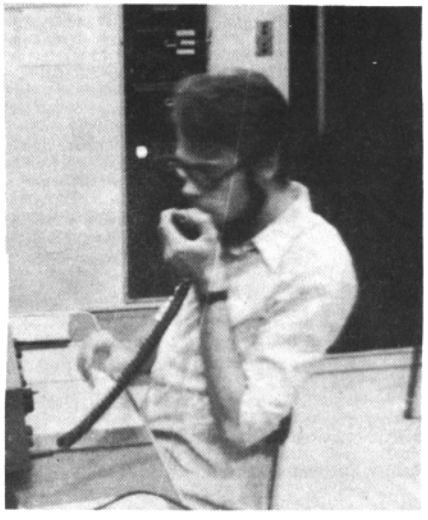
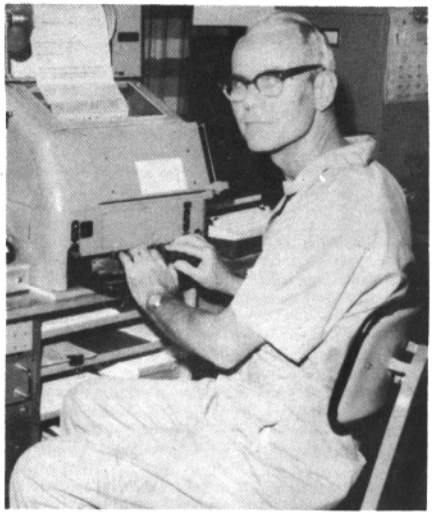


'JEAN' FM7AJ



'REGIS' W4ILE

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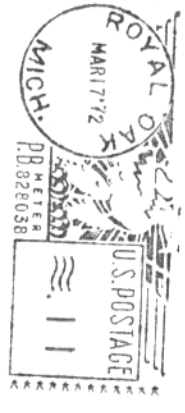


RTTY JOURNAL

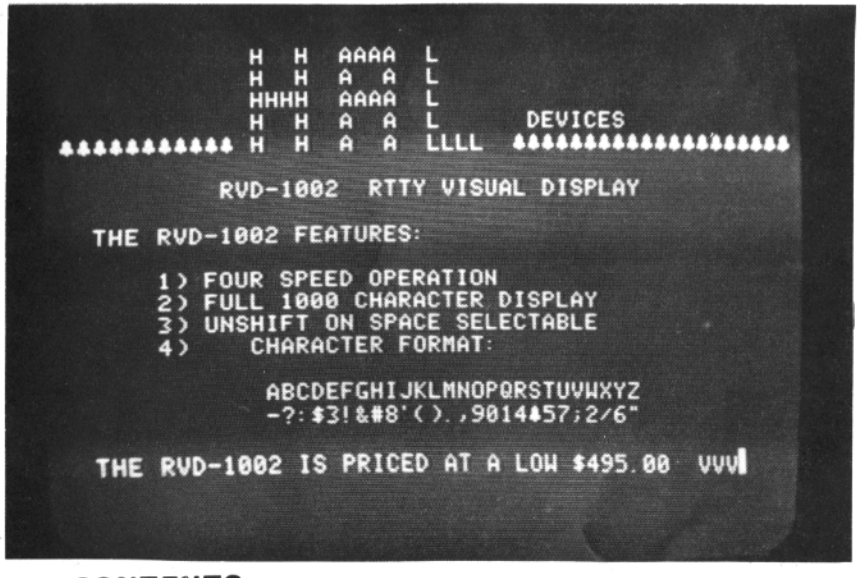
APRIL 1972

EXCLUSIVELY AMATEUR RADIO TELETYPE

VOLUME 20 No. 4 30 Cents

NO MOVING PARTS;--NO NOISE! --
An All Electronic Teletypwriter System

SEE STORY on PAGE 3



CONTENTS

BARTG DX CONTEST

WHEN

0200 GMT Saturday March 25th until 0200 GMT Monday March 27th, 1972.

The total Contest period is 48 hours but not more than 36 hours of operation is permitted. Times spent in listening periods count as operating time. The 12 hour non-operating period can be taken at any time during the Contest, but off-periods may not be less than two hours at a time. Times on and off the air must be summarized on the Log and Score sheets. The Contest is also open to SWL RTTYers.

BANDS

3.5, 7, 14, 21 and 28 Mhz. Amateur Bands.

STATIONS

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.

COUNTRY STATUS

ARRL Countries List, except KL7, KH6 and VO to be considered as separate Countries.

MESSAGES

Messages exchanged will consist of:
(A) Time GMT
(B) Message Number and RST

POINTS

(A) All two-way RTTY contacts with Stations within one's own Country will earn **TWO** points.
(B) All two-way RTTY contacts with Stations outside one's own Country will earn **TEN** points.
(C) All Stations will receive a bonus of 200 points per Country worked including their own. **NOTE** any one Country may be counted again if worked on another Band but Continents are counted once only.

SCORING

(A) Two way exchange points times total Countries worked.
(B) Total Country points times number of Continents worked.
(C) Add (A) and (B) together to obtain your final socre.

Sample Score:
(a) Exchange points (302) x Countries (10) - 3020
(b) Country points (2000) x Continents (3) - 6000
(c) (a) and (b) added to give a score of 9020

LOGS AND SCORE SHEETS

Use one log for each Band and indicate any rest periods. Logs to contain: Band, Time GMT, Message and RST Numbers sent and received and exchange points claimed. **All Logs must be received by May 31st 1972 to qualify.**

AWARDS

Certificates will be awarded to: The leading RTTY Stations and SW Listeners.

The final positions in the Results Table will be valid for entry in the "World Champion of RTTY" Championship.

The Judges decision will be final and no correspondence can be entered into in respect of incorrect or late entries.

Unsportsmanlike operating will be deemed sufficient reason for possible dis-qualification.

Send your Contest Logs to:

Ted Double G8CDW
B.A.R.T.G. Contest Manager
89 Linden Gardens
ENFIELD
Middlesex, England

VOLTA Contest Results- 1971

1)	KZ5LF	177.603	
2)	WA3KEG	114.912	
3)	i1KG	102.358	
4)	VP7NH	88.040	
5)	K3NSS	81.700	
6)	KL7GRF	78.360	
7)	i1CAQ	75.792	
8)	FO8BO	70.725	
9)	DL2AK	66.379	
10)	W3KV	63.844	
11)	W1GKJ	59.736	
12)	WB6SCH	54.540	
13)	i5MPK	47.744	
14)	iT1ZWS	41.223	
15)	DL1VR	40.552	
16)	WB6IMP	39.897	
17)	K5ARH	39.456	
18)	WA0TLT	38.656	
19)	W5EUN	38.605	
20)	G3MWI	35.871	
21)	i1EVK	34.846	
22)	DL8VX	33.929	
23)	VE7UBC	33.488	
24)	DJ8BT	32.572	
25)	F9RC	31.790	
26)	DL0AK	29.986	
27)	W9AE	28.551	
28)	W1KJ1	24.070	
29)	PY2CBS	23.148	
30)	W2VAQ	22.014	
31)	DM2BRN	21.549	
32)	SM0CBC	19.425	
33)	i1LCL	19.030	
34)	iS1AOV	18.690	
35)	WA5LJZ	18.225	
36)	G3OZF	17.469	
37)	W7RSJ	16.590	
38)	UK2FAD	16.566	
39)	SM4CMG	16.250	
41)	VO2AF	14.421	
42)	WO1TU	14.060	
43)	SM3DKL	13.446	
44)	WOHAH	11.772	
45)	ON4CZ	11.648	
46)	JA1FFX	10.946	
47)	W5TZB	10.206	
48)	ZL2ALW	9.420	
49)	JA1ACB	9.276	
50)	HA4KBF	6.636	
51)	EI5BH	5.339	
52)	W8CQ	5.325	
53)	HA5KBF	4.991	
54)	DL8RW	4.900	
55)	WB2JBH	4.576	
56)	VK6PG	4.384	
57)	W6AEE	3.900	
58)	WA6TLA	3.852	
59)	W7RGL	3.519	
60)	i5CW	3.328	
61)	W1BFS	3.060	
62)	OK1MP	2.707	
63)	DL8CX	2.563	
64)	SM0FO	2.562	
65)	OA4BR	2.543	
66)	W7FFY	2.140	
67)	G3LDI	2.010	
68)	PY2CYK	1.912	
69)	PA0/WDW	1.815	
70)	G3IGG	1.771	
71)	i1AMP	1.690	
72)	K9BJM	1.629	
73)	CE3EX	1.350	
74)	ON4WG	1.232	
75)	LX2FD	1.150	
76)	K2RYI	749	
77)	DL3II	715	
78)	WA6WGL	565	
79)	W8TCO	186	
80)	DM3RYA/A	60	
81)	DL2XP	54	

SWL

1)	A.T. MORTON	74.760
2)	KILPS	70.512
3)	PAUL MENADIER	27.216
4)	i3-13.018	48

***

WAE RTTY DX CONTEST

THE 4TH RTTY WAE DX CONTEST- RTTY WAEDC '72

The Deutscher Amateur Radio Club (DARC), the sponsor of the RTTY WAEDC, and the Deutsche Amateur Fernschreib Gruppe (DAFG), the manager of the RTTY WAEDC, have the honour to invite RTTY amateurs all over the world to participate in the 4th RTTY WAE DX Contest 1972. This contest is always held on the last weekend of April.

1. CONTEST PERIOD:
April 29, 0000 GMT to April 30, 2400 GMT (cf. also 5.: rest period).

2. CONTEST CALL:
CQ WAE de . . .

3. BANDS:
All bands 3.5 thru 28 MHz.

4. CLASSIFICATIONS:
Single operator, single transmitter - Multi operator, single transmitter.

CONTINUED ON PAGE 17

ELECTRONIC TELETYPWRITER SYSTEM

TOM KNECH, K9LUG
806 South Birch St.
URBANA, ILL. 61801

Teletype without gears, motors, paper, ink or noise--sounds like a RTTY man's dream. Impossible? Not at all. In fact, a completely electronic teletype system could have been built back in the days of the vacuum tube, but the size and cost would have been overwhelming. Now, thanks to recent advances in integrated circuits and the ingenuity of a small group of amateurs and engineers, a fully electronic terminal is available at about the same cost as used conventional gear.

If you've ever visited a computer installation, you've probably cast longing glances at the video display terminals the operators use to communicate with the big brain. Instead of printing on paper, these terminals display characters on a CRT screen. They're not uncommon where the hardware budget runs to five or six figures. Until now, though, they've been beyond the budgets of all but the wealthiest amateurs, and most are not compatible with amateur RTTY standards.

The system shown in Figure 1 is similar to the computer terminals. It's a complete, all-electronic teletype terminal specially designed for the needs of the amateur RTTY operator. It consists of two packages: a visual display system to decode the incoming signal and "print" the characters on the screen of a video monitor, and an all solid-state keyboard, which generates teletype code for transmission.

An electronic terminal offers many advantages. In addition to eliminating all moving parts, along with their noise and maintenance problems, this modern approach to RTTY offers economy and convenience that just can't be achieved with conventional machines. For example, you can select any of the four standard operating speeds with a front panel switch. And, of course, you can monitor nets and conduct QSO's without piling up reams of paper behind your operating desk.

It's hardly necessary to say that hard-copy printers have their place, too. With autostart and selective calling, they can operate unattended for long periods. Traffic handlers would find it hard to get along without printed or punched copy. But the electronic terminal can add a great deal of flexibility to elaborate setups as well as provide a complete, compact package for the more casual RTTY operator.

Visual Display System

Whenever the electronic teletype terminal is demonstrated, the visual display

Figure 1: The Electronic Teletype

catches everyone's attention first. It takes the RTTY signal from a terminal unit, stores up to 1,000 characters, and displays them on the screen of a video monitor (or a slightly modified television receiver). Each 1,000-word "page" contains 20 lines of 50 characters each.

The first incoming characters are displayed across the bottom line of the screen. When that line is filled, an automatic line-feed shifts the displayed characters up one line, just as in hard-copy printers. The bottom line is then filled again from left to right as new characters come in. The process is repeated each time the bottom line is filled; when all 20 lines are full, the next line-feed causes the top line to be deleted. Therefore, the most recent input plus the preceding 950 characters are displayed at all times. The display also responds to incoming line-feed codes as well; thus a string of 72 characters will be displayed as one full line of 50 characters, and a line of 22 characters.

Individual characters are produced by matrixes of dots on the screen, with one 5-by-7 dot matrix for each character. The system logic stores each incoming teletype character and converts it to a special "dot" code. During the scanning of the monitor screen, the dot code for each character is fed to the video circuits at the proper instant, so that the dots required to reproduce that character are brightened, as shown in Figure 2. The display is "refreshed" 60 times per second (once for each complete scan of the screen) by recycling the contents of the internal memory. A block diagram of the system is shown in Figure 3.

Three recent developments in large-scale integrated circuitry have made it possible to shrink the size and parts count of the system. The first problem the designers faced was to come up with a compact and economical means of storing the incoming teletype code for all 1,000 characters. Six dynamic shift registers, each capable of storing 1,024 data bits, provided the answer. Incoming data pulses are first converted from serial to parallel form in the input circuitry. Then the parallel data is entered into the six shift registers, which together constitute the "page" memory.

Six smaller static shift registers, each capable of storing 50 bits of data, make up the line memory. Every time a line of characters is to be produced, the codes for those fifty characters are transferred from the page memory to the line memory. Its contents are fed to a character converter, which determines the pattern of dots needed to display each character in the line.

Converting from teletype code to the special dot code presented the designers with a second problem. A read-only memory (ROM) integrated circuit, factory programmed with the dot pattern for 64 alpha-numeric characters and punctuation marks, solved this one. When the teletype code for a character, along with various control codes, is supplied to the memory, the dot pattern needed to reproduce the character is fed out at the correct moment. Ten of the 64 characters corresponding to control codes (line feed, carriage return, etc.) are not displayed.

The dot code, however, must still be transformed into a composite video signal to drive the monitor. The recent development of another large-scale IC simplified this task. The IC, when supplied with a signal from an external timing oscillator, provides all the required synchronization and blanking signals. Its output and the dot code from the ROM are mixed in a video combiner, amplified, and fed to the external video monitor.

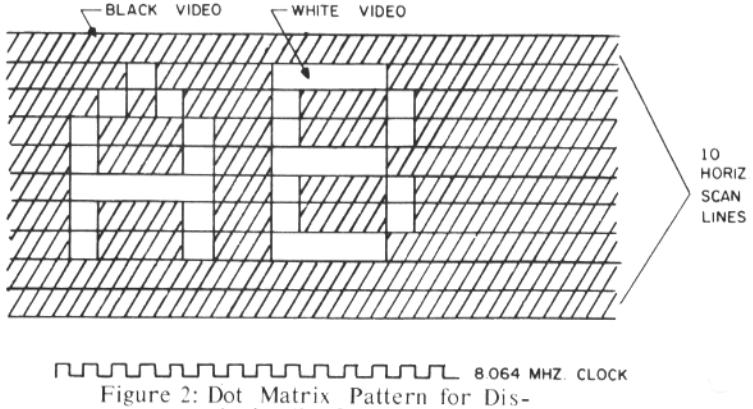


Figure 2: Dot Matrix Pattern for Displaying the Characters A and B

As you have probably guessed by now, the timing and control circuits that synchronize the system's operation are rather complex. There's not enough space here to describe them in detail, but some of the features are worth mentioning. In addition to the front-panel switch which selects one of the four operating speeds (60, 66, 75 and 100 WPM), there are buttons which allow the operator to manually insert extra line-feeds and to shift to letters case. There's also a button for selecting the unshift-on-space mode, so that the display automatically returns to letters case whenever a space character is received.

The entire visual display system (except the monitor itself) is built, believe it or not, on five 3-by-6 inch printed circuit cards housed in a cabinet occupying less than half a cubic foot and weighing about ten pounds!

Like any type of printer, the visual display performs best when driven from a high-quality TU. Therefore, its input was designed for compatibility with the Mainline ST-6 terminal unit, although other types can be modified to drive it.

Electronic Keyboard

The second half of the electronic terminal is the solid-state keyboard. Although it usually doesn't attract as much attention as the display at first, those who try it find it has some very convenient features.

Of course, the concept of an electronic keyboard isn't new. Several amateurs have designed successful keyboards to generate Morse code, and at least two have come up with versions for teletype. 1, 2

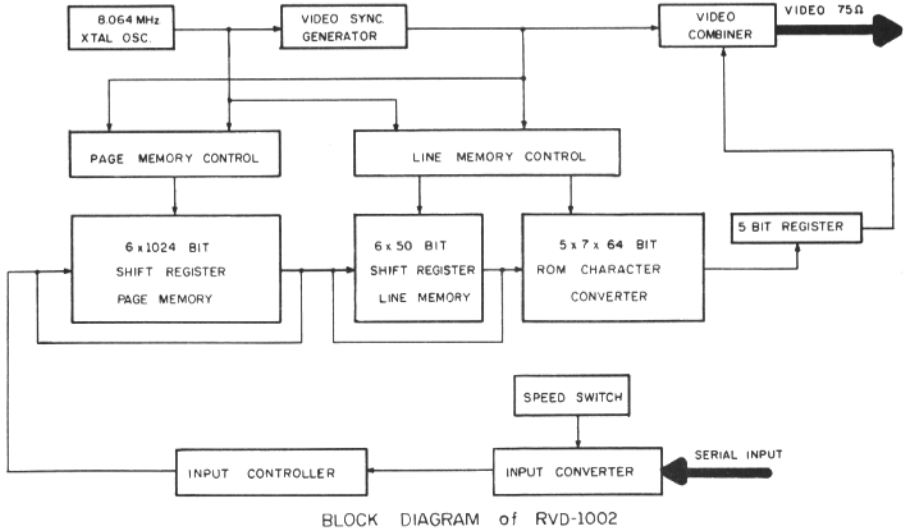
The keyboard designed for the electronic terminal was inspired by a code typer, the Touchcoder II, developed by J.A. Bryant. 3 Like Bryant's unit, it uses integrated circuits and toroidal-core transformers. But to make teletyping simpler, some unique features were added.

The most notable of these is an automatic numbers-shift/letters-shift circuit. The keys are laid out just like those on a modern typewriter. To type numbers, you don't need to shift to figures case. You just press the key of the figure you want to send and the circuit generates the shift code automatically before it sends the character. Likewise, if you've been typing in figures case and then press a letter key, the letters-shift code is sent automatically.

A repeat key is included, too. If you want to send a character repetitively, all you do is hold down the character key and the repeat key at the same time. And, as with the visual display system, you can choose any of the four operating speeds with a front-panel switch.

Keyboard Circuitry

The basic character-generating cir-



BLOCK DIAGRAM of RVD-1002
FIGURE 3

cuit in the teletype keyboard is simpler than that in the Touchcoder II because, unlike Morse code, teletype pulses are all of equal length (except the stop pulse) and all characters have the same number of pulses.

As the block diagram (Figure 4) shows, the proper combination of marks and spaces is loaded into the second through sixth flip-flops of an six-bit shift register by toroids driven from the keyboard switches. The toroids simply serve as pulse transformers to isolate the keyboard contacts from each other. They take the place of the more costly diode matrixes used in some keyboard designs. The first flip-flop in the register is permanently wired for a space code, since the start pulse for eacn character is a space. Two mark codes are inserted at the end of the 6 bit data entered in the shift register to establish a stop pulse, which must be longer than the rest of the select pulses.

After a key has been pressed and the code loaded into the shift register, an internal clock oscillator starts. Since this process takes only a few microseconds, there is virtually no delay between the pressing of a key and the generation of the first output pulse. The clock output steps the shift register so that the character code is shifted out, one pulse at a time, into a circuit which keys a second oscillator. Its putput signal is fed through a special isolation transformer, rectified, and applied to the base of the loop keying transistor. Since this transistor is effectively isolated from ground and from the keyboard power supplies, it can be inserted at any convenient place in the station's loop circuit.

An automatic identifier is optional on the keyboard. When the "ID" key is pushed, a counter and decoder circuit starts, electronically "pulling down" in proper sequence the keys corresponding to the station call letters.

Except for those components mounted on the keyboard switch assembly, and the automatic identifier, all circuits including the power supply are contained on one 3-by-6 inch circuit card. The entire keyboard unit takes up less than one quarter of a cubic foot and weighs about 7 pounds.

Any way you look at it, the all-electronic teletype system is an innovation. It brings some of the newes products of the semiconductor industry to the RTTY shack. And it provide: a very attractive aiternative for thos RTTY operators who would like to ge

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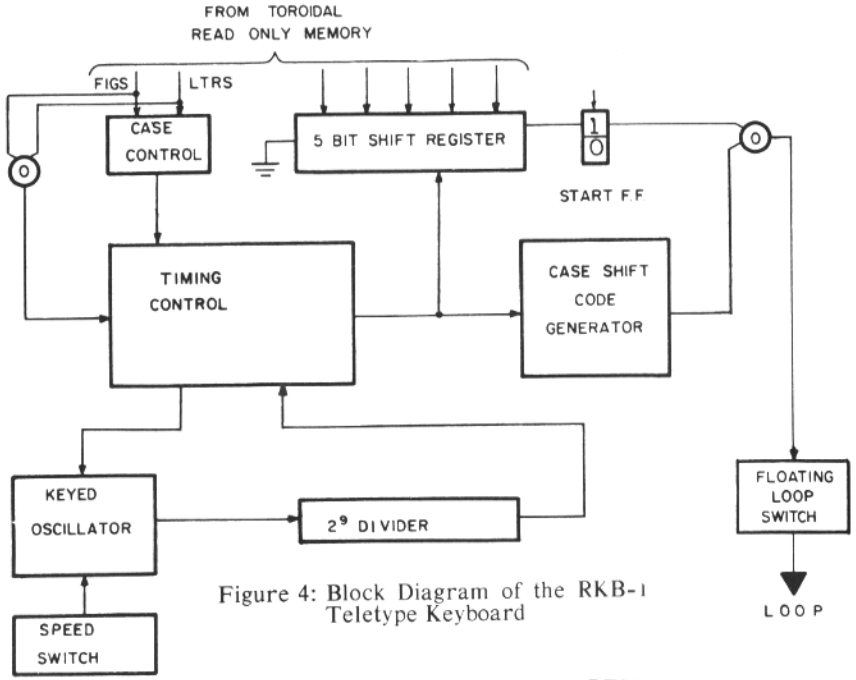

Figure 4: Block Diagram of the RKB-1 Teletype Keyboard

EVOLUTION of AFSK -

FRANK GREENE, K5IQL
303 South C St.
YALE, OKLA. 74085

When AFSK was limited to the VHF bands, it took the role of a simple gadget. So long as the tones were tuned to the proper frequency, whatever other faults they might possess really didn't matter that much. The modulated sidebands were but a fraction of the total output - so, unequal amplitude of Mark and Space were unimportant.

Then, owners of SSB rigs began using the tone generator; feeding it into the microphones or phone-patch jack. If carrier suppression and sideband rejection were good enough, it came out FSK. Now, through the normal processes of frequency conversion, the audio tone becomes the final carrier. Its quality, stability and amplitude all have a direct bearing on the total transmitter output.

Other steps in the progress of Amateur RTTY continue to complicate the job. Multiple shifts, narrow-shift ID and, finally, Solid State. AFSK became a whole new ball game - to coin a phrase.

For several valid reasons, the LC type of oscillator is out. Unfortunately, the choice of RC circuits with good stability and waveform is not wide. Our quest for an acceptable circuit is the subject of this essay.

In 1969, Irv Hoff published the AK-1; a modification of a unit by K3NIO. The AK-1 has been quite popular-especially with the boys on the autostart nets. Designed around the Unijunction transistor, the fundamental frequency is divided in a flipflop and the resultant square wave is smoothed through a low-pass filter. The writer took a dim view of such a circuitous route. Besides, we couldn't scrounge a unijunction.

QST, in the September 1969 issue, featured "A Simple Two-transistor AFSK Generator". It was extremely simple. Battery powered. But it had merit. The Twin-T phase-shift circuit appealed to us - so, we built one. (regulated power supply, of course) After the usual problems one finds in building from a magazine article, it performed nicely.

We planned to utilize this unit both on VHF and with the SSB rig on the low bands. However, modifying the KWS-1 for an offset xtal proved to be a major operation. Since we needed both wide and narrow shifts, the solution was to construct another unit with suitable lower tones which would pass the sideband filter. A desire to make it a bit more sophisticated led us to an exhaustive series of experiments.

An elaborate breadboard arrangement was set up. Sockets for the transistors for easy comparison of types. Each resistor (except those in the bridge) was made variable. Capacitors of various values were substituted; and the effects noted on scope, meter and frequency counter.

The first major change was gleaned from the GE Transistor Manual, Seventh edition. Their example utilizes 2 transistors in an emitter-follower configuration. Results were great! Large increase in gain; and frequency became almost completely independent of voltage change. Another benefit which should appeal to those of us who build with surplus and salvaged semiconductors: Almost anything which looked like a transistor would oscillate.

The normal emitter-follower output stage was added with little change. We did bypass the collector for audio. Next, the keying method was studied. The original QST unit was designed for 'dry' contact keying. Drivers, such as the "Mainline Floating Loop" which, provide a positive pulse for Space and Negative for Mark may not be used. So, we borrowed the switching circuit from the AK-1. Notes will be given on how to adapt this to any system.

PARTS AND CONSTRUCTION

Q1, 2, 3 and 4 are all NPN. Silicon is preferred but none is critical in this configuration. Germanium audio and switching types worked quite well.

Q5 is PNP and the only one which might be considered critical. Germanium is selected because of the lower voltage drop. Choose one designed for switching - such as the 2N404. We did find some unmarked units on Stelma cards which showed lower leakage than the 2N404.

DIODES: D1 is the shift diode. When it conducts (on Space), the resistance of R2-a is paralleled with R2. In the original QST circuit this diode proved critical. Any substitution created problems. Apparently the varicap and varactor properties (which all diodes exhibit) was responsible. Happily, we discovered

that the addition of a second diode in series (D2) cured the problem. All diodes may be GP silicon but, good, 'computer' types won't hurt.

(*) D4: This is an "option" - as is the resistor shown in dotted lines at the trigger input. The type of driver used will determine if it should be used or not. If the generator is to be used with a driver which applies both positive and negative pulses, such as the "Mainline" floating loop, the diode should be included; and the resistor omitted. On the other hand, if you use 'dry' contacts (polar relay, magnetic-reed or -shun the thought- keyboard contacts with no current through them). The diode may be omitted; and a 22K resistor connected to the 12-volt source. Obviously, if both diode and resistor are included, the unit may be used with any system.

The switching action is trigger-like. Less than 1 volt pos. will trigger it.

THE BRIDGE OR "TWIN-T": This phase-shift network is the heart of the oscillator. All capacitors associated should be stable types such as mica or Mylar. Separate sets of values are listed for your choice of tone ranges: 2125 to 2975; and 1275 and 2125. Five components are involved in the change. Capacitor C2 remains the same.

RESISTORS: Those in the Bridge are the only critical values. Close-tolerance units should be chosen although, in tests, a deliberate mismatch of 10% was not serious. Most are ball-park values. The bias resistor on Q3 is shown as 270K. This may result in negative-peak clipping with some transistors. Reduce it to 180K if this occurs.

ZENER DIODE: This provides adequate regulation for the oscillator and shifting switch. We chose a 10-volt 1-watt unit which checked out to be 9.4 volts. Any value from 8 to 12 volts will serve. The supply voltage should be slightly higher. The 150-ohm dropping resistor should be adjusted for a total drain around 20 ma. This will put the Zener well up on the 'knee'.

SHIFT NETWORK: Two preset legs are shown on the diagram, with a switch for selection. If the builder does not desire multiple shift, the circuit may be simplified accordingly. If a shift-

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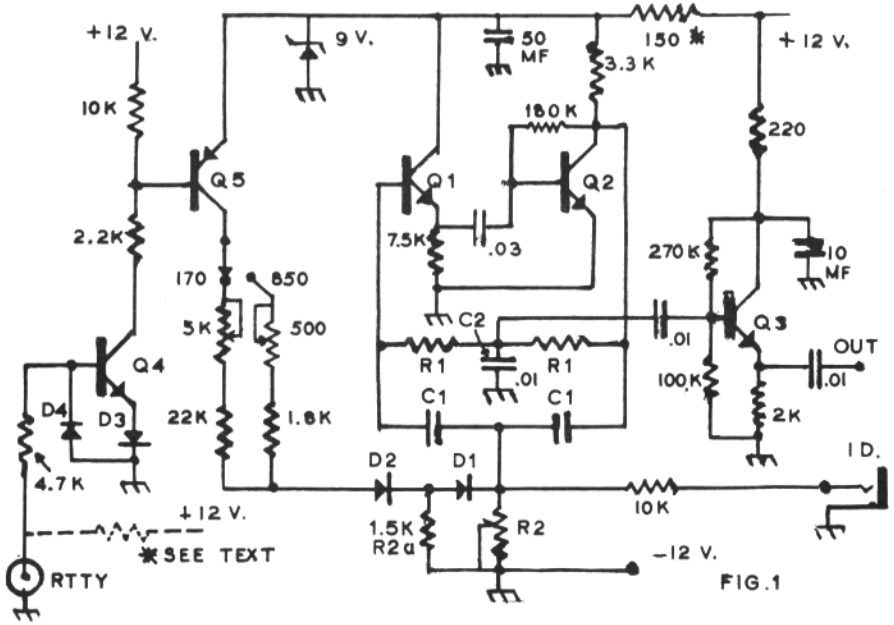

FIG.1

COMPONENT VALUES OF THE TWIN-T BRIDGE

Item	Std. tones, 2125 to 2975	Low, 1275 to 2125
R1 (2 req.)	20 K ohms	30 to 33 K ohms
R2(adjust to Mark)	2.5 K	appr. 12 K (adj)
C1 (2 req.)	.005 mfd	.0056 mfd
C2	.01 mfd	.01 mfd

OSCAR 6 & RTTY

PART 3

ELMER MOORING, W3CIX
9318 Millbrook Rd.
Ellicott City, MD 21043

MORSE CODE TELEMETRY

This month's column is devoted to the Morse Code Telemetry system which will be included in the AO-C amateur satellite scheduled for launch this summer. Although the telemetry can be copied by hand (or tape recorded) this is an excellent opportunity for the design oriented RTTY enthusiast to experiment with direct CW-to-RTTY conversion systems. The hardware necessary for converting AO-C Telemetry to RTTY should be much simpler than the systems designed for general CW decoding (see References). All transmitted data are numbers; thus, each CW character is easily decoded as a logical code. The dot, dash, and space times are accurately controlled (within 5%) which eliminates problems of accommodating various fists, speeds, and weighting. Anyone wishing to experiment with Telemetry-RTTY conversion schemes is encouraged to write the author for further details.

TELEMETRY FORMAT

The CW Morse code telemetry is accurately controlled at 10 or 20 WPM (selectable by ground command), with standard character spacing; i.e., a dash is three dot lengths, element spacing is one dot length, character spacing is three dot lengths, and word spacing is seven dot lengths. Each telemetry word is a three digit number, with the first digit being an identifier and the remaining two digits the value of the function. As shown in Figure 1, telemetry data are transmitted as 6 lines of 4 numbers per line (24 channels of data). The first channel is preceded by the familiar OSCAR greeting HI HI in Morse Code.

The 24 telemetry channels are assigned to monitor such functions as: solar panel charging currents, battery voltage and current, various temperatures, transmitter power, and receiver AGC. The measured value of each function is converted to a number from 00 to 99 and transmitted in the telemetered message. The conversion equations or table will be presented in a future column to enable the receiving stations to convert these numbers back into engineering units of voltage, current, etc. The raw data as received should be relayed to AMSAT for computer processing.

HI	HI		
1 XX	1 XX	1 XX	1 XX
2 XX	2 XX	2 XX	2 XX
3 XX	3 XX	3 XX	3 XX
4 XX	4 XX	4 XX	4 XX
5 XX	5 XX	5 XX	5 XX
6 XX	6 XX	6 XX	6 XX
HI	HI		
1 XX	1 XX . . .		
	(Repeats)		

Note: XX - Number from 00 to 99 to indicate function value for that channel.

Figure 1
MORSE CODE TELEMETRY FORMAT

A reminder that these data are of utmost importance to AMSAT to enable most efficient use of the spacecraft so the one year lifetime can be realized from the satellite. In the past, some data were not relayed because the receiving station did not copy the whole message. Even portions of the data are valuable and might be just the data needed to make the proper control decisions. Just include date and time received and your QTH and forward to AMSAT. RTTY traffic nets are ideal for relaying these data.

REFERENCES:

1. Clarence Gonzales, W7CUU & Richard Vogler, K7KFA, "Automatic Radiotelegraph Translator and Transcriber", HAM RADIO, November, 1971.
2. Raymond C. Petit, W7GHM/4, "The Morse-A-Verter", QST, January, 1971.

***

Auto-start Legality-

Kermit Slobb forwarded us a letter from ARRL General Counsel Robert Booth, Jr. W3PS. The letter states that after checking with the FCC, auto-start operation of a RTTY station was legal. This has been going on for years but it is nice to know, in this case at least, that we are legal.

***

Since we are now publishing only 10 issues a year the May-June issue and the July-August issues will be combined.

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RTTY theory & applications.

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

Gears and Things

This month, we will discuss the consequences of the Baudot code as related to machine operating speeds.

Unlike the code used for hand-keyed telegraphy with its variable-length characters, the Baudot code used with amateur printing telegraphy (Teletype) has a fixed-length format; i.e., all characters, be they the letter E or the letter Y, are of the same length. This fixed-length format is related to operating speeds within the machines.

Teleprinters, when arranged to communicate with each other, are connected in a series circuit called a loop. That is, the keyboard contacts and the selector magnets are in series. Power is supplied to this series circuit by means of a dc power supply of at least 130 volts. A resistor is inserted into the loop to at least 130 volts. A resistor is inserted into the loop to limit the current to 60 mA.

A character is sent by depressing a key on the keyboard. When the key is depressed, contacts within the machine open and close in a predetermined pattern at a fixed rate. (See last month's column or any of the RTTY handbooks for the code format.)

The actual character is composed of five time intervals during which the circuit is either open or closed. The condition when no current is flowing (contacts open) is referred to as a Space (S). When current is flowing, it is called a Mark (M). Each M or S is approximately 22 milliseconds (ms) long. Each character is preceeded by a Space, called the Start pulse. Each character is followed by a Mark, called the Stop pulse.

With Bell System machines running at so called "60 Speed", the Stop pulse is 31 ms long. The Start pulse and the five character elements are 22 ms long. Therefore, it takes 163 ms for every character. A "word" is defined as 5 characters and a character space. Therefore, it takes 6 times 163 ms or 978 ms (0.978 seconds) for one word. The number of words per minute is 60 (1 minute equals 60 seconds) divided by 0.978 which equals approximately 61.3 words per minute (WPM). Therefore, a Bell System teleprinter operating at its maximum speed will print 61.3 words per minute; this is called "60 Speed" operation.

With Western Union machines, the code is the same as for Bell System machines (the only difference being that the apostrophe and bell are interchanged). However, the Stop pulse is only 22 ms long with a Western Union machine (vs. 31 ms with a Bell System machine). Therefore, a W.U. machine character takes 7 times 22 ms equals 154 ms. A word takes 6 times 154 ms equals 924 ms or 0.924 seconds. Dividing 60 (seconds per minute) by 0.924 gives 65 words per minute.

In spite of the different operating speeds in words per minute, the **two machines are perfectly compatible.**

The next item to consider is the speed at which various things within a teleprinter operate.

In the U.S., commercial ac power is generated at exactly 60 Hz. Therefore, an 1800 RPM synchronous motor will operate at exactly 1800 RPM. Ditto for a 3600 RPM synchronous motor.

Because the transmitting shaft (the keyboard shaft), the receiving shaft (the selector shaft), and the motor are geared, they must always revolve at constant **relative** speeds. So long as a synchronous motor is used, they also rotate at constant **absolute** speeds. Because gears must have an integral (whole) number of teeth, only certain speed ratios are allowed. One revolution on the transmitting (keyboard) shaft corresponds to one character. If you lift the lock loop on the transmitting shaft or depress the repeat key, the machine will continuously transmit a character at machine speed. On a Bell System machine, one character takes approximately 0.163 seconds; therefore, the transmitting shaft should rotate at 1/0.163 revolutions per second or 60/0.163 RPM which equals 368.1 RPM. Assuming that the motor is a synchronous motor operating at 1800 RPM, the gear ratio from the motor to the transmitting shaft must be close to 1800/368.1. The closest integral ratio is 1800/367.5 which is 30/7 times 24/21; 367.5 RPM is 367.5 characters/minute which equals exactly 61.25 WPM. (The reason for a double ratio such as 30/7 times 24/21 will be explained later; it is related to the mechanical power train sequence within a machine.)

On the Western Union machines, the ratio desired is 60/0.154 or 389.61 RPM. The closest gear ratio to 1800/389.61 is 30/7 times 13/12. Therefore, with a motor speed fixed at 1800 RPM exactly, the transmitting shaft will revolve at 387.6923077 RPM which will give a speed of 387.6923077 characters/minute or 64.61538 WPM or Mark and Space time intervals of 22.10884 ms.

When receiving a RTTY signal, the receiving shaft operates continuously. However, the "decoding" mechanism on that shaft does not run until the Start pulse is received; the mechanism on the receiving shaft then rotates until the code elements have been received. Because the receiving cam does not have to rotate for the entire character interval, but only during the start pulse and the five intervals that contain the character code, the receiving shaft can run faster than the transmitting shaft.

There is a subtlety involved here. If the two machines are not running at exactly the same speed, then the receiving shafts must run faster than the transmitting shafts. If they did not, the receiving machine that was running slower would fall behind. Machines had to be designed to run at slightly different speeds because when the machines were first designed and built, governor-controlled motors had to be used because either only dc power was commercially available or the commercially available ac power was not frequency stable. (This leads into a long, perhaps interesting, discussion about electric clocks, synchronous converters, constant voltage transformers, etc.) Also, if machines are operating at exactly the same speeds, and the transmitting and receiving shafts are also operating at the same speeds, and one machine gets out of step with the other, they can never get back into step. However, if the receiving shaft is running faster than the transmitting shaft and stops at the end of each character, then if they get out of step, they can resynchronize within a few characters.

Anyway, the receiving shaft has to run faster than the transmitting shaft. The receiving shafts in both Western Union and Bell System machines run at exactly 420 RPM. With an 1800 RPM synchronous motor, a gear (actually a pinion-gear combination) ratio of 30/7 will give exactly 420 RPM from 1800 RPM. Not only do W.U. and Bell machine receiving shafts run at the same speeds, but the **selector mechanisms are identical.** Hence, the machines are perfectly compatible because their selectors are identical!

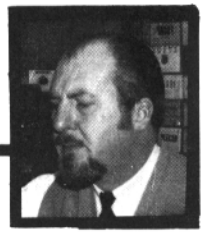
One further note on the gear ratios. Within a TTY machine such as the Model 14 and 15, the motor drives the receiving shaft. For "60 speed" (61.25 WPM, Bell; 65 WPM, W.U.), the receiving shaft must run at 420 RPM. Therefore a gear ratio of 30/7 is always used between an 1800 RPM synchronous motor and the selector shaft. The transmitting shaft is run from the receiving shaft. (A jack shaft may be used between the receiving shaft and transmitting shaft.) The gear ratio between the receiving shaft and the transmitting shaft is fixed dependent upon whether the transmitting shaft has a 7-unit cam for W.U. format or a 7.42-unit cam for Bell format. The ratio is 39/36 on a W.U. machine and 24/21 on a Bell machine. With a Model 28 for Bell System operation, the 3600 RPM motor has a 14-tooth pinion driving a 96-tooth gear on a jack shaft. The jack shaft has a 48-tooth gear which drives a 60-tooth gear on the selector shaft. This combination gives a 60/7 ratio which results in a selector shaft speed of exactly 420 RPM from the 3600 RPM motor. The selector to keyboard shaft gear ratio is the same 24/21 as on Bell System Model 14 and 15.

Because the gear ratio between the receiving shaft and the transmitting shaft is set according to the cam format on the transmitting shaft, these gears should never be changed. However, if the motor speed or operating speed is to be changed, then the gear ratio between the motor and the receiving shaft is to be changed.

When changing speeds while still using the Baudot code, only the motor or selector shaft speed is to be increased because the transmitting shaft speed will change accordingly. However, a sad fact of life is that essentially no one except amateurs are using the Baudot code. Commercial operation is now at 100 or 150 WPM. You cannot speed up your machine to 100 or 150

CONTINUED ON PAGE 19

RTTY-DX



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

Hello there. . .

The big event since our last meeting was the unique "Giant Flash Contest" It is unique in that it covers an eight hour operating period for each of two sessions and the two sessions are staggered to allow for any handicap in various areas of the world due to propagation conditions. Although we missed the first session we were able to make the second and we would like to pass on a few observations. The activity was excellent and in the period which we operated we found conditions on 10, 15, and 20 in very good shape. Had we the opportunity to take part in the first part 40 and 80 meters would have been the bands to use with the higher frequences just about coming in as the first session ended. That would have been the picture from the East coast USA anyway. We also noticed that it does pay off to operate through the entire eight hour period. Although Continents do not count as a multiplier in this Contest we found the last half hour the most exciting with Gin, Ja1ACB blasting through on 10 and 15 and in the final ten minutes of the Contest Ed, 9J2ED showed up on 15 after having some "Murphy" problems earlier. In effect, sticking out the whole eight hours allowed us to make WAC which on RTTY is not too bad for an eight hour period. To newcomers to RTTY Contests we can really say that high power is not the answer to high scores. Possibly we could say that having the TU and machine in top condition, a fairly good antenna system, a knowledge of propagation conditions from your location to other areas of the world, narrow shift capabilities to allow full use of sharp receiver selectivity, and an iron bottom, in that order of precedence.

The highlight of the Contest was the operation from HV3SJ by Tony, IOJX and Paul, I1PEP at the Vatican for an RTTY "first". It seems that they were active on all bands for both Contest periods and we hear that they will again be QRV from this location for the BARTG Contest the latter part of March. QSL's go to .... Antonio Vernucci
via Lanciani 30
00162 Rome, Italy

Another rare country was active for a bit from this same area shortly before the Contest and that was M1I in San Marino. Not too much information on this one but if you did work him send QSL's via I1BNZ.

Jay, VP8ME on South Orkney has been very punctual at 0300z on Fridays in his skeds with W5EUN and W5QCH on 14080 khz and after traffic is completed he will QSO anyone else on the frequency. He sends at 50 baud and a 425 hz shift inverted but he receives our standard wide shift ok and 45 baud seems to be no problem. In this area he is in and out real fast due to conditions at that time and we will eventually try to get him to come down to RTTY at a later hour to work into other areas of the world. There was an error in his QSL managers QTH as listed previously. The correct QSL information for VP8ME is as follows.

Gary Pannell, WA5FWC
2013 Melissa St.
Arlington, Texas 76010.

Things are really looking up in the Pacific area. George, VK9GG, should be QRV toward the end of April and Fred, YBØAAO and DJ8RR have already sent a TU and machine to Olaf, VK9JV. So RTTY activity from the rare Territory of New Guinea should not be long in coming.

For those looking for Guam, KG6JGM was active during the Flash Contest and word has been passed that KG6JBG is also QRV. Jerry, KS6DH, American Samoa, has a TU and a machine and it is just a matter of time before he will be sending. The forecast is the end of March. KC6BW on Ponape is very interested in the mysteries of RTTY and Paul, KH6AG has sent him lots of information on the subject which will possibly bear fruit in the future. The same may be said for KC6CD/KX6 on Majuro.

Paul has told us that he received an alert for his return trip to the Central Pacific so he may be active from this area again sooner than expected. It would be best to listen on 14 mhz for QST tapes that will give the latest information on this DX-pedition.

Two new stations are QRV from the Ryukyu Islands, KR6SW and KR6JP. The former was active in the Contest as we heard stations calling him.

Japan is really getting into RTTY in a big way and Gin, JA1ACB passes along some info of stations currently active. They include JA1FFX, JA1EUL, JA1ADN, JH1ISF, JR1CFP, JA7UZ, JA1ZZ, and JA1MP. The JH and JR prefix is still in Japan proper but a good catch for the WPX hunters. Gin has been working into the West Coast USA on 80 Meters and advises that 3790 khz is about the only clear spot on his end. Time is about 0800-1300z. UA9PP is QRT at the moment but hopes to be back soon.

Bob, YA1OS continues to be active and looking for "W" contacts at around 1200-1300z on 20 and 15 meters. We are informed that he does have a QSL manager that gives fast service so it may be best to QSL via SM5BGK as follows.

Gary Wilkstrom
Orrstigen 36
15024 Ronninge, Sweden

Incidentally, when at home Bob signs SMØOS.

From Africa Wil, CR6IK sends word that the Model 15 consigned to him through the efforts of Ray, W8CNL has arrived in Angola and should be in his hands by this time. It should not be too long before he will be quite active along with his XYL, CR6YY.

Via Frank, 9Y4VU we hear that Rudolph, PZ1RK is now QRT and back in Guyana under his permanent call of 8R1W and there is an excellent possibility that he will soon be active from here with this call.

Bob, HI8XRM, has been having QSL manager problems and promises to get caught up soon. If you had sent a QSL via the manager as previously listed and have not received a QSL Bob asks you to QSL to him direct and you will get an immediate reply. The QTH is as follows and a SASE and IRC's are requested ...

Bob Meyer
P.O. Box 385
Santo Domingo, Dominican Rep.

KG4FK has been active from Guantanamo Bay, Cuba to revive a prefix and rare country that has been dormant for a long time.

Congratulations are extended to the following stations for making WAC RTTY.

Nr. 183 Gabriel Fuentes III KP4BJD
Nr. 184 Bob Sitterley W6BTV

In addition to credits as noted we wish to thank the following for their valued contributions ... SMØOY, WA2-YVK, WA3IKK, W5EUN, W5QCH, and Sandy Morton of Scotland.

73 de John

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HEATH 220 FINAL for RTTY

Irvin M. Hoff W6FFC
12130 Foothill Lane
Los Altos Hills, Calif. 94022

I recently wrote the Heath Company regarding the new SB-220 linear amplifier. This unit has two Eimac 3-500Z tubes and is rated at 2 Kw p.e.p. with RTTY capacity of 1 Kw. for up to ten minutes. It was that "10 minutes" that interested me, so here is the Heath Company's answer:

Dear Irv,

Your letter concerning the new SB-220 linear amplifier has been referred to me for reply.

The limiting factor determining the RTTY duty cycle is definitely the power supply. Heating of the tank coil and switches is rapid and has stabilized well before the specified ten minute interval.

The duty cycle specification for the SB-220 was determined somewhat arbitrarily and is considered to be quite conservative. The power transformer heat rise is measured under EIA continuous duty conditions at 125 volts 50 Hz. input. The conversion of this transformer specification into intermittent service with 60 Hz. input frequency is not easily definable. Therefore, we decided to be on the safe side and specify the SB-220 accordingly.

While the output power of a DX-60 (about 60 watts) is only about half the specificed input required for a SB-220, I would expect it to drive the SB-220 to nearly 70% of its rating. This is possible because the amplifier is actually voltage driven which is naturally not a linear function with driving power. Either plate voltage (high or low) position of the amplifier may be used but more output should be obtained in the higher voltage position....

Very truly yours,
(THE HEATH COMPANY)

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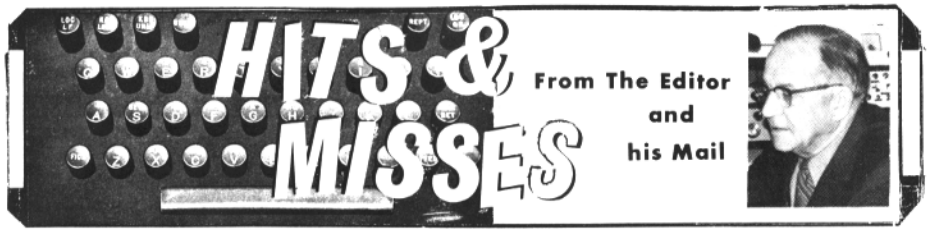

The Dayton Hamfest - April 21-22, is almost here again. Will we see you at the RTTY JOURNAL suite in the Sheraton Dayton Hotel? Look for us in 909-910, if the hotel goofs up our reservation look on the bulletin board. Our wine making efforts were a complete failure but we will have Kentucky Kool Ade on tap for those with a dry throat from talking too much. Room will be open from about 5 p.m. Friday until the wee hours and again Saturday evening. We usually eat about 7 p.m. Friday evening so if the gang is missing hang around. Both John, W3KV and Ron, W8BBB our fearless column editors will be on hand to handle complaints while the editor keeps things lubricated.

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We get requests from time to time regarding information on any RTTY nets that might be in operation. Frankly we have no definite information on any but believe there are several in operation. If someone will send us the data as to time, frequency and areas covered we will be happy to print the information.

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Effective with the June issue we have been forced to increase our Air Mail rate for European subscriptions to $6. per year. The postage alone for a year figures out at $4.20 leaving us only $1.80 for the magazine. This is still less than we get from domestic subscriptions. The $3.50 surface mail rate will remain the same.

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Just as we go to press we heard of the sudden death of Fred W. DeMotte, W4RWM. Fred was the secretary-treasurer of the Florida RTTY society since its beginning in 1959. He was probably better known around the country as the publisher of the RTTY BULLETIN which he edited and printed since its beginning.

Although we had never met Fred personally we join with a host of others in saluting his untiring efforts and faithfulness to the RTTY fraternity.

RTTY JOURNAL BINDERS-

RTTY JOURNAL Binders - Red with gold lettering are available at $3.00 ea. Canada $3.50. We regret custom regulations make it impractical to ship to other countries.

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BACK ISSUES-

New subscriptions and classified ads are cash in advance as we have no method of 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. If available, back issues may be ordered at 30¢ each at time of subscription. The Journal is mailed about the 20th of the month preceding the dated month.

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1968-March, May, Sept. (3)
1969-Oct., Nov., Dec. (3)
1970-None
1971-Jan., May, June, July, Sept., Oct., Nov., Dec. (8)
1972-Jan., Feb. Mar.

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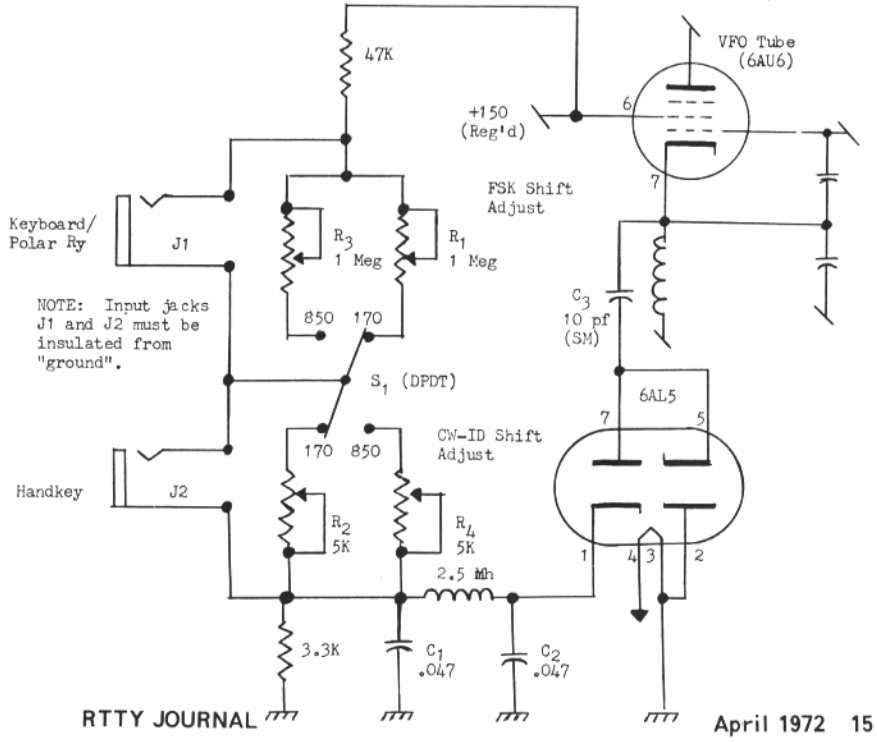
FSK for the JOHNSON INVADER 200

Sgt. SEYMOUR, WA2HVN/7
2402 Navajo
GLENDALE, AR. 85301

The circuit described below and in the attached schematic marks nothing new in the way of amateur RTTY; and, if "imitation is the sincerest form of flattery", a whole lot of people should feel sincerely flattered that I have plagiarized their ideas. I have no illusions about the originality of this circuit. Parts of it, in one form or another, are in use in nearly every RTTYer's equipment lineup; but, in all the literature, I have never seen published the particular combination presented here. So, for the benefit of any "new boys" among us, or any OTs who want to add a modicum of convenience to their operation, it can stand to be reiterated here.

Having considered several different methods for putting my Johnson Viking "Invader 200" on RTTY, and being frequently disappointed by what I considered the excessive complexity or expense of most, I finally fell back upon one of hamdom's reliable "old standby" circuits with some modifications suggested by my own needs. The end result provides a really simple means of putting any rig with the same, or a similar oscillator scheme to work on the HF RTTY bands with very little expense, no chassis metal-working, and the assurance that, whether you understand its operation or not, it will work right the first time. Application of this circuit adds the convenience of rapid selection of either of the "standard" shifts (170/850 Hz) currently in use, together with the proper amount of shift for narrow-shift CW-ID for both. Additionally, should you ever decide to sell or trade the rig, the circuit can be readily removed and the rig returned to its original configuration without the least trace that it had ever been there. The entire circuit shown in the schematic may be constructed on a 3" x 4" printed circuit board with ample room for all components. In my case the board is mounted vertically above the chassis directly behind the 6AU6 oscillator tube (V—). It is held in this position by means of brackets soldered to the board's ground plane which are fastened to the chassis by means of



the nuts and spade lugs used to hold the oscillator shield box in position underneath the chassis. Required voltages (150VDC, regulated, and 6.3VAC for filaments) are obtained from the oscillator's tube socket by means of "chicken" connections (wrapping two turns of #22 hookup wire tightly around the appropriate pin, being careful to short out other pins) brought out to the board underneath the tube's shield; and the lead from C3, which should be kept as short as possible, is returned to the oscillator's cathode by the same means. For the purist, of course, this method of construction is "strictly verboten"; but, if you've ever had the cover off the oscillator shield box under the chassis, and seen how much stuff is packed into that 2" x 2" space, you'll understand why I chose to make the connections above chassis rather than dig through that mass of resistors, capacitors, chokes, terminal strips and leads to do it the way a purist would.

The method here employed does the job nicely without introducing any measurable instability in the oscillator; however, as with any circuit of this type, you can expect to find that there will be a slight (500 Hz) shift in the oscillator's operating frequency which will upset your rig's dial calibration. This is due to the introduction of the small additional capacitance into the circuit, not to the method of construction, and is unavoidable; the dial may be recalibrated, if you desire, by whatever method is described in your rig's handbook or maintenance instructions.

Adjustment of the circuit is straightforward. With S1 in the "170" position, and R2 at its minimum value, adjust R1 for the proper amount of FSK shift; then adjust R2 for the desired amount of CW-ID shift. Since there will be some slight interaction between these adjustments, repeat the procedure until both shifts are correct. Repeat the procedure for R3, and R4 with S1 in the "850" position.

Make sure that your teleprinter and the rig's chassis are solidly grounded together and to the station ground. This simple expedient, (which I should have performed anyway) cured the only problem I had with this installation when 60-Hz "hum" was introduced on the oscillator signal through the keying line. A word of caution is in order, also, regarding the operating conditions for the rig. Most rigs, my Invader 200 included, will not stand for much in the way of extended duty-cycle RTTY operation under full key-down CW conditions without experiencing markedly shortened life among the driver and finals. Application of adequate cooling may help this situation somewhat; but the simple expedient of reducing drive to the recommended AM level works better; and the resulting loss of signal at the receiving end is only just perceptible as a result.

Most of the parts required for construction, with the sole exception of the materials for making and etching the PCB, may be found in even the modestly-stocked junkbox; but, even if purchased "new" from your friendly, liberal neighborhood electronics parts store, should cost less than $10. Capacitor C3 should be a good quality NPO unit, and may be either a fixed or variable type as both have been found to give equally good results. Capacitors C1 and C2 should be good quality paper or mylar. The potentiometers used at R1 - R4 should be "linear-taper" types as these afford the smoothest adjustment of the various shifts; other types may be substituted, but their adjustment will be found to be extremely "touchy" over some portions of their range.

Construction time will depend, of course, upon how much experience you've had with PCBs etc.,; in my own case the project, my first attempt at PCB construction, occupied one evening just nicely.

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ELECTRONIC RTTY

CONTINUED FROM PAGE 6

away from the bulk and noise of mechanical terminals or who simply want to take advantage of the system's solid state reliability.

I would like to thank Paul Tucker, the designer of the electronic RTTY terminal, George Henry, K9GWT, and George Perrine, W9KOI, all of HAL Communications Corp., producers of the Electronic RTTY terminal, for their permission to describe the system and for providing technical information, photos, and drawings. The RVD-1002 visual display system, the optional video monitor, the RKB-1 teletype keyboard, and the companion Mainline ST-6 terminal unit are all available from HAL. For further information and prices, send a postcard to HAL Communications Corp., P.O. Box 365RJ, Urbana, Illinois 61801.

1 David M. Krupp, "Attache Case RTTY", **QST**, February, 1968.

2 Paul Horowitz, "Perfect Teletype at Your Fingertips," **QST**, October, 1968.

3 J.A. Bryant, "Touchcoder II," **QST**, July, 1969.

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WAE Contest-

CONTINUED FROM PAGE 2

5. REST PERIOD:
Only 36 hours of operation of the 48 hours are permitted for single operator stations (no limitation for multi operator stations). The 12 hours of non operation may be taken in one, but not more than 3 periods anytime during the contest. The periods need not be equal but must total a minimum of 12 hours and must be clearly indicated in the log.

6. EXCHANGE
a) QSO-Nr. b) RST.

7. POINTS:
Each two-way RTTY contact with stations within one's own continent will count 1 point, with stations outside one's own continent 3 points.

Contacts of non-Europeans with Europeans will count 5 points for non-Europeans but 3 points for Europeans.

Each station may be worked once per band. Each QTC (cf. also 10.: QTC-Traffic) will count 1 point - given or received.

8. MULTIPLIER:
The multiplier is determined by the number of countries worked on each band.

The WAE country list and the latest ARRL country list will be used. In addition each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, ZS, UA9, UAO.

9. SCORING:
The final score is the total QSO points plus QTC points multiplied by the sum total countries from all bands.

10. QTC - TRAFFIC:
Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has been taken place earlier in the contest and later sent back to another station. The general idea being that after a number of stations has been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.

a) A QTC contains time, call and QSO number of the station being reported. ie.: 1300-DJ3KR-50. This means that at 1300 GMT you worked DJ3KR and received number 50.

b) A QSO can be reported only once and not back to the originating station.

c) Only a maximum of 5 QTC's to a station is permitted per band. You may work the same station several times to complete this quota. Only the original contact, however, has QSO point value.

d) Keep a uniform list of QTC's sent. QTC 3/5 indicates that this is the 3rd series of QTC's sent and that 5 QSOs are reported.

11. CONTEST AWARDS AND CLASSIFICATION OF WINNERS:
There are three classifications:
a) up to 200 watts D.C. input
b) more than 200 watts D.C. input
c) S W L's

Certificates to the highest scorer in each classification in each country and call area mentioned above. Continental leaders will be honored and 2nd and 3rd place certificates will be given in areas of sufficient participation.

There is no minimum of operation time, but a reasonable score is required for an award.

12. SWL-SCORING:
Each QSO of a station within one's own continent reported will count 1 point, of a station outside one's own continent 3 points. Each QTC reported will count 1 point. For multiplier and scoring confirm 8. and 9.

Each station may be reported once per band and 5 QTC's per station per band may be reported.

13. DISQUALIFICATION:
Violation of the rules of the contest, or unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification.

14. LOGS:
Logs must contain: bands, exchanges sent, call signs, exchanges received, QTCs sent and received, points, multipliers. Use a separate log for each band. Enclose a summary sheet showing the scoring, rest period, classification, your name and address in BLOCK LETTERS!

15. DEADLINE: June 10th, 1972.

16. The decisions of the Contest-Committee are final.

The Contest-Committee of the DARC and of the DAF new address:

WAEDC - Committee
D-8950 Kaufbeuren
P.O. Box 262
Germany - West

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AFSK Evolution-

CONTINUED FROM PAGE 8

pot arrangement is preferred, with panel control, use the narrow-shift leg; and shunt a toggle switch across the 22K resistor for wide shift.

A word of caution applies here. Exercise caution in choosing a remote position for the selector switch or shift pot. RF carried into the unit may cause problems. This is true of all solid-state devices.

OPERATION: After preliminary smoke tests, adjust R2 to the Mark frequency. Although this is shown as a single variable resistor, precise adjustment will be easier if the variable portion is a small part of the total. A 2.5 or 5K pot in series with an appropriate fixed resistor.

The output is more than adequate to drive the phone-patch input of our rigs. In fact, we included a small 5K volume control not shown in the diagram. The response is fairly flat across the entire wideshift range - with maximum very near the low end.

When using the lower tone range, we noticed that some low-gain transistors were sluggish about taking off from a cold start (in the Mark mode). However, the first Space pulse kicks it off; and no tendency to quit, once it started.

Current drain in the Mark condition is less than 5 ma. This does not include the Zener. It goes slightly over in the Space mode. Unlike the little QST unit, the shifting network conducts only on Space. Thus making for a shorter duty cycle.

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CLOSING DATE FOR ADS- 1st of month.....

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READY FOR MULTI SPEED RTTY? 195154- M 28ASR shift kit, (60-67-100 wpm), unused $225.00. KSR, LPR, LXD shifts too. 28 RO base with variable speed motor, $95.00. Gov't. Tech. manuals; TM112223, full scoop on M.14 typing & non typing reperf, $16.50; TM 11-2222 for M 14TD, $3.00. Kleinschmidt manuals TD, $2.; JR-TD (TT-176) $6.50; TT-4 page printer $6.50. Manuals postpaid. Many more teletype bulletins. Paper winders M15- $15.00. A few teletype tools for sale. Send $1. for latest tool catalog with list of what we have. Wanted your tools, parts, mod. kits & late machines especially 33ASR. SASE brings list. Typetronics, Box 8873, Ft. Lauderdale, FL. 33310. W4NYF.

21ST ANNUAL DAYTON HAMVENTION will be held on April 22, 1972 at Wamplers Hara Arena. Technical sessions, XYL programs, flea market, etc. For information write Dayton Hamvention, Dept. R Box 44, Dayton, Ohio 45401.

MAINLINE TT/L-2, with scope $200. or best offer. See picture in April RTTY Journal. WB4RKA, R. Wanat, 443 Atlas Dr., Madison, Ala. 35758.

TYPEWRITER RIBBON REINKER, Hand operated model now only $3.50. K575 or K764 Ink available at all National Cash Register Co. stores at 75c per tube. Walter Nettles W7ARS-8355 Tanque Verde Rd. Tucson, Ariz. 85715

MORE RTTY! THAT'S RIGHT. In 1970 there were more feature RTTY articles in HAM RADIO Magazine than any other general amateur magazine. You need RTTY Journal, but you need HAM RADIO also. $6.00 per year; $12.00, 3 years. Ham Radio, Greenville, N.H. 03048

WANTED-COLLINS 399C-1 PTO Console. 32W-1 exciter. National HRO-7 receiver. All in any condition. G.S. Naniwada, JA1ACB. 3-4-8, Izumi, Hoya, Tokyo 188, Japan.

TELETYPE MACHINES, TABLES, COVERS, power supplies, reperferators, cabinets, tape punches, parts etc. Loads of electronic equipment and parts also. PC boards, Western Union items, clocks etc. Goodman 5826 S. Western Avenue Chicago, Illinois 60636 (312-476-8200).

SALE; MODEL 28 TYPING REPERFORATOR Transmitter or "RT" mounted on a tape handling stand which includes large tape take up and supply reels as well, as an intermediate storage bin. O/A dim. 36" high, 20" long and 8-1/2" wide. Both LAXD-4 transmitter - distributor and LPR-3 typing reperforator come equipped with three speed gear shift. Allowing down speed conversion as well as up speed conversion. Synchronous motor LMU-12, excellent $150.00. Atlantic Surplus Sales, 580 3rd Ave., Brooklyn, N.Y. 11215.

SALE: B&W 5100 with SSB adapter $150.00. 75A-4 serial 4089 $325.00. SB-101 with power supply $325.00 Wanted Collins S line at reasonable price. WA3KDJ, PO Box 204, West Newton, PA. 15089.

SELL: 51J3 with product detector installed, good to excellent condition with cabinet. $325. Wanted Collins KWS-1, within 400 miles. J. Cress, K0GCJ, 122 Blawvelt Rd., Grand Island, Nebraska 68801. (308)-382-6503.

WANTED - FOR USE BY DEAF PEOPLE - TELETYPE MACHINES Model 15-19-26-28-32. Must be in reasonable condition, complete with keyboards. Can pick up anywhere. Send information to R.H. Weitbrecht, W6NRM, PO Box 555, Belmont, CA. 94002. Phone numbers - 213-793-4780 - 415-592-1622.

WANTED: WIRING DIAGRAM W.D. - 2496 for a FRXD 10; also, schematic for Philco F.M. A.M. Generator, Model 7170. Contact W.A. Jaqua, 1218 Chimes Blvd., South Bend, Indiana 46615.

FM MOTOROLA SCHEMATIC DIGEST - 136 giant pages 11-1/2 x 17 schematic diagrams, alignment instructions, crystal information, trouble shooting information. $6.50 postpaid. S.M. Wolf, PO Box 535, Lexington, Mass. 02173.

BACK ISSUES - RTTY JOURNAL - Have all issues from Vol. 1, No. 1, will reproduce any issue for $1.00 PP. John Isaacs, 3175 Val Verde Ave. Long Beach, Cal 90808.

HAL COMMUNICATIONS: 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 will be available soon. For budget TTY, consider the RT-1 for VHF, the ST-5 for HF. 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, Box 365RJ, Urbana, Ill. 61801. Phone 217-359-7373.

FOR SALE: 28ASR, 28KSR, other items. WANT: BRPE 18 Six level advance feed hole tape punch. Hank Scharfe 1015 Fremont Ave., South Pasadena, Calif. 91030 - 213-799-5886 or 213-682-3705.

WANTED: 33ASR or other 8-level gear to be used in amateur experimental project. State type, condition, and lowest price. Don Jackson W9BQC, 13693 Beaver Drive, Roscoe, Ill. 61073.

HAL COMMUNICATIONS: Announces 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, 66, 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 Dayton. Get the details from HAL COMMUNICATIONS, Box 365RJ, Urbana, Ill. 61801 Phone 217-359-7373.

CV-57 EXCELLENT, $40-CV-31D dual-div. new, $50-URR-13 RCVR 200-400 mhz. $30- PulseCom motor Control, $15- 28 typeboxes, any kind, $5- many parts - WA2HWJ, 133 William Rd., N. Massapequa, NY 11758.

TTL SELCAL drilled Fiberglass P.C. Boards. See RTTY Journal DEC 1971-JAN 1972. Double sided, solder coated. Shipped with instructions. $15 each. K7WJC 7234 East Papago Drive, Scottsdale, Arizona 85257.

INTEGRATED CIRCUITS - TTL 7400 series - new, factory-fresh: 7400 - 34c, 7490 - $1.35, 7495 - $1.59, 74151 - $3.25. Many others - write for list. Introductory special: three 7400 for buck postpaid. HPC, Box 644-A, Beloit, Wis. 53511.

T-192-C TYPING REPERFORATOR (Model 28) with case. New $150.00 CV-89 Converted Used $70.00. CM-22 Comparator $10.00 Mike Tewksbury Box 8324, Norfolk, Va. 23503.

TELETYPES AND DATA COMMUNICATIONS Equipment Wanted. Cash available. We are mostly interested in purchasing Models 33, 35, 32, and a limited amount of 28. We are a full-time organization solely dedicated to the purpose of buying, and rebuilding/reconditioning Teletypes. We also have available for sale, various types of Teletype accessories; modems and couplers, multiplexers, etc. Call or write: Vardon & Associates, 1201 E. Irving Boulevard, Irving, Texas 75060 - (214) 259-7966.

TAPE SPLICING AND CORRECTION PATCHES Splicing patches, all channels punched, for joining two pieces of tape, or mending tape. Correction patches, feed holes only punched, for correcting errors. 50 one-inch gummed patches only $1.50 postpaid in U.S. and Canada. $1.50 minimum order. R.H. Andrews, W6ITR, P.O. Box 1158, Tahoe City, Ca. 95730.

MODEL 19 AND ROTR, both in excellent condition. Waiver for 19. Must go together for $125.00. Prefer local buyer. Herb Drake, 16 Monte Cimas, Mill Valley, CA. 94941.

28KSR-$200, 14 typing reperf, w/cover, no keyboard-$20. ea. with keyboard $30. 2B- RO's (5/16 wide tape), cover, no kbd, $15. 11/16 wide tape - $8.00 case of 40 rolls, 2/$12.00. Black ribbons, 6 for $2.00, 12 for $3.50. All FOB- P. Davis, 1830 Toepher Rd., Akron, OH. 44312.

BUYING? SELLING? TRADING? Don't make a move until you've seen our new publication. Free sample copy! Six issues $1. HAM ADS, P.O. BOX 46-653J, L.A., Cal. 90046.

WANTED: TELETYPE #28, 32, 33, 35 page printers, keyboards, cabinets, covers for 28 Reperforators. Cash, or trade for new Drake equipment. Sell LRX #28 typing reperforator-transmitter with two 3 speed gear shifts. $100. checked out $145. LRP #28 Typing reperforator without cover $49. checked out $69. Alltronics - Howard Co., Box 19, Boston, Mass. 02101 (617-742-0048).

WANTED; MODEL 28KSR KEYBOARD, LP printer, LESU. Prefer MarkIII. For Sale, QST's 1940-64, CQ's 1952-70, 73's 1961 - 71, $2.00 per year. Prefer to sell in sets. Ed Wagner, 208 S. Monroe, Stoughton, Wisc. 53589.

EXHIBITORS - Reserve space now for ARRL Hudson Division Convention, Oct. 21-22, Tarrytown, N.Y. Contact Hank Frankel, WB2DQP, Box 535, Bellmore, N.Y., 11711. Phone 212-394-5257.

WANTED WANTED Model 28 ASR .. Sprocket feed paper or conversion of a Model 15 to friction feed ... 6 meter and 2 meter convertors transistor into the Broadcast Band ... Ed Galovic K8OXO, 86 Egbert Rd., Bedford, Ohio 44146.

HAL COMMUNICATIONS: ONE SOURCE FOR ALL your construction needs. Our line of resistors, capacitors, and semiconductors will fill your requirements for practically any project. TTL devices are stocked in volume to support production of our keyers, identifiers, and the fantastic RVD-1002 RTTY Visual Display System. Fast service at reasonable prices. HAL COMMUNICATIONS, Box 365RJ, Urbana, Ill. 61801 Phone 217-359-7373.

SALE: MODEL 14 TYPING REPERFS - send receive, complete with cover, sync motor, keyboard, end of line indicator, excellent $37.50 Model 14 transmitter - distributor, complete with cover, sync motor, excellent $20. ea. Model 28 type box, complete, excellent $15. Platen for model 15 teletypewriter rubber covered, unused, $4.00 Tuning Fork (speed indicator) 96.19 V.P.S. with instructions sheet for using tuning fork to set motor speed of teletype equipment to operate at speeds of 368 O.P.M. and 404 O.P.M. Unused $2. ea.-3 for $5. Drum, fascimile, key design 12-1/2" long, 6" dia, unused $8. ea. Atlantic Surplus Sales, 580 3rd Ave. Brooklyn, N.Y. 11215.

WANTED; SERIES TYPE, GOVERNOR MOTOR (115 volt AC or DC) for 28 KSR Teletype. Elmer Rowekamp, 8850 West Midland Drive, Greendale, Wisconsin 53129.

4-1000 TUBE, NEW, $75. 24C w/ probes $60. TS34A scope $25. HP560 digital recorders $80. 1193 manual and chest $12. TEK 514AD $135. DYMEC 25038 6 digit $150. USM 105 $425. USM 105 $350. GR133OA, $290, with manual, adaptors and calibrated $360. TDA2 $35. GR1001-A Lavoie Labs LA20M Spectrum analyzer with 120 tuner, no plugins or extra parts to buy, $350. SASE for list of excess and new components. HP425A $40. Kintel 203A, $90. Trade your list for mine. Douglas Craton, 5625 Balfrey Dr. West Palm Beach, FL. 33406.

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THEORY & APPLICATION-

CONTINUED FROM PAGE 11

WPM operation and expect to copy the commercial stations because they use an entirely different code! The trouble with the Baudot code is that is contains only 5 code elements and that means only 32 characters are possible without shifting. The commercial users are using the ASCII (American Standard Code for Information Interchange). This code contains 7 code elements, giving 128 characters without shifting (and twice that many with shifting).

The ASCII code and its details can be found in the IT&T Handbook (Reference Data for Radio Engineers, 5th ED., Howard Sams). It is a 7-element code, plus a start pulse, a stop pulse, and a parity pulse. For 100 WPM operation, the stop pulse is two units long, resulting in 11 units per character. The units are 9.09 ms long. The 150 WPM version is the same except the stop pulse is only one unit long, giving a 10 unit character with 6.66 ms long units.

See RTTY, 1969 JUL-AUG, p. 4 for speed information on the amateur Baudot code and p.11 for motor-selector shaft gear information.

We would like to acknowledge the assistance of Clarence Kersker, WA8AYS, and Dave Goodman, WA8UIT, who dug into the innards of machines to count gear teeth.

That's it for this month. Keep the questions coming!

73 ES CUL, RG.

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