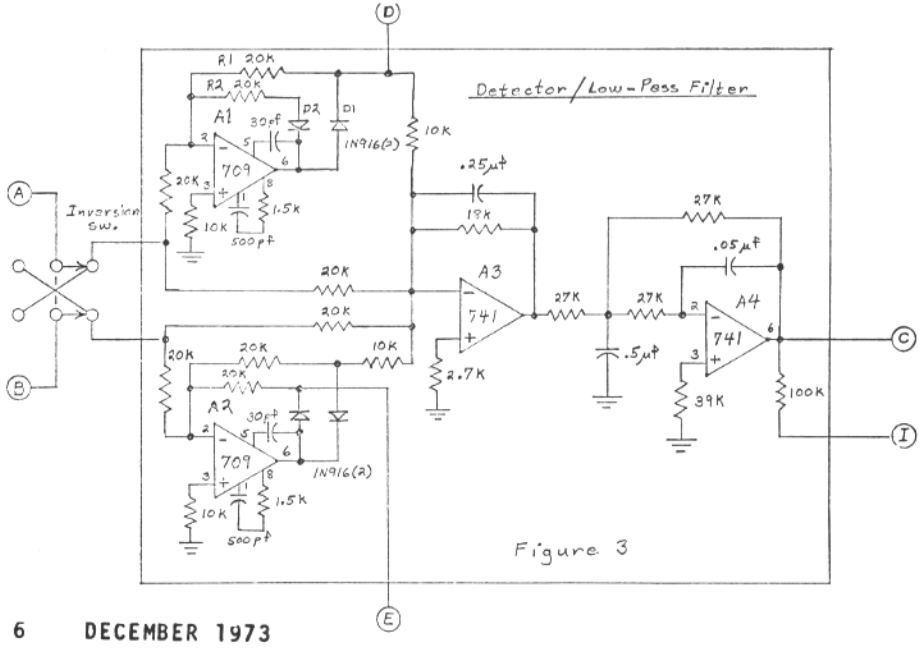


Figure 3

connected from the summing junction to ground are for latch-up protection.

The output of the limiter/linear amplifier is applied to the channel filters through a 2.5k balance pot. The balance pot. adjusts the gains of the channel filters differentially and provides a means of balancing the noise outputs of the channel filters when no signals are present. Such balancing, while not critical, improves noise immunity of the demodulator. The channel filters are essentially identical to the input filter sections. In both the input filter and channel filters, the feedback capacitor values shown in Figure 2 are nominal values. In the actual circuit, additional padding capacitors were added to adjust the center fre-

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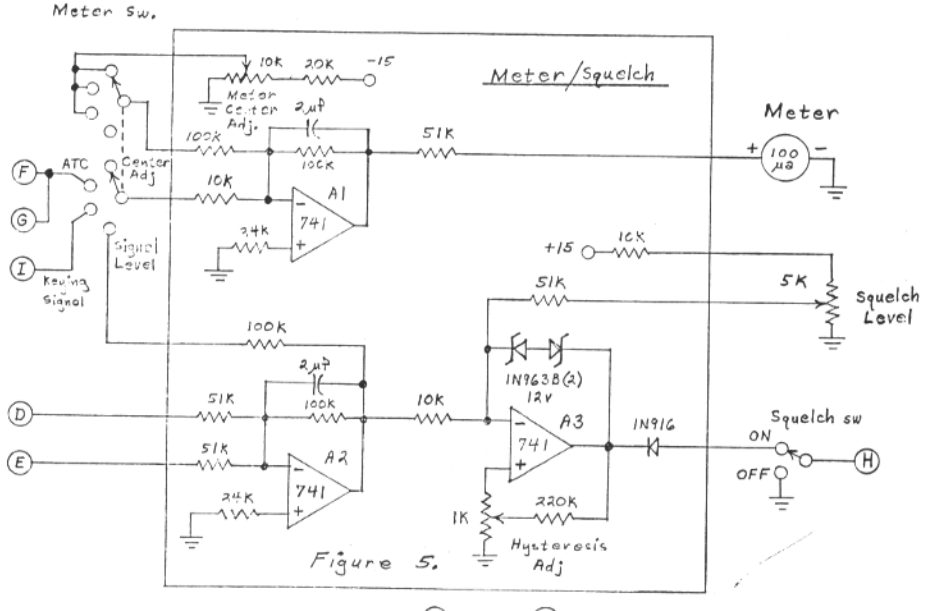

Figure 5.

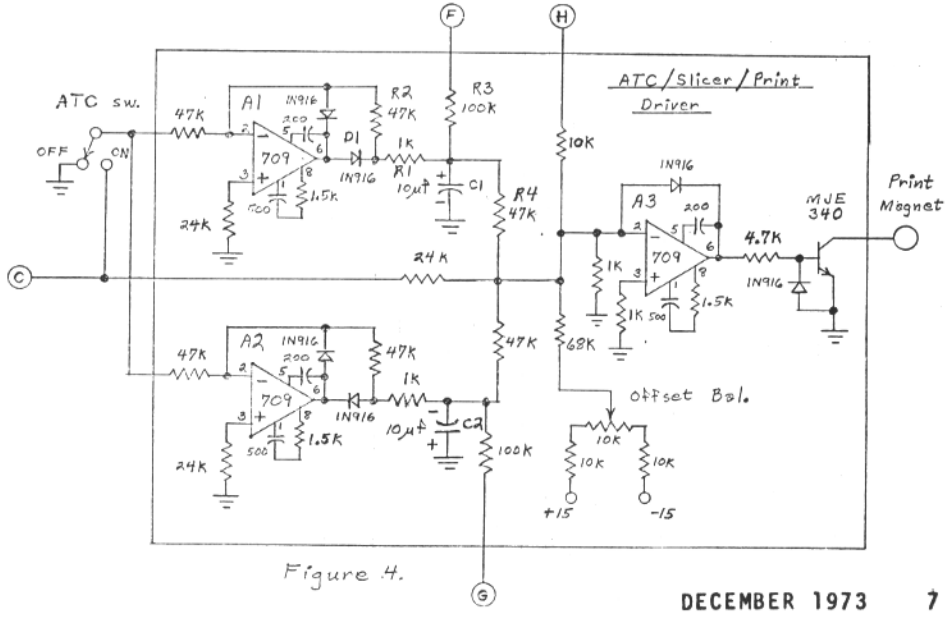

Figure 4.

*FINALLY ** ** ** The Hard Way*

***

The letter last month, from W2ZPW, Mack, who is deaf, about his problems getting started in RTTY brought a lot of nice comments. Another letter from Mack has brought us up to date and we are running it here as proof of "where there is a will, there is a way".

***

We also received a very interesting letter from Bob Weibrect, W6NRM. Bob is also deaf, but has been one of the pioneers in amateur RTTY. Bob's interest started in 1948 and he has many innovations and pieces of equipment to his credit. He has been very active on the amateur bands and lately has been one of the pioneers in making teletype available to deaf people using the telephone lines. Lack of space keeps us from running Bob's letter in this issue but look for it in a near future issue.

***

October 28, 1973

Dear Dusty;

I finally did it! Made my first RTTY contact. Had a half hour QSO with a chap in Ansonia, Conn., about 75 miles from here. Was nervous as a bride on her wedding night! My hands shook so that the errors must have flowed a veritable flood. We had about four exchanges before I begged to call it quits. Signal report for my 38 watts input was pretty good but my 850 shift was a bit too wide. Readable, but still wider than it should have been. Am playing around with it now until it gets under control.

Perhaps I should have told you that I wrote to "RG" Guentzler, W8BBB for help and he must be one of the greatest guys on earth. He sent volumnous letters of circuits and advice until I finally got that first contact. Don't know what I would have done without his help. But let's get back to where I left off in my last letter. That was where I had a basement full of unworkable TTY junk, a flat wallet and an XYL with much advice that had better not be repeated for the tender ears of your readers.

Just about that time an electronics surplus dealer friend told me he had recently got hold of some Model 14 typing reperforations with keyboard, complete with a very small, but efficient power supply that he would let me have for $25! We tested one in his store and it worked real fine. Together with the Model 14 T-D previously purchased I had a fairly good nucleus for the start of a RTTY station. Next I needed a receiver. Here I thought I better not look for any bargains. A visit to a New York store brought to light a well used, but in perfect condition, Collins 75A3, complete with mechanical filter and frequency marker. I paid for it and picked it up a week later in clean and almost like new condition.

Next job was to put up an antenna. This posed something of a problem. My house, a private home, two families with attic, has a sharply peaked roof. Makes it hard to mount an antenna. Besides which there is no access to the roof except by a 35 foot ladder which I don't have. So, instead, I hung a piece of solid copper, plastic coated, #12 lighting wire (the kind used in electrical conduits) from a telephone pole in a corner of my property, to the side of my house right over the rear basement window where I have the shack. The wire is about 35 feet long. Lead-in is another 20 feet long. The entire mess was hung as high as I could reach while standing on a six foot ladder, about 15 feet off the ground. Doesn't sound very efficient, but with that random length of wire I've picked up RTTY signals from much of Europe, the West coast, South America, Canada, Seattle, Washington, Texas and numerous locals. How well they print depends largely on THEIR antennas and station gear. I'm absolutely amazed that this antenna has done as well as it has. Most of the DX tuned in was on 20 meters. But even 80 does a good job. I've printed you, in Royal Oak, Mich, on 80 several times in a satisfactory manner. Tune in on the Virginia Radio-teletype Net almost every evening. Know most of the locals almost as if I had been working them already. Can't wait to actually QSO with the bunch.

But I'm getting ahead of myself. When the new (?) receiver finally got home I tried hooking it up with the CV89A converter but with no results. No matter how I tried, the trace on the CRT indicator refused to show a signal. Had almost given up on the CV89A when I saw a classified add in one of the ham magazines. Tom Perera, K2DCY was offering a used, but working W2JAV type of TU for sale at a very reasonable price. A letter to him brought both the TU and Tom to my shack one Saturday afternoon. He checked out the CV89A and found a piece of dirt had fallen into one of the tube socket pins effectively insulating it and preventing proper operation. Cleaning out the dirt made the thing work instantly and he tuned in United Press news bulletins and then weather reports from Miami, Florida. From then on, at least, I was in receiving condition. Bought some other gear he had for sale. Both out of gratitude and because the price was attractive. Got a good deal all around.

Next problem was to either build or buy a transmitter. My first thought was to build, but even after I had gathered all the necessary parts (what a job THAT was!!!) I simply couldn't find the time for it. Then, one fine day, I ran across a used Eico model 723 sixty watt CW job that was tested in the store. Bought it at a very attractive price. On advice of Al LaPlaca, W1GRE, of the ARRL technical staff, I reduced the plate voltage about one third, doubled the resistance of the grid resister and wound up with an xmtr with 38 watts input. All this with crystals.

Thought it would be nice to have a VFO to drive the Xmtr, so I ordered a Heath HG-10B which was easy to build and worked first crack out of the box. Unfortunately, I soon discovered that it was way too unstable for RTTY work. Even the Heath technical advisers told me it would not be suitable for RTTY.

Just about this time, Jim Cooper finally come through with the Model 19 TTY I had ordered four months before and he had done a wonderful job of reconditioning it. Jim delivered it himself from way out in the wilds of New Jersey and set it up in my basement shack until it worked to absolute perfection. At last I would no longer have to be knee deep in tape.

The last problem was to get all this gear to transmit. No matter how I tried, no matter what circuits I built out of the several RTTY handbooks. nothing wanted to work. In sheer desperation I wrote to Ron "RG" Guentzler, W8BBB and as I said earlier in this letter, he came through 100%. With his easy to understand advice, I was on the air with that first nervous contact within a week.

But most important of all is the irrefutable fact that I did make that first RTTY contact and the only way to go from here on in is up. I've tried a bunch of CQs but conditions on 80 of late have been very poor. Besides which my 38 watts input is not very good competition for the (mostly) higher power stations, nor the "thick-as-flys" CW crowd. I can see all this on my 5" CRT panadapter, probably better than hams who can hear OK, since the scope displays 200 Khz all at one time. The scope also reveals when conditions are noisy. The base line tends to flare up along its entire length in multitudinous spikes. So being able to hear may be of no matter in this mode of operation. For tuning, the 2" scope on the CV89A is beyond excellence. Here the display is two parallel lines rather than the usual crossed lines. The width between lines tells when the received signal is wide or narrow shift, and is a good indication of my own shift width.

So, as you said at the end of my letter (for which THANKS for publishing it) "where there is a will there is a way." Perhaps I should modify that by saying it may be more a matter of being stubborn rather than simply persevering. At least that is the unbiased opinion of my entire family!!!

Lastly, I want you to know that I get more pleasure and information out of reading the RTTY Journal than all the other ham magazines combined. More than anything else you, alone, have no chip on your shoulder, as do some of the other editors. They always seem to be taking up the cudgle against either the FCC , ARRL or each other. You not only have no bone to pick with anyone, but always seem to be offering a pat on the back to one ham or another for all kinds of varied reasons.

So, all I can say in closing is, trite as it my sound, please do KEEP UP THE GOOD WORK!

Vy best 73 and most cordially yours,
Mack W2ZPW

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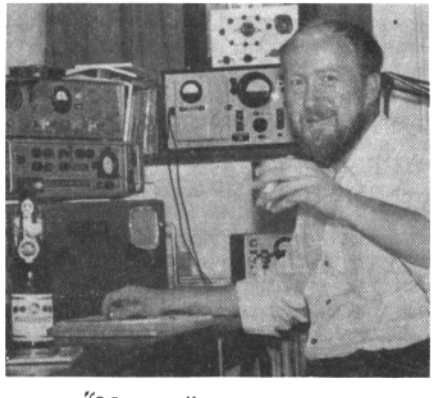


"Hans" DJ8BT

Hans was the leader of a group that put 4U1ITU on RTTY during the BARTG Contest. A new one for everybody that worked them

***

RTTY theory & applications-

RON 'RG' GUENTZLER, W8BBB
Route 1 Box 30
ADA OHIO, 45810

RTTY for Beginners- Part 8

Last month we described the fundamentals of the receiving process for FSK and AFSK signals.

When an AFSK signal is received, the receiver (AM or FM) is tuned to the signal and the tones being sent are heard in the loudspeaker. The frequency of the tones is not affected by tuning the receiver; tuning merely optimizes for minimum noise. When an FSK signal is received, the receiver is operated as it would be for a CW signal (or more accurately, as it would be for an SSB signal). When the receiver is tuned, the FSK signal appears as tones coming from the loudspeaker. The tuning of the receiver affects the frequency or pitch of the tones as well as the relative amount of interference and noise. Therefore, the receiver must be tuned so that the FSK signal has exactly the right pitch.

In either case (AFSK or FSK), the tones coming from the receiver audio output are applied to the input of a TU. The TU has the job of distinguishing the Mark and Space tones, and, ultimately, opening a loop when a Space is received and closing a loop when a Mark is received. The loop is connected to the selector magnets in a teleprinter.

A SIMPLE TU

We are going to describe a simple TU in order to show how a TU converts the audio tones into the opening and closing of a loop. We have selected the Twin City TU for two reasons: 1) It uses vacuum tubes and will therefore be understandable to the maximum number of readers, and 2) It contains all of the absolutely necessary circuitry, but at the same time is simple enough to be easily understandable.

When looking at the circuit diagram it will be noticed that no component values are given. We did this because we are trying to remain neutral in the area of which TU is the best for a particular application. Anyone interested in building the Twin City TU can find it in: THE NEW RTTY HANDBOOK, Byron H. Kretzman, W2JTP, Cowan Publishing Co., 1962.

The circuit can be divided into several separate and essentially independent portions as follows: 1) Input "amplifier" and isolation (T1, R1), 2) Limiter (C3, R2, V1, R3, R4), 3) Amplifier (C4, R5, R6, V2, R7), 4) Space and Mark filters (C5, R8, L1, C1, L2, C2), 5) Space voltage doubler rectifier (C6, CR3, CR4, C8), 6) Mark Voltage doubler rectifier (C7, CR5, CR6, C9), 7) DC amplifier (R9, R10, R11, V3, R12), and 8) Loop keyer (K1).

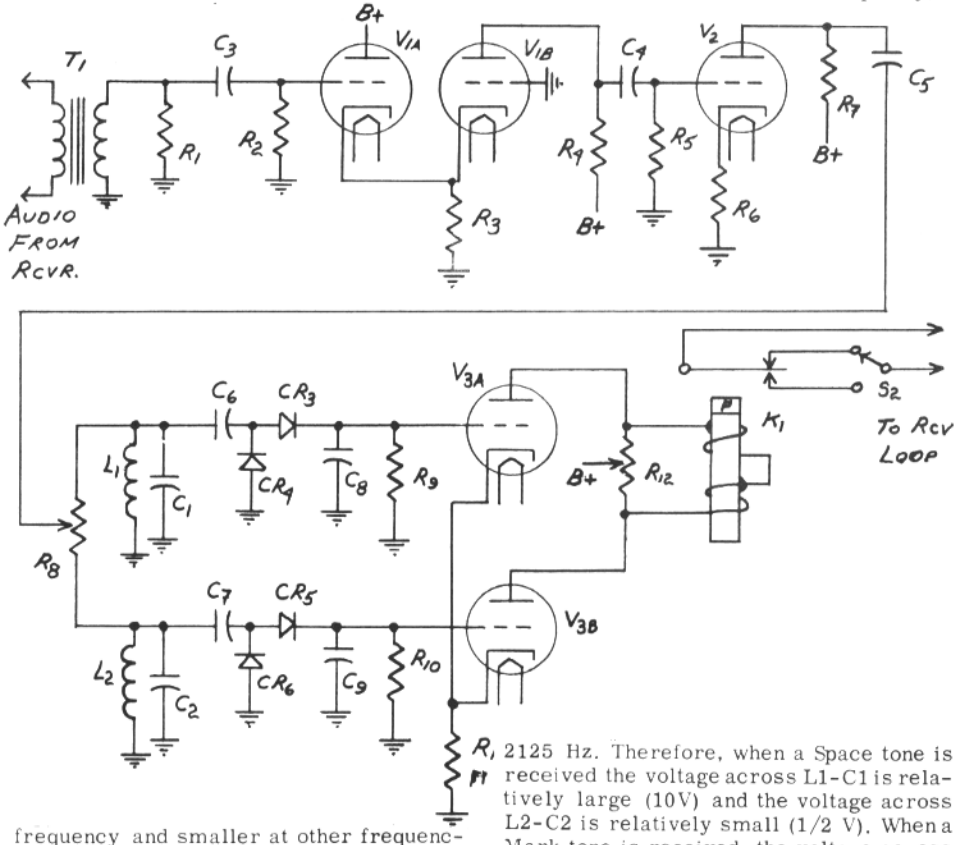
1) The input "Amplifier" and isolation is obtained by means of transformer T1. The AFSK signal obtained from the loudspeaker terminals of the receiver is relatively weak. By running it thru a transformer the signal voltage can be increased many times. Also, the input transformer provides isolation thus preventing possible introduction of noise due to "Ground loops".

2) The purpose of the limiter is to provide to the rest of the unit, especially the DC amplifiers, a signal relatively independent of the strength of the tones coming from the receiver.

3) The amplifier composed of V2 and its associated components is needed to increase the constant but relatively weak signal coming from the limiter to a magnitude large enough to insure that the DC amplifiers have adequate signal. The output from the amplifier V2 consists of the same audio tones that came from the receiver output; the processing of the signal to this point simply amplifies the tones to a constant level.

4) The signal from the amplifier is delivered to the Space and Mark filters thru R8. R8 serves the purposes of effectively isolating the filters from each other, and, because it is variable, permits compensation for differences within the two filters.

The Space filter composed of L1 and C1 is a simple parallel resonant circuit tuned to the Space frequency of 2975 Hz. At resonance it has a relatively high impedance, but off resonance the impedance is relatively low. If a constant-amplitude, variable-frequency signal is fed from V2 to the L1-C1 filter, the voltage across the filter will be a maximum at its resonant frequency and smaller at other frequencies. For example, when a 2975 Hz tone is fed from the plate of V2, the audio voltage across L1-C1 may be about 10 V, but when a 2125 Hz voltage of the same value is fed from the plate of V2 only about 1/2 volt will appear across L1-C1. This is similar to the action of any tuned circuit. The Mark filter composed of L2-C2 acts in exactly the same manner except its voltage is maximum when a 2125 Hz tone is present and quite small when a 2975 Hz tone is present.



Before continuing, we will summarize operation up to the filter outputs. The audio signals from the receiver are amplified, then limited, then amplified again. Therefore regardless of the frequency of the tone the voltage appearing at the plate of V2 is the same. The signal from the plate of V2 is split by means of R8 and is applied simultaneously to the two tuned circuits composed of L1-C1 and L2-C2. L1-C1 is tuned to the Space frequency, 2975 Hz, and L2-C2 is tuned to the Mark frequency, 2125 Hz. Therefore, when a Space tone is received the voltage across L1-C1 is relatively large (10V) and the voltage across L2-C2 is relatively small (1/2 V). When a Mark tone is received, the voltage across L1-C1 is relatively small (1/2V) and the voltage across L2-C2 is relatively large (10V). Because of dissimilarities within the circuit, the voltages may not be exactly as stated. This can be partially compensated by adjusting R8.

5) The Space voltage doubler rectifier circuit (C6, CR3, CR4, C8) converts the audio frequency voltage appearing across the Space filter into a positive DC voltage which is approximately proportional to the audio voltage appearing across the Space filter.

6) The Mark voltage doubler rectifier

rectifies the audio voltage appearing across the Mark filter and delivers a positive DC voltage approximately proportional to the audio voltage appearing across the Mark tuned circuit.

7) One portion of the DC amplifier (V3A) amplifies the positive DC voltage appearing from the Space voltage doubler rectifier and the other half (V3B) amplifies the DC voltage from the Mark voltage doubler rectifier. The common cathode resistor R11 serves the purpose of making one of the DC amplifiers discriminate against the other one. For example, when a Space tone is received, the voltage appearing on the grid of V3A may be about 20 volts and the voltage appearing on the grid of V3B may be only 1/2 volt. (These are voltages measured to ground). Because the grid on V3A is being driven rather hard, the plate current on V3A will increase significantly and this will increase the voltage across R11 making both cathodes more positive with respect to ground than they were with no signal. The Space tone resulted in about 1/2V appearing from the Mark circuit on the grid of the Mark triode (V3B). However, the cathode voltage on V3B has increased thereby cancelling the effect of the small Space voltage appearing on the Mark grid. When a Mark tone is received, the Mark triode V3B receives the larger voltage and it (V3b) discriminates against V3A. The net result is that the plate current in the triode receiving the signal will be about 10 mA and the plate current in the other triode will be about zero mA.

8) The combination of R12 and K1 translate the varying plate current from the two halves of V3 into loop opens and closures. K1 is a polarized (polar) relay such as the 255-A. When current flows thru the windings in one direction, the armature operates in one direction and when current flows thru the windings in the other direction the armature moves in the opposite direction. For example, when a Space tone is received, current flows from B thru the top half of the R12 into the plate of V3A and from B thru the bottom half of R12, up thru the relay windings, and into the plate of V3A. This operates the armature in one direction. When a Mark is received, the current flows from B+ down thru the bottom half of R12 and into the plate of V3B; it also flows from B+ up thru the tophalf of R12, down thru the windings of K1, and into the plate of V3A. Because the current is now flowing down thru K1, the armature moves in the opposite direction closing the opposite contact. The armature of K1 and only one contact are inserted into the local loop. Therefore, when the armature of K1 is operated in one direction the loop is closed, and when operated in the other direction the loop is open. By operating switch S1, either relay contact can be used to close the loop. This permits interchanging Mark and Space in case the signal being received is "upside-down".

SOLID STATE TUs

An inconsistency exists between last month's installment and this one. Last month we said that the diodes used to rectify the outputs from the tone filters were reversed in one of the circuits; thus a positive voltage was present when a Mark tone was received and a negative voltage was generated when a Space tone was received. In the circuit discussed this month, both tuned circuits fed diodes which were connected to give positive output voltages. Why the apparent discrepancy?

The answer goes something like this: It is desired to have the loop closed when a Mark is received and to have it open when a Space is received. When a polar relay operation is sensitive to the **direction** of the current thru its windings. Therefore, if a positive voltage (or current) is applied to one end of the coil, the relay will close its contacts. If a positive voltage (or current) is applied to the other end of the relay coil, it will open its contacts. In the circuit described this month (the Twin City TU), the positive voltage from the Mark circuit is applied (after amplification by V3A) to one end of the relay coil. The positive voltage from the Space circuit (after amplification thru V3B) is applied to the **other** end of the relay coil. Thus the Mark and Space signals are effectively subtracted within the polar relay. (Some subtraction occurs in the common cathode circuit of V3, but the bulk of it is done in the relay.)

If an NPN transistor is used to key the output loop, it requires a positive voltage to turn it on and a negative voltage to turn it off. Therefore, the signal applied to the base of the transistor must be alternating plus and minus. This can be accomplished by simply taking the dc outputs from the Mark and Space tuned circuits and subtracting them. The subtraction can most easily be accomplished by reversing the diodes connected to one of the tuned circuits, and then simply adding the dc signals. (Adding numbers of opposite sign is the same as subtracting two numbers of the same sign.)

Because silicon transistors will turn off with no bias, the Mark signal alone could be used to operate the loop keying transistor. However, the transistor operation is better if it is purposely turned off, and, especially if noise or fading are present, it is better to use the difference between Mark and Space to operate the output loop, rather than either one alone.

As a summary of the diode polarity situation, it can be said that when using a polar relay, it will do its own subtraction, but when using a transistor, the subtraction must be done before the transistor gets the signal.

For the reader interested in solid-state URs, two different ones are worthy of mention. Harry Legler, WOPB, presented the F2RU in QST, 1973 JAN, p.25ff. His circuit is amazingly simple (only one transistor). Because it was designed for use with FM receivers, the input limiters were eliminated. Voltage transformation (amplification) to drive the filter circuits is accomplished within the filter circuits themselves by winding 5-turn primaries on standard 88 mH toroids (this also eliminates the need for an isolating input transformer!).
The outputs from the tuned circuits are bridge rectified (notice that the bridges are oppositely-poled to give the subtracting action) and then the difference signal is supplied to the loop transistor.

The other TU is Irv Hoff's (W6FFC) ST-3 which appeared in RTTY Journal 1968 SEP, pp.5-11. It is quite similar to the Twin City described here, but it is all solid-state, and it does include some refinements. For our purpose here, it also has the diodes oppositely poled to give a polar signal to the loop keyer. In addition, it contains a Schmitt trigger ("Slicer") to present the loop keying stage with a definite on-off signal. (The desirability of a trigger of "slicer" will be discussed next month.)

SUMMARY

We have just described the operation of a simple TU. The performance of this unit is comparable to any of the more complex units (and much better than some of the all transistor units) When a good signal is presented (proper tone frequencies, no noise, no interference, and no fading). However, when conditions are other than ideal, it suffers from various problems. Next month we will describe some of the problems and possible ways to overcome them. ***

RESULTS -

S.A.R.T.G. Contest

Class A & B, Single Opr:
(A equals up to 100W, B equals over 100W)

Nr.	Call	Final Score	
1	I5KG	171.450	B
2	WA3IKK	166.320	B
3	K2PAR	164.430	B
4	OZ4FF	150.780	B
5	I1BAY	135.720	B
6	I5MPK	129.745	B
7	KZ5LF	121.680	B
8	I6NO	112.420	B
9	W4CQI	108.675	B
10	VP2KH	107.800	B
11	WA2YVK	105.485	B
12	KH6AG	97.600	B
13	OH2BW	95.480	B
14	K5ARH	91.975	B
15	LU2ESB	86.390	B
16	I5CW	82.655	B
17	W5EUN	82.500	B
18	SM6AEN	76.570	B
19	SM5BTG	74.790	B
20	VE7UBC	73.700	B
21	SK4RY	71.960	B
22	XE1YJ	71.040	B
23	I4AOV	70.760	A
24	OE9ERI	66.825	B
25	OK20P	57.120	B
26	K6YUI	53.075	B
27	PAØSCH	53.000	B
28	DK3MG	52.430	B
29	K6WZ	48.500	B
30	WAØTAS	47.300	B

31	PAØGKO	44.100	A	51	K6TV	9.450	B
32	HB9AVK	39.715	B	52	W7CBY	8.295	B
33	XE1LL	39.400	A	53	PY2CYK	7.505	B
34	JA1BLV	32.980	B	54	SM7BGE	6.600	A
35	SL5AR	30.895	A	55	VE4SC	5.865	B
36	W3KV	30.400	B	56	OZ8GA	5.175	B
37	OH2BJ	29.260	B	57	PAØWDW	4.680	A
38	HB9HK	28.980	B	58	SM4CMG	4.505	B
39	W9OEQ	27.040	B	59	K1SGU	4.165	B
40	K6ZDL	26.910	A	60	DK2XV	3.900	B
				61	W6AEE	3.280	B
41	CE3EX	22.200	B	62	I8AMP	2.860	B
42	SM6EZD	21.460	B	63	K8KAG	2.700	B
43	VO1EE	20.460	A	64	UA9PP	2.640	B
44	W8CQ	16.675	B	65	JA1DI	2.535	B
45	PAØGIN	16.350	A	66	OZ4SO	1.960	B
46	K5QBU	13.635	B	67	SMØOY	1.870	A
47	VE3IR	13.350	A	68	DK1AQ	1.550	B
48	I8SAT	11.625	A	69	SMØACY	450	A
49	G3RDG	10.875	A	70	DJ8BT	180	A
50	I2KD	9.775	A	71	OZ3VJ	15	A

Class C, Multi Opr:

1	DL8VX	132.325
2	HG5A	119.460
3	OZ7RD	95.370
4	DLØTD	40.500
5	SM4BKD	27.650
6	OZ4EDR	22.755
7	YU2CAL	15.375

***

RTTY-DX

JOHN POSSEHL - W3KV
Box 73 Blue Bell, Pa., 19422

Hello there . . .

I would suppose that anyone even a bit superstitious had a good supply of Hex signs, Voodoo charms, Alchemist potions, or just plain barbed wire encircling the ham shack to ward off that gremlin Murphy during the "Lucky 13th" RTTY DX Contest. At the stroke of 0200 GMT, 13th of October it started off with a crescendo of signals on 14 mhz with the din hopping from band to band as propagation dictated for the next forty-eight hours. As always activity was at a very high level and the published scores will reflect that in the near future. All continents were represented and band conditions were something of a mixed bag. In some areas Ten meters was wide open with little or no activity to be found. Fifteen was open during most of the daylight hours. Twenty was pretty much the same and Forty and Eighty took over during the hours of darkness. Here we found Oceania contacts, particularly VK/ZL hard to come by while the west coast USA found Europe and Africa hard to penetrate, and so it went.

The highlight of the Contest was of course the operation by Hans, DJ8BT and his group from 4U1ITU. They were set-up and making contacts for several hours before the Contest and during the test they were active on all bands with good signals. WAC was accomplished and there cannot be many in the Contest that did not contact this new country. Hans repeats that all QSL's must go via his QTH as listed in the October column. We notice a printing omission occurred and the correct name and call is "Hans-Jurgen Schalk, DJ8BT", the rest of the QTH is correct.

Gin, JA1ACB, tells us that JD1ACX and JD1AGZ were active from Marcus during the Contest. They called stations in practically all US and Canadian districts as well as many other countries with negative results. Henri, LU2ESB, is the only station we know of that made contact with both calls. The boys on Marcus had some problems with the power line frequency and their speed was somewhere between 45 and 50 baud.

100 DX Confirmed on RTTY

Nr. 1	ON4BX	125 Confirmed
Nr. 2	W3KV	124 Confirmed
Nr. 4	ON4CK	116 Confirmed
Nr. 3	I1KG	100 Confirmed
Nr. 5	W5QCH	100 Confirmed
Nr. 6	W8CQ	100 Confirmed
Nr. 7	WA3IKK	100 Confirmed
Nr. 8	DK3CU	100 Confirmed
Nr. 9	W5EUN	100 Confirmed

DX HONOR ROLL

1	FG7XT	128/117	18	KL7GRF	74/66
2	W4YG	107/98	19	W4CQI	76/64
3	W2LFL	103/97	20	I1WT	71/64
4	G6JF	109/96	21	K8QLO	70/64
5	ZS3B	103/94	22	W8JIN	71/62
6	K8YEK	98/94	23	OK1MP	68/62
7	W3DJZ	98/88	24	LU2ESB	83/59
8	K6WZ	85/77	25	ZL2ALW	63/58
9	I1ROL	83/76	26	K4VDM	62/58
10	W4EGY	82/74	27	WAØTLT	66/56
11	W1GKJ	82/74	28	K6YUI	64/55
12	DJ8BT	78/73	29	SMØOY	59/53
13	WA6WGL	73/70	30	SM5BO	60/52
14	WA2YVK	78/68	31	WØHAH	62/51
15	F9RC	76/68	32	CE3EX	60/51
16	DL8VX	75/68	33	W2PLQ	56/50
17	CR6CA	67/67			

DX Worked listing.

1	XE1YJ	58/49	14	HB9AKA	48/36
2	K3SWZ	50/48	15	F5JA	52/33
3	EI5BH	53/45	16	ON5CZ	60/31
4	ZS6BBL	53/45	17	WB6QFE	37/31
5	W5TZB	51/44	18	YA1OS	54/30
6	HB9HK	56/42	19	HB9ACQ	40/29
7	WØMT	51/41	20	W2IDX	50/28
8	W9BT	45/41	21	DJØRR	49/28
9	I5CLC	61/40	22	DLØAK	49/28
10	EA7PZ	55/40	23	PY6HL	33/23
11	K2CY	46/40	24	PAØWDW	39/20
12	KH6AG	53/39	25	SK4RY	39/18
13	9Y4VU	45/39	26	W4ZLH	24/12

We will plan to run the next listing in the April 1974 issue. Please have updated totals to me by 1 March 1974.

***

They would be no problem to copy however with a slight adjustment of the range finder.

Some of the other more exotic calls or prefixes QRV during the Contest came from 5T5, KG4, GM3, KJ6, FO8, FG7, 9Y4, YJ8, CE3, to recall a few.

A quick glance at the RTTY-DX Honor Roll this month and you will see that there are several stations just about to make DXCC-RTTY. This month we are pleased to present two of the boys that did make it for the 100 DXCC-RTTY Award.

Nr. 8 Dieter Ulrich, DK3CU
100 Confirmed

Anyone at all active in RTTY knows Uli, He has been one of the most consistant stations on the bands for the past several years and a great booster for 15 meter activity. If 15 is open you can be sure to find Uli. He also has a great interest in getting RTTY activity started in countries not previously heard in the mode, particularly in Eastern Europe where lack of machines is the big problem. It was through Uli's efforts that Gene, YO2AFB was able to get going on RTTY. We understand that Uli is presently trying to promote activity in SP and LZ land. The Customs problems are tremendous but we are confident that Uli will prevail.

Nr. 9 Mark Thompson, W5EUN
100 Confirmed

Mark is one of the most active state-side stations and has been on RTTY for quite a while, on and off. However, instead of listening to my harsh New York, cum lately Pennsylvania accent we will let Mark tell it in his soft Texas Drawl. De W5EUN - "I began on RTTY June 14, 1961 and continued intermittantly active until April 5, 1963. During that period I had confirmed 7 countries, including KM6BU and KR6MF. After being off the air entirely for 7 years I again began assembling a RTTY station in April 1970. The station at that time consisted of a very old Hallicrafters SX-28A general coverage receiver and a 150 watt Heathkit Apache transmitter, with a Model 15 printer and a 20 meter dipole strung in the attic of the house (17 feet high). My first few contacts with the newly organized RTTY station included Eric, VK3KF, who I had worked originally in 1961! My second and third new DX contacts were Uli, DK3CU, and Arthur, ON4BX. In October 1970, with 25 countries confirmed, I finally got around to putting up a better antenna, a 40 foot vertical for all bands. At that time I also replaced the SX-28A with a Drake 2B. The Model 15 was replaced by a 28 KSR in May 1971. By October 1971 I had 51 countries confirmed and had the DX bug so I put up a tri-band beam. Finally with the band conditions deteriorating and the DX bug biting harded, at 84 confirmed, I built a home brew linear." SK.

The ranks of WAC Award recipients was substantially increased in the final weeks of 1973 and we congratulate the following stations upon receiving the certificate. Most of those listed below were obtained thru the efforts of Bo, SM4CMG, Contest and Awards Manager for the SARTG and were certified from logs submitted in the August SARTG Contest.

Nr. 212	Gosta Nathell	SM7CLZ
Nr. 213	Pierre Pollidoro	F2PY
Nr. 214	Hans Diederich	DK2XV
Nr. 215	Mario Lucci	I5CW
Nr. 216	Keitaro Sekine	JA1BLV

In early October that call EIØWPO you may have printed was located at the site of the 20th World Plowing Contest. The station was set up by the Amateur Radio Society of Ireland, and Paul, EI5BH was at the keyboard at the time we made contact. A special QSL and certificate is available to anyone that made contact twice, in any mode, during the week the special station was in operation. QSL via the EI bureau.

A few new stations have been active during the past month bringing renewed activity to some areas that have been dormant for several months. From Surinam, PZIDJ, has been quite active with good signals. QSL's can go to. . .

Jeff Stuart
P.O. Box 7
Paramaribo, Surinam

From Martinique Frantz, FM7AA, has been putting a terrific signal into North America in the early evening hours, and this with only 40 watts. QSL to. . .

Frantz Louis
Quartier Jenne D'Arc
Lementin, Martinique

In Burmuda VP9CB has been reported active with some shift problems which should be cleared up by this time. . .

CFS Amateur R.C.
Daniels Head, Mongrove Bay
Somerset Island, Burmuda

During the Contest one of the really active stations on all bands was KG4AA. You can send yours to. . .

KG4AA
Box 35F USNAS
FPO, Norfolk, Va. 23593

In another Contest and on another

CONTINUED ON PAGE 19

This issue completes 7 years of our publishing the RTTY JOURNAL. Counting the 14 years it was published under the name of RTTY by Merril Swan, W6AEE, the magazine has reached the mature age of almost 22 years. This may not be a record for a specialty magazine in the amateur field but at least we are no longer a kid.

As we have stated many times in the past, it has been the loyalty and contributions of our readers that has made this possible. Hams are ever willing to help each other but the RTTY group have been especially so or the magazine would have perished long ago.

We particularily appreciate the fine job done by our two regular columists, Ron Guentzler with his VHF column and "RTTY for Beginners" series and John Possehl, W3KV, for his DX column and handling of various awards. Ron's "RTTY for Beginners"series has been chosen by a Mars unit as the best available information on RTTY for new operators and we understand will be published as a small handbook. Over the years most of the popular pieces of RTTY equipment has appeared first in the RTTY Journal and RTTY. Many of the recent items include the TT/L and the ST-3, 5, and 6 series of demodulators. The AK AFSK unit and many others, The Selcal and several modifications, several lists of commercial frequencies and a large number of modifications of popular exciters for RTTY use. The awarding of a plaque for DXCC on RTTY (which the ARRL refuses to do) and information on contests and results is of interest to a certain group.

Something for everybody has been our goal, not always possible in each issue, but our readers contributions have done a good job for 21 years and we hope they continue in the future. Thanks to everyone.....

***

Speaking of articles-right now we are looking at almost the bottom of the barrel. Occasionally we have a few back log articles we are saving for a future date, usually because they are similar to a recent published article. We particularly like shorter ones, something that fills up a half page or so to fill in those left over spaces. Information on putting any of the current exciters on RTTY are always of interest. Hints & Kinks, converting from wide to narrow shift, all of these things may be old stuff to you but "just the thing" many others are looking for....Just one request--if possible--please use a regular typewriter, the all caps of a TTY machine make it necessary for us to retype it, and we are a two finger typist.

***

As we mentioned last month the Dayton Hamvention has been extended from one day to two and a half days. Friday, April 26th at noon to Sunday, April 28th, probably 3 PM.

The RTTY JOURNAL will have a hospitality suite, same as last year, at the Imperial North Motel. If you plan, or hope, to attend we suggest a room reservation be made as soon as possible. Last year all rooms were spoken for a month ahead. There are a number of other good motels close by but many of the RTTY group like to stay together and in this case the early bird gets the Imperial North rooms. Address is "Imperial House North" -- 2401 Needmore Rd., Dayton, Ohio.

***

We stand corrected -- A note from K6KA reminds us that a revised rule by the FCC requires speed for CW identification to not EXCEED 20 words per minute. The article on RTTY identification we ran was taken from a Journal of several years ago and we are glad to have the information to bring it up to date. Also remember the shift must be adequate for easy readability, we have heard some that sounded like an unstable continuous tone.

***

Harry March, WB4HZD, 200 Fox Drive, Winchester, VA. 22601 has had a lot of experience on Mite machines and is always willing to answer questions and help fellow hams.

***

"TRUE TRANSCEIVE" FSK operation with the SB102 (and other SSB rigs)

KEN RIDOUT, WB5FHF
1521 Cranford
GARLAND, TX. 75401

The main problem in using FSK with a sideband transceiver is that you cannot vary the transmitting frequency without also varying the receiving frequency. Whenever you re-tune the transceiver to obtain proper mark and space tones for reception, you are also moving the transmitting frequency. The station that you are in QSO with has to retune his rig in order to receive your transmission. This has been called "Leap-Frogging".

The solution to this problem is to vary the transceivers output frequency while leaving the receiver portion stationary. A person can use one of the AFSK units and do slight modification to his rig to allow these standard tones to pass. There is a simpler way to do this without any modifications to the rig.

My rig is the Heathkit "SB102". The LMO(VFO) of this rig has one terminal on it, that, when grounded gives a shift of approximately 1000 Hz. The amount of the shift may be varied by adding resistance between terminal and ground. I use a mercury wetted relay to key this connection. The coil of the relay is connected to the common and normally open contacts of the keyboard, and voltage is supplied by a six volt battery.

Now all you need is a carrier to shift. To get this carrier I use a small audio generator (model TS 382). Connect the audio generator output through a small matching transformer to the mic jack of the transceiver. By varying the audio input frequency, the transceiver's output carrier frequency is varied.

By using another receiver, you can tune in a station on it and the transceiver, key the transceiver in upper side band into a dummy load, and adjust the frequency of the audio generator until your rig matches the other stations mark tone.

After initial adjustment of the audio oscillator, whenever you tune in a FSK signal with the transceiver, your transmitted signal will match the other stations frequency. The result is true transceive operation.

To transmit, I move the function switch from P.T.T. to Vox. Then the audio tone keys the rig.

To get FSK operation, key the SB-102 L.M.O. as described. With other transceivers, you can use one of the applicable VFO keying circuits.

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BACK ISSUES

New subscriptions and classified ads are cash in advance as we have no method for billing. New subscriptions will be started with the current issue and one back issue, if requested. Please do not ask us to start any further back than this. Back issues - if available - may be ordered at 30¢ each at time of subscription. The JOURNAL is mailed about the 20th of the month preceding the dated month. May and June are a combined issue and July-August is a combined issue.

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1973-Jan.-Feb.-Mar.-Apr.-May - July,-Sept.-Oct.-Nov.-[9]

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RTTY JOURNAL
Box 837
Royal Oak, Mich. 48068
Editor & Publisher 'Dusty' Dunn, W8CQ

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MORE RTTY! ONLY HAM RADIO MAGAZINE consistently brings you more RTTY articles and better RTTY articles than any other general amateur magazine. You need RTTY Journal, but you need HAM RADIO also. $7.00 per year, $14.00 for 3 years. Ham Radio, Greenville, NH 03048.

TELETYPE, KLEINSCHMIDT, MITE, gears, ribbons, supplies, parts, manuals, tuning forks, motors; tape $9.00 per case. Mite 66 wpm printer set, ditto. SASE for list Typetronics, Box 8873, Ft Lauderdale, Fl. 33310. W4NYF. Wanted- Northern Radio 107 teleprinter parts.

BACK ISSUES OF RTTY JOURNAL - I have a complete file of all issues from Vol. 1 No. 1 to date. Will reproduce any issue for $1.10 pp. Add 25¢ for air mail delivery. John Isaacs, 3175 Val Verde Ave., Long Beace, CA. 90808.

NEWS-NEWS-NEWS - Amateur Radio's Newspaper, "Worldradio", Trial subscription - Two issues for one dollar. "Worldradio". 2509-F Donner Way, Sacramento, Calif. 95818.

RTTY FREQUENCY STANDARDS --- Three brand new Tuning Forks, better than 0,0005 accuracy, especially designed for complete adjustment of TU filters and/or AFSK oscillators at 2125, 2295 and 2975 --- available separately at $7.40 each or set of three $19.90 postpaid. Henry Frankel, Box 535, Bellmore, NY 11711.

"RTTY SPEED CONVERTER" A drilled, fiberglass 4" x 6 1/2" printed circuit board now available for the WA6JYJ speed converter in the DEC 71 issue of HAM RADIO. $6.00 postpaid. Complete parts kit including PCB, $40.00, postpaid. P & M Electronics, 519 South Austin, Seattle, WA 98108.

SWAP: Excellent #28 ASR with gear shift, other goodies, for restorable Model A Ford Roadster body with doors. Don't care if the chassis & engine are shot but body must be in fair shape. I have several receivers, demods, other ham, RTTY goodies to trade if you know of a decent '30-'31 around. G. White, Box 3067, Alexandria, Va., 22302 703-683-4019.

WANTED: Model 33 & 35 equipment. Complete or partial units, any quantity. Will pay shipping. Terminal Systems, Inc., 11300 Hartland St., North Hollywood, CA 91605 (213) 769-6772.

RTTY-VIDEO DISPLAY UNIT. 1,000 characters, Plugs into loop or logic circuits. ASCII or BAUDOT available. Works with any TV set. Leland Associates, 18704 Glastonbury Rd., Detroit, Michigan, 48219

WANTED URGENTLY. I will pay top dollar for your LPR50ARE or LPRI0ARE twin shaft typing reperf in good working condition. Also need entire base mounting for dome mounted Aux. Reperf in 28ASR. John E. FAIL, Box 1196, Petersburg, Alaska 99833.

ST-5A Boards only $5.25. Parts kit $54.00 (includes boards) Mod. kit for up-dating ST-5 to an ST-5A, $9.00. ST-6 boards only $18.00 (8 original by Irv Hoff W6FFC). Pemco 50A frequency counter semi-kit $125.00, Pemco SC250 frequency pre-scaler kit, $30.00. ST-5A, AK-1, ST-6 boards are 12 pin plug-in. All boards etc. shipped postage paid. All boards G-10FR4 glass epoxy and plated, all boards are drilled. Please write for details. Pemco, 422 18th St N.E. Salem, Oregon, 97301.

100KHZ CRYSTALS. octal base. $2.50 postpaid. Limited supply. Nat Stinnette Electronics, Tavares, FL 32778

WANTED - 33ASR, B. A. THUNMAN, W8ISG, 71 McCollum Street, Galesburg, Michigan 49053. Phone 616 665-7071 or 731-5164.

WANTED: HIGHEST PRICES PAID for M32 KSR printers and parts in ANY quantity - Prefer within 150 miles - Lee Brody, NY-NJ Phone - TTY for the Deaf, 14-25 Plaza Rd. Fair Lawn, N.J., 07410

TYPEWRITER RIBBON RE-INKER; Hand operated model now only $3.50. K575 or K764 ink available at all National Cash Register Stores. 75¢ per tube. Walter Nettles, W7ARS, 8355 Tanque Verde Rd., Tucson, AR 85715.

KLEINSCHMIDT TT-4A/TG printer, keyboard, used, good, $60.00 with 60-100 gears. Freight $20. east of Miss. $10. west of Miss. Also have ASR, KSR typing punches. Mark/Space Systems Co. 3563 Conquista, Long Beach, CA. 90808. (213) 429-5821.

BAUDOT LOOP TO ASCII CONVERTER connects right into your loop and delivers 8-level or 6-level ASCII for electronic readouts or ASCII-coded c.r.t. display systems. Loop interface features bridge rectifier and opto-isolator: connects anywhere in your loop trouble-free. Internal latch recognizes LTRS and FIGS codes for correct translation of all RTTY symbols; unshift on space available with one jumper wire on p.c. board. Wired and tested, complete except for 5 volt power supply and one potentiometer, on one 4X6 inch circuit board: $120. Petit Logic Systems, P.O. Box 51, Oak Harbor, Wa. 98277.

TTY Distortion analyzer, Stelma TDA-2, needs work, $30. Rack mounted 48 VDC power supplies, 5 ea, model CA1502/2, $10 ea All items postpaid. Also M28 cabinets and bases, M15 parts, and M14/15 manuals, info on request. Bering Sea Communications, Box 32, Nome, Alaska 99762.

R390A-ULTIMATE RECEIVER FOR RTTY-mint condition - $850.00.M28 ASR (3 speed) with dome reperf (3 speed). Professional condition - $1,200.00 - Phone evenings - 201 - 796-5414. Will deliver within NYC area.

HAL COMMUNICATIONS CORP.: HEADQUARTERS for MAINLINE Solid State RTTY Equipment. In demodulators, choose from the incomparable ST-6 or, for a low cost beginning in RTTY, the ST-5. Tailor either to your requirements by selecting the 425 Hz press discriminator, the AK-1 AFSK oscillaror, and tabe or rack mount cabinets for the ST-6, or the AK-1 AFSK and the ST-5/AS autostart for the ST-5. Full details available in our current catalog. Charge your purchase to your BankAmericard or Mastercharge account. Everything is going up, but our prices haven't changed in 2 years, so act now. HAL Communications Corp., Box 365RJ, Urbana, Il. 61801. Phone 217-359-7373.

WANTED: M28 reperf (ROTR) and M28 TD. Both should be complete with covers and in working order. Mint condition preferred. Submit best price to Herb W6GQC, 1057 Moana Drive, San Diego, Ca. 92107. Phone 714-224-8065.

FOR SALE: MITE EQUIPMENT, TECHNICAL MANUALS. TM-03315-15, $9.95. Navships 0967-170-8010, $12.50. Navships 0967-066-1020, Simplified Preventive Maintenance Procedures for TT-298s and TT-299s, $4.50. Shipped postpaid, No CODS. Allow 3 to 4 weeks for delivery. Harry F. March, 200 Fox Drive, Winchester, VA. 22601.

HAL COMMUNICATIONS CORP. is the place to order the ST-6, ST-5, ST-5A, AK-1 and the ST-6 425 Hz discriminator if you want to receive a complete kit containing all parts and a complete manual now available for $4.00 ppd. BankAmericard and Master Charge accepted. HAL Communications Corp., Box 365RJ, Urbana, Ill. 61801. Phone 217-359-7373.

CLASSIFIED ADS-

FOR SALE ST-3 and ST-5 terminal units. Write for prices and details. Want mint Drake 2NT, DX-60, Ranger II, HQ-180, GPR-70, 5IJ3-4, K9POU, 607 Pine St., Batavia, Ill. 60510.

RTTY PICTURE TAPES, Chad type, fully guaranteed, stamp for list. (many new ones from Europe just in) Joe Dickens, 601 S. Dodson, Urbana, IL. 61801.

WANTED: MODEL 28 Typing unit, with roller feed, for spare parts. Stunt box not needed. Have sprocket feed printer to convert. All letters answered. KZ5PW, Box 2821, Balboa, Canal Zone.

FOR SALE: Hal ST-6 RTTY Converter recently built in mint condition and working. Price firm Cashier check or M.O. $225.00. Will Ship. James Young, 62 Hetcheltown Rd., Scotia, NY 12302.

OA-5 SOLID-STATE TERMINAL UNITS for sale. All of the function of ST-6 but on one circuit board. Board with parts list and layout, $15.00. Kit of parts, less cabinet, but including circuit board, $100.00. Circuit board aligned and tested, ready for your cabinet, $160.00. Complete unit, ready to put on air, $210.00. Ken Simpson, WA8ETX, 3700 Mountview, Alliance, Ohio 44601.

PL-172 $80; 4-1000 $40; 4-400As $30; 4-125As $25; 4-125As $20; Hammarlund SP-600 $200; RCA rcvr SRR-13A $100; 32S1/516F2 $375; Homebrew amplifier 4-400As variac supply $200; Boehme-5C TTY receiving converter, variable shift, scope $50. Vacuum variables; VACAP 42-400Pf $30; EIMAC 20-60Pf $20; JENNINGS 10-30Pf $10; G.L. HALE KØPIV, 6334 Edward St., Norfolk VA 23513. 804/857-1507.

NEW TELETYPE RIBBONS, 12 to box, heavy red ink. ONLY $5.00 postpaid USA. A. Clark W4IYT, 41 Lanape Dr., Miami Springs, FL 33166 (305) 888-3874.

MODEL 28 KSR WITH MANUALS, very good condition, floor model $259.00. URA-8/CV-89 converter with manual excellent condition $100.00. Model 14TD-60 WPM gears, good condition $25.00. Kliendschmidt TT-122 TD, 100 WPM very good condition $30.00. Teletype distortion analyzer $40.00. Mite KSR, very good $150.00. Avcom 1W.F.M. xmitr never used $40.00. 4430 Fitz, Bremerton, WA. Available at following Jan. 1st, WA4BZP, Tom French, Rte. 2, Glenwood, GA.

11/16 PERF. TAPE, 3.00 box of 10, 8.00 per case of 40 rolls FOB. New nylon ribbons @ 6 for 3.50, 12 for 5.50 PPD. Model 14 typing reperfs w/KBD, running but sold as is - 10.00 FOB. P. Davis, 1830 Toepfer Rd., Akron, Ohio 44312.

HAL COMMUNICATIONS CORP. can provide you with the proven video display system, the RVD-1002. When coupled with the RKB-1 keyboard, you will have the ultimate in noiseless, reliable reception and transmission of Baudot coded TTY. The RVD-1002 receives TTY pulses from the HAL ST-6 or any other demodulator, and generates a 1000 character display. Copies at all four standard speeds with selectable unshift on space. The RKP-1 features a high quality commercial keyboard, reliable solid state circuitry, and a rugged, attractive cabinet. Our prices haven't changed for 2 years, so act now. BankAmericard and Mastercharge now accepted. HAL Communications Corp., Box 365RJ, Urbana, Il. 61801. Phone 217-359-7373.

WANTED: 604D Altec-Lansing 15" HiFi Speaker. State condition and Price. Elmer F. Rowekamp, 209 Carriage Lane, Upper St. Clair, Pennsylvania 15241.

CHICAGO AREA RTTY OPERATORS; Expert repair work performed at reasonable prices. Cleaning and lubrication; printers $10.00, keyboards $5.00, reperfs $7.00. Repair work $15.00 plus parts, any Teletype apparatus. Rebuilding by estimate. Phone 312-392-2358, ask for Neil.

CIRCUIT BOARD SET for "Low Cost Rtty Counter' Oct 73 Journal. Includes two counter modules, FET front end, 60 hz time base, and a bonus scaler board. Scaler will operate to at least 220 mhz. Boards are G-10 epoxy, plated, undrilled, with full size photos showing each assembly. Necessary info included. Set $10 postpaid in US., add $8 for Universal Frequency Standard Board. Bert Kelley, 2307 S. Clark Ave., Tampa, Florida 33609.

FOR SALE: MITE TELEPRINTER MODEL tt-532/UG, 60-67-100 WPM gears, spare motor and plug in circuit board and all plugs, also instruction book. Wired and relay added for auto start. $250. FOB Los Angeles, W6BRD.

U.S. GOVERNMENT SURPLUS Typewriters, Jeeps, Walkie Talkies, Rifles, Binoculars, Hand Guns, Boats. Official Guide tells you how and where to buy. $2.00 H. Morgan, 883 Diana, Akron, Ohio 44307.

KLEINSCHMIDT MODEL 311 RO electronic data printers. Late model dual hammer version set up for 150/300 baud but easily modified to any speeds, with instructions included. $95.00 FOB. Some M311 parts available, write your needs. F.K. McGinnis, 4304 McFarlin Blvd. Dallas, TX 75205.

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DX - Cont. -

CONTINUED FROM PAGE 15

mode we had a brief exchange of numbers with CT2AK who has a machine in the shack but gearing problems at the moment. We hope to have further info from John and will keep you advised on the progress.

Look for a new station to be active from Hong Kong soon. Drake, VS6EK is soon to be QRV with help from Ian, VS6GA.

SARTG President, OZ4FF, is still pushing to get OX, OY, and TF on the air so watch the printed page closely. Arthur, ON4BX, also reports that OX3-WH has been active again on 14 mhz.

If you look on page 82 of October QST you can see Paul, DU1PT, giving the local boys a few pointers on the mysteries of RTTY.

I presume that many of you pushed the "OFF" button at the end of the CARTG Contest and haven't been near the machine since. If such is the case everything will come to life again if you press the "ON" button on December 1 at 2000 GMT. The occasion is the A. Volta RTTY DX Contest. See the rules on other pages and have fun!

This being the last issue for 1973 we would like to take the opportunity to thank all of you boys for the support given to RTTY-DX during the past year. Your contributions of band activity, no matter how small, are very much appreciated and are really what makes this column a continuing thing. Best Wishes to all for a Happy Holiday Season.

73 de John

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