March 6, 1951 F. R. LINDA 2,543,858

FUNGICIDALLY TREATED MULTIWALL BAG

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Fig. 1.

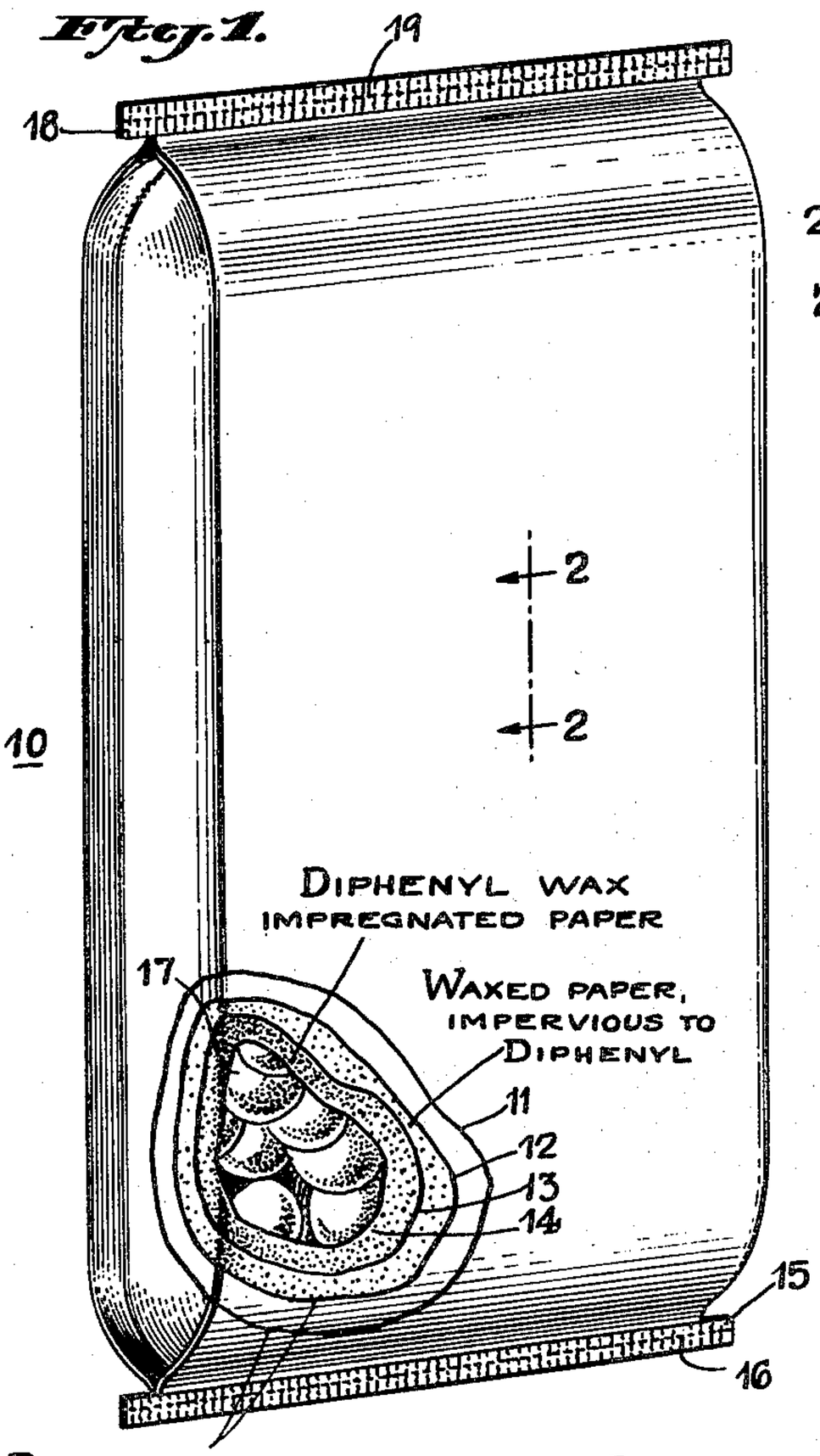


Fig. 2.

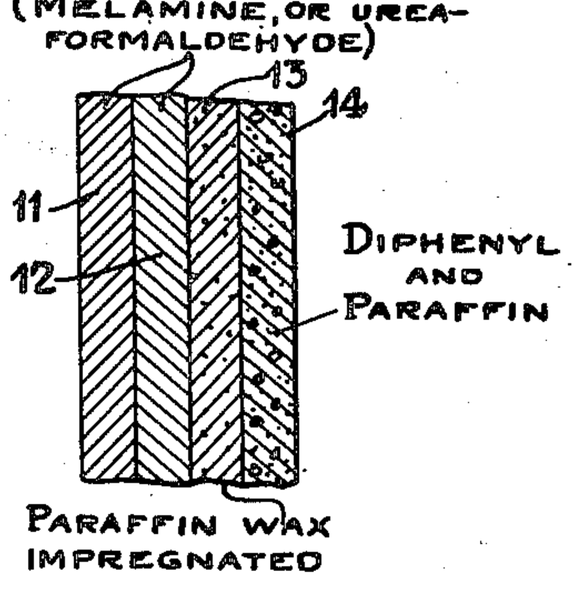
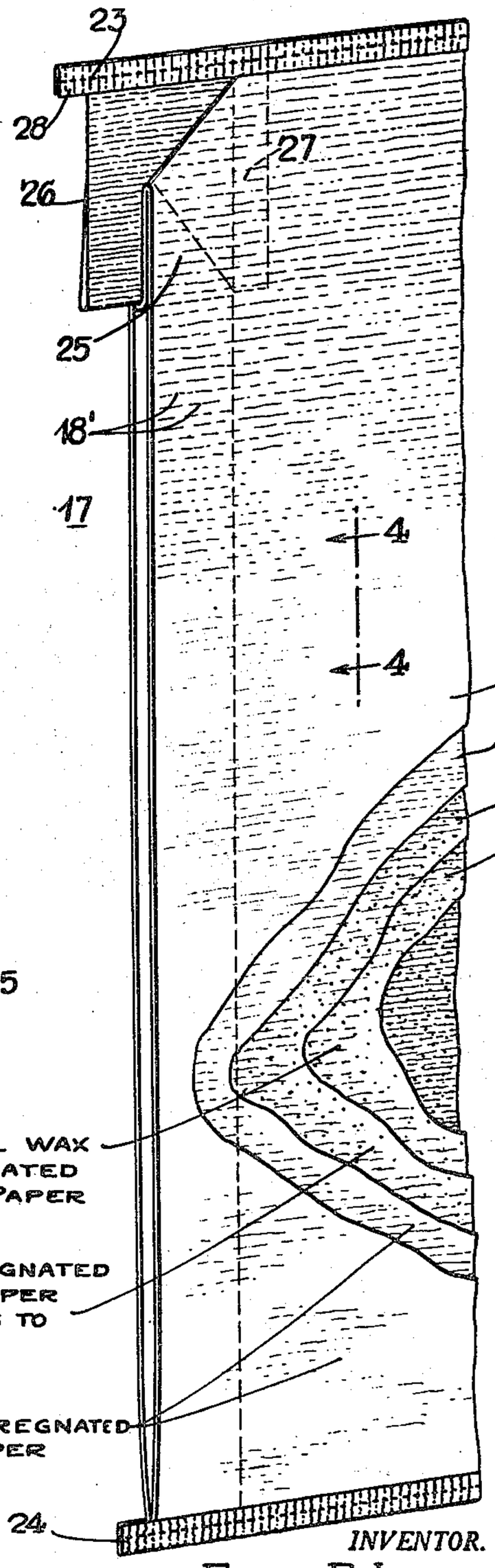


Fig. 3.



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FUNGICIDALLY TREATED MULTIWALL BAG

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Fig. 4.

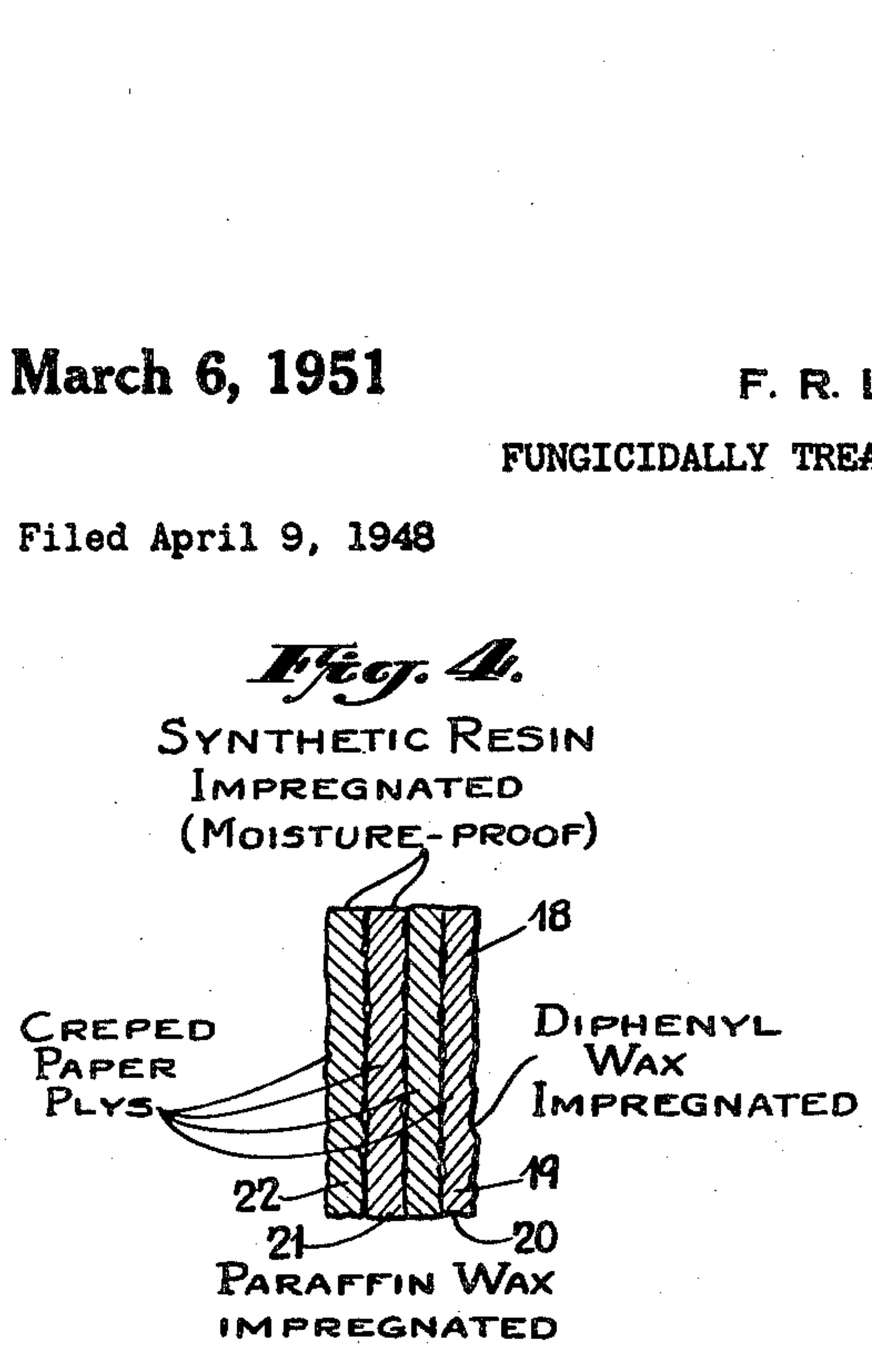


Fig. 6.

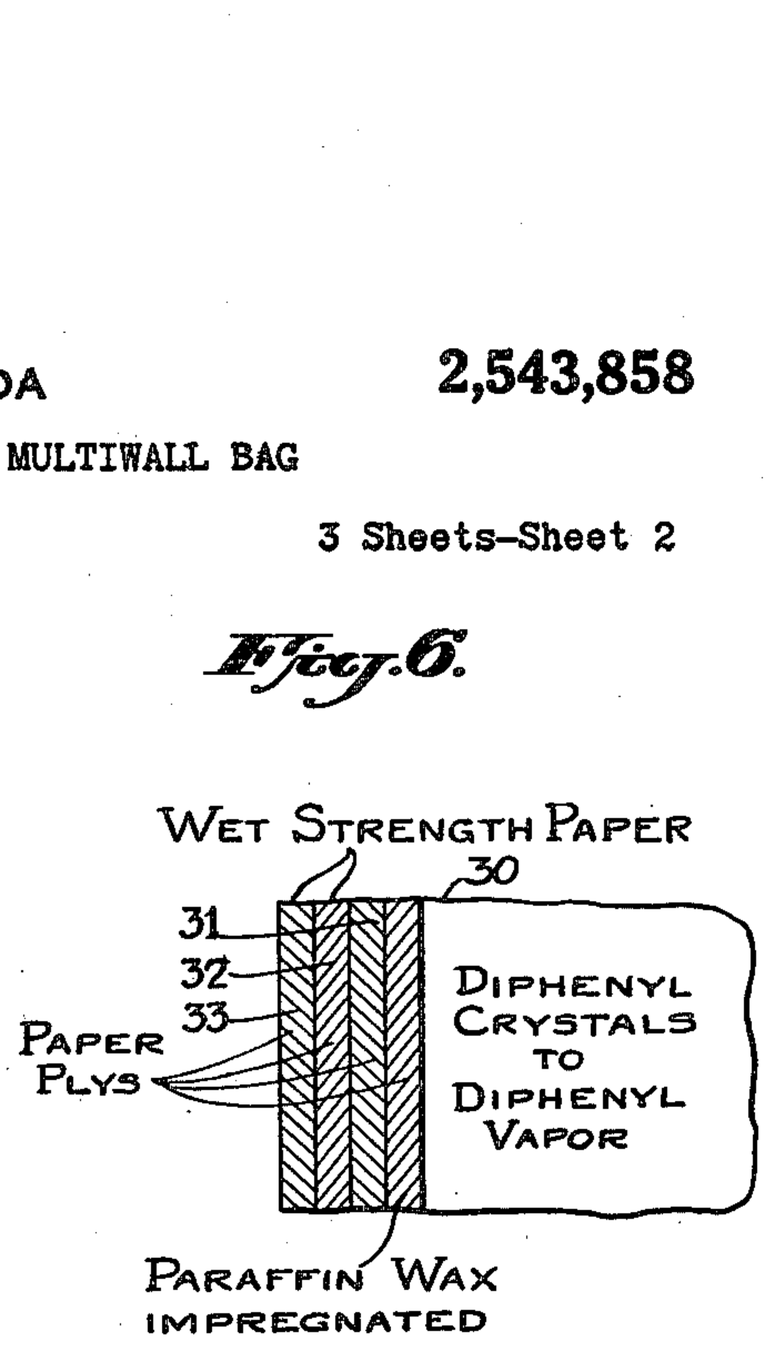


Fig. 7.

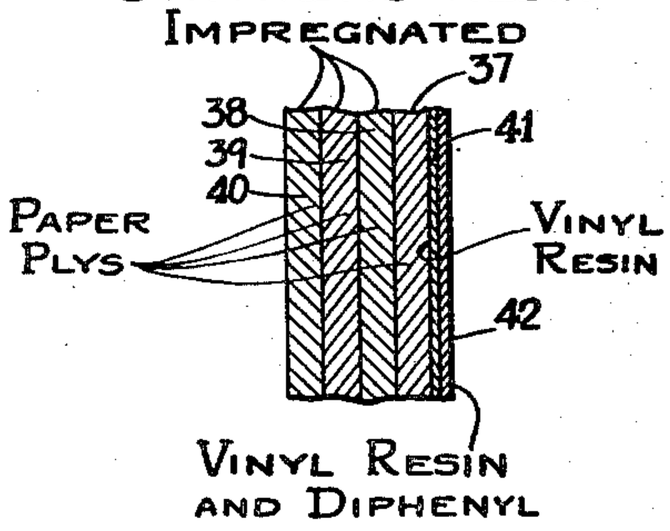


Fig. 8.

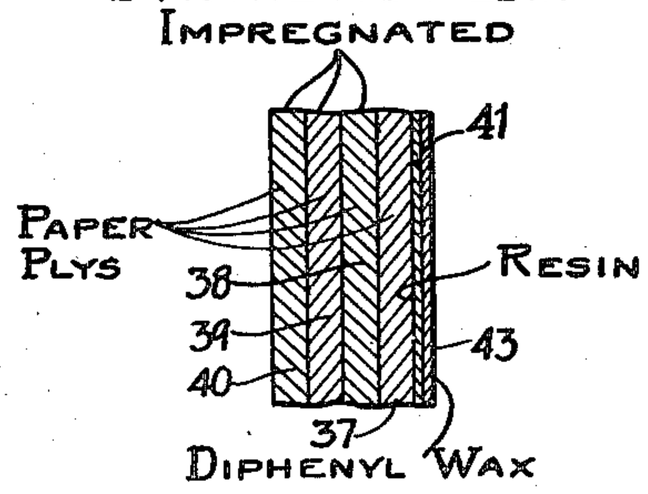


Fig. 9.

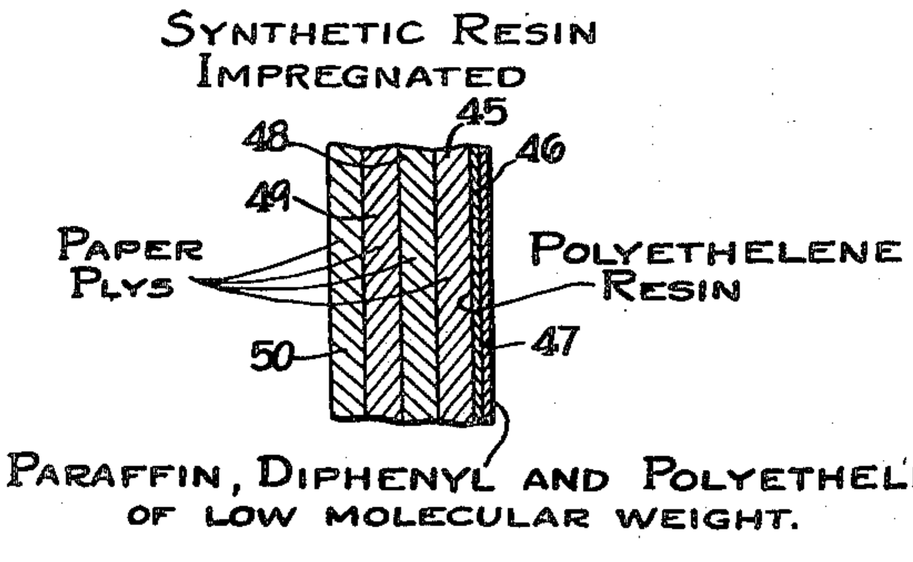
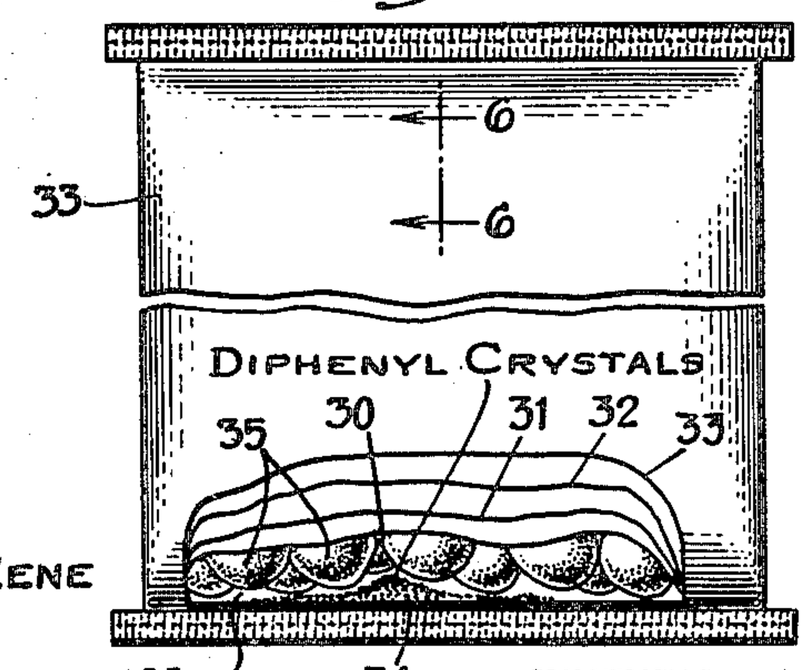


Fig. 5.



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FUNGICIDALLY TREATED MULTIWALL BAG

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Fig. 10.

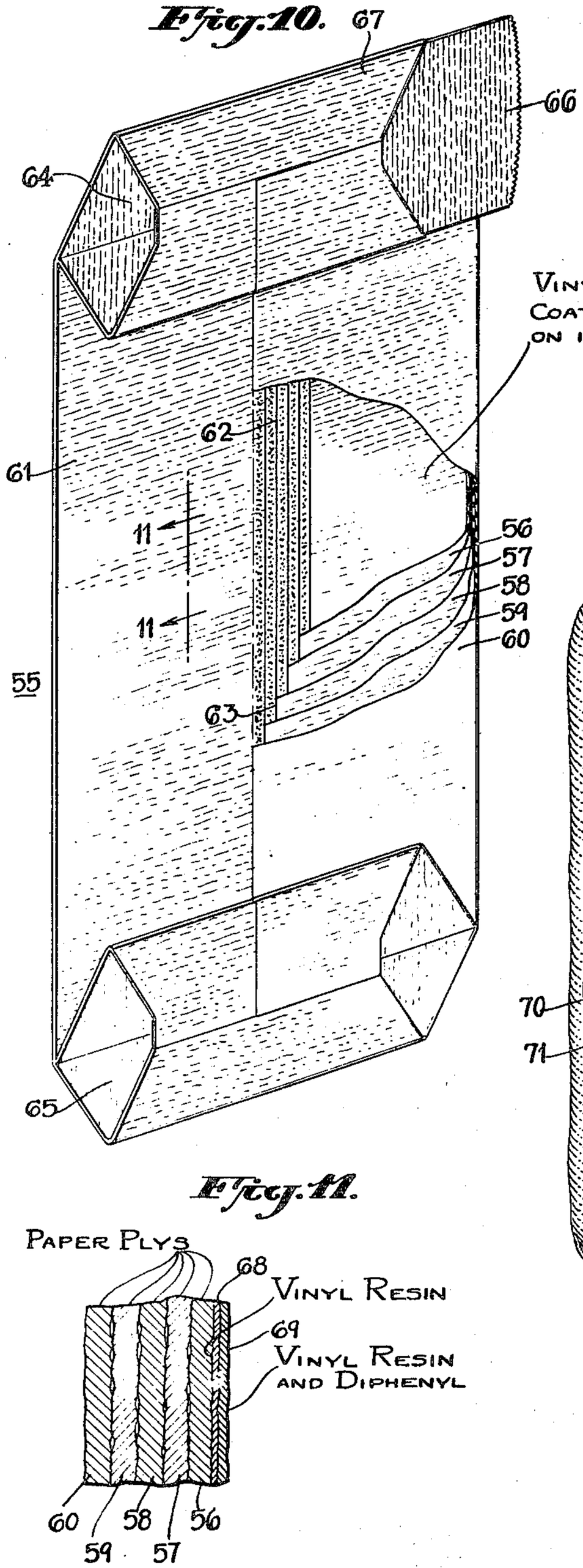
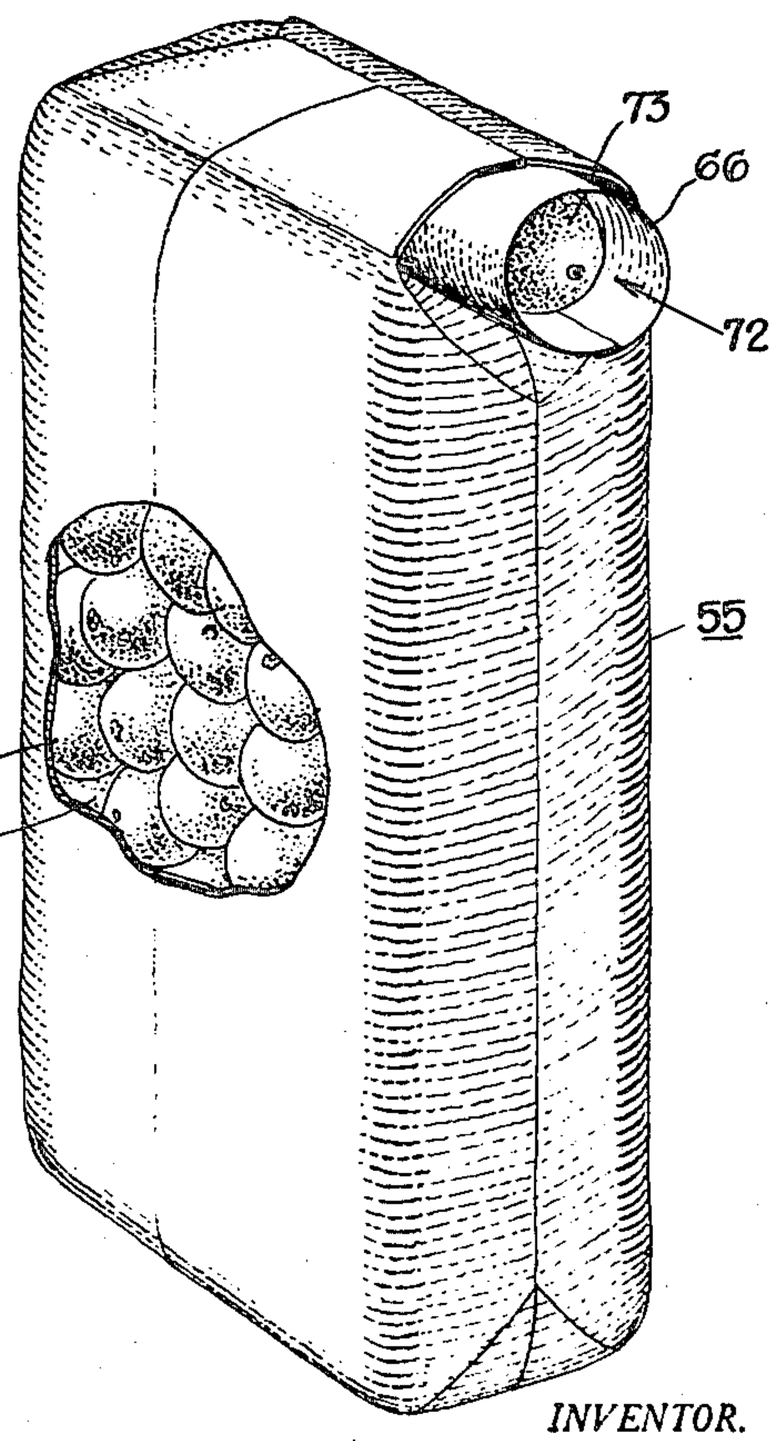


Fig. 11.

Fig. 12.



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2,543,858

UNITED STATES PATENT OFFICE

2,543,858

FUNGICIDALLY TREATED MULTIWALL BAG

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Application April 9, 1948, Serial No. 20,054

11 Claims. (Cl. 229—55)

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This invention pertains to shipping or packaging containers, fabricated of organic sheet material, such as paper and the like, and treated, at least on the inner surface thereof, with fungicidal agents for preventing or inhibiting mold formation or growth on substances packaged therein, and treated more particularly with fungicidal agents especially adapted to inhibit mold formation on citrus fruit, such as lemons, oranges, grapefruit and the like.

The invention pertains more especially to paper bags treated or coated with fungicidal agents as aforesaid, including paper bags of both single-wall and multiwall construction, and of both the open-ended and valve-sleeve types.

A primary object of the invention is the provision of paper shipping or packaging containers, including paper bags as aforesaid, which are intended for the packaging or shipping of citrus fruit, and which are treated with fungicidal agents effective to inhibit mold growth on such fruit, and which fungicidal agents are applied to such containers in such manner as to render the same most effective for this purpose.

Citrus fruit is susceptible to the formation and growth thereon of such molds as blue mold, green mold, stem end rot, etc. The effective inhibitors of such mold growths have been found to include propionic acid and salts thereof, such as the sodium, potassium, and ammonium salts, and also the propionic esters. Outstandingly effective for this purpose is the aromatic compound diphenyl, i. e., $C_6H_5.C_6H_5$.

One way of treating paper bags and the like with fungicidal agents of this character, is to impregnate the paper with a solution of the selected fungicidal agent. Such treatment, however, does not render the container an effective inhibitor of mold growth over long periods of time, such as is ordinarily required in the packaging and shipping of citrus fruit, since the fungicidal escapes through the paper container into the outer atmosphere, by diffusion and vaporization, leaving the packed fruit unprotected against attack by molds.

In accordance with a basic concept of the present invention, I substantially prevent or greatly retard this outward diffusion and escape of the fungicidal agent, by interposing a relatively impervious barrier between the interior of the bag or other container, and the outer wall or wall surface thereof, and, in conjunction therewith, I so dispose the fungicidal agent on the interior of this barrier as to provide for its gradual diffusion and vaporization into the container, when packed,

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so as to form and maintain a fungicidal atmosphere within the container, which, by thus constantly bathing the therein packaged goods, substantially prevents or inhibits any tendency to mold formation or growth on the packaged fruit.

As applied to single-wall or single-ply bags or containers, this barrier may take the form of an impregnation or coating of the container, with a plastic substance which renders the container relatively impervious to escape of the fungicidal agent therethrough. Thus, for example, I may impregnate or coat the container with a suitable wax such as a mineral or petroleum base wax, for example, a paraffin wax, having a melting point, for example, of about 150 to 200° F. Such wax impregnation or coating may be effected in known ways, as by feeding the paper stock, prior to fabrication of the container, through a molten bath of the wax, or by wax-coating one or both paper surfaces by employment of transfer rolls dipping into the wax bath and rotating against the paper surface or surfaces, or by spraying the molten wax, or a solution or emulsion thereof, onto the paper surface, followed by sufficient heating to melt the wax into a smooth, continuous surface coating. The fungicidal agent, for example, diphenyl, may be incorporated directly in the wax bath, and thus applied to the paper therewith, since diphenyl is compatible with and soluble in the waxes aforesaid. Preferably, however, the fungicide is applied only to the inner surface of the paper stock, for example, as an inner wax coating on the plain or wax-impregnated paper stock, since this avoids waste of the fungicidal agent, and assures optimum diffusion of the agent into the interior of the container when packed.

Alternatively, the relatively impervious barrier interposed between the inside and outside of the paper bag or other container, may take the form of a resinous film applied as a continuous coating to the inner surface of the paper. This resinous coating may comprise, for example, a thin layer of any suitable and preferably thermoplastic resin, such, for example, as the vinyl resins, or so-called "vinylites," such as polymerized vinyl chloride or vinyl acetate, or resins comprising copolymers thereof; or polyethylene; or stylene, a copolymer of styrene and isobutylene, etc. This resinous film may be applied to the paper surface, prior to fabrication into bags or other containers, by any of the various processes, as, for example, by hot calender rolling the resinous film onto paper while the resin is in a heated and plastic condition, or by a blade coater procedure wherein a roll rotating against the paper dips into a bath

of the molten resin, or by a similar procedure wherein the resin is dissolved into a suitable solvent, or by the so-called "flame spray gun" method, wherein the resin is sprayed in finely subdivided and molten state onto the paper by means of a spray gun similar to the well-known types of spray guns for spraying molten metal, or is sprayed onto the paper in the form of an emulsion or aqueous dispersion, and is thereafter dried and melted by heating, etc.

In this resin film modification of the invention, the fungicidal agent may be incorporated in the resin prior to coating and thus be incorporated directly in the resinous film applied to the inner surface of the container. Thus, for example, diphenyl, being compatible with vinyl resins, may be applied to the inner surface of the paper container in this way.

Another modification consists in first coating the container interior with a layer of pure resin, on the inner or exposed surface of which is applied an overcoating of the fungicidal agent or a suitable plastic composition containing the same. Thus the overcoating layer may be a wax film incorporating the fungicide, or may comprise a second coating of resin containing the fungicide, for example, a vinyl resin containing diphenyl.

As applied to multiwall or multiply bags or containers, the innermost ply may be impregnated or coated on its inner surface with wax containing diphenyl or other fungicidal agent aforesaid, while the next adjacent ply may be impregnated or coated with pure wax, thereby to provide the relatively impervious barrier above referred to, interposed between the outer bag ply or plies and the inner ply impregnated or coated with the fungicide. The imperviousness and strength of this multiwall bag modification of the invention may be further enhanced by making the outer ply or plies of wet-strength paper, i. e., paper having incorporated therein, in process of manufacture, a small amount of a thermosetting synthetic resin, for example about 2 to 5% of an urea-formaldehyde or melamine-formaldehyde resin, which is thereafter thermoset by subsequent heating and curing.

Alternatively, as applied to mulitwall bags, the inner surface of the innermost ply may be coated with a resinous film as aforesaid, containing the fungicidal agent, or may have applied thereto a coating of pure resin which is thereupon overcoated with the fungicidal agent or with a plastic coating composition of wax or resin incorporating the fungicide.

Having thus described the invention in general terms, reference will now be had, for a more detailed description, to the accompanying drawings, wherein:

Figure 1 is a perspective view of an initially open ended, sewn seam type of multiwall bag, embodying the modification aforesaid, wherein the inner ply is impregnated with wax containing the fungicidal agent, while the next adjacent ply is impregnated with the pure wax. In the Fig. 1 showing, portions of the bag plies are broken away to show the successive plies and the bag interior. Figure 2 is an enlarged, fragmentary, sectional view taken at 2—2 of Fig. 1.

Figure 3 is a perspective view, analogous to Fig. 1, of a portion of a multiwall valve sleeve type of bag, made of creped paper, embodying the Fig. 1 modification of the invention, while Figure 4 is an enlarged fragmentary sectional view taken at 4—4 of Fig. 3.

Figures 5 and 6 illustrate a multiwall bag modification of the invention, wherein the innermost ply is impregnated with pure wax and the fungicidal agent is dispersed in loose crystalline or powdered form within the bag, Fig. 5 being a front elevation of such a bag construction with parts broken away to show the interior; while Fig. 6 is an enlarged sectional detail taken at 6—6 of Fig. 5.

Figure 7 is an enlarged fragmentary sectional view, similar to Fig. 2, through a multiwall paper bag, the innermost ply of which has applied to its inner surface a thin film of a pure resin, this film being overcoated with a further resinous film embodying the fungicidal agent; while Figure 8 shows a similar construction, but one wherein the film of pure resin is overcoated with a film or layer of wax incorporating the fungicidal agent.

Figure 9 is an enlarged fragmentary sectional view, similar to Fig. 7, but wherein the innermost paper ply has applied to its inner surface a coating of pure polyethylene, which in turn is overcoated with a composition comprising a mixture of low molecular weight polyethylene, paraffin and the fungicidal agent, for example, diphenyl.

Figure 10 is a perspective view of a pasted or glued, stepped-end and stepped side seam type of multiwall bag, of the valve sleeve construction, embodying the modification of the invention wherein the inner surface of the innermost bag ply is coated with a pure thermoplastic resin, such as a vinyl resin, to which is applied a resin overcoating containing a fungicidal agent, such as a vinyl resin containing diphenyl. Figure 11 is an enlarged sectional detail taken at 11—11 of Fig. 10.

Fig. 12 is a perspective view of the multiwall bag of Figs. 10 and 11, after filling with citrus fruit, for example, oranges, with a portion of the bag broken away to show the fruit packaged therein.

Referring to Figs. 1 and 2, there is illustrated generally at 10 a multiwall paper bag, of an initially open-ended type, and consisting of a plurality of paper plies or tubes, as at 11 to 14, inc., disposed one within another, and secured together at the base by means of an overlapping paper strip 15 and a sewn seam 16. After the bag is filled with the citrus fruit, to be packed therein, as illustrated at 17, the upper end of the bag is closed, in similar fashion, by means of an overlapping paper strip 18 and sewn seam 19.

In accordance with the modification of the invention illustrated in Figs. 1 and 2, the innermost ply 14 of the bag is impregnated with a paraffin or other mineral wax, having a melting point, for example, of about 150 to 160° F., and incorporating therein a fungicidal agent, such as diphenyl, adapted to prevent or inhibit mold growth on the fruit. Thus, the inner ply 14 may be impregnated with diphenyl dissolved in a paraffin or other mineral oil, and thus admixed with a molten bath of paraffin or mineral wax. In the bath, the ratio of diphenyl to wax will range preferably from about ½ to ⅓, and the paper impregnated therewith to such degree that the resulting impregnated paper will contain about 8 to 12% of diphenyl to the weight of the paper, and about 10 to 20% of wax to the weight of the paper. This impregnation may be effected by feeding the paper through the aforesaid fungicide-containing, wax-oil bath, while the bath is maintained in a molten state at about 150 to 160° F. Instead of employing diphenyl as the fungicidal agent, propionic acid or a salt of propionic acid, such

as the sodium, potassium or ammonium salt thereof, may be employed in such proportion that the impregnated paper will contain about 2% of the propionic acid or propionate, by weight of the paper. Where propionic acid is employed, it is best to employ, for impregnation, an acid-resistant, wet-strength paper. Where a salt of propionic acid is employed, ordinary kraft paper may be employed as the inner bag ply, inasmuch as these salts do not attack the paper.

Still referring to Figs. 1 and 2, the next adjacent ply 13 of the bag is rather heavily impregnated with a pure paraffin or mineral base wax, in the manner aforesaid, and to the extent of about 20 to 30% of the wax to the weight of the paper, thereby to provide a relatively impervious barrier as aforesaid, between the inner, fungicidally treated ply 14, and the outer bag plies 11 and 12.

With the bag as thus constructed, and having the inner plies thus fungicidally treated, the fungicidal agent will diffuse and vaporize into the bag interior, when packed as illustrated in Fig. 1, and thus form therein a fungicidal atmosphere which bathes all surfaces of the fruit 17 packed therein, thereby preventing the formation and growth of molds thereon. Meantime, the relatively heavily impregnated, and, hence, impervious wax-impregnated paper sheet 13 will prevent or at least greatly retard the diffusion and escape of the fungicidal agent from the bag interior through the outer bag plies into the outer atmosphere.

The fungicidal agents aforesaid vaporize rather readily to produce a fungicidal atmosphere within the bag, inasmuch as diphenyl has a melting point of about 160° F., while propionic acid has a melting point slightly below 0° F., and hence tends to fume at room temperature. The salts thereof are less volatile, and hence diffuse somewhat more slowly into the bag interior. None of the above-mentioned fungicidal agents is injurious to humans and other warm-blooded animals, nor do they burn or injure the fruit, and hence may be employed with safety as regards both.

Referring now to Figs. 3 and 4, the valve sleeve type of bag illustrated therein, and shown generally at 17, is made of creped paper as indicated at 18, this bag comprising a multiplicity of paper plies or tubes 19 to 22 inc., disposed one within another, as shown, these tubes being secured together, to form closures, at the uper and lower ends thereof by means of overlapping paper strips and sewn seams as indicated at 23, 24. At the upper left-hand corner the valve plies are folded inwardly in the conventional manner, as indicated at 25, to provide an aperture through which the valve sleeve 26 is inserted and secured in place, in the conventional manner, by gluing, as at 27, and by means of the overlapping paper strip and sewn seam 23, as indicated at 28.

As in the Figs. 1 and 2 modification, the inner bag ply 19 is impregnated with a wax-like composition comprising paraffin or other mineral wax having dissolved or suspended therein the fungicidal agent, such as diphenyl, ammonium propionate, etc.; while the next adjacent ply 20 is impregnated rather heavily with a pure wax as aforesaid. As in the Figs. 1 and 2 modification, the inner ply 19 is impregnated with wax to the extent of about 10 to 20% of the paper weight, and with the fungicidal agent, in the case of diphenyl, to about 8 to 12%, preferably about 10% of the paper weight, and, in the case of ammonium propionate, to the extent of about 2% of the paper weight. The next adjacent paper ply 20 is more heavily impregnated with wax, namely, to the extent of about 20 to 30% of the paper weight.

In the modifications of Figs. 1 to 4 inc., the outer paper plies 11, 12 and 21, 22, may be made of ordinary kraft paper, but preferably are made of wet-strength paper, i. e., paper incorporating therein in process of manufacture, a small amount of thermosetting synthetic resin, such as a urea-formaldehyde resin to the extent of about 3 to 5% by weight of the finished paper, or a melamine-formaldehyde resin to the extent of about 2% by weight of the finished paper, the resin so incorporated being thereafter cured and converted to the thermoset condition, during the drying operation of the paper manufacture.

In the modification illustrated in Figs. 5 and 6, the innermost ply 30 of the multiwall paper bag illustrated, is heavily impregnated with a pure paraffin or mineral base wax, i. e., to the extent of about 20 to 30% of the paper weight, while the remaining or outer plies 31, 32, 33, are preferably made of wet-strength paper as aforesaid. In this modification, a small amount of the fungicidal agent is merely dumped into the bag, in powdered or crystalline form, for example, diphenyl or ammonium propionate crystals, as indicated at 34, Fig. 5. After the bag is filled with the citrus fruit 35 and sealed or closed, following the packing operation, the crystals of the fungicidal agent will vaporize to form the aforesaid fungicidal atmosphere within the bag, thus to protect the fruit 35 packed therein, while the wax-impregnated inner ply 30 will serve as a substantially impervious barrier, preventing or retarding the escape of the fungicidal agent into the outer atmosphere through the outer bag plies 31 to 33 inc.

In the modification of Fig. 7, there is illustrated a section of a multiwall bag comprising an inner ply 37 and outer plies 38, 39 and 40. The inner surface of the inner ply 37, has applied thereto a closely adhering coating 41 of a thermoplastic resin, such, for example, as a pure vinyl resin, or one obtained by copolymerizing about 95% vinyl chloride with 5% vinyl acetate. The resin coating 41 is thereupon overcoated with a second resin coating 42 having the fungicidal agent incorporated therein. The resin coating 42 may comprise, for example, a vinyl resin incorporating therein the fungicidal agent diphenyl, the latter to the extent of about 10% by weight of the paper ply 37. Also, the resin in the coatings 41 and 42 will be applied to such thickness that the resin film constitutes about 50% by weight of the paper ply 37, for example, at the rate of about 25 pounds of resin per 50 pounds of paper. For the paper plies, a 50-pound paper may be used, which runs about 5 mils in thickness, whereas the resin coatings 41 and 42 would run about 1 to 2 mils in total thickness. The resin undercoating 41 is quite impervious to penetration by the fumes of the fungicidal agent, for example, diphenyl, and thus forms an effective barrier between the interior of the bag and the exterior thereof, as regards escape or leaking-through of the diphenyl fumes. The inner resin coating 42 containing the fungicidal agent, serves as a surface medium for diffusing this agent into the bag interior when packed, thus producing therein a fungicidal atmosphere for protecting the packed fruit.

Fig. 8 illustrates a modification of the Fig. 7 embodiment, wherein the inner resin coating 41 is provided with an overcoating 43 of wax incorporating the fungicidal agent therein. Al-

ternatively, in the modification of Fig. 8, the fungicidal agent may be incorporated in the resin undercoating 41, and also in the wax overcoating 43. Likewise, in the Fig. 7 modification the resin coatings 41 and 42 may be combined into a single coating incorporating the fungicide.

It should be pointed out in connection with the modification of Figs. 7 and 8, that the resin coatings referred to, greatly enhance the mechanical strength of the inner paper ply, and thus result in a multiwall bag which is much stronger mechanically than one made of the same number of paper plies of straight kraft paper, this in addition to the function of the resin undercoatings 41, in forming a relatively impervious barrier, between the inner bag surface coated with the fungicidal agent, and the outer bag plies.

Referring to the Fig. 9 modification, the inner surface of the inner bag ply 45, is first coated with a polyethylene resin film 46, which is thereupon overcoated with a layer 47 comprising a solution of paraffin wax, low molecular weight polyethylene, and a fungicidal agent, such as diphenyl. In this modification, as in those previously referred to the polyethylene undercoating layer 46 serves as an impervious barrier between the inner layer 47 containing the fungicidal agent, and the outer bag plies 48, 49 and 50.

Referring to the modifications of Figs. 10 to 12 inc., there is shown generally at 55 a multiwall paper bag, consisting of a succession of paper plies 56 to 60 inc., made of creped paper, as indicated at 61, these plies taking the form of paper tubes disposed one within another as shown, the paper tubes having longitudinally extending seams arranged in stepped configuration relative to each other, as shown at 62, 63, to provide overlapping stepped edges, as illustrated, which are glued to one another. The bag ends are disposed in similar stepped configuration, and are creased, folded and glued together, as indicated generally at 64, 65, the upper bag ends being provided with a valve sleeve 66 extending from the exterior to the interior of the bag and glued to the upper bag end 64 as indicated at 67.

As shown more particularly in Fig. 11, the innermost surface of the inner bag ply 56 is coated with an adherent layer 68 of a pure thermoplastic resin, such as a vinyl resin, on which is superimposed an overcoating resinous layer 69, comprising for example a vinyl resin incorporating a fungicidal agent, such as diphenyl, the coating weights, thicknesses and proportions of the fungicide to the resin, in layer 69, being as above stated for the previously described modifications of the invention.

The bag when packed with citrus fruit, will have the appearance shown in Fig. 12, wherein the packed fruit, for example, oranges, is shown at 70 in the broken-away portion 71 of the bag, the packaging being effected by feeding the oranges, either manually or automatically, into the aperture 72 of the valve sleeve 66, as indicated at 73, whereupon the valve sleeve is folded over and tucked in in conventional fashion.

The stepped seam and glued bag construction of Figs. 10 to 12 inc. may of course be applied to a bag of the initially open-ended type, having no valve sleeve, and the open end of which is closed by folding and gluing, after packing. Both this modification and the valve sleeve modification illustrated in Figs. 10 to 12 inc. are especially effective modifications of the invention, inasmuch as, when packed, these bags are substantially leakproof as regards escape of the fungicidal agent.

The bag modification of Figs. 10 to 12 inc. may, of course, have the fungicide applied thereto or incorporated therein in any of the various ways illustrated in Figs. 1 to 9 inc. For example, instead of resin coating the inner bag ply 56, this ply may be impregnated with a wax-containing fungicidal agent, and the next adjacent ply 57 heavily impregnated with pure wax to provide the relatively impervious barrier referred to between the fungicidally treated inner ply 56 and the remaining outer bag plies 58 to 60 inc.

The paper bags or containers, in accordance with the present invention, in addition to inhibiting mold growth on goods packaged therein, serve the additional important function of substantially preventing or greatly minimizing the drying out or evaporation of moisture from such goods, especially citrus fruits and the like, owing to the aforesaid relatively impervious barrier, in the form of resin or wax coatings or impregnations, interposed between the bag interior and the exterior thereof. In this way shrinkage of the fruit is prevented, with consequent unsalability resulting therefrom. Likewise since citrus fruit and the like are ordinarily sold by the pound rather than by the unit of fruit, the selling price of the goods is enhanced by the packaging containers of the present invention.

What I claim is:

1. A multiwall bag comprising a plurality of paper tubes, disposed one within another, said tubes being formed with overlapping edges glued together longitudinally thereof, and all of said tubes being secured together at one end thereof to form a closure, one of said tubes being treated with a fungicidal agent, vaporizable at atmospheric temperatures, and in amount sufficient effectively to inhibit mold growth on goods packaged therein, and one of said tubes being treated with a plastic composition in amount sufficient to render the same relatively impervious to diffusion and escape of said fungicidal agent therethrough, said fungicidally treated tube being disposed inwardly of said plastic treated tube.

2. A multiwall bag according to claim 1 wherein said fungicidal agent comprises a compound containing the radical $CH_3CH_2COO—$.

3. A multiwall bag according to claim 1 wherein said fungicidal agent comprises diphenyl.

4. A multiwall bag comprising a plurality of paper tubes, disposed one within another, said tubes being formed with overlapping edges glued together longitudinally thereof, and all of said tubes being secured together at one end thereof to form a closure, the innermost tube of said bag being treated with a fungicidal agent, vaporizable at atmospheric temperatures, and in amount sufficient effectively to inhibit mold growth on goods packaged therein, and one of said tubes disposed outwardly of said innermost tube being treated with a plastic composition in amount sufficient to render the same relatively impervious to diffusion and escape of said fungicidal agent therethrough.

5. A multiwall bag according to claim 4 wherein said fungicidal agent comprises a compound containing the propionic acid radical $CH_3CH_2COO—$.

6. A multiwall bag according to claim 4 wherein said fungicidal agent comprises diphenyl.

7. A multiwall bag comprising a plurality of paper tubes, disposed one within another, said

tubes being formed with overlapping edges glued together longitudinally thereof, and all of said tubes being secured together at one end thereof to form a closure, the inner surface of the innermost tube of said bag being coated with a fungicidal agent, vaporizable at atmospheric temperatures, and in amount sufficiently effectively to inhibit mold growth on goods packaged therein, and one of said tubes disposed outwardly of said fungicidal coating being treated with a plastic composition in amount sufficient to render the same relatively impervious to diffusion and escape of said fungicidal agent therethrough.

8. A multiwall bag comprising a plurality of paper tubes, disposed one within another, said tubes being formed with overlapping edges glued together longitudinally thereof, and all of said tubes being secured together at one end thereof to form a closure, the inner surface of the innermost tube being coated with an adherent layer of a plastic composition, said layer being treated, on its exposed inner surface, with a fungicidal agent, vaporizable at atmospheric temperatures, and in amount sufficient effectively to inhibit mold growth on goods packaged in said bag, and said adherent layer of plastic composition being relatively impervious to diffusion and escape of said fungicidal agent therethrough.

9. A multiwall bag according to claim 8 wherein

said fungicidal agent comprises a compound containing the radical $CH_3CH_2COO—$.

10. A multiwall bag according to claim 8 wherein said fungicidal agent comprises diphenyl.

11. A multiwall bag comprising a plurality of paper tubes, disposed one within another, said tubes being formed with overlapping edges glued together longitudinally thereof and all of said tubes being secured together at one end thereof to form a closure, the innermost tube of said bag being impregnated with a mixture of wax and diphenyl, the latter in amount sufficient to inhibit mold growth on goods packaged therein, and one of said tubes, disposed outwardly of said innermost tube, being impregnated with wax in amount sufficient to render the same relatively impervious to diffusion and escape of said fungicidal agent therethrough.

FRANK RAYMOND LINDA.

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