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A. W. COFFMAN

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PROTECTED METAL ARTICLE AND METHOD OF MAKING THE SAME

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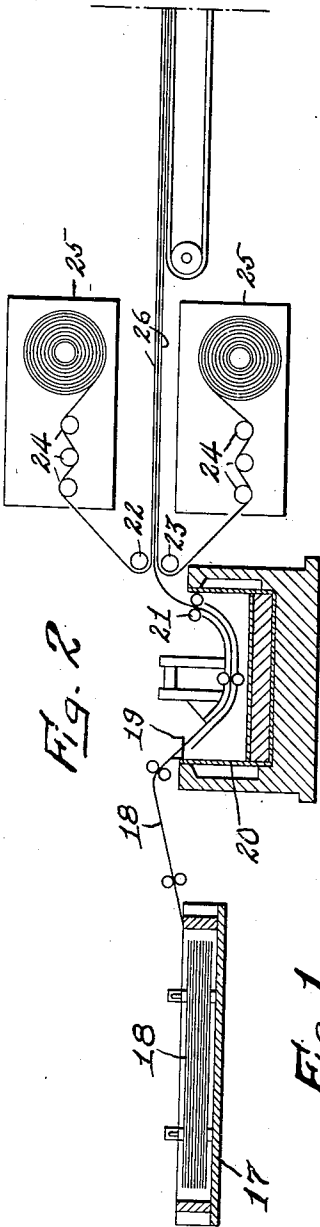


Fig. 1

Fig. 2

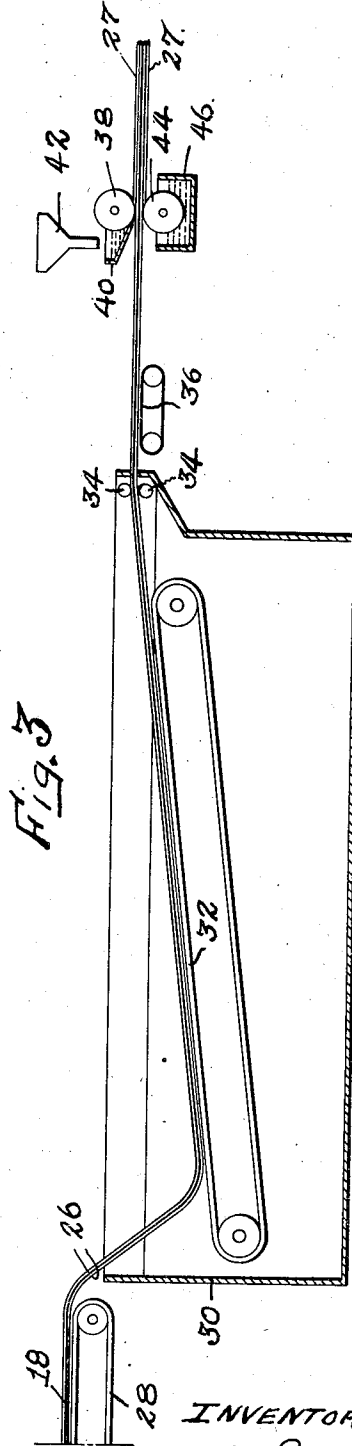


Fig. 3

INVENTOR:

Alden W. Coffman  
by J. Stanley Churchill  
Atty.

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PROTECTED METAL ARTICLE AND METHOD  
OF MAKING THE SAMEAlden W. Coffman, Pittsburgh, Pa., assignor to  
H. H. Robertson Company, Pittsburgh, Pa., a  
corporation of Pennsylvania

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16 Claims. (Cl. 154-2)

This invention relates to a protected metal article and to a method of making the same.

One object of the invention is to provide a novel and superior protected metal article which is particularly useful for building purposes such as roofing and siding material, which is capable of withstanding mechanical shock in cold weather, which may be formed into various shapes with minimum liability of damage to the protective coatings thereof, and also which is extremely durable and possesses superior fire resistance as compared with other protected metal articles heretofore manufactured.

Another object of the invention is to provide a novel and improved method by which the protected metal article may be made at minimum expense and in a rapid and efficient manner.

With these general objects in view and such others as may hereinafter appear, the invention consists in the protected metal article, in the method of making the same and also in certain novel steps in the method hereinafter described and particularly pointed out in the claims at the end of this specification.

In the drawing, Fig. 1 illustrates a cross sectional view of a protected metal article embodying the present invention; Figs. 2 and 3 are sectional views illustrating the apparatus preferably employed in practicing the present process.

In general, the present invention contemplates an improved protected metal article produced by the process hereinafter to be described and which comprises a metal article 10 preferably a metal sheet such as an iron or steel sheet. The metal sheet 10 has secured to the opposite surfaces thereof layers 12 of fibrous material, preferably asbestos paper or felt, by an interposed metal adhesive 14. The metal adhesive 14 completely envelopes the metal sheet 10 and may comprise zinc, tin, cadmium lead or other alloy and the metal adhesive is alloyed to the metal sheet 10 and keyed or anchored to the fibers comprising the fibrous layers 12.

In order to further protect the article thus far described, it is preferred to saturate or impregnate the fibrous layers with saturant or an impregnant preferably comprising a bituminous composition such as asphalt or any of the other commercial impregnants now used for impregnating fibrous layers. The saturated protected metal sheet thus far described is further protected against weather, gas and fume conditions and for the purpose of increasing the durability of the protected sheet and, as herein shown, the protected metal article is provided with an outer

weather-proofing coating 16 which may comprise any desired composition of bituminous material and preferably a composition comprising cottonseed pitch, and asphalt melted together and which possesses satisfactory weather resistance and durability.

In producing the present protected metal article it is preferred to affix the fibrous layers 12 to the metal sheet 10 immediately after the metal sheet has passed through a bath of the molten metal adhesive and before the latter has solidified in producing the preferred protected metal sheet. Zinc is preferably used as the metal adhesive and as illustrated in the drawing, 20 represents, more or less diagrammatically, the usual galvanizing bath to which steel sheets 18 are conveyed from the usual storage tank 17. The steel sheets are conducted through the galvanizing bath in the manner usually practiced in producing galvanized steel sheets where they receive the zinc coating. In accordance with the usual galvanizing practice the temperature of the bath of zinc within the galvanizing pot 20 runs from 830° F. to 875° F., and the usual fluxes are utilized in the flux box 19 and upon the exit rolls 21. After the sheets 18 leave the exit rolls 21 and before the zinc coating upon the sheets has become solidified, provision is made for applying fibrous layers 18 to one or both surfaces of the sheets. As herein shown, supply rolls of such fibrous material preferably asbestos felt, are mounted within enclosures 25 by which they are protected from the fumes, moisture, etc., evolving from the composite sheet by reason of the relatively high temperature of the zinc coatings. From the supply rolls the fibrous webs 26 are conducted around heating rolls 24 by which moisture is removed from the fibrous material and the webs are then conducted between combining rolls indicated at 22, 23 and between which the metal sheets 18 with the molten zinc coating thereon are passed. The combining rolls 22, 23 cooperate to firmly impress the fibrous material into the molten zinc coating and the composite sheet thus produced is conducted from the rolls on a suitable conveyor indicated generally at 28. When the sheet has become cooled and the zinc coating solidifies, the fibrous layers are firmly bonded to the metal sheet by the zinc coating which is alloyed to the opposite surfaces of the metal sheet 18 and is also keyed to the fibrous layers 12.

While the composite protected sheet in the condition thus far described may be used with advantage for many purposes, nevertheless for some purposes I prefer to impregnate the fibrous

layer or layers of the sheet with an impregnant or saturant such as asphalt, and it is preferred to impregnate the composite sheet while the temperature thereof is relatively high. The exact temperature at which it may be found most desirable to impregnate the fibrous layer or layers of the composite sheet will depend, of course, upon the temperature and composition of the impregnating material, and the temperature of the sheet may be controlled by the length of the conveyor 28 or by any convenient cooling or heating methods. The impregnation of the fibrous layers has been found to take place much more rapidly when the composite sheet is impregnated while hot and the degree of impregnation produced has been found to be more complete.

As herein shown, after the composite sheet has left the conveyor 28 it is submerged beneath the surface of a bath of impregnating material within an elongated tank 30, and as herein shown is deposited upon a conveyor 32 by which it is caused to traverse through the bath and to be elevated at the exit end of the bath to pass through a pair of squeeze rolls 34 by which the excess of impregnating material is removed and permitted to return to the bath. Thereafter the impregnated sheet may be conveyed on a suitable conveyor indicated generally at 36.

From the description thus far it will be observed that in practicing the present process it is essential to apply the fibrous webs 26 to the zinc or other metal adhesive coating as soon as practicable after the metal sheet 18 has left the galvanizing or other coating bath, and while the distance from the exit rolls 21 at which this operation may be performed varies within reasonable limits, care should be taken for best results to apply the fibrous layers before the zinc or other coatings have solidified to any extent. In practice, operating upon 12, 14 and 16 gauge steel sheets a distance from the exit rolls of the galvanizing bath to the combining rolls 22, 23, of approximately five to seven feet has been found satisfactory.

The asbestos paper or felt commercially obtainable usually embodies a substantial amount of organic binder, and after such asbestos felt has been applied to the molten zinc coatings in the manner above described, the heat in the coatings and in the steel sheet operates to burn out a substantial part of the organic matter. This removal of the minor proportion of the organic matter, however, does not destroy the continuity of the asbestos layer and the resulting product has been found to be capable of being impregnated more thoroughly or more completely as a result of this burning of the organic binder. The extent to which the organic matter is removed depends upon the temperature of the galvanizing pot and the thickness of the metal sheet governs the amount of heat stored in the metal sheet, so that the thicker the steel sheet the more complete the removal of the organic matter from the asbestos sheets. When operating upon thin steel sheets supplemental heating means may be utilized if the removal of the organic matter is found to be insufficient for any particular purpose.

From the above description, it will be understood that in addition to the above described process involving the application of the fibrous layer or layers at the galvanizing pot, the fibrous layer or layers may be applied to the metal sheet or member immediately following the application of a terne, tin cadmium, or any other suit-

able alloy coating which may be used as the metal adhesive.

In order to further protect the metal article against weather conditions and particularly against severe fume conditions, it is preferred to envelop the composite sheet or article either before or after saturation or impregnation as described, in a bituminous weather-proofing coating and as illustrated herein, after leaving the impregnating bath the composite sheet is passed between coating rolls 38, 44. The bituminous composition in molten condition may be flowed from a supply tank, indicated at 42, to coating tanks 40, 46 in which the coating rolls 38, 44 run. As the composite sheet passes between the coating rolls, the desired layers 27 of bituminous material, such as a cotton seed pitch-asphalt composition, are applied to the opposite surfaces of the sheet and in their molten condition fuse together over the sides of the sheet forming the weather proofing envelope shown at 16.

From the foregoing description it will be observed that the present process, involving the application of the fibrous layers upon the metal adhesive before the solidification or cooling of the metal adhesive subsequent to the passage of the metal sheet through the bath of the molten metal adhesive, lends itself to continuity of operation and accompanying economy in the manufacture of the composite sheet, and also of the weatherproofed protected metal sheet. In addition to the economy in the manufacture of the products it has been found that in the products produced by the process described in which the fibrous layers are applied before the metal adhesive has cooled or solidified, the fibrous layers adhere to the metal in an improved and superior manner. The fact that the metal adhesive is not reheated reduces to a minimum the formation of metal oxide on the surface of the metal adhesive coating, thus making it possible for the metal adhesive to inter-penetrate more completely with the fibrous layers, producing a superior and much firmer bond. When zinc is employed as the metal adhesive, the present process also produces a minimum of the zinc iron alloy layer between the pure zinc and the steel comprising the metal member 10, and as a result there is less tendency for flaking off of the zinc coating, so that in the products produced by the process a superior bond and improved durability results. The present process also has the advantage that a minimum amount of the zinc or other metal in the metal adhesive coating is lost by oxidation and by penetration into the steel so that a maximum layer of pure zinc or other metal is available, thus contributing to the uniformity with which the fibrous layers may be embedded in the pure zinc or other metal adhesive.

The protected metal article embodying the fibrous layers 12 united to the metal member 10 by the interposed layer of metal adhesive 14, produced in accordance with the present process, and also embodying the envelop 16 of weather-proofing bituminous material as described, is less inflammable than other comparable products heretofore produced; it may be frozen and subjected to shock at very low temperatures without removal of the protective coatings, thus contributing to the durability of the protected metal article, particularly when used as a roofing or siding material, and in addition the protected metal sheets may be formed into various shapes and corrugated with minimum liability of damage to the protective coatings. In the practical

use of the present protected metal sheets raw edges are at times produced during the erection of the sheets, such for example as at bolt holes and where the sheets have been cut, and the present structure of sheet has been found to possess to a substantial extent the ability of automatically sealing the steel sheet to protect it from corrosive action or rusting, thus contributing to the durability and life of the sheet. A protective film of zinc oxide and possibly zinc carbonates and sulphates appears to be formed across the thickness of the zinc coating at the raw edge, and this film appears to progressively spread across the steel sheet 10, and as a result, after corrosion has started and this protective film has been developed, the rate of corrosion at the raw edge of the protected metal sheet is substantially diminished. The overhanging fibrous layers assist in retaining this protective film in place.

Another important advantage resulting from the structure of the present protected metal sheet resides in the improved ability of the protective coatings to remain in place in the event that the sheet is subjected to fire conditions. This appears to be due to the continuous alloying of the zinc with the steel member 10, and the progressive increase of the melting point of the alloy enables the sheet to withstand progressively increasing fire temperatures and thus contributes to the ability of the sheet to remain in place under such conditions.

This application is a continuation in part of my application for Protected metal article, filed June 11, 1935 and bearing Serial No. 26,081, and of my copending application Serial No. 26,078, filed June 11, 1935, entitled "Method of making protected metal articles".

Having thus described the invention, what is claimed is:

1. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the asbestos sheet is affixed to the metal sheet by the metal adhesive in its molten condition, as initially applied to the metal sheet, and wherein the asbestos sheet is keyed to the metal adhesive when said metal adhesive has solidified.

2. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the metal adhesive in its molten condition, as initially applied to the metal sheet, alloys with the metal sheet and penetrates into the asbestos sheet to key the asbestos sheet to the metal adhesive when the latter has solidified.

3. As a new article of manufacture, a protected metal article comprising a metallic sheet, a layer of fibrous felt, and an interposed layer of metal adhesive alloyed with the metal sheet and penetrating into the fibrous felt layer in its molten condition, as initially applied to the sheet, whereby the protected metal article having the metal adhesive alloyed with the metallic sheet and keyed to the fibrous felt layer may be produced in a continuous manner.

4. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the asbestos sheet is affixed to the metal sheet by the metal adhesive in its molten condition, as initially applied to the metal sheet, and wherein the asbestos sheet is keyed

to the metal adhesive when said metal adhesive has solidified and a protective bituminous coating covering the fibrous material.

5. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the metal adhesive in its molten condition, as initially applied to the metal sheet, alloys with the metal sheet and penetrates into the asbestos sheet to key the asbestos sheet to the metal adhesive when the latter has solidified and a protective bituminous coating covering the fibrous material.

6. As a new article of manufacture, a protected metal article comprising a metallic sheet, a layer of fibrous felt, and an interposed layer of metal adhesive alloyed with the metal sheet and penetrating into the fibrous felt layer in its molten condition, as initially applied to the sheet, whereby the protected metal article having the metal adhesive alloyed with the metallic sheet and keyed to the fibrous felt layer may be produced in a continuous manner and a protective bituminous coating covering the fibrous material.

7. A continuous method for fabricating metallic elements which comprises the steps of applying a metallic adhesive to a metal base member while the metallic adhesive is in a heated fluid condition and thereafter applying fibrous material thereto before the metal adhesive has solidified, whereby to firmly key and anchor the fibrous material to the metal base member, then applying a protective bituminous coating over the fibrous material.

8. In the method of making a protected metal article, the steps comprising applying layers of fibrous material to the opposite surfaces of a metal sheet provided with a layer of molten metal adhesive, permitting the metal adhesive to cool whereby to be alloyed with the metal sheet and keyed to the fibrous sheets, and then enveloping the thus protected sheet within a weather-proofing bituminous coating.

9. A continuous method for fabricating metallic elements which comprises the steps of applying a metallic adhesive to a metal base member while the metallic adhesive is in a heated fluid condition and thereafter applying fibrous material thereto before the metal adhesive has solidified, whereby to firmly key and anchor the fibrous material to the metal base member.

10. A continuous method for fabricating metallic elements comprising passing a metallic base member through a heated bath of fluid metallic adhesive, removing the metallic base member from said bath, and thereafter applying fibrous material thereto before the applied metal adhesive has solidified, whereby to firmly key and anchor the fibrous material to the metal base member.

11. A continuous method for fabricating metallic elements which comprises the steps of applying a metallic adhesive to a metal base member while the metallic adhesive is in a heated fluid condition and thereafter applying, under pressure, a fibrous sheet thereto before the metallic adhesive has solidified, whereby to firmly key and anchor the fibrous material to the metal base member.

12. A continuous method for fabricating metallic elements which comprises the steps of successively advancing metallic sheet members to a heat bath of fluid metallic adhesive, continuously removing the metallic sheet members with the applied metallic adhesive from said bath, and

applying thereto, before the heated metallic adhesive has become solidified, fibrous material, under pressure, whereby to key and anchor the fibrous material to the metallic sheet members.

- 5 13. A continuous method for fabricating metallic elements comprising passing a metallic base member through a bath of fluid metallic adhesive maintained at a temperature sufficient to raise the temperature of the metallic base member, as it is passed therethrough, to the point where the metallic adhesive alloys with the base member, and thereafter applying fibrous material thereto, before the applied metallic adhesive has solidified, whereby to firmly key and anchor the fibrous material to the metal base member.

14. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the metal adhesive in its molten condition, as initially applied to the metal sheet, alloys with the metal sheet and penetrates into the asbestos sheet to key the asbestos sheet to the metal adhesive when the latter has solidified and a weather-proofing

bituminous coating enveloping the composite sheet thus formed.

15. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the metal adhesive in its molten condition, as initially applied to the metal sheet, alloys with the metal sheet and penetrates into the asbestos sheet to key the asbestos sheet to the metal adhesive when the latter has solidified, said asbestos sheet being impregnated with bituminous material.

16. As a new article of manufacture, a protected metal article comprising a metallic sheet, an asbestos sheet and an interposed layer of metal adhesive, wherein the metal adhesive in its molten condition, as initially applied to the metal sheet, alloys with the metal sheet and penetrates into the asbestos sheet to key the asbestos sheet to the metal adhesive when the latter has solidified and provided with a protective bituminous coating enveloping the composite sheet thus formed.

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