RTTY

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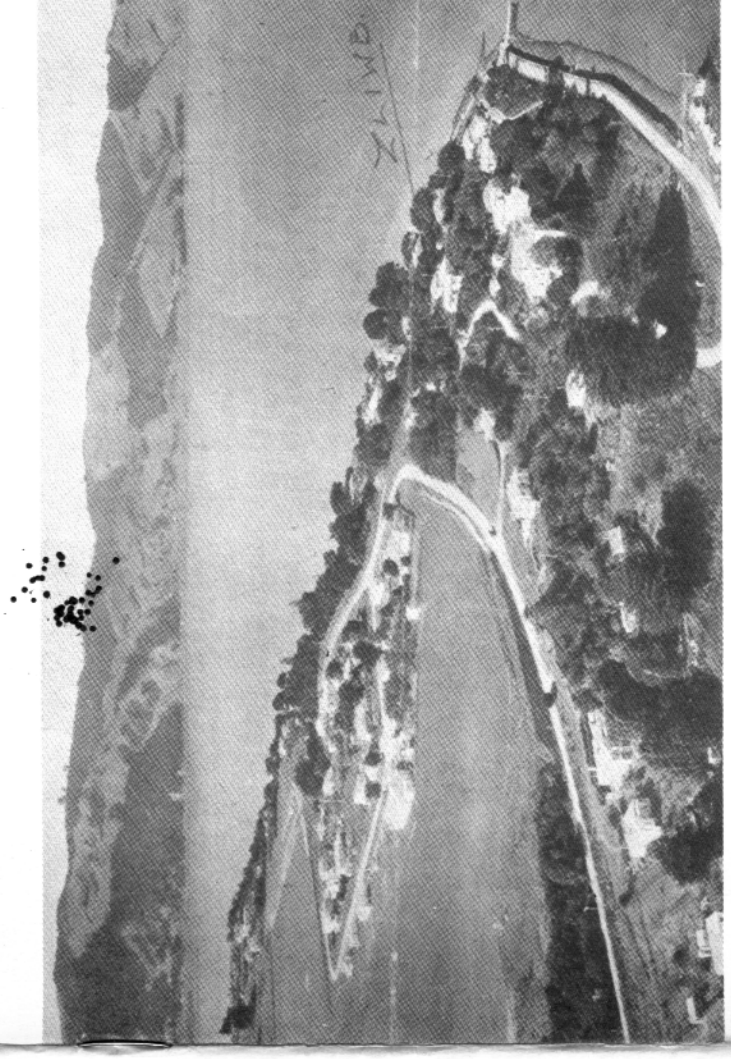

ZL1WB



## HORSE TRADES

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

For Sale or Trade: Model 12 printer only, Junkeyboard keyboard es DC motors.....W3LDS
Wanted: Table for Model 15 also Model 14 TD and Typing Reperf.....K6KFF
Wanted: Tape Gear, Have Model 12 to Trade.....WØKXB
For Sale: RTTY Call Books—$1.00.....RTTY
For Sale: Model 26's complete with Tables .....W6VPC, W6SCQ, W7HRC, W9GRW, WØWRO
For Sale: Teletype paper at $1.50 for a case (12 rolls) FOB Hayward, California.....F. C. Pratt, 1257 B St.
For Sale: Two Model TG-7Bs complete reasonable.....W4UYU
Trade: Model 26 for 14 Perforator.....W4EHU
Wanted: Model 26.....W4AIY
Wanted: 1953 RTTYs all issues, 1954, Jan. Feb. Mar. Apr. May, June, July and November.....W9FQU
For Sale or Swap: WU Distributor with AC Sync Motor WU 7B Transmitter with base, Receiving dist for 12, Model 21A printer.....K2OBJ
For Sale: Model FRF Converter (0-1000 cycles) Model FRA Converter (Dual Channel AFSK) Model FRA Converter Model FSK FSK Keyer with power supply WE 255A Polar Relays, Brand new. Model 12 Complete .....W2AKE
For Sale: Parts and repairs for RTTY gear.....W9GRW

**RTTY, Inc.**
372 West Warren Way
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PRAY FOR PEACE

# Rtty Station Description, ZL1WB

BRUCE H. ROWLINGS, ONERAHI, WHANGEREI,
NORTHLAND, NEW ZELAND

Station description. ZLIWB. New Zealand. (Radioteletype)

Antennae.

Long wire, and half-wave dipoles, favouring the U.S. Directive array, for twenty/ten metres, at present, in "moth-balls."

Receivers.

EX Army type ZC-I for "80" and "40." 10 tube, home-brew (B10 tuning unit) receiver, covering B'cast. thru' to 15 metres, bandspread on all amateur bands. Use 'outboard' BFO, with variable output level.

XTAL/VFO 80/40 6AG7 6V6 813 100 watts. CW/PH.

XTAL 6AG7 6V6 Y; 6V6 813 100 watts, on 40, 20, 15, Q 10 metres. (FSK/MAB)

Terminal Units.

W2PAT polar, "Little Monster" and Keyer type, using 6Y6's and polar relay, for "keying" the transmitters. This latter unit has an audio oscillator, which is keyed from the keyboard, for local copy thru the TU, and keys the transmitter simultaneously via the polar relay.

Output from OSC can also be fed into modulator, for AFSK.

On reception, use polar W2PAT unit preceeded by an "DT" type filter constructed from output transformer replacement windings. The polar relay then keys thru the local audio OSC. To operate the printer by a mere flick of the switch. The "Little Monster" uses a 6Y6 which provides 70 milliamps, for the tape printer. This unit has been

adapted, to use parts available, the only resemblance to the original being the "After-End."

Printing Equipment.

Model 26. This has switch installed, to enable instant operation from any TU at either 30 or 60 MA. Also, provision has been made for hand key to be switched in series with KB. (This machine supplied by Merrill, W6AEE).

A Model 401A, Tape Printer. This operates from the "Little Monster." (This Printer supplied by John, W2BFD).

A 1A tape head is also available, which is to be pressed into service as soon as a suitable distributor is constructed.

Frequency shift is by XTAL diodes, and reactance type (on VFO). A cathode ray tube, is used as a tuning indicator hooked into the output of the "Double Tuned" type filter unit. This is a 5BP1, which has its indipendent amps. built into a separate unit, making it a very versitile piece of equipment in the shack. Audio sub-standard is a commercial generator, covering 15-cycles to 50kc. all items, subject to change—without notice, hi.



# Additional Thoughts on, "Those Filters!!"

BY DON WIGGINS, W4EHU

The article on filters by R. Couppez in the July, 1956 RTTY caused me to sit down and do some figuring (just as R. C. was inspired to do). However, I get some different results than R. C.

The idea of treating the mark and space frequencies as carriers is a useful concept as normal demodulation and filtering techniques can be applied. There is a difference, however, from a communiaction audio signal as we know in advance what information is contained in the sidebands and do not need "hi-fi" circuits to discover this information. Thus I feel Mr. Couppez has concentrated on filters and overlooked a number of points in the entire system. The picture looks much better when the following factors are taken into account:

1. Filter "skirt" contributions
1. Tuning technique of operator
3. Post-detection limiting
4. All characters are not composed of 22.72 cps square waves
5. Pre-detection limiting

There seems to be some errors in the Fourier analysis of a square wave in the July article. The time function for a positive going square wave expressed in terms of its frequency components yields:

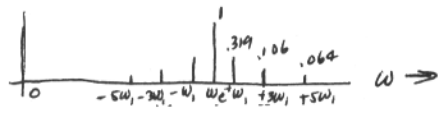
$$f(\omega_1 t) = \frac{1}{2} + \frac{2}{\pi}\cos\omega_1 t - \frac{2}{3\pi}\cos 3\omega_1 t + \frac{2}{5\pi}\cos 5\omega_1 t - \cdots \pm \frac{2}{n\pi}\cos n\omega_1 t + \cdots$$

This series converges to 1 from -T to O and to zero from O to +T.

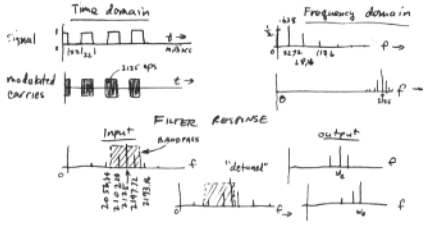
Thus for 100% modulation of a carrier, the sidebands will be as follows:

| Freq. | amplitude | % of carrier | db down from carrier |
|---|---|---|---|
| W. | .319 | 31.9% | − 9.8 |
| 3W. | .106 | 10.6% | −19.5 |
| 5W. | .064 | 6.4% | −23.8 |

The d-c term is lost at the transmitter. The spectrum of this waveform will be like this:

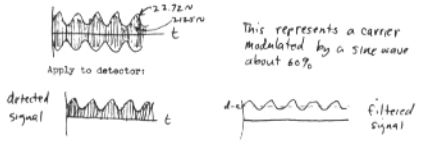



Now the question is: How much bandwidth is necessary to obtain sufficient information to operate a printer (not to reproduce a perfect square wave)? Undoubtedly, this problem can be resolved on a statistical basis by applying information theory but this approach is far from attractive to the amateur. Let us try an ideal filter which has a flat top and straight sides for its amplitude plot and uniform phase shift in the pass band, and inspect the response to our modulated carrier. Using 100 cps as the "flat top" and the signal shown in the above spectrum, apply this signal directly to the filter:



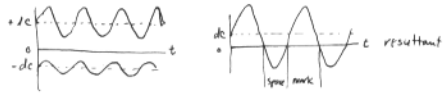

For the carrier centered on the pass band we obtain the fundamental only of the sidebands. With slight detuning, however, we can get one fundamental and one 3rd harmonic sideband with a reduction in percentage modulation (single sideband, unsuppressed carrier!)

The worst case for a square wave is the "fundamental only." Let's look at this situation. The wave envelope will be as follows:




If our illustration is considered to be one channel of an FSK T. U. the other channel will be producing an identical wave, shifted in phase 180 deg. These waves are subtracted to produce the final signal.

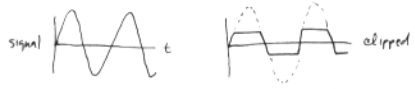

If both mark and space signals are of equal amplitude, the "audio" is twice the amplitude of the audio from one channel alone. The d-c components are also equal and thus cancel out. Incidentally, if one channel is weak, there will be a resultant d-c component which shifts the audio signal. This causes distortion of the "pulse" widths.




This points up the advantages of using a-c coupling out of the detector to remove this component.

In any event, we now have a sine wave signal instead of a square.

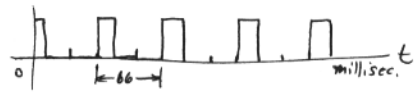
Fortunately, we know what we should have so by clipping or limiting this signal, we end up with a fair reproduction of the original wave which the printer will accept.



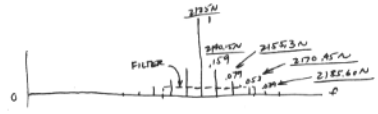

So for the worst situation where we pass only the first sidebands, the printer will operate. Actually, in most cases we have more components since our filter does not have straight sides as will be mentioned later.

If we are not sending RY'S but have a 22 millisec. pulse followed by 2 spaces, the time function will look like this:






Again, assume this is a repetitive waveform. Now our Fourier series contains both odd and even harmonics and the relative amplitudes of each component are smaller. Since the period is now 66 millisec., the first sideband component is 15.15 cps and the various sidebands occur at this spacing from the carrier. The spectrum for this case is shown below:




Now the 100 cps "flattop" of our ideal filter will pass three sideband frequencies if centered and six if "detuned." The result here is that the filter output will have a faster rise time and will be a better reproduction of the original than for the square wave case. Clipping after detection will again give the keyer a good waveform.

So far, we have discussed an ideal filter. Actual filters will allow the higher order sidebands to contribute something to the resultant waveform since the attenuation increases gradually instead of sharply. Both the amplitude and phase of these components will be modified so it is difficult to predict exactly what the result will be without knowing the exact transfer function for the filter.

In most TU's some pre-detection limiting is used. If the various spectral components of interest are clipped to a uniform level, their sum no longer converges to a square top pulse since the amplitude relations have been changed. Feeding this "uniform" spectrum into a filter results in an amplitude relation between the spectral components proportional to the filter amplitude response. Also, the phase of these components will also be changed proportional to the phase characteristics of the filter, so, again, the exact shape of the resultant waveform is hard to predict.

Note that Phil's filters shown in Feb., '56 RTTY are down about 15 db at 2550 cps. If the 19th harmonic of the 22.72 cps wave (which falls about here) were at the clipping level, it would come out of the filter at 15 db down from the carrier. Its proper amplitude is about 34 db down.

The contribution of these higher order sidebands in general is to decrease the rise time of the waveform. Post-detection clipping helps to restore the square top of the pulse so things are not as bad as they might seem at first glance.

It certainly appears that there is room for serious study of the entire system; limiters, filters, detectors, amplifiers, etc. and their effects on the pulses. I hope to find time to check some of these theories in the lab soon, at least to satisfy myself on these points.

# Pull-In and Drop-Out

BRUCE L. MEYER, WØHZR

Of all the standards for technical perfection considered by the RTTY enthusiast for his receiving converter, perhaps the polar relay and selector magnet drive circuits get the least attention. This is unfortunate since a malfunctioning relay or magnet armature will generally not be uspected when signal bias and week signals conspire to discourage even the most ardent follower of the radio teleprinter art. I have often dug deeply and painfully into the guts of my converter looking for filter troubles and wrong grid biases, seldom finding any. The lowly selector magnet or else the polar relay was the hidden culprit . . . "vacationing" part-time.

Although it may be argued that an appreciable relay armature transit time may be desirable for filtering out short noise pulses, the fact remains that teleprinters in general require a minimum delay in shifting the printing selector from mark to space, and an equal delay in shifting from space to mark, if signal pulses are to be undistorted. Factors affecting these transitions include the characteristics of the relays and selector magnets involved. Let's look at some electromagnetic relationships rather critically:

1. The armature of a relay is attracted to the pole pieces only by an electromagnetic force.
2. The magnetic force on the armature varies inversely as the square of the air gap distance between the armature and the pole pieces.
3. The armature requires a stronger magnetic force for pull-in than for drop-out.
4. The speed with which the armature moves from one limit to the other depends upon the mass of the armature and upon the speed with which the magnetic force intensity changes.
5. The intensity of the magnetic field acting on the armature is proportional to the product of the current through the coil times the number of turns of wire on the coil bobbins.
6. The steady-state current in the coil is limited only by the d-c circuit resistance, which includes the coil resistance.
7. The rate of rise of current, (speed of pull-in), in the coil is decreased by high coil inductance and increased by high applied voltage.
8. The rate of decay of current, (speed of drop-out), is decreased by high coil inductance and increased by high circuit resistance.

The reason for having a great number of coil turns is of course the low line current required for pull-in and, naturally, the lower resulting telegraph line losses. The reason for high coil resistance is to minimize the current-delaying effect of the coil inductance. A series resistor permits the supply voltage to be many times greater than the minimum voltage required by the coil for a slow pull-in. At the instant of circuit closure, because of the coil inductance, the entire supply voltage can appear across the coil, insuring an extremely rapid build-up of coil current and a fast armature pull-in. Later, when the voltage is removed by opening the circuit, a high coil series resistance permits the counter EMF resulting from the flux field collapse to rise to a high value without generating a correspondingly large current to delay the collapse of the flux field and the armature drop-out.

Boyd Phelps, WØBP conducted a very interesting series of experiments relating supply voltage, coil resistance, and armature adjustment to signal bias and misprinting. He found that even 12 volts would pull in a machine selector magnet if the external resistor were removed, but intelligible printing was impossible!

*CONCLUSIONS*

Use a coil series resistor ten to twenty times as large as the coil resistance, and a supply voltage adequate to push rated coil current, (20 to 70 ma. depending of relay or selector used), through the coil and resistor in series. Avoid placing the magnet coil more than 150 volts above chassis potential, however. The insulation may be inadequate.

The writer personally favors a vacuum tube keyer with the coil in the plate circuit. Most triodes work well but a beam pentode is best because its plate resistance is so high compared to that of the coil that it may be neglected, except at very low plate voltages. If the pentode is used, a high resistance may be connected across the coil terminals to limit the counter EMF to a safe value, say 50 volts. I believe firmly that the cathode follower type of coil driver should be avoided unless the grid can be driven at least 90 volts beyond projected cutoff. The cathode follower is a constant voltage device like a battery and will delay drop-out appreciably.



RYRYRYRYRY

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# Report on the Rtty Meeting Held in Chicago Sept. 30, 1956, at the Hallicrafters Co.

BY ROGER WIXON, W6FDJ

The meeting was called to order by George Boyd W9SPT at 1345 CDST. He then introduced Boyd Phelps, WØBP, (Beep) who reviewed the meeting held last year. Beep outlined the program to follow which was to include technical talks on RTTY terminal equipment and other pieces of RTTY gear. Beep spoke briefly on the basic theory of teletype and described the advantages of AVC, limiting, band width, selectivity, and their effect in combating selective fading. Beep also said that he did not know which was the best system of terminal equipment and that he was spending a lot of time building and rebuilding. The use of diode and grid limiting was brought out and the simplicity of grid limiting was emphasized. Another point that Beep brought up was the importance of where limiting was used. It was said to generate high harmonic content of 35 to 6Ø percent from severe limiting and heterodynes from phones or CW tones 15ØØ cycles or lower would often have audio harmonics that would get into mark and space filters. To prevent this Beep said a band pass filter should be used ahead of limiting so as to pass only about 18ØØ-32ØØ cycles. The ideal band width for mark and space filters is still under argument for amateur use and since the recent article by Rudy Couppez to be kind to the side bands of the 22.7 cycle keying modulation there has been renewed interest in I F types such as the "FRA."

Beep introduced Dave Chapman W9DPY whose topic was FSK and AFSK requirements for proper operation. Two points Dave brought out were: 1. Wide enough band width and 2. That the area under each half of the discriminator curve must be equal. Dave showed some construction practices using relay rack mounting with complete access to the circuitry through a cut-out in the panel. Photographs of this type construction were passed around.

Beep brought up the matter of NFSK and thought that now was the right time to set some standard narrow shift the amateur could adopt. Shifts of 18Ø, 17Ø, 16Ø, 9Ø, 6Ø and 3Ø cycles were suggested. W9SKF Norm Krohne pointed out that it would be advisable to keep away from multiples of power line frequency such as 6Ø-12Ø-18Ø cycles as this would eliminate possible trouble caused by ripple and pickup in the amplifier stages. Fritz Franke stated his I F discriminator with crystal would work down to twenty cycles. FSK . . . W9LZV Jim Lomansney spoke on VNFSK as low as 8 cycle shift of broadcast carrier and RTTY simultaneously. Less than 2Ø cycle FSK was not noticeable on broadcast programs and the RTTY unit used carrier limiting, AFC, and 1ØØ cycle band width. Beep showed an experimental unit with variable Q, variable band widths and variable shift reception. It was voted that NFSK in the region 16Ø-17Ø is best. 17Ø is a fifth of 85Ø, and 16Ø is easily calibrated from WWV tones of 44Ø and 6ØØ, but a terminal unit would cover either.



Bob, W9JBT, presented a paper by Edwin J. Obrien, W6LDG, on "An Audio frequency discriminator converter" operating on either AFSK or FSK independent or amount of shift. The diagrams with circuit constants were passed around. As the author unfortunately could not be present, the address of W6LDG was given for any further questions.

Bob Wesslund, WØAUS, was unable to attend and present his data on "Filter Design." Bob has contributed much to filter design in the famous Univac computer, and printing 6ØØ lines per minute is everyday stuff for him.

Beep spoke briefly on his experiments with various printer magnet currents and the importance of the series resistance and high voltage sourcen, illustrating this with pictures of the scope patterns which showed armature movement and bias distortions.

Fritz Franke of Hallicrafters extended a welcome to any of the gang to utilize their quarters for a meeting place. He then gave a talk on IF vs. AF systems terminal units, limiter design vs. ratio detector for better noise ratio figures, and narrow shift with crystal in the IF. Diagrams and data were distributed for all.

Ray Smessaert, W9MDQ, or Teletype Corp. Gave a talk on the Model 26. Pointing out the printing ability on a 9 milisecond interval. He answered questions regarding oil, grease and maintenance.

R. D. Cortright, W9NOE, gave a short impromptu talk on a keyer he made from a surplus stepping switch wired for CQ and call sign.

Bob Weitbrecht, W9TCJ, the Wisconsin wizard, for his bag of tricks this year gave an interesting demonstration of auto-start auto-print on low frequency FSK. During the past year numerous messages have been left on Bob's unattended printer from WØBP 37Ø miles away, on either 362Ø or 714Ø KCS but accuracy of 5Ø cycles RF is required. A 5 second 6Ø cycle buzz starts up and 5 second space signal stops after message and the standby drain is 35 watts.

Bob and Beep argue like brothers so Beep held up a simple unit he built from junk parts that does not print but rings an alarm bell, lights a light and starts a clock if anyone sends twenty fast letter "O" within plus or minus two KCS of his listening frequency.

The technical session ended with a brief question and answer period and drawing of prizes consisting of polar relays from Ray W9GRW, call books and subscriptions to RTTY.

Following were present at meeting in Chicago September 3Øth 1956:

| | |
|---|---|
| W6FDJ, Roger | W9PBT, Bob |
| W9VMG, George | W9OKS, Stephen |
| W9DRW, Dick | W9NGX, Ray |
| W90CV, Bert | W9IQS, Bob |
| W9PRO, Hap | W9CYL, Jim |
| W9MGV, Dan | W9PHJ, Herb |

WØFQW, Lyle
WØBP, Beep
W9GVN, Ray
W9VOK, Bob
W9AKM, Bob
W9SPT, George
W9GLR, Jim
W9UEZ, Frances
W9BOQ, Alan
W9GRW, Ray
W9TUZ, Art
W9OMF, George
W8OJS, Clyde
W9WKM, Homer
W9LZV, James
W9GRU, Fred
W9SKF, Norm
W9QKE, Jordan
WØKUJ, Don
W9DNP, George
W90FR, Bob
W9BWM, Bill
W8GRL, Larry
W9LKK, Loren
W9MDQ, Bob
W9BGC, Joe
W9TCJ, Bob
W3JUE, Fred
W9NOE, Dean
W9DPY, Dave
W9PUF, John
W9KLB, Al
W9KLB, Al
W2PEE, Eh
W9BQY, Bill Jr.
W9BQV, Bill Sr.
ON-WZ, Rudy

(Above pieced from reperfs from W6VPC & W6FDJ thru week-end QRM plus slight editorial changes at WØBP.)

The banquet Sunday evening was excellent, well attended, and reports received from representatives from various parts of the country. It was announced that in all probability the meeting next year will be combined with the national A R R L convention in Chicago Labor Day.

Bob, W9JBT, was host Saturday evening to early arrivals consisting of W6FDJ, W9GRW, W9SPT, W8GRL, Rudy Couppez, and W9KUJ.

Monday October first a tour of the teletype factory proved very interesting. In addition to progressive assembly of 15 and 28 models up to their precision dance line run-in at 6Ø or 1ØØ WPM, multiplex gear was viewed and the "monkey on a string" unit wherein the transmitter does not stop when the tape is all used from the bin but gets up and runs down the tape right to the punch! The display rooms had the 6Ø WPM gear of last year and the 28 printing while rotating in all upside down positions as well as the screen projection of incoming info, but new emphasis was placed automatic relaying and selective call systems whereby messages distribute themselves to one or more cities on a wire circuit or wait their turn, the basis being the versatile and easily changed stunt box of the modern model 28. Production appeared to be 1ØØ-2ØØ per day of the models 15 and 28, along with many verixx versions of the 14 tape gear and much custom built variations. Fairly close price guesses ranged around $45Ø for the 14 T.D., $1800-$2000 for the 28, and $14,000 for the tape routing system, but as first quotations would depend upon quantity ordered, apparently the Hams present were undecided and no orders seemed to be written up. The tour and demonstration left no doubts about the growing teletype field, just in case anyone has not tuned across the commercial short wave channels. The lab is believed to be developing page printing or punched tape directly from the spoken voice!!! No more corns on our two digits!!!

—De "Beep"

RTTY wishes to thank Bert Cottrell W90CV, and to the Teletype Corporation for their kindness to the Meeting. Thanks also to the Hallicrafters Company and Fritz Franke.




Both Bob Wesslund, WØAUS and I are working on transistorized converters, but have very little to show for our efforts as yet. After a person has designed around vacuum tubes for as many years as we have, it is darned hard to change our thinking to accommodate transistor parameters.

I have a really simple and inexpensive automatic carriage-return and line feed function built into my Model 26. It requires only a microswitch, a washing machine solenoid, a piece of brazing rod, a piece of aluminum sheet, and a few nuts and bolts. If you want details, please let me know. It positively prevents the carriage from sitting at the end of the line and packing the information into the "eighth-inch square."

Kindest regards, and keep 'em coming . . .

—Bruce Meyer, WØHZR

* * *

If I don't use it for anything else, I want to find out who that !?*?!*?!* station is on about 5195kc who knocks our CW out every night with his RTTY. Hi Hi 5195kc is used by police in the states as a calling frequency.

Nuff fer now, better get this ole bug to moving, TFC starting to pile up while I'm writing this.

73

—N. L. Bell—Roy—WØOOT—KØEXX
% Radio Division
Missouri Highway Patrol

Since I acquired my machine, this wonderful digest of the happenings in this fascinating field has been mine, and I want to continue to receive it.

Although to date I have not been "on the air," I have made progress in that direction. The necessary accessories to go with the machine are on hand. They include O5B/FR teletype keying excitor to kick my parallel pair of 4-400th's in the transmitter, a good Navy surplus receiver-connector, and a re-built Hammerlund Super Pro, together with tape keying transmitter distributor. The only thing missing in the equipment line is the typing-tape perforator.

Sincerely,

—Colonel William B. James
K6JPD

* * *

Non amateur teletype heard in 14 and 21 M.C. CW bands bringing increasing complaint but those Hams have no way to identify interloper stations. Can you recommend some RTTY'ers who might put a machine on some of these and get the identification noting frequency and time? Will be glad to send a bunch of our CD-36 commercial intercept forms to make reporting easy. RTTY might tell readers such forms to facilitate reports would be sent by the league on any request. 73.

—Ed Handy, W1BDI AR