June 4, 1946. C. HERZOG ET AL 2,401,638

METHOD OF VACUUM SEALING

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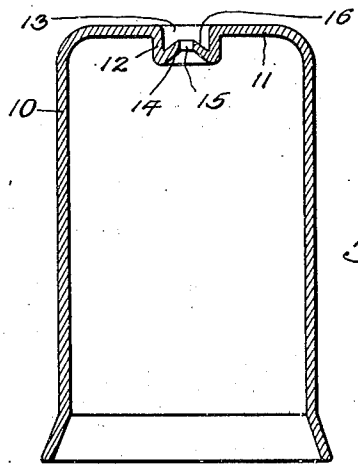


Fig. 1.

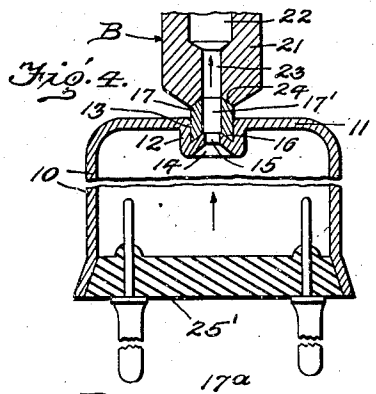


Fig. 4.

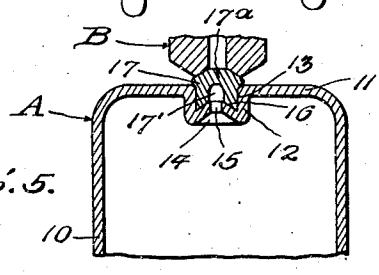


Fig. 5.

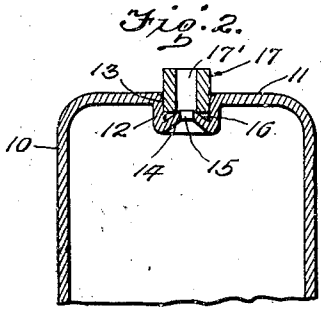


Fig. 2.

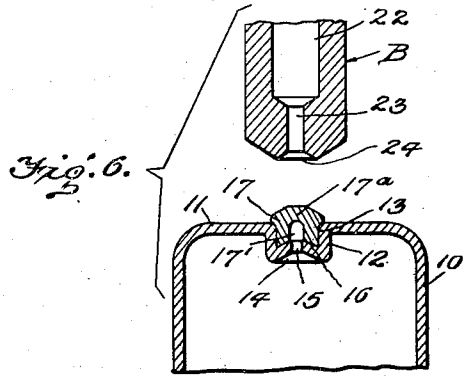


Fig. 6.

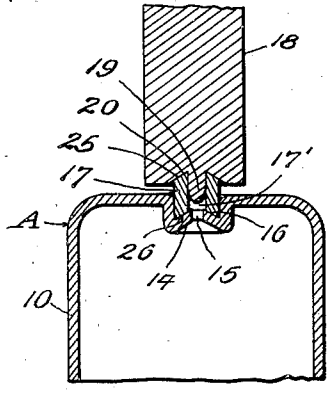


Fig. 3.

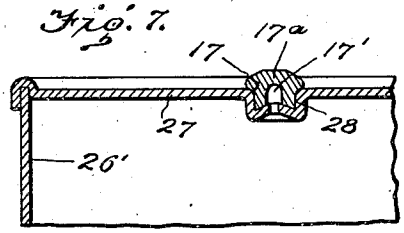


Fig. 7.

Inventors

Carl Herzog and

Paul A. Hauck.

By B. O. Wilson

Attorney

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METHOD OF VACUUM SEALING

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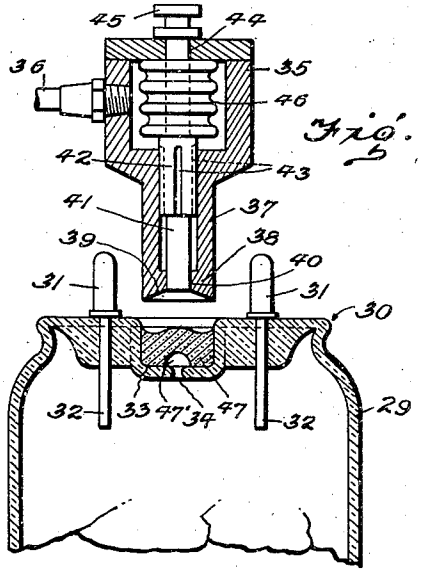


Fig. 8.

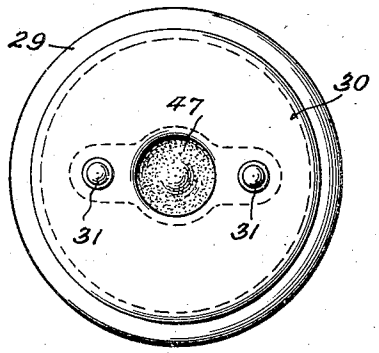


Fig. 8.a

Fig. 9.

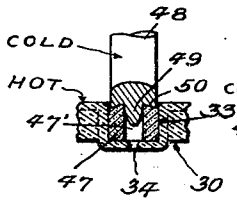


Fig. 10

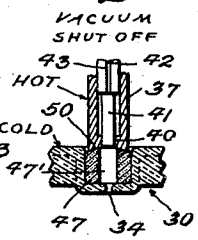


Fig. 11.

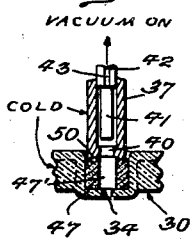


Fig. 12.

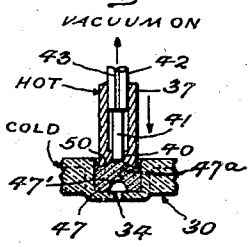


Fig. 13.

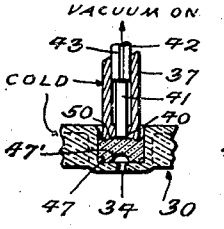


Fig. 14.

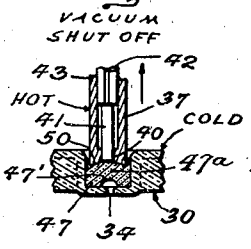
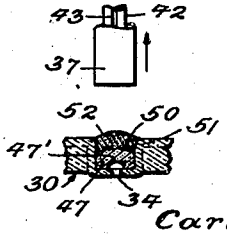


Fig. 15.



Inventor

Carl Herzog and

Paul A. Hauck.

By B. P. Richemond

Attorney

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UNITED STATES PATENT OFFICE

2,401,638

METHOD OF VACUUM SEALING

Carl Herzog, Belleville, and Paul A. Hauck, Union, N. J., assignors, by mesne assignments, to themselves as joint tenants

Application July 19, 1943, Serial No. 495,342

14 Claims. (Cl. 226—20.2)

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The present invention relates to a method of vacuum sealing receptacles.

An important object of the invention is to provide a method of the above mentioned character for vacuum sealing receptacles having metallic parts, metallic receptacles and glass receptacles.

A further object of the invention is to provide a method of the above mentioned character for sealing radio vacuum tubes, thermionic tubes and lamps, such as fluorescent lamps, without the use of the usual exhaust tubes attached to the same, which may be formed of metal or glass.

A further object of the invention is to provide a method of the above mentioned character which will eliminate the long exhaust tube used in vacuum sealing, 95% of which is usually thrown away, after the sealing operation is completed.

A further object of the invention is to provide a method of the above mentioned character which will eliminate the use of the compression rubber nipple of the usual vacuum machine, which nipple receives the exhaust tube carried by the envelope.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is a central vertical longitudinal section through a radio vacuum tube shell, showing a recess or depression formed in the top of the metallic shell, before the base is applied to the shell,

Figure 2 is a similar view, parts broken away, showing a tubular solder material pellet placed within the recess,

Figure 3 is a similar view, parts broken away, showing a cold forming tool engaging the tubular solder material pellet,

Figure 4 is a similar view, parts broken away, showing the base applied to the metallic shell and a tubular metallic exhaust connection engaging the tubular solder material pellet.

Figure 5 is a similar view, parts broken away, showing the tubular exhaust connection moved downwardly to close the tubular pellet,

Figure 6 is a similar view, showing the tubular exhaust connection raised and separated from the tubular pellet,

Figure 7 is a central vertical section, parts broken away, through a tin can equipped with a recess and tubular pellet for vacuum sealing the same,

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Figure 8 is a central vertical longitudinal section through one end of a fluorescent lamp and associated vacuum connection,

Figure 8ª is a plan view of the fluorescent lamp,

Figure 9 is a central vertical section through the base of the fluorescent lamp, parts broken away, showing the use of a cold forming tool and the fusing of the pellet to the base,

Figure 10 is a similar view showing the vacuum connection fused to the upper end of the pellet, with the vacuum cut off,

Figure 11 is a similar view showing the vacuum connection fused to the pellet and the vacuum connection and base cold and the vacuum turned on and the plunger raised,

Figure 12 is a similar view, showing the vacuum connection heated and moved downwardly to close the bore of the pellet, the plunger being in the lowered position and the vacuum on and the base cold,

Figure 13 is a similar view, with the parts in the same position with the vacuum connection and the base cold and the closed pellet set,

Figure 14 is a similar view, with an upward force applied to the vacuum connection which is heated to produce a molten film at the top of the set pellet, and

Figure 15 is a similar view, with the vacuum connection raised and showing the recess above the pellet filled with additional sealing wax.

In Figures 1 to 6 inclusive, the numeral 10 designates a metal shell or envelope of a radio vacuum tube or the like. This shell has an upper closed end or part 11, provided preferably centrally thereof with a cylindrical inwardly formed portion 12, producing a recess 13. The top of the cylindrical portion 12 is open while its bottom is covered by a head 14, provided at its center with a port 15. The head 14 is frustro-conical in vertical cross section and tapers upwardly, as shown.

The numeral 17 designates a tubular solder material pellet, adapted for insertion within the recess 13, and preferably having a sliding fit therein. This tubular solder material pellet 17, which is annular in cross section, has a bore 17', and this bore has a length considerably greater than its diameter. Satisfactory results are obtained by having the length of the bore substantially twice that of the diameter of such bore. By employing a tubular pellet having an elongated bore, the lower portion or bottom of the pellet may be chilled or rendered solid or main-

tained solid while its top or upper portion is plasticized.

The numeral 18 designates a cold forming tool, preferably formed of metal, and provided at its forward end with a center pin 19. At its forward end, this tool has an annular recess 20, surrounding the pin. This annular recess is frustro-conical in cross section, providing an upwardly tapered face or wall.

The numeral 21 designates a tubular vacuum connection, preferably formed of copper, and having a main bore 22 in communication with a source of vacuum. This bore 22 is in communication with a port 23, communicating with a recess 24 formed in the forward end of the tubular connection 21. The recess 24 is concentric with the port 23 and is frustro-conical in vertical cross section, providing a face or wall which tapers upwardly, as shown.

The cylindrical portion 12 forming the recess 13 is preferably formed upon the metallic shell 10 while this shell is being produced, but the invention is in no sense restricted to this procedure. The shell 10 provided with the recess 13 is now suitably supported in a vertical position with its top 11 uppermost, and the tubular solder material pellet 17 is inserted within the recess 13, and the shell 10 and pellet 17 being cold or at room temperature. When the pellet 17 is inserted within the recess 13, its bottom contacts with and is supported by the upper end of the tapered head 14. The bore of the tubular pellet is larger than the port 15 and is slightly larger than the upper end of the tapered head 14, so that the upper reduced end of the head 14 extends for a short distance into the bore of the tubular pellet. The top of the tubular pellet projects above the top 11, as shown.

The cold forming tool 18 is now positioned over the tubular pellet 17 and its pin 19 inserted into the bore of the tubular pellet, while the top of the tubular pellet contacts with the upwardly tapered wall of the frustro-conical recess 20. The shell 10 and tool 18 are now cold or at room temperature. Downward pressure is now applied to the cold forming tool. This pressure is sufficient to form an upwardly tapered end 25 upon the tubular pellet 17 and an upwardly tapered end 26 at its bottom, this cold forming being effected by the ends of the tubular pellet being pressed against the inclined head 14 and the wall of the recess 20. The pin 19 by entering the bore of the tubular pellet prevents the tubular pellet from collapsing and maintains its bore open during this cold forming. The downward pressure upon the tubular pellet, causes its bottom to slide down the inclined face 16 of the head 14, whereby the top end of the head 14 projects further into the bore of the tubular pellet. This prevents the liability of any small particles of the solder material from the tubular pellet entering the shell 10. After the cold forming step, the downward pressure upon the tool 18 is removed, and only a slight downward pressure is applied to the tool 18. The upper portion of the shell 10 is now suitably heated, at about the point A, and this heat is transferred by conduction to the lower end of the tubular pellet, and this lower end is then sweated to the inclined face of the head 14 to form an air tight joint therewith. As soon as this sweating operation is completed, the cold forming tool is raised and separated from the upper end of the tubular pellet and this tubular pellet and the shell 10, which are sweated or fused together, are cooled to room or atmospheric temperature. When the lower end of the tubular pellet 17 was heated, as explained, the heat treatment is regulated or stopped before the upper end of the pellet 17 is heated sufficiently to become sweated or fused to the tool 18. During this heat treatment, the upper end of the pellet 17 and tool 18 may be chilled by blowing cold air upon the same, and this will prevent the upper end being sweated or fused to the tool 18.

The above described operations are performed upon the shell 10 previous to the assembly of the base and elements carried by the base with the shell. The base 25' which may be formed of glass, is now applied to the lower end of the shell 10, Figure 4, in any well known manner and forms an air tight joint therewith. This base carries the usual parts of a radio vacuum tube.

The base 25' is applied to the shell 10, as stated, and the shell 10 is again vertically supported with its top 11 uppermost, and the tubular exhaust connection 21 is arranged above the tubular pellet 17 and moved downwardly so that the tapered upper formed end of the pellet enters the tapered recess 24, these parts being correspondingly tapered so that the end fits snugly within the recess. The tapered recess 24 is tinned with solder and engages the upper tapered end of the tubular pellet and is held in firm engagement therewith. Heat is now applied to the tubular suction or vacuum connection 21, preferably at about the point B, Figure 4, and passes by conduction to the engaging faces of the recess 24 and the tubular pellet, and this heat causes the top of the pellet to be fused to the wall of the recess 24, forming a solid air tight connection between the tubular vacuum connection 21 and the shell 10. The tubular vacuum connection 21 and the tubular pellet 17 are now cooled to room or atmospheric temperature, which may be effected by blowing air thereon. With the tubular vacuum connection 21 thus rigidly secured to the tubular pellet and forming an air tight connection therewith, the vacuum valve of the vacuum pump is now opened and the shell 10 is placed in communication with a source of vacuum through the tubular pellet and the shell 10 is properly evacuated.

When the selected degree of vacuum is obtained within the shell 10 and while the vacuum valve remains open in whole or in part and the shell remains in communication with the source of vacuum, heat is again applied to the tubular vacuum connection 21, preferably at about the point B, Figure 4, and passes by conduction to the top of the tubular pellet 17, causing the upper portion of the pellet to plasticize. While this occurs, the tubular vacuum connection 21 is moved downwardly, to follow up the flow of the plasticized solder at the top of the pellet, and force the plasticized material at the top of the pellet inwardly toward the center of the bore 17' and downwardly, thereby closing the upper end of the bore 17', by forming a bridge 17a, Figure 5. This inward moving or forming of the plasticized material toward the center of the bore 17' is effected by the frustro-conical or tapered recess 24, when the connection 21 is moved downwardly. At the same time that the tubular vacuum connection 21 is being heated, the top of the shell 10 is chilled or cooled to prevent the lower portion or bottom of the pellet from plasticizing. This cooling may be effected by blowing cold air upon the shell 10 at about the point A, Figure 5. Since heat is applied by conduction to the top of the pellet 17, such top is heated to the maximum extent, while the heat imparted to the pellet de-

creases downwardly of the pellet, which is further aided by the chilling of the lower portion of the pellet. The lower portion of the pellet remains permanently set or solid, while the upper portion increases in plasticity toward the top, and has a maximum plasticity at the top which is in thermal contact with the tubular vacuum connection 21. When the upper portion of the pellet is moved inwardly and downwardly to close the bore 17' and form the bridge 17a, the closed end or bridge 17a is brought into close relation to the chilled lower portion of the pellet 17, and this tends to further chill the bridge 17a so that it is rendered solid throughout the major portion of its vertical dimension, extending from its bottom to substantially its upper face, while the upper face which contacts with the connection 21 remains plasticized. The bore of the tubular pellet is therefore closed at the top but remains open at the bottom. Since the same degree of vacuum is now placed upon opposite sides of the closed end or bridge 17a of the pellet, there is no tendency for such closed end to be drawn down into the shell by the vacuum therein.

As soon as the vacuum connection 21 has moved downwardly and closed the upper end of the tubular pellet by forming the bridge 17a, the vacuum connection 21 and shell 10 are chilled by blowing cold air upon the same at the points B and A, respectively, and the closed pellet 17 is set and this occurs while the vacuum is still turned on. After the closed pellet has set, the vacuum valve is closed, subsequently to which an upward lifting force is applied to the vacuum connection 21, and while this is done, the vacuum connection is heated at about the point B and this heat passes by conduction to the top of the pellet 17, and this produces a plastic or molten layer or film at the top of the pellet, while the remainder of the pellet remains set, and when this occurs the vacuum connection 21 separates from the pellet.

We also contemplate the use of a slightly different method. As soon as the vacuum connection 21 has moved downwardly to close the upper end of the tubular pellet and form the bridge 17a, as explained, Figure 5, and while the upper end of the pellet is still plastic, the vacuum connection 21 is raised and separated from the tubular pellet, and simultaneously with the raising of the vacuum connection, the vacuum valve is closed, cutting off communication between the source of vacuum and the port 23. Simultaneously with the closing of the exhaust valve, the closed end or bridge 17a of the tubular pellet is chilled and set throughout its entire vertical dimension by the lack of heat in the shell and by an additional blast of cold air applied to the top of the pellet. The pellet should be rendered completely solid or set simultaneously with the breaking of the vacuum in the connection 21 exteriorly of the pellet, so that the vacuum within the shell will not draw particles of solder down into the shell, where they would cause harmful results. All of the steps of the method remain identical with those hereinbefore described.

In Figure 7, is shown a receptacle such as a tin can 26', which has been vacuum sealed in accordance with our method. This tin can has a top 27 provided with a recess 28, corresponding to the recess 13, and receiving the tubular pellet 17 which has been treated in accordance with either method described in connection with Figures 1 to 6 inclusive.

Attention is now called to Figures 8 to 15 inclusive.

The numeral 29 designates the glass tube or envelope of a fluorescent lamp, having a glass base 30. Secured to the base 30 are contacts 31, carrying mount wires 32. This glass base is provided centrally thereof with an exterior recess 33, having an opening 34 in its bottom.

The numeral 35 designates the body portion of a tubular vacuum connection, having a pipe 36 connected in its side and which leads to a vacuum pump. A suitable valve (not shown) is connected to the pipe 36 for opening and closing the pipe 36, to supply the vacuum, or cut the same off. At its lower end, the body portion 35 is provided with a sleeve 37, provided at its lower end with a head 38, having a frustro-conical or upwardly tapered face 39. A cylindrical opening 40 is formed in the head 38 and receives a plunger 41. This plunger is provided with an intermediate enlarged portion 42, having longitudinal grooves 43. The plunger 41 extends through an opening 44 and is provided with a connection 45, by means of which the plunger may be raised and lowered with relation to the body portion 35. The plunger passes through a packless gland 46, as shown. When the plunger 41 is in the lowermost position, it enters the opening 40 and closes the same and the lower end of the plunger is then substantially flush with the face 39, the plunger and face then producing a continuous surface.

The numeral 47 designates a tubular pellet, having a bore 47', which is preferably formed of sealing wax. Sealing wax when plasticized will adhere to glass. We also contemplate using tubular pellets formed of other thermoplastic material.

In the practice of the method as indicated in Figures 8 to 15 inclusive, the tubular pellet 47 is introduced into the recess 33, and for this purpose the tubular pellet may be applied to the pin 49, and the cold tool 48 moved downwardly to insert the tubular pellet into the recess, this tubular pellet having an upper tapered end 50 which was previously formed thereon. Downward pressure is applied to the tool 48, while the glass base 30 is heated, and this heat passes by conduction to the tubular pellet, heating and plasticizing the outer surface or periphery of the tubular pellet and fusing the same to the wall of the recess 33 and the base of the same to form a vacuum tight joint between these parts. Before the upper end of the tubular pellet 47 has fused to the cold tool 48, this cold tool is moved upwardly and separated from the pellet. Instead of using the cold tube 48, as described, the tubular vacuum connection, Figure 10, may be used. If this is done, the sleeve 37 would be cold and brought down into engagement with the upper tapered end 50 of the tubular pellet 47 and exert a downward pressure upon the same, while the base was heated. This action will fuse the pellet to the walls of the recess 33.

After the pellet is thus arranged within the recess 33 by the use of the cold tool 48 and fused to the wall of the recess 33, the face 39 of the sleeve 37 is brought into contact or engagement with the end 50 of the pellet, and the base 30 is chilled by blowing cold air upon the same while the sleeve 37 is heated and the plunger 41 is in the lowermost position to cover the opening 40 and the vacuum valve is closed and the vacuum also cut off by the plunger 41. This heat passes by conduction through the sleeve 37 to the upper end of the tubular pellet, which has previously set, and the upper end of the tubular pellet is plasticized and is fused to the face 39 of the sleeve 37, Figure 10. The sleeve 37 and base 30 are now

chilled by blowing cold air upon the same so that the pellet 47 and its end which is fused to the face 39 are set, and the vacuum valve is now opened and the plunger 41 is raised to uncover the opening 40, Figure 11, whereby the envelope 29 is placed in communication with the source of vacuum and properly evacuated. While the vacuum valve remains open, the plunger 41 is moved downwardly to enter and cover the opening 40 and the sleeve 37 is heated while the base 30 is chilled. The heat passes by conduction through the sleeve 37 to the upper end of the tubular pellet which plasticizes this upper end, and when this occurs, the sleeve 37 and plunger 41 are moved downwardly and press the plasticized upper end of the tubular pellet downwardly and inwardly closing the upper end of the bore of the tubular pellet by forming a bridge 47ª, the lower end of the plunger 41 and the face 39 forming a continuous surface for this purpose. The lower end of the tubular pellet remains set due to its contact with the cold wall of the recess 33 and the lower end of the bore 47' of the tubular pellet remains open. The vacuum valve remains open during this operation. This operation is shown in Figure 12.

With the sleeve 37 in the lowered position and the plunger 41 in the lowered position and the tubular pellet closed, as described, the sleeve 37 is chilled and the base 30 is chilled and the pellet is set, while the vacuum valve remains open, Figure 13. The vacuum valve is now closed while the plunger 41 remains in the lowered position with the sleeve 37, and a lifting force is applied to the sleeve 37, Figure 14, and sleeve 37 is now heated, while heat passes by conduction to the upper closed end of the tubular pellet, providing a plastic or molten film at the top of the closed pellet, and when this occurs the sleeve 37 rises and separates from the tubular pellet. When the sleeve 37 is thus separated from the tubular pellet a recess 51 is formed above the closed pellet and this recess is filled flush with a layer of sealing wax 52, as shown in Figure 15.

Attention is called to the fact that the solder material 17 and the sealing wax 47 are both formed of thermoplastic material. The thermoplastic material of which the pellet is made, must have a lower melting point than the envelope to which it is attached, and a higher melting point than the temperature at which the device operates or is used in its final application.

It is to be understood that the forms of our invention herewith shown and described are to be taken as preferred examples of the same, and that various changes in the shape, size, and arrangement of parts may be resorted to, and that changes may be made in the order of the steps of the method, without departing from the spirit of the invention or the scope of the subjoined claims.

Having thus described the invention, what is claimed is:

1. The method of vacuum sealing a receptacle having an opening, comprising attaching a tubular thermoplastic pellet to the receptacle for forming a vacuum tight joint and placing the bore of the pellet in communication with the opening, bringing a tubular vacuum connection into contact with the free end of the pellet and forming a substantially vacuum tight connection between the same, evacuating the receptacle through the connected vacuum connection and tubular pellet, heating the outer end of the tubular pellet to plasticize the same, moving the vacuum connection toward the receptacle to aid in closing the tubular pellet, causing the closed tubular pellet to set, applying a force to the vacuum connection in a direction from the receptacle, and again heating the outer end of the pellet to produce a plasticized layer between the pellet and the vacuum connection while said force is applied to the vacuum connection.

2. The method of vacuum sealing a receptacle having a metallic part, comprising bringing a tubular solder material pellet into contact with the metallic part and placing the bore of the tubular pellet in communication with the interior of the receptacle, heating the contacting portions of the metallic part and pellet to cause them to fuse together and causing the same to subsequently cool, bringing a metallic tubular vacuum connection into contact with the tubular pellet and placing the same into communication with the bore of the tubular pellet, heating the contacting portions of the tubular vacuum connection and the pellet to cause them to fuse together and then allowing such parts to cool, evacuating the receptacle through the connected tubular vacuum connection and tubular pellet, heating the tubular pellet to plasticize the same, moving the tubular vacuum connection toward the receptacle to close the tubular pellet, and separating the vacuum connection from the closed pellet.

3. The method of vacuum sealing a shell having a metallic part provided with an opening, comprising bringing the end of a tubular solder material pellet into contact with the metallic part and placing the bore of the tubular pellet in communication with the opening, heating the contacting portions of the metallic part and pellet to cause them to fuse together, then causing the contacting portions to cool, bringing the end of a metallic tubular vacuum connection into contact with the outer opposite end of the tubular pellet, heating the contacting portions of the tubular connection and pellet to cause them to fuse together, then allowing such parts to cool, evacuating the shell through the connected tubular connection and tubular pellet, again heating the outer end of the tubular pellet to plasticize the same, moving the tubular connection toward the shell to apply pressure to the plasticized outer end of the tubular pellet to close the same, moving the tubular connection from the tubular pellet while simultaneously cooling the outer closed end of the pellet.

4. The method of vacuum sealing a shell having a metallic part, comprising bringing the end of a tubular solder material pellet into contact with the metallic part and placing the bore of the tubular pellet into communication with the interior of the shell, heating the contacting portions and pellet to fuse them together, then causing the contacting portions to cool, bringing the end of a metallic tubular vacuum connection into contact with the outer opposite end of the tubular pellet, heating the contacting portions of the tubular connection and pellet to fuse them together, then allowing such contacting portions to cool, evacuating the shell through the connected tubular connection and tubular pellet, again heating the outer end of the tubular pellet to plasticize the same while cooling the inner end of the tubular pellet to prevent the same being plasticized, moving the tubular connection toward the shell to aid in closing the bore of the tubular pellet by the plasticized solder, moving the tubular connection from the tubular pellet

to separate the same therefrom while simultaneously stopping the evacuation of the shell through the tubular pellet and simultaneously cooling the outer end of the pellet so that it sets.

5. The method of vacuum sealing a shell having a metallic part provided with a recess having an apertured head, comprising inserting a tubular solder material pellet into the recess so that its inner end contacts with the head, applying pressure to the outer end of the tubular pellet to cold form its inner end to correspond to the shape of said head and cold form its outer end into a selected shape, applying heat to the contacting inner end of the pellet and the head to cause these portions to fuse together, then causing these portions to cool, causing the outer formed end of the tubular pellet to enter a correspondingly shaped recess in a tubular vacuum connection, heating the outer formed end of the tubular pellet so that it becomes fused to the wall of the recess, causing these parts to cool, then evacuating the shell through the tubular connection and tubular pellet, again applying heat to the outer end of the tubular pellet to plasticize the same, then moving the tubular connection axially toward the tubular pellet to aid in closing its bore, then moving the tubular connection axially from the tubular pellet to separate the same therefrom while simultaneously stopping the evacuation of the shell through the tubular connection and tubular pellet and simultaneously cooling the outer end of the pellet so that it sets.

6. The method of vacuum sealing a shell having a metallic part provided with a recess having an apertured head, comprising inserting a tubular solder material pellet into the recess so that its inner end contacts with the head, applying heat to the shell adjacent to the recess so that the inner end of the pellet is heated by conduction and fused to the head, then causing these portions to cool, causing the outer end of the tubular pellet to contact with a tubular vacuum connection, heating the tubular vacuum connection adjacent to the pellet to cause the outer end of the pellet to be heated by conduction and be fused to the vacuum connection, causing these parts to cool, then evacuating the shell through the tubular connection and tubular pellet, again applying heat to the tubular connection adjacent to the pellet to cause the outer end of the pellet to be heated and plasticized, then moving the tubular connection axially toward the tubular pellet to aid in closing its bore, then moving the tubular connection axially from the tubular pellet to separate the same therefrom while simultaneously stopping the evacuation of the shell through the tubular connection and tubular pellet and simultaneously cooling the outer end of the pellet so that it sets.

7. The method of vacuum sealing a receptacle having a recess accessible from the exterior, said recess having a bottom provided with an opening, comprising arranging a tubular thermoplastic pellet within the recess, effecting a fused vacuum tight joint between the pellet and the wall of the recess, bringing the end wall of a tubular vacuum connection into contact with the outer free end wall of the tubular pellet and effecting a fused vacuum tight joint between such end walls, evacuating the receptacle through the connected vacuum connection and tubular pellet, heating the tubular pellet to plasticize a portion of the same, moving the vacuum connection toward the receptacle and thereby causing the plasticized portion to close the bore of the tubular pellet, and separating the vacuum connection from the closed pellet while the tubular pellet remains attached to the receptacle.

8. The method of vacuum sealing a receptacle, comprising arranging a tubular thermoplastic pellet with its bore in communication with the interior of the receptacle, effecting a fused vacuum tight joint between the pellet and the wall of the receptacle, bringing a tapered end wall of a tubular vacuum connection into contact with the outer free end wall of the tubular pellet and effecting a fused vacuum tight joint between such end walls, evacuating the receptacle through the connected vacuum connection and tubular pellet, heating the outer portion of the tubular pellet to plasticize the same, moving the tubular vacuum connection toward the receptacle to cause the tapered end wall of the tubular vacuum connection to crowd the plasticized material inwardly and close the bore of the tubular pellet, and separating the vacuum connection from the closed pellet.

9. The method of vacuum sealing a receptacle having a metallic part, comprising fusing a tubular pellet to the receptacle for forming a vacuum-tight joint and placing the bore of the tubular pellet in communication with the interior of the receptacle, fusing a tubular vacuum connection with the outer end of the tubular pellet for forming a vacuum-tight joint, evacuating the receptacle through the tubular connection and tubular pellet, applying heat to the tubular connection and thereby causing the tubular connection to heat the outer end of the tubular pellet by conduction and plasticize such outer end, moving the tubular connection toward the receptacle to close the tubular pellet, causing the closed end of the pellet to set, breaking the vacuum within the tubular connection, and separating the tubular connection from the tubular pellet.

10. The method of vacuum sealing a receptacle, comprising effecting a fused vacuum-tight joint between a tubular thermo-plastic pellet and the receptacle and placing the bore of the tubular pellet in communication with the interior of the receptacle, effecting a fused vacuum-tight joint between a tubular vacuum connection and the free end of the tubular pellet, evacuating the receptacle through the connected vacuum connection and tubular pellet, heating the tubular pellet to plasticize a portion of the same, moving the vacuum connection inwardly toward the receptacle to aid in closing the tubular pellet, and separating the vacuum connection from the closed pellet at a point adjacent to the free end of the tubular vacuum connection while the tubular pellet remains attached to the receptacle.

11. The method of vacuum sealing a receptacle, comprising effecting a fused vacuum-tight joint between a tubular thermo-plastic pellet and the receptacle and placing the bore of the tubular pellet in communication with the interior of the receptacle, effecting a fused vacuum-tight joint between the end of a tubular vacuum connection and the free end of the tubular pellet, evacuating the receptacle through the connected vacuum connection and tubular pellet, heating the outer end of the tubular pellet to plasticize the same, moving the vacuum connection inwardly toward the receptacle to close the bore of the tubular pellet by the plasticized outer portion, and separating the vacuum connection from the outer closed end of the pellet.

12. The method of vacuum sealing a receptacle,

comprising fusing to the receptacle for forming a vacuum tight joint a tube having a lower fusing point than the receptacle and placing the bore of the tube in communication with the interior of the receptacle, fusing the free end of the tube to the free end of a tubular vacuum connection provided with an outwardly flaring recess and having a higher fusing point than the tube for forming a vacuum tight joint and placing the bore of the tube in communication with the bore of the tubular vacuum connection, evacuating the receptacle through the connected tube and tubular connection, heating the outer end of the tube to plasticize the same, moving the tubular vacuum connection toward the receptacle for aiding in closing the tube, and separating the tubular vacuum connection from the tube at a point adjacent to the free end of the tubular vacuum connection while the tube remains attached to the receptacle.

13. The method of vacuum sealing a receptacle, comprising fusing a tube having a lower fusing point than the receptacle to the receptacle for forming a vacuum tight joint and placing the bore of the tube in communication with the interior of the receptacle, fusing the free end of the tube to the end of a tubular vacuum connection having a higher fusing point than the tube for forming a vacuum tight joint and placing the bore of the tube in communication with the bore of the tubular vacuum connection, evacuating the receptacle through the connected tube and tubular connection, heating the tube to plasticize the same, moving the tubular vacuum connection toward the receptacle for aiding in closing the tube and shortening the tube, and separating the tubular vacuum connection from the tube while the tube remains attached to the receptacle.

14. The method of vacuum sealing a receptacle, comprising placing a tube having a lower fusing point than the receptacle into contact with the receptacle, heating the receptacle and thereby heating the tube by conduction and fusing the same to the receptacle for forming a vacuum tight joint and placing the bore of the tube in communication with the interior of the receptacle, placing the free end of a tubular vacuum connection having a higher fusing point than the tube in contact with the outer free end of the tube, heating the tubular vacuum connection and causing the same to heat the outer end of the tube by conduction and thereby fusing the tube to the tubular vacuum connection and placing the bore of the tube in communication with the bore of the tubular vacuum connection, evacuating the receptacle through the connected tube and tubular connection, again heating the tubular vacuum connection to cause the same to heat the tube by conduction and plasticize the same, moving the tubular vacuum connection toward the receptacle for aiding in closing the tube, and separating the tubular vacuum connection from the outer free end of the tube while the tube remains attached to the receptacle.

CARL HERZOG.
PAUL A. HAUCK.