

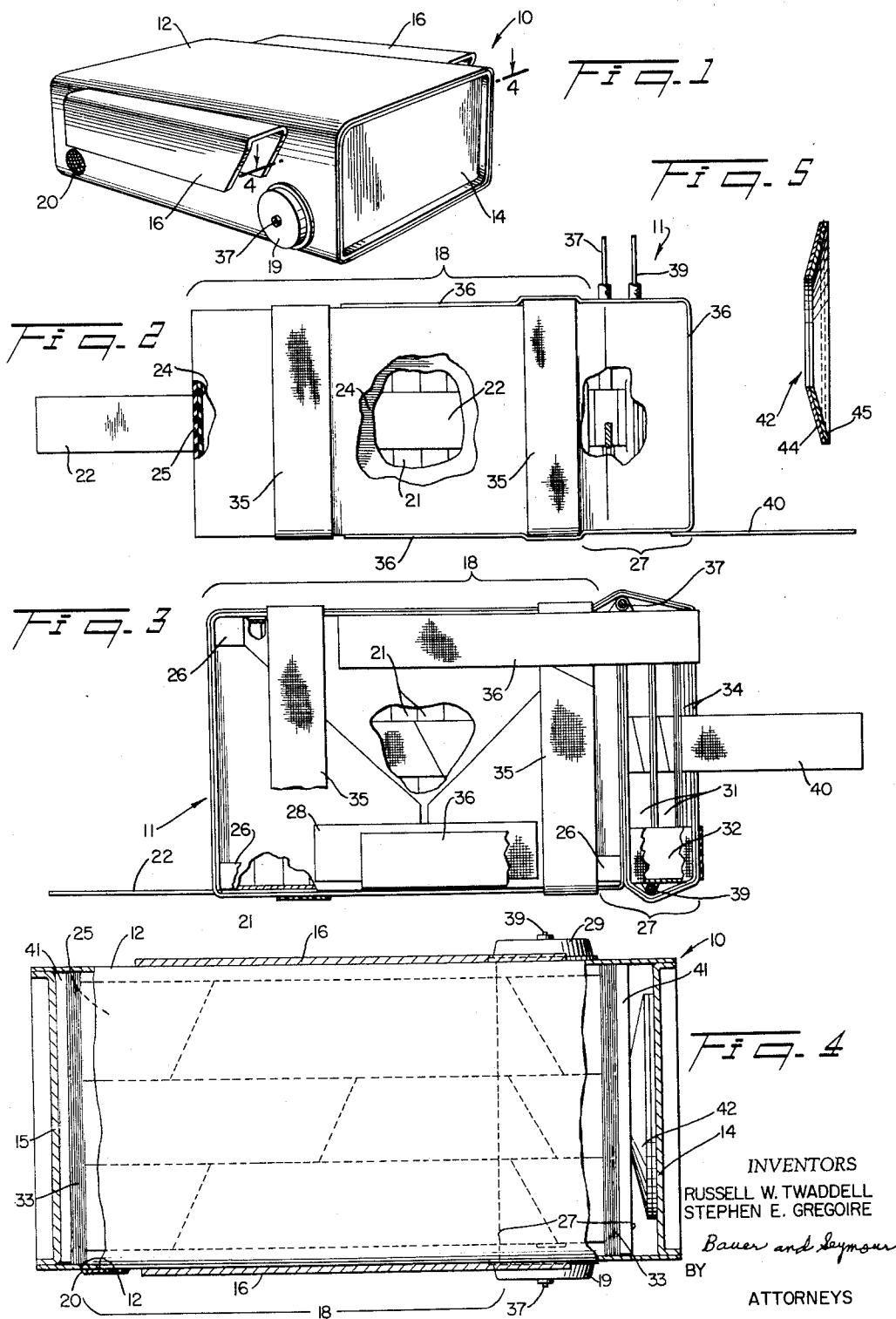
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ELECTRICAL CONDENSER

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ELECTRICAL CONDENSER

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This invention relates to an electrical condenser, and more particularly relates to the combination of an electrical condenser having a plurality of condenser sections of the laminated sheet type and a mounting device for such condenser.

The invention has among its objects the provision of a novel, improved condenser incorporating condenser sections of the laminated sheet type.

A further object of the invention lies in the provision of a condenser of the type above indicated which may be used throughout an extended range of temperatures from atmospheric to elevated temperatures.

Yet another object of the invention resides in the provision of a condenser incorporating a novel mounting device therefor to maintain the capacity of the condenser substantially constant over such extended range of temperature.

A further object lies in the provision of an improved mounting device for a multiple-section condenser wherein the sections are of the laminated type, the mounting device being of simple rugged construction and preserving the condenser units against damage under conditions of severe vibration at elevated temperatures.

The above and further objects and novel features of the invention will more fully appear from the following description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a view in perspective of an assembled condenser and mounting device therefor made in accordance with the present invention;

Fig. 2 is a view in elevation of the condenser in partially assembled condition, parts of the condenser being broken away to show the internal structure thereof;

Fig. 3 is a view in elevation of the condenser in a condition of assembly similar to that in Fig. 2, the view in Fig. 3 being taken from the point of view displaced 90° around the longitudinal axis of the pack from that in Fig. 2;

Fig. 4 is a fragmentary view in longitudinal section through the finally assembled condenser and mounting device therefor, the section being taken generally along the line 4-4 of Fig. 1, certain parts of the mounting device and of the condenser being broken away for clarity of illustration; and

Fig. 5 is a view in axial section through a bimetallic spring forming a portion of the condenser mounting device of the invention.

The condenser and mounting device therefor of the present invention are illustrated herein in an embodiment designed to be incorporated in a high temperature igniter such as that disclosed and claimed in application Serial No. 707,388, filed January 6, 1958 by Twaddell and Gregoire. A rectifier mounting device for such an igniter

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is disclosed and claimed in application Serial No. 671,462, filed July 12, 1957, and a circuit for such device is disclosed and claimed in application Serial No. 665,558, filed June 13, 1957, by Donald C. Loudon.

The igniter with which the condenser and mounting device therefor of the present invention may advantageously be used is designed to be affixed to the housing of a jet or ram-jet engine. During periods in which the engine is running, the housing thereof reaches temperatures on the order of 700 or 800° F. so that the casing of the igniter and the components of the igniter circuit therein may reach temperatures as high as 500° F., despite the use of the inflowing fuel as a coolant for the igniter. The heating and cooling of the condenser of the circuit, particularly if it is of the laminated pack type, tend to produce marked and undesirable variations in the capacity of the condenser when it is positioned in a container having fixed end walls. This arises from the subjection of the condenser to variable compressive forces directed endwise of the condenser stack. Further, since the igniter is attached to the housing of the engine, the component elements of the igniter are subjected to severe vibrations while the engine is running. The present invention is concerned with the provision of a condenser and a mounting device therefor such that the condenser is protected against damage under such arduous operating conditions, and such that the capacity of the condenser is maintained substantially constant over the wide temperature range of its use.

The assembled condenser and the mounting container device therefor are shown in Fig. 1, where such combination is generally designated 10. The condenser, designated 11, is shown in an intermediate assembled stage in Figs. 2 and 3, and is shown finally assembled in the mounting container device in Fig. 4.

Such mounting container device, generally designated 12, is in the form of an elongated metallic housing or sheath of rectangular section, the sheath being provided within an end closure member 14 at the right thereof (Figs. 1 and 4) and an enclosure 15 at the left thereof (Fig. 4). The engine fuel circulated as a cooling fluid through the igniter, flows into housing 12 through a screened opening 20 and out of housing 12 through a similar opening, not shown. The mounting container is provided with elongated inverted U-shape channel members 16 affixed to opposite sides of the container. Members 16 form hangers by means of which the mounting is supported on the frame of the igniter as more fully shown in application Serial No. 707,388.

Condenser 11 includes a main container unit 18, at the left in Figs. 2, 3, and 4, and a voltage-doubling unit 27, shown at the right in such figures. Each of sections 18 and 27 includes a plurality of condenser sections of the laminated type wherein layers of electrically conducting foil are separated by interposed sheets of dielectric material such as paper. In the assembly shown, the voltage-doubling section 27 includes two condenser sections 31 connected in series by a wire 39 which forms one lead from the condenser assembly. The other, free end of the outer condenser section 31 is connected to ground through a broad electrically conducting tape 40. The free end of the inner condenser section 31 is connected to a second lead wire 37 from the condenser assembly and is also connected to a common lead connected to one set of alternate plates of the sections 21 of the main condenser unit 18. The other set of plates of the condenser sections 21 are connected to a common tape lead 22 which is connected to ground. As shown in Figs. 1 and 4, the lead wires 37 and 39 are brought out through insulating bushings 19 and 29, respectively, on the side of housing 12.

In making up the condenser assembly composed of units 18 and 27, a sufficient number of sections 21 are

chosen to give the unit 18 the desired total capacity. In practice, the sections will differ somewhat in capacity when made by production methods. Accordingly, the capacities of an appreciable number of sections are determined, and the sections employed in making unit 18 are chosen so that the total capacity closely approximates that desired. The housing 12 is made of sufficient length to receive the maximum number of condenser sections which will ever be required to give the desired total capacity. In Fig. 4 housing 12 is shown containing a maximum number of condenser sections, end member 15 lying at the end of the housing. When less than such number of condenser sections is required, end member 15 will be positioned inwardly of the end of the housing. The voltage-doubling unit 27, in the embodiment shown, consists of the two condenser sections 31 which are carefully chosen to have substantially the same predetermined capacity desired. Unit 27 is positioned at one end of unit 18, as shown.

The condenser sections 21 are assembled in a stack and the described connections are made to the alternate plates thereof. The voltage-doubling sections 31 connected in series by lead 39, are added to the stack formed by sections 21. The free end of the inner section 31 is connected to one of the common leads of unit 18, and the condenser lead 37 is connected thereto. From the thus far assembled condenser pack there extends the ground lead 22 at the main condenser end, the ground lead 40 connected to the free end of the outer section 31 at the voltage-doubling end, and the two condenser leads 37 and 39 from the sides of the housing 12 adjacent the voltage-doubling end of the pack.

The condenser sections 21 of unit 18 are first held tightly together in a stack by one or more layers of insulating fabric 24, 25 wrapped about them, the fabric being retained by corner tapes 26, side tapes 28, and peripherally extending tapes 35. The lead tape conductors extend from the opposite ends of the thus assembled and wrapped unit 18.

The condenser sections making up unit 27 are now assembled and are secured together by insulating adhesive tape such as shown at 32. Unit 27 is then superimposed on the stack forming unit 18, and the described electrical connections are made between it and unit 18. A plurality of layers 34 of insulating material are placed on the outer end of unit 27. Unit 27 and layers 34 are secured to unit 18 by longitudinally extending insulating adhesive tapes 36.

End closure member 14 is secured to housing 12 as by being edge welded thereto. An annular spring member 42 is placed in the housing in the manner shown in Fig. 4, following which a rigid metal pressure or plunger member 41, slidably fitting within the housing, is placed in the housing. A number of thin layers 33 of insulating board, made for example of "Isomica," are then placed in the housing to lie against the inner face of member 41. The assembled and insulated condenser pack is then telescoped within housing 12 in the manner shown in Fig. 4. The lead 22 from the main condenser unit may be suitably connected to the housing 12, which is to be at ground potential by reason of its connection to the frame or housing of the igniter. The ground lead 40, at the other end of the condenser pack is likewise suitably connected to the housing 12. A number of layers of insulating board 33 are placed at the end of the condenser pack, and a second rigid metal plunger or presser member 41 is placed in the housing outwardly of such layers 33. The assembly is completed by placing end closure member 15 in the housing, pressing member 15 axially of the housing with a predetermined pressure, and edge welding closure member 15 to the housing 12. In the illustrative embodiment shown, spring 42 is placed under an axial pressure of 800 lbs. with the condenser assembly at room temperature, the spring being held under this pressure when end closure member 15 is welded to the housing.

The annular spring member 42 is dished as shown, being of a frusto-conical shape converging toward the body of the condenser. Spring 42 is made of bimetallic stock as shown in Fig. 5. The metallic component 45 lying radially inwardly of the spring member 42 has a higher coefficient of expansion than the outer metallic component 44. A satisfactory member 42 is one known as a Belleville bi-metal washer, made of a bimetallic stock sold under the trade-name "Wilco Thermo-Metal, High Heat 47." Preferably member 42 is stabilized before assembly by being heated for one hour at 650° F.

When spring member 42 is subjected to elevated temperatures its axial height, when it is unrestrained, decreases. When member 42 is held in compression between member 41 and end closure member 14 in the assembly shown, it compensates for the difference in spacing between the inner surface of end closure member 14 and the outermost layer 33. Such differences are caused by the marked expansion of condenser units 18 and 27 upon a rise in temperature, and a somewhat smaller increase in length of housing 12. Member 42 is so chosen as to maintain the condenser sections under substantially constant compression throughout the extended temperature range in which the igniter is used.

It will be seen from the above that the present invention provides means for mounting a condenser pack made up of a stack of superimposed laminated sections so as to protect it from injury. Further it holds the sections under substantially the same axial pressure, so that the capacity of the condenser does not vary appreciably, even though parts of the condenser and of the housing therefor vary substantially in length upon changes of operating temperature. It will be understood that the term "laminated sheet type condenser" used herein includes condensers in which the various layers are formed separately and then superimposed, and also includes condensers formed by wrapping the various layers in superimposed relationship as on a mandrel, withdrawing the mandrel, and flattening the wound body to form a generally flat sheet type condenser having superimposed layers.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that various changes, such as in the relative dimensions of the parts, materials used, and the like; as well as the suggested manner of use of the apparatus of the invention, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art. Thus, for example, a plurality of pressure compensating springs may be employed in pressure transmitting relationship with both ends of the condenser pack.

What is claimed is:

1. A condenser comprising a rigid housing made of material having a substantial coefficient of expansion, fixed end members on the opposite ends of the housing, a condenser pack comprising a plurality of sheets of conducting material separated by layers of dielectric material, the condenser pack being positioned in the housing with one of the broad surfaces of the pack parallel to and in thrusting relationship with one end member of the housing, and resilient compressive means acting between the other end member of the housing and the other broad surface of the pack, the resilient compressive means comprising a bimetallic spring which is so positioned as to maintain the condenser pack under a generally constant compression through out an extended range of temperature.

2. A condenser as defined in claim 1, wherein the condenser pack expands with rising temperature in a direction longitudinally of the housing to an extent greater than the elongation of the housing, and wherein the bimetallic spring contracts in a direction axially of the

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housing upon a rise in the temperature to which the condenser is subjected.

3. A condenser as defined in claim 2, wherein the bimetallic spring is of annular frusto-conical shape and is positioned generally coaxially of the condenser pack, and wherein the higher expansion component of the bimetallic spring is positioned radially inwardly of the lower expansion component.

4. A condenser comprising an elongated housing made of metal having substantial coefficient of expansion, fixed end members on the opposite ends of the housing, a stack of condenser sections in the housing disposed longitudinally thereof, the sections comprising a plurality of sheets of electrically conducting material separated by layers of dielectric material, one end of the stack abutting a first end member on the housing, a rigid plunger member slidably fitting within the housing in thrusting relationship to the other end of the stack, and resiliently compressive means interposed between the other end

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member and said plunger member, the resiliently compressive means being a bimetallic spring of annular frusto-conical shape which is positioned generally coaxial of the stack, the higher expansion component of the bimetallic spring being positioned radially inwardly of the lower expansion component, whereby the bimetallic spring contracts in length in the direction axially of the housing as the temperature to which the condenser is subjected increases.

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