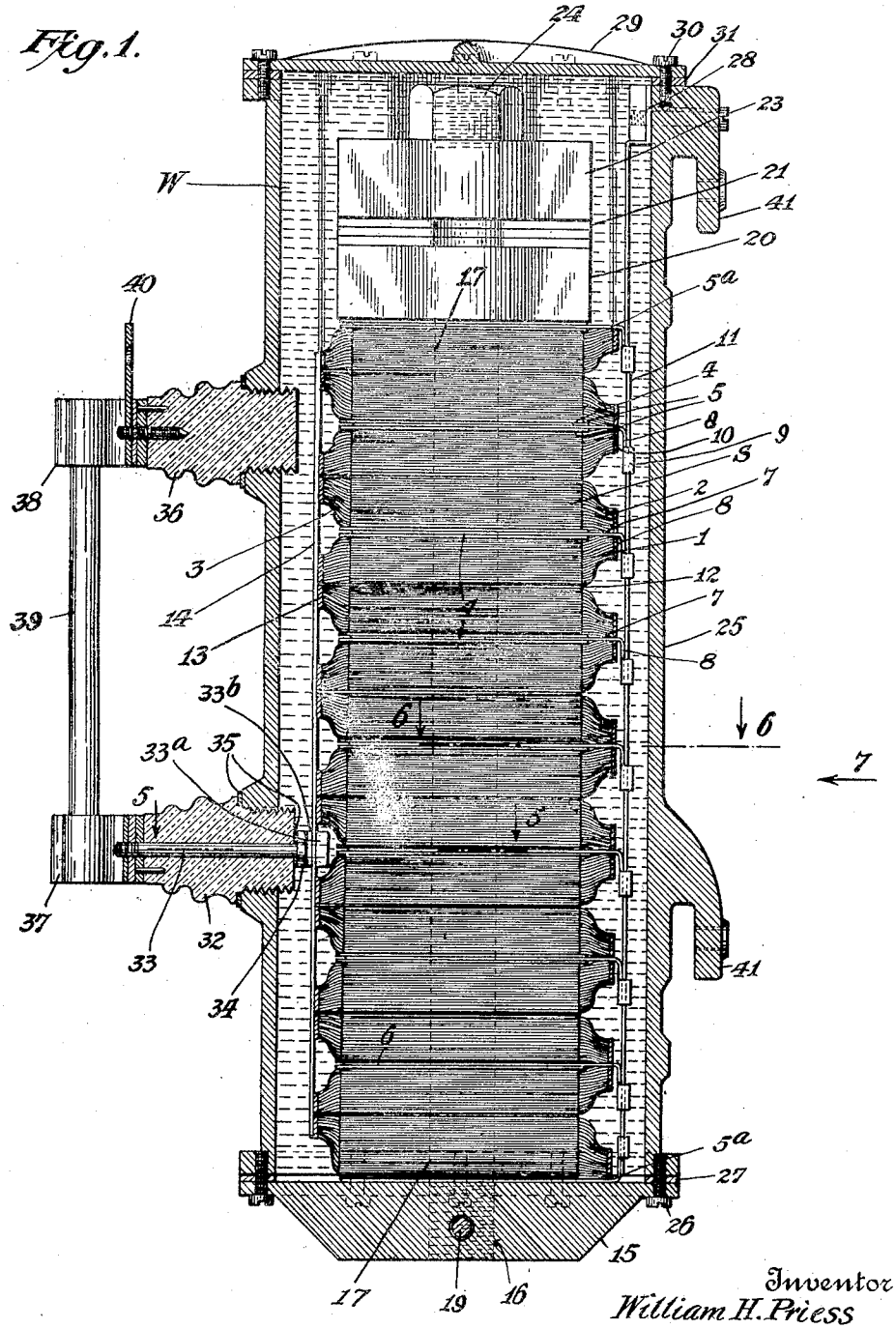
Sept. 29, 1925. 1,555,252

W. H. PRIESS

ELECTRICAL CONDENSER

Filed June 7, 1921 4 Sheets-Sheet 1

Fig. 1.



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ELECTRICAL CONDENSER

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Fig. 2.

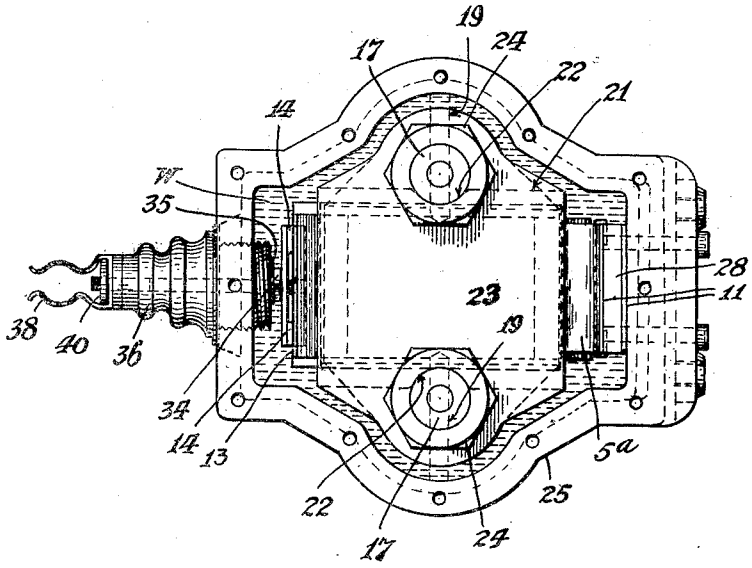
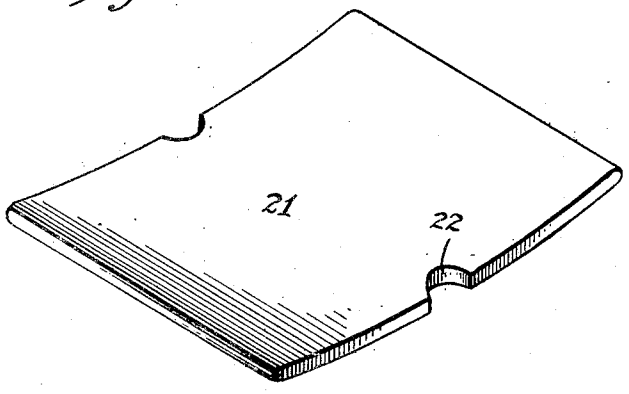


Fig. 3.



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Fig. 4.

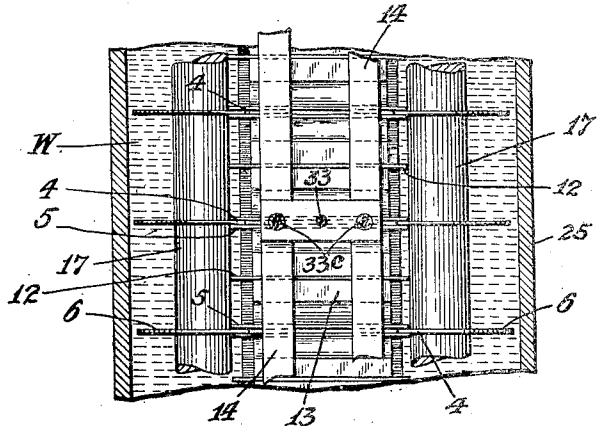
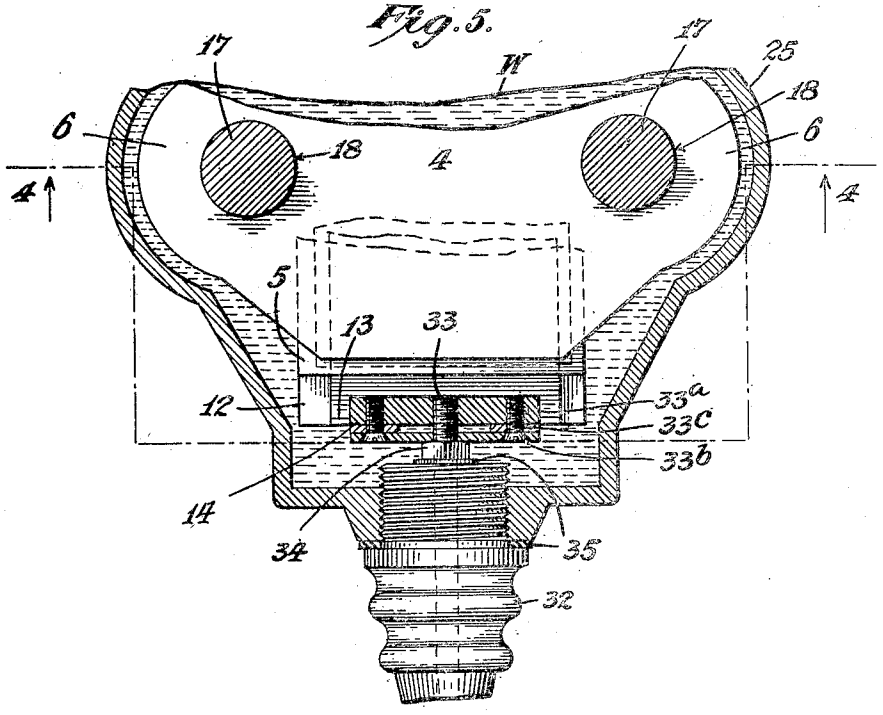


Fig. 5.



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Fig. 6.

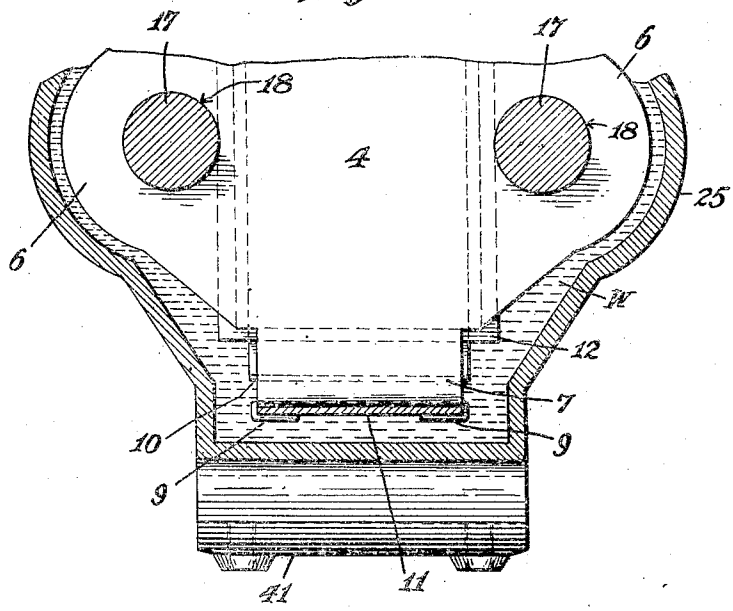
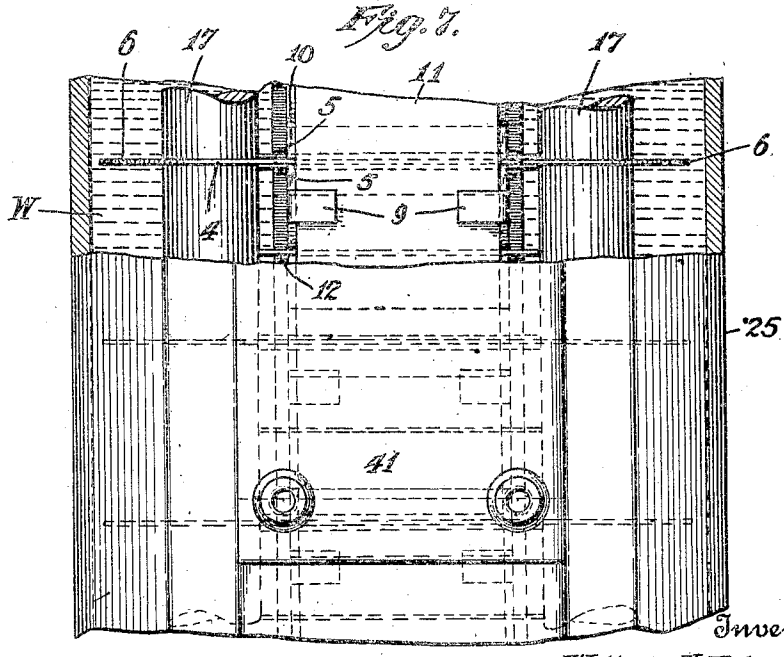


Fig. 7.



Inventor.

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Patented Sept. 29, 1925. 1,555,252

UNITED STATES PATENT OFFICE.

WILLIAM H. PRIESS, OF BELMONT, MASSACHUSETTS, ASSIGNOR TO WIRELESS SPECIALTY APPARATUS COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF NEW YORK.

ELECTRICAL CONDENSER.

Application filed June 7, 1921. Serial No. 475,645.

To all whom it may concern:

Be it known that I, WILLIAM H. PRIESS, a citizen of the United States of America, and a resident of Belmont, State of Massachusetts, have invented certain new and useful Electrical Condensers, the principles of which are set forth in the following specification and accompanying drawings, which disclose the form of the invention which I now consider to be the best of the various forms in which the principles of the invention may be embodied.

This invention relates to electrical condensers. The invention is capable of being embodied in condensers of many types for high potential use and specifically includes condensers of the sheet type for use in radio communication circuits, electric power circuits, and the like.

An object of the invention is to provide a condenser adapted mechanically and electrically to preserve during service the high pressure initiated upon the condenser stack during the process of manufacture and consequent greatest practicable closeness of contact of surfaces of dielectric and conducting sheets, all under conditions of compactness and lightness.

Another object of the invention is to provide a construction permitting the building of a stack relatively long compared to the shortest dimension of the stack.

Another object of the invention is to provide a construction comprising means for conducting and radiating heat from the interior of the stack.

It is important that the heat developed in the stack, due to dielectric, ohmic and other losses, should be speedily dissipated and conducted to the space external of the condenser. In condensers of the type in which an embedment of insulating material is utilized for embedding a stack within its casing, it is very difficult, owing to the heat insulating properties of the embedment, to properly conduct heat and radiate it from the condenser. Assume a temperature rise in some region in the stack, this region will in general be in the dielectric, which possibly may be of mica. On both sides of each mica dielectric are metal sheets or foil elements. These sheets are joined in parallel groups in a given condenser or condenser section. Their thermo-conductivity is fairly great along the direction of current flow thereon. I have provided means, applicable to condenser stacks whether in series sections or in parallel sections, for conducting the heat developed in the stack through these metal sheets of the condenser to a metal casing, where it may be readily radiated to the air. The thermo-conductivity via opposing foil elements is a maximum when there is but one section with the foil elements of maximum thickness and maximum conductivity. When the foil elements of each opposing group are connected in parallel as illustrated, one set of foils may be connected to a metal casing as a terminal permitting the other terminal connected to the opposing foil sheets to be designed simply as a current-carrying member. The invention provides, in effect, a heat-conducting element in contact with the surface of each dielectric or mica in the stack, these elements having a highly thermal conductive path to a casing. This I have accomplished by the present invention.

I have found by experience that an unsupported stack which is more than twice as high as the smallest plane dimension of the stack, tends to buckle when placed under compression. In the present invention, I place stiff pieces in the stack at spaced points, dividing the stack into sections of small mechanical height, providing mechanical means which opposes the forces tending to buckle the stack under compression. These dividing pieces in turn engage portions of the clamp or other part of the condenser which in turn braces them. With this construction, it is possible to build a condenser stack of any height compared with the smallest dimension of the stack without buckling under pressure.

In the accompanying drawings,

Figure 1 is a sectional elevation of the complete condenser not showing one of the two connecting rods 17;

Fig. 2 is a plan view of the condenser with the cover and fuse omitted;

Fig. 3 is a perspective view of one of the spring plates used in the condenser;

Fig. 4 is a detail vertical section on the line 4—4 of Fig. 5, looking in the direction of the arrows, and on a reduced scale from that of Fig. 5;

Fig. 5 is an enlarged horizontal section on

the line 5—5 of Fig. 1 looking in the direction of the arrows, and with parts broken away;

Fig. 6 is an enlarged horizontal section with parts broken away on the line 6—6 of Fig. 1, looking in the direction of the arrows; and

Fig. 7 is a side elevation of a portion of Fig. 1 looking in the direction of the arrow of Fig. 1, with part of the casing broken away.

The specific construction and embodiment of the invention herein disclosed is a 5 K. V. A. power factor condenser, workable at 60 cycles, and capable of standing a testing voltage of 3200 maximum for two hours. The invention, however, is not limited to a commercial construction of this specific type, although it is adapted for continuous service as required in power factor work.

Referring to Fig. 1, I have illustrated a stack S which, for convenience in assembly, has been built up and assembled of several sections 1, each section terminating at one end in a foil bunch or foil terminal 2, and at the opposite end in a foil terminal 3. Each section of the condenser comprises alternate sheets of conductors and dielectric, preferably lead foil and mica, built up in the manner hereinafter described.

In the embodiment of the invention here illustrated, between each alternative pair of sections is located a rigid, stiff plate 4, each of such plates having on opposite sides thereof (and between it and the adjacent sections) separators 5 of dielectric, preferably mica. Each plate 4 projects at opposite sides 6 (Figs. 4 to 7) beyond the stack, and beyond the foil and dielectric sheets constituting the stack, and also is provided with a tongue 7 (Fig. 6) projecting between adjacent foil bunches or terminals 2, as illustrated in Figs. 1 and 6. The outer portion of each tongue 7 is bent at an angle 8, Fig. 1, and such portion 8 is provided with clips 9, which are bent around a copper conducting strip or lead 11 and electrically connected thereto. The foil bunches 2 upon opposite sides of the tongue 7 are soldered to this tongue as indicated at 10. Several of the double pairs of connected sections with the interposed plates 4 are mounted in superimposed position over each other in a stack, each adjacent pair of sections which are not connected together by the foils being separated by a mica separator 12.

In the embodiment of the invention disclosed in the drawing, there are seven double sections or pairs, each containing between its sections one of the plates 4. At the opposite ends of said seven double sections are single sections, each provided upon the outside thereof with rigid plates 5^a, like plates 4, connected in like manner to the strip 11 and adjacent foil terminals. The foil terminals 3 projecting from the opposite side of the stack are connected together by means of solder 13 (Fig. 1) to a pair of conductors 14 (Fig. 2), which are insulated from the casing and clamp hereinafter described and which may comprise any suitable conducting material such as Belden braid.

The members 4 and 5^a are of a material such as to form stiffening means for the stack, and are arranged at equal distance along the stack. Although these members or plates 4 and 5^a may consist of any good stiff material, yet, preferably, in view of the fact that they are utilized for soldering the terminals 2 thereto in heat and electrical conductive relation, should consist of some good conductive metal having high heat-conductive properties, such as copper. In the embodiment of the invention disclosed, the height of the stack is over six times that of the width of the foil sheets used in the construction of the stack. In the specific condenser herein disclosed as an example of an embodiment of the invention, the copper plates 4 and 5^a had a thickness of about $\frac{1}{32}$ of an inch, although this thickness would vary in condensers of different types and constructions and according to the requirements.

The condenser stack S rests upon a cast iron base member or pressure plate 15, having at opposite sides thereof threaded holes 16, into which are threaded iron supporting rods 17 (Figs. 1–7) arranged and spaced upon opposite sides of the stack and extending through holes 18 in and closely fitting the plates 4 and 5^a at opposite sides of the stack, whereby the plates 4 are braced by rods 17 against turning or buckling although plates 4 may be braced by any other fixed part of the condenser. The rods 17 are further secured in the pressure plate 15 by means of pins 19 extending through the rods 17, into the sides of casting 15 (Figs. 1 and 2). Mounted upon the opposite end of the stack and provided with holes receiving the rods 17 is a pressure plate or metal casting 20. Mounted upon this casting are a plurality of spring plates 21 of a bowed character disclosed in Fig. 3 when under no stress and nested one above the other with their convex sides uppermost. Each of these spring plates is made of vanadium steel and the complete spring is designed to require a pressure in the neighborhood of a ton per square inch of the active area of the stack to flatten it out.

In order to position these springs 21 in place and to lock them in position, they have upon opposite sides thereof notches 22 (Fig. 3) adapted to fit around the supporting rods 17 as illustrated in Fig. 2, whereby they are held in place by the rods 17. Mounted above the spring plates 21 is a second pres-

sure member or metal casting 23 having holes receiving the rods 17 as illustrated in Fig. 2. Nuts 24 are threaded upon the upper ends of the two rods 17 and exert a pressure upon the upper pressure plate or member 23 for holding the stack under compression. In this embodiment of the invention, the plates or pressure members 15 and 23 with the connecting rods 17 and their nuts 24 constitute the clamp of the present invention.

The springs 21, co-operating with the clamp, provide a rigid, powerful clamp for maintaining a resilient spring pressure upon opposite ends of the stack of the order of magnitude of two thousand pounds per square inch of the active area of the stack, whereby the sheets of dielectric and foil processed as hereinafter described are maintained in intimate contact. The copper conductor 11 is electrically and conductively connected to foils or conductors in the stack in contact with all the dielectrics of the stack, whereby heat may be conducted from the stack as it accumulates in the dielectric or in the conductors.

For radiating the heat conducted by the strip 11 and for mechanically protecting the condenser stack, a metal casing member 25 encircles the sides of the stack and clamp. This member is open at its opposite ends and is closed at one end by the casting 15 to which it is secured by screws 26, a suitable rubber or lead gasket 27 being interposed between the casing 25 and casting 15 to provide a water-tight joint, thus providing a casing with member 15. The copper strip 11 is electrically and thermally connected at one end 28 to the casing 25 and also conductively connected to the casing through plate 5^a to member 15 and plate 5^a at the other end.

The conductor 11 of the present invention has a thermal conductivity to the casing of approximately the same order of magnitude as the aggregate thermal conductivity of foils or stack conductors to which it is electrically connected. That is to say, the conductor 11 preferably is of such material and such dimensions as to properly and fully conduct the heat delivered to it by the foils in contact therewith. By connecting conductor 11 at both ends to the casing, a conductive path is provided towards both ends of conductor 11, a part of the heat generated in the stack going one way on the conductor to the casing and a part going the other way. Were the conductor connected to casing 25 at one point only, its thermal conductivity would have to be approximately twice as great.

The top of the casing is closed by a metal cover 29, secured in place by means of the screws 30 extending through the cover into the casing 25, a rubber or lead gasket 31 being interposed between the cover and the casing for water-tightness. Prior to the securement of the cover 29 in place, however, the whole condenser stack is embedded with suitable insulating material W, such as oil or paraffin, in the manner hereinafter described.

The clamp 17, etc., casing 25 and plates 4 and 5^a being all electrically connected together and at the same potential may be placed close together to provide a compact condenser. The clamp and plates 4 and 5^a are in direct contact with the stack and may be placed close to casing 25, whereby the heat may be more readily conducted from the stack via embedment W. The plates 4 project substantial distances into the embedment W with their edges close to casing 25, providing heat-conducting paths through the embedment.

A thermal path for the heat developed in the stack S is also provided, co-operating with path 11, to the casing from plates 4 and 5^a, (to which foils are electrically connected), to the parts 20, 21 and 23 in conductive relation to the upper plate 5^a and from these parts to rods 17 in contact therewith and also from plates 4 and 5^a to rods 17 in contact therewith. The rods 17 are conductively connected to the casing including parts 15 and 25 as described above.

In order to bring out the opposite terminal of the stack from the pair of conductive strips 14, there is threaded or otherwise secured into the casing 25 an insulating bushing 32 having extending therethrough a metal rod 33 which is electrically connected to the conductors 14. This connection is preferably obtained, as more clearly shown in Fig. 5, by providing a pair of metal clamping members 33^a and 33^b upon opposite sides of conductors 14 and secured thereto by screws 33^c extending through them and conductors 14, the inner end of the terminal 33 being threaded into this clamp. Washers 35 are interposed between bushing 32 and the casing 25, and between the bushing 32 and the nut 34 on the inner end of rod 33 for the purpose of securing a water-tight joint. In spaced relation to the bushing 32 is a second supporting bushing 36 (Fig. 1) threaded or otherwise secured into the casing 25. Secured to the outer ends of the bushings 32 and 36 are spring clips 37 and 38 of phosphor bronze, adapted to receive and support a fuse 39 of any suitable construction, protecting the condenser. The fuse 39 is electrically connected at the clip 37 with the high potential portion of the condenser through the conductor 33, and the high potential terminal 40 of the condenser is electrically connected to the opposite end of the fuse. In the present disclosure, the cas-

ing 25 constitutes the low potential part of the condenser. The casing is also provided with a pair of spaced hooks 41 (Fig. 1) on the side remote from the fuse 39, whereby the condenser may be secured in any suitable rack or in any suitable place and form the low potential connection to the rack.

The above-described construction is one which provides a very strong clamp for the stack, maintaining the sheets in intimate contact and in which the foil sheets projecting from one side are all connected together and to the casing, preferably as here illustrated, although not necessarily, constituting one terminal of the condenser, and the opposing sheets from the other side are all connected together and to a conductor insulated from the casing and constituting another terminal of the condenser.

In the embodiment of the invention disclosed, there are interposed in the stack spaced copper supporting plates 4 braced at points externally of the stack and as here illustrated, connected to the iron rods 17 forming part of the clamp and bracing the stack. These plates also serve as supports for the foil bunches 2, to which they are electrically connected. Conduction of heat from the stack to the outside air in the power factor condenser herein disclosed is accomplished by connecting one side of every mica sheet in the stack to the metal casing, either as a terminal or otherwise. The plates 4 of the present invention are primarily mechanical members for supporting the stack and bracing it, and secondarily conductors for supporting the foil bunches 2 and serving as connectors therefrom to the casing through the thermal paths provided, these connections having good thermo-conductivity and forming good electrical contact.

The condenser stack S, such as disclosed in the drawings herewith and above described, may be built by first building a number of sections in a material stack in the manner described in my co-pending application, Serial Number 456,903, filed March 30, 1921. As in the application above-mentioned, this material stack is built up of alternate sheets of foil and dielectric, the sheets being preliminarily dipped in molten paraffin to wash out air and moisture. After each section is built as above described, a temporary brass separator or marker is placed on top of the section and another section built on top of the brass separator, etc. After building approximately four inches of stack, the stack is taken from the building stand and transferred to a cooling stand. The cooling stand consists of four notched vertically-spaced pins, permitting the stack to be centered between the pins. Over the stack when in the cooling stand is placed a metal plate, and on this plate is placed a second metal plate having a depression for centering a **C** clamp. The stack after being transferred to the four pin stand is placed in a wax bath and heated to a temperature of 150° C. for a half an hour. It is then removed from the bath, the plates last mentioned are added, and the whole is clamped in a **C** clamp while hot, applying a pressure of approximately a ton per square inch of active surface. The stack is then cooled by an air blast. After the cooling, the stack should be removed from the cooling stand, and the sections tested for capacity and thickness.

In the present embodiment of the invention, I have illustrated sixteen sections (fourteen double and two end single sections). After enough sections have been made in the manner above-described, they are placed under pressure in a clamp with the sections separated by insulating material and tested for breakdown, for example,—3,500 volts maximum, 60 cycles, applied for five minutes. Sections which break down can be reclaimed and re-entered into the process at a point equivalent to removing the stack from the first stand. Sections that have passed the test then have their foil ends clipped and soldered together. Two soldered sections should then be assembled on either side of a bracing plate 4, and soldered to this plate in the manner above described. Sectional mica separators 5 are then inserted on either side of the plate 4 between the plate and each section (Fig. 4). Sections should be polled so that the sides of the sections away from the plate 4 end in a strip of foil which will connect to a group in contact with the pair of Belden braid conductors 14 (Fig. 1). Seven such assemblies should be made. Two assemblies should be made with the plates 5^a for the two end sections, consisting each of one section and a sectional separator 5. These two assemblies are to be placed at the opposite ends of the stack after the partial assembly of the clamp.

The two rods 17 of the clamp are then threaded and secured in base plate 15. One of the single end sections is next slid over the two rods 17. Holes 18 in the plate 5^a (like plates 4) are provided for this purpose, so that the member 5^a of such single section assembly rests upon the casting 15 as shown in Fig. 1. (Sectional separators 12 (Fig. 4) are inserted between each section group in assembly in the clamp.) The seven double sections then are assembled as indicated in Fig. 1 and the remaining single section with its plate 5^a (like plate 4) is then slid over the rods 17 on top of the double sections with the plate 5^a at the top. The pressure plate 20 is now placed on top of the stack S over rods 17 and against plate 5^a.

The spring plates 21 are next positioned, and on top of these the upper pressure plate 23 is mounted upon the rods 17. The nuts 24 are now threaded upon the rods 17, deflecting the spring 21 approximately $\frac{1}{32}$ of an inch, all in the same direction. The whole stack with its clamp is then placed in a large wax boiler and heated for about forty-five minutes at a temperature of about 120° C. in a bath of molten paraffin. The assembly is then removed, and the nuts 24 tightened to flatten out the spring 21 while the stack is still hot, the flattening of the springs indicating that the correct pressure is now applied to the stack and is such as to maintain the dielectric and foil of the stack in intimate contact and to remove all air and moisture from between the sheets and remove most of the insulating material or wax from between the sheets of the stack. The stack should now receive another fifteen minutes' heating at 140° C. in a bath of molten paraffin and then be removed from the bath to ascertain whether any release of pressure has occurred due to the squeezing out of wax in the stack. If such release has occurred, the stack is tightened up, reheated in a bath of molten paraffin, and removed and the clamping repeated as above described until no release of pressure occurs. After this, the sections are again tested for breakdrown.

After passing the breakdown test, the strip 11 is positioned and the clips 9 on the copper conductors 4 are bent around the strip 11 and soldered to it. The two Belden braid strips 14 are laid along the length of the opposite pole terminals of the stack and soldered to them. The parts 33^a and 33^b (Fig. 5) are then secured to the members 14 by means of the screws 33^c, and soldered thereto if necessary. A gasket 27 (Fig. 1) is then placed upon the base plate 15, and the casing 25 placed over, down and around the clamped stack, and screwed to the base plate. The high potential stud 33 and bushing 32 are then assembled and stud 33 screwed in the clamp 33^a, 33^b (Fig. 5), insulators 32 and 36. The ground strip 11 is screwed to the case 25 at point 28.

A process gasket is now placed around the top of the case 25, a head plate placed thereon, a second gasket secured around the head plate, and a waxing head is added and screwed into place; this head may be of a character described in United States patent to Byron Macpherson, No. 1,502,343, dated 22 July, 1924. The condenser casing 25 and its head are then filled with hot paraffin around the stack and heated to 140° C. for a half-hour. The wax is then poured off and the entire condenser and head placed in a vacuum tank. Vacuum is applied and the condenser filled under vacuum with paraffin wax, which has been boiled and strained. The wax when flowing should have a temperature of approximately 150° C. After filling the casing and head with molten paraffin, air should be allowed to enter the vacuum tank. The condenser is then removed and cooled from the bottom upwardly, either by forcing an air blast against the bottom or inserting hot irons in the head, or both. More molten wax should be added to the head as the shrinkage pulls down the level of the wax in the head. After cooling and solidification of the wax, the waxing head should be removed, the surplus wax cut off, and the final cover 29 (Fig. 1) placed in position over its gasket 31. The upper part of the stack and clamp may be braced in the casing by a screw (not illustrated) threaded through cover 29 and engaging member 23. The terminal 14 and fuse clips 37, 38 then should be assembled and the condenser tested.

The above-described method of building a condenser stack and embedding it provides a construction as described in my application above-mentioned in which the sheets of the stack are maintained in intimate contact under spring pressure, and also provides an embedment W which is holosteric, i. e., a compact, uniform embedment, free from voids and holes.

It is to be understood that the invention is not limited to the embodiments and features specifically shown and described herein, but that such embodiments and features are subject to changes and modifications without any departure from the spirit of the invention.

I claim:—

1. In an electrical condenser, a stack comprising sheets of dielectric and opposing conductors, a stiff plate interposed in the stack between the ends thereof, and means external to the stack for engaging the plate to brace the plate and the stack, said means comprising a clamp arranged to compress the stack from end to end.

2. In an electrical condenser, a stack comprising sheets of dielectric and opposing conductors; means for compressing the stack from end to end, said stack being of sufficient length to be liable to buckling; and a stiff plate interposed in the stack between the ends thereof and engaged externally of the stack by said clamping means to brace the plate and stack.

3. In an electrical condenser, a stack comprising sheets of dielectric and of conductors projecting beyond the dielectrics; a metal casing enclosing said stack with a space around the sides thereof and the ends of the projecting conductor sheets; and means located in the space between the metal casing and the ends of the projecting conductor sheets, and thermally and electrically connected to the projecting por-

tion of a plurality of adjacent conductor sheets in the space between the latter and the casing, said means having a thermal conductivity of approximating the order of magnitude of the aggregate thermal conductivity of the conductor sheets to which said means is connected, and means being conductively connected to said metal casing as a heat-radiating means.

4. In an electrical condenser, a stack comprising opposing sheets of foil elements and interposed dielectrics, the foil elements of each set being connected in parallel and projecting beyond the dielectrics; a metal casing enclosing said stack with a space around the sides thereof and between the casing and the ends of the projecting conductor sheets; a thermally conducting strip independent of the casing, extending from end to end of the stack, and conductively connecting the foil elements of one set together, said means being thermally and electrically connected to the casing at two points in the vicinity of the respective ends of the stack; and a terminal lead for the other set of foil elements, said lead being insulated from the metal casing and extending therethrough.

5. An electrical condenser which comprises a stack of sheets of dielectric and of conductors which project beyond the dielectrics, said stack including a metal plate of greater thickness than the conductor sheets but disposed therein in parallelism with said sheets intermediate the ends of the stack, and said plate projecting between projecting portions of a plurality of said conductor sheets; the projecting portion of said plate being soldered to the adjacent projecting portions of a plurality of the conductor sheets to be in good conducting relation therewith; heat-radiating means; and a thermal conductor connected between said radiating means and said soldered plate and conductor sheets, the thermal conductivity of said thermal conductor approximating the order of magnitude of the aggregate thermal conductivity of the soldered-together plate and stack conductor sheets.

6. In an electrical condenser, a stack, a clamp for said stack, and a stiff plate interposed between portions of said stack and engaged by said clamp to prevent buckling of the stack.

7. In an electrical condenser, a stack comprising alternate sheets of dielectric and of foils projecting beyond the dielectrics; a plate of metal stiffer than the foils and interposed parallel thereto in the stack between its ends, one end of which stiff plate projects beyond the stack, and the adjacent projecting foils on opposite sides of the stiff plate being electrically and thermally joined with the projecting portion of said plate; a thermally conducting strip extending from end to end of the stack; and a metal clip connecting said joined foils and plate to said strip in heat-conducting relation thereto.

8. An electrical condenser comprising a stack of sections of sheets; a clamp for compressing said stack from end to end; and stiffening plates interposed between certain of said sections, each stiffening plate being connected to said clamping means to be braced thereby, the stack as a whole being thereby braced by the aggregation of plates braced by the clamping means.

9. In an electrical condenser, a plurality of sections comprising alternate sheets of foil having foil terminals and dielectric forming a stack, plates of relative stiff metal interposed between certain of said sections and each projecting beyond the same at opposite sides and one end, and a clamp for said stack cooperating with said plates at said opposite sides for bracing the same, the foil terminals of adjacent sections upon opposite sides of the end projecting portions of said plates being electrically connected to said plates and supported thereby.

10. In an electrical condenser, a stack of sections having foil terminals connected in parallel, metal plates interposed between certain of said sections and each projecting beyond opposite sides thereof and one end, a clamp for said stack co-operating with said plates at said opposite sides for bracing the same, the foil terminals upon opposite sides of the projecting ends of said plates being electrically connected thereto, a thermally conductive strip electrically connecting the end projecting portions of said plates, means electrically connecting the opposing terminals of said sections in parallel, a metal casing to which the conductive strip is thermally and electrically connected, and a terminal insulated from said casing and connected to said opposing foil terminal connecting means.

11. An electrical condenser which comprises a plurality of sections of sheets each having opposing sets of conductor sheets; a metal casing for such stack; a metallic clamping means arranged to compress the stack from end to end and having thermal and electrical connection with the casing as a heat radiator; metal stiffening plates interposed in the stack between its ends, the several plates being soldered to adjacent conductor sheets on opposite sides of each plate and in locations outside of the stack; said stiffening plates having metallic connection with the clamping means to brace the stack and constitute a thermal and electrical path to said casing; and a second thermal and electrical path between said plates and said metal casing and in shunt with said path via said clamping means.

12. In a foil-sheet stack condenser, the combination with a plurality of stack-sec-

tions insulated from one another at their faces and each comprising mutually distributed sheets of dielectric and foil armatures, with the foil armatures of opposite potential projecting in bunches from different portions of the side of the stack-section and having terminal edges lying at said side; the stack of said sections being of such a nature as to prevent desirable dissipation from the stack itself of the heat generated therein; the stack-sections being electrically connected together via said projecting foil bunches; of metal heat dissipators exposed to atmosphere and extending as plates over the faces of the stack-sections and between which said sections are clamped, said heat dissipators being in good thermal connection with said projecting foil bunches.

13. In a foil-sheet stack condenser, the combination with a plurality of foil-armatures distributed with dielectric sheets through the stack, the foil armatures of opposite polarity projecting from different portions of the side of the stack and having terminal edges lying at said side; of a metallic clamping member for the stack; the stack being of such nature as to prevent desirable dissipation from the stack itself of the heat generated therein; and metallic means located exteriorly of the stack of sheets but adjacent the foil terminals of one polarity at the side of the stack, said metallic means establishing good thermal connection between said metal clamping member and said foil terminals.

14. In an electrical condenser, a stack comprising a number of sections having foil terminals projecting at opposite ends of the sections, a pressure member at one end of the stack, a pressure member at the opposite end of said stack, a spring plate upon one of said pressure members, a pressure member on said spring plate, rods secured to and connecting said pressure members for clamping the stack, metal bracing plates interposed at spaced distances in said stack between sections, projecting at opposite sides beyond the stack and having holes receiving said rods whereby the stack is braced and supported by said plates and rods, said plates having parts projecting at one side of the stack between foil terminals which are electrically connected thereto and supported thereby, a common conductor electrically and conductively connected to said projecting parts of the bracing plates, means electrically connecting opposing foil terminals projecting at another side of the stack, a metal casing enclosing the stack and secured to one of said pressure members and to which said common conductor is electrically connected, a terminal extending through said casing and insulated therefrom and connected to said means connecting said opposing foil terminals, a fuse electrically connected at one end to said terminal, supported on said casing and insulated therefrom, and an embedment of insulating material within said casing and embedding said stack.

15. In an electrical condenser, a stack of alternate sheets of foil and dielectric, stiff metal plates interposed in said stack at spaced points and to which certain of the conducting foils are electrically connected, a metal clamp for said stack engaging said plates for bracing the stack, a conductor having high thermal conductivity connected to said plates, a metal casing enclosing said stack and clamp and to which said clamp and conductor are electrically connected, and an embedment of insulating material within the casing around the stack and clamp.

16. In an electrical condenser, a stack comprising sheets of conductors and dielectrics, a metal clamp for compressing the stack from end to end; a metal casing enclosing said stack and engaging said clamp, whereby said clamp provides a thermal path from the stack to the casing; and a heat conductor extending between the metal casing and portions of the conducting sheets which project from the stack and arranged in good thermal conductivity with said sheets and casing to constitute a second thermal path between stack and casing in shunt to said first path via the clamping means.

17. In an electrical condenser, a stack comprising opposing sets of conductor sheets and interposed dielectric sheets; a metal casing enclosing said stack; and a thermal conductor extending within the casing, having high thermal conductivity, and connected intermediate its ends to one set of stack-conductors, said thermal conductor being thermally conducted to the casing at two points beyond its connection with said set of stack-conductors.

18. In a foil-sheet stack condenser, the combination with a plurality of foil-armatures distributed with dielectric sheets through the stack, the foil-armatures of opposite polarity projecting from different portions of the side of the stack and having terminal edges lying at said side; the stack being of such nature as to prevent desirable dissipation from the stack itself of the heat generated therein; of a metallic heat radiator extending over an end of the stack and against which the stack is clamped from end to end, said heat radiator being exposed to atmosphere and in good thermal connection with the projecting foil portions at the side of the stack.

19. In an electrical condenser, a stack comprising opposing sets of conductor sheets and interposed dielectric sheets; a metal casing around such stack and providing a filler space between the stack and cas-

ing; insulating material in such filler space; a thermally conducting strip extending through the insulating material within the casing from one end of the stack to the other; means for thermally connecting to said strip the sheet conductors of one set; and means for thermally connecting opposite ends of said strip to the metal casing at points in the vicinity of the respective ends of the stack.

20. In a foil-sheet stack condenser, the combination with a plurality of foil-armatures distributed with dielectric sheets through the stack, the foil armatures of opposite polarity projecting in bunches from different portions of the side of the stack and having terminal edges lying at said side; the stack being of such nature as to prevent dissipation from the stack itself of heat generated therein; of means for removing the generated heat directly from the foil-armatures distributed with the dielectric sheets, said means comprising metal heat dissipators exposed to atmosphere and extending as plates over and clamping between them the faces of the stack-sheets, said heat dissipators being in good thermal connection with the projecting bunches of stack-foils.

21. In a foil-sheet stack condenser, the combination with a plurality of foil-armatures distributed with dielectric sheets through the stack, the foil-armatures of opposite polarity projecting in bunches from different portions of the side of the stack and having terminal edges lying at said side; the stack being of such nature as to prevent desirable dissipation from the stack itself of heat generated therein; of means for removing the generated heat directly from the foil-armatures distributed with the dielectric sheets, said means comprising two metal heat dissipators located exteriorly of the stack of sheets and exposed to atmosphere but respectively adjacent the foil terminals of opposite polarity at the different portions of the side of the stack, said heat dissipators being insulated from one another; the foil-armatures of each foil bunch being fused together; and the two heat dissipators respectively being held in good thermal connection with the fused foil-bunches of opposite polarity.

22. In a foil-sheet stack condenser, the combination with a plurality of foil-armatures distributed with dielectric sheets through the stack, the foil-armatures of opposite polarity projecting from different portions of the side of the stack, and having terminal edges lying at said side; the stack being of such nature as to prevent desirable dissipation from the stack itself of heat generated therein; of means for removing the generated heat directly from the foil-armatures distributed with the dielectric sheets in the stack, said means comprising two metal heat-dissipators located exteriorly of the stack of sheets and exposed to atmosphere but respectively adjacent the foil terminals of opposite polarity at the different portions of the side of the stack, said heat-dissipators being insulated from one another and held in good thermal connection with the projecting foil portions at the different portions of the side of the stack, of all the foil-armatures inside the stack.

23. In a foil-sheet stack condenser, the combination with a plurality of stack-sections insulated from one another at their faces but each having opposite-potential foil bunches projecting from different portions of the side of the stack, the sections being electrically connected together via projecting foil bunches of like polarity; of metallic heat-dissipators exposed to atmosphere, extending in the stack between the sections thereof and in good thermal connection with the several foil-armatures of said foil-bunches.

24. In a foil-sheet stack condenser, the combination with a plurality of stack-sections insulated from one another at their faces and each comprising sheets of dielectric and foil-armatures distributed with one another through the stack, the foil-armatures of opposite polarity projecting from different portions of the side of the stack-section and having terminal edges lying at the side of said section; the stack of sections being of such nature as to prevent desirable dissipation from the stack itself of the heat generated therein; of means for removing the generated heat directly from the foil-armatures distributed with the dielectric sheets in the stack, said means comprising two metal heat-dissipating members located exteriorly of the stack of sections and exposed to atmosphere but respectively adjacent the foil terminals of opposite polarity at the different portions of the side of the stack, said heat-dissipators being insulated from one another and held in good thermal connection with the projecting foil portions at the different portions of the side of the stack.

25. In a foil-sheet stack condenser, the combination with foil-armatures distributed with dielectric sheets through the stack, the armatures projecting from the side of the stack, of a metal casing enclosing said stack and electrically spaced from the side thereof; and metal heat-conducting means extending through the space between the casing and the stack and thermally connecting the casing with the projecting stack-foils.

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