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2,446,701

RADIO APPARATUS OF REPLACEABLE STANDARDIZED UNITS

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2 Sheets-Sheet 1

Fig. 1.

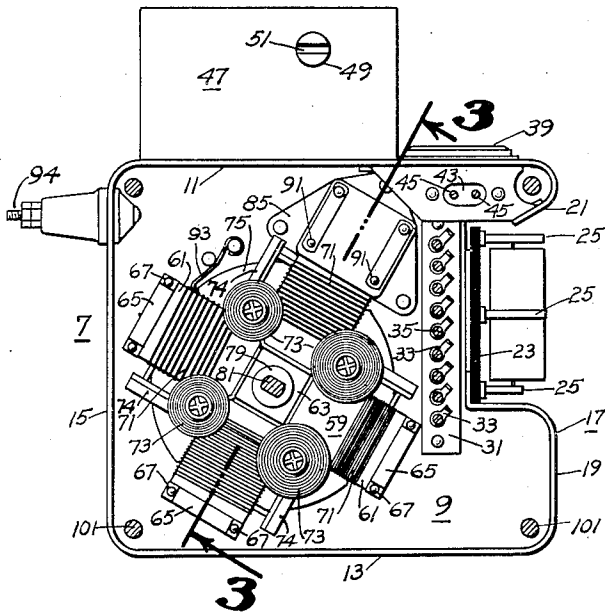


Fig. 3.

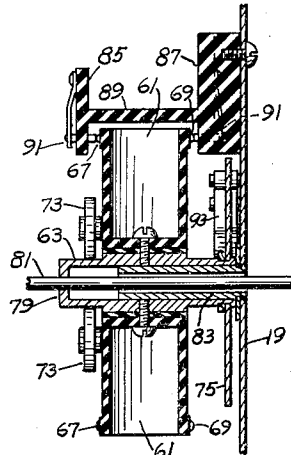


Fig. 2.

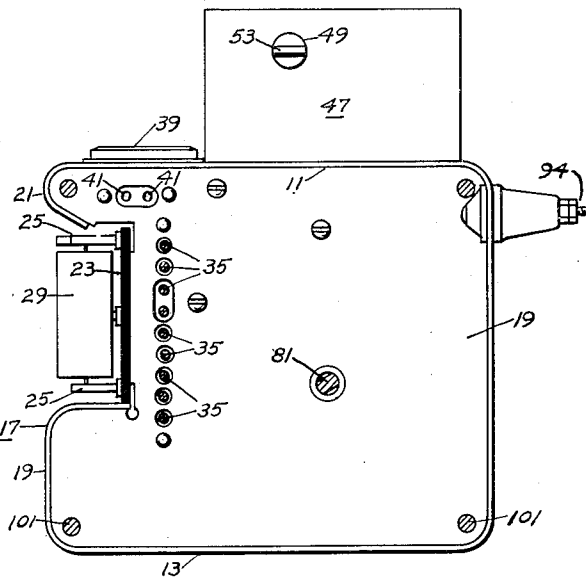
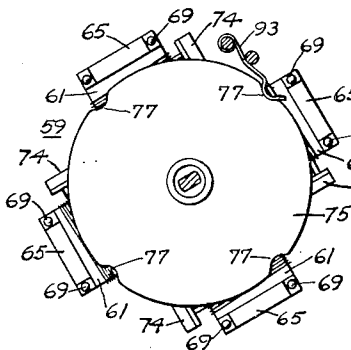


Fig. 4.



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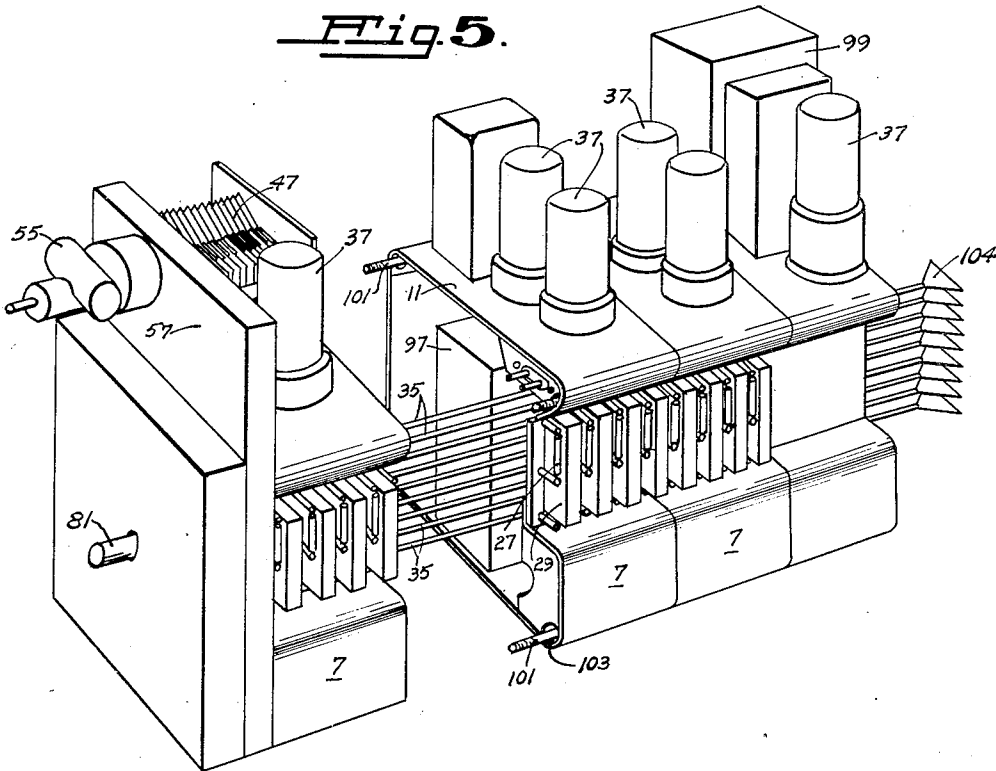
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2 Sheets-Sheet 2

Fig. 5.



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RADIO APPARATUS OF REPLACEABLE STANDARDIZED UNITS

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7 Claims. (Cl. 250-16)

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My invention relates to radio apparatus and has for its objects:

(1) To provide novel and improved radio apparatus of replaceable standardized units.

(2) To provide novel and improved radio apparatus permitting of considerable flexibility in the matter of circuit assembly.

(3) To provide novel and improved radio apparatus of standardized units capable of being assembled into different circuit assemblies, each adapted for a widely different purpose.

(4) To provide novel and improved radio apparatus capable of quick repair in the field through the replacement of standardized stage units, in addition to being readily convertible to apparatus of different types.

(5) To provide novel and improved radio apparatus protected against destruction of insulation by rodents.

(6) To provide novel and improved radio apparatus in which the wiring has been reduced in amount to about 5% of that normally required in comparable apparatus of prior art design.

(7) To provide novel and improved radio apparatus in which the lead lengths have been reduced to a minimum, thereby correspondingly reducing undesired interlead coupling and stray capacities.

(8) To provide novel and improved radio apparatus wherein undesired electrostatic feedback coupling between the plate winding of a radio frequency stage and the remainder of the stage to which it electrically belongs, is substantially eliminated.

(9) To provide novel and improved radio apparatus units of standardized design and construction adaptable for assembly into radio apparatus of divers types and power requirements.

(10) To provide novel and improved radio apparatus units of standardized design and construction adaptable for assembly into radio apparatus of divers types without involving the soldering or joining of leads.

(10a) To provide novel and improved radio apparatus wherein undesired wiring and band-switch capacitance is minimized, to increase the L./C. ratios, sensitivity and selectivity.

(11) To provide novel and improved radio apparatus for selective wave band operation.

(12) To provide novel and improved radio apparatus of rugged construction and involving simplicity of operation and control.

Additional objects of my invention will be brought out in the following description thereof

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taken in conjunction with the accompanying drawings wherein,

Fig. 1 is a side elevational view of a unit adapted for application as a tunable radio frequency stage including frequency band selection.

Fig. 2 is a side elevational view of the same unit, as viewed from the other side.

Fig. 3 is a fragmentary sectional view taken on the line 3-3 of Fig. 1.

Fig. 4 is a rear end view of a turret coil assembly incorporated in the unit of Fig. 1.

Fig. 5 is a view in perspective, illustrating the manner of assembling a plurality of units to form a radio receiver or the like.

In general, my invention resides in the construction of radio apparatus from standardized stage units, and in the details and features of such units which permit of the assembling thereof to provide such apparatus. These units are similar in construction, have many important features in common, though differing slightly in certain respects depending on their intended use in the apparatus, that is whether they are to constitute radio frequency stages, intermediate frequency stages as in a super heterodyne circuit, audio frequency stages, etc. Each unit carries radio apparatus essential to a complete stage, though where transformer coupling is employed between stages, such stages are electrically split up between units by placing the coupling transformer in the following stage unit. This has been found to produce certain advantages which will be discussed more in detail in the following description of a preferred form of my invention.

Referring to Fig. 1 of my drawings, I have illustrated therein a unit 7 adapted for operation in a radio frequency stage of a receiver. In common with all other units, it comprises a preferably sheet metal container 9 having a top wall 11, bottom wall 13, front and rear end walls 17 and 15 respectively, and a side wall 19, the container being preferably open opposite the side wall.

The front end wall is preferably divided into two sections 20 and 21 respectively with the opposing edges turned inwardly to provide a gap. This gap is substantially spanned by a terminal panel 23 of insulating material, carrying a plurality of terminal posts 25 extending outwardly therefrom. These terminal posts are preferably of the pin type having split ends and are arranged in pairs, thereby adapting the panel 23 for the external mounting of resistors 27 and fixed condensers 29 of commercial types, having extending end connections adapted to fit the split ends of the terminals 25 to which they may be

soldered if desired. Inasmuch as each stage of a conventional radio receiving circuit or like circuit calls for a plurality of such resistors and condensers to function as leaks, by-pass and filter elements, the panel thus offers a convenient mounting for these elements, where they will be exposed to the cooling effect of the external atmosphere, as well as being readily accessible for replacement, should any of them go bad.

Each container is further provided with a contact strip 31 along the side wall 19 adjacent the panel 23 carried by the front end wall, this strip carrying insulated pin jacket fittings or contacts 33 exposed to openings 19' through the side wall 19. These openings 19' are adapted to receive a plurality of bus bars 35 which effect electrical engagement with the exposed contacts, and with proper potentials applied to these bus bars the bus bars provide means within the container from which the necessary operating potential may be obtained. In this connection, it is important to note that the bus bars 35 are not in any way permanently connected to any of the circuit elements, each connection being merely a frictional engagement with one of the contacts 33 exposed to the openings in the side wall, the connections to the circuit elements being through short leads, not shown, from the circuit elements to the contacts.

The tubes 37 employed in the various stages of the apparatus I prefer to mount on the upper wall 11 externally of the container, and for this purpose I provide a tube socket or sockets 39 as the case may be, through openings in the top wall and affix the sockets in this position, with the socket connections below the top wall within the container.

On the side wall, in proximity to the tube socket 39, there is mounted a pair of insulated contacts or pin jacket fittings 41 exposed to openings provided in the side wall 19. At the open side of the container and in alignment with the last mentioned openings and contacts 41, there is mounted a strip of insulation 43 carrying a pair of plug-in terminals 45 adapted to register with the corresponding openings and contacts 41 of an adjacently disposed container of similar construction.

These particular connections constitute the means for carrying the plate circuit of a tube into the next adjacent unit, and are of particular importance in connection with transformer coupled stages, in which case the transformer is preferably placed in the unit following that of the tube which feeds it. When arranged thusly, the tube and its input circuit are shielded from the transformer by the intervening side wall and the enclosing top, bottom and end walls, whereby feedback through capacitance and inductance coupling is avoided.

The above described stage unit, when adapted for application as a tunable radio frequency stage will have mounted in the top wall thereof a tunable condenser section 47, the shaft 49 of which at one end is formed with a slot or groove 51 while the other end will be shaped to provide a complementary key 53 adapted to fit the corresponding slot or groove of an adjacent condenser section, whereby a series of condenser sections may be coupled to form a gang condenser, controllable from any suitable adjusting mechanism 55 mounted on a suitable panel 57 and effecting engagement with the exposed end of the shaft of the first condenser section of the gang. Thus, where a particular apparatus calls for a plurality of radio frequency stages, the proper number of

condenser sections will automatically take care of itself.

The radio frequency transformer is preferably mounted within the unit, and for selective operation within any one of a plurality of frequency bands, I provide a turret coil assembly 59 comprising a plurality of tubular coil forms 61 of molded plastic supported radially from a preferably hollow metallic core 63. Each form terminates in a square end 65 each of two opposite sides of which carry a pair of coil terminals 67 and 69 respectively. One pair constitutes the terminals for a winding 71 of one frequency band transformer, which winding is wound on the associated coil form. The remaining pair constitute the terminals of the associated winding 73 illustrated as a pancake type winding carried on a plastic core mounted on the coil form 61, the leads being preferably carried through the coil form wall to the coil terminals. Trimmer condensers 74 may also be included and connected in the conventional manner.

One end of the turret assembly core 63 has affixed thereto a disc 75 formed with a plurality of spaced peripheral notches 77 equal in number to the number of coil forms in the assembly. The other end of the assembly core is provided with a lip 79, broached to receive a flat sided control shaft 81.

A hollow trunnion 83 extending into the container from the side wall 19 constitutes a support on which the turret coil assembly 59 may be rotatably mounted, the assembly being mounted thereon with the notched disc 75 adjacent the side wall.

Each terminal end of the coil forms 61 is adapted to rotate between the ends 85 and 87 respectively of a contact block 89 in which are disposed spring contacts 91 simultaneously engageable by the coil terminals 67 and 69 carried by the coil forms. Proper engagement of contacts with the coil terminals is assured by a spring 93 mounted on the side wall 19 with one end riding the periphery of the disc 75 under pressure, the spring being disposed to engage a peripheral notch 77 at the proper time to hold the assembly against unprovoked shifting.

The contact block 89 is preferably located in the region of the tube socket 39 and contact strip 31, thus concentrating essentially all connections to reduce lead lengths to a minimum, thereby not only conserving materials and space, but at the same time eliminating the undesired interlead capacity and coupling associated with the use of long leads. No attempt has been made to illustrate leads or connections, as they would merely serve to confuse the showing of the structural features and relationships wherein applicant's invention lies.

It will be apparent from the above, that a plurality of turret coil assemblies 59 are capable of actuation simultaneously from a common control shaft, whereby the frequency band of a receiver or the like may be quickly changed at will to suit the desires of an operator.

When necessary a radio frequency unit may be provided with an insulated antenna terminal post 94 on the rear wall 15 of the container.

Of course, the contents of a stage unit adapted for intermediate frequency operation, as in a superheterodyne circuit, will differ from the contents of one adapted for use as a tunable radio frequency stage, and likewise with a unit adapted for operation as an audio frequency amplifier. In lieu of a turret coil assembly, an intermediate

frequency stage will employ an intermediate frequency transformer 97 (Fig. 5) and an audio frequency stage might include an impedance matching output transformer (not illustrated) within a unit container.

A unit may also be adapted for power supply purposes, in which case the power transformer 99 might be mounted on the top wall along with the rectifier tube, and all the filter components might be supported within the container. In this unit, the operating voltages could be developed and applied to the bus bars 35 by way of the contacts or pin jacket fittings 33.

In assembling apparatus from such units, the units are strung on the bus bars 35 in proper sequence, preferably starting with the power supply unit at one end, then the audio amplifiers and intermediate frequency amplifiers and ending up with the radio frequency amplifier stages, to which the control panel 57 may be added. The assembly is then bound into a rigid, unitary assembly by tie rods 101 extending lengthwise thereof through corner openings 103 provided for the purpose. Corner gussets may be added in the open side of each unit to enhance the rigidity of the assembly.

The bus bars 35 preferably terminate in insulated finger grips 104 to facilitate the insertion of the bus bars through the various units.

With units of the above character prefabricated and available, it becomes a relatively simple matter to assemble any one of a number of different types of apparatus such as tuned radio frequency receivers, superheterodyne receivers, etc., in addition to employing such units in the assembling of apparatus such as aircraft automatic direction finders, homing devices, and combined duplex automatic direction finder and automatic pilot.

The invention further permits of the assembling of such units into apparatus of any one of a wide range of power requirements thereby rendering the invention applicable from the relatively low power scout car receiver for police work to the more powerful apparatus for aircraft work.

Disabled apparatus, furthermore, may readily be placed back in service by operators or others having little experience or background in radio, merely by the replacement of a damaged stage unit with a good one, and this becomes of prime importance in war activity where so much depends on the maintenance of communication lines.

Thus, it will be apparent that I have provided means for carrying out the objects of my invention, and while I have described a preferred embodiment of the same in considerable detail, the same is subject to alteration without departing from the principles of the invention. I accordingly do not desire to be limited in my protection to the specific details disclosed except as may be necessitated by the appended claims.

1. Radio apparatus comprising a plurality of replaceable individual cell units, each including a container having a side wall and an end wall provided with a gap therein, a terminal strip on said side wall having a plurality of contacts exposed in openings through said side wall, a terminal panel bridging the gap in said end wall and carrying a plurality of pairs of aligned split-end terminal posts extending outwardly therefrom, and circuit elements carried by said container and connectible to said contacts; a plurality of tie bolts binding said individual cell units into a unitary assembly; and a plurality of bus bars extending through the openings in said side walls

and contacting the corresponding contacts of said cell units.

2. Radio apparatus comprising a plurality of replaceable individual cell units, each including a container having a side wall, a terminal strip on said side wall having a plurality of contacts exposed in openings through said side wall, and circuit elements carried by said container and connectible to said contacts, one of said circuit elements constituting a variable gang condenser section including a horizontal shaft having one end grooved and its other end terminating in a key shaped to fit the corresponding groove of an adjacent similar condenser section; means binding said individual cell units into a unitary assembly with said variable gang condenser section shafts keyed one to another to form a variable gang condenser; and a plurality of bus bars extending through the openings in said side walls and contacting the corresponding contacts of said cell units.

3. A replaceable cell unit for radio apparatus comprising a metallic container having a top wall, a side wall, and a front end wall provided with a gap therein, said container being open opposite said side wall; a terminal panel bridging the gap in said front end wall and carrying a plurality of terminals exposed outwardly therefrom; and a terminal strip supported on said side wall adjacent said front end wall and having contacts exposed in openings through said side wall, said openings permitting of the insertion of bus bars through a plurality of such containers in alignment.

4. A replaceable cell unit for radio apparatus comprising a metallic container having a top wall, a side wall and a front end wall provided with a gap therein, said container being open opposite said side wall, a hollow trunnion extending interiorly of said container from said side wall and adapted to mount a turret coil assembly; a terminal panel bridging the gap in said front end wall and carrying a plurality of pairs of aligned split-end terminal posts extending outwardly therefrom; and a terminal strip supported on said side wall adjacent said front end wall and having contacts exposed in openings through said side wall, said openings permitting of the insertion of bus bars through a plurality of such containers in alignment.

5. A replaceable cell unit for radio apparatus comprising a metallic container having a top wall, a side wall and a front end wall provided with a gap therein, said container being open opposite said side wall; a terminal panel bridging the gap in said front end wall and carrying a plurality of pairs of aligned terminals exposed outwardly therefrom; a terminal strip supported on said side wall adjacent said front end wall and having contacts exposed in openings through said side wall; and a tube socket on the top wall of said container.

6. A replaceable cell unit for radio apparatus comprising a metallic container having a top wall, a side wall, and a front end wall provided with a gap therein, said container being open opposite said side wall; a hollow trunnion extending interiorly of said container from said side wall; a terminal panel bridging the gap in said front end wall and carrying a plurality of pairs of aligned split-end terminal posts extending outwardly therefrom; a terminal strip supported on said side wall adjacent said front end wall and having contacts exposed in openings

through said side wall; and a turret coil assembly rotatably mounted on said trunnion.

7. A replaceable cell unit for radio apparatus comprising a metallic container having a top wall, a side wall and a front end wall provided with a gap therein, said container being open opposite said side wall, a hollow trunnion extending interiorly of said container from said side wall; a terminal panel bridging the gap in said front end wall and carrying a plurality of pairs of aligned split-end terminal posts extending outwardly therefrom; a terminal strip supported on said side wall adjacent said front end wall and having contacts exposed in openings through said side wall; a tube socket and variable gang condenser section on the top wall of said container, said gang condenser section including a horizontal shaft having one end grooved and its other end terminating in a key shaped to fit the corresponding groove of an adjacent similar condenser section; a turret coil assembly rotatably mounted on said trunnion and a contact block mounted in said container in the path of rotation of said turret coil assembly.

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