## Additional Classified on Page 19

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# RTTY JOURNAL

MAY 1970

EXCLUSIVELY AMATEUR RADIO TELETYPE

Volume 18 No. 5 30 Cents

## 'Larry' KG6NAA

(K1LPS)

**Contents-**

# A New Limiter Circuit-

**Wilf van Heddegem. ON4HW**
**Kortrijkstraat 40**
**9700 Oudenaarde 3**
**Belgium**

Introduction

The title of this note may sound risky; without doubt the circuit described below isn't new at all. Anyway I never found a trace of it in any amateur radio publication and therefore, I believe it can safely be assumed that it is new for many of us.

It is a non-blocking limiter, working perfectly symmetrical over its whole limiting range, which can be as wide as 60 db for only one stage and the notion "recovery time" doesn't seem to apply to it. After experiments with some of the more common limiters, this one has been found to have the best cost/performance ratio.

Basic circuit

Fig. 1 shows a common emitter amplifier equipped with a voltage dependent negative feedback path through two antiparallel connected silicon diodes D1 and D2.

These diodes have a treshold voltage of about 0.5 volts; therefore for a small input signal, which does not cause an output voltage swing at point B of more than 0.5 volts, the circuit acts as a common linear amplifier. However, when the input signal amplitude is increased there will be a point where the output signal peaks above 0.5 volts will pass through the diodes to point A where they counteract the input signal. From here on the signal amplitude at the base of the transistor Q will remain virtually constant for any further increase of Vi and hence also the output signal amplitude. Obviously the latter will be equal to the treshold voltage of the diodes.

Instead of the diode configuration shown in fig. 1, two zener diodes connected back to back can also be used. The zener voltages should be equal and not exceed the d.c. voltage at the collector of Q less half a volt.

R1 and R5 are used to keep both ends of the diodes at the same d.c. potential (ground). This is a condition sine qua non for symmetrical operation. C1 and C2 isolate these points from the base and collector voltages of Q and must have sufficiently low reactance at the lowest operating frequency.

The input impedance for small signals is equal to R2 plus the base impedance of Q, which normally is a few thousand ohms. In the limiting state the input impedance approaches the value of R2. The outout load Impedance may be between infinite and a value that should preferably be taken not much smaller than R4, otherwise the gain will suffer.

A test circuit was built with the following components: R1 and R5: 47K; R2 and R4; 5K6; R3; C1 and C2: C.1 uF; D1 and D2: BA100 (low power silicon junction diodes); Q: BC108C (low power NPN silicon transistor; hFE approx. 250). VS=+12 volts: Measurement results are listed below. The input signal was a 2500 Hz sine wave. All voltages are peak to peak values.

| Vi | Vo |
|---|---|
| 10 V | 1.15 V |
| 1 V | 1.07 V |
| 0.1 V | 0.93 V |
| 10 mV | 0.60 V |
| 6.5 mV | 0.40 V |

(limit of good linear operation)

Above 10 V pp input the output wave shape became distorted. By increasing R2 to 12K up to 27 Vpp was handled properly but at the expense of the gain figure. If higher voltages are to be handled it may be better to apply some prelimiting as is done in fig. 2.

Practical circuit

The circuit of fig. 2 has an input impedance of roughly 500 ohms. Prelimiting by the diodes D1 and D2 results in high voltage handling capability without impairing the gain figure. This setup is expected to handle at least 50 volts r.m.s. which is the voltage developed by 5 watts over a 500 ohm load.

The first stage is essentially the same as the one of fig. 1. The second stage uses two 3.3 volt zener diodes (up to 5.6 volts would be all right if the value of R9 is such that the collector voltage of Q2 is 6 volts); this results in a maximum peak to peak output voltage of about 6 volts.

RC interstage coupling is applied. Strictly speaking Ce and R6 (or R7) could be omitted since both ends of C3 are at the same d.c. potential. This however, is only true provided that the zener voltages of D5 and D6 are exactly equal. If they are not, which is likely to be the case when the diodes are taken by haphazard, the d.c. voltage at the base side of D5 will deviate slightly from zero when a signal is applied, and bias D3 and D4 if C3 wasn't there to stop it. This would cause a symmetrical operation of the first stage.

C6 prevents possible h.f. or v.h.f. oscillations.

Measurements on this circuit, varying the input signal by 100 db in steps of 20 db, yielded the following results. Again the input signal was a 2500 Hz sine wave and all values are peak to peak.

| Vi | Vo |
|---|---|
| 40 V | 6.2 V |
| 4 V | 6.2 V |
| 0.4 V | 6.2 V |
| 40 mV | 6.0 V |
| 4 mV | 5.2 V |
| 0.4 mV | 2.0 V |

These figures speak for themselves. It is to be noted that 40 volts peak to peak corresponds to only 14 volts r.m.s., so that at least 10 db still has to be added to the limiting range.

The frequency response curve of this circuit is flat between approximately 300 Hz and 3000 Hz. It could be extended at the low frequency side by using higher C's, but this is not necessary if the circuit is to be used in an audiotype RTTY demodulator.

The response at the high frequency side is limited by the characteristics of the zener diodes of the second stage. The 3 db attenuation point is at 5000 Hz and from there on the gain drops by about 6 db per octave. This is quite adequate for an audio type RTTY demodulator.

The first stage's 3 db point is at 80 KHz.

The following test was carried out on the limiter. A 20 volts pp 2500 Hz sine wave was fed to the input through the keyboard contacts of a teleprinter. With some precautions the leak through voltage in the "key up" state could be reduced to 4 millivots pp, corresponding to an attenuation of 74 db. The teleprinter was made generate a continuous train of letter shift signals and the output of the limiter was watched on an oscilloscope. This test showed that the transistions from "key up" to "key down" and vice versa were extremely clean, without a trace of breaks or thumps. The wave envelopes in both states were perfectly flat and symmetric with respect to a common zero axis.

The toal cost of the components used in the circuit of fig. 2 amounts to 100 BF ($2.00).

Conclusion

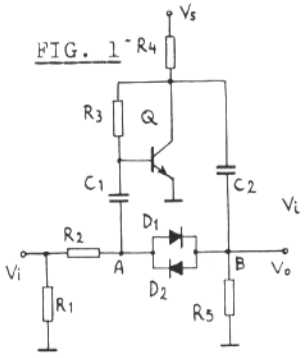
Taking my stand on descriptions of other limiters published in this and other amateur radio magazines and on tests on some of these, I can't but conclude that the performance of the limiter shown here in fig. 2 exceeds that of any of them, as far as audio applications are concerned, and that it is markedly more economic than the best of them.

Its perfectly symmetrical operation makes it also ideal as a speech clipper; for this application the amount of clipping that can be obtained by a one stage limiter such as the one of fig. 1 is much greater than needed.

I feel sure that this circuit will find many useful applications.

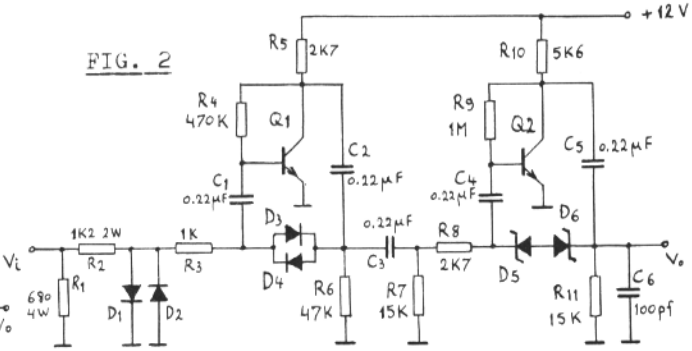
***

FIG. 1




All resistors 1/4 watts unless specified otherwise

FIG. 2




$D_1$ thru $D_4$: low power silicon diodes (BA 100)

$D_5$ and $D_6$: 3.3 volts low power zener diodes (BZY88/C3v3)

$Q_1$ and $Q_2$: a.f. silicon transistors; $h_{FE}$ approx. 250 (BC108B)

# *Simple—Solid-State—Efficient-*
# *'Mainline ST-5 RTTY Demodulator-*

By IRVIN M. HOFF, W6FFC
12130 Foothill Lane
Los Altos Hills, Calif. 94022

For some time a simple yet effective RTTY demodulator has been needed. The typical newcomer does not want to build a complex "best there is" sort of thing, yet the W2PAT unit in the ARRL HANDBOOK has long since been obsolete.

With the intention of providing something that will give excellent results on normal signals that could readily replace the W2PAT unit, the ST-5 was designed.

BRIEF DESCRIPTION OF THE ST-5

This unit uses a 709C linear integrated operational amplifier ("op amp") for a limiter, and a second 709C for a slicer (trigger) stage. It uses a Motorola MJE-340 300-volt transistor as a keyer to turn the printer from mark to space. It offers the identical "floating loop" power supply which we developed for the TT/L. It has a well-balanced linear discriminator for 850 shift that gives the user the option of normal 2125-2975 tones for mark and space, or if he insists on using "low" (non-standard) tones we have included figuresfor 1275-2125 tones. It can quickly be adapted to 170 shift although this is not shown on the basic diagram -- it will be explained in the text later. A "plus-plus" takeoff is provided for a tuning meter, and scope points are shown if you wish to use a scope.

THE LIMITER

The 709C offers gain so fantastic it's hard to describe the potential performance available. Where something like the TT/L offered perhaps 50 db. of limiting, the 709C offers closer to 90 db. This would be comparable to raising the voltage in the TT/L from say 230 to nearly 7500 volts! There are other advantages as well, since this takes the place of three tubes and two transformers; is all d.c. coupled; responds up to 10 MHz (which puts the recovery time in the microsecond category); is inexpensive and no larger than many transistors. It has a good output swing of better than plus-minus 10 volts. With the circuit shown, it will start to limit on a signal as low as 200 microvolts input level. A simple one-pole R/C high-pass filter is included in the input to keep the 60 Hz. hum in the receiver audio from reaching the limiter, thus some of the advantages of a bandpass input filter are realized.

THE DISCRIMINATOR/DETECTOR

With simple one-toroid per channel filters, it is rather difficult to design a proper discriminator. A lot of problems are inherent that most casual observers would not consider. Indeed, when looking at the circuits offered by many designers, no consideration at all appears to have been given some of these areas. "Q" is dependent on frequency, and so is impedance and output voltage. Bandwidth is dependent upon "Q". To simplify the matters we can say that if you merely put a capacitor across a 88 mh toroid, the bandwidth will be too narrow to be useful in RTTY, it will not be the same for two different frequencies such as 2125-2975 (it will be worse for 1275-2125!) and the voltage developed across the filter with a given input will be considerably different for the two frequencies. Hence the designer has to take all these things into account, and at the same time realize that the "total area under the curve" affects the general noise balance as well. Hence it is no simple matter to get a well-designed linear discriminator that exhibits relatively equal bandwidth for mark and space, has equal output voltages, good linearity (proper crossover) and reasonable noise immunity.

The detector stage on most demodulators is half-wave rectification, and on some units, voltage doublers are used, making the filtering problem even more difficult. The Mainline ST-series (ST-3, ST-4, etc.) use full-wave detection, which results in much less ripple and easier and more effective filtering.

THE LOW-PASS FILTER

Most simple demodulators do not offer any low pass filtering at all. The best units have complex 3-pole Butterworth minimum bandwidth filters that usually take a large and expensive inductor plus an isolation stage at either end. The ST-5 has a single-pole R/C filter that does an adequate job of removing the audio ripple from the d.c. keying signal.



THE SLICER

Another of the 709C op amps is used. Since we are now dealing with d.c. signals instead of audio, you will notice different "compensating networks" are shown at points 1-8 and 5-6. This slicer has so very much gain that a signal variation as low as 1-2 Hz. will cause the keyer to switch completely from mark to space. Shifts as small as 3-4 Hz. then could easily be copied if the operator had a steady enough hand!

THE KEYER

This is the identical keyer stage that will be used in the deluxe ST-6. The MJE-340 is a 300-volt transistor costing approximately $1. Although capable of handling power up to 25 watts, it is used here as a saturated switch that is either "on" or "off". Even with a 60 mill. loop, the keyer therefore pulls something like 0.012 watts in mark, due to the very low saturated collector-emitter voltage of only 0.2 volts. Under normal circumstances, it is thus virtually indestructible in RTTY use. It is cut off hard for space, by negative voltage from the slicer. The diode at the base diverts this excessive negative voltage to ground which keeps the base-emitter junction from acting like a Zener diode when the slicer goes to negative 10 volts.

A spike-absorbing network goes from collector-to-ground to reduce the "back e.m.f." caused by the selector magnet inductance as it switches from space back to mark.

THE LOOP SUPPLY

This is a similar concept to that we developed for the TT/L. The resistor values are changed somewhat since the 6W6 vacuum tube in the TT/L acts like a switching resistor, while the solid-state keyer in the ST-5 acts more like a typical switch. The f.s.k. output point will supply a minus-plus voltage as you switch from mark to space, thus it offers excellent adaptability to various types of transmitters, some of which need "conduct-on-mark" instead of the normal "conduct-on-space". If you are "upside-down" merely reverse the diode in your transmitter's keyer and it should then be normal. Few f.s.k. driver systems will offer this simple remedy, so don't expect this trick to work with demodulators other than the Mainline types.

STANDBY SWITCH

Shorting the Standby switch S1 puts the printer into mark configuration. The voltage across the switch contacts is normally 0.2 volts for mark and perhaps 175 volts for space. This is not alarming, the voltage across switch S2 is of course 120 VAC.

THE LOOP TRANSFORMER

Do not get excited if you find the rating of the Stancor PA-8421 to be "only 50 ma." Once again we should point out this does not apply to our use of the transformer. The high voltage secondary of this transformer is rated on the basis of the current in the primary, which is capable of supplying nearly 20 volt-amperes to the two secondary windings. Since the filament winding is rated at 2 amps at 6.3 VAC, this leaves around 50 mills for the 125 VAC winding. However, if the filament winding is not used, the secondary can then take the entire 20 volt-amperes by itself, which would be some 150 mills. So do not be alarmed at the ratings, you'll never hurt the transformer. As an example, I have had a similar transformer running for six years at 24 hours per day in the TT/L and have never experienced any difficulty nor do I expect to. As long as you can hold your hand on any transformer, it's usually not too hot!

THE POWER SUPPLY

Practically any 24 volt center-tapped transformer will work fine. The op amps can take up to plus-minus 18 volts on them, so if you get anything from 10-18 volts plus-minus, it's fine. Regulation is not needed on this unit, and in fact offers very little advantage, since you will be pulling the same amount of current on both the plus and minus supplies. Any change in the transformer will be reflected by an equal change up or down on both supplies at the same time, and cancel out. The voltage at the pin 3 of the limiter will not matter once initially set for the nominal power supply output voltage. It is only a few millivolts and a radical change in the power supply voltage would have negligible effect, if any.

If the voltage is more than 15-16 volts, just increase the size of the 15 ohm resistors until it is what you want. This offers the possibility of any of a number of power transformers being suitable.

TUNING THE FILTERS

This has been discussed before a number of times. For the most accurate

tuning, a counter or accurate audio generator is needed. Otherwise, just put a 0.068 capacitor across a 88 mh toroid and you'll come out "close enough" to 2125, although the exact right capacitance is 0.06374, assuming no error in the capacitor value. Use Mylar capacitors, such as the Sprague "Orange drop" as an example. The toroids are connected in a normal "series" manner with the middle connection of the two windings grounded as shown. The values for the capacitors shown in the table are quite accurate, and assuming you have 10% capacitors, you should be close enough to mark and space to be happy. Of course even at 10%, you can miss it 100 cycles easily.

ADJUSTING THE ST-5

With no input signal or with the input grounded, put a voltmeter at pin six of the limiter, or any place connected directly to pin six, such as the one side of the 5K pot. This is a very low impedance point so you need not use a v.t.v.m. for the purpose. Any voltmeter will do. Adjust the 25K pot until you get zero volts at pin six. If you cannot zero this adjustment, you'd better write me a letter, you've done something else wrong or ruined the op amp somehow.

Now put the voltmeter at point "A" or refer to the tuning meter which we will talk about a bit later in the text. Go from mark to space on the input and adjust the 5K pot until the meter reads a similar amount of voltage for both signals.

You are finished. Neither adjustment should need to be made again. The only other adjustment would be of the pot in the narrowshift c.w. identification system on the f.s.k. output.

THE TUNING METER

Fig. 1 shows a suitable O-1 ma. meter used for tuning purposes. You can also use any other voltmeter or v.t.v.m. hooked to point A as a tuning indication. If the meter flickers as the station goes from mark to space, you don't have him tuned correctly. A capacitor may be placed across the meter if desired to dampen its oscillations somewhat. This may be necessary if using an inexpensive imported meter. Although a scope display is preferred by most serious enthusiasts, the meter display is quite adequate, and more accurate than many might at first think.

170 SHIFT

If you wish to occasionally copy "narrow shift", add a 0.022 capacitor in series with a toggle switch and put this combination across the space toroid. This automatically will change the 2975 frequency to very close to 2295. However, the balance at point "A" will be upset somewhat, and it is merely an expediency which will give reasonably good 170 shift.

If using the 1275-2125 tones, you need to put two capacitors in parallel -- a 0.068 and a 0.0068, then put the switch in series with these two parallel capacitors and then put this combination across the space toroid. This changes the 2125 space frequency to about 1445. Again this is only an expediency, and does not give optimum filter balance, etc.

AUDIO INPUT

If your receiver does not have a 500 ohm tap you can hook the ST-5 directly across the speaker impedance. However, you have automatically 'thrown away" about 20-25 db. potential performance in the limiter. A better idea would be to get a voice coil to 500 or 1000 ohm transformer. Inexpensive, imported transformers are available for under $1. If you do hook directly to the speaker tap, just be sure to run the receiver at least a normal room volume.

COMPONENTS

The 709C op amps are available in a number of brands. The best known is the Fairchild, but Signetics and Motorola have them also. They vary (as of this writing) from $2.62 to $2.80 brand new, depending upon brand selected. Motorola are available through Allied, Newark, etc. The other brands are a little harder to find. Here are two addresses for the Fairchild for mail order.

G.S. MARSHALL CO.
732 No. Pastoria Avenue
Sunnyvale, California 94086

Hamilton Electro Sales
340 East Middlefield Road
Mountain View, California 94040

The item to ask for is the 709C op amp in the "TO-5" can. This is so much easier to work with than the 14-pin "dual inline" package. However both cost $2.65 currently. Send additional money, approximately $1 to cover packaging and mailing costs, plus sales tax if from California.

If buying the Motorola, you need to get the "MC-1709CG" version, they are $2.80.

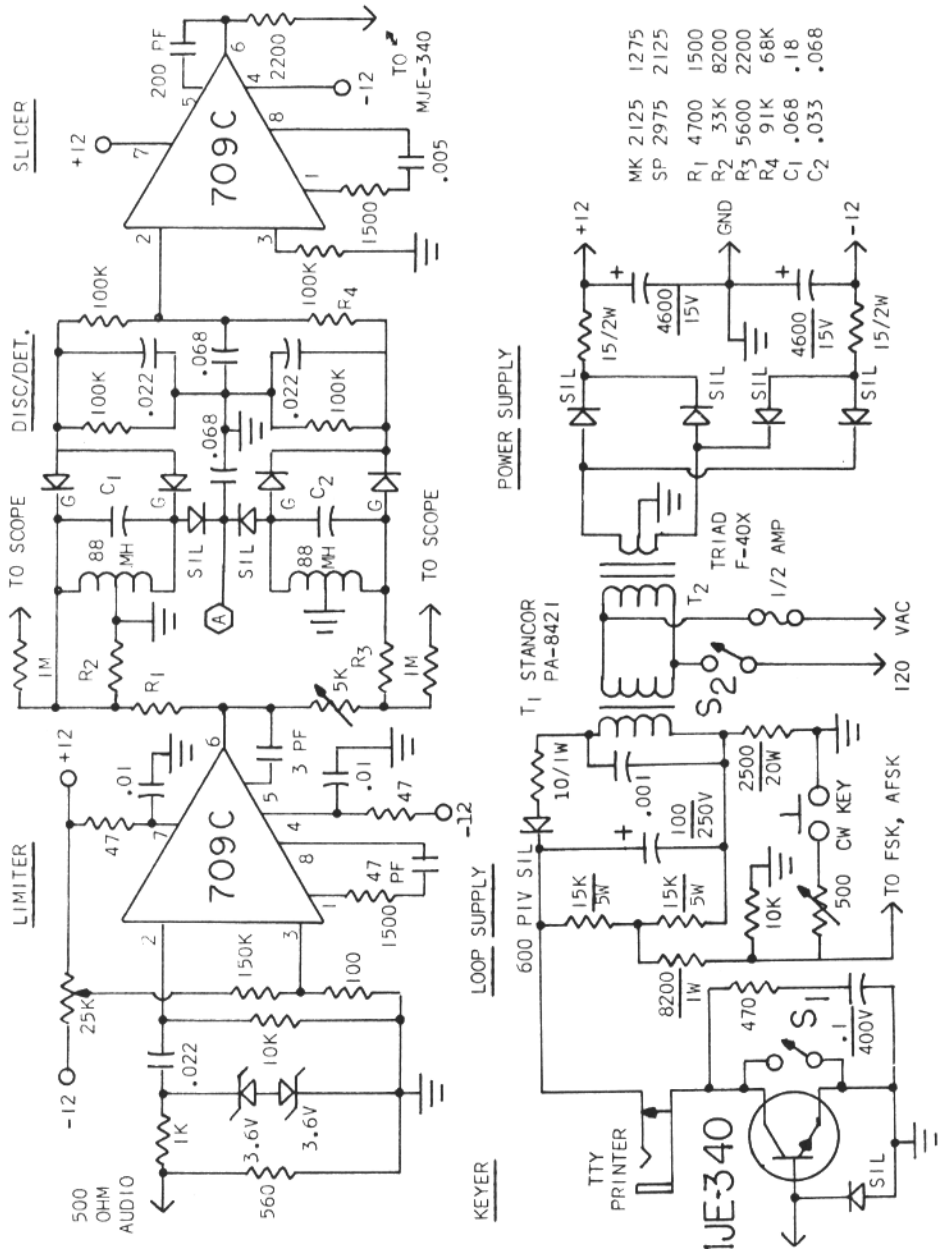
Several firms dealing with surplus semi-conductor items such as advertise in ham magazines are selling the 709C for as low as $1.49 each.

The 88 mh. toroids are available from advertisers in various ham magazines and in RTTY JOURNAL ads.

The 4600 MFD. capacitors in the power supply are Sprague 36D462GO15AA2A types at $2.31 each, but any large size



## ST-5 Demodulator



15V capacitors will work fine. We recommend at least 2000 Mfd.

The diodes marked: "G" are 1N270 Germanium, those marked "Sil" are most any silicon types. The 1N4816 or 1N2069 should be adequate (about 32¢ each) for anything other than the loop supply. There a 400 PIV should be used, or better, such as the 1N2070, etc. The Zener diodes in the limiter input can be replaced with two silicon diodes if cost is essential. In that event, do not put them in series as is shown for the Zeners, but put them in parallel, with one in reverse direction from the other. This is a protective device to keep the input on the op amp under the maximum allowed, which is around plus-or-minus 5 volts peak-to-peak. You can even leave the Zeners off entirely, but it is possible to ruin the op amp if you inadvertently tune the receiver quite loudly. It's possible on some receivers to get as much as 50 volts peak-to-peak at the 500 ohm tap if the volume control is "wide open."

WIRING THE OP AMP

Looking at the bottom of the op amp where the wires come out, you will see a small tab on the outer circumference. This tab is opposite pin 8 of the op amp. Looking from the bottom, you then go clockwise from there for the other pins. This is similar to an octal plug for a vacuum tube.

WHAT'S MISSING IN THE ST-5?

This is an elementary demodulator of few parts. Unlike most simple units, it also offers a superb means of keying the transmitter along with narrow shift c.w. identification.

The limiter section is equal to the very best. The discriminator section is equal to anything published and is comparable to that in the ST-3. The slicer is equal to anything published or likely to be published for some time to come. The keyer section is in the same category.

However, this unit does not have a deluxe low pass L/C 3-pole filter nor does it have a threshold corrector that would allow automatic copy on mark-only, etc. Thus, for something that can be quickly built at low cost and still do a good job as a simple demodulator, it should fit a needed vacancy on the RTTY operator's table. One could not expect to design a suitable unit for much less money.

COST

The semi-conductors cost $6.36 total. The front end, including semi-conductors, up to the collector of the MJE-340 would cost about $14.50. This is using Mallory 39¢ pots. The loop supply would be around $8, and the power supply around $11. You can thus see that the power supplies are (as always) a disproportionate part of the cost on a simple demodulator.

It is interesting to note, however, that these power supplies may be used to power other solid-state devices as well as the ST-5, and in any event, should you desire to later build a more complex unit, you would use about 95% of the components already used in the ST-5, so it would make an excellent building block for better things to come.

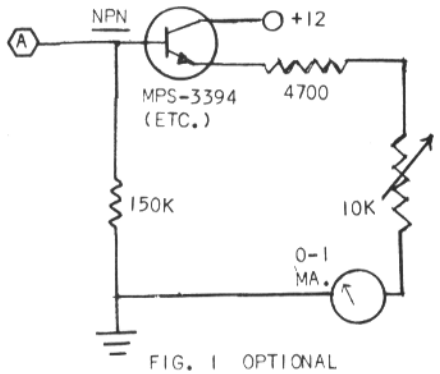



FIG. 1 OPTIONAL TUNING INDICATOR

THE ST-6

The Mainline ST-6 has already been designed. It is as complex as this unit is "simple". It will be published when we have time to do so and there is room for it. It uses 7 op amps and 9 transistors, including two in the regulated power supply. Practically everything in the ST-5 is used in the ST-6, plus of course a great many more components as well. That unit offers among other things autostart, anti-space, an "active" low-pass minimum bandwidth filter, optional limiter-on/off switch, threshold corrector for single channel copy and optional bandpass input filters for 170 and 850 shifts. If you were to assemble the parts for the ST-5, it would be a marvelous introduction to the ST-6, later, and almost all the parts would be used for the other unit. The ST-6 will be the long-awaited solid-state replacement for the TT/L or TT/L-2. Schematics are available now from the author for $1.

***



# *Modifying the Model 28 Teletype*

## PART 4 — The STUNT BOX

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THE STUNT BOX

This is possibly the section that a great many of you have been waiting for. There is so much to cover, however, that we shall have to do it in bits and pieces.

If you have wondered why this unit is called the "stunt box" you will better understand after we have shown you how to remove it. Since this mechanical marvel enables the operator to accomplish a great variety of features (or "stunts") it became known as the "stunt box". An excellent booklet going into elementary detail of the stunt box was available for free from the Teletype Corporation until recently, but unfortunately they no longer print the booklet. We shall therefore, have to try to describe the action of the various parts through a few simple photographs. The 216B manual on "Description and Principles of Operation" has some modest but information drawings of the stunt box in Section 573-115-100 on pages 33-37.

It would probably be easier to discuss the stunt box and components in it if we were to first have a look at it.

REMOVING THE STUNT BOX

The stunt box is located at the rear of the typing unit, directly below where the roll of paper sits. Fig. 7 shows the unit removed, just as it would be pulled out of the machine, with the rear part facing you, as well as the rear of the typing unit. Fig. 8 is approximately the same thing, but with the stunt box swung around to show the "business end" that plugs into the typing unit. Fig. 9 probably is a poor photograph, but shows the stunt box in my particular 28ASR, which is "loaded" and has all 42 slots being used for various purposes. This is getting ahead of the story, but figs. 8 and 9 show the two extremes between a "minimum loading" and a "full house" loading.

Now to get on with taking it out of the machine as shown in Figs. 7 and 8. First, remove the typing unit from the keyboard base. We have discussed this before, if you need a review, see Article 3 where we were talking about the keylevers -- under that section we discussed removing the typing unit.

Set the typing unit on a piece of newspaper, then turn it around so the rear faces you. Remove the paper roll if you have not already done so. About the bottom of where the paper had been, you will see (on most of the machines, probably all of them) a six-sided rod about the size of a wooden pencil that runs between the left and right fram members (that supported the paper roll.) There is a bolt on each end holding this rod to those frame members. Get a small bowl or box to put these parts in, otherwise you'll surely knock them on the floor sooner-or-later and perhaps lose them. Remove the bolt at either end of that rod, then pull the rod out and lay aside.

Now looking slightly ahead of where this rod was, we see another one, only this one is round and smaller in diameter -- about an inch ahead of the one we just removed. This rod is part of the stunt box (operates the "stripper blade") and will not be removed, but there are some things attached to it which have to be disconnected. At the left end of this rod, about one and three-quarters inches from the left frame, there is a connection to this rod that goes to the main shaft below and operates the rod as the motor turns the gears. There is a bolt and retaining ring ("C" ring) that holds this piece to the shift. Remove the ring and the bolt. Now the rod is free from the coupling, which may be pushed to one side to disengage it from the arm that goes to the main shaft -- this arm then will drop down out of the way (depending upon whether the main shaft below has been rotated far enough).

Directly ahead of this rod we have been working on is the "stripper blade". It looks a little like a household "ruler" that you use to measure lengths up to one foot width. About one-half inch from the right side you will see a piece that has been added to the stripper blade. This "strips off" the pawl on the line feed slot. Look at the bottom of that added piece and you will see a hook that engages a small lever that projects through the hook. Keep this in mind, as this hook can get caught when trying to remove the stunt box (or replace it) unless

you first lift it up with respect to the stripper blade; also when replacing the stunt box it is imperative that it re-engage the lever again.

Now just below the stripper blade at each end you will see two bolts. At each end, one of the two will be lower and farther away from the center of the machine than the other. It is this "lower" bolt at each end that holds the stunt box in the machine. Remove this "lower" bolt from each side, and now the stunt box is ready to be pulled out. Before you do so, note that the electrical wiring along the top of the stunt box is held from getting in the road of the paper by a small metal arm along the left frame member. Loosen that arm, swing it down a bit, free the electrical wires, and then put the arm back where it was. Now pull the stunt box out. When you have removed the two "lower" bolts, usually the stunt box "pops out" about a quarter-inch from the spring tension on the function bars. If it has not already "popped free", tug a little at either end of the rod ahead of the stripper blade, or rotate the main shaft below a revolution.

You can now slide the stunt box out, noting that it has grooves at either end to assist in this. At the right end, make sure that little "added piece" on the stripper blade is high enough to clear the bracket where you removed that "lower" bolt, otherwise you will be unable to pull it out any further. You will also perhaps need to rotate the main shaft somewhat so that the arm that hooked to the rod clears the bottom of the stunt box.

Although this has been quite detailed in an unscientific manner, you will appreciate these hints for the first attempt. After that of course, it immediately becomes a very simple job. Those reading this information who have already removed the stunt box a few times will find this section too elementary to be of any interest. But when working with a machine whose new cost was around $1,200, a person finds even the most simple detail of great interest.

The end of the stunt box that has the electrical wires connected is the "beginning" end, and the slots are numbered starting at this end.

TYPICAL SLOTS

The "repaired" mouse machines should all have a common stunt box arrangement. I think the non-repaired will all be identical except for a "Z" instead of an "H" on the motor-stop set-up as discussed in article 3.

Slot 1 - "Space"
Slot 2 - "Figures"
Slot 3 - "Letters"
Slot 5 - "Carriage Return"
Slot 22 - "Blank"
Slot 28 - "Blank", upper-case"
Slot 29 - "H, upper-case"
Slot 30 - "S, upper-case print-only"
Slot 35 - "Blank"
Slot 36 - "Blank"
Slot 38 - "Line Feed"
Slot 40 - "Line Feed, print-only"

Now to explain. Slot 1 (space) is the "downshift-on-space" system. When a space is typed, it will pull a "shift-fork" on the top part of the stunt box which in turn operates the bottom code bar and puts you back into lower-case, if you were in upper-case. All the Mouse machines have this feature. About the middle of the top part of the stunt box at slot one is a bolt and locking nut. If this bolt is run "down" into the top of the stunt box, it causes the front of the function pawl in slot 1 to tilt down, causing the rear part to raise (Front in this case being toward the "business end" of the stunt box, rear being toward the stripper blade and rod.) If the function pawl is raised, it disables the "downshift-on-space" feature. Under rare circumstances you may want to disable this feature, as for copying certain commercial stations, but in general it is a most valuable feature and you would want to run the bolt out to where it does not interfere with the operation of the function pawl.

Slot 2 operates a slide on the top which pulls the shift fork the other way, causing the bottom code bar to go to "upper-case" and slot 2 also suppresses spacing during operation of "Figures" characters. Slot 3 pulls the same lever that slot 1 can operate, and moves the shift fork to "lower-case". Slot 3 also suppresses spacing.

Slot 5 operates a slide on the main frame of the typing unit just below the stunt box, which mechanically trips the carriage return mechanism. It also suppresses spacing.

Slot 22 has only one purpose, it suppresses spacing on "blank" characters, or during "open loop" configuration as when holding the "break key" down.

Slot 28 and 29 work together. If you get an "upper-case blank" slot 28 works, and latches up for one slot, so if immediately followed by an "H" (or "2" on some machines) it will then complete the switch



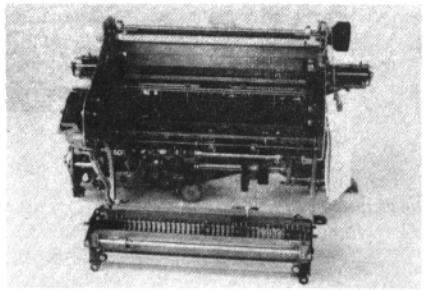

Fig. 7 Showing a stunt box as pulled out of the rear of the typing unit.

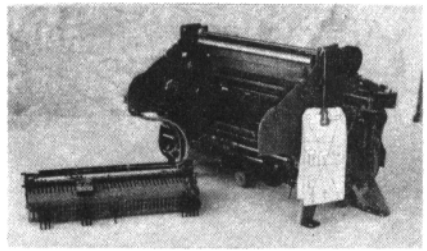

Fig. 8 Same stunt box showing the front side. The function bars are visible sticking out the front plate.

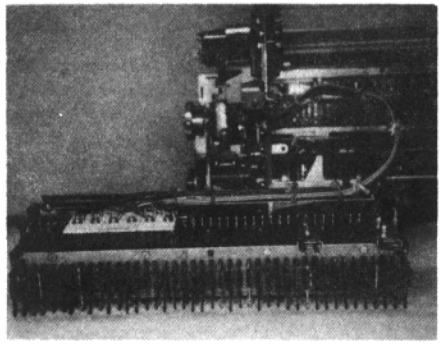

Fig. 9 A completely "loaded" stunt box using all 42 slots as used at W6FFC in the main 28ASR.

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above slot 29 and this will activate the "Motor-stop" relay. Slots 28 and 29 are called "sequential" since 29 cannot work unless 28 has been selected immediately prior.

Slot 30 is the "bell" and works from an "upper-case S". The bar is also coded for "print only" which has to do with selective call-up (Selcal) so the bell won't ring if you are in "non-print".

Slots 35 and 36 are also "sequential" so if you get two consecutive "blank" characters (or an open circuit) it will activate a slide on the main frame under the stunt box and mechanically lock the keyboard so you cannot type on it. This feature is of no particular value on radio circuits and may be disabled by tying up the function pawl on slot 35. This was discussed in Article 3, relative to the "motor stop" on slots 28 and 29. For simplification (in Article 3) we suggested typing up the function pawl "in the slot adjacent to the bell slot". That would be slot 29. However, now that you understand a "sequential pair" of slots, you will see it would actually give less wear and tear if you prevented the first slot from working rather than the slot that actually performs the function. We'll recommend you thus tie up slots 28 and 35 to prevent motor-stop and keyboard lock.

TYING UP FUNCTION PAWLS

This was discussed in Article 3 under "motor stop". We suggest if any of the pawls are now tied up (or if you are using an intentionally disabled downshift-on-space system in slot 1) you temporarily now put these slots back to normal. Here's the reason. When the function pawls are tied up, the function bars are free to slip out of the stunt box if it is tilted, and in any event the springs on the function bars will attempt to pull them out of the box. This makes it very awkward to replace the stunt box properly, even when you know what you are doing. By lowering the function pawls to normal position on such slots as 1, 28, 29, 35, and 36, then the function bars associated with those slots will be kept from slipping out of position, and returning the stunt box to the typing unit will be a simple job. Otherwise, even experts would have a most difficult problem without using special tricks of some sort. Those slots are easily enough tied back up to their "inactive" position once you get the stunt box back in the typing unit. This is a most important and useful hint, so do not overlook it! You will also find on many machines a small bracket on the top of the stunt box adjacent to slots 28 (may be partially hidden by the switch block) and 35. These little metal brackets are for the purpose of holding up the function pawl automatically. I suggest you do not use them, but instead just "tie up" the function paw via a piece of string or small wire to the channel iron that holds the electrical wires. There are also special clips for the purpose which resemble bent paper clips.

THE REMAINING SLOTS

We had two slots to go before getting side-tracked about the sequential slots. Slot 38 has a "line feed" function bar in it whose only purpose is so suppress spacing for a line feed character. Slot 40 has a "line feed" function bar also, but responds only during "print". This is for "Sel-cal" action so that if in "non-print" you do not turn up a new line feed each time one is called for.

You will probably wonder why it is not possible to suppress spacing with slot 40 instead of having to add slot 38 for that purpose. It's a very interesting situation. Slot 40 actually operates the slide which trips off the line feed clutch. This is a "3-stop" clutch. That is, it COULD BE operated 3 times while the others are operated once. (The "spacing clutch" is also a 3-stop all the others are "1-stop".

The reason the line feed clutch is a "3-stop" is to enable it to turn up two lines if desired rather than one. Many commercial installations such as radio stations, TV news departments, etc. prefer to double-space all incoming text automatically. The function pawl on the slot 40 is tripped off not by the main stripper blade but by the "added piece" we mentioned previously, so that it could be operated several times for double line-feeds. Anyway, to insure proper spacing suppression for line feed, we do it in "some other slot", namely slot 38 in this case.

REQUIRED SLOTS

Assuming you want to later add "auto CR-LF", we must use seven specific slots and 2-3 others of those remaining.

Slot 1 - Space -- for downshift on space
Slot 2 - Figures -- for upper-case
Slot 3 - Letters -- for lower-case
Slot 4 - Auto CR
Slot 5 - Carriage Return
Slot 39 - Auto LF
Slot 40 - Line Feed
Slot "A" Bell -- upper-case S
Slot "B" Suppress spacing for line feed
Slot "C" Suppress spacing for blank

Thus we have pretty much committed 10 of the 42 slots. This leaves 32 more that you can do all sorts of fancy things with, such as "Sel-cal", excess line feed prevention, excess bell-ringing prevention, automatic station control, remote control, automatic T.D. control, have it ring a bell in the house or shack if somebody mentions your name or call letters, have it ring a bell if somebody unexpectedly sends "BK", and many other things which you may wish to do. Now let's show you how to install "non-overline in your machine in a few seconds and at no expense.

ADDING NON-OVERLINE

On a "normal" Teletype machine, if someone accidently hits the "Carriage Return" character, of course the carriage comes back, but will not turn up a new line. Thus it is easily possible to retype over the same material a second (or more!) times. This is called "over-lining", and of course is more than slightly annoying, as it not only wipes out what you have printed previously, but also destroys what is now being printed.

Fortunately the 28-series of Teletype equipment adapts immediately to "non-overline protection", and without use of new parts. The system requires almost no effort to incorporate and can be changed back in a few seconds to "factory stock" anytime the stunt box is removed from the typing unit.

In the case of the "mouse" machines, merely exchange the function bars in slots 5 and 38. That's absolutely all there is to it! The function bar is the item with the various "teeth" (tynes) that sticks out the front (business end) of the stunt box. To remove a function bar, unhook the spring on the bottom side of the stunt box, and merely pull the function bar out. It will probably catch on the hook of the function pawl at the rear of the stunt box, in this case, merely take your finger and hold up the function pawl for that particular slot and at the same time pull the function bar out.

If you are reading this series of articles and do not have a "Mouse" machine, it is simple enough to find the proper function bars. Prior to removing the stunt box, do this:

1. Remove the roll of paper
2. With the motor running peer at the top of the stunt box.
3. Hit the "carriage return" key -- some slot should show activity -- probably slot 5, starting your count at the right end of the stunt box as you look in while standing in front of the machine. Remember this slot number.
4. Now hit the "line feed" key. Two slots should show some activity. Slot 40 no doubt, and some other slot somewhere, probably (but not necessarily) slot 38.
5. Leave slot 40 alone, but exchange the other two you found and replace the stunt box.



WHY NON-OVERLINE WORKS

We have now placed a "line feed" function bar in slot 5. This also suppresses spacing for line feed characters. We have now put the original "carriage return" function bar in the "other slot". Thus all it now does is suppress spacing for "carriage return" characters.

Thus when a "carriage return" characters is typed or received, nothing at all happens, and the carriage really does not come back at all, like it once did. On the other hand, now when a "line feed" character is received or typed, this will return the carriage via slot 5 and turn up a new line via slot 40. Thus we have eliminated the possibility of an erroneous carriage return wiping out previous material via "over-lining", and now the machine acts more like a normal typewriter insofar as we get carriage return and line feed concurrently.

The 28 machine gets back so rapidly to the beginning of a line it is not necessary to type some "non-printing" character (such as a "letters") following the line feed, but it is still standard practice and always has been. Even at 100 speed, the unit should "get back in time" if properly adjusted. Perhaps normal "end-of-line" sequence should be reviewed as many people apparently are not aware of customary routine in this respect:

1. CR
2. CR
3. LF
4. LTRS

It may feel awkward for awhile to hit the "CR" key and have nothing at all happen, but the delightful improvement in copy will make it most worthwhile.

Before leaving the subject of non-overline, let me say that there are many other systems which you can use as well. It should be obvious that none of them could approach the simplicity of this system where you merely exchange two items in the stunt box that are easy to get at. The other systems require moderately elaborate slot components, some special parts, and rely completely for normal operation upon the reception of "CR" and "LF" in their proper sequence. Some of these systems are fascinating to install or decipher, but in general you would find them costly, inferior in performance to this ultra-simple system, and worst of all, they tie up several slots you may need for other things. Later in the year we may mention some of them for their interesting application of stunt box potential.

REPLACING THE STUNT BOX

If you now have the "non-overline" feature added (or for some reason decided you didn't have any need for it) you are ready to replace the stunt box. We have not installed "auto CR-LF" parts as yet, we'll get into that a little later in the series as right now we are trying to give you the "feel" of the stunt box and don't want to rush things too fast.

Make sure none of the function pawls are tied up or held up via the little metal brackets we talked about. Peer under the stunt box and make certain all the springs are hooked properly to the function bars. Now note that on either side of the stunt box is a little guide to go in the "rails" to help put it back in the typing unit. There are only three things to particularly watch as you slide it back in.

1) The "arm" from the main shaft below might get in the way of the leading edge of the stunt box, so be careful to keep it out of the way.
2) As you get a little further in, make sure the hook on the bottom of the "added piece" of the stripper blade clears the bracket that holds the right side of the stunt box, and then as you get further in, make sure this hook engages its lever properly.
3) The "shift fork" at the top left of the stunt box (we are at the rear of the unit, and "left" corresponds with slot 1, etc.) must engage the shaft in the typing unit properly. You may take a screwdriver and tap the "U" slot in the shift fork so it will properly engage, if necessary.

When you get within a quarter-inch or so of all the way in, you will meet sudden resistance. This is normal, as the function bars are spring-loaded and resist this final short distance. If everything else appears normal, just give a quick push at each end of the stunt box and it should snap into place. It may be necessary to hold it there while you install the two "lower" bolts to hold it in place.

Then hook up the main shaft "arm" to the coupler on the rod at the rear of the stunt box and install the locking bolt and "C" retaining ring again. Put the electrical

Continued on page 18

# RTTY-DX

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

Hello there. . . .

When the Contest Committee of the B A R T G gazed into the Crystal Ball to pick a date in March for the Annual Spring Contest, a big number "21" must have emerged from the haze in stark contrast to the rest. A better week-end could not have been chosen. Conditions were superb, to put it mildly. The preceeding and following week-ends were terrible by comparison and at this writing WWV is still sending out the big "U".

It was our misfortune to miss this one and we sorely regret it, but with thanks to KG6NAA, VK3DM, ON4BX, WB6RXM, and others we are able to piece together some of the highlights for you. A few of the lucky ones made W A C. South America was hard to find but late in the game Frank, YV5CIP showed up on Ten Meters for a short while and gave out numbers to the lucky ones that were around. Asia, usually the tough one to get in a Contest, was ably represented by Gin, JA1ACB and John, KR6JT, both stations putting in a sustained effort. And you must thank Leo, EL2BD for putting Africa in many logs, and as a three band multiplier for some. His was the only active station from that Continent that we know of. This too was the first Contest of late in which some of the participants made a determined effort to make five band contacts. KG6NAA made a few four band jobs with W and VE stations and did copy WB6RXM on 80 Meters but unfortunately it was no go. Charlie W5QCH and Adrain, VK2FZ had planned a sked on 3600 khz but apparently the conditions were not THAT good, besides Charlie was plagued with a high QRN level on that band. In the not too distant future the lower frequencies, 80 and 40, will gain more importance as the Sun Spot Cycle takes control of propagation on the higher frequency bands. There were some pretty high numbers given out toward the end and there should be some pretty high scores. By all means please send in your score to the Contest Committee, no matter how small you think it is.

## DX HONOR ROLL

| | | | | | |
|---|---|---|---|---|---|
| 1. | ON4BX | 90/86 | 29. | W5VJP | 37/32 |
| 2. | FG7XT | 95/84 | 30. | XE1YF | 38/31 |
| 3. | I1KG | 86/79 | 31. | VE5LG | 37/31 |
| 4. | W3KV | 85/77 | 32. | WA2YVK | 43/29 |
| 5. | ON4CK | 77/67 | 33. | VK3DM | 36/29 |
| 6. | K8YEK | 71/66 | 34. | K6EV | 33/29 |
| 7. | W8CQ | 68/65 | 35. | W4EGY | 37/28 |
| 8. | VE3AYL | 63/59 | 36. | ZL2ALW | 37/27 |
| 9. | W5QCH | 58/52 | 37. | CE3EX | 37/27 |
| 10. | G6JF | 55/51 | 38. | WB6QFE | 31/27 |
| 11. | WA6WGL | 53/50 | 39. | G3IYG | 33/25 |
| 12. | K8QLO | 56/49 | 40. | HK3SO | 28/23 |
| 13. | W3ISE | 58/48 | 41. | PJ2CR | 31/22 |
| 14. | I1ROL | 54/46 | 42. | VE4FG | 23/21 |
| 15. | W6CG | 51/46 | 43. | DL8VX | 33/20 |
| 16. | W1GKJ | 52/45 | 44. | KG6NAA | 32/20 |
| 17. | W2LFL | 51/43 | 45. | CX6CB | 33/19 |
| 18. | W4YG | 52/42 | 46. | WØHAH | 32/19 |
| 19. | K8JTT | 44/42 | 47. | W1ACW | 28/19 |
| 20. | WA8BOT | 51/41 | 48. | W3AVQ | 22/19 |
| 21. | I1CAQ | 43/40 | 49. | G3LDI | 26/18 |
| 22. | K4VDM | 42/40 | 50. | K9BJM | 23/18 |
| 23. | W8CAT | 41/39 | 51. | WB6RXM | 28/17 |
| 24. | WB6ADY | 39/38 | 52. | KL7EBK | 27/17 |
| 25. | VK3NR | 51/33 | 53. | K9QNV | 24/17 |
| 26. | I1CGE | 42/33 | 54. | HP1XHG | 24/15 |
| 27. | W7VKO | 35/33 | 55. | I1THB | 22/15 |
| 28. | VE4BJ | 33/33 | 56. | DL3NO | 14/10 |

Please be reminded that the next posting of the Honor Roll will be in the September issue.

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Well now, by the time you read this you will just have had time to squirt some oil in the vital places, put in a new ribbon and a fresh roll of paper, and you are all set for the WAE Contest which takes place the week-end of April 25th. Don't forget the "QTC" message to gain extra points and also in this Contest each call area in certain countries count as a multiplier. The rules appeared in the March issue.

This month we all extend our congratulations for W A C to --

Nr.124 Bob Stanek WØHAH

From the dates on the cards presented Bob has been on RTTY since 1961 and possibly before but the last one in March of this year from JA1ACB finally did the trick. Also, to keep the record straight, due to some administrative error back in the dim past the listing of most all the W A C Certificate holders last month was off by one number. It should have read as follows. Nr. 41 - W6LVQ, Nr. 41a LU1AA, and after that each number would be one less than listed. This would end with HA5FE as Nr. 123.

Apparently in our enthusiasm over being allowed to operate RTTY on the low end of 10 Meters we overlooked one important fact. A letter from Bud, W6CG informs us that the German hams are not allowed to operate RTTY below 28100 khz. So if we follow the custom as on other bands of centering around 090 khz we will miss out on some of the activity on Ten, particularly during Contests. Bruce, ZL1WB recently sent some info on band allocations down there and the ZL/ZM boys can operate F-1 only from 28000 to 28100 khz. Probably it would be best if we center around 28100 khz on that band. If there are similar restrictions in other countries please let us know so we can get a spot that is compatible to all. So it looks like we are back to a bit of "cross band" operation again on ten. Fortunately it is only khz now instead of mhz as before.

Wolf, DL8VX sends some information that will be of particular interest to the European Hams. He is transmitting "RTTY NEWS" every Sunday at 0830 GMT. He will find a clear channel between 7025 - 7050 khz and the transmissions will be in narrow shift. Wolf also tells us that he and a few of the Hamburg area hams were scheduled to meet with Ole, OZ60B on April 14th. Ole, as you know, is the author of the excellent article on the solid state TT/L2 so it was no doubt a very interesting meeting.

Merrill, W6AEE sent us some information he had received from Gin, JA1ACB which covers RTTY conditions in Japan and I am sure that Gin's comments will be of interest to all. First of all, permission to use FSK on 15 to 160 Meters requires a special license which takes more than six months to obtain. Next, the standard commercial Japanese RTTY code is a 6 unit code so the surplus Japanese machines are not useful for international RTTY. The machines being used by the hams are the Teletype Model 15 and Model 14 of which there seems to be a fair supply in the "scrap shops", to quote Gin, but the price is kept high by commerical uses. There is quite a bit of VHF activity and that is all with the 6 level code.

The power line frequency is 50 hz in most areas of Japan hence the necessity to use governed motors to get on 45.5 Baud. Gin sends his thanks to W6AEE and WO1TU for their help and advice in quieting the hash from his governed motor and it is now a minor problem. Additional activity can soon be expected on the HF bands. JA1ADN and JA1HNO are already set up with machines and TU's and awaiting the license. JA1MP as you may recall was the first JA to be active and used a modern Model 32 which he now has running on 45 Baud. Saku has not been very active lately since his duties as President of YAESU keep him quite busy. Right now there are about ten or so M-15 machines in the hands of JA hams so the prospects of increased RTTY from Japan looks real good. Gin points out one additional problem; quote "our Japanese wooden houses do not easily withstand the big vibration and sound of the machines so operation after mid-night local time is quite unlikely" unquote. Gin is really looking for RTTY contacts and will be on every Saturday at 2100 GMT on either 10 or 15 Meters depending upon conditions. He hears many stations and calls and calls with no response. Dig down for the weak signals fellows and you will no doubt come up with an Asian contact for that W A C.

In a way, and as they say in the story books, "we have come to the end of an era". If you are at all interested in DX and don't have Guam in the log you probably have not been active for six months or more. Shortly after you read this KG6NAA will be QRT. Larry certainly put out a tremendous effort to give us all the rare KG6 prefix and during his stay on the island had been active practically seven days a week plus sustained activity in all of the Contests. But time marches on and as we mentioned in earlier columns Larry will be reassigned to the States as of May 1st. After that date he can be reached at the following QTH-

Larry Filby, K1LPS
P.O. Box 47
Peacham, Vermont 05862

Well, with a QTH like that I guess that Larry will be busier than ever as many of you are just waiting for a Vermont contact to complete W A C. A final word.

Continued on page 16

# VHF RTTY NEWS

RON GUENTZLER, W8BBB Editor
Route 1, Box 30
Ada, Ohio 45810

Cappy, W8DXW, is Chardon, OH, sent along the following information: "In the NCV. 68 Journal a letter from Dave, K3ASI, might be updated now to say the fellows have got new xtals on 145.3 and are on autostart. They are K3ASI, K3YAK, and K3TNC. In addition, in Cleveland, Akron, and Eastern Ohio there has been quite a bit of activity on two meters on random frequencies: K8CXO, W8DXW, WA8TNG, W8EKJ, W8FQM, W8LEW, WA8MRT, W8NQR, K8QQQ, and W8URX.

"Not much activity on six anymore on RTTY, but this station, W8DXW, is still calling CQ on six at times in hopes that someone will again become interested in six RTTY. . . .This operator was surprised to hear a Clearwater, FL, station calling him on RTTY and had a nice QSO with same for about an hour til the band went out. This was with W4VME, Jim on DEC 23. Using a Utica 650 here to five element Telrex bean."

Joe Giovanelli, W2PVY, in Brooklyn, NY had the following information to supply the readers: "Our radio club, QRP International, Chapter 1, New York City, prepares a newsletter which we call THE MODULATOR. Naturally, it is mailed to all of our members and to the other QRP chapters. In addition to this, though, it is transmitted on RTTY on the two-meter band each Thursday evening at 7:45 p.m. EST or EDT as the case may be. Our frequency is 145.640 MHz.

"Perhaps it's also worth mentioning that all copies of the newsletter are printed via teleprinter gear. To save time we use eight-copy NCR paper. We find that with the Model 15 printer that all copies are very readable, with just a slight loss of sharpness on the last one.

"By the way, we won't be transmitting our newsletter during the summer months of July and August."

Thank you Cappy and Joe for the VHF RTTY News.

73 ES CUL, RG

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(NOTE FROM THE EDITOR)

We know that there is a lot of VHF RTTY activity but Ron our VHF editor receives very little information. True, VHF activity is of local nature and usually grouped around metropolitan areas but if someone would send in the operating frequencies and general practices of an area it could possibly standardize these practices and give other groups ideas.

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## DX cont.-

Continued from page 15

Larry is trying to infect some of the radio personnel on Guam with the RTTY bug and has been checking some of the boys out on the gear he is leaving behind. In this instance let's hope that the bug bites and that the infection lasts.

QSL EXCHANGE BUREAU

Since the initial announcement last month, Newt, K8QLO has expanded his QSL Service to include Stateside stations. The Service is for RTTY contacts only and will operate as follows.

DX STATIONS --

1. Write to K8QLO and give authorization and date you wish to start the Service.
2. Submit copy of Log, For Stateside contacts only, to K8QLO every TWO months.

STATESIDE STATIONS --

1. Send your QSL for DX contact to K8QLO, along with SASE. Upon confirmation by the DX stations Log WSL's will be exchanged.

Address all correspondence to --
K8QLO - QSL
5725 Lodewyck
Detroit, Michigan 48224

73 de John

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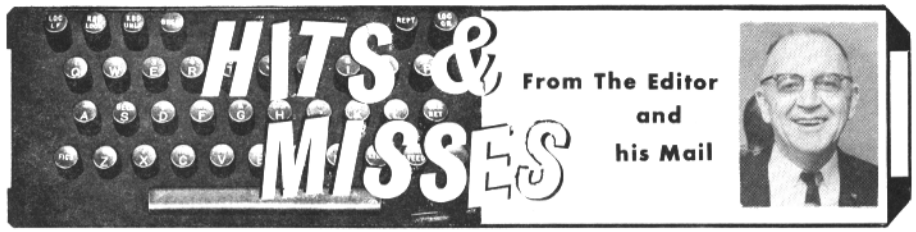


Back home from the sunny south and the usual stack of mail. But our being away accomplished one thing. A smart high school girl arranged our subscription list so we now have our card file alphabetical according to names and the stencils according to calls and call areas. Now when we get a check from a Mr. A. Smith from California with no other information we can find it without going through all the W6 call area. Something that should have been done long ago has finally happened.

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The Dayton Hamvention April 24-25 will be on shortly after this issue is mailed. Be sure and look us up at our suite at the Dayton Sheraton hotel either night. Usually the room number is on the bulletin board in the lobby.

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## BACK ISSUES

The ONLY back issues available are:

July through December 1966. No issues of 1967. All issues of 1968 except January and November. All issues of 1969. (July-August is one issue.) Copies are 30¢ each. RTTY JOURNAL binders are $2.50 each in the USA and $3.00 in Canada.

Our last copies of the TT/L-2 reprints are exhausted. Since this article has been reprinted in the May and June 1969 issues of QST

**RTTY JOURNAL**
P.O. Box 837 Royal Oak, Mich. 48068
"Dusty" Dunn — W8CQ
*Editor & Publisher*

**SUBSCRIPTION - 1 Yr. (11 issues)**
**U.S. - Possessions - Canada - Mexico**

First Class - $3.00
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All Others - Air Mail ----- $5.50

This is the third consecutive issue with 20 pages. We can't afford this forever but for once we have so many good articles it is hard to get all we want in the regular size. If you keep the articles coming in we will try to print them all. We especially need short fillers, hints, kinks, etc. Our biggest problem is filling in those partial columns.

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## Results 1969 'VOLTA' DX Contest.

| | | | | | |
|---|---|---|---|---|---|
| 1 | VK2FZ | 99.615 | 38 | W9HHX | 5.454 |
| 2 | SM4CMG | 61.740 | 39 | F5OL | 5.160 |
| 3 | I1KPK | 53.956 | 40 | W6FFY | 5.100 |
| 4 | I1CGE | 44.460 | 41 | HA5FE | 4.922 |
| 5 | SVØWO | 43.617 | 42 | WA8GVK | 4.873 |
| 6 | W3KV | 34.565 | 43 | K1YGF | 4,840 |
| 7 | VU2KV | 33.320 | 44 | WB2JBH | 4.202 |
| 8 | VK6DM | 32.952 | 45 | HA5KBF | 4.071 |
| 9 | I1CAQ | 32.490 | 46 | W2DIZ | 3.650 |
| 10 | K2LGJ | 30.402 | 47 | K8QLO | 2.853 |
| 11 | DJ6JC | 28.475 | 48 | EI5BH | 2,835 |
| 12 | ON4BX | 25.088 | 49 | DJ8BT | 2.700 |
| 13 | VE7UBC | 23.760 | 50 | K9KAG | 2.660 |
| 14 | K8ILL | 19.580 | 51 | DK1RV | 2.460 |
| 15 | W3IIZ | 18.501 | 52 | WA3LKD | 1.830 |
| 16 | I1EVK | 17.226 | 53 | OZ6OB | 1.651 |
| 17 | HB9AKA | 15.620 | 54 | I1KFL | 1.339 |
| 18 | W1JKL | 15.504 | 55 | WØTFP | 1.324 |
| 19 | W7RSJ | 15.470 | 56 | K2YEQ | 1.323 |
| 20 | W6LDF | 14.080 | 57 | IT1ZWS | 1.296 |
| 21 | WA6WGI | 13.855 | 58 | G3VQF | 1.265 |
| 22 | ZM2ALW | 13.762 | 59 | LA6OI | 1.152 |
| 23 | HA5KFB | 13.525 | 60 | VE3RTT | 1.045 |
| 24 | KG6NAA | 12.636 | 61 | K2RYI | 915 |
| 25 | WB6JBY | 11.886 | 62 | DL3NO | 240 |
| 26 | W1BGT | 11.747 | 63 | K9BJM | 230 |
| 27 | HB9ADM | 11.472 | 64 | I1VN | 210 |
| 28 | DL8CX | 10.849 | 65 | SMØKV | 208 |
| 29 | I1CWX | 10.848 | 66 | W9CTX | 205 |
| 30 | PAØGKO | 9.723 | 67 | W6BTV | 204 |
| 31 | DL8VX | 9.394 | 68 | K4GJW | 196 |
| 32 | K4VDM | 9.268 | 69 | ON5WG | 156 |
| 33 | AM2AFE | 7.900 | 70 | W6AEE | 144 |
| 34 | CE3EX | 7.569 | 71 | OK1MP | 120 |
| 35 | WB6RXM | 6.710 | 72 | WA6GGQ | 24 |
| 36 | I1LCL | 6.300 | | | |
| 37 | HB9P | 5.592 | | | |

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# *Armed Forces Day - 1970*

The annual Armed Forces Day Communication Tests will be held on May 16, 1970.

QSL cards for RTTY contacts may be obtained from any or all of the Armed Forces stations in operation.

QSLs will not be acknowledged from SWL stations but they may copy the official Message text and a certificate will be awarded for perfect copy as well as from licensed amateurs.

Military radio stations WAR, NSS, NPG and AIR will be on the air from 16/14ØØ GMT to 17/Ø245 GMT. During this test of crossband operations, the military stations will transmit on specified military frequencies while amatuer stations will transmit in the indicated portions of the amateur bands. Contacts will consist of a brief exchange of locations and signal reports. No traffic handling will be permitted.

A radioteletypewriter "RTTY" receiving contest will be conducted for any individual amateur or station possessing the required equipment. The "RTTY" broadcast will consist of a special Armed Forces Day message from the Secretary of Defense to all radioteletypewriter enthusiasts.

SUBMISSION OF COMPETITION ENTRIES

Transcriptions should be submitted "as received". No attempt should be made to correct possible transmission errors.

Time, frequency and call sign of the station copied as well as the name, call sign (if any) and address of the individual submitting the entry must be indicated on the page containing the text. Each year a large number of perfect copies are received with insufficient information, thereby precluding the issuance of a certificate.

Completed entries should be submitted to the Armed Forces Day Contest, ATTN: AFOCCOM, Room 3E 099, James Forrestal Building, 1000 Independence Avenue, Washington, D.C., 20330, and postmarked no later than 31 May 1970.

| TIME | S TRANSMITTING STATION | FREQUENCIES (KHZ) |
|---|---|---|
| 16 May 1970 | WAR - Army | 3347, 6992.5, 14405 |
| 17/0335 GMT | NSS - Navy | 4012.5, 7380, 13940 |
| 16/2335 EDST | NPG - Navy | 4016.5, 7347.5, 13922.5 |
| 16/2035 PDST | AIR - Air Force | 3397.5, 7315, 13995 |
| | A6USA - Army Radio San Francisco | 6997.5 |
| | A5USA - Army Radio Fort Houston, Texas | 4025 |

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## 28 Modifications -

Continued from page 13

wires under the little metal arm to keep them out of the way of the paper roll. Reinstall the support bracket (the six-sided rod), put the printer unit back on the keyboard base, turn the motor by hand (CCW) 1-2 revolutions, replace the four bolts holding it to the base, reconnect the cable to the rear of the right ribbon spool and you should be back to normal after re-tying up the function pawls for keyboard lock (slot 35) and motor-stop (28 or 29). You will now have non-overline and have learned quite a bit about the stunt box in the process. Now you will be anxious to add auto CR-LF, and that will come soon.

Article 5 will give a basic discussion of the stunt box components and how different items can do some of the things we have already mentioned.

Ester XYL & Denny WA8BVY — Laura XYL & 'Len' VE5LG — Grovie K9SLQ & XYL Susan

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**Signal One-on RTTY - Next Month- RTTY JOURNAL**



## CLASSIFIED ADS Rates- $1. - 30 words - Additional words 2¢ea. Closing date 1st of month.

PARTS - ALL MACHINES - fast service on all machines from 14s thru 35s. SASE for list. Sell Fred your surplus TTY for highest cash or trade. Typetronics, Box 8873, Ft. Lauderdale, Fla. 33310 W4NYF

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

WANTED: Teletype Models 28, 32, 33, and 35 and accessories, printers, etc. We pay highest prices - and freight. Cash or trade. AMBER INDUSTRIAL CORPORATION, P.O. Box 2129, South Station, Newark, N.J. Tel: 201-824-1244.

SPECIAL PROJECTS, TU's, kits, expertly built to order. Estimates without obligation. Of, by, and for hams. Applied Electronics Laboratories (W6BD, ex-W6CQK), 1068 Eden Bower Lane, Redwood City, Calif. 94061.

J & J ELECTRONICS WILL custom build your Mainline TT/L2 FSK demodulator completely wired and tested exactly as described in May 1969 QST with or without scope indicator, with two sets of filters, 850 and 170 shift with an 8 3/4 x 19 grey hammertone silkscreened front panel suitable for rack mounting. Wired and tested by the expert: W1SOG, John F. Roache. TT/L-2 plug in filters in vector C-12 cans. J & J Electronics, Canterbury, Conn. 06331

MOTOROLA MC790P, $1.90, MC789P, MC724P, $1.05 TI SN72709N op amp $2 6/$10. Other op amps and devices available. Write for list. HAL Devices, Box 365 RJ, Urbana, Illinois 61801

SWAP; NEAR MINT HQ18OC for a likewise 28KSR, Might pay cash difference for extra clean machine. F. Timberlake, W9EE, 2002 N. Elizabeth, Arlington Hts., Ill. 60004

FOR SALE: TT-117B, $175.00; TT-98A, $100.00; TT-119/FG, $100.00; TT-4A/TG, $100.00; Model 19, $85.00; Model 14 TD, $25.00 TS-2B/TG "Fox" Machine, $35.00; Mite machine, write. All plus shipping costs, Will consider swaps. WA5OVG, P.O. Box 38368, Dallas, Texas 75238.

FOR SALE - MODEL 19 complete $90.00 you pick up or will deliver 100 miles of Hartford $100.00, Sorry, can't ship. WA1LJM, 673 Dart Hill Rd., Rockville, CT 06066.

THE BTI LK-2000HD is built to take the tough service of RTTY. Not for just a few minutes but on an all day basis even with 2 KW input. Clean signal with minimum harmonics too. About 20 db more supression than most linears. Write W6KNK c/o HT Products, 4616 Santa Fe St., San Diego, Calif. 92109 for technical information.

WANTED: #28,32,33,35 ASR & KSR page printers, complete or parts. We pay cash and freight, or trade for new ham equipment. Alltronics-Howard Co. Box 19, Boston, Mass. 02101. (Tel: 617-742-0048)

TOROIDS 88mhy. center tapped - not potted 5/$1.50 postpaid USA. Foreign orders include extra postage. John Dilks III, Rte 1 Box 218, Mays Landing, N.J. 08330.

HOT CARRIER DIODES; New HP 2800, 90¢. 12/$1.00pp. Integrated Circuits; New Fairchild Micrologic, epoxy TO-5 package. 900 buffer, 914 gate, 60¢ ea. 923 J-K flip flop, 90¢ ea. Guaranteed. Add 15¢ postage. H.A. L. DEVICES, Box 365RJ, Urbana, Ill. 61801.

MODEL 100 TTY (pick up only), CV57/URR, Northern Radio FSK model 4, FS exciter 0-39C/TRA-7, for sale or trade. Make offer. John Herring, Box 426, Weaverville, Calif. 96093. Phone 916-623-4372

60 CYCLE SYNC MOTOR - $6.00 over 200 isues RTTY JOURNAL - $11.00. John Crysty, 14945 Dickens Street, Sherman Oaks, California 91403

TELETYPE PARTS and Supplies; DC supply new $7. Wheatstone perforator with keyboard, accepts 5 unit teletype tape and converts to morse code for automatic keying of CW signal, $75. WE polar relay 255A, $2.50. Polar relay socket for 255A, $2.50. Teletype page printer paper, 3 copies, case of 12 $5.00. Single roll, $.50. shipping weight 50 lbs. per case. Miscellaneous teletype parts and tools. Send SASE for list. L & L Electronics, PO Box 1327. Harrisburg, PA 17105.

FOR SALE: Teletype Model 15 pageprinter with table. Newer version with holding magnets and sync motor. $75.00 or best offer. Michael A. Persson, WAØGYQ, 1724 Fairview Ave., Cloquet, Minnesota 55720. 218-879-8332.

MODEL 19, Synchro Motors, TD and Power Supply. Recently overhauled by Teletype Service man. Standard keyboard, wooden table, new Paint job, $125.00 F.O.B. Rocky River, Ohio - H.W. Lingenfelter, 21352 Kenwood Ave., Zip 44116

HAVE TWO TT/L-2 Demodulators - will sell one. Standard 5 1/4" high fully shielded rack panel construction. Eye tube and 2" scope indicator, with loop current meter, switched wide and narrow shift filters. Excellent condition and fully guaranteed. See photos on left column page 3 of January, 1968 RTTY Journal. First $160 certified check or money order, FOB my QTH. Cole Ellsworth, W2FLJ (ex K5ØLU) PO Box 227, Succasunna, N.J. 07876. Phone after 7 PM (201-584-7199).

**ADDITIONAL CLASSIFIED on NEXT PAGE**