

Intercommunication Amplification Wireless Set No. 19 to Clansman

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The typical wireless set in use in armoured vehicles before the introduction of the Larkspur range of wireless was the WS19. The WS19 contains two sets, an 'A' set and a 'B' set. It also contains an audio frequency amplifier that provides amplification for a vehicle harness intercom.

The WS19 intercom amplifier follows the standard design used in British army wireless that provide this facility, a two stage audio frequency amplifier using Class A amplification. The WS19 Canadian Mk. III, for example, uses a 6K7G radio frequency pentode with variable mu (Common Valve 1941) for the first stage and a 6V6G beam power amplifier (Common Valve 509) for the output stage.

The Larkspur C12, which is based on the pre-Larkspur WS62 and was used as a C13 substitute to replace the WS19, uses a 9D6 pentode (Common Valve 131) for the first stage and a 6AM5 pentode (Common Valve 136) for the output stage.

Larkspur wireless C11, C13, C42 and C45 all use 6AK5 pentodes (Common Valve 4010) for both amplification stages and this would appear to show a desire to standardise the intercom amplification valves across the Larkspur range.

The use of valves for amplification demands high tension power to be supplied to the valve anodes, +265v in the case of the WS19 and +175v for the Larkspur standard 6AK5 (Common Valve 4010). As these voltages are already being supplied to the wireless via their own dedicated power supply units this would explain why intercom amplifiers were built in to wireless sets.

The Amplifier A.F. 2-watt sealed No.1 which uses two 6AM5 pentodes (Common Valve 136) shows the size and weight of a harness box that uses an internal vibratory power supply to supply the high tension power for its two valves. It is slightly lighter than an I box (see following paragraph), though of a larger volume.

When the Larkspur series of wireless were introduced into service, another method of intercommunication amplification (using semiconductors) was used for the '200mW 'I' (provisional)', later renamed 'amplifier intercom (I-box)'. The I-box uses three pnp transistors, a 2N280 / OC71 (Common Valve 7005), a 2N281 / OC72 (Common Valve 7006) and an OC16 (Common Valve 7010). These transistors have a maximum voltages of 30 to 32 volts, much lower than the voltages required to supply valve anodes and just above the standard +24v for most army vehicles in the 1950's (NATO would later raise the standard voltage to +28v). This use of transistors removes the need for a supply unit to convert the vehicles standard +24v supply to a high tension supply which reduces the danger of electric shock.

The use of transistors to provide intercommunication amplification using voltages at or below the standard voltage available from the vehicle allowed the next development embodied in Larkspur II to occur. The amplification is still external, but now it takes place within the personal units of the crew members when Larkspur II commander's personal units and crewman's personal units are available for use with the 'A' harness JD9 (modification 2 and above) and the 'B' harness RSB2. A Larkspur II harness can still use Larkspur standard insert microphones and headphones exclusively if either a C11, C12, C13, C42 or C45 is used as the 'A' set or an I box is attached to the 'A' set plug on the JD9 / RSB2. The voltage required to power the amplifiers in Larkspur II personal units is +6.8v which is supplied via the pressel line. With the development of intercommunication amplifiers that were small enough to fit inside crew worn personal units it was only one more step to the system used in the Clansman harness.

No Clansman radio is capable of providing intercommunication amplification. If a Clansman radio needs to be used with a Larkspur harness or a Larkspur II harness using only standard insert microphones and headphones, then an Interconnecting Box Radio Adaptor needs to be used for VRC radios and a combination of an IBRA and an I box if a PRC radio is used. The reason Clansman radios do not provide intercommunication amplification is that the harness boxes of the Clansman system incorporate amplifiers if they allow the connection of vehicle headsets and thus no external source of amplification is needed. The only deviation from this is the Commander's Personal Unit/Commander's Box Fixed combination and the Remote Personal Unit. The CPU and the RPU both contain transistorised amplifiers and both use the same casting which is very similar in size and shape to the Larkspur II personal unit casting.

The following table shows the immediate reduction in size and weight when a transistorised amplifier is used (removing the need for a supply unit), and the further reduction in size and weight between the introduction of the I box and the introduction of the Larkspur II personal unit.

	weight lbs	width in	height in	depth in
WS19 Supply Unit No.2	30.5	6	8.25	12.25
C11 Supply Unit TR	39	8	8.5	14.25
C12 Supply Unit V	22	6.25	8.5	12
C13 Supply Unit V No.16	35	8	8.5	14.25
C42 Supply Unit V No.12	40	8	8.5	14.25
C42 Supply Unit T No.1	38	8	8.5	14.25
C42 No.1 Radio	40	14	8.5	14.5
Amplifier A.F. 2 watt No.1	5	9	9	3.25
I box	5.25	6	4.5	3.5
Larkspur II Personal Unit	1.125	2.5	3.875	1.25
Amplifier AF Loudspeaker	5	8.8	6.3	4.1
Crew Box 2 set	2.625	6.5	4.9	3.5
CPU or RPU	1.156	3	3.5	1.625
Pressel box	0.523	1.625	3	1.25
RT-353	49	9.5	8.5	14.25

The supply unit No.2 for the WS19 uses a vibrator to supply high tension for low current drain and a dynamotor for high current drain. The supply unit for the C11 uses a rotary transformer to provide a high tension supply. The supply unit for the C12 uses a vibrator to supply high tension as do supply units No. 12, No.16 and the Amplifier A.F. 2 watt No.1. In late 1961 the Supply Unit, Vibratory, No.12 was supplemented by the Supply Unit, Transistorised, No.1 which has the same dimensions but is 2 lb lighter.

It is interesting to note that whilst the Supply Unit, Transistorised, No.1 draws less current than the Supply Unit, Vibratory, No.12, Mk.2 at all settings (up to 1.5 amps less), it can only achieve parity with the Supply Unit, Vibratory, No.12, Mk.1 at the highest output setting and otherwise uses up to 0.4 amps more current.

The fact that transistors are used in the I box, Larkspur II personal unit and Clansman commander's personal unit not only reduces their size and increases their robustness, it also removes the need for ventilation openings to remove the heat that valves create inside equipment when they are in use.

It may be useful when discussing robustness to note the following values for a 5654 pentode (Common Valve 4010) taken from various manufacturer's data sheets:

Shock resistance 450G

Vibration resistance 2.5G for 32hrs @ 25c/s

Heater cycling life 2000 cycles

It would seem that when transistors were first used in army equipment the main reason was their robustness. Certainly no great reduction in size or weight

was achieved in the early items brought into service. The Supply Unit, Transistorised, No.1 is the same size as the Supply Unit, Vibratory, No.12 and only 5% lighter. The I box is actually 5% heavier than the Amplifier A.F. 2 watt No.1 (which has a very similar function), though it is only 1/3 of the size. The maturity of vibrator power supplies when compared to transistorised equipment of the mid 1950's and early 1960's probably goes some way to explain the similarities in size and weight. By 1970, when both Larkspur II and Clansman systems would have been at the design stage, transistor technology had developed to the stage that amplifiers were light enough to be worn on the person and radios no longer required separate power supply units.

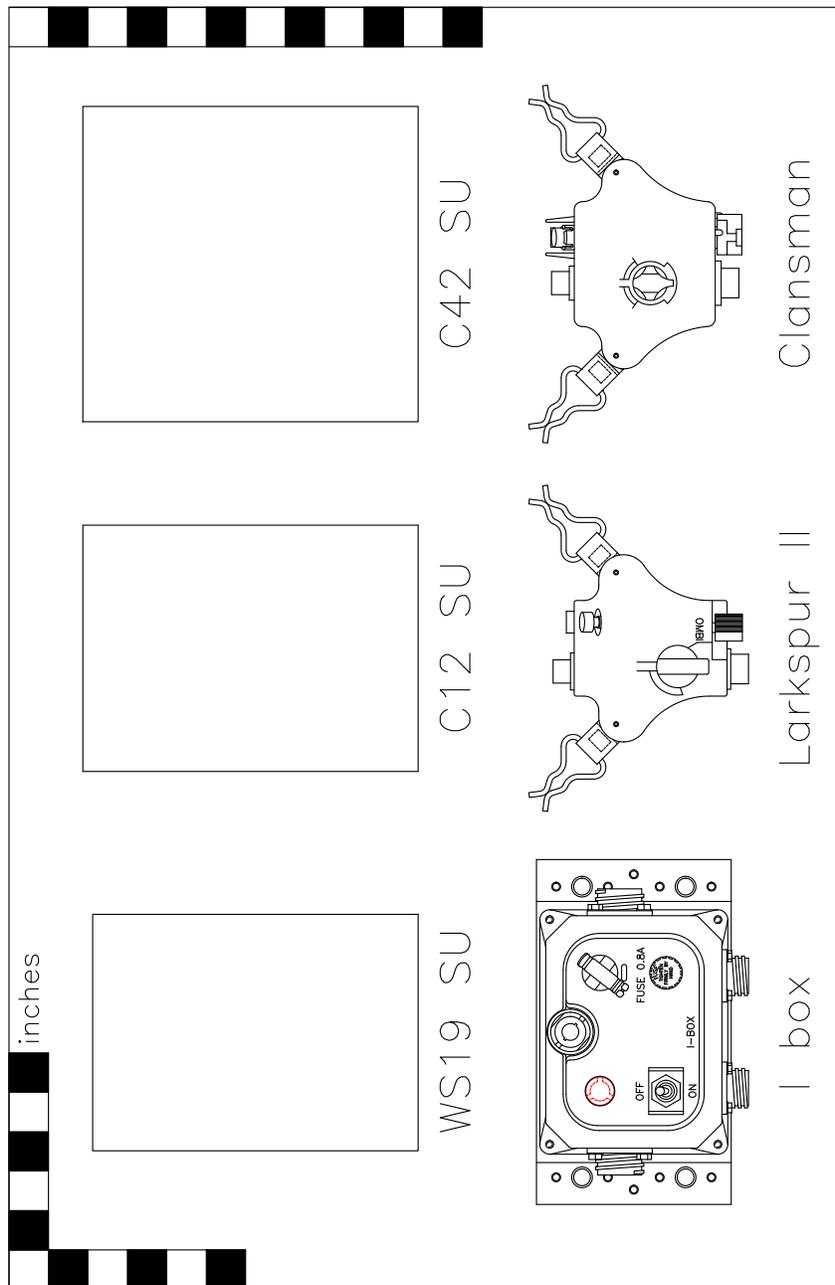


Fig. 1 frontal areas of some of the units under discussion.

It should be remembered that the supply units are at least 12" deep as represented by the scale on the right hand side of the drawing.