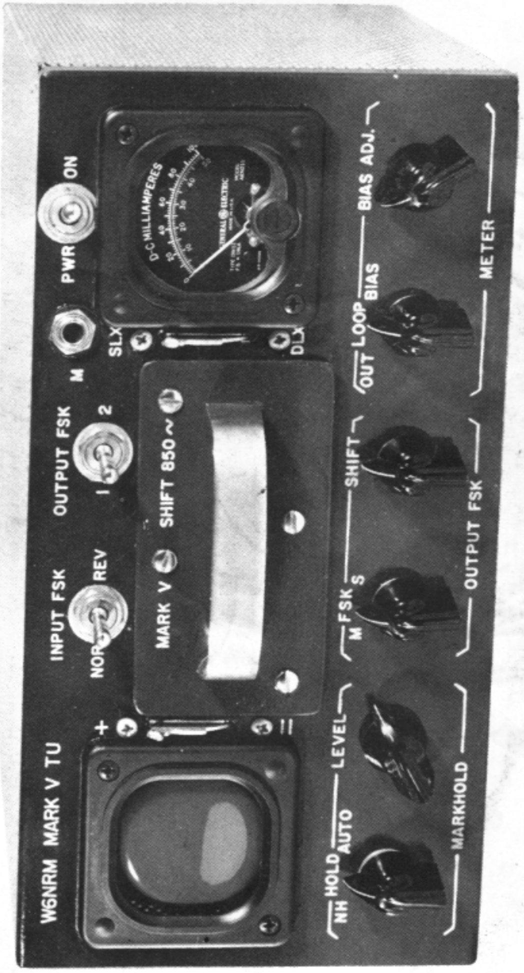
RTTY



W6NRM RADIOTELEPRINTER TERMINAL UNIT
MARK V

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NEWS OF AMATEUR RTTY

September 1965
30 Cents
Vol. 13, No. 9

HORSE TRADES

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

WANTED: Instruction manuals and schematics for Northern Radio Type 105 Model 4A keyer and Hallicrafters O-39C/TRA7 keyer. Trade Model 15 printer complete, Model 14 reperf., Model 14TD, extra polar relays. Will pay shipping to Seattle. Also one Model 19 complete. Looking for VHF gear or what have you? KL7CVB, Box 840 Delta Junction, Alaska.

WANTED: RTTY back issues; Oct. 1957; Jan, Apr., May, 1964. Will trade or sell, 1956 Jan., Mar., May, June, Nov.; 1958 Jan., Feb., Apr., Aug., Nov.; 1959 Jan., Feb., Apr., July; 1961 Jan., Feb., May, Sept.; 1963 Sept., Oct. WA6NAT, 9802 Foerni Road, Placerville, Calif. 95667.

WANTED: Audio type Terminal Unit preferably with CRT tuning. Have good condition LM-7 frequency meter with calibration book, and well built power supply for trade. W6GC, 737 12th Street, Manhattan Beach, California. Phone FR 9-8870.

FOR SALE: Model 15, sync, 60wpm $75.00 Model 15 glasses, by Teletype $1.00 postpaid in U.S. Test tape, magnetic or perforated paper, $2.00. K5BQA, 11040 Creekmere, Dallas, Texas 75218.

FOR SALE: Model 26 machine and table. Also converter, tuning scope, 2 meter Transmitter and power supply, and beginnings (cabinet and ceils) of a high voltage power supply. Everything for 175 dollars! Phone area code 213 699-4079 or write John Herr, 1815 Maple Street, Whittier, Calif.

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WANTED: Circuit and Lay-out for FSKing Johnson VFO #122, parts, voltages, etc. W2KPF, 541 Marcy Avenue, Brooklyn, N.Y. 11206.

FOR SALE: Model 26 in excellent condition. Table has furniture finish. $75.00, pick up. $85.00 shipped. K0GXL, 5732 Ovid Avenue, Des Moines, Iowa 50310.

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372 Warren Way
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THE W6NRM RADIOTELEPRINTER TERMINAL UNIT, MARK V

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PART ONE

Introduction

The Mark IV Terminal Unit, described two years ago[1], has proved itself to be a quite satisfactory unit for general radioteleprinter communications work. It was further improved to enable "Mark-Space Frequency Diversity" through the incorporation of Two-Tone detection techniques[2]. As usual, the combination of transmit and receive functions in one unit has made this TU exceedingly convenient during operation, lending itself not only for radio circuit working but also for patching over landline circuits. The versatility of the entire system permits operation of the RTTY station in a variety of ways; for instance, the loop circuit is switchable into independent send-and-receive portions — this permits simultaneous reception and transmission of different-text messages. This same split-loop arrangement is quite useful for separate punching up of tape through a typing reperforator placed in the receive loop, and the punched result is later picked up and transmitted via the send loop by a transmitter distributor placed therein. This procedure is used often at W6NRM to prepare messages on tape, as during bulletin work, and as convenient the punched result is picked up and sent on over the air. The TU system can also be set up as to be controllable over a landline circuit; at least, landline signals can be patched into or out of radio circuits. The utility of this arrangement for emergency or Civil Defense operations is obvious. This landline-patch setup is in routine use at W6NRM to enable communication with local teleprinter stations not only for landline contacts but also for patching into radio circuits.

The Mark V Terminal Unit, herein described, is the solid-state equivalent of the Mark IV. In fact, the design philosophy of the earlier unit was rather closely followed, except for the use of transistors in all possible places to replace vacuum tubes. The only exception is the cathode-ray tube used for tuning indication; as yet there is no fully satisfactory solid-state substitute for this indicator. The panel arrangement, the plug-in filters, and even the input and output connections as well as the controls are almost identical to those in the Mark IV. Even the filters can be swapped between the old and new TU's for comparative purposes. The Automatic Markhold is an all-electronic setup in the transistorized unit and is in itself quite smooth in operation. The AFSK oscillator design was revised and improved; it provides a 1-milliwatt output into a 600-ohm termination.

Circuit Description and TU Construction

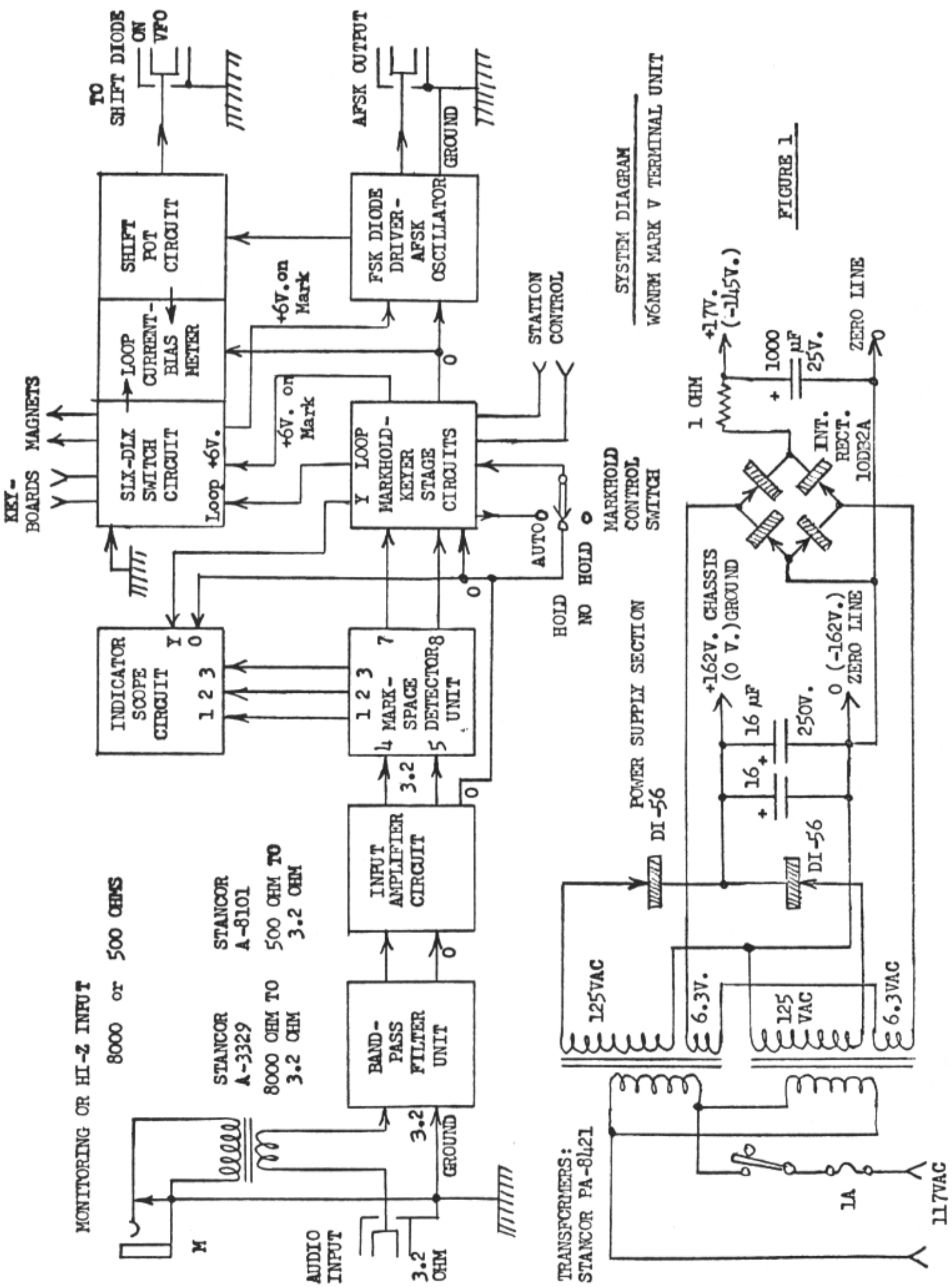
Twelve NPN silicon transistors are employed in the Mark V. Ten of these transistors are RCA type 2N3053 units, while the remaining two are Industro Transistor type TRS-301 units. The latter two are special 300-volt types, required for keying the loop and FSK diode driver circuits at a voltage level of some 165 volts, with reserve to take care of teleprinter magnet inductive surges. The new RCA type 2N3440 transistors can of course be used in place of these TRS-301 units if desired. As for silicon diodes — there are some 27 units distributed over the TU circuit. Most of these diodes can be of the low voltage types, except for the power supply diodes — which should be of the 400 PIV type, at least. For that matter, silicon diodes of a single type, having 400 PIV, can be employed everywhere. Current size could be 300 or 500 mA. There is one Zener diode employed for voltage regulation in the FSK diode driver circuit; a 50-volt 1-watt unit serves nicely.

Two power supplies are employed in the terminal unit. One supplies 17 volts at about 80-100 milliamperes for the low voltage stages; the power is obtained from two seriesed 6.3 VAC windings on the two Stancor PA-8421 transformers via a silicon bridge rectifier feeding into a high capacity filter unit. The other power supply operates at some 165 volts at currents up to 100 milliamperes; it is used to provide loop power as well as to energize the FSK diode driver circuit. The same PA-8421 transformers are used, with their high-voltage secondaries so hooked and phased correctly to provide a 125-0-125 VAC output feeding into a full wave rectifier consisting of two silicon diodes. A 32-μF capacitor provides the filtering.

The Mark V's system diagram is presented in Fig. 1. The power supply circuit is shown, along with various blocks showing circuit functions along with interconnections needed to organize the whole terminal unit. The succeeding figures show the circuits involved in all the blocks concerned.

Two types of signal inputs are available;

[1]W6NRM Radioteleprinter Terminal Unit, Mark IV, RTTY, March 1963.
[2]"What is this Two-Tone Detector?", RTTY, September 1963.



one at 3.2 - 4 ohm impedance level and the other at 8000 (or 500 ohms if desired). Either input permits connection to a radio receiver having either impedance; however one of the two inputs can be employed in a bilateral sense – i.e. audio signal can be put into or taken out as required. For instance the 8000 ohm termination is employed for monitoring purpose; a front-panel jack as well as another one in series at the rear accomplishes this connection. A power level of several milliwatts is sufficient to operate the TU from a radio receiver, so there is no undue demand upon the latter's audio stage circuits.

The TU is built into a California Chassis Company type LTC-470 cabinet. This box comes complete with both front and rear panels, a ventilated enclosure, and a chassis ready to punch and mount parts thereupon. On the front panel, round hole cutouts are made to fit two Millen type 80072 bezels for the 2-inch CRT and a similarly sized 0-1 milliammeter (General Electric DW-51, from surplus). A rectangular cutout is placed between these bezels to accommodate the paired Vector can plugins. The controls are disposed as indicated in the front-view photograph for the various functions required for TU operation. Two Centralab type 1458 lever switches are installed in the two spaces between the bezels and the rectangular cutout; one switch is employed for selecting indicator display while the other switch is used for split loop control.

The rear panel of the cabinet has been enlarged to accommodate the connectors and parts needed for input-output connections, loop-current switching and adjusting, etc. On the chassis, a new rear panel is formed out of a piece of 1/16-inch thick aluminum to hold the additional controls needed for adjusting the various circuits in the TU. The views presented in the photographs should be self explanatory.

The power transformers are placed along one side of the chassis, away from the C-R tube with its shield. Otherwise, placement of components and transistors is not particularly critical. The parts have been conveniently situated with respect to each other for ease of connection to the three Vectorboards placed flat underneath the chassis. Arrangement is such that a smooth flow of signal results from stage to stage as well as from connection to connection. As a sizeable number of resistors, capacitors, and semiconductor elements are used, be sure to mount them as close together as possible on the Vectorboards. The zero line is wired in a length along the bottom row of holes while the 17-volt line is wired in a similar position along the top row of holes. Parts are easily mounted and wired in between these "bus-wires". This, looking at the chassis turned upside down, makes for a logical wiring pattern. The Vectorboards are type 64AA18, whilst the pins are Alden type 651-T. (Alden Products Company, Brockton, Massachusetts; price $8.00 for 1,000 pins).

It is to be noted, as in the Mark IV, that the TU has a grounded B-plus supply system. That is, the positive end of the high-voltage portion is grounded. The zero "0" line is at some −165 volts with respect to chassis ground. The 17-volt circuit is also at that high voltage; hence care will be necessary to avoid shorting some of the internal circuits to chassis with possible damage to the semiconductor components. This of course indicates care in wiring as well as lead dress to enable checking of the various circuits with a minimum chance for short-circuits due to placement of test instrument leads. Also, clearances should be observed so that, for instance, plug-in filters being inserted or removed do not cause short circuits. All in all, common sense is indicated in layout and construction work.

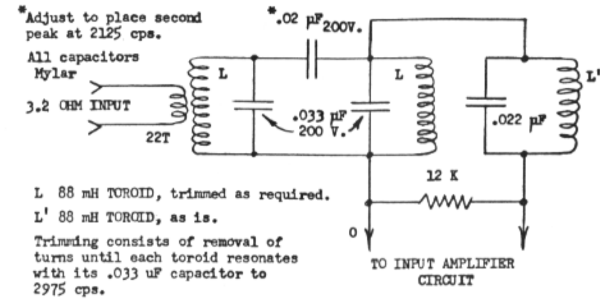
The reasons for this grounded B-plus scheme are to obtain grounding of at least one side of the teleprinter line at all times and to simplify the output FSK diode driving circuitry. Aside from the caution notes above, no compromises are involved in this TU design. Incidentally, the terminology "zero line", etc., is used merely to keep the reader on an even keel when he is reading and studying circuits contained in this grounded B-plus setup. In a sense, consider the O-line as a hot ground. In the figures, voltages placed between parentheses refer to voltages measured with respect to chassis ground, while voltages not so placed are with reference to the O-line buswire.

Bandpass Filter and Mark-Space Detector Units

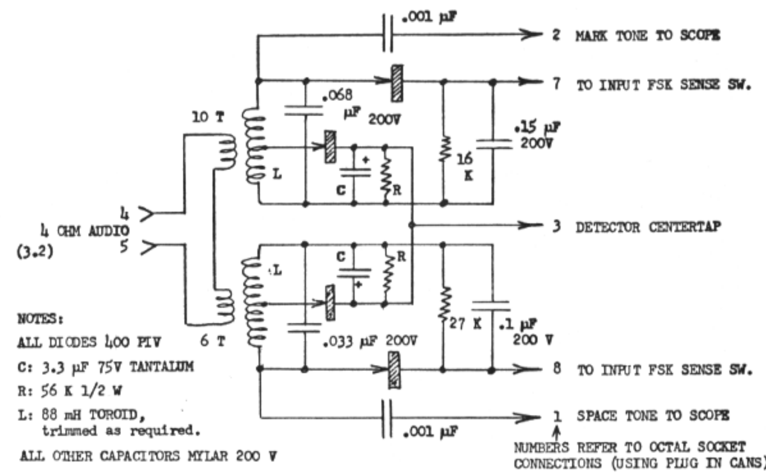
Information is presented here for the construction and tuneup of a Bandpass Filter Unit and a Mark-Space Detector Unit for a shift of 850 cps, corresponding to 2125 cps Mark and 2975 cps Space. Data on other shifts, such as 170 cps, is available in reference (1) which should be consulted for a more rounded-out story on the basics of the entire Mark III-IV-V concept.

The filters are mounted into Vector C-12 octal-based plug-in cans. The parts are mounted on Vectorboard pieces set diagonally into the cans. For this TU, the filters have been paired to form a bandpass filter-detector unit assembly, using a piece of 1/8-inch aluminum panel and a cabinet-type doorpull.

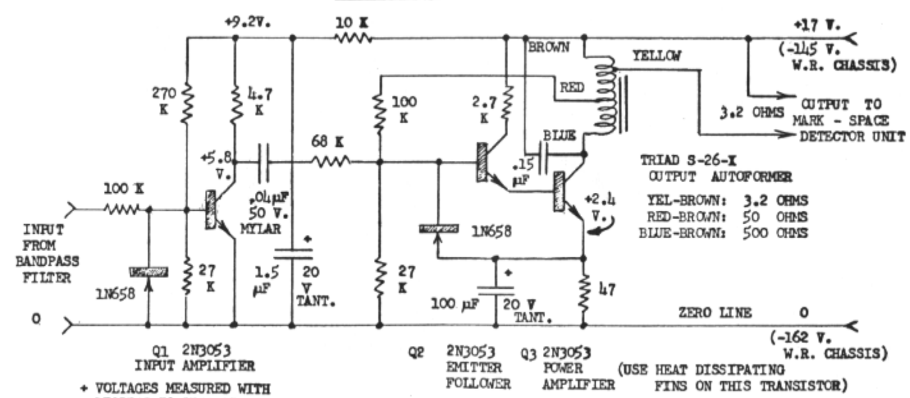
Figs. 2 and 4 show the configurations of the Bandpass Filter Unit and the Mark-Space Detector Unit, respectively. The tuned circuits employed in both of these units are made up using ordinary 88-millihenry toroidal inductors tuned with Mylar capacitors. The inductors are of the telephone loading coil type, which is quite plentiful in surplus and other places connected with telephone companies. These coils are also available from a number of sources advertising in *RTTY*,



BANDPASS FILTER UNIT
W6NRM MARK V TERMINAL UNIT
FIGURE 2



MARK - SPACE DETECTOR UNIT (850 cps shift)
W6NRM MARK V TERMINAL UNIT
FIGURE 4



INPUT AMPLIFIER CIRCUIT
W6NRM MARK V TERMINAL UNIT
FIGURE 3

QST, and other radio journals. The inductor proper consists of two windings on a permalloy doughnut core. In our application, these two windings are placed in series-aiding (by tying together the two flying leads on one side) so that one obtains a typical value of 88 millihenries with a Q of about 50 at 3 kc/s. The tap between the two windings is used to drive the fade compensating circuit in the Two-Tone detection system.

Each inductor must be tuned to a certain frequency using its associated Mylar capacitor. A suitable procedure is to employ a calibrated audio oscillator feeding into the LC under check, via a stepdown transformer (audio speaker type, such as Stancor A-3329, borrowed from the TU during construction) with a single wire run through the "hole" in the inductor and connected to the low impedance side of the transformer. The tuning is maximized by using a cathode-ray oscillograph hooked across the tuned circuit and its frequency is determined by reference to the audio oscillator's dial. On first trial, it will be noted that the resonant frequency is too low; hence a few turns (or sometimes as many as 30 or 40 turns) will have to be removed from the inductor under check. Finally one obtains the proper resonant frequency for each inductor-capacitor pair, and it is then ready for installation.

The Bandpass Filter Unit, shown in Fig. 2, is made up using a pair of LC's tuned in the above manner to 2975 cps. One of the inductors already has a 22-turn link handwound on to serve as a 4-ohm coupling. The addition of a typical .02 μF capacitor will result in a pi-filter configuration with the second peak moved down to around 2125 cps. The frequency of this second peak should be determined by means of the calibrated audio oscillator with its output transformer feeding into the 4-ohm coupling link and oscillograph connected to the output of this newly-made filter. The size of the coupling capacitor (.02 μF) should be adjusted by trial and error, using small capacitors placed in parallel until the second peak is definitely located at 2125 cps.

The dropoff on the high frequency side of this filter is steepened by use of a LC trap circuit placed in series with the filter's output. Its notch frequency will be around 3500 cps, using an unmodified toroidal inductor with its .022 μF capacitor. Finally the response characteristic of this bandpass filter is flattened using a 12 K load resistor on its output. This completed Bandpass Filter Unit makes an effective coupling transformer between the 4-ohm output from a radio receiver and the rest of the TU circuit. Isolation is maintained insofar as d-c grounds and the TU's zero line are concerned.

The tuned circuits for the Mark-Space Detector Unit, shown in Fig. 4, are made up in much the same fashion. One LC is required for 2975 cps and other one for 2125 cps. Some care, however, should be exercised during turns-removal tuning to equalize — at least approximately — the number of turns removed from each of the two windings. In other words, take a few turns off one winding and then the other winding as required. We wish to maintain an approximate centertap on each complete tuned LC to achieve a one-half voltage division for proper driving of the fade compensating circuit in the Two-Tone detection system.

The filter and detector units should be checked for proper frequency peaks in the completed terminal unit; they should be adjusted if necessary to bear upon the 2125 and 2975 cps spots. This is quite important as the completed detector unit with its indicator scope forms a standard against which the transmitter is adjusted to an 850-cps shift.

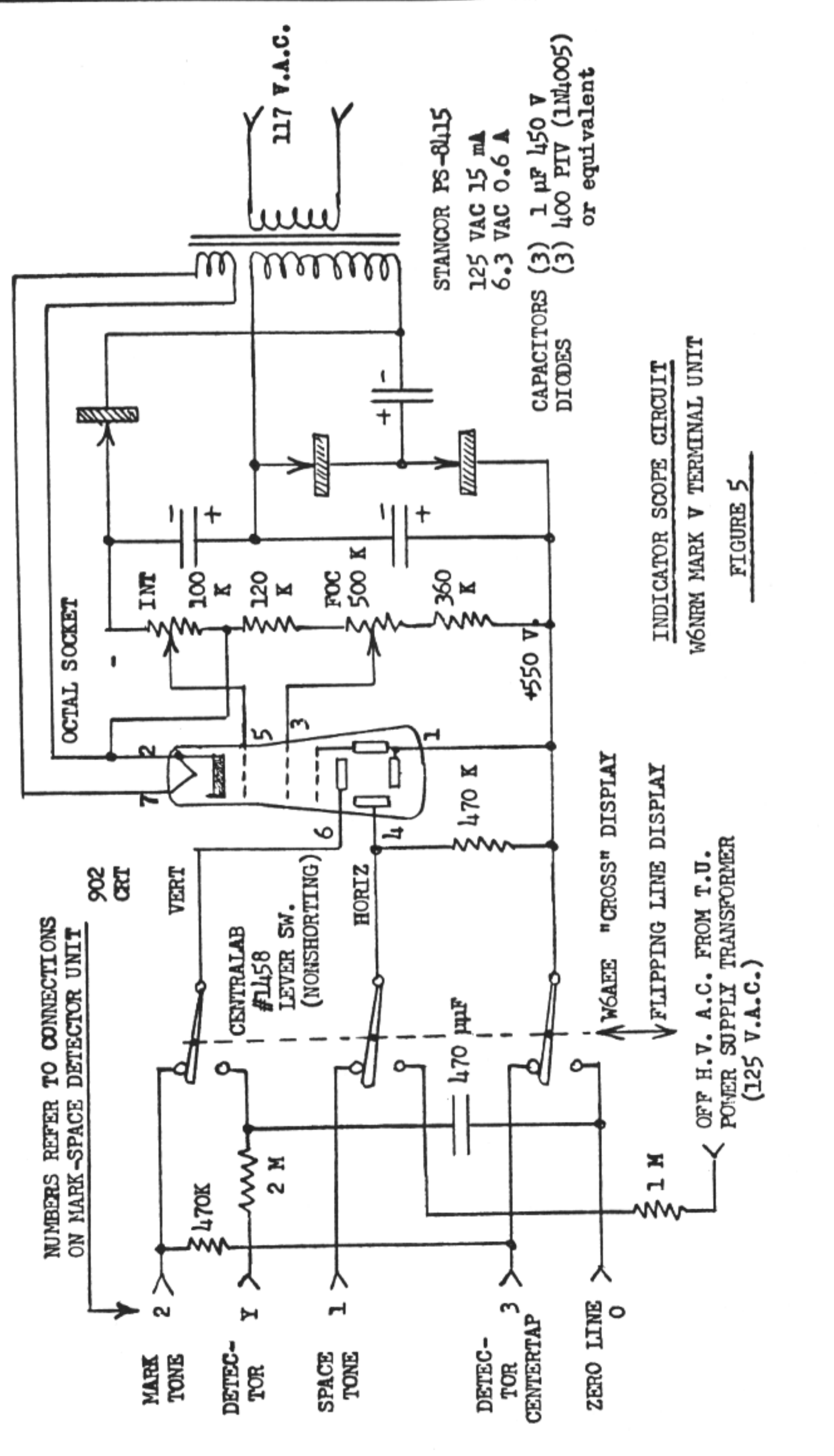
The fade-compensating networks are formed using 3.3 μF 75-volt tantalum capacitors with 56-K resistors; these networks are driven off the half-voltage taps on the toroidal inductors via silicon diodes. The modus operandi of the Two-Tone system is explained in reference (2); however it will be briefly mentioned that these networks act as storage devices (memories) to track stored information as to amplitude levels of just-received Mark and Space tones. Redundancy in the form of Mark-Space Frequency Diversity is obtained through the ability of each of the two channels to operate independently of each other — handling each tone on a make-break basis — and then algebraically combining the result before injection into the loop keyer circuit.

Input Amplifier Circuit

Shown in Fig. 3, this is a 3-transistor amplifier circuit with an output stage having sufficient power to properly drive the Mark-Space Detector Unit. The stages are operated in an essential Class-A condition, although they can be driven to saturation by a large amplitude input signal; during this time the circuit has symmetrical clipping to achieve a true limiter action. This is accomplished by use of the silicon diodes so placed as to clip the waveform in a reverse bias swing insofar as inputs to the transistors are concerned.

The Bandpass Filter Unit feeds into the input amplifier via a 100K isolating resistor. The latter resistor is of course a mismatch and results in attenuation going into the low input impedance of the first transistor (Q1) stage; however it serves to avoid loading the filter with consequent problems in filter response as well as in symmetrical clipping during overload conditions. After all, the entire amplifier circuit has more than adequate gain for normal RTTY operations.

The low impedance input of the power amplifier (Q3) is increased to a suitable point by means of the emitter follower (Q2) hooked therein. The impedance at this point is high enough so as not unduly load Q1's



INDICATOR SCOPE CIRCUIT
W6NRM MARK V TERMINAL UNIT
FIGURE 5

output; in fact there is a series resistor placed therein to serve partly for isolation and partly to enable the negative feedback loop (from off the 50-ohm tap of the output autoformer) to function to damp out the power amplifier's output. This provides a relatively stiff drive to the Mark-Space Detector Unit, with a minimum of ringing.

The output stage, Q3, runs at a collector current of approximately 50 milliamperes. Hence it is advisable to provide a heat sink on the transistor; an inexpensive clipon finned device performs nicely.

Check to be sure that the transistors are properly biased. Measure the voltages at the indicated points. It may be necessary to adjust the 270K resistor feeding into the base of Q1. In general, the 2N3053 transistors have been found fairly uniform enough to enable construction of these circuits without too much fussing around with biasing points. Most of these units have high Betas, but an occasional unit may have poor Beta — hence it is well to check to be sure of proper circuit operation.

Indicator Scope Circuit

This is the only tube stage in the entire Mark V terminal unit. Thus far, there seems to be no satisfactory solid-state tuning indicator comparable in performance and convenience to that of the display afforded by a cathode-ray tube. Here in this design we have two displays available — the W6AEE "cross" display and a flipping-line display — either one selectable via a lever switch on the front panel.

The scope circuit, shown in Fig. 5, is largely self explanatory. The C-R tube has its own power supply, which is entirely separate from the rest of the TU circuits so that its neutral can be switched to either the center-tap on the Mark-Space Detector Unit or to the zero line as required for either cross or flipping-line display respectively.

The connections between the Mark-Space Detector Unit and the Indicator Scope Circuit are indicated in both Figs. 4 and 5. Be sure to wire the lever switch as indicated; also make certain that this switch is of the non-shorting type so as to avoid bridging contacts involved in both display setups. The specified Centralab #1458 switch is of such type.

The display afforded by the "cross" setup is actually a pair of elongated ellipses. The appearance is not important; rather, it shall be sufficient to tune in the signal so as to provide a symmetrical appearing cross pattern.[3] If such display obtains, one not only has correct tune-in on the RTTY signal but the latter has correct shift as well. Incorrect shift is indicated by varying tilt of the two "ellipses" with respect to each other; also the curves become noticeably distorted. Tuning indication afforded by this display is quick and precise — capable of showing not only direction but also sense as well — when tuning across a RTTY signal.

The flipping-line display is useful mainly when trying to straddle-tune a narrow frequency-shift keyed signal. The aim is to center the flipping line over a certain point in the center of the C-R screen which indicates the transit between Mark and Space in the loop circuit. This point is rather easily determined by tuning a constant carrier signal in into the TU, and observing the action of the loop circuit (with Markhold placed in No-Hold position). Eventually, though, if a bright spot is allowed to "burn in" on the screen, it will leave a tiny reference mark which will be quite adequate enough as a fiducial spot.

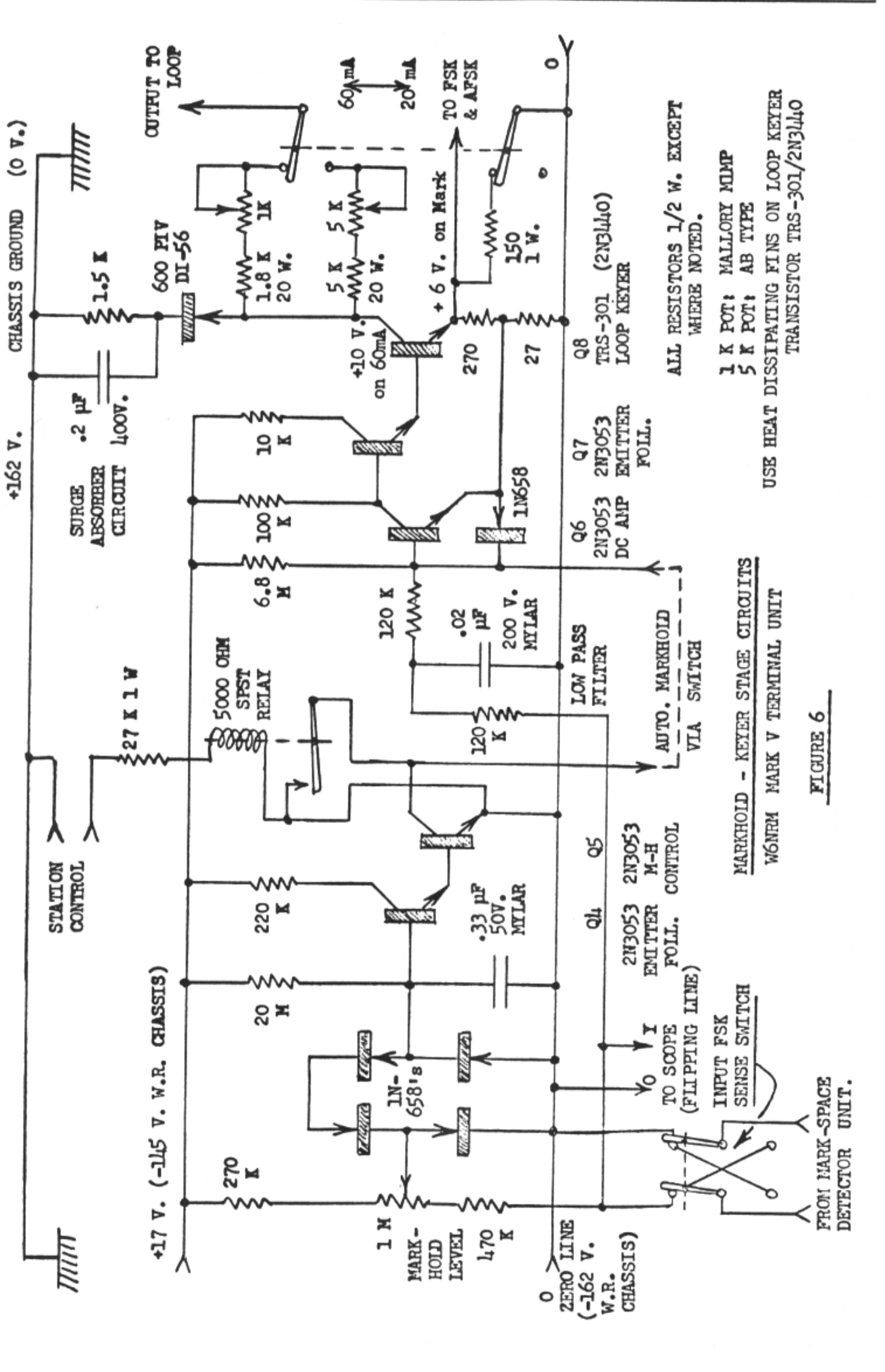
Markhold — Keyer Stage Circuits

Two general areas are shown in Fig. 6. The area shown to the left concerns a Markhold circuit, and the area shown to the right has the loop-keyer circuit. Both areas are shown because the output waveform from the Mark-Space Detector Unit is fed to both areas at the same time. The Markhold circuit, in its automatic mode, exerts a clamping effect upon the loop-keyer circuit in case of insufficient Mark indication from the detector unit. In other words, if there is no signal and only noise enters, the Markhold places a clamp so as to keep the teleprinter loop on steady Mark rather than have the noise key the loop in a random manner.

When a Mark voltage appears, having sufficient amplitude (approx. 20 volts for instance) appears at the detector's output, this negative voltage overcomes the bias introduced from the +17 volt buswire through a control called "Markhold Level". This negative voltage then goes through the silicon diode network to drive the .33 μF time-constant capacitor to —0.6 volt (clamped there by a silicon diode, part of the network). Q4, an emitter follower, is thus cut off due to reverse bias on its base. Hence there is no base current flowing into Q5, the M-H control. As a result, Q5's collector circuit is an open circuit and there is no clamping effect on the loop keyer. In other words, with a good Mark signal coming in, the Markhold circuit is unlocked.

The .33 μF time-constant capacitor is fed by +17 volts through a 20-megohm resistor. Hence, if the Mark signal disappears for a sufficient period of time, the input to the network is biased towards +17 volts, and the two series diodes in the upper portion of the network is nonconducting (reverse biased). As a result there is no output from this network, and the time-constant capacitor is allowed to charge up. At some +1.2 volts with respect to zeroline, the M-H control transistor, Q5, will conduct and its collector will clamp on the loop keyer. This point begins approximately 0.6 second after the disappearance of the Mark signal; this period is sufficiently long enough to take care of nor-

[3]See front cover photograph, **RTTY**, June 1965. Mark V TU is shown, in operation, with the "cross" display in action. Also see reference (1).



MARKHOLD - KEYER STAGE CIRCUITS
W6NRM MARK V TERMINAL UNIT

FIGURE 6

mal teleprinter signal which rests on Mark most of the time, and has a maximum Space interval of 132 milliseconds (corresponding to BLANK).

In essence, the Markhold circuit just described functions as a fast-attack slow-release switch to control the loop keyer as required. The fast-attack phase takes approximately 15 milliseconds; in fact this is the time required to charge the time-constant capacitor from +1.2 volt to —0.6 volt. The slow-release phase last 0.6 second, being dependent upon the charging of the capacitor by the +17 volts through the 20 megohm resistor.

In regard to Q4, the emitter-follower transistor in the Markhold circuit – it may be necessary to select a 2N3053 that features good Beta at very low collector currents. The controlling base current into this transistor is only a fraction of a microampere (at least 1 μA, max), and we wish to have enough emitter current flowing to exert a good control on the base of Q5. The new Fairchild NPN silicon high-gain transistor, type 2N3565, would be a good choice in this spot, and it is quite inexpensive – in fact, lower in cost than that of the 2N3053.

The right-hand area in Fig. 6 shows the circuit for the loop keyer. This is the stage that directly keys the teleprinter magnet (or several in series, if desired) at 20 or 60 milliamperes. At the same time this stage provides a signal for the FSK/AFSK transmitting portion of the terminal unit. In essence, this circuit takes the place of the d-c amplifier and 6W6GT loop keyer of the Mark III and IV systems. The advantages of the Teleprinter Loop, with its seriesed inputs and outputs is continued. For instance, keyboards, TDs, magnets, etc., are placed in series in this loop, and the terminal unit can be so controlled for transmitting or receiving as required. In addition, incoming signal can be retransmitted out at the same time, as during relay operation from HF radio circuit to VHF or landline. Inasmuch as the keyboard is placed in series with the magnet in this loop, this offers the advantage of local copy, without the necessity for "tuning one's own signal in". Whatever intelligence is keyed into the loop in this manner is transmitted via one of the "output ports" in this loop.

The loop just mentioned above is actually a part of a to-be-described-later switching system that permits splitting into separate send and receive loops for yet greater versatility in handling a number of machines and signal paths on a simplex or duplex basis.

The loop is operated at a high voltage – typically 162 volts as shown in Fig. 6. The self-contained terminal-unit power supply supplies all loop currents; no external line-current supplies are required. The use of high voltage in the loop offers a number of advantages – for instance, the 60-mA pulling magnet type equipment require considerable voltage drop through a relatively high resistance to permit free magnet-armature action voltage is, in fact, high enough to permit with a minimum of damping effects. The seriesing of two or three such magnets in the same loop without adverse effect on teleprinter range margins.

The introduction of high-voltage transistors has facilitated the design of the Mark V system. We have the Industro Transistor TRS-301, rated at a BVCEO of 300 volts and capable of handling collector currents up to some hundreds of milliamperes. Its dissipation rating is one-half watt. Further, RCA has its new 2N3440, having similar ratings, and it is quite inexpensive. Either unit will serve very nicely in the loop keyer circuit.

The fact that these transistors are rated only about one-half watt introduces a limitation in the design of high-current high-voltage d-c amplifier circuits. Suppose we have a loop keyer stage with such transistor placed so that its collector is in series with a 3,000 ohm resistor, and the whole loop circuit is energized at 180 volts. With the transistor sufficiently forward biased, we shall have a very low collector-to-emitter voltage drop – assumed zero – and then all the dissipation of the 60 mA resultant current will be in the 3,000 ohm resistor – 10.8 watts! Now, suppose we reduce the forward biasing current to the transistor's base so it draws 30 mA through its loop circuit. Half of the voltage, or 90 volts, will appear across the collector-to-emitter junction – while the rest of the voltage is impressed across the series resistor. The junction will dissipate 2.7 watts, and hence it will become very hot – leading to its failure, unless it is adequately heat sinked.

However, our teleprinter loop current is in the form of squarewaves ranging between zero and 60 mA. The Mark-to-Space and Space-to-Mark transitions are extremely rapid – as rapid as is practical considering circuit elements in the loop. Hence, the function of the loop keyer transistor is to act as a switch. Normally, the teleprinter signal coming through the Mark-Space Detector Unit is in the form of squarewaves. However there exists the chance that the transistor keyer could become accidentally forward biased so it dissipates at half loop current for some time. This is avoided by making the loop keyer transistor stage a part of a Schmitt-type toggle system – thus the loop current can never rest at any value except zero and a maximum value as determined by the loop's series resistance. The transistor runs cool as a result of this duty-cycle consideration.

In Fig. 6, on the right, we have three transistors, Q6, Q7, and Q8, forming the semiconductor elements in a Schmitt trigger circuit. The signal from the Mark-Space Detector Unit is fed through a low-pass filter (mainly for isolation purposes, like in the Mark III/IV TU's) into the base of Q6. This transistor is in a d-c amplifier circuit; its output now feeds into Q7 arranged as an emitter follower. Sufficient current output is now available at this point to drive firmly the base of Q8, the high-voltage loop keyer transistor, so it becomes fully conducting. This happens with a negative signal swing applied to Q6, and hence there results an essentially-full current flow.

Positive feedback is introduced to obtain a toggle action in this Schmitt circuit. This is accomplished by feeding a portion of signal from the emitter circuit of the loop keyer, Q8, back into Q6's emitter so as to have the output in phase with the input driving signal. The amount of feedback involved has been so proportioned as to achieve a distinct toggle action, with hysteresis of less than 1/4 volt at the input to the low-pass filter. Normally the "swing" from the Mark-Space Detector Unit will be of the order of 20 to 40 volts, and this just-described trigger circuit "sees" only the midpoints of the swings between positive and negative ends as during Space and Mark signalling. There is plenty of dynamic range to handle widely varying voltage swings yet the loop is keyed in a manner approaching zero-bias condition or symmetry. This is the critical area where conversion is accomplished from the polar condition of input frequency-shift keyed signal to the neutral condition needed for keying the on-off current pulses into the usual teleprinters' magnets.

A reverse polarized diode is placed between the base and emitter of Q6 to enable proper low-pass filter action and minimize the possibility of characteristic distortion – by equalizing charging effects in both Mark and Space directions. Further, the Schmitt trigger is adjusted close to the point where it is ready to transit to Space condition by feeding some current into Q6's base from +17 volts through the 6.8 megohm resistor. During construction of Mark V's, it may be well to check and see how the triggering point stands during no-signal condition. Merely vary the above resistor between say 3 and 10 megohms, and determine the point where the loop keyer goes to Space condition. Afterwards, choose a somewhat higher valued resistor to finish the adjustment. The Beta of the transistors involved vary rather markedly, especially with respect to Q6; hence circuit parameters may differ slightly.

The "output port" in the Teleprinter Loop – or the point where the following FSK/AFSK transmitting circuits obtain their signal voltage from the loop – is between the emitter of the loop keyer transistor, O8, and zero line. With the loop current switch set to either 20 or 60 mA, there obtains a 6-volt output on Mark. During Space, there is no output. In other words, we obtain a small replica of the squarewaves circulating in the Teleprinter Loop for further handling by subsequent transmitting circuits. The 20-60 mA switch is a double-pole double-throw switch which functions not only to switch the series resistances in the loop for either current, but also adjusts the emitter series resistance so that a constant 6-volt level is maintained at either current level.

Teleprinter magnets have inductive surges that occur during current cutoffs. These transients may run to some hundred volts or more. The loop keyer transistor is protected by means of a "surge absorber circuit", consisting of a diode feeding into a resistance-capacitance load. It is very effective, and yet it allows maximum normal teleprinter range margins. It is to be noted that the diode involved is reverse biased insofar as normal loop power voltages are concerned. When a transient comes, it is of such value as to exceed in a positive direction in the collector voltage with respect to chassis ground. The diode thereupon conducts and bypasses the spike into the RC cushion. Hence the excessive voltage swing is kept down to less than the BVCEO of the transistor concerned. This effect can be observed with an oscilloscope connected so as to observe the collector swing of the loop keyer with respect to ground. With the surge absorber circuit disconnected and with a teleprinter magnet in the loop, it will be noticed that the loop keyer transistor avalanches and thus showing up as a flattened point on the spike as induced during loop current cutoffs. Any such avalanching must be avoided in interests of having satisfactory transistor life; hence the surge absorber circuit is necessary.

The loop keyer transistor, Q8, still does dissipate somewhat, especially on a 60-mA current flow. Measure its collector voltage with respect to its emitter – this will measure about 4 volts – showing a drop of that value existing across the collector-emitter junction. If this measurement is taken with respect to zero line, this will be 10 volts, as the 6-volt drop existing across the "output port" is added to the 4 volts across the junction. At the indicated current level, there is a dissipation of 0.24 watt in the junction. This is well within the transistor's dissipation rating for ambient temperature condition; however a clipin finned heat-sink device is suggested. The transistor runs quite cool, and no trouble has ever been noticed in this circuit during months of terminal-unit operation.

As for Markhold – when it operates as during no-signal and only noise coming through the TU – in functions through its M-H control transistor, Q5, so as to ground the base of Q6 to zero line. The loop keyer stage is thus kept in a Mark condition. This is also operative when Station Control exerts control through its 5,000 ohm SPST relay to short the base of O6 to zero line. All in all, a versatile Markhold system to work with the loop keyer circuit. By the way, Station Control is merely a pair of contacts as a part of, say, the transmit-receive switch in the station.

(Continued next month)

[4]The W6NRM Radioteleprinter Terminal Unit, Mark III, RTTY, January and February 1961.

ARMED FORCES DAY 1965 COMMUNICATION TEST RESULTS

Orig.: R. E. MICKLEY, LCDR,
USNR, OP-945N, Room 5D564, Pentagon, Ext. 71219

The annual Armed Forces Day communication tests conducted by the Army, Navy and Air Force on 15 May 1965 were evaluated as being highly successful.

Four military radio stations, WAR (Army), NSS (Navy) and AIR (Air Force) located in the Washington, D.C. area and NPG (Navy - San Francisco) participated in the communication tests which included military-to-amateur crossband operations and receiving contests for both continuous wave (CW) and radioteletypewriter (RTTY) modes of operation.

CROSSBAND RESULTS

WAR, NSS, NPG and AIR had a combined total of 8431 QSO's during the twelve hours and forty-five minutes devoted to the military-to-amateur crossband portion of the communication tests. Commemorative QSL cards have been mailed to all contacts that could be identified in the Spring 1965 issue of the "Callbook". Any amateur who has not received a QSL card confirming his contact should address a request for clarification to the Armed Forces Day Contest, Room 5B960, the Pentagon, Washington, D.C. 20315. This request must include the amateur's call sign, the station worked, time of contact and the frequency utilized by the military station.

CW RECEIVING CONTEST RESULTS

There were 632 perfect entries for the 25 WPM CW Broadcast Message originated by the Secretary of Defense.

CATS MEETING

The RTTY boys in the Chicago area have decided to QRT during the summer months; some are picking suckers off their tomato plants, some go golfing, while others go boating. There is a good deal of activity on 80 meters, but none on 40. Two meter AFSK is dead, but expect a lot of noise from this source this winter.

The CATS do not meet during the summer months, but their officers are busily engaged in preparing for the big shindig at McCormick place in Chicago on October 24. They recently installed new officers as follows: Mike Smith, K9HYF, President; Bert Prall, WA9-NKQ, Vice President and Treasurer; Bob Paculat, W9JBT, Secretary.

The Illiana Teleprinter Society, however, has been meeting regularly with good programs. They meet every second Wednesday and they serve the best coffee you ever tasted.

RTTY RECEIVING CONTEST RESULTS

There were 422 perfect entries for the 60 WPM RTTY Broadcast Message originated by the Secretary of Defense. The complete text of the 60 word per minute radioteletypewriter message is printed below:

"The wholehearted support of the American people is basic to a strong Department of Defense. Such support required knowledge and understanding of what the Department is doing and why it is doing it. Annual Armed Forces Day observances fill this requirement in the form of a report to the nation and the people of the world on the Armed Forces defense capabilities and readiness. These annual observances demonstrate the unity, interdependence and close working relationship existing in the Armed Forces, their reserve components and auxiliary organizations at all echelons.

Radio amateurs through their productive efforts in the fields of research and development, emergency communications, affiliation with Armed Forces training programs, and furtherance of international understanding, have made tangible contributions to the spirit of unity and preparedness which strengthen our resources for peace.

As Secretary of Defense I am pleased to acknowledge the accomplishments of radio amateurs working together throughout the free world, and to welcome your participation in these 16th Annual Armed Forces Day activities, signed Robert S. McNamara, Secretary of Defense."

OFFICIAL BULLETIN NR 16 FROM ARRL HEADQUARTERS NEWINGTON CONN., JULY 22, 1965 TO ALL RADIO AMATEURS

The Federal Communications Commission has granted an extension of time for filing comments in Docket 15928 until September 1. The time for reply comments also has been extended in the incentive licensing matter until October 1, 1965. Full details of the extension and the full text of the ARRL comments in the docket will appear in the September issue of QST.

AUTOMATIC CW IDENTIFICATION

ROBERT E. FORD
5422 Bermuda Avenue
Normandy 21, Missouri

Received your nice letter this morning and want to thank you very much for the compliment on the unit. Would be very pleased if you think the information on the keyer would be of interest to the readers, so you can publish whatever information you care to and perhaps a lot of the RTTY'ers will have a starting idea on building an automatic code ID machine. The RPM of the motor should be around 11-13 RPM in order to give approx. 22-25 WPM speed on the CW ID. Will give you a sketch of the wiring diagram that I have been using and the way I have mine hooked up here locally. Of course every installation is a little different, but whoever makes one will of course wire it for his own particular needs.

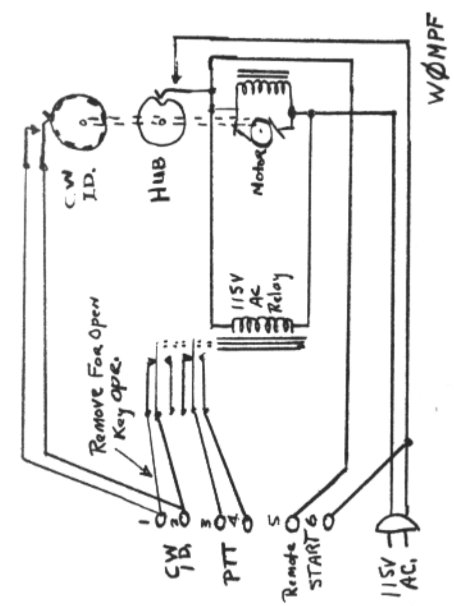
On the keyer I had acquired about 35 motors like the one in your machine and have made up about 20 so far, but inquired about motors from "Herbach and Rademan, Inc., 1204 Arch St., Philadelphia, Pa.," and they have about 350 motors available at $2.50. And there is a little motor available from "Fair Radio" that would be suitable also. On the aluminum disc, you can cut them out with a fly cutter in a drill press, and then file the call in the disc with a little file. It isn't near as much trouble filing the call in the wheel as you might imagine. I used a chassis nibbler to cut out the wheel in between the letters where you use a "E three dot space" on the unit you have, you have to hold the start switch down for a second in order to give the motor time to get the micro switch riding on the high side of the hub, I put in a little sensitive relay with a capacitor across the coil winding to give it a delay so that just a momentary touch would start the CW IDer. And on my own installation I put in a flip flop relay that is alternately on, and off, and it controls the PTT on the transmitter, so the action is, that when you press the button the CW ID comes on and the carrier stays on, the next time you press the button the CW ID comes on and when it cycles thru the carrier drops off. So this gets it down to a one button operation for CW ID and going to carrier on-off. I disabled the "break key" on the ASR here and am using it to control the on, off and CW ID.

Thank you for your interest in the CW IDer, and hope it will help the fellows with that problem.

I might add, that I made an adapter for the "Re-inker" that has been advertised for the 15-19 and I think it is well worth the time to put it on, I like this idea of having black type, as you see here, all the time and not have it fade out as the ribbon runs dry.

Very best 73, CU real soon, I hope.

de WØMPF



NOTICE — RENEWALS SHOULD BE MADE TO EXPIRE ON DECEMBER 1965 OR 1966 ONLY.

Subscription Rate $3.00 Per Year
Via Air Mail or Overseas $4.00 Per Year

RTTY is the Official Publication of the

RTTY Society of Southern California

W6EV

and is published for the benefit of all RTTY Amateur and Experimenters

For "RTTY" Information:
W6AEE, Editor W6CG, DX Editor

DX-RTTY

BUD SCHULTZ, W6CG
5226 N. Willmonte Avenue
Temple City, Calif. 91780

Hi DX'ers:

The mail bag is a bit light this month but here we go with the latest from the DX hounds who did manage to get something in the mail. It's always like this during mid-summer due to vacations, etc., so please bear with me. Ed, K3GIF, writes that the main piece of news he has come across concerns the PY2DXI-CP1BX operation from La Paz, Bolivia. CP1BX is Jose who lives there and John, PY2DXI, is visiting him and helping out on the RTTY chore. Their QTH is very high—about 4000 Meters—and they put a very fine, consistent signal into the States. A "CP" station is still a good trick on any mode of Ham radio so Jose and John should find plenty of takers whenever they show up on FSK. Several of the gang have reported that ON4BX, Arthur, is a new one from Belgium who has been putting a fine signal into the USA. ON4BX is using a Drake TR-4, a TH-4 antenna and a model 19. This is the first report of Belgium activity on RTTY for over a year and if any of you missed the previous ON4 stations this is your chance to get one on your country list. K3GIF also tells me that LU1AA is back in business after equipment repairs. Rene, DL3IR, is also back on with his fabulous signals after a month's layoff while he rearranged his shack and installed a photolab.

SM5KV, Olle, writes that OHØNI has a model 15 printer and will be on the air as soon as he completes a K6IBE converter he is assembling. He should create quite a "pile-up" when he shows for the first time on RTTY! Eric, VK3KF, tells me that he received word from Cas, ex-KR6AK, HL9KK, that he is now stationed in Japan and is involved with MARS at that location. At this time FSK is not allowed from Japan but if anyone can negotiate permission for this mode Cas is the one who can handle it. He is one of the real pioneers of the RTTY-DX movement and knows all the answers. Speaking of VK3KF—Eric is once again coming through every week-end with his "pipe-line" signals along with ZL1WB, Bruce, and between the two of them the "down under" group are well represented. VK2EG is also back in operation again after having receiver trouble. Alec, ZL3HJ, also wrote in this month to say that he is getting settled in a new home and as soon as he completes a W6ZH converter he will be back on the FSK Channels. For those of you who are fairly recent to the RTTY mode I should point out that ZL3HJ like ZL1WB and VK3KF is one of the real old timers who helped to pioneer the DX activity on RTTY.

Through the efforts of K3GIF I received the following info on a worthwhile DXpedition from G3LPC relayed by I1ORS. (If the above sentence isn't exactly clear please read it through a couple of times—I have trouble making myself coherent.) The Royal Signals Club will be sending a DXpedition to the Isle of Lundy from September 18 to the 25th. The call sign to be used will be GB3LPC. The object of the expedition will be to establish RTTY QSO's with as many stations as possible. Should the support of the RTTY group not be forthcoming then SSB and CW will be used. All bands from ten through eighty meters will be used with twenty being the main operational point. All reports should be sent together with QSL's to G3LPC, 3 Squadron — 14th Signals Regiment, Weald, Bampton, Oxon, England. It is unnecessary for me to point out that this will be a golden opportunity for the RTTY gang to get another rare one and at the same time keep the English lads so busy they won't have to resort to such old fashioned modes as CW or SSB to keep themselves busy. Keep your weather eye open for this one!

Another reminder is to plan on participating in the Fifth Annual World-Wide Sweepstakes next month. Band conditions should be the best we have had for this contest since it began and the committee is hoping for a monster turn-out. Even if you don't make one of the top scores you are a cinch to pick up some new countries and make some new friends. This is one of the biggest events of the RTTY year so even if you're not a contest man join in the fun for a few hours and get your feet wet. I can guarantee you will never hear more QRM anywhere than you will find around the RTTY channels on that week-end —and send your score into the committee no matter how small it is. This is one time that we love to be swamped with mail and your log may help some-one to confirm a contact that might otherwise not check out. If we're willing to wade through hundreds of logs and work up a summary you shouldn't throw your log in the wastebasket because it seems unimportant to you. Just drop it in an envelope and let us dispose of it. Thanks a million, Gang! See you next month, 73

Bud Schultz, W6CG

HORSE TRADES

FOR SALE 40 cases of 40 rolls each, 11/16" oiled tape. J. C. Biddy, 2312 N.W. 47th Street, Oklahoma City, Okla. 73112.

FOR SALE: One 05B FSK Exciter, with two 40 meter xtals, one 6997.5 kcs $50.00, one SF02 regenerator repeater, excellent cond., with spare relay and manual, $35.00. Also several past issues of RTTY some fair cond., some water stained. Vol. 1 April, May, July, November and December. Vol. 2 March, April, November and December. Vol. 3 January and April. Vol. 5 May. Vol. 7 July. One RTTY call book, 1956 issue. Need January and February 1963. Also need a good TU. W6LIP, 4570 San Blas Avenue, Woodland Hills, Calif. 91364. Phone 213 347-7462.

FOR SALE: TM-11-2223 for model 14 TR, $5.00 each, plus postage for 2 lbs. Also 15s, 14TRs, TDs, parts. Want Kleinschmidt equipment, tuning forks, gears and parts. Model 28 components, misc. parts. Send for list. W4NYF, 405 NW 30th Terrace, Ft. Lauderdale, Florida 33311. Phone LU-3-1340.

FOR SALE: Model 15, holding magnets, sync motor, waiver, comm symbols 60 wpm, with table, WE loop supply, $85.00 CV89A/URA-8A converter, works good $195.00; Model 15 base, new $10.00 model 14 typ-reperf unit, sync motor, 60 wpm gears, comm symbols, w/o cover or kybd. $40.00. Model 15 cover w/o glass $10.00. MXD3 headed TDs 60 wpm gears sync motor $47.00. Send for list of items. All items FOB, N.Y. Packing and shipping extra. J. Smisloff, 1969 Elmwood Avenue, Rochester, N.Y. 14620.

FOR SALE: New 6 head remote controlled TD complete with cable and push button control panel, $75.00. 75A-4 Receiver $375.00. Also misc transmitting and receiving equipment. Want 28ASR or equivalent. K2DCY 410 Riverside Drive, N.Y.C., N.Y. 10025.

FOR SALE: All in excellent condition, New model 14TD $85.00. Model 14 typing reperf with end of line indicator, $100. Model 15 with auto car. ret. line feed, and glare free glass and manuals $115.00. Model 26 with auto car. ret. and line feed, manuals $55.00. Cannot crate but will cooperate on delivery. W2OKO, 27 Somerset Place, Murray Hill, New Jersey. Phone 201-464-5244.

FOR SALE: Kleinschmidt TT4A/TG, needs stop arm and cover, otherwise complete. Also another TT4A/TG for parts w/spare motor, gears, keys, new platten, etc. Both for $50.00 pick up only, or you pay shipping and crating costs. W3GBA, 377 South Empire Street, Wilkes-Barre, Penna.

FOR SALE: Almost new table model 28, $350.00; several excellent model 15s. RTTY converters with built in scope. K6PZT, 9337 Gotham Street, Downey, California. Phone TO 9-3292.

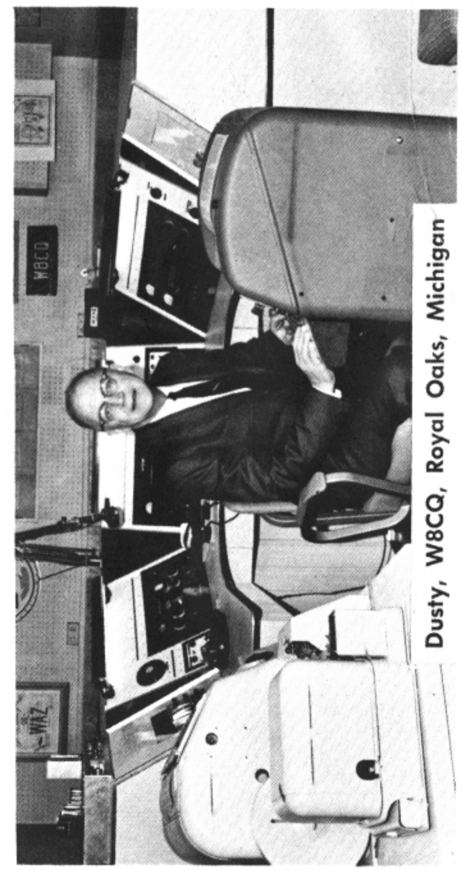
FOR SALE: 1) model 19 system, very clean with latest type power supply: $140.00 1) model 14 send & receive exceptionally clean $75.00 1) RBC receiver – perfect cond. 1) FRF dual diversity conv. Note: RBC has IF cathode follower output for FRF, FRF is similar to CV31a. Both for $165.00. Ron Burns, 877-8721, 984-1616, 12732 Hortense St., Studio City, Calif.

FOR SALE: RTTY Channel Filters, octal mounted, 2125/2975 cps, $5.95 pair. 88 mhy toroids, 5 for $2.50. WA6JGI, 3232 Selby Avenue, Los Angeles, California 90034.

WANTED: Manual and parts information for FRXD-3 TD. WA0JXN, 2310 South Ridgewood Drive, Wichita, Kansas 67218.

FOR SALE: Model 28 KSR Table top, type $300, Model 28ASR, including LESU, printer, perf, TD, $950.00. Also model 15s, 14s. Send for list. W6VPC, 1067 Mandana Blvd., Oakland, California 94610. Phone HI 4-5410.

FOR SALE: New Transistorized terminal equipment including key on MARK and/or SPACE converters. (TUs). Filters, preamplifiers, SSB generators, monitor 'scope. Write for FREE catalog. TUCK ELECTRONICS, 2331 Chestnut Street, Camp Hill, Pa. 17011.



Dusty, W8CQ, Royal Oaks, Michigan