Optical Couplers cont.-

Continued from page 13

input very rugged as well. In series with a telephone, hung up so that the bell and its capcitor are in the circuit, a ringing signal causes conduction in the forward direction, and breaks down the diode Zennor-fashion in the reverse direction. The MOC1000 does not complain - it happily puts out bursts of conduction on the secondary whenever the phone rings. Thus I would not worry about loop current reverse transients on the device.

Since the input side conducts quite well at something around 5MA, a bias will result when driven in the teletype loop with sloping waveform. The solution is simple-shunt part of the loop current around the input. For a 20MA loop, the first 10MA should go around the device, and for a 60MA loop the first 30MA should go around. Since the input diode has had a threshold of 1.2 volts (like a 1.2 V.R. tube or like a silicon diode with higher than normal threshold), 120 ohms across the input will bypass the first 10MA, the 40 ohms will bypass the first 30MA. The rest of the current will go thru the device, since the voltage will not rise above 1.2 volts. I suggest 150 ohms and 47 ohms for 20MA and 60MA loops respectively. See figure 2.

This bypass resistor has the added advantage that it drains reverse current transients, making the device nearly indestructable.

Pin 6, the base of the output transistor, is not connected to anything. Pin 3 has no internal connection.

***

CONTEST RESULT

TEN HIGH SCORES

WAEDC DX		BARTG DX	
I1BAY	26535	I1BAY	156250
IT9ZWS	25346	I5MPK	147254
LU2ESB	19488	IT9ZWS	134028
DL2AK	15232	G3OZF	126390
PY6FI	14782	KH6AG	90200
W2LFL	9996	VP2KH	80700
(N.A. Winner)		DL1VR	74928
ZL2ALW	8430	HG5A	65592
SM2EKM	8128	K6WZ	62640
K6WZ	7659	I1PXC	56848
I1PXC	7560		

***

*****

Address Correction Requested
RTTY JOURNAL
P O Box 837
Royal Oak, Mich. 48068

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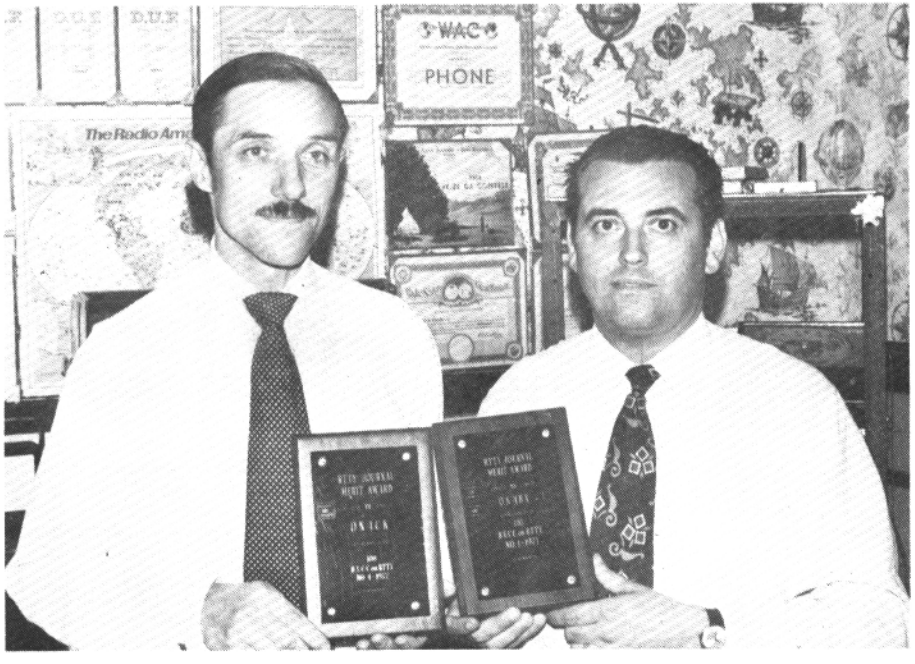
RTTY JOURNAL

September 1973

EXCLUSIVELY AMATEUR RADIO TELETYPE

VOLUME 21 No 7 30 Cents



-Belgium may not have the largest number of RTTY stations but they rate first and second on the DXCC List

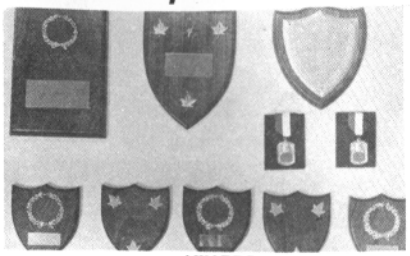
Above (left) is 'Bob' ON4CK with 116 and 'Arthur ' ON4BX with 123 confirmed, holding their RTTY JOURNAL Plaques.

CONTENTS

'Lucky' 13' CARTG DX Sweepstakes ---

The "LUCKY 13th" RTTY DX World Wide Sweepstakes sponsored again by the Canadian Amateur Radio Teleprinter Group - CARTG - once again promises to be bigger and better than ever. A few rule changes have been made, the main one in shortening the operating time to 30 hours - and several new categories have been added with 19 plaques or medallions being awarded as well as many certificates. Look over the awards - pick out your choice - and make your plans to go after it - October 13-15, 1973. No losers as every entry has oodles of enjoyment at least.

Pre-printed log sheets and zone charts are available for a large envelope and IRC coupons from CARTG, 85 Fifeshire Rd., Willowdale, Ontario, Canada. M2L 2G9



AWARDS

1. Plaque - "C.A.R.T.G."
2. Plaque - "RTTY JOURNAL"
3. Plaque - "C.A.R.T.G."
4. Plaque - "RTTY JOURNAL"
5. Plaque - "C.A.R.T.G."
6. Plaque - "A Group Member"
7. Plaque - "RTTY JOURNAL"
8. Plaque - "C.A.R.T.G."
9. Plaque - "RTTY JOURNAL"
10. Plaque - "C.A.R.T.G."
11. High U.S.A. Score, Gold Medallion & Ribbon - "RTTY JOURNAL"
12. High Canadian Score - Gold Medallion & Ribbon. Canadian Director's Award.
13. Worked Most Canadian Stations Silver Medallion & Ribbon - "A Canadian Amateur".
14. High Score for Green RTTYer (No participation in previous RTTY test) Sidney Burnett Memorial Plaque.
15. High Score for 10M operation Silver Medallion & Ribbon "RTTY JOURNAL"
16. Most two-way 80M contacts. Silver Medallion & Ribbon. - "C.A.R.T.G."
17. SWL Printer High Score Plaque - "C.A.R.T.G."
18. High Score using Low Power (under 100 w). Silver Medallion & Ribbon. "RTTY JOURNAL"
19. High Score for Multi-operated stations. Plaque - "C.A.R.T.G."
20. Certificates for top scores in each U.S.A. and Canadian District, and each Country.

1. CONTEST DATES

Saturday, October 13th 0200 GMT to Monday, October, 15th, 1973, 0200 GMT. Total Contest period is 48 hours but no more than 30 (thirty) hours of operation is permitted. Time spent in listening counts as operating time. The non-operating period can be taken at any time during the test but summary of times on and off must be included in the Score Sheet.

2. BANDS

Contest will be conducted on 3.5, 7, 14, 21 and 28 MHz amateur bands.

3. COUNTRY STATUS

ARRL Country List, except KL7, KH6 and VO considered separate countries.

4. MESSAGES

(a) Message Number, Time GMT
(b) Zone and Country

5. EXCHANGE POINTS

(a) All two-way RTTY contacts with stations in one's own zone - 2 Points.

(b) All other two-way RTTY contacts will receive points listed in Zone Chart (same chart as used before).

(c) Stations may not be contacted more than once on any one band.

Additional contacts may be made with same station on different bands.

6. BONUS POINTS

100 additional Bonus Points to be added for each VE or VO station worked on all bands. Bonus Points to be added to final score.

7. CLASSIFICATIONS

(a) Single operator station (one transmitter).

(b) Multi-operator stations with one transmitter. Individual operators of multi-operated stations may submit their Logs singly and compete as single operators instead of submitting a Group Log, if desired.

8. MULTIPLIERS

A multiple of one is given for each country worked including one's own on each band. e.g. If one country worked on 3 bands, three multipliers given.

9. LOG SHEETS

Separate page for each band. "CARTG" Log Sheets & Zone Charts available for SAE or IRC's. Logs to contain band, exchange numbers, times GMT, station calls, Zones, Countries, exchange points and number input. Logs must be received not later than December 1st, 1973. Send to the Canadian Amateur Radio Teletype Group, 85 Fifeshire Road, Willowdale, Ontario. CANADA M2L 2G9

SCORING

Total Exchange Points multiplied by number of Countries worked, multiplied by number of Continents (maximum 6). Canadian Bonus Points added last.

Scoring Example:

Exchange Points 2020

Countries:
- 3.5 MHz. - 5
- 7 " - 4
- 14 " - 18
- 21 " - 10
- 28 " - 3
- 40

Continents 5

Score - 2020 x 40 x 5 - 404,000 pts.

Bonus: 6 VE's x 100 - 600 pts.

TOTAL SCORE 404,600 pts.

YOU DON'T HAVE TO WIN
TO HAVE A GOOD TIME!!

TRY IT !
YOU'LL LIKE IT !!!!

***

Modifying the DX60B for RTTY

CAL SONDGEROTH, W9ZTK
800 Fifth Ave.
MENDOTA, ILL. 61342

DX-60B MODIFICATIONS

The Heath DX-60 transmitters have become quite popular for use on RTTY autostart. They are normally driven by an external crystal controlled FSK oscillator such as the XT-4. This arrangement provides exceptional frequency stability for working on a fixed frequency on a 24-hour basis.

Most of the transmitters now available from retired Novices, etc. are the DX-60B and the notes here apply to that model. This is a well constructed little rig and most of the parts are quite conservatively rated. A few as noted below were replaced and changed to better suit the continuous "key down" operation necessary for RTTY. These are some notes I made when converting my surplus DX-60B.

XT-4 SUPPLY

The accesory socket on the back of the stock transmitter provides the full unregulated B-plus (approximately 250 volts key down) for the external accesory. The XT-4 requires a 150 volt regulated source. The first approach might be to add an OA2 voltage regulator and dropping resistor, but the circuit shown provides regulated voltage which is adjustable to any value from about 120 to 200 volts. Its regulation is as good or better than obtainable with a VR-tube. In addition, this modification makes use of one of the tube sockets (and the tube) already in the transmitter.

This assumes, of course, that the components associated with the speech amplifier/modulator section are removed. This is one of the first things done on my rig leaving only the filament connections on the tube sockets.

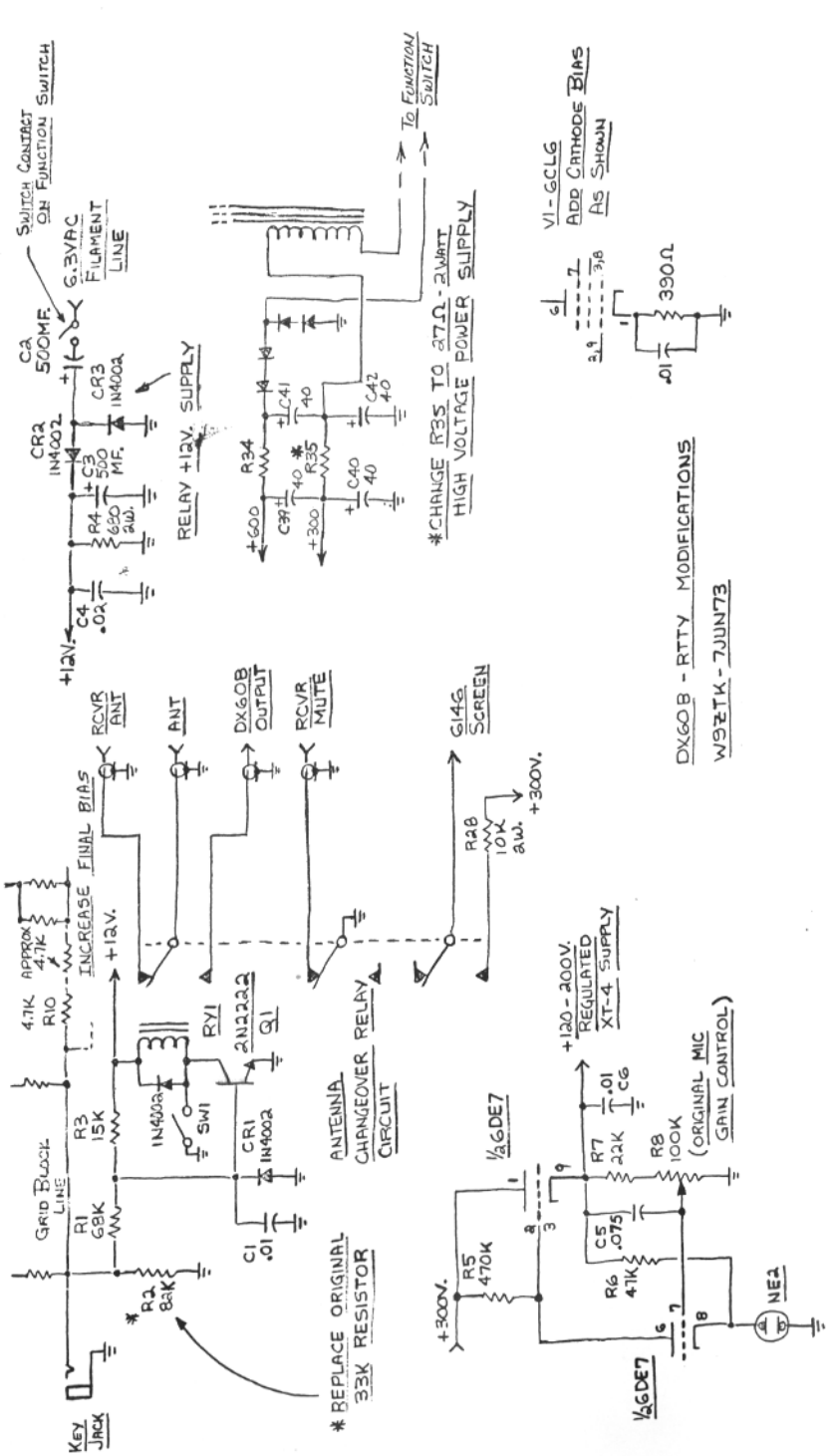
The original 6DE7 modulator tube will easily handle the regulated 150 volts at 15-20Ma. as required by a normal XT-4. The regulator circuit itself is straightforward and out of the handbook. The 100K audio gain control is conveniently mounted on the top of the chassis and is used to set the regulated output voltage. The .075 capacitor shown on the grid of the first half of the 6DE7 helps suppress ripple on the regulated output. There are two NE-2 bulbs already in the DX-60B -- both used as power indicators -- one for "power on" and the other for "high voltage on". One of these could be used in the regulator circuit, but I preferred to retain them as indicators for their specific functions. The "power on" indicator is actually on the grid bias negative supply, so the two give a good indication of whether or not a fuse might be popped or something else wrong.

ANTENNA RELAY

The transmitter does not have an antenna relay, nor does it really have internal switching suitable for operation from a single remote contact closure. Many people control their transmitters at some distance across the room from the TTY printer as is the case in my station. The modification indicated shows how a 12VDC relay was added which not only switches the antenna between transmitter and receiver, but also removes screen voltage from the final stand-by and mutes the receiver during transmit.

The first approach to driving the relay was to use the second existing nine-pin tube socket and a type 5763 tube with screen and plate tied together. The control grid was connected to the negative grid block line and grounding the key line would allow the tube to conduct closing the relay. With a suitable relay this method of operation would probably be ok. In my case, however, I wanted to make use of the available 12 volt relay which had three sets of DPDT contacts. Since it required about 50-60 Ma. to operate, this added load on the plus 300 volt supply seemed undesirable. I might point out that it was possible to drive the low voltage relay coil with the triode connected 5763.

As a better solution, a voltage doubler type power supply was added to the 6.3 volt filament line, and this provides 12VDC for the relay with plenty of current reserve in the DX-60B filament winding. The circuit shown was used to drive the relay with a switching transistor. Adding this circuitry requires a change in R2 to about the value shown to maintain the same key up negative blocking voltage on the line. The network of R1, R2 and R3 was adjusted so that the base of Q1 is slightly negative with the key up and fully saturated



to close the relay with the key down.

One set of relay contacts is used to remove screen voltage from the 6146 final during standy and another mutes the receiver. Thus running the function switch in the "CW" position, a single contact closure on the keying line controls everything necessary to put the transmitter on the air.

The relay used was obtained at a swapshop and is made by C.P. Clare. It is marked No. 35 E. C. (5300 turns) 200 ohms. One set of contacts is quite heavy (used for the antenna switchover) and the other two sets of contacts are somewhat lighter duty; ideal for the application. Other relays could easily be used.

The switch shown at the collector of Q1 can be mounted in the unused microphone connector hole and it closes the antenna relay continuously if the transmitter is to be used for CW work.

The relay was mounted on a small bracket on top of the low pass filter shielded enclosure. This requires removal of the low pass filter which is somewhat difficult, but in my case this was a blessing as a bad solder joint was found on the lead going into the filter! Also, another bracket was mounted on the rear of the filter to hold a standard SO-239 output connector and two phono jacks for the receiver antenna and muting. There is probably room to do this on the rear wall of the filter, but the bracket makes the job a little easier and neater.

FINAL AMPLIFIER GRID BIAS

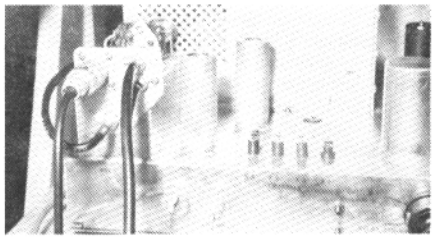
The bias on the 6146 was somewhat low for true Class C operation of the stage. To increase this slightly, a 4.7K (1/2 watt) resistor was added in series with R10. This could be a 10 or 20K potentiometer adjustment, so that the final could be set up for linear operation if ever needed. (For linear use, the final screen voltage could be taken off the 6DE7 voltage regulator and adjusted to suit.) With the additional 4.7K resistor in the grid circuit, the bias now runs about minus 50-60 volts with 2.0Ma. drive to the final. This is about normal for Class C.

OTHER CHANGES

While running some key down bench tests into a dummy load, it was found that resistor R35 in the plus 300 volt supply became overheated. A little checking indicated that this component was dissipating at or in excess of its 2 watt rating. Rather than put in a power resistor, I changed it to a 27 ohm 2 watt unit. It might be noted that the original version of the transmitter (DX-60) shows a 100 ohm 2 watt resistor for R35. In any event, the 270 ohm value is probably suitable for CW work, but it was felt that it should be a little more conservatively rated for RTTY. Thus the change.

Also, it was noted that the 1000 ohm resistor in the plate circuit of the first 6CL6 stage became quite hot. This was due to the fact that when using this stage as an amplifier for the XT-4 it obtained very little if any grid bias and so drew excessive plate current. When used as a crystal oscillator, this stage gets its proper bias by virtue of the grid current flowing from the oscillator action.

To cure this problem, a cathode bias network was added to V1 consisting of a 390 ohm (1/2 watt) resistor bypassed with a .01 capacitor to ground. This holds V1 plate current down to 20 Ma. or so during normal operation.



FUSING

Although not shown on the diagram, considerable extra fusing was added to protect the power transformer and the rest of the transmitter when operating over long periods of time. Two fuses were added to the incoming 117VAC line -- one in each leg. (The original circuit breaker was left in place.) Also, fuses were placed in the transformer high voltage secondary, the bias winding and the 6.3 volt filament line. The fuses I ended up with were as follows:

1. 117VAC -- 2 amp regular
2. High voltage -- 1/2 amp slow blow
3. Bias winding -- 1/10 amp slow blow
4. Filament -- 6 amp slow blow

In addition to the extra fusing the function switch was re-wired so that it not only removed the high voltage secondary during standby on the switch, but also removes the bias winding and the 6.3 VAC line going to the voltage doubler power supply (12 volt relay supply). With the function switch in the standby position all power from the transformer secondaries is disconnected except the filaments of the tubes. This is added protection when the transmitter is to be left unattended for extremely long periods of time.

***

Crystal Controlled RTTY with the SB-102

TIMOTHY JUHL, WA8QWR
Box 32
CARSONVILLE, MI. 48419

I recently became interested in finding a simple means of getting on the 14075 khz RTTY autostart frequency. After seeing what others were doing and pricing a few construction projects, I began to think of some method for using the SB-102's own built-in auxiliary crystal oscillator. First, a few notes about the SB-102: When operating RTTY, it is wise to run at reduced power, say around 120 watts. This may be accomplished by the installation of a 50 K potentionmeter in the screen voltage line to the final amplifiers. Adjust it for the desired plate current. The use of a fan over the finals is also recommended. There is a FSK circuit built into the SB-102's LMO, but the unit cannot be operated transceive when it is used, as it will not transmit and receive on the same frequency for RTTY. If AFSK is used, transceive operation is possible. It should be pointed out that when operating AFSK with the SB-102, you are limited to 170 Hz shift unless some internal modifications are made. In actual AFSK operation, the output from an AFSK oscillator (2125 Hz on mark - 2295 Hz on space) is fed into the microphone or phone patch input (in the LSB mode) and it essentially comes out FSK. Needless to say, good carrier and unwanted sideband suppression is a must. You are also cautioned to keep the audio input level low, so as to not overdrive the transmitter. The transceiver's PTT circuit may be operated by a switch or relay.

To determine the crystal frequency required, first look up the section in the manual concerning "special crystal considerations," and then perform the following operations: (Example: 14075 A/S Freq.)

22,895.000 khz (Heterodyne Crystal freq. for 20 meters)
-14.077.125 khz (Net Freq. plus 2125 Hz (mark tone))
8,817.875 khz
- 3,393.600 khz (LSB Carrier Osc. crystal freq.)

5,424.275 khz (Correct crystal for khz operation)

Using similar calculations, I came up with a crystal frequency of 5361.775 khz for the 3637.5 khz A/S frequency. I should note here, that according to Heathkit, the heterodyne crystals for each band may be off as much as 1500 Hz, so it might be wise to determine the exact frequency (see manual) before ordering your crystal. I don't have a counter, so I experimented by ordering a "bargain" crystal from Jan Crystals (Ft. Meyers, Fla.) which was on a stock frequency of 5424.218 khz. I installed it in the circuit and had no trouble putting it on frequency by adjusting the trimmer included in the oscillator circuit. I observed that I was able to shift the frequency of the crystal a few hundred Hz, so there should be no problem putting your crystal on frequency. In the interests of stability, you might consider using high accuracy crystals, such as the International Crystal Mfg. (Oklahoma City, Okla.) "HA" type, whose characteristics have already been described in great detail in other articles 1.

1 Irvin M. Hoff, "Xtal Controlled RTTY," RTTY JOURNAL, Dec. 1967, p 4.

*****

To Check Motor Speeds--

In the course of developing a variable speed motor drive for my Kleinschmidt printer, I have found a number of commerical stations helpful. In the hope they will prove helpful to some of the bretheren, I am passing them along. Frequencies are within a KHz and shifts are approximate. As you can see all frequencies are available on "Hand Band" only receivers.

Keith Sueker, W3VF
110 Garlow Dr.
Pittsburg, Pa. 15235

FREQUENCY	CALL	SHIFT	POLARITY	SPEED (WPM)
14,395	WBR7Ø	85Ø	NORM	1ØØ
747Ø	KKN5Ø	85Ø	NORM	1ØØ
7425	CHP	85Ø	REV	75
7356	CLN62	4ØØ	NORM	67
7387	DJG/ZWN	3ØØ	REV	67
74Ø9	CML5/CML47	4ØØ	REV	6Ø
74ØØ	(MEXICO)	45Ø	REV	6Ø

*****

Using Kenwood R-599 Receiver for RTTY

BILL CRAIG, WB4FPK
P.O. Box 947
GRAYSON, KT. 41143

The new Kenwood R-599 receiver seemed to be an ideal candidate for amateur RTTY operation, when taking into consideration its excellent frequency stability, and narrow IF filter passband (500 Hz), which is just about 'ideal' for 170 Hz shift RTTY. With many current production receivers available it becomes necessary to 'sacrifice' one of the BFO crystal positions, and dedicate it to RTTY operations. This becomes necessary in order to demodulate the incoming signal (and obtain the 'normal' 2125/2295 Hz tones), as the BFO crystal must be off-set from the center of the 500 Hz filter passband by approximately 2.2 Khz. (Actually 2.210 Khz). In the case of the Kenwood, the BFO should should be lower in frequency from the center of the passband, in order to demodulate the signal 'right-side up'.

Because of a unique diode switching scheme used in the Kenwood, to select the desired BFO crystal for the mode desired, it permits us to lower the frequency of the lower sideband BFO crystal with a very simple modification. The interesting part of the story is that the only additional material required to accomplish this modification is aSPST miniature toggle switch. And best of all, by operating this switch we can restore the receiver operation to normal lower sideband reception at any time.

The Kenwood uses diodes as remotely controlled switches, which eliminated the need for long leads to a mechanical function switch. While preforming some measurements to the receiver to check its stability, I was surprised to find that the 'CW' crystal, although marked '3395.000 Khz', actually oscillated at 3394.300 Khz! It seems that this same PC board is used also in the matching transmitter, and a bit of study of the design revealed the reason for this strange condition. The crystals used in this circuit are series resonated by 22 Pf capacitors wired in series with each crystal. (A trimmer in parallel with each crystal is provided to make frequency adjustment.)

In simplified form, a diode associated with each crystal, when forward-biased from a control voltage, causes the diode to appear as virtual dead short to ground, which effectively connects one end of the 22 Pf capacitor to ground, allowing that particular crystal to oscillate. However, the 'CW' crystal is provided with two diodes, one of which is wired as just described, and the other wired so that it connects one side of the crystal directly to ground, effectively 'deleting' the 22Pf capacitor from the circuit. When this diode is selected, the crystal will oscillate approximately 700 Hz lower than its marked frequency! In the receiver, this is the only diode used, which allows the received 'CW' signal to have a pleasing audio tone after demodulation of within the range of 450-950 Hz, depending upon where in the IF passband the operator positions the signal. (In the transmitter, the other diode would be selected, causing the transmit crystal to oscillate at its marked frequency; i.e., the center of the filter passband, permitting carrier generation.)

It becomes immediately apparent, that if we were to apply this or a similar technique to the normal lower sideband crystaln, it too, would oscillate approximately 700 Hz lower in frequency. Since the normal lower sideband crystal oscillates at 1.5 Khz from the center of the IF passband, this additional lowering of the frequency would move it to our desired value of 2.2 Khz off-set, permitting normal demodulation of narrow shift RTTY signals through the 500 Hz filter. To do this it was only necessary to mount a miniature SPST toggle switch on the outside rear wall of the BFO enclosure, with a pair of leads routed from this switch to the interior of the enclosure, and then connected across the 22 Pf resonating capacitor for the lower sideband crystal. (This is the crystal nearest to the front of the receiver, the 22 Pf capacitor is located immediately below and slightly to the rear of the crystal holder, and is marked 'C-6' on the PC board and schematics.) The holes that this capacitor are installed in are larg enough to accomodate the additional thickness of a 20 gauge wire, which permits easy connection. (It's necessary to completely remove the BFO cover to permit access to the foil side of the PC board of course.) The leads from the switch to the capacitor should be kept as short as possible to prevent any large change in frequency due to the added capacitance of the leads and switch. The switch is best mounted with the end of

Continued on Page 13

RTTY theory & applications.

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

RTTY for Beginners- Part 5

TRANSMITTING A RTTY SIGNAL

This month we will discuss transmitting a RTTY signal. It may appear a bit backward to discuss transmitting a signal before the process of receiving is considered because all amateurs receive before they can transmit (some for years!). However, if you know what you are trying to receive, it should be easier to understand why the receiving equipment is constructed and operated as it is.

TYPES OF SIGNALS

There are many ways to transmit a RTTY signal. Three simple methods are:

1. On-off keying
2. Frequency shift
   a. RF (FSK)
   b. Audio (AFSK)

The first method listed is the most obvious, especially when one is familiar with CW and the analogy between CW and RTTY that was described previously. In a simple telegraph loop, the signal is sent by opening and closing the keyboard contacts; because the keyboard contacts just open and close, it should be possible to substitute the keyboard contacts for a telegraph key on a CW transmitter and have "instant" RTTY.

This scheme will work and has been employed, but, although it represents the ultimate in simplicity for the "sender", the "receiver" may be faced with a serious problem. With this simple scheme, a mark is something and a space is nothing. What happens when a burst of static comes along? A burst of static is something, therefore the receiving equipment mistakes the static for a mark and prints an error; the simple on-off scheme is prone to errors. (One might argue that CW is amazingly free of such problems, and on-off RTTY should be also. However, when employing CW there is one additional item that is not employed in RTTY. It is a mass of grey matter located between a pair of ears. It is capable of doing things that no electronic circuitry can come close to matching.)

FREQUENCY SHIFT KEYING

For the time being, we will ignore the differences between audio frequency shift keying (AFSK) and carrier frequency shift keying (FSK) and discuss their common features.

In a frequency shifting scheme, something is always being transmitted; i.e., the transmitter is always sending RF into the antenna. For example, whenever a mark is to be sent, the output from the sending end is a particular frequency, and when a space is to be transmitted, a different frequency is sent. Because there is always a mark or a space being sent, the receiving equipment has a much easier time deciphering the signal.

This will be explained fully at some later date, but a brief explaniation follows: The receiving end can copy from mark only because a knowledge of the marks implies that there are spaces between the marks. If only spaces are received, marks must be in the "gaps" between the spaces. Therefore, if both marks and spaces are sent, the receiver can use either one and obtain all the information sent. If bursts of noise are present, the receiver can employ a simple scheme where it uses both marks and spaces in such a manner to reduce its sensitivity to interference.

FSK

Carrier frequency shift keying (FSK) is most commonly employed on the HF bands (and is the only legal means of transmitting RTTY on these bands; see for example, pages 13 & 14 of the 1968 Edition of THE RADIO AMATEUR'S HANDBOOK: FSK is called F1 modulation).

Usually, the carrier frequency is shifted by placing a small capacitor across the oscillator tank circuit. The capacitor is connected and disconnected by the keyboard contacts. When the capacitor is connected, the frequency of the oscillator is lowered, which results in a lower transmitted frequency (unless a heterodyne system that inverts relative frequencies is employed within the transmitter).

Because of the unsuitability of conducting RF into the keyboard contacts, a few simple components are placed between the keyboard contacts and the frequency-shifting capacitor. These components are typically a capacitor, a diode, and RF choke, and a few resistors. The diode is used as a switch to connect and disconnect the shifting capacitor. The other capacitor and the RFC are used as a simple low-pass filter to block RF from the contacts.

We will not attempt to describe a specific circuit for many reasons. The most important reason is that we have had very little experience with FSK transmitters. Another reason is that the FSK circuit is to be added to an existing transmitter (in most cases) and the exact component values most cases) and the exact component values and modification method is dependent upon that particular transmitter. (Ask Dusty how many requests he gets regarding. FSK'ing a particular transmitter.)

Again, an FSK signal can be generated by connecting and disconnecting a small capacitor across the oscillator tank in a transmitter in response to the opening and closing of the keyboard contacts in the teleprinter.

Normally, the space frequency is lower than mark. A little reflection will reveal that if the keyboard contacts were used to add the shifting capacitor without any intervening circuitry (assuming that RF in the contacts were acceptable) the mark frequency would be lower than space. (This can happen, thus a reversing switch is usually employed in the receiving equipment to permit copying someone who is sending "upside-down".)

Typically, space is 850 Hz lower in frequency than mark. (By law it must be less than 900 Hz). Some amateurs are using a shift of 170 Hz; this is called "narrow shift". Narrow shift has many advantages compared to 850-shift, and only one disadvantage; the disadvantage is that both the transmitter and receiver must be stable (free from frequency drift problems).

AFSK

On 6 meters and above, audio frequency shift keying is permissable. (FSK is also permissible).

AFSK is usually obtained in the same general manner as FSK, but the frequency of an audio oscillator is shifted. The output from the oscillator is fed into the audio input of a transmitter.

The most common method used to obtain AFSK is to build an audio oscillator whose output frequency is as high as possible within legal limits. Usually 2975 Hz is used. A capacitor can be placed in series with the keyboard contacts and the combination is placed across the oscillator tuned circuit. When the contacts are open (space), the output of the oscillator is 2975 Hz. When the contacts are closed (mark), the resonant frequency of the circuit is lowered because of the additional capacitance and the output frequency is lower. The most common frequency for mark is 2125 Hz (850 Hz lower than space). (Note that with FSK mark is the higher frequency whereas with AFSK mark is the lower frequency).

The oscillator containing the shifting capacitor and usually a few other components including a diode to do the actual switching in order to keep the audio out of the keyboard contacts is called a keyer. The keyboard contacts are connected to the input of the keyer and the output of the keyer is connected to the audio input (microphone input) of an AM or FM transmitter.

When an AM transmitter is used, the modulation is called A2. When an FM transmitter is used, the modulation is called F2. When an SSB transmitter is used, the modulation is called Fi or illegal depending upon the harmonic content of the keyer and the amount of carrier suppression in the SSB transmitter. (Note that an AFSK keyer into an SSB transmitter results in an output that looks like carrier frequency shift keying so long as the keyer is well-designed and the SSB transmitter is adjusted properly. Irv Hoff has some comments on this subject in the 1967 OCT issue pp. 4-5 and is expected to have more,

For specific circuits of AFSK keyers see: 1. THE NEW RTTY HANDBOOK Byron Kretzman, pp. 102-3; 2. "Audio Frequency-Shift Keying for RTTY", Irv Hoff, QST, 1965 June, p. 32ff; 3. "An AFSK Keyer", R.E. Guentzler, RTTY Journal, 1967 July-Aug. p. 9ff; 4. This "column" next month.

SUMMARY

Because RTTY is sent over a local loop by simply opening and closing contacts,

Continued on Page 13

RTTY-DX

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

Hello there. . .

Although this is being written at the end of July which is still the middle of a long hot Summer, the masthead says this is the September issue, and editorially speaking the start of the Fall season. In any event we are again together on a monthly basis and looking forward to a season of DX activity on RTTY.

Since the last issue the mail pouch has been full of Contest information, Past - Present - and Future. The results of the BARTG and WAE contests should be found on other pages of this issue. While both of these Contests were plagued by very poor propagation conditions we must give a standing ovation to I1BAY who is TOP man in both activities. An excellent performance by Attilio under trying conditions.

The annual SARTG Contest took place shortly before you received this and we hope to have a report on this activity for the next issue.

Coming up in October is the "Lucky 13th" RTTY DX Sweepstakes again sponsored by the CARTG. This is the "BIG" Contest of the year with categories and prizes for just about every facet of RTTY operating. Rules are about the same as in previous years with one important change, no more than 30 hours of operating out of 48 total, so it should be more a test of skill than endurance. Log sheets and Zone chart available from CARTG Headquarters - WRITE.

An advance tip about next year's WAE Contest. It will take place a week earlier than usual, April 20/21. This change will allow the boys that usually make the annual pilgrimage to the Dayton Hamvention to participate. Full rules will be published closer to the event.

WAC applications have slowed down to a trickle but we are pleased to announce that the following stations received the Award in the past several weeks.

Nr. 209 Don Runmark W0NP
Nr. 210 Steve Roth CE3Y0

Steve, CE3Y0, is now QRT and back in the States (WA3PMS) awaiting a new assignment with the U.S. Department of State. He will advise as to his new location as soon as he is settled and hopes to fire up the machine with a new and exotic call sign. Meanwhile, RTTY from Chile is being adequately handled by Henry, CE3EX; Pedro, CE3GK; and Mario, CE3MA.

It is not often that one hears RTTY activity coming from Morocco, but this Summer there was a big signal coming from CN8BO and the fellow behind the keyboard is an old hand at the game. You may remember Gary under his stateside call of K7VAT and also as operator at the Naval Amateur Station in Washington, K3NSS. Gary says that it took several months of trying and a lot of persuasion to get permission to operate and that QSL's should go ONLY via his manager, who is --

Charles Cone, Jr. W4GKF
535 Windsor Park Place
Atlanta, Ga. 30305

Gary expects to be at this QTH for a few years so everyone should have Morocco in the log before too long.

Another country that one does not come by easily in any mode is Iran. However, Wolf, operating EP2WB, made the mid Summer doldrums a bit easier to cope with. His home call is DL2WB and QSL's can possibly go via that QTH which is listed as --

Wolfgang Bauer
P.O. Box 70052
Muenchen 70, West Germany

From the Central Pacific area WA6-AXE/KG6 keeps Guam active from time to time and comes through quite well at around 1200z here in the States.

QSL To - Joseph Gluckner
329 Johnson Rd.
U.S. Naval Hospital
F.P.O. San Francisco,
Cal. 96630

We are quite certain that many an RTTY DXer had his beam fixed on the Marcus, Bonin, Volcano, Island Groups listening hard for JD1AGZ, who was due to fire up from Marcus on the 29th of July. Gin, JA1ACB was a big factor in getting this station on RTTY and had a machine there waiting a few weeks prior to the start of operation. Unfortunately, in this part of the world anyway, the bottom fell out of the band at that time and the propagation continues to be ZERO at this writing. All is not lost however as JD1AGZ is officer of the weather station on the island and will be there for the next three months. Bonin and Volcano Islands will be activated by JD1AII and JD1AIS, but Gin reports that the situation and general conditions there are terrible so our advice is that you continue to monitor the band when it is open to that area. QSL's for the latter two stations can go via Gin and a small contribution is requested. For JD1AGZ cards can go via JARL.

When conditions are good, . Paul, DU1PT, is an almost daily attraction on the 14 mhz band at about 1200z. Paul is using transceive so his RX and TX signal are offset causing some operational problems at the present time. If he comes back to you it is usually one or two khz higher in frequency so do not attempt to zero beat him as he will lose your signal. When Gin is on the band he has been a great help in getting some order out of chaos by acting as MC and feeding Paul the call signs in an orderly manner and this has worked out very well. In any event, if you make the contact you get a fast QSL direct as Paul sends his out before he gets yours. Just in case you need it here is Paul's QTH --

Dr. Paul Tolentino
312 Manga Ave.
San Juan, Rizal
Rep. of the Philippines

or you can also send it to P.O. Box 2017, Manila.

We understand that DU1JS is another possibility from this area but is not very active at the present time.

Gin also passes word that in the near future and as soon as it can be arranged he will try to place a printer on Norfolk Island, with some assistance from Mac, VK9MC. This would be another VK9 prefix but a new and separate country of course.

In the span of a couple of mornings here not too long ago we were surprised to print VK6KR, VK6LF, VK6PG, VK5IF, and VK4VU all putting in great signals. To compound the surprise we looked at the set of Great Circle Bearing Charts put out by Bill, WB5CBC, and we find that Perth is the furthest place on earth from the latitude/longitude of Blue Bell, Pa., 11591 miles (short path).

At about the time you are reading this there may very well have been some RTTY signals emanating from the island of Montserrat, VP2M- with Sid, VP2KH, at the keyboard. Sid says that he will be on that island for quite a while on an airport construction project and was rushing to get a Creed machine in shape and a ST-5 completed to take along with him. He plans to leave his present equipment with Keith, VP2KF, so that St. Kitts can continue to be QRV.

Jan, ZS6BBK, tells us that all cards have been sent out for contacts made during his DXpedition to Botswana as A2CAK. A combination of problems forced a sharp curtailment of that operation particularly in that the very poor band conditions did not give too many an opportunity to contact this rare prefix. A similar trip was planned for Swaziland, 3D6, in late May early June. However, the propagation was again very poor or non-existent from that part of the world at that time and the trip was cancelled. We believe this to be a wise decision as it takes a tremendous effort in time, material, and energy; not to mention money, to go off to some strange place and set up a station hoping to give the boys a new one in the log only to have it come to naught due to bad band conditions. Jan says that he may try again in late August or early September to make a dash for 3D6 land. Just when this will occur will be based on propagation forecasts but you can be assured that when Jan passes the word "GO" you will be printing QST tapes on the band with the details.

On the Continent of Europe Uli, DK3CU is trying to get a printer to SP6DOI in Poland. The problems are too numerous to mention, but if Uli can overcome the Customs barrier it should be clear sailing.

During May and June I am sure that many of you made contact with OK5OR. This station was set up to commemorate the 50th Anniversary of Czechoslovak Amateur Radio. The operator was Milos OK1MP and a very nice QSL is available from either Milos or via the OK bureau.

DX-RTTY. . .September 1963

HZ1AB on RTTY. K3GIF his first QSO followed by WB2CVN and K8DKC. Bill, G3CQE moved to a new QTH on the Bristol Channel. DL4ZU and DL5LM are a couple of new ones on from Germany. K3GIF keeps weekly skeds with LU1AA and ZS1FD. Some of the "down under" boys on the band are VK3KF, VK4RQ, ZL1WB, and ZL3HJ.

73 de John

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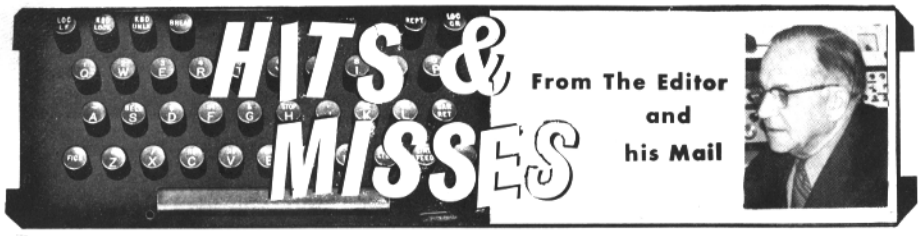

For a number of years we have had a stack of TTY manuals piled on a shelf. Finally at the urging of Crys to "get rid of that stuff" (I think she wanted the room for HER junk) we ran an ad in last months Journal. The very next day the phone started ringing and in a few days letters arrived asking for the manuals. Although we had about 30 of the advertised numbers, some went out immediately and we began refunding for out of stock items and mailing others. I guess Journal ads are read but personally we would hate to be in the mail order business.

***

One common request we seemingly ignore is a change of call signs on the mailing stencils. The stencils are filed according to call areas and as that is the only reason we use them it makes little difference as long as the call area number is correct. Probably another reason is the cost of 15¢ for each stencil as well as typing a new card and pulling the old stencil. However, if you REALLY would like that new call on the stencil I think we can afford the charge.

***

Classified Also- Pages 14--15

HAL COMMUNICATIONS CORP: HEADQUARTERS for MAINLINE Solid State RTTY equipment. You can do no better than the ST-6 demodulator at any price. Screened, punched cabinets for the ST-6 now available. For budget TTY, it's the ST-5 for HF or VHF. And the best in AFSK is provided by the AK-1. Our new model 1550 electronic keyer, or the MKB-1 Morse Keyboard, will automatically identify your RTTY station at the push of a button. The extra values are available from HAL Communications Corp., Box 365RJ, Urbana, IL 61801. Phone 217-359-7373.

WESTERN UNION DESK-FAX TELEFAX TRANSCEIVER MANUAL: Complete theory of operation, adjustment, lubrication, preventive maintenance, troubleshooting, parts list. Includes all schematics and mechanical parts drawings. $3.80 postpaid. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

TELETYPE SERVICE AND ADVICE: (15-28) available reasonable rates, will travel. Write Box 1208, Edison, N.J. 08817.

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.

The ONLY back issues available are listed below. 30¢ each.

1966-Oct-Nov-Dec- [3]
1967 & 1968 -None.
1969-Oct-Nov- Dec-[3]
1970- None.
1971 May-June-July-Sept-Nov-Dec- [6].
1972-Jan-Feb-Apr-May-July-Sep-Oct-Nov-Dec- [9]
1973 Jan-Feb-Mar-Apr-May-July- [6]

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

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Air Mail - - -	All Other Countries	$6.00

Kenwood Rec. Cont.-

Continued from Page 7

the toggle handle just below the top surface of the BFO enclosure, and on the rear wall of the enclosure, where it is readily accessible when opening the top cover of the receiver. When the switch contacts are closed, (which effectively shorts out the 22 Pf capacitor), and the function switch is in the 'Lower sideband' position, normal RTTY reception occurs. Opening the switch contacts of course restores the receiver to normal lower sideband operation.

***

RTTY for Beginners cont.-

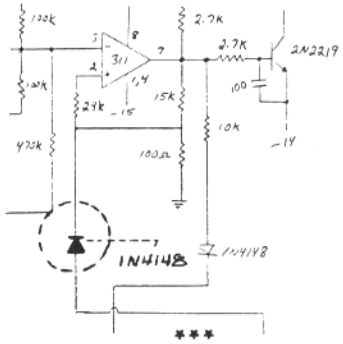
Continued from Page 9

it is possible to substitute the keyboard contacts for a telegraph key on a CW transmitter. This means of transmission is very difficult to receive except under very favorable conditions. A better method known as frequency shift keying requires the transmitter to be on continuously whether a mark or space is being sent. The carrier frequency can be shifted between two frequencies, one for mark and a lower frequency for space (FSK of F1). On 6 meters and above a voice transmitter can be used and the frequency of an audio modulating signal can be shifted (AFSK, F2 or A2). With either FSK or AFSK the frequency can be shifted by placing a capacitor across the tuned circuit in the oscillator.

***

MISSING--!

Errors do creep in, the drawing of the TU73 demodulator was missing a diode, shown in the corrected portion below. Although the demodulator would probably work "as is" under most conditions better take your July issue - page 4, and make a note of the correction in case of future need.



***

Optical Coupler in RTTY

N.J. THOMPSON, KH6FOX
1615 Wilder, Apt 401
HONOLULU, HAWAII, 96822

THE OPTICAL COUPLER AS A TTY LOOP COMPONENT

The MOC1000 optical coupler is an even better device than has been suggested by recent comments in the RTTY Journal.

It has a rated voltage of 30 volts, but it is good for much more than that. I have used the circuit of figure 1 extensively with many MOC1000 units - ten in daily use. I have never had a failure.

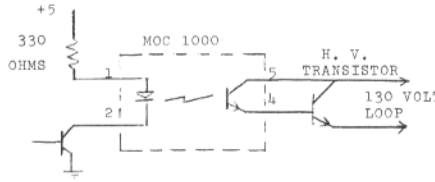


FIGURE 1 LOOP OUTPUT

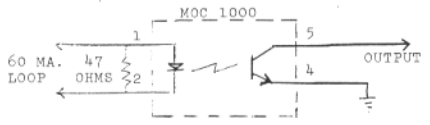


FIGURE 2 LOOP INPUT

In figure 1, the output transistor drives a high voltage transistor, such as the MM301 Motorola, rated at 150 volts and 200 MA. The circuit is a simple Darlington, and takes no extra parts on the output side. The voltage across the optical coupler in the circuit is the full 130 volts in the space condition. Nevertheless, I am driving 20MA and 60 MA loops at 130 volts, with inductive loads. The resistor in the input side of the coupler is chosen to pass enough current to fully saturate the Darlington at the desired loop current. This takes some 5 to 10 MA. I adjust the resistor until the Darlington begins to have voltage across it in the mark condition, then use half of that many ohms. 330 Ohms is a good number for a 5 volt drive system.

DRIVING THE OPTICAL COUPLER FROM TTY LOOPS

As for the input side of the MOC1000, I attempted to destroy them and find the

Continued on Page 16

CLASSIFIED ADS- 30 words $1. Additional words- 3¢ ea.

Cash with copy, Deadline 1st of month.

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PC BOARDS AND KITS; Phase locked loop, autostart, RY generator, CW/RTTY identifier, tone burst generator, two tone decoders, two meter preamp and channel scanner. Write for free flyer. Signal Systems, 2650 Durango Dr., Colorado Springs, Colorado 80910.

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.

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.

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

WANTED; STELMA PC-334, PC-336 or PC-403 PC plug in or any information on these. G.S. Naniwada, JA1ACB,3-4-8, Izumi, Hoya, Tokyo 188. Japan.

HAL COMMUNICATIONS CORP. can provide you with autostart for the ST-5. Adapated from the proven ST-6 circuity, the ST-5 autostart kit contains drilled, plated PC board, relay and all parts for only $15.00 plus shipping. For the best in UHF RTTY order the ST-5A with auto start and AK-1 only $92.50 plus shipping (no cabinet). Available late April or pick up at Dayton. Hal Communications Corp. Box 365, Urbana, ILL. 61801. Phone (217) 359-7373

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.

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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.

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

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WANTED FOR MODEL 26 TELETYPEWRITER, four new or near-new letter cylinder drums with full sets of letters, numerals, and punctuation marks. Also interested spare parts same machine and possible buyer of near-new condition Model 26s. M. Williams, 2139 North Angus St., Apt. A, Fresno, Calif. 93703.

WANTED URGENTLY: 2 or more FFRD-7 8-16 MHz tuning heads for an AN/FRR-49 receiver. Must be in working condition, state price and condition first letter. No junk wanted. Will also consider other range tuning heads and parts for heads and FRR-49 receivers. John Fail, Box 1196, Petersburg, Alaska. 99833

FREDERICK MODEL 1500 SOLID STATE 1.8 to 30 Mhz receiver, FB for autostart, $250 or trade for ST-6, Fred Slaughter 3636 Douglas, Toledo, Ohio 43613 Phone 419-474-7484.

FOR SALE: CE-100V ($250), CE-200V ($300), Model 35 eight level table-top TeeDee mounted on front panel with take up spools, rewind, etc., ($100). BRPE-18 eight level tape punch (?). WANT: Keyboard for late model 28KSR. Hand W6SKC, 1015 Fremont Avenue, South Pasadena, California. 91030, 213-682-3705 or 799-5886.

DESK-FAX TELEFAX TRANSCEIVERS: Several machines, $14 each, shipping collect. Desk-Fax Western Union shop manual, $3.80 each postpaid. Bill Johnston, 1808 Pomona Drive, Las Cruces, New Mexico 88001.

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CIRCUIT BOARDS. AFSK April 73 Journal $8; Monitoring Receiver Sept 72 Journal $10; Digital Autostart, June 73 Ham Radio $12; Automatic line feed modified with carriage return, January 73 Ham Radio $7. All boards are G-10 epoxy, plated, undrilled with parts values screened on; photos and parts list included. Bert Kelley, 2307 S. Clark Ave., Tampa, Florida 33609.

WANTED: INFORMATION ON FULL & part-time teletype repairman or organization able to work on subcontract basis. Contact Terminal Systems, Inc., 11300 Hartland St., North Hollywood, CA 91605 (213) 769-6772.

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WANTED: LDX T.D. WITH BASE, must be complete with covers (top and front) for ASR, must be in working condition. Also want LPR50 or equivalent typing reperf for 28ASR. No junk wanted, state price and condition first letter. John Fail, KL7GRF, PO Box 1196, Petersburg, Alaska 99833

SELL MODEL 19 MACHINE $60.00. Model 14 reperf $25.00. Terado Mark 1 inverter nearly new $60.00. You pick up. Phil R. Greene, PO Box 188. Lowville, N.Y. 13367

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"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.

WANTED TO BUY FOR EXHIBIT; Cryptography and coding equipment, manuals, magazines. I would also like to buy Kleinschmidt manuals, back issues of RTTY. For Sale; Digital components, mag. tape units, elapsed time meters, Fred Hatfield, K8VDU, (614)-237-3111, Drawer 27100, Columbus, OH. 43237.

TELETYPE MANUALS - hundreds in stock: TT-107 $6.50, TT-100 $6.50, TT-117 $10.00, TT-76 $6.50, TS-2/TG $4.50, TT-63A/FGC $6.50. Hundreds of Model 28 TTY manuals available. Also, tons of manuals on military surplus receivers, transmitters, on military surplus receivers, transmitters, test sets, teletype. Send 50¢ (coin) for large list. Sam Consalvo, W3IHD, 7218 Roanne Drive, Washington, D.C. 20021.

FOR SALE: ONE MODEL 28 ASR with upper reperf, 60/75/100 WPM gears, non-chad, auto carriage/line feed, two TD's, stunt box, spare motor, three spare type boxes, spare parts and schematics. One Model 28 Rec. Only Unit. Both Typing Units just overhauled and cleaned. One KY463A Converter. Asking $1000 for all, F.O.B. Laurel, Maryland. Also one R-390A/URR receiver. For more info write: Dave Nixon, K3ZNJ, 16101 Roblynn Ct., Laurel, MD. 20810.

TMC MODEL FFR RECEIVERS - basic range from 50 kHz to 32 mHz using plug-in tuning drawers. Provisions for VFO or crystal control HFO and variable and crystal controlled BFO with remote or local control and slave operation of two receivers for diversity. Three receivers and five tuning drawers with crystal for BFO for RTTY and three crystals for popular RTTY stations. $200.00 for all. Other items - list for SASE. WA50VG, 9660 Leaside Drive. Dallas, Texas 75238.

HAL COMMUNICATIONS CORP: Announced the revolutionary new RVD-1002 and RKB-1 solid state RTTY system. Provides the ultimate in noiseless, reliable reception and transmission of Baudot coded TTY. The RVD-1002 visual display system receives demodulated TTY pulses from the ST-6 and provides video output to a video monitor, or modified TV set. One thousand (1000) characters are displayed in a 20 line, 50 character per line format, at 60, 75, and 100 WPM if your TU will copy it. The RKB-1 combines reliable TTL circuitry, a high quality commercial keyboard, and a rugged case to provide the best Baudot TTY keyboard available. The electronics is arranged so that you type as if you were using a typewriter. See them on display at - Findlay 9/9 — Peoria - Cincinnati 9/16 — Roanoke Division 9/23. Get the details from HAL Communications Corp., Box 365RJ, Urbana, Il 61801. Phone 217 - 359-7373.

SALE: SYNCHRONOUS MOTOR FOR MITE teleprinter, 115 VAC, 60Hz, $9.00 ea. Model 28 transdistributor type TT334/UG code LXB-8, high speed, 8 level, excellent $17.50 ea. Reader, Feranti, high speed 8 level model II or III, used, excellent $15.00 ea. Model 28 typing reperf TT315/UG code LPR-35 or TT317/UG code LPR-37 used excellent, $17.50 ea. Typing reperf, Kleinschmidt, TT107/FG 60 - 75 or 100 wpm, used, excellent $28.00 ea. Pinion gear 80166 for model 14 TD unused, or pinion gear 78510 for model 14 typing reperf, unused, $2.00 (minimum order of 3) Send us your requirements for teletype equipment. Atlantic Surplus Sales, 580 3rd Ave., Brooklyn, N.Y. 11215

28-KSR; 28-Cabinet, LESU, Polar relay; Electrocom FSC-250 converter; 2- Regenerative Repeaters for parts; 6' Bud relay rack; 110-110 voltage regulator; RCA BC-10 Fixed Frequency receiver other goodies, swap for 33-ASR, or offer. WØEGA, 2310 Jones St., Sioux City, Iowa, 51104, (712) 255-8332.

WANTED, GOVERNED MOTOR FOR 28 ASR, equipped with RF noise suppression. WOMT. 355 Monroe St., Denver, Co. 80206.

WANTED; TECH AND OPERATING MANUAL for a model 1909A universal repeater made by Ortronix, Inc. I will pay for an original or copy of manual or schematic. Reuben Meeks, K6GUC, 3159 Donner Way, Sacramento, Ca. 95817.

TELETYPE: 5-MODEL 28 KSR COMPACTS, $225 each/offer; 1-model 28KSR floor stand, $250/offer; 1-model 28ASR, $650/offer. All machines are in excellent condition overall with little use. All FOB. Paul Beavin, WB6NLT, 1 Adams Ct., Novato, Ca. 94947 (415) 897-8843.

TU FREQUENCY STANDARDS --- Three brand new tuning forks, with better than 0.0005 accuracy, especially designed for tuning TU filters at 2125, 2295 and 2975 --- available separately at $7.40 each or set of three $19.90 postpaid. Hank Frankel, Box 535, Bellmore, NY 11711.

28KSR's; HORIZONTAL TAB, End of line lights, auto Cr & LF kits, New $825., Like new $725. (with keyed answerbacks). New 28 paperwinder $65.00. Like new 28ASR LAK-4 perforator, keyboard, $150.00. Type boxes, any style $10.00. MK111 (nylon gear) gearchangers $50.00. Tempo idle line motor control new $50.00. TDA-2, $50.00. Atlantic DMC-1's $65.00. Model 20 printer set, excellent, $300.00.20A reperf $195.00.32 TAM RO's new in boxes $295.00. New Mite manuals 1 & 2 $10.00. New nylon gear sets $6.50. Prices FOB- Computronics, 5526 Mona, Dallas, TX. 75211.

FOR SALE: DISTORTION TEST SET TS-2C/TG. See pages 160 thru 164 of the RTTY (A to Z) Handbook for complete details. Excellent. $35.00. C & H Sales, Inc., 2176 E. Colorado Blvd., Pasadena, California, 91107. 213-681-4925.

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