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PATENT SPECIFICATION
DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Container Closing

- WE, UNITED GLASS LIMITED, a Company organised under the laws of Great Britain, of Kingston Road, Staines, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—
- The present invention relates to a method for applying sealing membranes to containers.
- It is known that products such as dried milk powders and instant coffee powders, when placed in containers, require to be sealed by means of a membrane that prevents the ingress of both moisture and gases and that also has tamper-proof properties. The conventional method of effecting this seal is to fit the closure caps with waxed pulpboard pads or wads to which are lightly heat-sealed double glassine membranes. In the course of application of the closure caps, the sealing surfaces or finishes (i.e. the lip or rim of the mouths) of the containers are first made adhesive by passing them under glue-coated rollers. Caps are then applied to the containers, and, after the adhesive has had time to dry out, the caps are unscrewed and the membranes part from the waxed pads and remain adhered to the finishes of the containers. In those cases where metal foil membranes are provided on metal cans or tins, the membranes may be crimped in place.
- It is, of course, essential that the membranes are intact when the closure caps are removed from the containers, thus providing evidence that the contents of the containers have not been tampered with.
- Membranes applied by means of adhesively coating the container finish possess the disadvantage that the adhesive takes some time to dry and the resultant water vapour is absorbed by the contents of the container. It is also difficult for the efficiency of the operation to be inspected at the end of the packing line.
- This disadvantage has been overcome to a certain extent by a method which applies a flat disc of adhesive-backed metal foil cold to the finish of the container by the impact of a punch to attach it lightly, subjects it to the action of a heated pressure member to cause it to adhere to the glass, and then completes the capsuling by pressure alone applied by a resiliently mounted pressing member. This method also has its disadvantages, however, since it has to be carried out in three stages with three different pressing members, with the result that the sealing efficiency is impaired due to the heat not being applied at the same time as the resilient pressing member.
- The crimping of metal foils to metallic tins or cans also has disadvantages, for instance filling disadvantages and the fact that the seal is not perfectly hermetic.
- These disadvantages of sealing membranes removably to containers have been great enough for a suggestion to have been made of completely fusing a thermoplastic membrane to a container of thermoplastic material, this being effected by an inductive heating method. Such is far too drastic a sealing method for most purposes, since the seal cannot be broken without damaging or distorting the container neck, and this makes re-sealing or re-use difficult or impossible.
- It is the object of the present invention to provide a method for applying metal foil membranes to containers, metallic or non-metallic, which will give a hermetic gas-tight seal, which may be carried out in a single stage, which, in one embodiment, may be accompanied by the application of a

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SEE ERRATA SLIP ATTACHED

closure cap, and which may lend itself to the highest closing speeds attainable. Such membranes are to be readily removable without damaging or distorting the container.

- 5 According to the present invention, there is provided a method of sealing a container mouth by bonding to the container finish a metal foil membrane which can be readily stripped away to leave the container finish 10 unimpaired, comprising pressing against the container finish a metal foil membrane which is coated with a thermoplastic material, at least on the portion of the membrane opposed to the container finish, 15 the pressure being insufficient to deform the container finish, and, while maintaining such pressure, subjecting the assembly to high frequency induction heating so as to plasticise the thermoplastic coating but not 20 the material of the container finish. This will normally mean that the temperature of the thermoplastic coating is brought to above its softening point but below its melting point and the temperature of the 25 material of the container finish is maintained below its softening point.

- Preferably, the metal foil membrane has only one coating of thermoplastic material on its face opposed to the container finish, 30 and the exposed surface of this coating is placed in direct contact with the container finish.

- The container may be of a wide variety of materials, for example metal, glass 35 ceramic or synthetic plastics. In the case of a synthetic plastics container, to avoid distortion of the container the thermoplastic coating must have a melting point lower than the material of the container.

- 40 Normally containers provided with sealing membranes are also supplied with closure caps, although this is not always the case. The closure caps may also be provided with resilient wads such as pulp 45 board or composition cork wads. Basically there are two types of closure cap for use with such containers as the present invention involves, and these may be classified broadly as the "snap-on" type and the "screw-on" 50 type. The screw-on type may have a continuous thread for engagement with a corresponding thread on the container neck, or it may be provided with a series of lugs which engage a rim on the container neck 55 or co-operate with a multi-start thread formed on the container neck. The screw-on type caps may be formed from metal, synthetic thermosetting materials such as urea-formaldehyde resins, and synthetic 60 thermoplastic materials such as polystyrene, high density polythene and polypropylene.

- The snap-on type caps are normally formed from metal or flexible plastics material, but can be formed of paper.

- 65 A particular advantage of the invention is

that the cap, a wad, for example of pulp-board, and the membrane may all be applied to the container at the same time, and the induction heating effected with the cap in place. This procedure is generally 70 easier if the cap is non-metallic.

When a screw-on closure cap is used, the cap may be fitted with a resilient wad and the metal foil membrane. The cap may then be screwed on to the container to 75 develop sealing pressure on the membrane, after which the high frequency heating current will be induced into the foil membrane. It is possible for the resilient wad and the metal foil membrane to be 80 formed as a unitary article. For instance a sheet of wad material, e.g. composition cork, may be stuck to a sheet of metal foil, and then discs may be cut from the laminate 85 so formed. It is important, however, that the bond between the wad and the foil membrane should be less than that between the membrane and the container, so that on removing the closure cap, the wad parts 90 from the membrane and may be used to reseal the container when the membrane has been discarded. It is to be noted that if a resilient wad is not used the foil membrane should be provided with a 95 backing of paper or the like so that the membrane does not adhere to the inside of the closure cap.

The sealing membrane may be of any metallic foil, but we have found that aluminium foil is the most economical. Tin 100 foil also makes a very good membrane. Another example is a tin-antimony foil. Before selecting the metal for the membrane consideration should, of course, be had to the contents of the container to be sealed. 105 The metal of the membrane must be inert with respect to the contents of the container. The thickness of the foil membrane should be as thin as possible consistent with it being free from "pin holes" and readily 110 handleable. Normally this will be between 0.025 and 0.05 millimetres.

When it is required not to use a separate closure cap, it being sufficient for the container to be closed by the membrane 115 only, the membrane may have the form of a disc, to seat on the container finish, with a continuous skirt on the periphery of the disc for engagement with the container below its finish, thus forming a closure cap 120 for the sealed container.

The thermoplastic coating may be, for example, of a vinylite resin, a natural or synthetic wax, or a microcrystalline wax mixture. It may also be of polythene or 125 polypropylene, or one of the many heat sealing coatings which are readily available, and which consist substantially of mixtures of plastics materials and resins. Examples include those which are sold under the 130

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Trade Names "Telstic", "Delseal",
"Inseal", "Thermostik" and "Elvax"
(Trade Mark). The thermoplastic material
may be coated on the whole of the underside
5 of the membrane, or it may be coated in the
form of an annular ring on the periphery
thereof. The former is preferred when the
membranes are stamped in large numbers
from sheet material, since the sheet material
10 may suitably be coated beforehand.

Plastics containers onto which membranes
may be sealed by means of the present
invention include those made from poly-
thene, polyvinylchloride, polystyrene, styrene
15 copolymers, for example acrylo-nitrile-
butadiene-styrene copolymers, polypropyl-
ene, cellulose acetate, polycarbonates and
phenoxy resins such as high molecular
weight polyhydroethers.

20 Since the sealing surfaces of containers
(especially glass containers) are rarely
uniform enough to ensure even adhesion
over the whole of the rim of the container,
a suitable tool for use in applying sealing
25 pressure to the membrane, and to the
closure cap and pulpboard wad when such
are used, includes a pad of resilient insulat-
ing material. This may conveniently be in
the form of an annulus corresponding to the
30 sealing surface of the container. The tool
is made of electrically insulating material,
and suitably it is this tool which is provided
with the source of high frequency current.
This may, for instance, be a coil or series of
35 coils surrounding the sealing head of the
tool, the coils being water cooled so that
they do not heat up to any appreciable
extent. No separate pressing tool is required
when sealing pressure is provided by a
40 plastics screw-on cap. The resilient sealing
pressure, which is most important if the
membrane is to bed down properly on the
container finish, is there provided by the
resilient wad in combination with the screw
45 cap.

The insulating material of which the
sealing head is made may be that sold under
the Trade Mark "Tufnol". The resilient
pad may be of any insulating material which
50 has resilient properties, for instance natural
and synthetic rubbers, foamed and expanded
rubbers, polyurethanes and other plastics
materials, natural cork and composition
cork.

55 The invention is illustrated by means of
the accompanying drawing, which is an
exploded, part sectional elevation of an
apparatus for applying, simultaneously, a
membrane, a pulpboard wad, and a closure
60 cap to a container.

Referring to the drawing, there is shown
a glass jar 1 to which is to be applied a
sealing membrane of aluminium foil 2
having a coating of thermoplastic adhesive
65 on its underside 3, a pulpboard wad 4, and

a snap-on closure cap 5. The vertically
reciprocable pressing tool, designated
generally 6, comprises a chuck of insulating
material 7, a resilient rubber ring or
annulus 8, and water-cooled radio frequency
70 heating coils 9 surrounding the chuck 7.
The apparatus also comprises an air press
10 and a pressure gauge 11.

In practice, the membrane 2, the pulp-
board wad 4 and the closure cap 5 are
75 pressed against the container finish by
means of the tool 6, whereafter the high
frequency current is switched on immedi-
ately the tool has attained its prescribed
capping pressure. The aluminium foil is 80
heated by means of the radio frequency
eddy currents induced in it, and this causes
the thermoplastic coating to become soft and
thus to cause adhesion. The heating time
is normally of very short duration, generally 85
considerably less than 1 second. We have
found a frequency of about 2 megacycles/
sec and a power source of between 1½ and
10 Kw to be very satisfactory.

It should be noted that the heat sealing 90
operation described herein may be carried
out by a simple manually-controlled
machine, or it can be effected by incorporat-
ing extra machinery into a single-or
multi-head semi- or fully-automatic capping 95
machine. For instance, a plurality of
capping heads such as that illustrated may
be used, or a single capping head mounted
on an intermittently rotating table. Again,
especially when plastics screw-on closure 100
caps are applied to the containers, the
containers may be fitted with their
membranes and screw-on caps and passed,
on a conveyor belt, through a continuous
induced high frequency field. This last 105
method permits very high speeds to be
attained.

WHAT WE CLAIM IS:—

1. A method of sealing a container
mouth by bonding to the container finish a 110
metal foil membrane which can be readily
stripped away to leave the container finish
unimpaired, comprising pressing against the
container finish a metal foil membrane
which is coated with a thermoplastic 115
material, at least on the portion of the
membrane opposed to the container finish,
the pressure being insufficient to deform the
container finish, and, while maintaining
such pressure, subjecting the assembly to 120
high frequency induction heating so as to
plasticise the thermoplastic coating but not
the material of the container finish.

2. A method as claimed in claim 1
wherein pressure is applied to the membrane 125
through the intermediary of resilient
material.

3. A method as claimed in claim 2
wherein the container is of glass.

4. A method as claimed in any of claims 130



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- Trade Names "Telstic", "Delseal", "Imseal", "Thermostik" and "Elvax" (Trade Mark). The thermoplastic material may be coated on the whole of the underside 5 of the membrane, or it may be coated in the form of an annular ring on the periphery thereof. The former is preferred when the membranes are stamped in large numbers from sheet material, since the sheet material 10 may suitably be coated beforehand.
- Plastics containers onto which membranes may be sealed by means of the present invention include those made from polythene, polyvinylchloride, polystyrene, styrene 15 copolymers, for example acrylo-nitrile-butadiene-styrene copolymers, polypropylene, cellulose acetate, polycarbonates and phenoxy resins such as high molecular weight polyhydroethers.
- 20 Since the sealing surfaces of containers (especially glass containers) are rarely uniform enough to ensure even adhesion over the whole of the rim of the container, a suitable tool for use in applying sealing 25 pressure to the membrane, and to the closure cap and pulpboard wad when such are used, includes a pad of resilient insulating material. This may conveniently be in the form of an annulus corresponding to the 30 sealing surface of the container. The tool is made of electrically insulating material, and suitably it is this tool which is provided with the source of high frequency current. This may, for instance, be a coil or series of 35 coils surrounding the sealing head of the tool, the coils being water cooled so that they do not heat up to any appreciable extent. No separate pressing tool is required when sealing pressure is provided by a 40 plastics screw-on cap. The resilient sealing pressure, which is most important if the membrane is to bed down properly on the container finish, is there provided by the resilient wad in combination with the screw 45 cap.
- The insulating material of which the sealing head is made may be that sold under the Trade Mark "Tufnol". The resilient 50 pad may be of any insulating material which has resilient properties, for instance natural and synthetic rubbers, foamed and expanded rubbers, polyurethanes and other plastics materials, natural cork and composition cork.
- 55 The invention is illustrated by means of the accompanying drawing, which is an exploded, part sectional elevation of an apparatus for applying, simultaneously, a membrane, a pulpboard wad, and a closure 60 cap to a container.
- Referring to the drawing, there is shown a glass jar 1 to which is to be applied a sealing membrane of aluminium foil 2 65 having a coating of thermoplastic adhesive on its underside 3, a pulpboard wad 4, and

a snap-on closure cap 5. The vertically reciprocable pressing tool, designated generally 6, comprises a chuck of insulating material 7, a resilient rubber ring or annulus 8, and water-cooled radio frequency 70 heating coils 9 surrounding the chuck 7. The apparatus also comprises an air press 10 and a pressure gauge 11.

In practice, the membrane 2, the pulpboard wad 4 and the closure cap 5 are 75 pressed against the container finish by means of the tool 6, whereafter the high frequency current is switched on immediately the tool has attained its prescribed capping pressure. The aluminium foil is 80 heated by means of the radio frequency eddy currents induced in it, and this causes the thermoplastic coating to become soft and thus to cause adhesion. The heating time is normally of very short duration, generally 85 considerably less than 1 second. We have found a frequency of about 2 megacycles/sec and a power source of between $1\frac{1}{2}$ and 10 Kw to be very satisfactory.

It should be noted that the heat sealing 90 operation described herein may be carried out by a simple manually-controlled machine, or it can be effected by incorporating extra machinery into a single-or 95 multi-head semi- or fully-automatic capping machine. For instance, a plurality of capping heads such as that illustrated may be used, or a single capping head mounted on an intermittently rotating table. Again, 100 especially when plastics screw-on closure caps are applied to the containers, the containers may be fitted with their membranes and screw-on caps and passed, on a conveyor belt, through a continuous 105 induced high frequency field. This last method permits very high speeds to be attained.

WHAT WE CLAIM IS:—

1. A method of sealing a container mouth by bonding to the container finish a 110 metal foil membrane which can be readily stripped away to leave the container finish unimpaired, comprising pressing against the container finish a metal foil membrane which is coated with a thermoplastic 115 material, at least on the portion of the membrane opposed to the container finish, the pressure being insufficient to deform the container finish, and, while maintaining such pressure, subjecting the assembly to 120 high frequency induction heating so as to plasticise the thermoplastic coating but not the material of the container finish.
2. A method as claimed in claim 1 wherein pressure is applied to the membrane 125 through the intermediary of resilient material.
3. A method as claimed in claim 2 wherein the container is of glass.
4. A method as claimed in any of claims 130



- 1-3 wherein the membrane is in the form of a simple flat disc having a diameter substantially equal to the outside diameter of the container finish.
- 5 5. A method as claimed in any of claims 1-3 wherein the membrane is provided with a skirt portion and forms a closure cap for the sealed container.
6. A method as claimed in any of claims 1-4 wherein the pressure on the membrane is exerted by a closure cap located over the membrane and secured to the container neck.
- 10 7. A method as claimed in claim 6 wherein the cap is of the screw-on type.
- 15 8. A method as claimed in any of claims 1-4 wherein the snap-on closure cap is applied to the container over the membrane before sealing and a pressing device applies the pressure to the membrane through the intermediary of the cap.
- 20 9. A method as claimed in any of claims 6-8 wherein a wad of resilient material is located between the cap and the membrane.
10. A method as claimed in any of claims 1, 2 and 4-9 wherein the container is of synthetic plastics material of higher melting point than that of the thermoplastic coating.
11. A method as claimed in any of the preceding claims wherein the metal foil membrane has only one coating of thermoplastic material on its face opposed to the container finish, and the exposed surface of this coating is placed in direct contact with the container finish.
- 35 12. A container whenever sealed by the method claimed in any of the previous claims.

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