Additional Classified on Page 19

MAINLINE TT/L-2 FSK Demodulator for sale. Used one month. Professionally wired. 85C and 170 cycle band pass and discriminator plug-in filters. Simpson meter. 60-75-100 WPM selection. Standard rack panel and Bud cabinet. $220.60. Ed Brackin, W8VAS, 3390 Higley Road, Rocky River, Ohio 44116.

TRADE: Model 28 console cabinets for typing units less keyboards, or take typing units without trade. Send list. Ray Westcott 399 S. Ore. St. Ontario, Oregon 97914

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.

TOROIDS, LOWEST PRICE ANYWHERE! 88 or 44mhy, center-tapped, 40/$10. $5/$2.) POSTPAID. Fresh 11/16" oiled perf tape $3/box/10, $10/case/40. Model 32KSR pedestal mounted page printer, 60 or 100 speed, complete $200. Lorenz, German page printer (slightly larger than 15 but has built-in perf and TD units) with table $100. (Send stamp for photo or see Florida RTTY Bulletin for Nov.) FRXD 60 speed typing reperf with TD base $25. Gears for most machines $6/set POSTPAID. FACIMILE paper. . .12x19" sheets, fresh. 250 sheet package for TXC-1 or cut it up. $3. Stamp for list. Van W2DLT 302R Passaic Avenue, Stirling, N.J. 07980

MAINLINE TTL-2 ENTHUSIASTS. . .will assemble your kit form p.c. board. Quality workmanship. dozens completed to date. W1FCV. John Roache. 153 Chestnut St.. Manchester. Conn. 06040.

TS-2B/TG Teletypewriter Signal Distortion test set used. good. $35.00 ea. Transmitter-Distributor. Teletype model 14. synchronous motor. used. good. $18.00 ea. 'Here-Is' answer back keyboard; for model 15 with attachments to set up identifications. complete. used. good $12.00 ea. Send us your requirements. Atlantic Surplus. 580 3rd Ave. Brooklyn. N.Y. 11215.

TIRED OF GARBLE? Don't give up. Treat yourself to a Mainline TT/L-2. Custom built by J & J Electronics. Canterbury. Conn. and enjoy RTTY with armchair copy.

TOROID COILS 88 mh, uncased, postpaid, 5 for $2. LaVon Zachry, PO Box 845 Apple Valley, Calif. 92307

STELMA TDA-2 distortion analyzer $35. Motorized paper rewind reel $15. John Christy, 14945 Dickens St. Sherman Oaks, Cal. 91403.

TELETYPE PARTS - New Mig KBD $10.00. new M14 ROTR typing unit less cabinet $16.00. rebuilt MI5 (BP22/210) typing unit $17.00 used TP with D.C. motor $10.00. M28 motor $15.00. Used M15KBP $5.00. URA-8A comparator. excellent condition $40.00. FOB. Omaha. Neb. F.E. Donze. 9422 N St. Omaha. Neb. 68127. phone 402-331-4133.

SOLID STATE TU AND AFSK GENERATOR KIT. Linear ratio detector and voltage comparator allows copy of regular or narrow shift. AFSK generator provides both shifts as well as CW ID. All circuitry excluding power supply on one 3 x 6" G10 glass expoxy PC board. Complete kit of parts $35.00. Drilled PC board only $5.00. Power supply kit $5.00. Drilled TT/L-2 3 pole Butterworth filter boards $2.00. HAL Designer Cabinet $5.00. Write for complete details.

HAL Devices, Box 365RJ, Urbana, Illinois. 61801

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

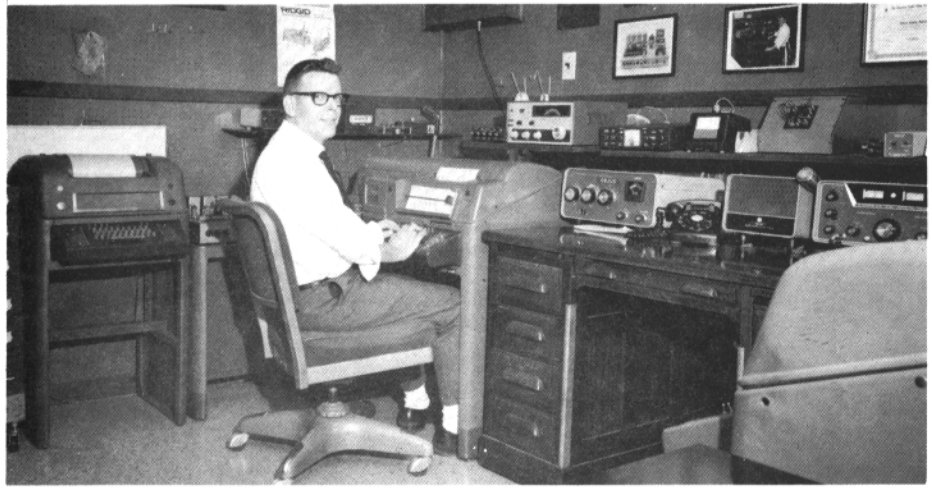
First Class Mail --

RTTY JOURNAL

APRIL 1970

EXCLUSIVELY AMATEUR RADIO TELETYPE

Volume 18 No. 4 30 Cents



'Tru' K8JUG

Contents-

Automatic CW from TD . . . . . Page 2
Model 28 Modifications . . . . . Part 3 - Page 6
RTTY Receiving Techniques . . . Part 2 Page 9
Theory & Application . . . . . Page 12
DX Column . . . . . Page 14
WAC RTTY Awards . . . . . Page 15
Russian Keyboard . . . . . Page 17
Reed Relays . . . . . Page 18

Automatic CW Sending from a TeeDee

Frank E. Stewart, K5ANS
Physics Department
Northeast Louisiana State College
Monroe, Louisiana 71201

Early Methods

During the last few years, at least five articles (1-5) have appeared which described a method for enabling one to send CW from punched RTTY tape. The articles differ principally in T.D. modification details. The method produces a CW quality (as determined by the preciseness with which the Morse letters are formed and the spacing accuracy) which is very good indeed, the time duration for dots and dashes being 88 and 251 ms, with a 75 ms space between them; it is inherently impossible to send perfect CW with a 7.42 unit character-T.D.

For a description of the method, one should see the references; however, the author would like to point out that there are at least three disadvantages associated with it.

1. T.D. modifications are necessary, being somewhat extensive in the earlier efforts.
2. The proper perforation of the RTTY tape is a tedious process.
3. There is no provision for coding the tape so that a T.D. will automatically send RTTY or CW at will.

Number 3 is a most serious disadvantage as far as automatic RTTY station operation is concerned.

A different approach to the problem of T.D.-CW, was taken in a QST article (6). To send CW, one simply broke the connection to the STOP segment of the commutator (the T.D. coding contacts). If this is done, one will force a spacing condition (zero loop current) during the 31ms STOP pulse. Playing a tape on which is a string of "Blanks" (five spacing pulses) results in a steady spacing condition for the entire duration (163 ms) of each RTTY character. A "Ltrs" (five marking pulses) may be used to send "dashes" and, for example, an "N" (two adjacent marking pulses surrounded by spacing pulses) to send "dots" If such a prepared RTTY tape is transmitted with the usual FSK circuits, the Morse information appears on the RTTY mark frequency.

This method alleviates somewhat disadvantages one and two above, at the expense of slightly inferior quality, but quite easily readable CW - certainly satisfactory for CW identification after a RTTY transmission. As described in the article, a slightly more complicated tape perforating procedure results in a higher quality CW. This method, however, does not alleviate disadvantage three, and creates a very serious problem of its own: during the time interval between Morse letters, a steady RTTY spacing condition exists which causes most RTTY machines to "run open". On an autostart net, this objection alone is enough to preclude the method's use.

Possibly the most convenient device commonly in use for CW identification is the code wheel (7). Its use involves no T.D. modification or tape perforation since the T.D. is not used at all, and automatic switching from RTTY-to-CW and back-to-RTTY is readily accomplished. Perfect CW is realized. The wheel's construction is somewhat laborious, however, and probably this is the only reason it is not in more widespread use (8).

One Common Annoyance

Common to virtually all methods currently in use for CW identification is the minor annoyance of garble being printed during that FCC-required ritual. Autostart demodulators do revert to a standby condition (with concominant turning off of the printer motor) after a few random letters are printed, but with RTTY operation on 170 Hz shift, and CW identification on somewhat-more-than-100 Hz shift, the "shut-down" process is sometimes agonizingly slow, especially if high-speed CW is employed.

Actually, in the author's opinion, it would be ideal if the machine did not shut down at all, but remained in a steady marking condition. One's printer would then be receptive immediately to various automatic-station-control commands should they be transmitted following the CW identification of the station with whom one is in contact. For example, many stations are so equipped that they may turn each other on-and-off the air by typing or receiving a "Figures-Blank-H" (typing those three keys in that order). Should one's printer shut down during a received CW transmission, the transmitter turn-on command would not be effective.

It may be argued that one should periodically listen for break stations anyway rather than come on the air immediately following another's transmission. This is certainly true to a degree, especially when an autostart transmission net frequency is being used. The objection, however, is to prolonged use of the H-break, rather than to printer shut-down during a CW transmission. Indeed, should the printer remain active (but not printing annoying garble) it would immediately respond to a break station.

A New Approach

The author has discovered a new method by which CW may be sent with a T.D. It is so simple in principle one wonders why it has not been discovered before. Claims for the method are as follows:

1. T.D. Modification is most minimal.
2. RTTY tape perforation is straightforward. "E", "Figs" and "Ltrs" may be used for all dashes, dots and Morse spacing, respectively. Other combinations could be used.
3. The tape may be coded so that automatic switching of the T.D. between the CW and RTTY modes is most easily accomplished.
4. The Morse intelligence appears on the FSK space frequency. During spacing between Morse letters and words, R.F. transmission is on the FSK mark frequency, thus all printers will revert to a steady marking condition when no Morse intelligence is being sent.
5. The printer does not print garble during CW identification. Instead, the printer prints a "Ltrs" for every Morse dot (actually, no printing at all), prints nothing (steady marking condition) during Morse spacing, and prints the letter "O" for every dash. Thus, as "DE K5ANS/5" is sent in CW by the T.D., the printer prints "0000000". Certainly this is not objectionable garble in the usual sense.
6. Acceptable quality CW is produced. Dashes are 88 ms and dots are 22 ms long -- not good enough for bulletins, but plenty adequate for the intended purpose, and quite easily readable.

The T.D. Modification

The author's approach to the problem might be considered the "mirror image" or the "opposite" of the QST effort. One need simply connect the STOP and START segments of the commutator to the contacts of literally any impulse ratchet or alternate pulse relay. These relays have double-throw contacts. Once pulsed (coil current need flow for, typically, less than a tenth of a second - less than the duration of a RTTY character), the relay reverses the electrical configuration of the contacts, so that the normally-open contacts become closed, and vice-versa. The author uses a Potter and Brumfield PC11A, 120 VAC coil, DPDT. A light is connected to the second pole as a warning that the T.D. is in the "CW Mode". In addition, the second pole starts the T.D. motor. Only upon being pulsed a second time, any time later, will the relay revert the contacts to the original configuration. Obviously, the entire modification is simply to short the START and STOP segments together during CW transmission, and to break that connection for normal RTTY transmission. The normal T.D. has no connection at all to the START segment, but there will be a terminal below it to which a connection may be made.

Automatic Switching from RTTY to CW

In lieu of a relay, one could simply use a SPST switch. Use of a relay allows automatic switching. Those with model 28 printers have a Stunt Box which may be programmed to momentarily pulse the relay after any predetermined RTTY characters are typed (9). A Stunt Box programming discussion is beyond the scope of this article. Instead, the automatic switching method used by the author in his model 19 printer will be discussed.

Model 15 and 19 printers have a set of Motor Stop Contacts located on the left of the printer at the lower right rear of the break switch. Above these contacts is the Motor Stop Lever, protruding horizontally outward toward the front of the printer, and located below and to the left of the function bar assembly. When upper case-H is received by the printer, this lever moves vertically downward, momentarily breaking the normally-closed Motor Stop Contacts.

If there are any wires leading to these

contacts, they should be removed, soldered and taped together. (Recall that the contacts continuously short them together anyway, except momentarily following an upper case-H, which is never used in normal typing.) In the author's equipment, all such extraneous wiring has been long removed.

The author allows his Motor Stop Contacts to control a continuous-duty relay, such as any of the Potter & Brumfield KL or KA series. The author uses a KL17A, 120 VAC, 4PDT, but three of these poles are used for purposes other than those discussed in this article. This relay has been activated continously, 24 hours a day, for several months with no ill effects. Following printer receipt of an upper case-H, the relay opens momentarily and pulses the alternate-pulse relay which puts the T.D. into the "CW Mode". A second such pulse restores the T.D. to the "RTTY Mode".

On some machines, the Motor Stop Contacts are normally open. In such a case, one need only unsolder the wires leading to them, tape them individually, and dispense with the continuous-duty relay. One would allow a momentary closing of the contacts to pulse the alternate-pulse relay directly.

(see photo - page 18)

Coding a RTTY Tape for CW

It is important to remember that with the usual FSK circuits, R.F. transmission is on the mark frequency when 60 ma flows in the local loop. Absence of loop current results in R.F. transmission on the space frequency. The normal T.D. has no connection at all to the START segment; thus loop current is zero during the 22 ms the rotating brush is in contact with the START segment of the commutator. The START pulse of every RTTY character is a space.

At this point the reader will find it helpful to have ready access to the standard RTTY code.

In the "CW mode" as defined in this article, the START and STOP segments are shorted together, resulting in an effective STOP pulse 53 ms duration with concominent elimination of the START pulse. Immediately following the 53 ms-STOP pulse are the five information pulses of 22 ms duration each. If the T.D., when pulling tape, senses a "Ltrs" character (five marking or "M" pulses), loop current will flow for the entire 163 ms-duration of that character. The sensing several "Ltrs" characters in succession results in A-O (steady carrier) R.F. transmission on the mark frequency. If successive "E" (MSSSS) or "T" (SSSSM) characters are encountered on the tape, "dashes" of 88 ms duration will be transmitted on the space frequency, each separated from the other by a time interval of 75 ms. If any of the RTTY characters V (SMMMM), X (MSMMM), Figs (MMSMM), Q (MMMSM) or K (MMMMS) are encountered successively, "dots" of 22 ms-duration each will be transmitted, still on the space frequency, with mutual separation of 143 ms. Combination of these characters could be used to provide dot separations ranging from 53 to 229 ms. Using "Figs" and "E" for all dots and dashes, the author can easily and quickly code a RTTY tape for CW with only two fingers on one hand.

Printer Response During CW Transmission

The printer "knows nothing" about any T.D. modification that may have been made. If the T.D. encounters an "E", corresponding to a Morse dash, the printer "sees" a long marking condition (60 ma loop current) of at least 75 ms, four consecutive spacing conditions (zero loop current) of 22 ms-duration each, followed by another long marking condition of at least 53 ms-duration, and probably longer. The "long mark-S-S-S-S-long mark" condition is identical to that which exists when a normal RTTY letter "O" is received and the printer responds accordingly. The second information pulse of the "E" serves as a START pulse for the printer. The third, fourth, and fifth information pulses of the letter "E" serve as the first three such pulses for the letter "O". Thus, the printer prints an "O" everytime the T.D. senses an "E".

In a similar manner everytime the T.D. senses a "Figs", the printer response is that for a "Ltrs", with the third information pulse of "Figs" serving simply as the START plus for "Ltrs". One now understands why the author uses "Figs" for dots -- to reduce unwanted printer activity. If either of the letters, "M", "B", "W", or "U" were used, resulting in 44 ms dots, the printer would print a "V" for every dot. Should the T.D., while in the "Cw mode", enounter an "O", "Z", or an "A" on the tape, the resulting dot would be too long-66ms; however, the printer would print an "M".

Automatic Switching from CW to RTTY

The fact that the printer may be "tricked" into printing certain RTTY characters, while the T.D. is still in the "CW mode" makes possible automatic switching back to the "RTTY mode". In the author's case, all that is necessary is for the printer to receive the "correct" RTTY code (mark-space sequence) for an upper case-H, or "Figs H". One may easily verify the sequence "F-Ltrs.-Car.Ret.-Ltrs" satisfies the necessary criterion. If the mark-space sequence of this combination is written out, remembering that the START pulse is to be considered a marking condition, one has: long mark-M (SMMSM - long mark) -M (SSSMSM-long mark). If "Figs-H" is written out in the correct RTTY code, with START and STOP pulses considered spacing and marking conditions respectively, one will have an equivalent expression. Indeed, parentheses have been placed around what the printer recognizes as a "Figures" and an "H".

The author uses a continuous loop of tape in his T.D. for CW identification. The RTTY tape begins with "Figs-H"; then follows the Morse intelligence. Concluding the loop if "F-Ltrs-Car.Ret.-Ltrs", which reverts the T.D. back to the "RTTY mode". In addition, the author has so wired his relays that his carrier automatically leaves the air following the CW identification.

In Model 28 equipment there are no Motor Stop Contacts, but rather a Stunt Box, which can be coded for making or breaking single-throw contacts upon printer receipt of "Figs-H".

Several Stunt Boxes across the country are so programmed that "Figs-Blank-H" automatically turns the RTTY station on-and-off the air. In such cases (unless one is using a code wheel) the Stunt Box could be so programmed that "Figs-H" puts the T.D. in the "CW mode" (Alas! "Figs-Line Feed" will not work for reasons that will appear shortly). An "F-Ltrs-Car.Ret.-Ltrs" later the T.D. sends normal RTTY again. Finally, a "Figs-Blank-H" may be used to turn off the T.D. and the transmitter.

Discussion

It has been pointed out that numerous RTTY characters may be printed even though the T.D. is in the CW mode (Here it is assumed that the T.D. coding contacts are in series with the printer selector magnets in the local loop and that the T.D. is pulling tape). Actually, the sixteen RTTY letters which have a mark for the fifth information pulse may be so printed. Although this information is of little practical use to those with Model 15 or 19 printers, it may be of interest to those with Model 28 printers in that the Stunt Box will still recognize "Figures", "Letters", and fourteen other letters of the alphabet while the T.D. is in the "CW mode". Table I lists all possibilities. For those eight characters which have a space for the fourth information pulse, there is only one possibility. For the remaining eight, any of several possibilities may be used. In many cases, the character put on tape should be followed by "Ltrs" to insure a sufficiently long STOP pulse. Thus, the use of "Figs-H" to control the alternate pulse relay is only one of many possible variations.

TABLE I: List of RTTY characters that may be printed while the T.D. is in the "CW mode".

Desired RTTY Character to be Printed	Character to be put on Tape
B	L, S
G	D, H
H	Car.Ret.
L	Space
M	O, Z, A
O	E, T
P	N
Q	C
T	Blank
V	M, B, W, U
W	I
X	G
Y	R
Z	Line Feed
Figs.	F, P
Ltrs.	V, X, Figs, Q,K

REFERENCES

1. CQ Magazine, February, 1963
2. CQ Magazine, November, 1966
3. RTTY Journal, September, 1967
4. RTTY Journal, April, 1968
5. RTTY Journal, November, 1968
6. QST, March, 1964
7. RTTY Journal, May, 1968
8. Many stations regularly monitoring the 3637.500 KHz and 14075.000 KHz RTTY autostart nets use the code wheel.
9. W6FFC uses "Figs-Line Feed" to pulse an impulse ratchet relay, which activates his code wheel.

***

Modifying the Model 28 Teletype

PART 3 Installing The Keypallets --

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

PROJECT MOUSE - ARTICLE 3

Up to this point, we have discussed what parts you would want to order, what manuals you might wish to obtain, how to hook up the machine to use it and how to bring out the keyboard and/or selector magnets directly if desired.

INSTALLING THE KEYPALLETS

The first thing to do is to remove the "type-box". This is the black rectangular object about 2" long and 3/4" high that sits directly in front of the platen. As you strike various keys, the type hammer hits various small projections sticking out of this unit, causing them to be knocked forward against the inked ribbon and making an impression on the paper.

This type-box is quite easily removed. Just to the right end, you will see a light-colored retaining clamp that is curved. At the top of this curved piece is a small lever. Just take your finger and push this lever to the right, and the curved piece will move away, allowing the type-box to be lifted out readily. At this time, note that end of the type box with the hook on it goes to the left, and the long stud is on the right end.

Now remove the bolts from either end of the type box and pry the two pieces apart. The unit that faces the type-hammer will look like a screen with a lot of holes in it. Lay this aside until finished putting in the new typepallets.

From here, you will want a tiny screwdriver a bright light, and if over 35 years of age, no doubt a magnifying glass of some sort that may be positioned without having to hold it manually (as you will need both hands free.) In my case, I found a nice pair of magnifying glasses at the local dime store for elderly people with poor eyesight, for around $2 that surely simplified this and many other jobs where you deal with small objects. (Stunt box parts, springs, etc.)

If you have the new typepallets and springs we mentioned ordering, you will probably see how the typepallet first is inserted through the screen that is closest to the ribbon, and then a spring is slipped over the typepallet so the end with the hook will engage the slot in the typepallet. If trying to use the original spring while exchanging the typepallet, this is entirely possible, but may be somewhat frustrating to disengage the hooked end so the spring may be lifted off the "old" typepallet. A small screwdriver can usually be manipulated so the spring may be removed satisfactorily, and you may even enjoy doing this rather than just ripping it off and replacing with a new spring.

Since on the original typebox there were two "0" typepallets and no "Ø", you will need to know where to put your new "Slant zero" typepallet. It goes beside the "8". The "comma" goes on the top row beside the "period", and the "#" (figs h number sign) goes beside the "comma", then.

I do not have any good pictures of the rear of the typebox, but here is a run-down on what mine now has in it:

Tow row, left-to-right -- 9 (blank) 5 (blank) (blank) # , . 0 (blank) T (blank) (blank) H N M

2nd row: ? $ " 3 (blank) 6 ! B D Z E S Y F X

3rd row: & 4) (blank) 8 Ø : ; G R L (blank) I P C V

4th row: (blank) ' 2 - 7 1 (blank) (blank) J W A U Q K

In putting the two pieces back together, just hold them tightly at each and move back and forth while many of the typepallets will pop through the rear screen. Then while still holding one end tightly take your other hand and wiggle the ones that would not pop through by themselves until they do come through. It's not a hard job at all and in no time they will all be properly positioned and the two ends can be bolted back together once more. Remember that the heads of the bolts are on the "ribbon side" and the nuts are on the "type hammer" side, with the long one being on the right end, as viewed from the "type hammer" side.

ADJUSTING THE TYPE-BOX

You will probably have no occasion to want to adjust the type-box at all, but you may wish to know how it is accomplished. When you had the type-box out of the printer, you probably noticed a small half-round tab right in the middle of the bottom. Directly ahead of this tab, in the typing unit itself, is a small bolt with a screw head and retaining nut to hold it in place. This bolt pivots the type-box slightly one way or the other so that the top and bottom parts of each character will be uniformly impressed on the paper. Thus if it appears you have normal appearing print, forget about this adjustment, but if all your letters seem to be darker at the top than at the bottom, or opposite, then adjusting this little bolt should cure the problem.

INSTALLING THE KEYLEVERS

The easiest way to install the new keylevers is to take the entire keyboard base out of the cabinet. You may leave the printer unit on the base, although it would probably be easier to carry the base around if the printer unit were first taken off the base. Since we have not previously discussed to any extent how to do this, a quick review might be helpful.

TAKING THE TYPING UNIT OFF THE BASE

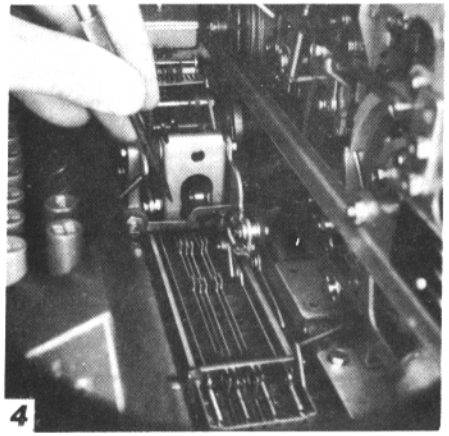
First of all, unplug the cable at the rear of the right-hand ribbon spool. Then you remove four rather large bolts that hold the printer to the keyboard base. There is one on each corner. (1) Left-front, almost directly below the left edge of the left ribbon spool, (2) Right-front, directly behind the right-hand edge of the "dashpot" cylinder. (3) Left-rear, directly under the left end of the paper spool's center and (4) Right-rear, almost directly under the right end of the motor cooling fan and slightly in front of it.

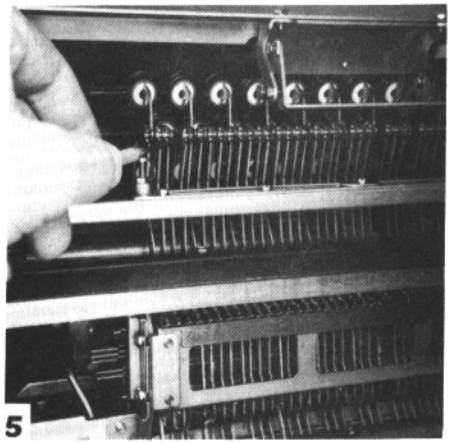
Lift the typing unit off the base and place on a spread-out newspaper someplace as the bottom will be oily.

TAKING THE BASE OUT OF THE CABINET

Disconnect the cable at the left rear, take out the four bolts at the corners, remove the small green part of the cabinet directly above the top edge of the keyboard (held in place by a large thumbscrew at either end that you loosed inside the cabinet to either side of the keyboard) and then the entire keyboard and base (with motor, etc.) may be taken easily out of the cabinet.

Set it on a piece of paper on a table or workbench in a flat position. To either side of the keyboard will be a plastic plate under which information is usually placed regarding who to call if trouble exists, or whatever information the company or operator has thought necessary to have available. Anyway, remove those plastic plates, and the papers that are beneath them. Now you will see some other bolts that hold the cover plate around the edge of the keyboard. Remove those bolts. The cover will not as yet come off.


4


5

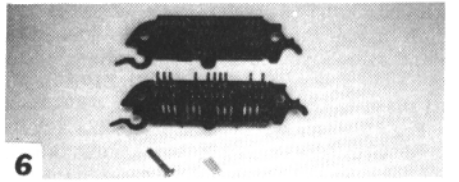

6

Fig. 4 - Keyboard reset bail
Fig. 5 - Under-side of keyboard with wrap-around cover removed.
Fig. 6 - Type-box taken apart, showing one typepallet and spring.

***

Now set the base on end with the keyboard in the air so that you are looking at the bottom side of the base. You now should see the remaining bolts that hold the wrap-around plastic cover around the keyboard, there should be a bolt at each end of this cover.

Take the cover off, and you will now see the underside of the keyboard proper. Before going any further, get out one of the new keylevers, such as the "B ?" one. Note how the bottom end has two projections with a slot between, and near the very end the slot become round. It is this round part that grips the pivot point on the keyboard lever. Find a screwdriver whose blade width is such that without undue work, can be used to slightly separate the two projections when the screwdriver is inserted in the slot and twisted a bit for prying purposes.

Now start with something like the "Z" character. Depress the key, and you should hear it go "clunk" and stay down. If you cannot see on the bottom of the keyboard where this one is now a little lower than the rest, wiggle the "Z" key somewhat until you see where it is, on the bottom. Insert the screwdriver above the pivot point, in the "slot" and twist slightly and just push the screwdriver straight up toward the keyboard while twisting -- the keylever comes right off with a minimum of effort. The new one then just snaps into place.

When finished with the "Z", and going on to whatever is next, you will find the "Z" has remained down, and you cannot push any others down. You merely need to take your hand and reset the keyboard bail, which brings the depressed keylever back up and allows you to depress another. See Fig. 4 -- you just push the bottom of this bail plate to the left to reset it.

Fig. 5 - shows the bottom of the keyboard with the screwdriver in the slot above one of the keylever pivot points, but does not show up as well as we hoped it would.

At any rate, replacing the keylevers is not at all difficult and in fact rather enjoyable. We have to assume that anybody interested in RTTY probably already has some interest in mechanical objects and not completely without at least a little talent in wielding a few basic tools. Not to slight anybody's ability, but with these instructions, a typical high school boy should be able to perform any of the tasks outlined so far or planned in the future.

After finished with the keylevers, just replace the wrap-around cover, the bolts under the plastic cover plates, then the papers and cover plates themselves, put the keyboard base back in the cabinet, reconnect the cable, put the typing unit back on the base, replace its connector, and put the bolts back. PRIOR TO PUTTING THE BOLTS IN HOWEVER, ROTATE THE MOTOR BY HAND (COUNTER-CLOCKWISE AS VIEWED FROM THE RIGHT SIDE OF THE CABINET) TO MAKE SURE THE GEARS ARE ENGAGED PROPERLY.

You should now be finished with the keypallets and keylevers.

DISABLING THE MOTOR-STOP RELAY

All mouse machines have a motor-stop relay so that on a given sequence of characters, the motor will automatically turn off. It comes on again as soon as anybody sends a character or otherwise causes the line to open. For amateur purposes this motor-stop relay has little or no practical use in "as is" condition. We do not recommend taking it out of the printer but you may wish to disable it for the time being.

On the "repaired" Mouse machines, the motor turns off if anybody sends "upper-case blank H". (This is similar to, but not necessarily the same as FIGS BLANK H). On some of the "non-repaired" machines, this sequence was "upper-case blank Z".

If you remove the roll of paper so you can look at the top of the "stunt box" you will see (slightly to the left of center) a tan-colored (or brown) plastic piece with some wires running to it. If you now turn the motor on and type "figs S", the bell should ring, and you should see some modest mechanical action near the left front edge of that plastic block each time you subsequently type another upper-case "S". Just to the right of the slot which jumps during an upper-case "S" is the slot that operates the switch adjacent to the switch for the bell. That adjacent switch momentarily completes a circuit if an "upper-case blank H" is typed (or "upper-case Z" on some machines) which pulls the motor-stop relay to the "stop" position.

Just to the rear of that switch is a black projection sticking out of the rear of the stunt box. This is the "function pawl". It has a hooktype end on it. If you want to easily disable the motor-stop from working, all that is needed is to lift up the rear of that black function pawl and keep it

Continued on page 18

Modern RTTY Receiving Techniques

Reprinted from December 1964 RTTY- Part 2

IRVIN HOFF, W6FFC
12130 Foothill Lane
Los Altos, California 94022
and
KEITH PETERSEN, W8SDZ
1418 Genesee Avenue
Royal Oak, Michigan 48073

14. The DTC Circuit

This circuit is protected by patent until 1978. Thomas described the conditions leading to such a circuit in 1960. Poor described an example of the circuit in January, 1964. Little else has been written. Several versions are described in the patent, one of which is now described.

If the decision point could remain at zero, most of the problems mention concerning "mid-mark", etc., could be avoided.

The DTC incorporates a very clever "disconnect" system that effectively removes the storage-capacitor from ground, allowing it to lose its charge. At the same time, the current through R and R ceases as this disconnect system also lifts one of the resistors from ground. This causes the input voltage to now rise to full output voltage, rather than the usual 1/2 value. In this condition, there is no variable threshold circuit remaining, and action comparable to a "normal" converter results. Thus the threshold remains in a stable, balanced condition at all times, giving maximum immunity to errors during slow typing or during static bursts.

Poor went into some detail on this system, but at the time did not mention one of the prominent features of the DTC circuit. Even during machine-speed, this circuit is superior to all other two-tone detectors as the threshold remains at zero. This occurs since the time constant of the disconnect system has been carefully chosen to equal that of the storage-system. Thus the DTC immediately demonstrates its superiority over any other two-tone system at any speed.

If this seems to be strongly stated, it should be remembered that the broad wording in the patent covers any device that would allow the threshold to automatically remain at zero while still providing a symmetrical output voltage.

To properly use this circuit (as well as the ATC), its output must look into an extremely high impedance at all times. Consequently, it cannot be introduced directly to any tube that would draw grid-current on positive voltage. Further, the time constants are considerably more critical than in other more simple circuits.

Use of the DTC in "normal" converters will make an immediate improvement, just as in limiterless units. Again, it should only follow a minimum band-width low-pass filter to be effective.

It is felt that the introduction of the DTC circuit is as important to the advancement of RTTY as was the introduction of the atomic bomb to the outcome of World War II.

15. Disadvantages of the DTC Circuit

The only disadvantage occurs during single-channel reception (mark-only, etc). at keyboard-speed. It then acts like a cross between an ATC and a "normal" system using no threshold correction. If reliable mark-only copy is desired, a simple switch can be used to short out the disconnect system, returning the circuit to ATC action.

16. Driving the ATC or DTC

Since capacitor-charging in the ATC circuit and capacitor-discharge of the disconnect system in the DTC circuit must take place in one bit-time or less (22 milliseconds), these circuits must be driven from a high-current low-impedance source such as a cathode follower circuit. This circuit also isolates previous circuits from being loaded down during charge or discharge.

17. The Time Constants

The time constants of any two-tone systems must be carefully chosen to minimize distortion during single-channel copy, yet follow the specific fade rate of the incoming signal. Since the opposite channel information comes from capacitor-discharge (which diminishes with time), certain combinations of letters require longer time constants to be correctly printed. The "hardest" test one could make would be to copy continuous "letters" keys on space-only.

If the total distortion for each of these conditions is acceptable, the time constants are adequate. If no distortion oc-

curs, probably the time constants are too long to faithfully follow quick fading conditions.

Thus the time constants become a compromise between the fade rate and allowable distortion.

18. Use of AGC in the Receiver

Since all two-tone methods other than DTC can go to an unbalanced condition on keyboard-speed typing, it has been necessary in the past for advocates of limiterless two-tone to rely heavily upon receivers that have excellent AGC systems in an effort to keep those sudden fades from affecting the output of the receiver by the "magic" 6 db. figure. Even with such receivers a radical decrease of errors was noticed during machine-speed reception. Several advocates have also found with current types of two-tone systems not incorporating DTC that better results were obtained with small amounts of limiting - this turning the linear two-tone into a non-linear system.

AGC does not particularly help dynamic range. Unless the AGC gets its feedback from the output of the channel filters (Henry Hall, W4MGT uses such a system rather successfully) or the output of the detectors, it will not be of great help in maintaining dynamic range. As a signal drops into the noise, the AGC is controlled completely by the noise or by nearby signals and even can make matier worse. Use of AGC will likely make a greater demand (rather than lesser) on dynamic range of the converter.

Use of AGC can also adversely affect reception during those times a quite strong nearby CW station is present. The AGC quickly "locks on" the CW station during key down, and then quickly back to the RTTY signal (which is weaker in this case) during key up. This can cause an extremely rapid fluctuation to the audio level presented to the converter that no two-tone system can satisfactorily handle. In this instance, one would need to disable the AGC, or back off on the RF gain to the point the AGC is effectively out of the circuit.

With the use of DTC, AGC is not needed except in an effort to remain at a somewhat uniform input level. This assumes the converter has good post-detector dynamic range to handle a wide variety of input voltages. For such a system, a receiver of a specific brand is not required. In general, ANY receiver that works well on single-sideband will then work well on RTTY.

19. Advantages of Two-Tone Reception

Exhaustive testing has shown one major and one minor area in which this method is undoubtedly superior to the FM limiter-discriminator with variable threshold corrector.

(1) Strong nearby stations (QRM) - A nearby signal disrupts the "capture effect" of a FM limiter, rendering it somewhat useless at times, as owners of "normal" converters will quickly accede. Use of a good band-pass input filter of course helps immensely in this situation. The more narrow filters normally used for limiterless operation have a distinct advantage, the maximum signal-to-noise ratio occuring when only the wanted signal is received. The ability of the two-tone to copy well on either mark-only or space-only is of interest under these conditions, although space-only is not satisfactory on keyboard-speed typing.

(2) Very weak signals exhibiting selective fading. Haynes has discussed the problems inherent in weak signal detection. Poor has also emphasized that a minimum band-width pre-detection system inherently is better than one with broad imput. Few amateur two-tone converters use channel filters narrow enough to take advantage of this situation.

Other situations favoring the two-tone over a well-designed FM system using threshold correction are not presently known to the authors.

20. Limitations of Two-Tone Limiterless

If no DTC is used, then the two-tone system is subjected to increased errors during slow typing or steady mark. DTC provides a solution for these problems.

On fast flutter fades like aurora and certain backscatter conditions, the two-tone system fails miserably in contrast with even a "normal" FM system without threshold correction. Of course these conditions often so badly distort the signal that the best system will be second-rate. The fact remains, however, that under certain conditions the FM system is the only method that will produce acceptable results.

To design the two-tone system properly, more must be taken into account than just the converter. The entire system must remain linear. That means the receiving system must stay out of saturation during a static burst and the converter not be overdriven. It is not likely this can be done, so the best compromise is a limiter.

For optimum performance on two-tone, very narrow filters should be used. This poses many problems (Section 6) which must be considered.

21. Advantages of Well-Designed FM Systems

It is not likely that even a half-dozen amateurs have ever had access to an optimum designed FM converter. This might cause doubt, but it shouldn't if the foregoing comments have been evaluated and the reference material studied.

This FM system would include:

1. A good band-pass input filter (Section 6);

2. A limiter with zero time constants that would fully limit over the entire range of input levels experienced;

3. A linear discriminator for optimum noise cancellation;

4. A minimum band-width low-pass filter;

5. Some adequate threshold correction such as the ATC or DTC; and

6. A slicer that provides a faithful output voltage for the printer.

No amateur design has ever incorporated all these criteria. No known commerical converter available to amateurs at reasonable prices will meet these stringent requirements, either. As a result, one cannot properly criticize FM systems as having no advantages over limiterless operation until an optimum FM system has been evaluated.

The Altronics-Howard model "L" comes closer to these criteria than any other simple circuit in use at present. The Mainline TT/L FSK Demodulator offers all these advantages plus others intended for limiterless operation.

A good FM converter offers many overall advantages:

1. They make possible the use of simple and inexpensive filters in the linear discriminator section;

2. With threshold correctors they allow great latitude for drift or mistuning--this being advantageous for round-table QSO's where the stations involved are seldom on the same frequency;

3. They provide a stable indication of tuning on the scope, etc.;

4. They recover quickly after a static burst;

5. They adapt readily to automatic auto-start or mark-hold reception so the operator can absent himself during reception; and

6. They need not be carefully monitored for correct input level.

Such FM systems are not typical to what the amateur has had available to him in the past. This is not a "new concept", but does offer new horizons for amateur development.

22. Disadvantages of FM Operation

There is no doubt that during heavy QRM the more narrow filters in use on some limiterless two-tone converters offer great opportunity for improvement. However, most amateur two-tone converters proposed to date have used channel filters as broad as those used in typical FM systems. In this event, the limiter on the well-designed FM system could be by-passed for equal results.

23. Use of Partial or "Controlled" Limiting

Several authors have suggested use of partial limiting by retarding the receiver's output to the point the limiter is at its threshold level. This and a "half and half" system which has been proposed and tried many times. It is poorer than either technique alone (FM or two-tone). The result is an FM system with a defective limiter in the one case, and a non-linear AM detector in the other. The S/N ratio of the receiver itself is degraded somewhat by turning the volume extremely low to circumvent limiting on those units which offer reduced limiting (usually as a result of poor design).

24. Testing FM Against Two-Tone

On two-tone systems not incorporating DTC, a radical improvement is noticed on machine-speed typing. Most observers have compared the two-tone with normal FM systems at machine-speed. This of course gives the two-tone an optimum opportunity to "show up" the usual FM system.

Such machine-speed conditions are seldom encountered on amateur frequencies, and a more reliable test would incorporate the use of an audio tape recorder. Typical signals would be recorded from the receiver and later played into both systems for error comparison. Another method in use by several observers involved a separate facility with independent printers operating. This system is acceptable, but has the disadvantage of additional variables.

An optimum system, not merely for testing but normal use, might, in fact, consist of two separate systems--one a

Continued on page 18

RTTY theory & applications-

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

RTTY SIGNAL BANDWIDTH
Part 6 - FSK Signal Spectrum

In this series, we have been discussing the spectrum of RTTY signals. Last month, we gave the spectrum of several repeated TTY characters using the Bell SYstem 7.42-unit code at 45.45 Baud (61.3 Speed). We also gave the spectrum or frequency components of a square wave having the same amplitude and Baud rate as the TTY characters. It was shown that the square wave has a spectrum that appears quite dissimilar to that of a repeated TTY character, but, although the square wave does not contain the "fine" structure of the TTY character, it does have the same general frequency spectrum. Therefore, the square wave should be a suitable (or even, desirable) substitute for a TTY signal.

This month we are going to show the spectrum resulting when a 45.45 Baud square wave is used to frequency modulate a carrier.

Frequency shift keying is used almost exclusively on the HF bands; it is a true frequency-modulation process. On the VHF bands, use is made of audio frequency shift keying which is applied to the audio input of either an AM or FM transmitter. When applied to an AM transmitter, the AFSK portion of the modulation process is true FM. When AFSK is used with FM, true FM is used twice. Therefore, no matter what means of keying is used (so long as it is one of the common methods mentioned above, and not make-and-break keying which is AM), it is always a frequency modulation process.

Unfortunately, mathematical analysis of FM other than the single tone modulation which is used as an illustration in most textbooks is almost impossible to handle! This is known as multitione FM. Therefore, we are not going into the mathematics behind frequency modulation because square wave modulation of an FM transmitter is just too gross, mathematically. If anyone is interested in the mathematics for multitone FM, we recommend: MODULATION, NOISE,. AND SPECIAL ANALYSIS, Philip F. Planter, McGraw-Hill, 1965. (Incidentally, this book is excellent for modulation and demodulation other than multitone FM.)

Utilizing Panter's formulas (7-79) and (7-80), we applied a 45.45 Bd square wave to a frequency modulator. Some of the results are shown in the Table and in the Figure.

The results shown in the Table are for a modulation index (beta) of 18.7 which is close to a frequency shift of 850 Hz and a modulation index of 3.74 which is close to a carrier shift of 170 Hz. The carrier amplitude (unmodulated) was taken as 100; this has the benefit that the results are directly in percent. The frequency given in the second column is the side frequency ("sideband" frequency) from the center or arithmetic mean frequency of the transmitted signal' in every case except the first, it represents two side frequencies, one above the center frequency and one below.

"% TOTAL POWER" gives the percentage of the total transmitted power present in the two side frequencies having the same frequency difference from the center; i.e., for the 850 Hz shift example, 0.20% of the total transmitted power is concentrated in the two side frequencies that are 90.9 Hz above and below the center frequency. It is interesting to note that practically all the power is concentrated in the vicinity of the nominal Mark and Space frequencies. The column headed "CUM %" is a running total for cumulative total of the power in the side frequencies starting at the center. The results were calculated out thru the 49th term. For the 850 Hz in the first 99 side frequencies. For the 170 Hz shift, 99.95% of the power is contained in the first 55 side frequencies! If 99.95% were taken as the criterion for determining bandwidth, the 850 Hz shift would require less than twice the bandwidth of a 170 Hz shift signal! Note that the nominal shifts are in a ratio of 5:1.

The figure shows, graphically, the spectrum resulting when a 45.45 Bd square wave is applied to a frequency modulator (FSK). Two of the plots are from the data given in the Table. A third plot for a modulation index of 7.5 (nominal 340 Hz shift) is also given. The unmodulated carrier amplitude is 100. The spectrum plots give amplitude as a function of frequency. The vertical scale is the amplitude and the horizontal scale is the frequency. The frequency scale corresponds to the Table. Zero frequency is the arithmetic mean of the Mark and Space frequencies. Because amateur RTTY frequency shifts are normally thought of in terms of shifting downward from Mark (for FSK), the frequency scale used may seem strange. In each case, the Mark frequency is indicated, and the nominal Space frequency shift is indicated as: -850 Hz, -340Hz, and 170 Hz.

It is interesting to note that if all side frequencies that are 2% of the unmodulated carrier amplitude (or total rms transmitted amplitude) are included (this is where the table stops), the bandwidth for a nominal 850 Hz shift is actually 1272.6 Hz or 1.5 times 850 Hz. In other words, the band required extends from 211 Hz above Mark to 211 Hz below Space. For the nominal 170 Hz shift, the actual bandwidth is 500 Hz (using the 2% criterion).

The 2% figure is quite arbitrary for use as a limit, but the 2% figure is only 28 dB down from the strongest component which is 50 (based upon a carrier of 100). The basic problem with defining bandwith with an FM signal is that the side frequencies extend (mathematically) to infinite frequency! Therefore, any bandwidth figure is based upon a somewhat arbitrary limit. However, significant energy is present and transmitted at frequencies beyond the nominal frequency shift.

Slight variations in the modulation index (beta) result in some suprising differences in the spectrum. There are also some similarities, of course. If any readers are interested in investigating the spectrum further, we will be happy to supply a program listing or a card deck in Fortran II-D.

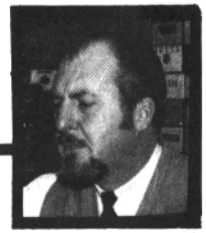
--73 ES CUL, RG

SPECTRAL COMPONENTS ON AN FSK SIGNAL MODULATED BY 45.45 Baud DOTS.
Carrier amplitude - 100.0

		849.91 Hz SHIFT			169.983 Hz		
Term	Freq. (Hz)	Amplitude	% Total Power	Cum %	Shift. Amplitude	% Total Power	Cum %
0	0.000	3.03	.09	.09	6.76	.45	.45
1	22.725	1.54	.04	.14	16.82	5.66	6.11
2	45.450	3.06	.18	.32	9.46	1.79	7.91
3	68.175	1.58	.05	.37	43.81	38.38	46.29
4	90.900	3.17	.20	.58	46.98	44.15	90.45
5	113.625	1.66	.05	.63	19.84	7.87	98.83
6	136.350	3.38	.22	.86	4.29	.36	98.70
7	159.075	1.79	.06	.92	6.24	.77	99.48
8	181.800	3.71	.27	1.20	1.89	.07	99.55
9	204 525	2.01	.08	1.28	3.26	.21	99.76
10	227.250	4.24	.36	1.64	1.09	.02	99.78
11	249.975	2.36	.11	1.75	2.04	.08	99.87
12	272.700	5.15	.53	2.29			
13	295.425	2.99	.17	2.46			
14	318.150	6.90	.95	3.42			
15	340.875	4.33	.37	3.79			
16	363.600	11.32	2.56	6.36			
17	386.325	8.90	1.58	7.94			
18	409.050	41.28	34.09	42.04			
19	431.775	47.78	45.67	87.71			
20	454.500	21.08	8.89	96.60			
21	477.225	5.91	.70	97.30			
22	499.950	7.89	1.24	98.55			
23	522.675	3.01	.18	98.73			
24	545.400	4.68	.43	99.17			
25	568.125	1.96	.07	99.25			
26	590.850	3.25	.21	99.46			
27	613.575	1.42	.04	99.50			

***

RTTY-DX



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

Hello there. . .

It is our usual practice to have the T1/L2 in the "Fast Automatic Receive" position when tuning around the bands. In this way the machine responds only to RTTY signals and eliminates the garble and noise created by other signals. While twisting the Rx dial one day in late February the machine suddenly came to life, and printed across the page was -- CQ de IS1GF -- the signal strength was tremendous, well over S-9, and the shift was just about perfect. Repeated calls however resulted in only another series of CQ de IS1GF -- the signal strength was tremendous, well over S-9, and the shift was just about perfect. Repeated calls however, resulted in only another series of CQ de IS1GF. After several attempts contact was finally made on CW and it was learned that this was the first RTTY attempt by John, in Cagliari, Sardinia. As can be assumed, he was not receiving, due to what he called QRM, but which we finally surmised was motor hash from the machine masking the signals on the receiver. By this time we are sure he has solved his problem and many of you have no doubt made contact with John. You can QSL to-

G. Fara, IS1GF
Box 25, Cagliari, Sardinia

The first activity from this country was a few years ago when I1KG and a group from the Italian mainland activated IS1KG during one of the Contests, but of course this was only a weekend Dx-pedition.

Venkat, VU2KV, is temporarily QRT and house hunting in New Delhi. He had hopes of getting back on for the BARTG Contest but this was not certain. Mail can still be directed to his Calcutta address as it will be forwarded to his New Delhi office.

Barney, ZM2ALW, finds his mail going astray and is sure he has missed some QSL's because of it. He can be reached direct at-

LJ. Barnett, ZM/ZL2ALW
4 Park Way
Wainuiomata, N.Z.

Fred, HK3SO has relocated and his new QTH is-

Fred Garbrecht, HK3SO
Ap. Aereo 52936 Bogota, Colombia

Gin, JA1ACB, must have resolved his motor noise problems on 15 Meters as he has been showing on that band at around 0000z in North America. He was recently heard in QSO with VE2LO/W6 and your scribe made contact immediately after. Here on the East coast Gin was pretty weak, but printable, which is amazing since he is running less than 100 watts to a KWM-1. John, KR6JT, has been coming thru to the East coast USA at about 12-1300z with real good signals on 20 Meters. However, at the times we printed him the boys in Europe had the better propagation and we could not break thru. Via Larry, K9BJM, and also from Larry, KG6NAA, we hear that KR6CF, KR6FQ, KR6AF, and KR6MD, all have RTTY capabilities but it is used on the MARS channels and rarely on the ham bands.

The "Giant Flash" Contest enjoyed excellent conditions during both eight hour operating periods and activity was quite high judging from the terrific QRM on the bands. Unfortunately we did not get into the second session but reports from Arthur ON4BX, indicated excellent conditions on the European end and word from Larry, KG6NAA, indicates that there was no lack of stations in the mid-Pacific area. Arthur racked up about 109 contacts in 39 band/countries and Larry ended with 41 exchanges in 17 band countries. At this station we had 36 QSO's for 20 band countries. Adrian, VK2FZ, had about 58 contacts in the log when the rig blew up and Murphy took his toll.

By the time you read this the BARTG Contest will have been just over and you will just have time to get things in shape for the WAE Contest scheduled for the week-end of April 25th. It is hoped that 10 Meters will show a tremendous increase in activity now that the band allocations for US amateurs is compatible with

the rest of the world. Increased activity on 10 should reduce QRM on the other bands, as it seems to us that all three of the popular DX bands are open at the same time.

A few quickies before closing. DL3ZW was recently heard in QSO with YU6ZAA, which should indicate renewed activity from Miki after about a years absence. ON4BX and ON4CK are in the process of getting 9U5CB in Burundi active. He already has a machine and Arthur and Bob are assisting with the incidentals. UK4FAD is reported by W7LZF. The UK prefix is a new reassignment of calls in the USSR and this station was formerly UA4KED in Penza.

- ANNOUNCING -

FOREIGN OPERATORS ONLY - I WILL ACT AS QSL MANAGER FOR RTTY CONTACTS, STATESIDE ONLY - IF INTERESTED CONTACT,

NEWT WILLIAMS, K8QLO
5725 Lodewyck
Detroit, Michigan 48224

--73 de John

***

WAC RTTY AWARDS

As we have had quite a few requests for information on the Worked All Continents Certificate issued for RTTY we will set forth the requirements along with a list of the stations to whom the Award has been issued to date. The Certificate was originally conceived by The RTTY Society of Southern California and issued by the RTTY Magazine, predecessor to the RTTY Journal. It is presently issued by the DX Editor of the RTTY Journal and all requests should be forwarded to the above QTH. In physical appearence it is very similar to the regular W A C Certificate as issued by the IARU, both in size and format. The requirements are that you submit proof of two way Radio Teletype contact with the six Continents - North America, South America, Europe, Asia, Africa, and Oceania. - There is no charge for the Certificate and it is forwarded in a mailing tube by 1st Class mail. Postage to cover the mailing cost and the return of your cards is very much appreciated. The present holders of the Award follows and the number indicates the order in which they were issued.

1.	VE7KX	4.	W6AEE	7.	W2JAV
2.	W6CG	5.	W7LPM	8.	W6TPJ
3.	K6OWQ	6.	W2RUI	9.	G3CQE
10.	W6LIP	49.	I1AHN	88.	K8JTT
11.	W7ESN	50.	K8MYF	89.	WB6ADY
12.	W8JIN	51.	ZL1WB	90.	F8KI
13.	K3GIF	52.	W4GJY	91.	KL7BAJ
14.	W5BGP	53.	KP4AXM	92.	3C3GK
15.	WONFA	54.	VE3BIJ	93.	K6EV
16.	W8UUS	55.	W2MXN	94.	ON4CK
17.	TG9AD	56.	SM6CSC	95.	W2UGM
18.	KR6MF	57.	W3KV	96.	WA8FYF
19.	K4JXG	58.	KR6BQ	97.	K7VDD
20.	W7FEN	59.	W7JWI	98.	VK2EG
21.	W6FYM	60.	W1GKJ	99.	K8QLO
22.	W1BGW	61.	DL1IN	100.	F3PI
23.	ZS6UR	62.	W3ISE	101.	3C3AYL
24.	VK3KF	63.	SM5KV	102.	WA6VVR
25.	VE4BJ	64.	KH6AX	103.	W5QCH
26.	WOPHM	65.	WA6WGL	104.	XE1YJ
27.	I1RIF	66.	FG7XT	105.	W6TX
28.	DL6EQ	67.	W6LDF	106.	3C3RTT
29.	WOFQW	68.	K5OLU	107.	W3ABT
30.	W6UGA	69.	W8CQ	108.	WA2YVK
31.	W9HJV	70.	KW6DS	109.	W3AVQ
32.	W5CME	71.	K8MZS	110.	CA4BR
33.	K8DKC	72.	G2HIO	111.	W8GPB
34.	W3DJZ	73.	PH2CQ	112.	W2LFL
35.	WB2CVN	74.	PH2SO	113.	DL5PQ
36.	W6JOX	75.	K7MNZ	114.	WB6QFE
37.	VK4RQ	76.	I1ROL	115.	VE5LG
38.	DL1VR	77.	I1ORS	116.	W6ZH
39.	DL3IR	78.	OZ8US	117.	WB6RXM
40.	W5SH	79.	I1KG	118.	W4CQI
41.	W6LVQ	80.	K8YEK	119.	WB6JSY
42.	LU1AA	81.	ON4HW	120.	DJ8BT
43.	W8CAT	82.	W6DNJ	121.	F8KW
44.	W6MTJ	83.	ON4BX	122.	DJ9XBA
45.	W7VKO	84.	WA8BOT	123.	W5VJP
46.	W6NRM	85.	W4EGY	124.	HA5FE
47.	W4AIS	86.	W8ZYW		
48.	W7UKH	87.	W7ATV		

***

LAST CHANCE- WPX Award

March 31, 1970 is the deadline for submitting claims for the PX Award. Full rules appeared in the January 69 issue, page 11. A Plaque will be awarded to the winner and certificates to the winners on each band. Send your claims to the DX editor now!

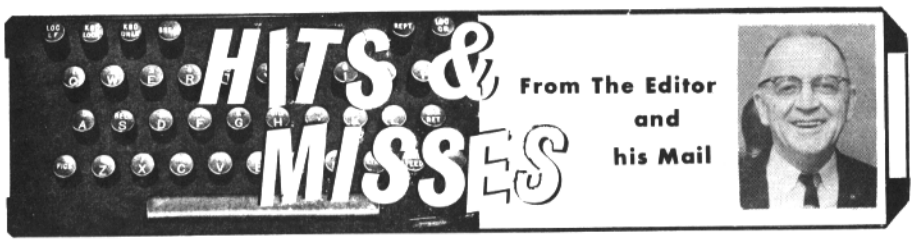
The correction of a programming error in the results of the CARTG DX Contest show DL8VX as the winner for Germany and 12th place over all.

***

RTTY Contest Calendar

DARC WAE RTTY Contest - last week end of April 1970

Complete Rules In Last Months Issue.



When you get this magazine we will be in Ft. Lauderdale for a couple of weeks. The mail stacks up so have patience again. Seems that for the past four months we have just crawled out behind the eight ball when something happens and we get behind again. It is fun though and so far we have managed to get the magazine out on time.

***

Our "Signal One" exciter finally arrived several days ago. So far in the limited time we have been learning what the 16 push buttons and 21 knobs are for. Next month we hope to include a short article on using this exciter on RTTY, there is more to it than just plugging in a jack.

***

A rule change now under consideration by the FCC will substantially raise fees for licenses and renewals. $13 for a license application and $25 for a special call assignment. Modifications would cost $4. This proposal is undoubtedly in line with other government economics with the hope of making the commission self supporting. From a strictly personal viewpoint we wouldn't object to the increase, five years of Ham Radio for $13 seems fair enough. However, many disagree with us and your ARRL director is the party to write to. Let him know how YOU feel about the matter and the ARRL will argue the majority opinion at the hearings before the commission. (One consolation - CB licenses would go to $19.)

***

For benefit of our overseas readers that may have access to a model 28 Teletype, and need a 50 Hz governed motor, a reader has informed us he has a number and will trade for a sync motor or the equivalent price. If anyone is interested write direct to Joe Tolbert, PO Box 96, Ninety Six (that's right) South Carolina 29666.

***

We still get inquires about the availability of boards for the TT/L-MKT demodulator. At present we know of none that are available but Jim Salter K5BQA, 11040 Creekmere, Dallas, Texas 75218 has shown an interest in making them if there is a demand. Write Jim if you are interested. If we hear of anyone supplying them we will be glad to announce the source.

***

Our supply of letter size drawings of the TT/L-MKT are exhausted. At present we will be unable to make more sets. If anyone has access to a duplicating machine and would be able to make a number of sets of copies we could probably arrange to send the originals on a loan basis. The 25 sets we originally made lasted just one month.

***

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 we have no plans for more reprints.

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
Air Mail - $3.50

All Foreign Countries-1st Class $3.50
Air Mail - South, Central America $5.00
All Others - Air Mail - - - - - $5.50

that Dual Russian Keyboard

That Russian keyboard keeps popping up in letters we get. The following letter from H. MacDonald G3SZN gives a little more information on Russian RTTY and may be of interest to those that like to print 'press' copy. Unfortunately the copy he enclosed is quite large and not suitable for reproduction. It does prove the tenacity and ability of hams to figure out a problem however.

Dear Dusty,

I write concerning the Russian keyboard shown in the September issue of RTTY Journal, and further in November issue which arrived today.

While not doubting the accuracy of the comments from WB2ZZB, i must add some remarks from my own observations.

The Soviet News Agency TASS is received here very strongly, and transmits in at least 5 languages on RTTY; English, French, German and Russian and Spanish. The four normal languages need no comment, but the Russian is very interesting. It uses 50 Bauds - with a fairly conventional TWO-LEVEL shift, 5-unit code which I have partially analysed in the accompanying "Copy". (I ran off a tape on the perf, as I made so many errors on the type-writer!) I also enclose a short piece of "off-air copy"; remember this was made on a British machine, so some of the combinations print out rather differently.

I shall be pleased to give you any more information that is in my power, if you care to let me know. Tass uses many transmitters on a wide range of frequencies - usually 3 transmitters simultaneously for each of the 5 languages, and sometimes as many as 5.

During the past 4 years that I have been interested in RTTY, I have logged wel over 140 different TASS RTTY transmission frequencies - and there are many more that are not receivable here. There is no point in listing any, as the schedule changes are frequent. However, I am sure that some of your readers in the States will have heard some of them, and may even have tried to decode the Russian ones. I have progressed this far with only a Russian dictionary and a lot of patience!

Hoping that this information will be of some interest to you and maybe your readers.

Yours sincerely,
Hugh MacDonald, G3SZN

***

RTTY Repeater, WA6TIC

For the last two years the Los Angeles area has been served by the WA6TIC Radio Repeater Teletype Station. The repeater is operating on an input frequency of 146.58 MHZ and regenerating teletype tones on the output frequency of 146.70 MHZ (the standard two meter frequency).

The transmiting and receiving equipment comprising the remote station are located atop the Santa Monica Mountains at an approximate hieght of 2,400 ft., and cover the greater Los Angeles Area. Good signal reports have been received from San Diego. It is expected that the coverage will extend to the Santa Barbara Area.

The equipment in use is converted Motorola 80 D type transmitting equipment and complimentary sensicon a type receiving equipment. The teletype tone converter is of local design and is all solid state operating a keying loop between the receiver site and in turn keying a solid state tone keyer, thus regenerating the teleprinter tones. Transmitter keying is affected by a conventional auto-start circuit sensing the presence of a mark tone at the receiver at output.

The tone frequencies are the popular 2125 mark tone and 2975 space tone.

Currently about fifteen stations are using this system as a fully automatic message system. New stations are encouraged to participate. It is expected that this system will become popular with message handlers accepting traffic from the low bands, and then looking for a handy way to trunk the traffic locally. In as much as the equipment is FM and Crystal Controled, automatic operation is effected with out the presence of an operator at the receiving end. Traffic can be passed with a high degree of certainty that it was received by the intended station, eliminating the hunt for a station to handle. QSL then may be sent at a time convenient to the receiving station.

MARTIN GEISLER
8926 KESTER AVE.
VAN NUYS, CALIF. 91402

***

SILENT KEYBOARD -

SILENT KEYBOARD: We are saddened to hear of the death of Elliott Buchanan, W6VUC. Elliott was one of the pioneers on RTTY on the west coast and president of Elliott Buchanan & Assoc., a dealer in teletypes and parts, of Oakland, California.

28 Modifications -

Continued from page 8

lifted. This can be done in a variety of ways, but for now let's just say that the easiest way is to slip a small wire (or string) under the hook on the function pawl and tie to the channel bracket above that has the sires in it that go to the switch. By tying the pawl up, the function lever cannot engage the function pawl, which in turn will not operate the function lever which would normally then operate the switch. This is getting a little ahead of the story for the next article, however, which should explain more about the stunt box.

NEXT TIME

In the next article, we'll discuss the stunt box itself, how the basic components in it work, how to remove it and how to install "non-overline" in a few moments once it has been removed.

***

RTTY Receiving -

Continued from page 11

good FM system and the other a good limiterless system. These would operate independent printers. When one failed, the other might produce satisfactory results.

25. Conclusions

Few amateurs have had access either to a good FM or to a good two-tone system. Neither system will give optimum results under all conditions. Of the two, the FM system offers the greatest advantages the majority of the time. The limiter on a good FM system could be bypassed to offer some advantages of the optimum two-tone limiterless.

The "ideal" converter would be one in which either a good FM system or a narrow band-width two-tone system could be selected. The MAINLINE TT/L FSK DEMODULATOR was designed with this in mind.

***

COMMING SOON -

Two - new - solid state demodulators from Irvin F. Hoff, W6FFC. One - a simple solid state TU for the beginner and the other a top performer with a minimum of parts but using the latest in solid state developments.

***

BROAD MINDED
USE NARROW SHIFT

REED RELAY ---

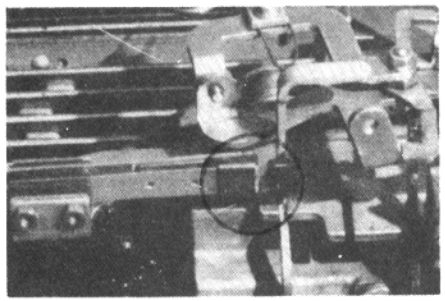
I am writing this as a follow-up to Herb Mesler's article in the June RTTY Journal. Herb pointed out the advantages of the reed relay on RTTY. I sure agree and I found a good cheap one listed in the catalogs. The Magnecraft number W101MX1 is small cheap, and works very well here. The coil is rated at 6 volts, and since the coil resistance is 100 ohms, it is perfect for a 60 ma. loop. The Allied Radio number is 41F4440 and the Newark number is 56F909. The price is $2.20. I don't see any excuse for dry keying with such a nice little reed relay available.

Ronald Finger, W4VZR

***

Dayton Hamvention
April 24-25
Welcome at the RTTY Suite
Sheaton Dayton Hotel -

***



Circle shows location of motor stop contacts as described in article on CW from a TD. Page. 2

'Bill' W8FQM

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.

P.C. BOARDS -- I.C. T.U. from July '69 73. AFSK generator from Sept. '69 QST. Provisions for wide or narrow shift. Each board approx. 5" x 2-1/4" plug-in type. Drilled and tinned epoxy (G-10) boards are $3.00 ea. or $5.50 for both P.P. R.M.V. Electronics P.O. Box 283, Wood Dale, Ill. 60191.

TELETYPE PARTS and Supplies; D.C. supplies, new $7.00. Tables 22 x 26 x 32 high with rectifier shelf, 2 doors in front and storage space. New $12.00. Wheatstone perforator w/keyboard accepts 5 unit punched tape and converts it to Morse code on narrow tape automatically. New, write for price. W.E. polar relay #255A $2.50. W.E. polar relay socket $2.50. Series governed motors, new, $4.00. Misc teletype tools and parts, send SASE for list. L & L Electronics, PO Box 1327, Harrisburg, Pa. 17105.

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

RTTY GEAR for Sale: List Issued monthly. 88 or 44 mh toroids - 5 for $2.50 postpaid. Elliott Buchanan and Associates. 1067 Mandana Blvd. Oakland, Calif. 94610

MODEL 19 and No Glare window, typing reperforator and keyboard, 14 TD, Line unit. $200. 60hz sync motor $6. John Christy, 14945 Dickens St. Sherman Oaks, Calif. 91403

RTTY RIBBON INK: economical (ribbon lasts for years), deep (easy-to-read) black. Widely accepted. Large 2 ounce size $1.25 Postpaid, U.S. Marv. Cook, WA2RDO, 1992 Windsor St., Westbury, N.Y. 11590

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)

RTTY PICTURES for sale. Vol 1, $1.00, Vol. 2, $2.00 with larger pictures. Audio and perforated tapes available. W9DGV, 2210-30th St. Rock Island, Ill. 61201.

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

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

FOR SALE: MAINLINE ST - 3 RTTY demodulator, has motor delay, FSK driver, meter tuning and auto print, missing 1-88 mm toroid, $70 Heath kit GR-54, 1 year old $100. Heath Kit HR-10B amateur receiver with crystal calibrator $120. Knight kit T60, 80-6 meter receiver $65. This equipment was built while in service and never used. Contact Richard Tieskotter, Rt 2, Lawler, Iowa. 52154

P.C. BOARD PROJECTS undertaken. Mainline TTL-2 p.c. and filter boards supplied assembled and checked. Dependable and experienced workmanship. W1FCV, John Roache, 153 Chestnut St., Manchester, Conn., 06040.

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

TT/L-2 WITH DISCRIMINATORS TUNED to 170-425-850 shifts $90. Model 26, complete and operating $25.00 DC Supply for model 19 $3.00 Ron Renaud, 9150 Texas Ct. Livonia, Mich. 48150

TTL/2 PRINTED CIRCUIT BOARD (QST, MAY 69) and two-frequency Discriminator/Filter Circuit Board (QST June 69, 6 x 9 inches, highest quality material, either board, $6.00 postpaid, USA. Also, single Discriminator board or Filter board (QST, June 69), $2.00 each. Jim Salter, K5BQA, 11040 Creekmere, Dallas, Texas, 75218.

ADDITIONAL CLASSIFIED on NEXT PAGE