STAT

Jule

Jack 1

THIRD PROGRESS REPORT

DEVELOPMENT OF AS-3 PORTABLE RADIO STATION

January 1, 1957

This report covers the progress in the development of the AS-3 Radio Station for the period of November and December. The work has been directed towards completion of the bread-board phase of the transmitter and preliminary bread-board of the other component units.

The schedule as outlined in the First Progress Report has been revised in accordance with the contract so that paragraph g should read: "Delivery of nine preproduction units and final report due March 1, 1958." Delete paragraphs f and h.

Transmitter AT-3

The bread-board stage was completed to a point where the initial steps of packaging were begun. As proposed in the second report, the tuning of the entire frequency range (3-30 mc) in one band has now been achieved using for the tests a commercial condenser and a specially constructed rotary coil. The use of a powdered iron core and variable-pitch winding in this coil provided the required inductance range of 10:1 with a very compact structure.

A special miniature condenser is now being designed using a number of available standard parts to achieve the required 10:1 capacity range in a minimum volume. The coil and condenser will be gang tuned at approximately one to one ratio between coil and condenser worm.

The oscillator tube is the 6417 which provides ample output throughout the frequency range. This is accomplished using 250 volts on the plate and 140 volts on the screen which will hold the crystal current below 30 ma. The crystal oscillator is a modified Pierce circuit employing grid, cathode and screen, and the output is taken at the crystal frequency or multiples of the crystal frequency in the gang tuned circuit connected to the plate.

Grid keying of the final amplifier has been tested. Experimentally, a punched tape keyer was used to facilitate study of the keying waveform for keying rates up to 200 cps.

For purposes of studying modulation methods a 150 cps square wave oscillator was constructed and applied to the grid or to the screen. Both methods were adequate; however, further investigation may prove that the oscillator could be modulated.

An extension of this idea, which would still further conserve power and perhaps reduce the number of components required, would be to perform both modulating and keying at the oscillator. This might allow the use of transistor keying circuitry, which could not be used in the amplifier due to the higher voltages. Circuits are under construction to investigate the possibilities of this approach.

Keyer AK-3

Two methods of driving the tape cartridge are being compared experimentally. In one the keyer unit will contain a 12^V motor operating through a slip clutch to drive the cartridge. A motor is available and is being incorporated in the bread-board model of this system. A voltage regulator will have to be incorporated so the motor will have a fairly constant 10^V applied to it, thus making the speed nearly independent of battery supply voltage.

Along with the above development, a spring type of drive will also be bread-boarded so that an evaluation of the two methods can be made. This unit will use the negator type motor, hand wound by the operator prior to message sending. The advantages of the spring type are (1) quiet operation and (2) independence from batteries.

The manufacturers of magnetic tape are performing evaluation tests on their tape to determine the characteristics of square wave pulses at a repetition rate of 150 cps. Their degree of magnetization is adjusted to that which we expect to obtain from the permanent magnets located in the coder. This magnetization is approximately 1000 gauss which should substantially saturate the tape. Their results will indicate the effect of print-through, if any, cross-talk between pulses, and noise effect and residual noise level using a permanent magnet type erase. This last effect will determine a lower cutoff point for the keyer pick-up amplifier so that it can not be triggered by random noise on the tape.

The manufacturers will also investigate the completeness of erase which will be necessary since no previous coding should be left on the tape.

Coder AC-3

The mechanism for the coder operation has been partially completed in a bread-board stage. The complete mechanism has been sketched and drawings are being made for fabrication of this system.

A spring clutch has been incorporated so that both directions of travel of the push buttons may be utilized. The magnets are brought against the tape near the completion of the down stroke, and then released. The advance of the tape is performed during the return motion of the button. Tests conducted on the first model have indicated the feasibility of this type of motion.

A direct gear drive to the cartridge will be necessary so that positive advance of the tape can be obtained.

Battery Charger ABC-3

The battery charger can be made to charge in two ways. The battery can be charged in two hours or less by maintaining a voltage of 15.5^{V} across the battery. This method, however, requires careful supervision during charge, for an overcharge or a too rapid rate of charge will cause the cells to gas and loose electrolyte.

The second method would be a modified constant potential so that as the cell approached full charge the charging current would drop off to a value which would not cause gassing or loss of electrolyte. This end potential, which is the open-circuit voltage of the charger, should be adjusted to a value between 14.0 and 14.5 volts as recommended by the battery manufacturers.

This latter method of charging does not give the 2 amperes charging rate as called for in the specification; however, it does afford protection against damage to the batteries in the event the charger can not be turned off at a specified time interval. This method of charging is sufficient to bring the batteries back nearly to full charge overnight. Preliminary tests with such a charger indicate a charging rate of .250 amp. for discharged batteries and this current holds constant until very nearly the end of charge.

It is believed that the charging method chosen for the final equipment should be decided on by your group since it will involve equipment operation methods.

Further tests will be conducted relative to the two types of charging methods, and combinations thereof. A regulated charger using Zener diodes for reference voltage and transistor output control has been constructed.

Battery ABA-3

Two sample 12-volt batteries of Ni-Cad cells have arrived and are undergoing tests. These tests are being conducted on the ACT8X (3 ampere hour) and ANC8Y (2 ampere hour) cells respectively.

Preliminary tests based on present system power requirements of approximately 75 watts on Transmit and 20 watts on Receive indicate at least three continuous cycles using the ACT8X and approximately one cycle of operation using the ANC8Y battery. Continuous discharge tests at 8 watts (single cells) show the ACT8X good for 30 minutes and the ANC8Y for approximately 12 minutes of transmitter operation. It would appear that for the small added volume and weight differential between the ACT8X and ANC8Y, it would be worth using the ACT8X cell, thus achieving greater capacity and dependability.

Plans for the Next Reporting Period

All effort will be placed on completion of the first engineering models of the transmitter, keyer, coder and cartridge. Similarly, sufficient components should be available so models of the AC supply, DC supply and battery charger can be completed.

Prepared By:

Approved By:

STAT