Aug. 14, 1956 R. C. LOCKWOOD ET AL 2,759,051

SUB-MINIATURE ELECTRON TUBE UNIT

Filed July 14, 1954 3 Sheets-Sheet 1

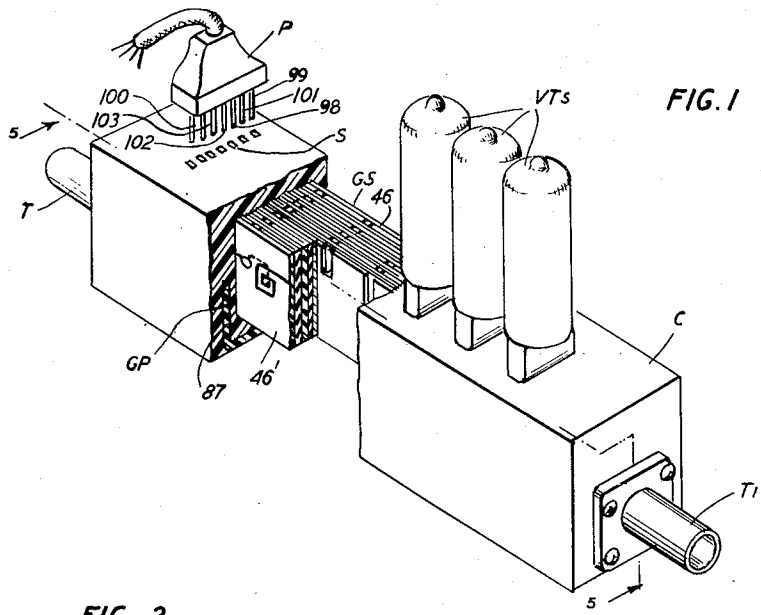


FIG. 1

FIG. 2

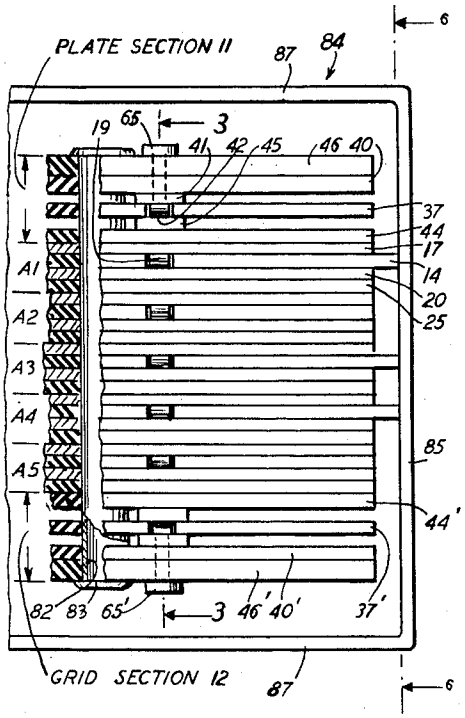
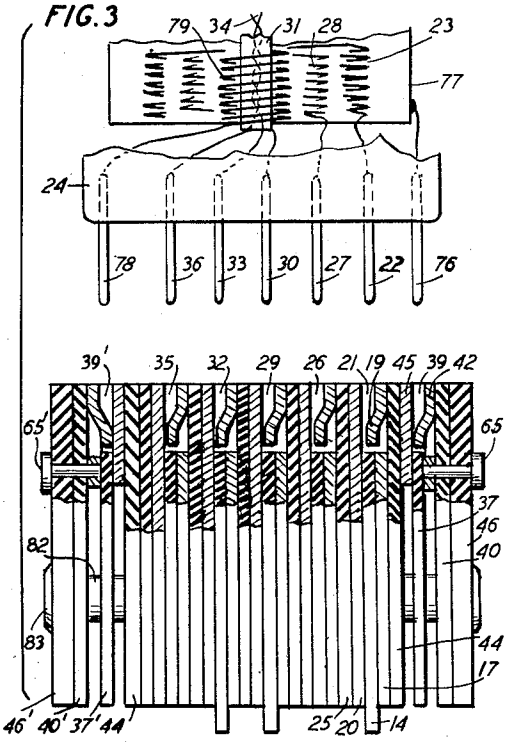


FIG. 3



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SUB-MINIATURE ELECTRON TUBE UNIT

Filed July 14, 1954 3 Sheets-Sheet 2

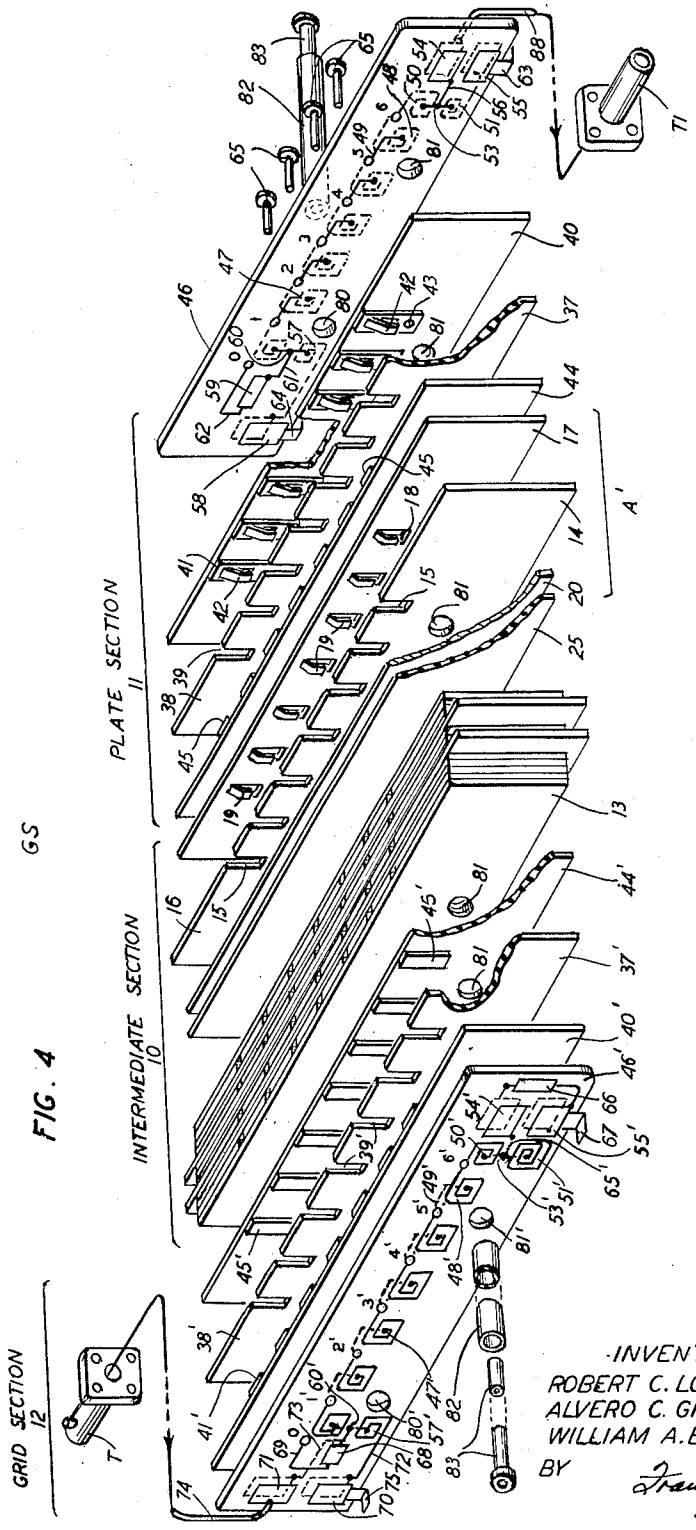


FIG. 4

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SUB-MINIATURE ELECTRON TUBE UNIT

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FIG. 5

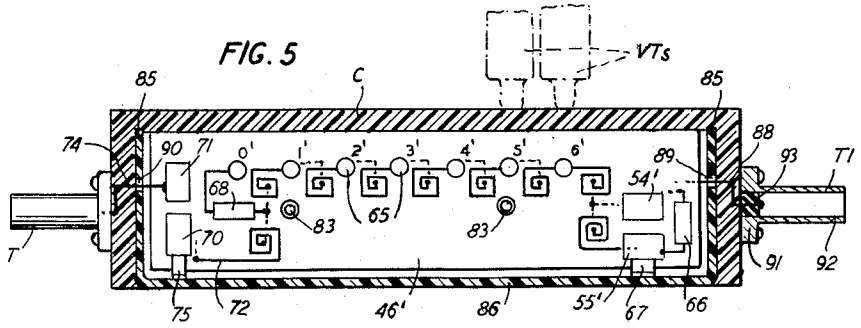


FIG. 7

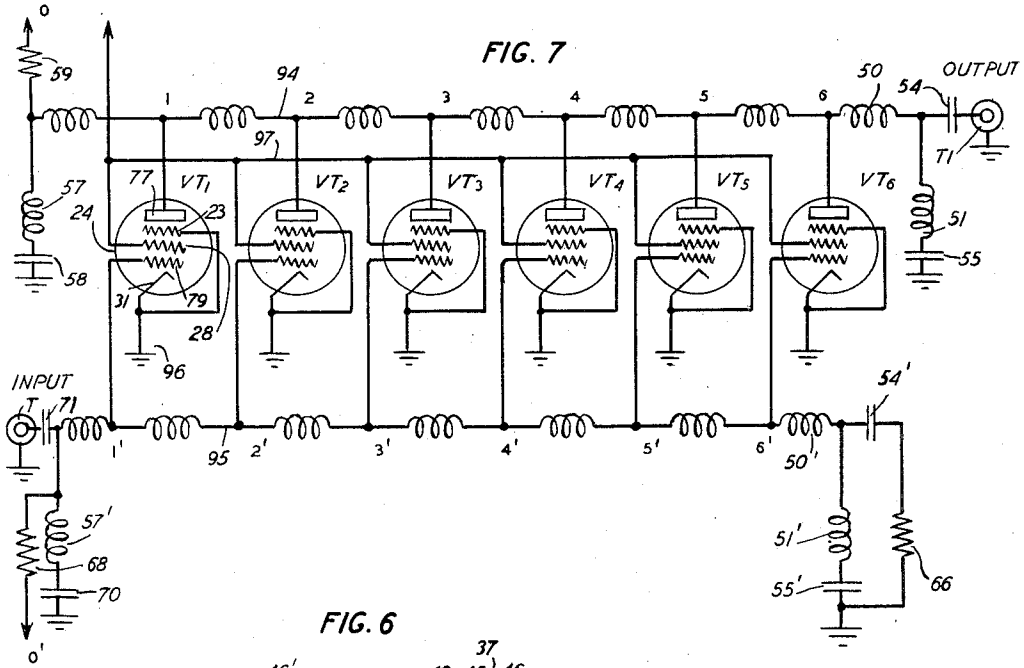


FIG. 6

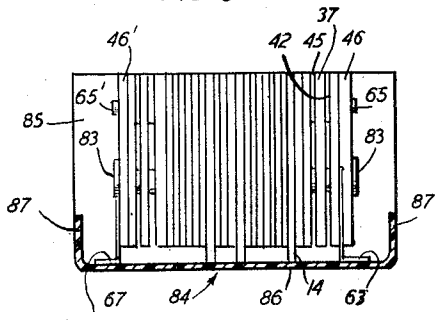
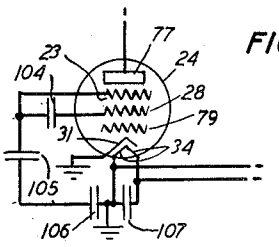


FIG. 8



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SUB-MINIATURE ELECTRON TUBE UNIT

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Application July 14, 1954, Serial No. 443,282

12 Claims. (Cl. 179—171)

This invention relates to the construction of a sub-miniature electron tube assembly or unit and more particularly to the encapsulation of a plurality of circuit components for a multiple electron tube array in a compact unitary arrangement.

The necessity for sub-miniaturization of equipment is primarily the conservation of space in large equipment installations, such as computers and other allied systems requiring numerous units of similar or related construction. The same type of unit also has desirable merits in other unrelated systems where such units may replace more cumbersome assemblies. The trend in sub-miniature construction in the past has resulted in reducing the size of components and rearranging these components in improved and compact chassis structures. Another tendency has been to substitute printed or bonded circuitry on insulating panels to eliminate to some extent the necessity for numerous soldered connections to the various components.

With all these modern advances in electronic technology the same basic tube socket arrangement has been retained which detracted from the ideal realization of sub-miniaturization which could be possible to attain.

These and many other electronic disadvantages are completely overcome by the concepts of this invention. Furthermore, numerous mechanical and manufacturing difficulties are eliminated by the novel embodiments of this invention which enhance the utility, cost and maintenance of the unit and facilitate the fabrication of the unit on a quantity production basis.

It is, accordingly, the primary object of this invention to facilitate the attainment of a compact, unitary sub-miniature structure, to accommodate a plurality of electron tube circuit stages adaptable for broad band-width coverage in the ultra high frequency range.

Another object of the invention is to fabricate the unit at low cost commensurate with the multi-stage electronic circuitry involved in the assembly.

A further object of the invention is to substantially eliminate soldering operations in the coupling of the various components involved in the complete unitary structure.

Another object is to provide a design with built-in by-pass capacitance features to establish all the grounded tube elements at radio frequency ground potential.

A further object of the invention is to protect all the components in the assembly from mechanical and environmental effects so that a high order of resistance to failure may be attained.

Another object of the invention is to provide an assemblage in which similar elements of the multi-stage combination are connected together through a low resistance unipotential surface with respect to the potential source of supply.

These and many other objects are attained, in accordance with the concepts of this invention, by a sub-miniature structure in which a gang socket assembly of novel

construction forms the crux of the unit. This socket or multi-stage array utilizes a straightforward stack or sequence of elements mounted in edgewise relation, to permit the insertion of the multiple tubes in aligned series of pin receptacles provided in the top edge of the socket array. The stack or sandwich of elements provides an assembly in which similar electrodes of all the tubes are connected in parallel at the same unipotential point with respect to the power supply source, and all the grounded electrodes are established at radio frequency ground with a minimum of high frequency loss.

A feature of this construction is that all the components of the stack or laminated array may be easily fabricated by machine methods on a mass-production basis and also assembled by automatic machine technique, thus permitting automation of the assembly lines.

A further feature of the invention relates to the encapsulation of the assembly in a high dielectric casting resin to completely seal the elements against the effects of humidity, fungus, mechanical damage or other environmental hazards. In this construction, the socket stack array is mounted in a clamping frame, which constitutes the electrical ground of the unit, and with suitable coaxial jacks at opposite ends, is encased in a cast resin material, to completely seal the components in a compact, sub-miniature unit, adaptable for use in distributed amplifiers, intermediate frequency amplifiers, or other types of amplifiers and related electronic equipment.

These main features and many other attendant advantages of this invention will be readily understood from the following detailed description when considered in connection with the accompanying drawings.

Fig. 1 is a perspective view, partly broken away, showing the general assembly of the unit of this invention, and illustrating the compact sub-miniature unitary array provided by this construction;

Fig. 2 is an enlarged plan view across one section of the unit showing the laminated stack of elements of the gang socket to accommodate the pins of a multi-element sub-miniature tube, such as a pentode of a type having the grid and anode pins at the ends of the series of pins;

Figs. 3 is an enlarged view in elevation of the socket stack, taken on the line 3—3 of Fig. 2, and showing a typical diagrammatic view of a pentode tube adaptable to be inserted in the socket;

Fig. 4 is an enlarged exploded isometric view showing the relationship of the many laminations involved in the assembly of the socket stack or sandwich construction of the main component of the unit assembly of this invention;

Fig. 5 illustrates in cross-section the components of the unit, taken on the line 5—5 of Fig. 1 and showing the relationship of the terminal jacks to the input and output ends of the unit;

Fig. 6 is a cross-section view, in elevation, of the socket stack taken on the line 6—6 of Fig. 2;

Fig. 7 is a schematic diagram of the distributed amplifier circuit as exemplifying one adaptation of this invention, and

Fig. 8 is a diagrammatic circuit of one stage of the amplifier showing the by-pass capacitances involved in the circuit through the novel socket assembly proposed by this invention.

Referring in detail to the drawings, the unit of Fig. 1, from a dimensional standpoint, is extremely small, for instance; 1⅜ inches high, 4 inches long and 1 inch wide, exclusive of the terminals, tubes and plug.

The unitary assembly comprises three main components, namely; the multiple gang socket member GS, the ground plate member GP and the solid dielectric block casing C. In addition to these components the unit includes the input and output terminals T and T1,

the power supply plug P and the miniature pentode tubes VT mounted in upright position in the successive series of aligned slots S provided in the top surface of the block casing of the unit.

It is evident that such a compact symmetrical unit will greatly reduce the space area necessary in large installations of numerous units for a given complement of equipment. Furthermore, the problem of maintenance, in case of operating difficulty, is easily solved in view of the plug-in construction of the unit. The unit also provides more efficient utilization of limited accommodations in equipment and greater flexibility in adaptation to a large range of circuit requirements. The block design of the casing provides a sealed solid mass which protects the enclosed components against the effects of humidity, fungus, mechanical damage, loose connections and corrosion.

The dominant element of the unit, which tends to produce the greatest consolidation of the components into a subminiature compact assembly of this invention, is the gang socket member GS, shown more clearly in Figs. 2, 3 and 4, the latter view being an exploded layout showing the detailed piece parts or elements and the manner in which they are combined into a rigid core of the unit which constitutes the heart of the assembly whereby the components can be compacted into a small volume of space, to achieve the sub-miniature combination evolved in the multi-stage amplifier unit.

The gang socket member is composed of a laminated stack of strips and, as shown in Fig. 4, is divided into three sections to clarify the understanding of the construction of the assembly. These sections are; the intermediate section **10**, the plate section **11** and the grid section **12**, the intermediate section being only partly exploded since all the combined strips in the compacted group **13** are substantially the same as the separated or exploded strips shown in the intermediate section **10**. The intermediate section includes the pin positioning slots for five terminals or pins of a pentode type tube, namely, the heater, cathode, screen grid and suppressor grid.

Each pin position has four strips or laminations of elongated rectangular formation which comprises a slotted metallic strip **14**, such as aluminum, about .032 inch in thickness, in which the slots **15** extend in parallel relation toward the upper edge **16** and in sequential arrangement along the greater portion of the central area of the strip. The strip **14** is slightly longer and wider than most of the strips in the intermediate section, as will be explained later. A metallic strip **17**, slightly smaller in size, is placed on the outer surface of the slotted strip **14** and is preferably of a resilient spring-like material, such as beryllium copper, approximately .008 inch thick. The strip **17** is provided with a series of U-shaped punchings **18** at spaced positions in alignment with the slots **15** in the aluminum strip. The integral tab **19** formed by the punching is bent outwardly and downwardly toward the slot, to form a resilient contact in the slot gap, as shown in Figs. 2 and 3.

On the opposite side of the slotted strip **14** is positioned a thin metallic strip **20**, preferably of copper, about .008 inch in thickness, to form a cooperating metal contact surface with the slotted strip and resilient strip so that a completely metallic pin receiving orifice or slot **21** is provided for the insertion of pin **22** of the suppressor grid **23** of tube **24**, as shown in Fig. 3. An insulating strip **25**, of "Bakelite" or similar insulation, is juxtaposed against the copper strip, to complete the group of laminations for one electrode of tube **24**. This group is identified in Figs. 2 and 4 as A1. Similarly, the laminated strips in block **13** in Fig. 4 are identical with group A1 but arranged in successive order to constitute the intermediate section **10** of the gang socket. However, certain strips, as will be pointed out hereinafter, are longer and wider, like strip **14** to fulfill a function to be described later. As shown in Figs. 2 and 3, respectively, the A2 group provides a guiding slot **26**, for pin **27** of

screen grid **28** of tube **24**. The A3 group or the median group provides a guiding slot **29** for the pin **30** of the cathode **31** of tube **24**, the slotted strip of this group is also similar to aluminum strip **14**. The A4 group provides a guiding slot **32** for one heater pin **33** of the heater element **34**, and the slotted aluminum strip of this group being the same size as strip **14**. Finally, the A5 group provides a guiding slot **35** for the other heater pin **36** of the heater element **34** of the tube **24**. The provision of a completely metallic surface around each pin of the tube elements establishes a conductive path to ground at radio frequencies for all the tubes in the amplifier and maintains all similar electrodes of the tubes at the same direct current potential. In addition the dielectric or insulating strip **25**, between adjacent metallic groups of strips, forms a by-pass capacitor of sufficient capacitance to maintain the intermediate group of pins of all the tubes **24** at the same radio frequency potential.

The remaining laminations in the stack of the gang socket GS, namely; the plate section **11** and the grid section **12**, as shown in Fig. 4, are different from the laminations in the intermediate section **10**, although the grid section strips are partly similar in general construction as the plate section but reversed in position with respect to the intermediate section **10**. The plate section assembly **11** consists of four rectangular strips in sandwiched relation and mounted or stacked to the right-hand position of the intermediate section, as shown in Figs. 2 to 4 inclusive. The rectangular strip **37** is of a dielectric material, about .030 inch in thickness, and preferably made of "Teflon," a polytetrachloroethylene composition, or similar material having high dielectric properties. This strip is slotted along one edge **38**, to provide pin guiding apertures **39**, in alignment with the slots in the intermediate section. Another dielectric strip **40**, of linen base "Bakelite," about 1/16 inch in thickness, is mounted on the outer surface of the slotted strip and a plurality of segregated resilient contacts **41** are positioned in alignment with the slots in strip **37**. These contacts are formed of beryllium copper, about .008 inch in thickness. The contacts are small rectangular pieces of metal having a U-shaped punching along the upper area and the formed tab **42** bent outwardly and downwardly, to provide a resilient portion which extends into the slot **39** of the strip **37**. These contact pieces are also provided with holes **43** at the lower end which coincide with similar holes or apertures, not shown, in the contact holding strip **40**. The manner of fastening these contacts to the strip **40** will be described later. A further insulating strip of "Bakelite" **44**, is mounted on the left-hand surface of the slotted strip **37** and attached to the inner upper edge are a plurality of rectangular copper tabs **45** bonded to the strip in alignment with the slots **39**, these tabs being about .003 inch thick. The final strip **46** of this section is also formed of insulating material of high dielectric properties, such as linen base "Bakelite," and approximately 1/8 inch thick. This strip includes the radio frequency circuitry of the amplifier and is integrally combined with strip **40** and the contacts **41** in a manner which will now be described, in accordance with this invention.

The strip **46** is provided with a series of drilled holes, marked **0** to **6** inclusive, to coincide with positions of the resilient contacts **41** on strip **40** and a plurality of radio frequency inductances are printed on the outer surface of the strip **46** between the successive holes. Each coil **47** between two holes is a continuous line or band in a rectangular form progressing from the center to the outer periphery, the outer band **48** being linear in relation and terminating at hole **6** and a coupling printed strap **49** being deposited on the inner surface of the strip **46** and connected at one end to the center of the coil **47** then terminating linearly with the preceding hole 5. The connection of the printed indicia on the opposite sides of the strip is produced by standard printing technique. The other coils are similarly connected between

the remaining holes 1 to 5 inclusive, to provide the radio frequency inductive coupling between the six stages of the distributed impedance amplifier. At the nearest termination of the series of printed coils on the strip 46 are a pair of additional coils 50 and 51, the outer linear termination of coil 50 being connected to hole 6 and directly below coil 50 is coil 51, the center terminals of these coils being connected together through a printed connector 53 and forming inductance elements of a terminating filter section connected to one end of the series line of the plate circuit of the amplifier. Coils 50 and 51 together with printed condensers 54 and 55 form a half-section M derived filter connected to the output terminal T'. These condensers are printed rectangular strips on both sides of strip 46 in line horizontally with coils 50 and 51, the latter being connected to the outer plate of condenser 55 and the upper inner plate being connected in parallel to the center of coils 50 and 51 by a printed strap 56 which forms a bond on the inner surface of strip 46. At the other end of strip 46 the filter coil 57 is associated with printed condenser 58 formed of two plates printed on opposite sides of strip 46 adjacent to coil 57 and a terminating resistance 59 is printed on the inner surface of strip 46 adjacent to the last coil of the linear coupling coils of the amplifier. The centers of the last series coil 47 and coil 57 are connected together by a strap 60 on the inner surface of strip 46 and the resistance 59 is connected at the nearest end to the mid-point of strap 60 by a strap 61.

The outer end of resistance 59 is connected to the zero (0) hole on strip 46 by a printed strap 62. The filter coil 57 has a linear end connected to the outer condenser plate of condenser 58. In addition, the inner plates of condensers 55 and 58 are provided with short angle straps 63 and 64, respectively, which project below strip 46 with the free ends extending toward the outer surface of the strip.

In order to connect the coupling coils to the respective stages of the amplifier, a plurality of brass rivets 65 are inserted in holes 0 to 6 inclusive and these extend through strips 46 and 40 to enter holes 43 in the contacts 41. As shown in Fig. 4, only four of the rivets are displaced in line with their respective holes 1 to 4 inclusive, but additional rivets are also required for the remaining holes in strip 46. When the contact supporting strip 40 is rigidly affixed to strip 46 by means of the rivets locking the contacts in position, these contacts are lined up with the corresponding slots 39 in strip 37 with the copper tabs 45 on strip 44 disposed on the opposite side of the slots to complete the plate section 11.

The grid section 12 laminations are the same as the plate section except they are disposed in reverse order with respect to the intermediate section 10, as shown in Fig. 4. In this relation strip 44' with the copper tabs 45' is placed against the block 13 with the tabs facing outwardly, then in succeeding order the slotted strip 37', the contact strip 40' and the printed strip 46' are mounted in juxtaposed relation.

Although the grid section 12 includes a group of strips similar to the plate section 11 but reversed in order with respect to the intermediate section 10, the printed strip 46' is slightly different in print circuitry with respect to the plate section strip 46. It should also be noted that while strip 46' is reversed, the relationship of the holes 0' to 6' corresponds to the hole locations in strip 46. While the series coupling coils 47' correspond to similar coils on strip 46 between the rivet holes 0' to 6' the filter section circuitry at opposite ends of the grid strip 46' are different in some respects. For example, coils 50' and 51' are the same as the plate strip and the condensers are the same but the outer upper plate of condenser 54' is connected to the midpoint of strap 53' by a connector 65' printed on the inner surface of strip 46' while the lower inner plate of condenser 55' is connected to the linear extension of coil 51'. A printed resistor 66 bonded to the outer surface of strip 46' is connected to the upper inner plate of condenser 54' and the outer lower plate of condenser 55' and an angle strap 67, extends downwardly and outwardly from the lower outer plate of condenser 55'. At the other end of strip 46' a coil 57' is printed below the last series coil and the centers of these coils are connected together by a strap 60'. A resistor 68, of a high value, being much greater than the characteristic impedance of the grid line, is connected at one end to the midpoint of the strap 60' and the other end is tied to hole 0' by a printed strap 69. In addition two printed condensers 70 and 71 are provided at the far end of strip 46', the inner lower plate of condenser 70 being connected to the linear termination of coil 57' by a printed strap 72 and the upper inner plate of condenser 71 being connected to the midpoint of strip 60' by a connector strap 73. The outer plate of condenser 71 is provided with a terminal wire connection 74 which forms a lead to the inner coaxial terminal T of the input. Finally, the outer plate of condenser 70 is provided with an angle strap 75 which projects in the same direction as strap 67. As shown in Fig. 3, the slot 39 forms a guide for pin 76 of the plate or anode 77 of tube 24 and slot 39' guides pin 78 of the control grid 79 of tube 24.

In order to align all the slots in the stack so that the multiple sections of laminations are combined into a unitary structure by aligned pairs of holes 80 and 81 extending transversely through all the strips in the stack intermediate the center and opposite ends of the strips, an insulating sleeve 82 extends through these holes to maintain the strips in vertical alignment and the whole stack is rigidly fastened together by tubular brass eyelets 83 which clinch the stack into a solid unit.

In view of the enlarged views of Figs. 2 and 3 it is to be understood that the outer sections are exaggerated to clearly show the relation of the contacts and tabs on opposite sides of the slotted strips. Therefore, the apparent spaces shown in between strips 40 and 44 in relation to the slotted strip 37 are not as pronounced as shown since the contact and tab material are very thin, of the order of .003 to .008 inch thickness, so that the strips 40, 37 and 44 are substantially in facing relation.

The gang socket GS of this invention provides a compact unitary assembly which has the series slots for six tubes and the power plug in aligned relation across the top edge of the stack and the slots in each elongated strip being in multiple with respect to a single electrode of each tube, namely; the plate circuit or output, the grid circuit or input and the respective intermediate electrodes, i. e., heater, cathode, screen grid and suppressor grid. Since the power plug is inserted in a similar series of slots at the far end of the stack it is evident that all the same electrodes of the several tubes are at the same potential.

A particular feature of the construction of the multiple laminations of the stack is the adaptability of the various strips to be manufactured by punch press operations. Similarly it is conceivable that this construction may be readily assembled by machine methods to automatically consolidate the whole stack into a unit without a single hand operation. Furthermore, the provision of the circuitry on the outer sections consolidates the whole amplifier arrangement in a compact assembly substantially the same size as the gang socket stack while dispensing with numerous solder connections. Another feature relates to the provision of the built-in by-pass condenser couplings between adjacent intermediate electrodes of the tubes so that all of the grounded electrodes of the tubes are at radio frequency ground potential. It also provides an extremely low resistance unipotential surface connecting similar tube electrodes to their source of power supply. Finally the compact assembly permits the attainment of a given band-width gain product in a smaller total volume than has been possible to accomplish heretofore.

The completely assembled stack GS is centrally mounted in a clamping member 84 with the longer slotted

metallic strips abutting against the end walls or portions 85, as shown in Fig. 2, and the same strips, being slightly wider than the other strips in the stack, abutting against the base portion 86, as shown in Fig. 6. The clamping member is also provided with short side portions 87 which extend the full length of the stack and are joined to the end wall portions, to form a common ground plate or grounding base for the gang socket stack. When the stack is clamped in the member 84 the angle brackets 63, 64, 67 and 75 on the plate and grid section strips may be soldered or rigidly affixed to the base 86, as shown in Fig. 6.

The plate section outer strip is provided with an insulated lead wire 88 attached to the outer plate of condenser 54 and this wire extends through aperture 89 in one end wall 85 and a similar insulated wire 74 connected to the outer plate of condenser 71 on the grid section strip extends through another aperture 90 in the opposite end wall 85.

The combined stack and grounding member assembly is then placed in a mold with the base 86 set on the mold bottom to prepare for the sealing operation of the unit. Prior to the encapsulation process, a masking fixture (not shown) is placed above the stack, the fixture being provided with pins to match the rectangular shaped slots in the slotted strips of the gang socket stack. Prior to potting, the stack and grounding member are thoroughly dried at an elevated temperature of 150° F. in an oven for about 30 minutes to one hour. When the fixture is properly positioned on the mold, a casting resin or plastic material C, having a low loss factor, such as epoxy, phenolic or polyester resin for example; "Scotchcast" #2, "Randac" #R4052 or "Laminac," representing a few typical low heat resins which are suitable for the potting mass of the unit. If desired, a crystalline silica filler may be included with the resin together with a distinctive dye or coloring material, to reduce shrinkage stresses and thermal conductivity and to lower the exothermic heat during cooling and setting of the resin mass.

After the encapsulated unit is removed from the mold the masking fixture is separated from the unit and the final operation is the connection of the terminals to opposite ends of the casing. These terminals are standard BNC connectors having a flange portion 91 integral with a sleeve portion 92 and a high dielectric insert 93 provided with a metallic eyelet which forms the coaxial contact of the terminal. The flange portion is affixed, for example, by screws which extend into the end wall portion 85 of the grounding member 84, as shown in Fig. 5. The insulated lead 88 from the plate section strip 46 is threaded through the eyelet and the wire is soldered in the outer end of the eyelet of terminal T'. The other terminal T is similarly attached to the other end of the casing and the lead 74 affixed to the central eyelet of the connector. The fabrication of the sub-miniature unit provides an economical assembly since all the components may be formed by punch-press operations and the parts assembled by automatic machinery and the finishing operations are reduced to a minimum. Furthermore, the potting of the complete assembly in a solid cast resin mass eliminates corrosive and other atmospheric effects, avoids mechanical injury to delicate components and produces a unit of very small size and convenient package.

To realize the compactness of the unit in a small rectangular block having the dimensions of 1 inch by 1⅜ inches by 4½ inches long, attention is drawn to the schematic diagram in Fig. 7 which represents the equivalent of the stack assembly with the tubes VT mounted therein, as shown in Fig. 1. It will be seen that VT1 is coupled to the series input and output circuits at position 1 with the anode 77 connected to the output coupling line 94, and the control grid 79 connected to the input coupling line 95. The suppressor grid 23 and the cathode 31 are connected to the ground plate 96 represented by the grounding member 84 through the slotted strips in the intermediate section of the socket stack. One side of the heater element of the tube is also grounded in a similar manner although this is not specifically shown in Fig. 7. The screen grid 28 is connected to series line 97 which is furnished with +120 volt direct current through pin 98 of plug P entering the third slot in the 0 position of the unit. The anode is supplied with power through the plug P pin 99 entering the first slot in the 0 position through resistance 59. The control grid 79 is biased negatively at about 2 volts through the last pin 100 of plug P entering the last slot in 0 position through a high resistance 68 having an impedance much greater than the characteristic impedance of the grid line.

The other tubes VT, namely; VT2 to VT6 inclusive, are respectively connected in multiple through their socket pins in the same manner as tube VT1 and coupled together in both the input and output lines by the printed coils extending between the series of contacts in the stack. The pins 101, 102 and 103 of the plug P enter the second, fourth and fifth slots in 0 position of the unit to couple the suppressor grid, cathode and one side of the heater circuit to radio frequency ground potential and also supply the low alternating voltage for the heaters of the tubes. The input circuit from the control grids is connected to the center coaxial terminal T through a portion of the full section filter including the series line coil and condenser 71 while the sleeve of the terminal is connected to ground.

The input line 95 is terminated by resistance 66 and a half section M-derived filter formed by coils 51' and 50' and condenser 55' to ground. The output line 94 is terminated at the coaxial terminal T' through another half K section filter formed by condenser 55 and coils 51 and 50 and the sleeve of terminal T' is grounded to the clamping member 84.

In addition to the radio frequency coupled multiple stage amplifier circuit, as shown in the schematic, the sub-miniature unit also provides by-pass coupling capacitance between the elements of the tubes in the intermediate section by the laminated construction of the stack, as shown in Fig. 8. This is accomplished by the laminated insulating strips in the stack between adjacent metallic contact strips, to form by-pass condensers 104 between the screen grid and the cathode, 105 between suppressor grid and screen, 106 between the cathode and heater and 107 between the heater strips. This arrangement establishes all of the intermediate section elements of the tubes at the same radio frequency potential with respect to radio frequency ground.

The series multiple radio frequency coupling circuit of this invention permits the realization of a considerably high effective gain band-width product than is possible with the usual cascade amplifier employing standard two terminal inter-stages. It also allows the realization of an over-all gain greater than unity, despite the fact that a single stage gain may be less than one.

While this invention has been set forth specifically in a particular embodiment it is, of course, understood that various modifications may be made in the detailed assembly without departing from the intended scope of the invention, as defined in the appended claims.

We claim:

1. An electron tube unit, comprising a gang socket assembly including a laminated stack component with aligned slots on one edge in parallel spaced relation, an elongated clamp member having a base and end portions transverse to said component, terminals extending axially from said end portions, connections between certain elements of said stack component and said terminals, said stack component being located centrally and perpendicularly to said base, and a molded insulating material embedding said stack component and clamp member to form a solid enclosure, said molded material having a series of perforations adjacent to and coincident with said aligned

slots for receiving the pins of tubes to be inserted in said unit.

2. An electron tube unit, comprising a gang socket assembly including a laminated stack component with aligned slots on one edge in parallel spaced relation, an elongated clamp member having a base and apertured end portions transverse to said stack component, terminals extending from said end portions, leads from said stack component extending through said apertured end portions and connected to said terminals, and a molded insulating material encasing said stack component and clamp member in an enveloping mass, said mass having a series of perforations adjacent to and coincident with said aligned slots for receiving the pins of tubes to be inserted in said unit.

3. An electron tube unit, comprising a gang socket assembly including a laminated stack component with aligned slots on one edge in parallel spaced relation, grounding means adjacent said stack component, certain elements of said stack component being connected to said grounding means, terminals extending axially from opposite ends of said assembly, connections between certain elements of said stack component and said terminals, and a molded insulating material encasing said stack component in a solid mass, said mass having a series of perforations adjacent to and coincident with said aligned slots for receiving the pins of tubes to be inserted in said unit.

4. An electron tube unit, comprising a gang socket assembly including a laminated stack component with aligned slots on one edge in parallel spaced relation, a dielectric material encasing said stack component in a solid molded mass to form a completely sealed structure, said mass having a series of perforations adjacent to and coincident with said aligned slots for receiving the pins of tubes to be inserted in said unit, and means embedded in said mass forming a ground connection for said component.

5. A sub-miniature electron tube unit, comprising a gang socket assembly including a plurality of members with slots in one edge, a metallic strip adjacent each member with a spring portion registering with the slots in said member, a metallic strip on the opposite side of each member to form a multiple pin receiving intermediate group, insulating strips between successive slotted members and metallic strips to form a laminated structure, a slotted member on opposite sides of said intermediate group, insulating strips adjacent each slotted member having metallic spring elements registering with the slots in each slotted member, means to rigidly attach all the members and strips into an integral stack with the slots on the upper edge, a grounding clamp member embracing said stack, coaxial terminals attached to said clamp member at the ends thereof, connections between the central terminal of said coaxial terminals and certain of said strips, and a dielectric material enclosing said stack and clamp member except for the slotted edge of said gang socket assembly, said material having a series of perforations adjacent to and coincident with the slots in the upper edge of said stack for receiving the pins of the tubes to be mounted in said unit.

6. A laminated electron tube socket comprising an intermediate section and two end sections mounted in edgewise relation and forming a stack assembly, said intermediate section consisting of a multiple group of similar components including a pin receiving strip having a series of slots extending from one edge, a metallic strip on each side of said pin receiving strip, and an insulating strip on the outer surface of each metallic strip, said group components being stacked in series relation, each end section consisting of a pin receiving strip having a series of slots extending from one edge and an insulating strip on each side thereof, a plurality of spring elements attached to one of said insulating strips in registry with the slots in said pin receiving strip, said end sections being disposed on opposite sides of said intermediate section with said insulating strips being outermost with respect to the stack assembly, insulating sleeves extending transversely through said stack, and fastening eyelets extending through said sleeves to lock said sections in alignment.

7. A laminated electron tube socket comprising an intermediate section and two end sections mounted in edgewise relation and forming a stack assembly, said intermediate section consisting of a multiple group of similar components including a metallic pin receiving strip having a series of slots extending from one edge parallel to the width of said pin receiving strip, a metallic strip on each side of said pin receiving strip and an insulating strip on the outer surface of each metallic strip, said group components being stacked in series relation, each end section consisting of a pin receiving strip having a series of slots extending from one edge and an insulating strip on opposite sides thereof, a plurality of metallic spring elements attached to one strip in registry with the slots and a plurality of segregated metallic tabs affixed to the other insulating strip in registry with the slots but oppositely disposed with respect to said spring elements, said end sections being situated on opposite sides of said intermediate section with said spring element strip being outermost with respect to said stack assembly, insulating means extending transversely through said stack, and fastening means extending through said insulating means to lock said sections in alignment.

8. A laminated electron tube gang socket comprising an intermediate section and two end sections mounted in edgewise relation and forming a stack assembly, said intermediate section consisting of a multiple group of similar components including a metallic pin receiving strip having a series of parallel slots extending toward one edge, a metallic strip on each side of said pin receiving strip, one of said latter metallic strips having bent out resilient portions registering with said slots, and an insulating strip on the outer surface of each metallic strip, said group components being stacked in series relation, each end section consisting of a pin receiving strip having a series of parallel slots extending toward one edge, an insulating strip on opposite sides thereof, a plurality of resilient leaf spring elements attached to one of said insulating strips and a plurality of metallic contacts in parallel arrangement being attached to the other insulating strip, said leaf spring elements and contacts being aligned in opposing relation with respect to the slots in said pin receiving strip, said end sections being disposed on opposite sides of said intermediate section, all three sections being juxtaposed in laminated relation so that the slots are aligned across the width of the edge of the stack and in multiple sequence, insulating sleeves extending transversely through said stack, and fastening eyelets extending through said sleeves to lock said sections into a unitary stack.

9. A sub-miniature electron tube unit, comprising a multiple gang socket including a laminated stack component with aligned slots on one edge in parallel spaced relation and adapted to receive a plurality of pentode type tubes with aligned electrode pins, said stack having outer insulating strips having spaced spring contacts registering with adjacent slots in said stack, printed coil elements on said strips joined to successive contacts along the length thereof, printed filter sections joined to the terminating contacts on said strips, a grounding metallic member supporting said stack, input and output coaxial terminals connected to opposite ends of said grounding member, a solid cast resin block encasing said stack and grounding member to form an elongated structure, said block having a series of perforations adjacent to and coincident with said aligned slots for receiving said pins of said pentode tubes mounted in said unit, and conductors coupling certain filter sections to the central contacts of said input and output coaxial terminals respectively, and means connecting the remaining filter sections to said grounding member.

10. A sub-miniature electron tube unit, comprising a multiple gang socket including a laminated stack com-

ponent with aligned slots in parallel spaced relation and adapted to receive a plurality of pentode type tubes with aligned electrode pins to constitute a multi-stage amplifier, said stack having multiple spring strips adjacent the slots in said stack to constitute an intermediate section, and outer insulating strips with a series of spring contacts registering with the slots adjacent thereto to form input and output sections of said amplifier, printed coil elements joined between adjacent spring contacts on said insulating strips, printed filter elements joined to the terminating contacts on said strips, an elongated grounding metallic clamp supporting said stack in position so that said slots are exposed at the upper edge, input and output coaxial terminals connected to opposite ends of said elongated clamp, a solid cast resin block encasing said stack and clamp said block having a series of perforations adjacent to and coincident with said aligned slots for receiving said pins of said tubes to be mounted in said unit, means coupling a filter element at the respective ends to the central contact of said input and output coaxial terminals, means coupling the remaining filter elements at opposite ends to said clamp, and a power supply plug member having aligned pins adapted to be inserted in said stack at one end of said block parallel to said tubes to energize said intermediate, input and output sections of said stack in multiple relation.

11. A laminated electron tube gang socket, comprising an intermediate section and two end sections mounted in edgewise relation and forming a stack assembly, said intermediate section consisting of a multiple group of elongated metallic strips, certain strips having a series of slots extending from one edge adapted to receive the pins of tubes to be inserted therein, insulating strips separating said multiple group strips, said end sections consisting of a plurality of insulating strips in juxtaposed relation, the intermediate strip thereof having slots on one edge in alignment with the slots in said multiple group of strips, metallic contacts on the insulating strips on opposite sides of said intermediate strips and aligned with said slots, and means extending through said strips to lock them into a laminated stack unit.

12. A laminated electron tube gang socket, comprising an intermediate section and two end sections mounted in edgewise relation and forming a stack assembly, said intermediate section consisting of a multiple group of elongated metallc strips, certain strips having a series of slots extending from one edge adapted to receive the pins of tubes to be inserted therein, insulating strips separating said multiple group strips, said end sections consisting of a plurality of insulating strips in juxtaposed relation, the intermediate strip thereof having slots on one edge in alignment with the slots in said multiple group of strips, one of said end section strips having a plurality of resilient contacts adjacent to and aligned with said slots, the opposite strip having metallic tabs in opposition to said contacts, printed impedance elements on said strips having said resilient contacts and coupled therebetween, and terminating conductive leads extending from said end sections and connected to said printed elements.

No references cited.