

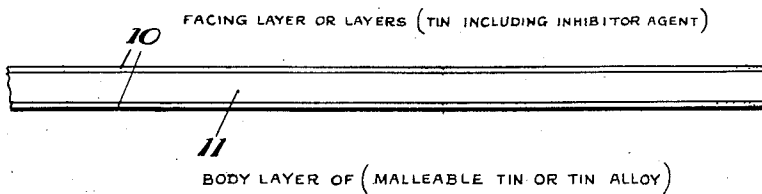
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TIN ALLOY

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TIN ALLOY

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This invention relates to tin alloys for food containers, and has for its object to provide a tin alloy that is chemically less active with certain foodstuffs than commercial tin and tin alloys now employed. Alloys in conformity with the present invention are susceptible to use with a wide variety of foodstuffs, and in containers of a wide variety of character and construction, but they have been found to be of particular utility when employed in metal foils for food packing, especially cheese wrappers, but it is to be expressly understood that in its broader aspects the present invention is of wider application, and may be used in the production of cans, boxes, casings, etc., or as a lining for or as an inner facing for the walls of such containers, or wherever it is desirable to have a metal surface in contact with foodstuff. For a specific illustration of the utility of the invention, however, the invention will be described with respect to its use in foil, particularly for wrappings for cheese.

Heretofore it has been customary to wrap cheese in tin foil, but several types of cheese have been found to have a relatively high chemical activity when in contact with such foil, causing a marked discoloration of the foil or corrosion thereof. In order to avoid such discoloration, inner paper linings have been used in conjunction with the foil, and also various resins and lacquer coatings have been applied to the foil, but such expedients have added materially to the cost of the wrapping and, moreover, they have not been found entirely satisfactory.

I have discovered that such discoloration can be largely if not entirely prevented by alloying with the tin a relatively small percentage of what may be termed "an inhibitor agent", i. e., an agent which decreases or substantially eliminates discoloration or corrosion of the tin when in contact with the foodstuff, as cheese under the illustration being considered. I have found that certain metals which are anodic with respect to tin, and which also are characterized by having a preferential affinity for oxygen as respects tin, when added to commercial tin or commercial alloys of tin whose other constituents do not prevent the inhibiting action of said agent, are highly effective in preventing discoloration or corrosion of the tin.

While not wishing to limit the present invention by the theory herein expressed, it is believed that the corrosion of the tin, which causes the discoloration, is electro-chemical in nature and due to the setting up of small galvanic cells because of the presence of certain impurities in commercial tin, and also perhaps because of ir-

regular concentrations of electrolytes in the medium. Some of these impurities are cathodic with respect to tin and therefore increase its tendency to go into solution, making it more susceptible to corrosion. By adding a small percentage of metal which is anodic with respect to tin the tendency of the tin to go into solution is decreased. Experience has demonstrated that with some cheeses the wrapper does not discolor or corrode unless exposed to air or oxygen containing compounds. This might be accounted for by the generally accepted theory of polarization the essence of which is that hydrogen, probably in an atomic state, is deposited on the metal and prevents further action taking place. Therefore, it may be that the addition of such inhibiting agents to the tin not only makes the tin cathodic but also acts as an anti-depolarizer, maintaining a state of polarization at the surface of the tin.

In conformity with the present invention, the alloy used consists chiefly of tin, which term is used as generic both to commercially pure tin and alloys of tin whose other constituents, such as antimony, for example, do not interfere with the inhibiting action of metals characterized by being anodic with respect to tin and having a preferential affinity for oxygen with respect to tin.

I have found that the addition to tin, as just characterized, of relatively small quantities, preferably less than three percent, of one or more metals of the character above referred to, such for example as magnesium, calcium, aluminum, etc., or combinations thereof, or combinations therewith of cadmium, results in the production of an alloy which is of great utility in preventing discoloration or corrosion in contact with foodstuffs. The particular inhibiting agent used varies to some extent with the characteristics of the foodstuff which is to be in contact therewith, some alloys being better suited than others for particular foodstuffs. For example, in the case of cheese, a tin alloy including .2% aluminum has been found to be better suited for a certain type of processed American cheese, while a tin alloy including .05% magnesium and .5% cadmium has been found to be better suited for processed Limburger cheese. Therefore, it is to be expressly understood that the present invention contemplates the selection of an inhibiting agent or agents best suited to the particular foodstuff to be enclosed.

I have found that the addition of as little as .01% of magnesium or aluminum largely inhibits the discoloration resulting from food corrosion. In the case of magnesium, even in an amount as

low as .01%, excellent results are obtained by adding .5 to 1% of cadmium. Cadmium may also be used as the sole alloying agent, in amounts from .1 to 3%, but less satisfactory results have been obtained therefrom. Other metals, characterized as above set out may also be used; for example calcium has been found to be a satisfactory inhibiting agent when used in amounts varying from .01 to .5%. Combinations of two or more of the inhibiting agents may also be used, as for example in the case of magnesium and cadmium as above referred to.

The addition of such inhibiting agents as magnesium or aluminum impairs the malleability or ductility of the resulting alloy, depending upon the concentration. This may be of little or no significance in the production of containers wherein the layer of alloy is relatively thick or does not have to be subjected to rolling, drawing or other operations to such an extent that reduced malleability or ductility is disadvantageous. In the case of foil, however, this impairment of malleability or ductility becomes important, and therefore the concentration of the inhibiting agent or agents is limited by the workability of the resulting alloy for the purpose intended.

In the production of foil, I have accordingly found it desirable to produce a composite or laminated foil including a lamination of the improved alloy of the present invention for contact with the foodstuff and one or more laminations which facilitate rolling of the foil to the desired thickness, and which latter may be composed of or include commercially pure tin and alloys thereof, as an alloy of tin with antimony ranging from one to three percent thereof, which is highly malleable and ductile.

In producing such a composite laminated foil, the preferred procedure is as follows: An alloy comprising tin and an inhibiting agent as aforesaid is rolled into sheets or heavy foil, preferably on the order of .15" thick, and such sheet or foil is then used as a casing upon one or both sides of a core, say about three fourths inch thick, which may be formed of commercially pure tin or alloys thereof, such as an alloy of 98% tin and 2% antimony which alloy is of increased strength as respects tin and has good rolling qualities. The combined alloy casing and core can then be rolled to foil of commercial thickness, as on the order of .0003" or less. Rolling the casing and core under pressure welds the two metals together, and the core metal gives sufficient body and support to the resultant foil so that the effects of brittleness in the casing metal, due to the presence of such inhibiting agents as aluminum and magnesium, are largely avoided. It is to be expressly understood that the relative thickness of the alloy casing to the core may be varied as determined by the thickness of the foil ultimately required, it being preferred that the casing comprise between fifteen and thirty percent of the thickness of the composite metal.

The accompanying drawing illustrates diagrammatically and with greatly increased size an example of a preferred foil for use in wrapping cheese, wherein the casing lamination 10, here shown as applied to both faces of the body layer, though that is not essential, is composed of .2% aluminum or magnesium with the remainder commercially pure tin, and such lamination constitutes between fifteen and thirty percent of the thickness of a foil, the remainder or body layer 11 of which is composed of an alloy of ninety-eight percent tin and two percent antimony.

Such a foil has been found to substantially prevent discoloration or corrosion when in contact with certain types of cheese, but as before noted a foil whose casing layer is composed of .5% cadmium and .05% magnesium, with the remainder commercially pure tin, has been found preferable for other types of cheeses.

Various modifications and combinations of the several features of the present invention may be used, as will now be apparent to those skilled in the art, the essence of the invention being the addition to tin of small quantities of one or more metals tending to reduce its discoloration or corrodibility in contact with foodstuffs. Other metals which are characterized by being anodic with respect to tin and by having a preferential affinity for oxygen with respect to tin than those specifically hereinbefore referred to may also be used. It is also to be expressly understood that various proportions and combinations of the inhibiting metals as characterized may be used depending upon the foodstuff to be enclosed, the workability of the alloy required, etc. Certain procedures described may be replaced by equivalent procedures, and certain features used without other features, without departing from the spirit of the invention. Furthermore, although the invention has been particularly described in connection with its application to the production of foil, and especially foils for use as cheese wrappings, the invention is not restricted thereto, as in its broader aspects the alloy of this invention may be used as a lining or facing for other metals and for other types of containers, or it may be used as the material for the wall, or a lamination of the wall, of any suitable container or for contact with any suitable foodstuff. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. A cheese wrapping foil which is substantially non-discolorable from contact with the cheese and which has a malleable tin alloy body layer and at least its cheese contacting surface composed of tin containing a relatively small percentage of an inhibiting agent which is anodic with respect to tin and adapted to maintain the tin polarized.

2. A cheese wrapping foil which is substantially non-discolorable from contact with the cheese and which has a malleable tin alloy body layer and at least its cheese contacting surface composed of tin containing a relatively small percentage of an inhibiting agent including one or more metals from the group composed of aluminum, magnesium and calcium.

3. A cheese wrapping foil which is substantially non-discolorable from contact with the cheese and which has a malleable tin alloy body layer and at least its cheese contacting surface composed of tin containing a relatively small percentage of cadmium and a relatively small percentage of one or more of the group of metals composed of magnesium, aluminum and calcium.

4. A cheese wrapping foil which is substantially non-discolorable from contact with the cheese and which has a malleable tin alloy body layer and at least its cheese contacting surface composed of tin containing a relatively small percentage of an inhibiting agent comprising not more than three tenths percent of a metal from the group composed of aluminum, magnesium and calcium.

5. A cheese wrapping foil which is substantially non-discolorable from contact with the

cheese and which has a malleable tin alloy body layer and at least its cheese contacting surface composed of tin containing an inhibiting agent comprising a relatively small percentage of cadmium and an amount not exceeding three tenths percent of a metal from the group composed of aluminum, magnesium and calcium.

6. A composite sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of tin-antimony alloy and a surface layer composed of tin containing a relatively small percentage of an inhibiting agent which is anodic with respect to tin and adapted to maintain the tin polarized.

7. A composite sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of tin-antimony alloy and a surface layer composed of tin containing a relatively small percentage of an inhibiting agent including one or more metals from the group composed of aluminum, magnesium and calcium.

8. A composite sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of tin-antimony alloy and a surface layer composed of tin containing a relatively small percentage of one or more metals from the group composed of aluminum, magnesium and calcium and a relatively small percentage of cadmium.

9. A composite sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of malleable tin alloy and a surface layer composed of tin containing a relatively small percentage of an inhibiting agent which is anodic with respect to tin.

10. A composite sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of malleable tin alloy and a surface layer composed of tin containing a relatively small percentage of an inhibiting agent which includes one or more metals from the group composed of aluminum, magnesium and calcium.

11. A composite sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of malleable tin alloy and a surface layer composed of tin containing a relatively small percentage of one or more metals from the group composed of aluminum, magnesium and calcium and a relatively small percentage of cadmium.

12. A non-ferrous sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having at least the food contacting surface thereof composed of tin containing a relatively small percentage of an inhibiting agent which includes one or more metals from the group composed of aluminum, magnesium and calcium.

13. A non-ferrous sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having at least the food contacting surface thereof composed of tin containing a relatively small percentage of an inhibiting agent which includes a small percentage of cadmium and a relatively small percentage of one or more metals from the group composed of aluminum, calcium and magnesium.

14. A non-ferrous sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having at least the food contacting surface thereof composed of tin containing a relatively small percentage of an inhibiting agent which is adapted to maintain the tin polarized and which comprises not more than three tenths percent of one or more metals from the group composed of aluminum, calcium and magnesium.

15. A non-ferrous sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of malleable tin and at least the food contacting surface thereof composed of tin containing a relatively small percentage of an inhibiting agent which is anodic with respect to tin and which has a preferential affinity for oxygen with respect to tin.

16. A non-ferrous sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having a body layer of malleable tin and at least the food contacting surface thereof composed of tin containing a relatively small percentage of an inhibiting agent which is adapted to maintain tin polarized.

17. A non-ferrous sheet metal or foil for contact with foodstuff which is substantially non-discolorable or non-corrodible from contact with the foodstuff and having at least the food contacting surface thereof composed of tin containing a relatively small percentage of an inhibiting agent which is adapted to maintain the tin polarized and which comprises not more than three percent of cadmium and not more than three tenths percent of one or more of the group of metals composed of aluminum, calcium and magnesium.

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