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SECOND PROGRESS REPORT

Task J

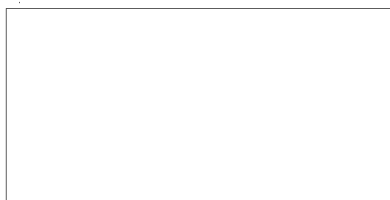
DEVELOPMENT OF AS-3 PORTABLE RADIO STATION

November 1, 1956

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This report covers the progress in the development of the AS-3 Radio Station for the month of October 1956. The work has been directed towards establishing a basic design plan for the component units of the AS-3 equipment. The basic philosophies were reviewed at [redacted] on October 29, 1956 in a meeting attended by the following:

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Maximum sizes for the components have been arrived at. However, where possible reductions in size will be made. It appears that the maximum volume of 468 cubic inches as the ultimate package can easily be attained.

The proposed component sizes are:

1. Transmitter AT-3 2 1/4 x 4 1/2 x 9
2. Keyer AK-3 2 1/4 x 6 1/2 x 4
3. Coder AC-3 2 1/4 x 6 1/2 x 4
4. Battery ABA-3 2 1/4 x 4 1/8 x 8
5. Charger ABC-3 2 1/4 x 2 1/2 x 8
6. AC Power Supply AP,AC-3 2 1/4 x 4 x 6 1/2
7. DC Power Supply AP/BA-3 2 1/4 x 4 x 4
8. Cartridge 2 1/4 x 1 7/8 x 3 1/2

These can be fitted into the allotted space for the entire equipment in a method shown in Figures 2-1, 2-2, and 2-3.

Transmitter AT-3:

It appears that there are several solutions to tuning the frequency range required. The most attractive ones are: (1) divide into three bands approximately as follows: 3-6.5 mc, 6.5-14 mc, and 14-30 mc and (2) tune the frequency range in one band. An attempt is being made to achieve the latter, but this may prove less economical in volume, and less reliable than the former.

SECRET

SECRET

Second Progress Rept., AS-3 - 11/1/56

- 2 -

The frequency region for change-over from fundamental to harmonic utilization of the crystals may not correspond directly with tuning bands. That is, fundamental crystal frequencies might be used in the 3-10 mc region, for example, and the third harmonic of crystals in the 3.333 to 10 mc region for the range of 10-30 mc. Rather serious consideration is being given, however, to utilizing fundamental frequencies to 15 mc. and second harmonic operation for frequencies between 15 and 30 mc. This would aid materially in keeping down unwanted radiation, since the spurious frequencies would be further removed from the frequencies at which the selective circuits are resonated.

A modified Pierce circuit will be employed in the oscillator since it: (1) will oscillate over a wide frequency range, (2) can be designed to have low crystal current, and (3) will provide sufficient harmonic output for driving the amplifier tube in the harmonic drive region.

Several tube types have been investigated for the oscillator circuit. These include the 5899, 5686, 12AT7, 5749, 6136, and 5763. The most likely choice seems to be the 6417 which is the 12 volt version of the 5763. This tube operates well as a grid-screen Pierce oscillator and permits ample output when its plate circuit is used as a multiplier.

It appears that special "tank" circuit components will need to be designed for the oscillator plate circuit to conveniently cover the frequency range of 3-30 mc. These include special miniaturized gang condensers and possibly special ferrite-cored coils.

Several tubes have been considered for the final amplifier circuit. The most likely choice is the 6883 which is the 12 volt version of the popular 6146. Again it appears that a special "tank" circuit element will be required. *[Amperex 6360] twin triode]*

A pi network may be used to tune the required antenna impedances of the specification. However, it must be remembered that it will not tune well antennas of a lower impedance than the specification though these could be encountered in actual operation. Further meetings with the technical staff will be required to resolve this problem.

Battery ABA-3:

Sample nickel cadmium batteries have been received. Evaluation tests will be conducted in accordance with the required duty cycle of the AS-3 equipment.

The two types under investigation have a capacity of 2 and 3 ampere hours respectively. Both types can be packaged in the proposed size of 2 1/4 x 4 1/8 x 8 inches. The ultimate weight will be between 4 and 5 lbs. depending upon which type of cell is chosen.

The use of the larger cell will give ample safety for the equipment; however, final decision should await the evaluation test results.

SECRET

SECRETSecond Progress Rept., AS-3 - 11/1/56

- 3 -

If the battery is sealed, it can be recharged at a potential of 14.5 (open circuit) in 12 hours and left in this condition for an extended period without gasing or consumption of electrolyte.

Battery Charger ABC-3:

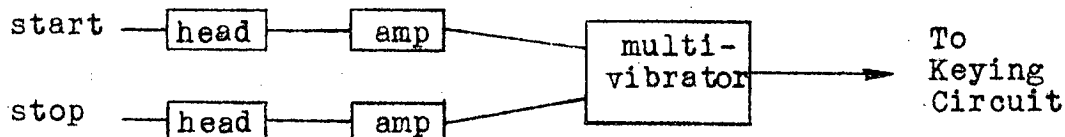
Studies of the nickel cadmium batteries indicate that they can be used in a completely sealed condition provided the charging current is kept below a specified level and provided that they are not charged above 14.5 volts. For the battery size chosen in the first trial, this current may be less than the specified value of current. Tests are being made to determine the maximum charging current. The alternate solution to the problem would be to provide a means of venting the cells during charging.

The design of the battery charger will await the conclusion of these tests.

Keyer AK-3:

The keyer will contain the amplification system for keying the transmitter in accordance with the pulse impressions on the recording tape. Since we will have a start and stop pulse on the tape, a dual pick-up head will be used. This will have an advantage over a single head in that the loss of either a start - stop pulse (insufficient rate of change of flux) with a single head could reverse the remainder of the message. However, with the dual head, only one character would be lost under the same circumstances.

The gap opening selected is .001 inches which should provide sufficient output to require only one stage of amplification ahead of the one-shot multivibrator. Commercial pick up heads are under consideration. Their impedance levels are sufficiently low so as to work directly into a transistor amplifier. The one-shot multivibrator will be conventional and its output will operate the transistor keyer in the grid of the 6883 amplifier.



The proposed size of the keyer is 2 1/4 x 6 1/2 x 4. This will allow the cartridge to be inserted directly.

Coder AC-3:

The coder will include the function of erasing in addition to printing the message on the tape. The erasing mechanism will consist of a permanent magnet mounted so as to erase a prior message before imprinting a new message. Thus, a saturated tape will be moved across the printing head. With the tape in this condition outside noise will be substantially reduced. Since the head operates on the

SECRET

SECRETSecond Progress Rept., AS-3 - 11/1/56

- 4 -

principle of change in flux the condition of the tape prior to being pulsed should not be critical.

The printing heads will be made from a block of Alnico V and shaped pieces of soft iron. These will be cast in a resin and mounted in a frame. The proposed size of the coder is 2 1/4 x 4 x 6 1/2 inches.

Cartridge:

The cartridge will be the carrying mechanism for the magnetic tape. We propose the use of 1/4 by .002 mylar tape since it is easily obtained and has excellent tear resistance.

The first unit will be built using approximately 12 feet of recording tape. The band spacing chosen is .020 inches which should give good isolation between pulses. The linear speed of the tape at present is to be 7 1/2 inches per second. This speed, at baud spacing of .020 inches, will give an output of 300 words per minute.

The first choice in spool diameters is 2 inches rotating at a speed of nearly 1 rev. per second. The resulting torque required by a drive motor is between 2 and 4 in. oz. To do this in the smallest space a negator-type spring motor is being investigated. This motor can be mounted integral with one spool and provide sufficient torque to operate the system. It is planned to have both spools on a common shaft and use a coil spring or spyrator to take up the differential spool revolutions and provide a constant tension of approximately 8 oz. on the tape.

Provision will be made so that the operator may rewind the cartridge spool while it is plugged into the keyer. Thus, if required the message may be retransmitted if necessary without its removal. In addition an indicating device shall be visible so the operating condition can be seen at a glance.

We would like to suggest that the cartridge be given nomenclature since it is a separate part of the equipment.

SECRET

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Second Progress Rept., AS-3 - 11/1/56

- 5 -

Plans for the Next Reporting Period:

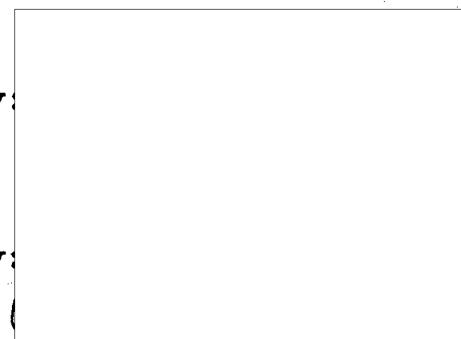
All effort will be placed on the completion of the bread board phase of the transmitter and the construction of first models of the cartridge and coder units.

Regarding the separate slow-speed play back keyer unit, it would be desirable to have a written request by the technical staff so that a formal addition can be made to the original contract which will cover the design and manufacture of prototype units. We feel that this unit should also have a unit designation if it is to be added to the equipment.

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Prepared By:

Approved By:



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PACKAGE PLAN

AS-3

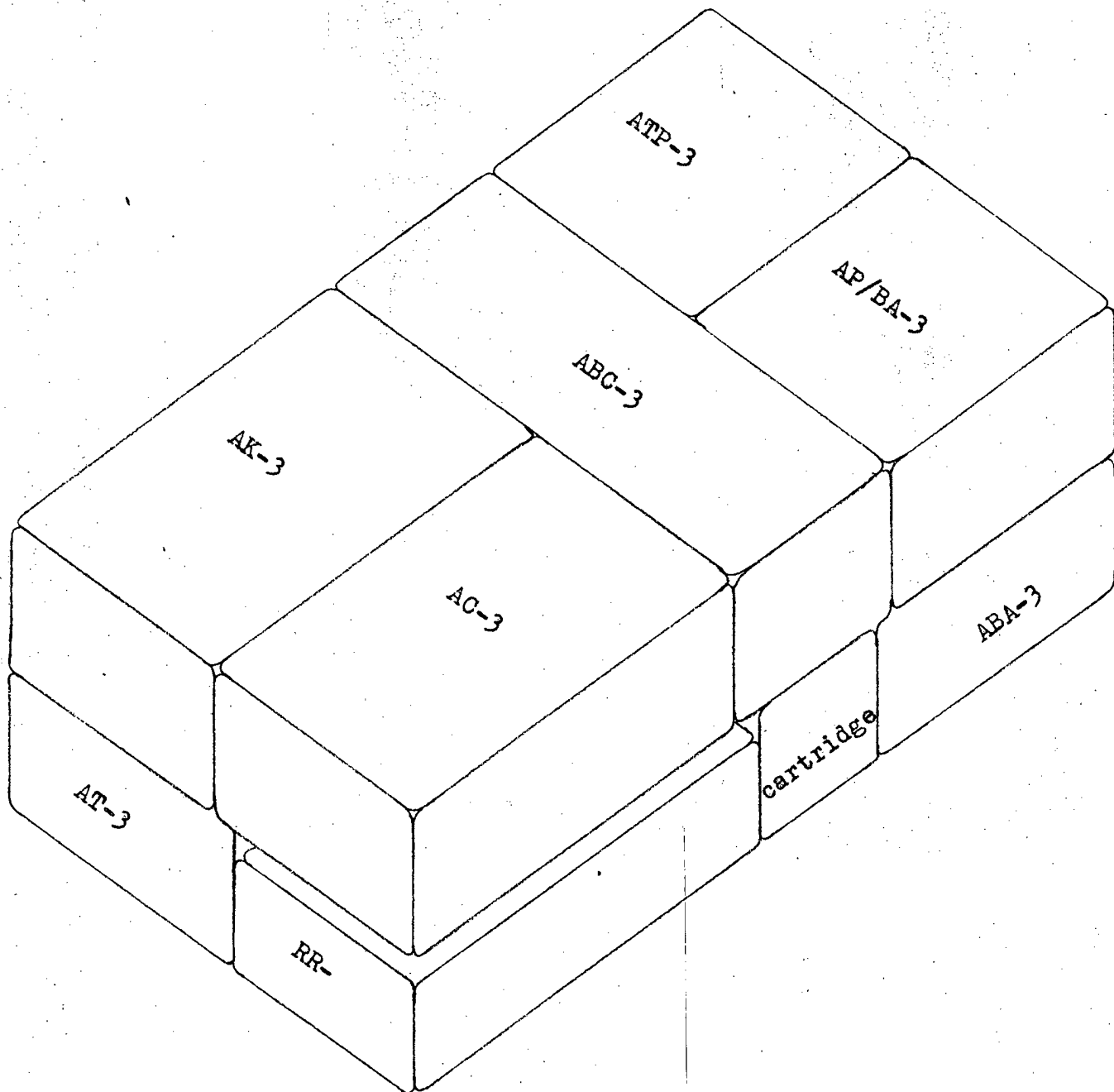


FIG. 2-1

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2nd Progress Rept., AS-3

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PACKAGE PLAN

AS-3

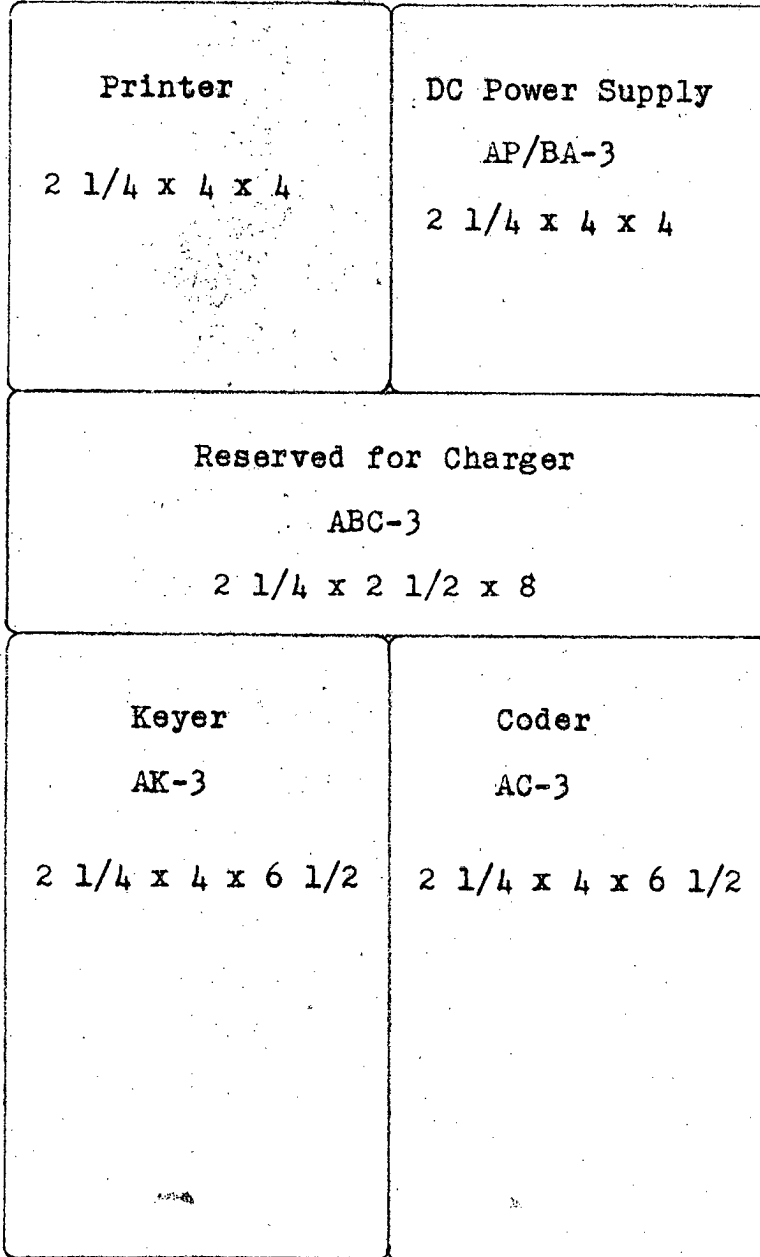


FIG. 2-2

ISSUE	DATE	APP.	ISSUE	DATE	APP.	
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PACKAGE PLAN

AS-3

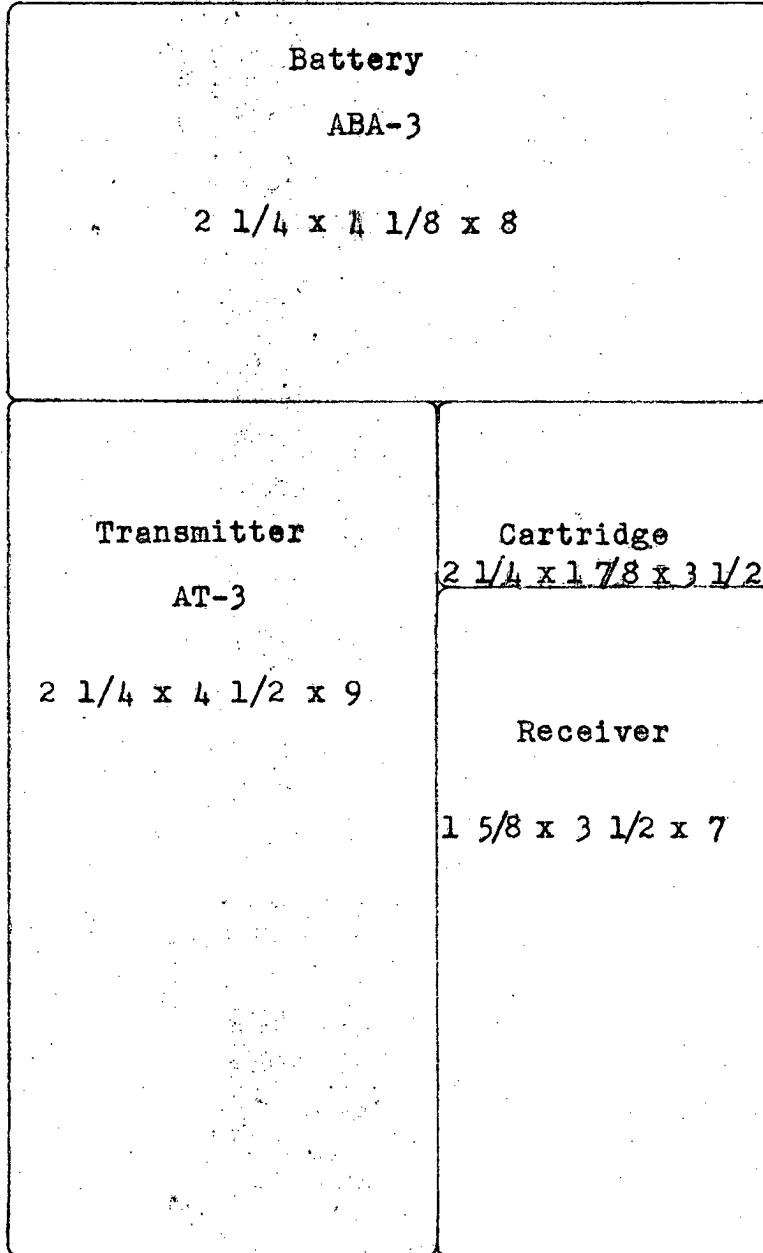


FIG. 2-3

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