

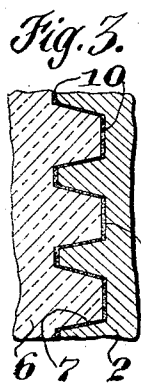
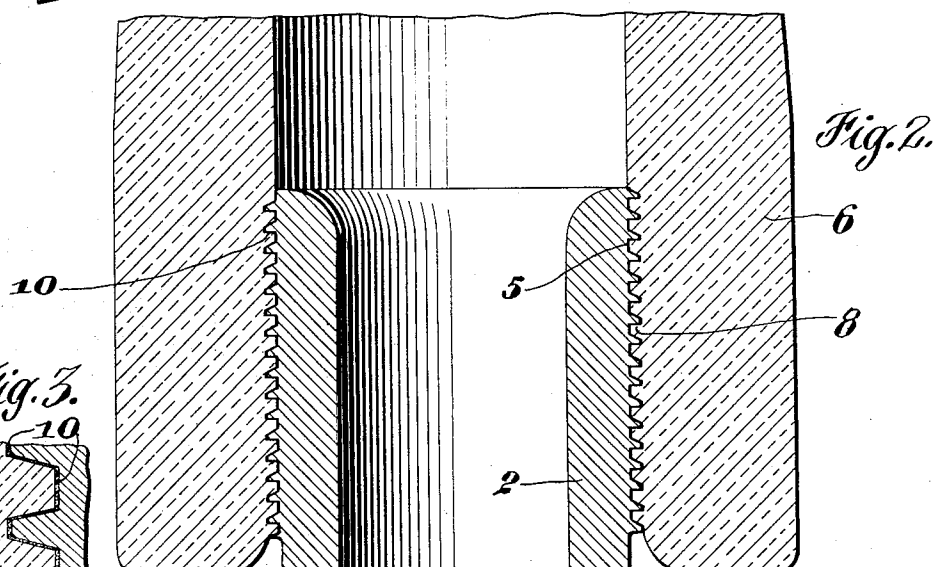
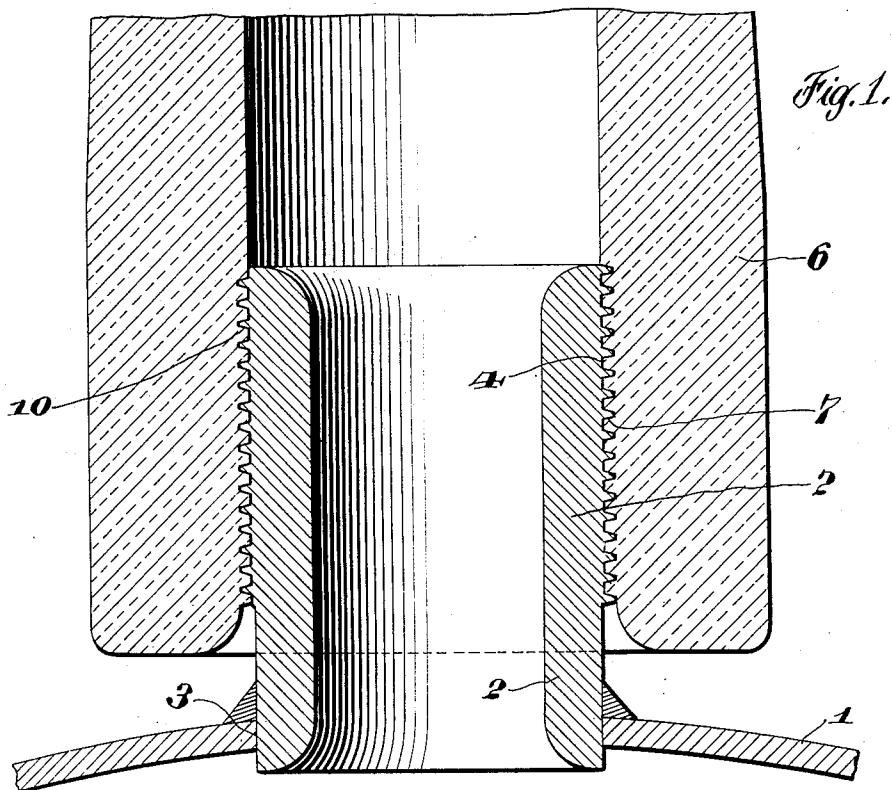
June 17, 1924.

1,497,952

F. S. SMITH

METHOD OF MAKING AIR TIGHT JOINTS

Filed April 13, 1923



INVENTOR
Franklin S. Smith
BY
Cyrus W. Anderson
ATTORNEY

UNITED STATES PATENT OFFICE.

FRANKLIN S. SMITH, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE PRODUCTS PROTECTION CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

METHOD OF MAKING AIR-TIGHT JOINTS.

Application filed April 18, 1923. Serial No. 632,832.

To all whom it may concern:

Be it known that I, FRANKLIN S. SMITH, a citizen of the United States, and a resident of Brooklyn, in the county of Kings and State of New York, have invented an Improvement in Methods of Making Air-Tight Joints, of which the following is a specification.

description thereof which follows or will be apparent from such description.

For the purpose of facilitating the explanation and description of my invention reference may be had to the accompanying drawing in which I have illustrated the same embodied in joints or connections between the solid dielectric tubular members of high voltage terminals and metallic bushings, which bushings have connection with the casings of the tanks of electric transformers and which communicate with the interiors thereof; but it will be understood that the invention is of general application for the construction of joints between materials or substances of the character above indicated and is not limited to any particular apparatus or to any particular art; and also that it is of particular advantage where the apparatus, or rather the joint, is apt to be subjected to considerable ranges of temperature.

In the drawing:

Fig. 1 is a longitudinal central sectional view of a portion of a high voltage terminal tube, a cylindrical metallic bushing to which it is connected; and a portion of the casing of an electric transformer tank to which the said bushing is secured;

Fig. 2 is a similar view showing a slightly modified construction of the screw threads by means of which the tube and the bushing are connected together; and

Fig. 3 is a fragmentary sectional view of the construction shown in Fig. 1, enlarged so as to indicate the filler of elastic and resilient cement interposed between the surface of the male and female screw threads of the bushing and terminal tubes.

Referring to the drawing: 1 designates a casing of the tank of an electric transformer, a portion only of which is shown, and 2 designates a cylindrical metallic bushing secured in an opening 3 within the said casing in any suitable manner, as by electric welding. The bushing 2 in Fig. 1 is provided with a modified acme thread 4 while the bushing 2 in Fig. 2 is provided with a modified buttress thread 5. High voltage terminal tubes 6 of suitable dielectric material, such as a phenolic condensation product, are provided with internal screw threaded portions, as indicated in Fig. 1 at 7 and in Fig. 2 at 8 by means of which they are adapted to be secured to the said bush-

My invention relates to joints or connections between materials having different coefficients of expansion and which are of different thermal conductivities and specific heats, such as metallic and non-metallic substances, and to the art of making the same.

Heretofore difficulty has been experienced in the joining or connecting together of bodies of the character above indicated in such manner as to produce joints which were completely sealed and air and gas tight. Such difficulties have been encountered in connection with electrical apparatus such, for instance, as the tanks of electric transformers, wherein a gaseous dielectric under pressure is employed in connection with which it is necessary to employ connections and fittings of various kinds of solid dielectric material, such as molded or otherwise formed phenolic condensation products. As an example of the latter, "bakelite" may be mentioned.

The general object of the invention is to provide a novel construction of joint between materials of the character above indicated which shall be hermetically sealed and absolutely air and gas tight.

A further object of the invention is to provide a joint between two members having means intermediate the adjacent and opposing faces of the connected members which shall be permanently elastic and resilient and adapted to yield and expand so as to compensate for the inequalities of expansion of the objects or parts joined together, and of a character such that it will completely fill and hermetically seal any clearance between the adjacent opposing surfaces of the said members.

An object of the invention is to provide an improved and novel process by means of which such joints may be made.

I shall not undertake at this point to set forth all of the various objects and advantages incident and appurtenant to my invention, but other and additional objects thereof will be pointed out in the detailed

ings. The fit of the external and internal (male and female) threads of a bushing and tube should be such as to permit of the tube being shaken perceptibly.

5 It will be seen that the construction is such that the internal threads of the terminal tubes 6 are of relatively large dimensions as compared with the external threads of the metallic bushing 2. This is desirable
10 because of the difference in the tensile strength of the threads of the non-metallic tubes 6 and the threads of the metallic bushings 2. The larger dimensions of the threads of the said tubes compensate somewhat for the lesser strength of the material
15 of the said tubes.

A filler of elastic cement 10 is provided between the external threads of the bushings 2 and the internal threads of the tubes 6.
20 This cement is of a character such that it retains its elasticity and resilience and is not injured by the temperatures to which it may be subjected in the use of the apparatus.

25 A suitable cement may be produced by combining shellac and tar, preferably North Carolina or Stockholm tar, in proportions which may be varied as may be desired to suit different conditions. The shellac and
30 tar preferably should be employed in the proportions of sixty to eighty parts by weight of the shellac to forty to twenty parts by weight of the tar, but it is to be understood that my invention is not limited
35 to these proportions. Shellac, of the character or quality known in the trade as of T. N. grade, which is a cheap grade, may be employed and appears to give better results than the pure orange shellac. This
40 probably is due to the fact that it is more resinous. Before employing the shellac all dirt and impurities must be removed therefrom, which may be effected in any preferred known manner. The shellac and tar,
45 say in the proportions of seventy-five and twenty-five parts respectively, are mixed together and are then heated and boiled for a short time, sufficient to partially polymerize the shellac in order that a product sufficiently
50 viscous to render convenient for handling may be produced, and also so as to raise its melting point. Furthermore, such partial polymerization at this time is desirable so that all of the polymerization which
55 is finally effected will not have to be effected after the mixture of the shellac and tar is placed upon the portions of the objects or members to be joined or connected together.

It will be understood that the period of
60 boiling the mixture, as above indicated, will vary with the mass being treated, being dependent upon mass action. After the mixture has been boiled as above indicated to effect partial polymerization of the shellac
65 it is discharged from the boiler and quick-

ly cooled. This cooling or quenching may be accomplished conveniently by pouring the boiled mixture upon a large flat metal plate having suitable thermal capacity. A small mass will cool more quickly than a
70 large mass. When chilled to room temperature the cement thus produced is ready for use. Care must be taken not to completely polymerize the shellac because it is thereby converted to a sponge-rubber-like condition
75 which renders it quite porous and therefore useless.

It will be understood that the higher the percentage of shellac which is employed the more viscous will the resulting material be
80 and the higher its melting point.

The melting point of the cement, comprising seventy-five and twenty-five per cent by weight of shellac and tar respectively, is approximately one hundred and forty degrees
85 centigrade.

The method of applying the cement and attaching a tube of phenolic condensation product or other similar material to the
90 bushing is as follows:

The said tube, consisting in the case under consideration of a phenolic condensation product, is first slowly heated in an oven to a temperature of about ninety degrees centigrade and a thin sheet of the cement is then
95 placed on the interior threaded portion of the tube which is kept in the oven until the cement softens. The tube with the cement thereon is slowly rotated about its axis and the softened cement pressed in the spaces between the internal screw threads
100 displacing the air between the same. Simultaneously the bushing is heated with a blowtorch or other suitable means to a temperature a little above the melting point of the
105 cement, which in the case of the cement consisting of the ingredients in the proportions last mentioned is approximately one hundred and forty degrees centigrade. The
110 cement is applied to all parts of the threaded portion of the bushing and is completely melted by the temperature of the bushing so that it will fill in the spaces between the threads and displace the air therefrom.

When there is only a slight evidence of
115 ebullition in the cement on the bushing, the non-metallic tube, assumed in the present case to be a phenolic condensation product, is removed from the oven and screwed onto the bushing. In screwing the tube onto the
120 bushing it is advisable and preferable to use a progressive forward and reverse turning motion except on the last few threads before the tube has reached its final or permanent position. The object of this is to
125 cause the cement to completely fill the clearance spaces between the threads of the bushing and the tube so as to displace all vapors which may be evolved. For the same reasons it is desirable that the rubbing of the
130

cement onto the threads of the bushing while the tube is being screwed on shall be continuous. The operation is now complete and the tube and the bushing should be protected so as to permit the same to cool slowly to room temperature. As the joint cools and contracts the cement is compressed. It seems that the effectiveness of the seal is due probably to this as the cement does not adhere to the phenolic condensation product of which the tube consists in the sense that glue or adhesives adhere to certain substances.

It should be noted here that the actual work of effecting the joint connection should be done as rapidly as possible because prolonged heating at one hundred and forty degrees will ruin the cement.

It will be understood that the pitch of the screw threads of the tube and of the bushing at ordinary room temperatures should be the same. It is also essential that at the time the seal or joint connection is effected the pitch of said screw threads should also be the same. The co-efficient of expansion of the phenolic condensation product of which the tube consists, in the construction as described, is approximately twice that of the steel bushing. It follows, therefore, that in effecting the seal the increase of temperature of the tube should be only half as great as that of the bushing in order that at the time of effecting the seal the pitch of the threads shall be substantially the same as was the case when the tube and bushing were at ordinary room temperature. For example, if the threads of the tube and bushing are properly engaged at room temperature, say twenty-five degrees centigrade, and the temperature of the bushing is increased by one hundred and twenty-five degrees centigrade, that is, to one hundred and fifty degrees centigrade (to melt and further polymerize the cement) then, owing to the fact that the co-efficient of expansion of the phenolic condensation product of which the tube consists is approximately twice that of the bushing, the increase in temperature of the said tube should be only one-half that of the bushing, or say sixty-three degrees, making the total temperature eighty-eight degrees centigrade. The temperatures of the tube and the bushing having thus been increased in the proportions as above indicated, the pitch of the threads of the bushing and the tube will be found to be equal.

Seals or joints produced in the manner above described successfully withstand test pressures of nine hundred pounds gage; but in the case of electrical apparatus for which the invention is particularly well adapted and for which it has been especially designed, pressures in excess of two hundred and fifty pounds gage are not required. Hence it will be seen that an air and gas

tight seal or joint is produced having a strength much greater than that which is necessary to withstand any pressure to which it is likely to be subjected.

It will be seen that by my invention I have provided means whereby joints between different substances having different co-efficients of expansion and different thermal conductivities and specific heats may be produced which are completely air and gas tight and which are adapted for use under conditions in which they are subjected to temperatures varying through relatively wide ranges; that is from -5° centigrade to about 115° centigrade.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. The method of producing joints between bodies having different co-efficients of expansion and different specific heats, in which a filler of elastic material is situated between the interlocked portions of the bodies to be joined, which comprises the partial polymerization of a resinous material, cooling the same, heating the portions of the bodies which are to be joined together, placing portions of the partially polymerized material upon the surfaces to be joined, thereafter engaging the said bodies with each other so as to leave a filler of the said material between the interlocked portions of the said bodies, and thereafter further polymerizing the said material.

2. The method of producing joints between bodies having different co-efficients of expansion and different specific heats, which comprises the heating of the portions of the bodies which are to be joined, placing portions of a non-fluid slightly elastic cement thereon, which cement is softened by the heat of the said parts so as to completely cover the same, thereafter interlocking the said parts and causing the said cement material after such interlocking to change into a more elastic and resilient material.

3. The method of producing joints between bodies, which comprises the heating of the portions of the bodies which are to be joined, placing portions of a non-fluid resinous cement thereon which is adapted to be softened by the heat of the parts so as to completely cover the same, thereafter interlocking the said parts while the said cement is in softened condition and causing the said cement after such interlocking to change into a permanently elastic and resilient substance.

4. The method of producing joints between bodies having different co-efficients of expansion, which comprises the heating of the portions of the bodies which are to be joined, placing portions of a non-fluid cementitious elastic material thereon, which material is adapted to be softened by the

heat of the said parts so as to completely cover the same, the heat of the body of lower expansion co-efficient being of a temperature sufficient to effect molecular change in the said cementitious material to convert the same into a more elastic material, and interlocking the said parts with a layer of the said material between the said parts.

5. The method of producing joints between bodies having different co-efficients of expansion and different specific heats, which comprises the heating of the portions of the bodies which are to be joined, placing portions of a partially polymerized resinous cementitious material on the said portions to be joined, which material is softened by the heat of the said parts so as to completely cover the same, thereafter interlocking the said parts, and thereafter effecting through the heat from one or both of said parts a temperature sufficient to effect further polymerization of the said material to produce a permanently elastic and resilient cement layer between the same.

6. The method of joining bodies having different co-efficients of expansion and different specific heats, which comprises the heating of the portions of the bodies which are to be joined, mixing together shellac and tar and heating the mixture to partially polymerize the shellac, quickly cooling the partially polymerized product, placing portions thereof upon the surfaces of the heated portions of the bodies to be joined together, thereafter interlocking the said bodies with each other and effecting further polymerization of the said resinous mixture after the said bodies have been joined together.

7. The method of joining together bodies having different co-efficients of expansion and different specific heats, which comprises the heating of the portions of the said bodies which are to be interlocked, mixing together shellac and tar in suitable proportions, quickly heating and boiling the said mixture to effect partial polymerization of the shellac, thereafter cooling the same, placing portions of the partially polymerized product upon the surfaces of the portions of the bodies which are to be interlocked, interlocking the said portions of the said bodies with a layer of the said partially polymerized material between the adjacent opposing surfaces thereof, and thereafter effecting further polymerization of the said shellac.

8. The method of joining together bodies having different co-efficients of expansion and different specific heats, which comprises the heating of the said bodies, partially polymerizing a resinous substance, thereafter placing portions of the said substance upon the heated surfaces of the portions of

the said bodies to be joined together and causing the said substance to completely cover the said surfaces, thereafter interlocking the said portions of the said bodies, and thereafter further polymerizing the said substance.

9. The method of joining together metallic and non-metallic bodies, which comprises the heating of the portions of the bodies to be joined, the metallic body being heated to a higher temperature than the non-metallic body, thereafter covering the surfaces of the heated portions of the said bodies with a resinous cementitious material, and thereafter effecting polymerization of the said substance by the heat of the heated portion of the said metallic body.

10. The method of joining together a metallic body and a body consisting of a phenolic condensation product, which comprises the heating of the portions of the said bodies which are to be interlocked, mixing together shellac and tar in the proportions which may vary from eighty to sixty parts by weight of the shellac and forty to twenty parts of the tar, boiling the same for a short time to partially polymerize the same, quickly cooling the mixture, placing portions thereof upon the surfaces of the heated portions and melting the same whereby the said surfaces become completely covered, interlocking the said heated portions, and thereafter effecting polymerization of the said mixture.

11. The method of joining metallic and non-metallic bodies together, the latter consisting of a phenolic condensation product, which comprises the heating of the portions of the said bodies which are to be interlocked and joined together, interlocking the said bodies, forming a layer of material between the adjacent opposing surfaces of the said portions simultaneously with the interlocking thereof, and thereafter by the action of heat thereon converting the said material into a permanently elastic and resilient substance.

12. The method of joining together bodies having different co-efficients of expansion and different specific heats, which comprises the heating of the portions of the bodies which are to be interlocked and joined, interlocking the said bodies and forming a layer of cementitious material between the interlocked portions simultaneously with the interlocking thereof and converting the said material by the action of heat thereon into a permanently elastic substance.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 12th day of April, 1923.

FRANKLIN S. SMITH.