Feb. 24, 1942. A. M. GEORGIEV ET AL 2,274,327

CONDENSER CONSTRUCTION

Filed March 30, 1939 2 Sheets-Sheet 1

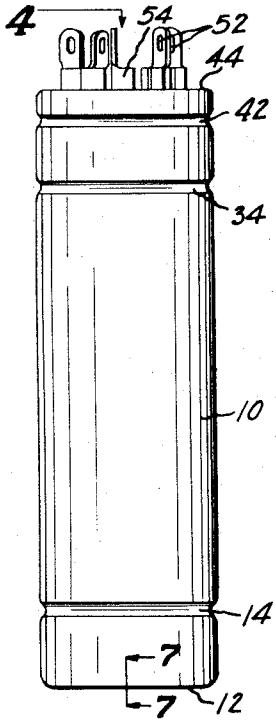


Fig. 1

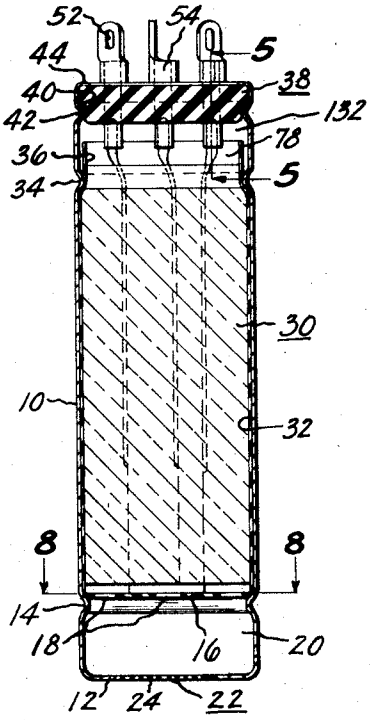


Fig. 2

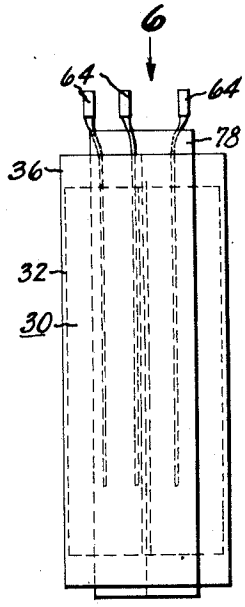


Fig. 3

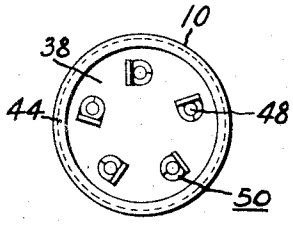


Fig. 4

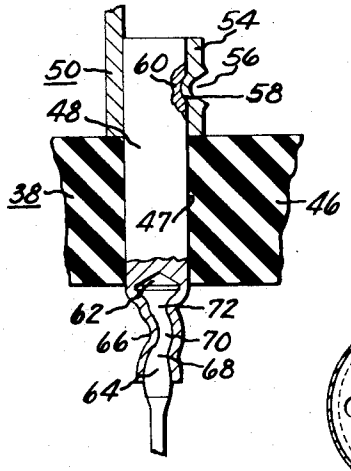


Fig. 5

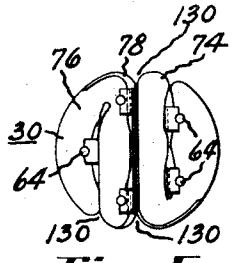


Fig. 6

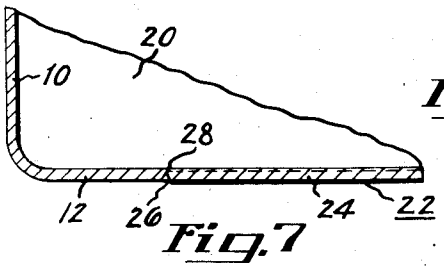


Fig. 7

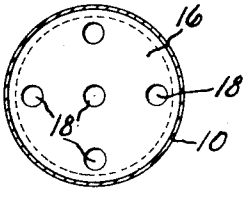


Fig. 8

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CONDENSER CONSTRUCTION

Filed March 30, 1939 2 Sheets-Sheet 2

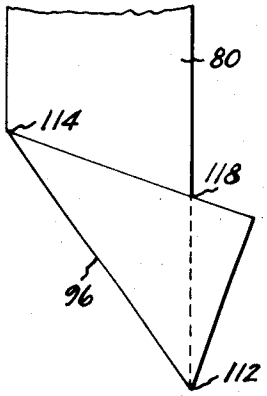


Fig. 9

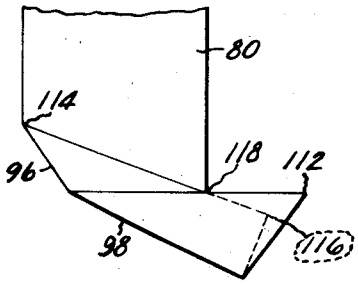


Fig. 10

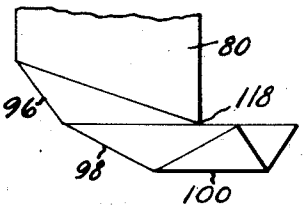


Fig. 11

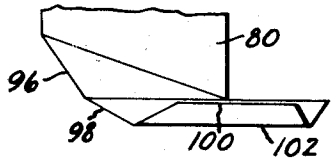


Fig. 12

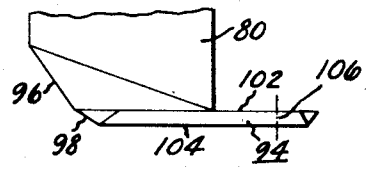


Fig. 13

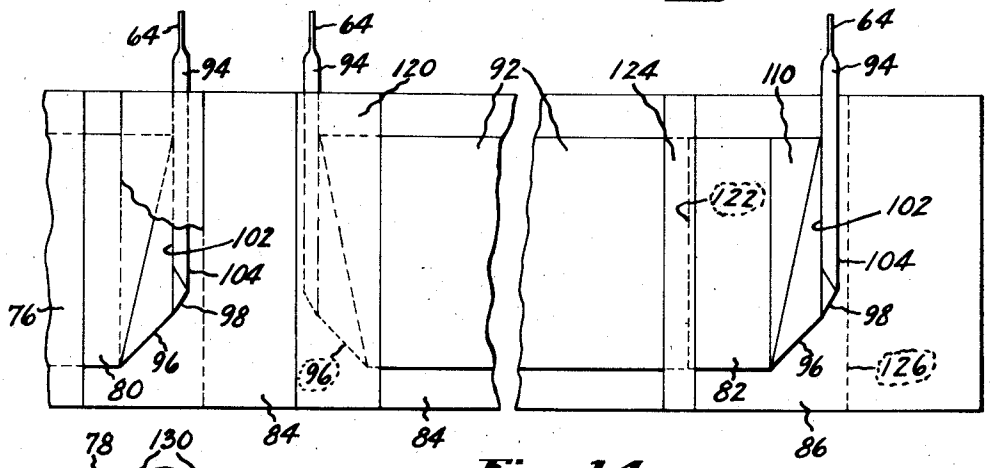


Fig. 14

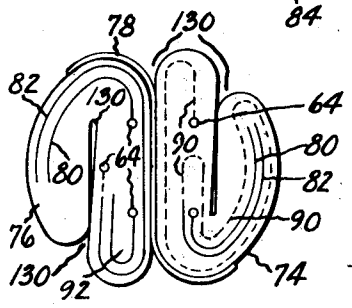


Fig. 15

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UNITED STATES PATENT OFFICE

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CONDENSER CONSTRUCTION

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Application March 30, 1939, Serial No. 264,886

7 Claims. (Cl. 175—315)

This invention relates to electrolytic condensers and has reference particularly to the multiple electrode type of condenser, or those units in which a plurality of electrode elements effect a plurality of capacities.

It is an object of this invention to provide a condenser with expansion chambers to forestall or at least reduce the probability of bursting under conditions of service.

Another object is to provide a blow out vent for a condenser casing that is normally hermetically sealed, but that will become operative should excessive pressures develop within the casing.

Another object of the invention is to construct a multielectrode condenser of compact arrangement with a small mass.

Another object is to simplify the formation of electrode tabs, and work a saving of material, by which they are formed.

Another object is to provide an efficient and dependable connection between a terminal member and an electrode tab, whereby corrosion or deterioration of the connections will be eliminated.

Another object is to provide a simple means and method for anchoring terminal members in a casing closure of molded material.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

The stated objects and advantages are accomplished by forming condenser sections to the desired capacity through winding strips of electrode material and intervening spacers in generally centered relation upon a mandrel of comparatively large diameter until the desired capacity is obtained. The condenser sections thus wound are removed from the mandrel and the finishing end of the electrode strips partially unwound for folding or formation of the electrode tabs, after which the finish end of the condenser sections are rerolled, and the section flattened, and then folded or otherwise compacted to form a composite bundle of small dimension, which is inserted in an enclosing casing. The assembled sections are disposed within a closely embracing casing that is somewhat longer than the bundle of condenser sections, the sections being spaced from either end of the casing. The casing is hermetically sealed by a terminal block carrying terminals, to one end of which are fixed terminal lugs and on the other end of which there are provided sockets for receiving the ends of electrode tabs. Before sealing the terminal block in the open end of the casing, the terminal lugs and the electrode tabs are secured in place, by staking or otherwise deforming so as to provide a good electrical contact between the engaging parts. A more detailed and specific description of the invention resides in the following specification, that refers particularly to the drawings, wherein;

Fig. 1 is an elevational view of the improved electrolytic condenser herein disclosed.

Fig. 2 is a longitudinal sectional view of the same.

Fig. 3 is an elevational view of the condenser sections or bundle of electrode elements.

Fig. 4 is a top plan view substantially as indicated by the arrow 4 of Fig. 1.

Fig. 5 is an enlarged view in section, showing details of electrical connections between the terminal lug and electrode tab, the view comprising a sectional view substantially as indicated by the line and arrows 5—5 of Fig. 2.

Fig. 6 is a plan view of the condenser section substantially as illustrated by the arrow 6 of Fig. 3.

Fig. 7 is an enlarged view in section showing a detail of the construction of casing vent means.

Fig. 8 is a transverse sectional view substantially as indicated by the line and arrows 8—8 of Fig. 2.

Figs. 9 to 13 inclusive, illustrate the method and succession of steps followed in formation of the electrode connectors.

Fig. 14 is a view of a condenser section partially unrolled at the finish end, and with parts broken away to illustrate the arrangement of electrode elements.

Fig. 15 is a schematic view indicating generally the arrangement and relation of the electrode elements in a completely assembled condenser.

With particular reference to the drawings, 10 indicates a deep drawn or extended metallic casing having a closed end wall 12, and whose cylindrical wall is rolled, spun, or otherwise deformed to provide an inwardly directed rib 14, spaced somewhat from the closed end 12 and adapted to seat a rigid disc of insulating material 16, having perforations 18. This disc when in place provides a chamber 20 that is bounded by the disc 16, the end wall 12 of the casing and the cylindrical walls thereof. In the bottom wall 12 there may be provided venting means 22, embracing a circular area formed by means of

a score mark or weakened line 26. In effecting the scoring, the body of the metal is not entirely cut through but goes only so deep as to provide a line of weakness 28, surrounding the section 24, and yet maintaining the section 24 in integral connection with the main body of the end member 12.

While the venting means has been illustrated as providing the scoring 26 entering from the outside surface of the metal casing, it is contemplated that the scoring may be effected on the inside surface of the end wall, whereupon the contiguous surface and integral connection at 28 would thence be located on the exterior surface of the end wall. Under the latter conditions the groove 26 would thence be filled, or substantially filled, with the insulating paint with which condenser casings of this type are customarily lined. In either instance of construction the venting means 24 responds to excessive pressures developed within the casing, and tears away from the body of the metal in the end wall 12, thereby affording an exit or relief passage for the excessive pressure developed. In the instance where the scoring 26 is within the casing, the insulating paint filling the groove would tend to reduce any minute leaking thru the pores of the metal at the thinned wall section 28.

Within the casing 10, and resting upon the insulating disc 16 there is a condenser body 30 that may be comprised of one or more condenser sections, as will hereinafter be described. Suffice it here to say that the condenser body 30 embraces an assemblage of electrode members and spacers eventually grouped into a cylindrical bundle and provided with tabs extending from one end of the bundle by which electrical connection is made to an outside circuit. The bundle 30 is embraced by a wrapper 32 of insulating material which when the body 30 is inserted within the casing rests against the side wall thereof substantially engaging the coating of insulating paint hereinbefore mentioned. After inserting the condenser body 30 within the casing, so that it rests upon the insulating disc 16, the side wall of the casing 10 is provided with a second inwardly directed rib 34 just at the end of the bundle near the open end of the casing. The depression in the side wall operates to position the body 30 within the casing 10 and prevent its shifting longitudinally thereof. In this respect it is desirable to have the wrapper 32 of an overall dimension greater than the length of the bundle 30, so that when both are resting on the insulator 16 the wrapper 32 will extend beyond the end of the body 30 toward the open end of the casing, substantially as indicated at 36. Thus, the rib or depression 34 engages the extended portion of the wrapper instead of the body 30.

The casing 10 is hermetically sealed by means of a terminal block or terminal head 38, that is peripherally grooved to receive a sealing ring such as a rubber band 40, that engages a third inwardly directed rib 42, where it is held in compressed relation by the turned over flange or rim 44 against the outside surface of the terminal head 38.

As to the specific formation of the terminal head 38, it comprises a molding or casting of non-conducting material such as Bakelite, and in this instance embraces a disc 46 molded with plain bore holes 47 into which, while the casting is still hot after being removed from the forms, there is inserted into each a cold terminal member 48, such as of aluminum and of a few thousandths of an inch in cross section larger than the bore of the hole, and which upon cooling of the casting are firmly held within the casting in a seal-tight relation, due to the shrinkage of the material of the casting. The terminal members 48 are particularly designed to afford electrical connections between the electrode members of the condenser sections and parts of the circuit exterior of the condenser. To accomplish this, the ends of the terminal members 48 on the exterior surface of the terminal block are closely embraced by terminal lugs 50 which are formed from T blanks, the stem of which is apertured at 52 to provide for anchorage of an exterior wire or conductor, while the arms of the T are wrapped around to provide an open or split cylinder, whose internal diameter is slightly less than the cross sectional diameter of the terminal member 48. The open cylinder of the terminal lugs is illustrated at 54, and when crowded over the end of the terminal member 48 is staked at 56 as shown in Fig. 5. This staking results in a portion 58 of a terminal lug being depressed into the body of the terminal member 48 as indicated at 60. The end of the terminal member 48 extending from the inside surface of the terminal block is provided with a straight bore substantially cylindrical recess 62, and is adapted to snugly receive the compacted end 64 of electrode tab, where it is secured as by staking at 66. It will be observed from Fig. 5 that this staking deforms the wall of the socketed end of the terminal member 48 and presses it into bighting engagement with the deformed tab 64. In Fig. 5 this is illustrated by the recurved bowed portions 68, 70 and 72.

The condenser body 30 from which extend the electrode tabs 64 here comprise a pair of condenser sections 74 and 76, and which as an entity are fashioned into a cylindrical bundle each electrically isolated from the other and in fact segregated by an insulating spacer 78 as will be observed upon reference to Figs. 6 and 15. Both of the condenser sections 74 and 76 are constructed by centering the start ends of the necessary electrode strips 80 and 82 with a selected number of spacers or paper insulators 84, 86 upon a rotatable mandrel of substantial diameter, and thence winding to a desired number of turns to provide condenser sections of prescribed capacity. By so doing, the result is a generally cylindrical body of convoluted and interleaved electrode members and spacers, in which the active areas of the electrode members are substantially coextensive and lie along a longitudinal center relative to the center of the spacers. The spacers or insulators as they are sometimes called, are of a width greater than the electrode strips and project beyond each side thereof. The condenser section 74, as illustrated, comprises one having a pair of electrodes, and is formed generally as has been set out with the exception that after sufficient of the electrode members 80 and 82 has been wound to provide the desired active area, one of the electrode members is severed from the supply roll while the other electrode member is wound one or more times completely about the section, so as to provide an electrostatic shield, which is graphically illustrated in Fig. 15 by the dashed line 90 forming a continuation of the electrode strip 82. In the instance of the condenser section 76, while following the general idea set out

hereinabove, we deviate therefrom and from the procedure followed in the formation of section 74 at the finish end of the winding, by severing at a definite point the electrode member 80, and thence complete the prescribed winding by leaving the supply end of the severed electrode strip in its centered relation, and finally cut off all electrode strips and all insulators. By so doing there is provided a condenser section in which there are three electrode members one of which is substantally coextensive with the other two. This in substance is illustrated in Figs. 14 and 15, where the third electrode member resulting from the severing of the electrode strip is indicated at 92.

In order to effect a direct and compact connection between the electrode strips and the terminal members 48, electrode connectors are formed integrally with a convenient end of each electrode strip, each of the electrode connectors comprising an extension 94 projecting transversely from the electrode strips and from the end of the respective condenser sections, to end in a generally rounded electrode tab 64. To effect the formation of the electrode connectors 94 the electrode strips are folded in a manner comprehended by Figs. 9 to 13 of the drawings, and the general arrangement of the completely folded connectors with respect to the condenser section 76 is illustrated in Fig. 14.

Referring to Figs. 9 to 13 as illustrative of the method of forming the electrode connectors 94 for the electrode strip 80, it will be observed that a short section of the electrode strip is folded obliquely with respect to the length of the strip, such as along the line 96, thence a second fold 98 is effected that is also oblique with respect to the length of the strip, but which is of a lesser angle than that of the fold 96. This step is illustrated in Fig. 10 of the drawings, and is followed by a third fold 100 which is substantially perpendicular to the length of the strip as illustrated in Fig. 11, after which two successive folds 102 and 104 are made parallel to the third fold as illustrated in Figs. 12 and 13, that result in the narrow, compact, laterally extending electrode connector 94, the end of which may be snipped off to provide the desired length as indicated at 106, and thence rounded or otherwise compacted to provide the electrode tab 64. As a result, an electrode connector is provided that is something like 32 thicknesses of electrode material at a section taken thru the portion 94 and provides a very firm substantial connector that is integrally joined to the electrode member. Where the electrode material is extremely thin, and it is desired to have an electrode connector 94 of greater mass, it is contemplated that a short section of the finish end of an electrode strip, such as 110 of the electrode 82 in Fig. 14, may be folded back. From that point on the successive steps of folding the electrode connector are substantially as set out hereinabove.

Practice demonstrates that satisfactory electrode connectors may be formed by use of a comparatively short length of the electrode strip material. As an example with an electrode strip of 2⅞ inches wide something like 3 inches off of the length of the strip is all that is necessary in forming a compact and satisfactory electrode connector. In forming the connector from that length of electrode material the first fold 96 extends from one corner 112 of the electrode strip diagonally across the strip to the opposite edge thereof to a point 114 about 4 inches from the finished end. This folding results in an overlapping portion of triangular shape designated by 112, 114 and 116, which extends beyond the edge of the electrode strip as at 118 which is about 3 inches remote from the severed end of the electrode strip. The second fold 98 manifests in bringing the fold 96 in registry with the point 118 or such as to lay along the 3 inch line, the repositioned fold 96 thence extending transverse and at right angles to the length of the strip and forming a guide to which the subsequent third, fourth and fifth steps of folding are made parallel to. This manner of folding saves a considerable amount of electrode material in the construction of electrolytic condenser, as compared with the older methods where something like 20 to 26 inches in length of electrode material was used in forming the electrode connectors. Substantially all of the electrode material, all except the three inch strip used in folding the connectors, is available for its function as a capacitative element.

After the folding of the electrode connectors, the electrode strips are recentered with respect to their associated electrode strips and spacers so that the electrode connectors extend from one end of the condenser section. This procedure is generally indicated in Fig. 14, and is followed by folding a paper insulator of sufficient thickness and lateral extent, such as that indicated at 120, one each of which is placed over the finished end of each electrode element, as indicator for the electrodes 80 and 92. In Fig. 14 there has been illustrated the shorter electrode strip 92 as extending in the opposite direction from the electrode connector, from which the electrode strip 80 extends from its electrode connector. Where that practice is followed the terminating end of the electrode strip 92 may be insulated by successive folds of the ends of the spacer 86 which are bent back over the end 122 of the strip 92 as illustrated at 124. Similarly the papers or spacers 84 may be doubled back and folded as along the line 126 so as to lay over the electrode connector for the electrode strip 82. Folding of the electrode connectors being completed, and the insulators therefor properly adjusted, the end of the condenser section is rewound after which it may be doubled, folded or rolled or otherwise compacted into the body 30 with the separator 78 and wrapper 32 as has been hereinbefore described. In this last mentioned folding or compacting and assembling of the condenser section 74 and 76, that is done with a view to leaving a firm but yet loosely compacted bundle, thru which impregnation of the sections may be effected and which will afford one or more voids or passages 130, that will extend thruout the length of the condenser section such that when assembled within the casing 10 there will be ready communication between the chamber 20 at the bottom of the casing and the chamber 132 at the upper end of the casing between the body 30 and the terminal head 38. That makes for equalization of pressure thruout the interior of the casing should there develop an increase of pressure at some localized point. Thus the whole void of the casing outside of the condenser body is available as an expansion chamber, which in the majority of cases, or in the range of contemplated service, will obviate the necessity for a condenser vent, inasmuch as the expansion chamber or chambers will permit a considerable increase of pressure within the casing without resulting in a burst of casing.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An electrolytic condenser comprising in combination, a condenser section including a plurality of electrode members with exposed connectors and loosely compacted into a bundle, a metallic casing surrounding the bundle, and a terminal block closing off one end of the casing, said casing being of substantially greater length than the condenser section, means including a part of the casing for retaining the condenser section substantially centrally of its length, whereby an expansion chamber of substantially equal volume is provided by the casing at each end of the condenser section.

2. The combination set forth in claim 1, wherein the means for positioning the condenser section centrally of the casing comprises indented portions of the casing immediately adjacent each end of the condenser section and projecting over the edge of the section.

3. An electrolytic condenser comprising in combination, a tubular metallic casing having inwardly directed rings spaced from each end thereof, a condenser section enclosed within the casing and disposed between the spaced rings so as to be engaged at each end thereof, and a terminal member hermetically sealed to the open end of the casing, whereby an expansion chamber is provided at each end of the casing between the ends of the condenser and the end members of the casing.

4. The combination set forth in claim 3, wherein the expansion chambers at each end of the casing are in communication along the folds of the section, and wherein the volumetric content of the expansion chambers is in the order of ⅓ of the total volumetric content of the casing.

5. An electrolytic condenser comprising in combination, a deep tubular casing having an inwardly directed ring spaced from the closed end thereof, a perforated insulator supported by the ring within the casing, a loosely compacted condenser section wrapped with an insulator being disposed within the casing so as to rest upon the insulator disc, said condenser section when so positioned ending remote from the open end of the casing and providing electrode tabs exposed thereto, said casing providing means engaging the end of the section at the open end of the casing for restraining the section from longitudinal movement within the casing, and a terminal block spaced from the end of the condenser section and secured in sealing relation in the open end of the casing.

6. The combination set forth in claim 5, wherein the chambers within the casing at each end of the condenser section are in fluid communication through the voids between the folds of the condenser section, whereby the pressure developed in one chamber is readily communicated to the other chamber, and wherein the closed end wall of the casing provides a weakened area operable as a pressure relief vent upon the occurrence of excessive pressures within the casing.

7. In an electrolytic condenser having electrode members of thin metallic section, the combination of each electrode member having successive folds to form a flat laminated connector of uniform cross section extending from one end thereof and gathered at the free ends into a compact rounded tab, the electrode tab formation including a first and second fold of the electrode material obliquely with respect to the longitudinal dimension of the electrode, and subsequent folds of the electrode material substantially at right angles to the longitudinal dimension thereof.

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