April 9, 1935. J. D'A. CLARK ET AL 1,996,951

APPARATUS FOR PRODUCING A THERMOPLASTIC COVERED METALLIC ARTICLE

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Fig. 1



Fig. 2

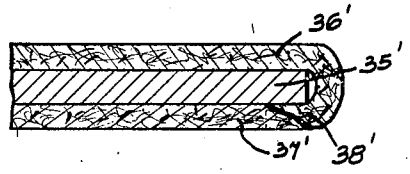


Fig. 1a

Fig. 3

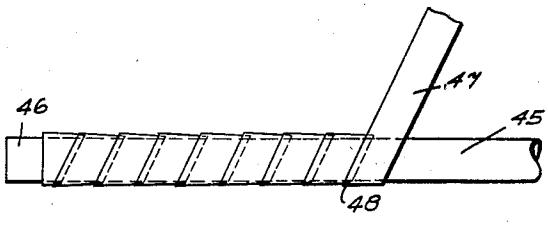


Fig. 4



Fig. 5

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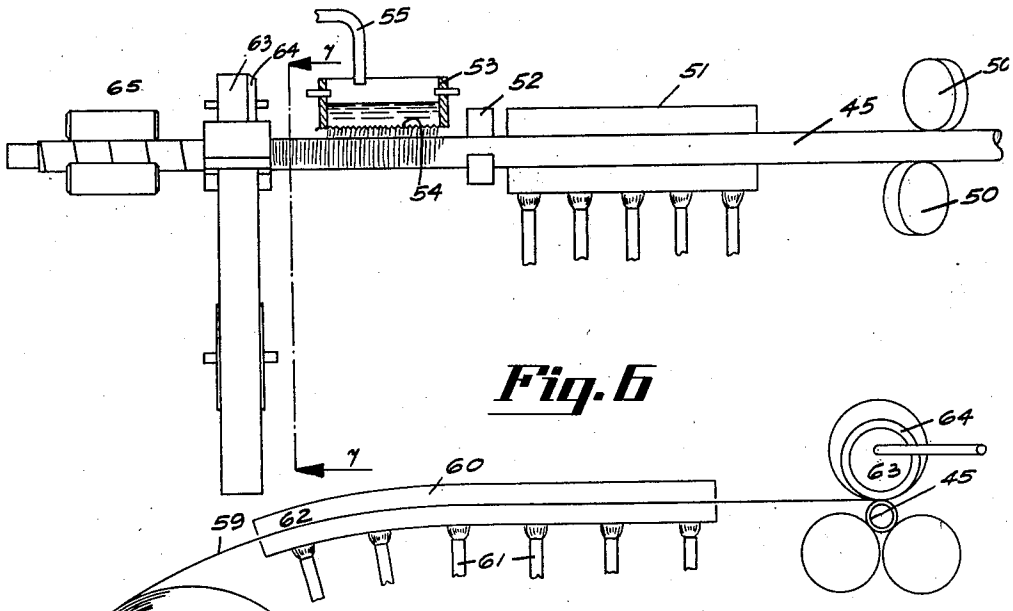


Fig. 6

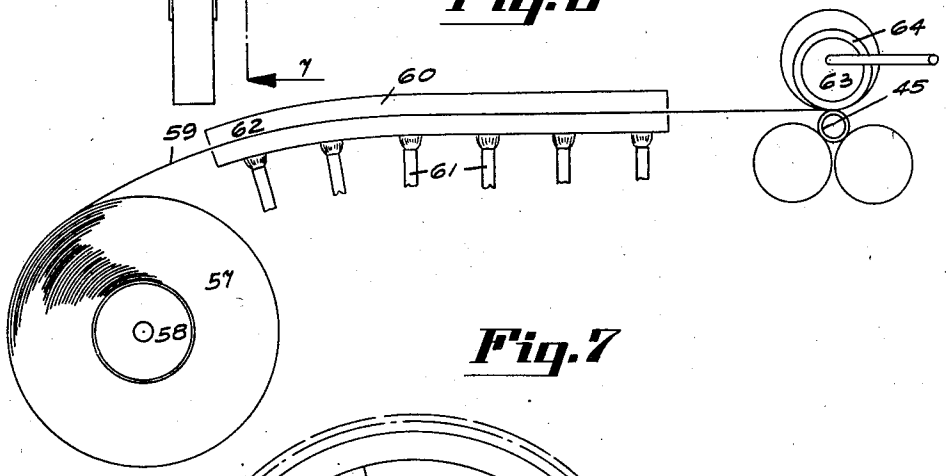


Fig. 7

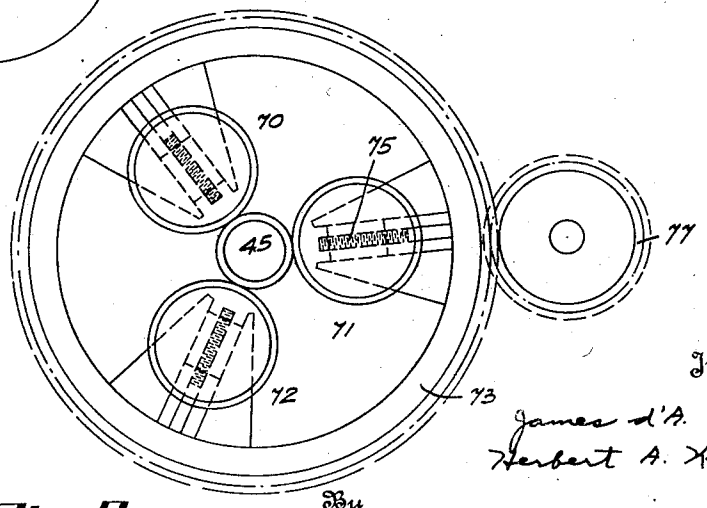


Fig. 8

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UNITED STATES PATENT OFFICE

1,996,951

APPARATUS FOR PRODUCING A THERMOPLASTIC COVERED METALLIC ARTICLE

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Application October 7, 1931, Serial No. 567,414

6 Claims. (Cl. 154—1)

This invention relates to the protective coating of metallic surfaces, and more particularly to a protective coating of that type in which a fibrous sheet covering is applied to the metallic object.

One of the principal objects of this invention is to provide a superior coated metallic article which is resistant to corrosion and wear, simple in construction, easy and economical to manufacture, and which has a substantially non-tacky surface within the range of ordinary atmosphere temperatures.

Another object of the invention is to provide such a metallic article which is surface coated or faced with a thermoplastic fibrous sheet containing normally solid low penetration waterproofing material, distributed uniformly throughout the fibrous sheet to impregnate the fibers, without the presence of any substantial amounts of free waterproofing material on the surface of the sheet.

Another object of the invention is to provide such a fibrous coated metallic article in which the fibrous thermoplastic surface is compacted and consolidated in situ on the metal foundation, and the waterproofing material concomitantly coalesced and impregnated throughout the fibrous sheet.

Another object of the invention is to provide a superior method of forming the above fibrous coated metallic article, to provide a substantially homogeneous fibrous thermoplastic covering effectively bonded to the metallic article.

Still another object of the invention is to provide apparatus for carrying out the above method and for producing the above products.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings, in which like characters of reference designate like parts throughout the several views thereof,—

Fig. 1 is a partial sectional view through a fibrous covered metallic sheet constructed in accordance with this invention;

Fig. 1*a* is a view similar to Fig. 1 illustrating a modified form of fibrous covered metallic sheet;

Fig. 2 is a partial sectional view through another form of fibrous covered sheet having a compound or double fibrous surface coating;

Fig. 3 is a diagrammatic view of apparatus for applying fibrous coverings to sheet metal, in accordance with the method of this invention and to produce the products of this invention;

Fig. 4 is a side elevational view of a cylindrical metal article, such as a pipe, showing one manner in which the fibrous thermoplastic covering is applied in accordance with this invention;

Fig. 5 is a vertical sectional view through the article of Fig. 4;

Fig. 6 is a diagrammatic elevational view showing apparatus for producing the article of Figs. 4 and 5, constructed in accordance with this invention, and adapted for carrying out the method of the invention;

Fig. 7 is a diagrammatic elevational view partly in section, the view being taken at right angles to that of Fig. 6 on substantially the plane of the line 7—7 of Fig. 6; and

Fig. 8 is a diagrammatic side elevational view of an arrangement of press rolls for compacting the fibrous covered cylindrical metal article, in accordance with Figs. 6 and 7.

The method of the present invention is adapted for the covering of metallic articles of various characters and shapes with a thermoplastic fibrous sheet material. Thus the method is applicable to the covering of metallic plates, such as sheet steel and sheet iron and the like, such as are adapted for roofing, building, insulation, and other uses. In some cases for building purposes where insulation is required, the metal may be covered with thermoplastic fibrous material on the weather side and a layer of insulating fibrous material on the inner side. The invention is also applicable to the covering of cylindrical metallic objects such as pipes, for example oil and gas pipes, such as are adapted to be laid in or upon the ground, or are subjected to the influence of a corrosive atmosphere.

The value of fibrous coverings impregnated with a bituminous material for protecting metal against wear and corrosion has long been recognized. Fibrous coverings for metallic articles, such as for sheet steel plates, have heretofore generally been manufactured by cleaning the surface of the metallic plate, applying thereto a layer of some hot adhesive and corrosion resistant material such as melted asphalt or bitumen, and then applying to the coated metal while the adhesive layer is still partially liquid or tacky a fibrous sheet covering, which may have been saturated after formation with a bituminous material such as melted asphalt. While providing a commercially salable product, this prior practice is subject to certain limitations and objections. Thus it has been found necessary to employ a high penetration bituminous or asphaltic material in order to get the liquid bitumen to satisfactorily impregnate the formed fibrous sheet covering. Such a sheet covering when subjected to higher atmospheric temperatures, such as are encountered in summer and in direct exposure to sunlight as in roofing, is subject to softening, bleeding of the asphalt to the surface, which becomes objectionably soft and tacky, and the covering is subject to rapid wear with result-

ant exposure in spots of the metallic foundation which hastens its failure due to corrosion. In order to overcome this, it has been suggested that a layer of a non-sticky coating material, such as lacquer, cellulose ester, bituminous paint and the like, be applied over the surface of the fibrous covering. This of course materially increases the expense of production, cost of the finished article, and has not been entirely satisfactory in the prevention of bleeding and wear of the fibrous covered metallic article. The use of high melting point low penetration bituminous materials or asphalt has not been heretofore practical in such fibrous covered metallic articles due to the inability to obtain satisfactory impregnation of the formed fibrous sheet covering with this type of asphalt.

According to the present invention, such a fibrous covered metallic article is provided, in which a low penetration high softening point bituminous material is easily and readily incorporated in the fibrous covering to secure satisfactory impregnation of the fibers. A metallic article is thus formed having a hard rigid fibrous covering of superior wear resisting qualities, whose surface is substantially non-tacky within the range of atmospheric temperatures normally encountered, and in which satisfactory protection against corrosion and wear may be secured in a simple manner with the application of only a single fibrous covering. In contradistinction to the prior methods in which a formed fibrous sheet is used which is impregnated by immersion or spraying with liquid bitumen, the present invention provides for the use of a material in which there is incorporated in the fibrous pulp stock prior to the formation of the completed fibrous sheet a powdered, solid, low penetration corrosion and moisture resisting thermoplastic material, such as described in the copending application of Herbert A. Kidd and Richard H. Watkins, Jr., filed of even date herewith, Serial No. 567,472. Any suitable type of fibrous pulp may be employed, such as cellulosic fibrous material, mineral fibrous material such as asbestos, or a mixture of cellulose fibers and asbestos. For example, in the process of the above mentioned application, there is added to the fibrous pulp suspended in a liquid medium, such as water, a low penetration high melting point asphaltic material in solid form. The asphalt may be added in lump form of substantial size, or in powdered form, and then the mixed pulp and asphalt disintegrated in the presence of each other and of the liquid suspension medium in a suitable conventional disintegrating mill in order to pulverize the asphalt and incorporate it in fine powdered form throughout the fibrous pulp stock. The disintegration or pounding action effects some impregnation of the asphalt into the fibers due to the impacting of the fine powdered material against the fibers; and the resultant material is a suspension of pulp stock containing finely divided solid asphalt distributed throughout in a substantially uniform manner. It is to be understood that the asphaltic material mentioned may be incorporated into the fibrous material before final formation of the covering by any other suitable well-known means, such as by emulsifying the asphalt with clay or other dispersion agent before mixing with the fibrous material prior to forming the covering, or by mixing the dry fibrous material with powdered asphalt and forming the dry mixture into a web or sheet using air as a carrier fluid to convey the mixed materials along and deposit them on a forming surface to build up the sheet.

The type of asphalt preferred for the fibrous material in accordance with this invention is a low penetration asphalt, having a penetration test below 10 as measured by the A. S. T. M. standard specifications. This means that a needle having a diameter of 1 millimeter tapered to a point having a diameter of .15 millimeter with a length of taper of ¼ inch, and weighted with 100 grams, will penetrate in five seconds time less than .10 centimeters into a solid mass of the asphalt maintained at a temperature of 77° F., measurements being taken by a suitable standard penetrometer. While the low penetration test of the asphalt is a prime factor in securing the desired type of product, preferably an asphalt having a softening point above 130° F., as measured by the ball and ring method, A. S. T. M. specifications, is used. Throughout the description and claims where the expression "low penetration asphalt" is used, this means a bituminous or asphaltic material or other similarly acting resinous material having a penetration test below 10 as measured by the A. S. T. M. standard specifications as described above. Likewise, where the expression "high softening point" is used in the description and claims, this means such a material having a softening point above 130° F. as measured by the A. S. T. M. specifications for the ball and ring method of testing.

In the case of asphalt, very satisfactory results have been secured by using substantially 35% to 50% by weight of asphalt with 65% to 50% by weight of fibrous furnish with or without an additional quantity of argillaceous or other filler material in quantities up to about 20% by weight of the other two constituents. When a percentage appreciably less than 35% by weight of asphalt is used, incomplete impregnation of the fibers is obtained in the manufacture of the thermoplastic board, so that the moisture resisting and corrosion resisting properties are reduced; whereas when a proportion appreciably in excess of 50% by weight of asphalt is used, a board may be obtained having a surface in which a substantial amount of free asphalt is present which may be objectionable. Within the proportion range mentioned above, a thermoplastic board is obtained in which the fibers are substantially impregnated, while the surface of the board is substantially devoid of free asphalt. While asphalt of the character described is satisfactory as having the desirable properties and as constituting an inexpensive raw material, very satisfactory results may also be secured with other types of bituminous products having the low penetration and high softening point characteristics mentioned above. These include the various pitches and bitumens. Likewise, resinous materials, either natural or synthetic, may be employed as the moistureproofing and corrosion resisting material. For example, the synthetic resin known as coumarone as made from solvent naphtha, may be employed especially for such articles as steel furniture, desk tops and the like. For convenience in description, all such analogous resinous and bituminous materials are herein termed "asphalt" or "asphaltic materials."

The pulp stock suspension with or without earthy filler material containing the powdered solid asphalt particles or dispersed asphalt is then sheeted on any suitable conventional forming machine to form a board in a well known manner. The fibrous pulp stock is thus formed

into a web, dried, and may be wound into rolls or cut into sheets. However, the board during formation is preferably unpressed or calendered only very lightly while hot, so as to be substantially thicker and less dense than is desired for the final product. For example, the sheet after formation may be passed through a heated drying chamber such as a Coe dryer, and then either unpressed or pressed very lightly so as to be approximately ⅛ inch more or less thick. The material in this form when dried and heated may be wrapped on large diameter cores into rolls, and is then ready for application to the metallic article to be covered.

Referring to the drawings, in which there are illustrated preferred embodiments of the invention, there is shown diagrammatically in Fig. 3 a suitable form of apparatus for the applying of this thermoplastic sheet material as a protective covering to flat metallic plates, such as plates of sheet steel, as are adapted for roofing or building purposes. As shown, a roll 10 of the thermoplastic sheet material is mounted upon a large diameter core 11 and is fed as a traveling sheet 12 over guide roll 13 and into contact with the upper roll 14 of a suitable press, the lower press roll of which is indicated at 15. Separate sheets, or a continuous sheet of metal, indicated at 17, are fed forward in any conventional manner across a heated table or furnace 18, indicated as being heated by gas jets 19. A perforate pipe 20, arranged transversely across the sheet, sprays the surface of the metal lightly with a liquid asphaltic material, which is preferably a high penetration asphalt, or one which is adhesive to metal within the normal range of atmospheric temperatures. This provides a thin coating upon the heated surface of the metal, which has been previously cleaned, and then the metal with adhesive coating is fed through the nip of felt covered pressure or distributing rolls 21 and 22 into the nip of the press rolls 14 and 15, and thus into contact with the thermoplastic fibrous sheet which is moving at a coördinated rate of speed. The press rolls 14 and 15 are preferably heated, as by the introduction of steam into hollow rolls, and are mounted for adjustment toward and away from each other so that the pressure of contact can be varied as desired in a well known manner.

A high pressure at the nip is employed, such for example as about 500 pounds per square inch so that the fibrous sheet is not only united to the adhesive surface of the metal plate, but so that the thermoplastic sheet is at the same time compacted and consolidated to desired density in situ on the plate. For example, the fibrous sheet may be pressed down from a thickness of substantially ⅛ inch to a thickness of about $\frac{1}{16}$ inch, giving a hard dense surface covering. The rolls are heated so that the asphaltic material within the fibrous sheet, due to the combined action of heat and pressure, is softened and flows somewhat so as to coalesce this asphalt throughout the sheet in a uniform manner and to substantially impregnate the fibers. In contradistinction to the usual processes of adding a definite thick well defined layer of adhesive asphalt to the metal surface so as to provide an intermediate adhesive layer in the finished product, the rate of addition of the high penetration liquid asphalt at the spray 20 is controlled so as to give only a very thin coating which is subsequently almost completely absorbed within the fibrous covering during the pressing operation, thereby producing a product which is substantially devoid of any intermediate free asphaltic layer that is apparent to the naked eye. The penetration of the adhesive asphalt is coordinated with the temperature employed during pressing so as to avoid too high a temperature which would cause absorption of the entire quantity into the sheet, to thereby leave sufficient on the surface to form the desired bond. Where the preformed asphalt sheet contains a substantial proportion of asphalt which is adhesive to metal, the intermediate coating may be omitted in some cases.

Where both sides of the metal sheet are to be surfaced, a second roll of fibrous sheeting 25 mounted on a core 26 is provided, and is fed in web form indicated at 27 over a guide roll 28 and into contact with the surface of the lower press roll 15, which then feeds it into the nip of the press rolls. For applying a light adhesive coating to the under surface of the heated metal sheet, a trough 30 is provided within which rotatably dips a roll 31 which contacts with the under surface of the metal sheet, and by rotation thereof applies a light film of liquid asphalt from trough 30 to the under side of the metal sheet. The trough or pan 30 may be provided with a steam heating jacket indicated at 32 so as to maintain the asphalt in heated liquid form. In this manner, opposed surfaces of the metal sheet are united with thermoplastic fibrous coverings, which are then simultaneously consolidated and compacted in situ on the plate as previously described. One or more sets of press rolls may be used for this purpose as desired. It will be understood that in the case of separate sheets the covering or coverings of thermoplastic material may be applied by means of a heated platen press such as is commonly used for other purposes.

Fig. 1 illustrates the composite fibrous covered metallic sheet material as produced with the apparatus of Fig. 3. As therein illustrated, the metallic sheet 35 has adhesively united therewith on opposite sides thermoplastic board coverings 36 and 37. As previously described, the thin coating of liquid asphalt applied to the metal sheet is subsequently substantially absorbed within the fibrous covering so that there is no defined free asphalt layer, but a cross-section through the article seems to show to the naked eye that the thermoplastic board is directly united to the metal sheet.

In order to protect the edges of the metal sheet, the thermoplastic fibrous coverings applied thereto preferably have edges 38 and 39 which extend beyond the metal sheet and are welded together into pinched overlapping joints by heat and pressure in a well known manner. In contradistinction to the usual construction of sheet with overlapped pinched joints, which contain a substantial layer or thickness of free low melting point asphalt intermediate the pinched joints and the edge of the metal sheet, the present construction is substantially free from a separate layer of such asphaltic material, and the fibrous coverings are pinched together closely adjacent the edge of the metal sheet. This construction avoids any objectionable bleeding of this intermediate layer of asphaltic material with resultant loosening of the edges of the composite article. An alternative manner of sealing the edges in indicated in Fig. 1*a* where the upper covering 36′ is folded around the edge of the plate 35′ and the under covering 37′ pressed and moulded over the lap of 36′ by means of pressure rollers such as 14 and 15, giving a close scarf joint 38′.

Where corrugated sheets are to be prepared, the press rolls **14** and **15** may be heated corrugated rolls, so that the composite article with the fibrous covering in situ its concomitantly compacted and corrugated by a single operation.

For a number of purposes a single thermoplastic covering on the surface of the metallic sheet is sufficient. However, two or more coverings may be united in successive operations, such as by passing the fibrous covered sheet formed at the press rolls **14** and **15** through another set of press rolls to which is supplied an additional fibrous covering, and if necessary a small quantity of high penetration asphalt may be applied in between. Such an article is illustrated in Fig. 2 in which the metallic sheet is shown at **40** with two thicknesses of thermoplastic covering indicated at **41** and **42**. As stated above, where the composite material is to be used for building purposes where heat insulation is required, the weather side of the metal sheet may be provided with the thermoplastic covering of single or more thicknesses, and the interior side will have united thereto as by mucilage a sheet **43** of insulation board or other suitable insulating covering.

There is formed in this manner a composite fibrous covered metallic sheet, in which the fibrous covering is a hard, dense, rigid, tough material which is non-tacky below 100° F., which is substantially uniformly impregnated but devoid of free asphalt on the surface, and which does not require the addition of an outer wrapping of paper or other non-sticky coating to prevent the sheets from sticking together during packing, shipping, and use. Throughout the description and claims the term "thermoplastic" as applied to a fibrous covering is used to designate such a fibrous covering, either cellulosic or mineral or both, which contains a substantial proportion of moisture and corrosion resisting asphaltic material, and which is capable of being softened and shaped under heat and pressure.

Referring to Figs. 6, 7 and 8, there is illustrated diagrammatically apparatus for carrying out the method of this invention in the application of a strip winding of fibrous thermoplastic material to cylindrical metallic articles, such as pipes. The methods heretofore generally used for the fibrous covering of pipes are similar to those heretofore used for the covering of sheet metal, and comprise the cleaning of the pipe, the addition of a coating of some hot adhesive and corrosive resistant material, such as melted asphalt or bitumen, to the pipe, and the winding spirally on the pipe of a strip or strips of a web made of some fibrous material, and perhaps at the same time saturating the strip with a hot liquid asphalt which is generally applied to the inner side of the strip forming the spiral. Another application of hot liquid asphalt may be made to the wrapped pipe; and then another spiral layer of relatively tough paper is wrapped thereover which acts as a protection for the felt covering during transport and laying, and further prevents the felt coverings of adjacent pipes from sticking together during transit. Several inches, depending on the size of the pipe and type of coupling to be employed, are left bare at the ends of the pipes to allow for welding or coupling in the field, and the exposed parts of the pipes or the joints are subsequently covered by hand.

In accordance with the present invention, a pipe may be covered in a simple and satisfactory manner by the application of only a single covering, if desired, of strip fibrous material, in which the corrosion resistant material has been previously incorporated in the manner described above. However, two or more layers of the thermoplastic fibrous covering may be applied for particular uses. In wrapping the pipe in accordance with this invention, the spiral winding is preferably arranged as illustrated in Fig. 4, in which the edges of adjacent spirals overlap. Thus as shown, the pipe **45** having a free exposed end **46** for coupling, is wrapped with a spiral thermoplastic strip material **47**, allowing an overlap as indicated at **48**. This is preferably the thermoplastic board which has been unpressed to final density as described above. The composite wrapped pipe is then subjected to heat and pressure to consolidate and compact the thermoplastic covering in situ to final density, and at the same time to weld and unite the overlaps in such manner as to substantially compact the seams, to thereby produce a uniform, virtually seamless, hard, tough, protective covering. Due to the characteristics of the fibrous covering made as described above, the pipe does not require the addition of an outer wrapping of paper or the application of a non-sticky coating, thereby affording additional economy in manufacture and cost. Moreover, the improved covering provides much greater resistance to pressure and friction due to movements of the soil after the pipe has been laid, and affords greater resistance to wear to exposed parts of the pipe line.

As illustrated in Figs. 6 to 8, the pipe **45** to be covered is rotated and at the same time moved forward or axially (towards the left in the drawings) by the skew rollers **50** of conventional and well known construction. As the pipe progresses and rotates, a given section moves through a furnace **51**, which may be of conventional type, to heat the pipe. The section then passes through a set of rotary wire brushes indicated at **52** or any other suitable conventional means for cleaning the pipe and then passes and rotates beneath the asphalt applying means, illustrated as a pan **53** having a perforate bottom **54** to which is supplied high penetration liquid asphalt by pipe **55**, so as to apply a thin coating of melted asphalt to the pipe. The section then passes through the helical winding mechanism where it is wrapped with a helical winding of the fibrous thermoplastic strip material. This is more particularly illustrated in Fig. 7, in which a roll of the fibrous strip material indicated at **57** wound on a large diameter core **58** is passed in strip form **59** into and through a heating tunnel **60** illustrated as heated by suitable gas jets **61**. The heating tunnel may be curved at its inlet end as indicated at **62** so as to more approximately conform to the curvature of the board as it is unwrapped from the roll, at which time it is substantially cold and comparatively rigid. Alternately the whole roll may be placed in a heated compartment and the web softened before unwinding. As the board is heated up, it softens somewhat, and may then be passed in a substantially straight path into contact with and wrapped about the pipe **45**. The rate of rotation of the pipe **45** is coordinated with its axial movement and with the rate of feed of the fibrous strip material so as to give the desired overlap of the adjacent edges as previously described. In order to secure desired contact of the strip material with the pipe as it is applied, a

roller **63** which may have a tapered forward edge **64** to accommodate the lap, is preferably mounted above the pipe so as to press the strip material lightly and evenly against the adhesively coated surface of the pipe.

The covered pipe then passes progressively through a suitable pressing arrangement indicated generally at **65** where the covering is consolidated and compacted and the seams are welded together as previously described.

A suitable form of press for this purpose is indicated more particularly in Fig. 8, which shows a plurality of press rolls, indicated as three in number at **70**, **71** and **72**, mounted on a large gear wheel **73** whose axis of rotation coincides with the axis of the pipe **45**. Suitable adjusting means **75** is provided for adjusting the rolls toward and away from the pipe along a radial axis, so that the proper pressure may be applied. Each of the rolls is preferably steam heated, so that the composite covered pipe is subjected to both heat and pressure for the compacting and consolidation. The large gear **73** is rotated about the axis of the pipe as by means of a pinion **77**, so that the press rolls are rotated around the pipe, as the pipe in turn rotates, which permits of its proper axial movement without undue friction during the pressing operation.

It will be understood that metal objects of various shapes may be covered with a thermoplastic covering in accordance with this invention. Where fireproofing characteristics of the composite article are desired, a substantial proportion of a finely divided inorganic filler, such as the fillers ordinarily used in paper and including clay, carbonate fillers and the like, may be incorporated with the fibrous pulp stock and mixed asphaltic material prior to the formation of the thermoplastic board or strip covering. Likewise, various fireproofing salts, such as the well known fireproofing salts, of tin or zinc or ammonium phosphate, may be added to the thermoplastic fibrous covering, as by spraying a solution thereof onto the covering during formation, to impart substantial fireproofing qualities to the finished composite articles. For example, a thermoplastic board containing about 15% to 25% by weight of the fibrous furnish of an inorganic mineral filler, such as clay, gives a product having improved surface characteristics as well as increased fireproofing quality. The addition of approximately 5% to 10% by dry weight of any of the fireproofing salts mentioned on the dry weight of the fibrous furnish imparts decided fireproofing qualities to the product and widens the field of use of the material.

While the forms of invention herein described constitute preferred embodiments thereof, it is to be understood that the invention is not limited to these precise forms, and that changes may be made therein without departing from the scope of the invention as defined in the appended claims.

What is claimed is:

1. Apparatus of the character described, comprising in combination, heating means, means for feeding a metal article in heat exchange relationship with said heating means, means for applying an adhesive coating to said heated metallic article, means for feeding a thermoplastic fibrous sheet into contact with the adhesive treated side of said metallic article, and heated press rolls for consolidating and compacting the composite fibrous covered metallic article.

2. Apparatus of the character described, comprising in combination, heating means, means for feeding a metal article in heat exchange relationship with said heating means, means for applying an adhesive coating to said heated metallic article, means for feeding a thermoplastic fibrous sheet into contact with the adhesive treated side of said metallic article, and heated corrugating rolls for concomitantly corrugating and compacting the composite fibrous covered metallic article.

3. Apparatus of the character described for covering cylindrical metallic articles, such as pipes, comprising in combination, means for holding, rotating and causing to travel axially such cylindrical metallic article, a heater for heating the metallic article during its travel, an adhesive applying means beyond said heater, a strip wrapping means for applying fibrous thermoplastic strip winding to said cylindrical metallic article beyond said adhesive applying means, and heated press rolls for pressing and consolidating the applied covering in situ on said cylindrical metallic article.

4. Apparatus of the character described for covering cylindrical metallic articles, such as pipes, comprising in combination, means for holding, rotating and causing to travel axially such cylindrical metallic article, a heater for heating the metallic article during its travel, an adhesive applying means beyond said heater, a strip wrapping means for applying a fibrous thermosplastic winding to said cylindrical metallic article, means for feeding a strip of fibrous thermoplastic material to said strip wrapping means, and means in advance of said strip wrapping means for heating the said strip of thermoplastic material.

5. Apparatus of the character described for covering cylindrical metallic articles, such as pipes, comprising in combination, means for holding, rotating and causing to travel axially such cylindrical metallic article, a heater for heating the metallic article during its travel, an adhesive applying means beyond said heater, a strip wrapping means for applying a fibrous thermoplastic winding to said cylindrical metallic article, means for feeding a strip of fibrous thermoplastic material to said strip wrapping means, and a heating chamber having a curved inlet and through which said strip of fibrous thermoplastic material is passed prior to reaching said strip wrapping means.

6. Apparatus of the character described for covering cylindrical metallic articles, such as pipes, comprising in combination, means for holding, rotating and causing to travel axially such cylindrical metallic article, a heater for heating the metallic article during its travel, an adhesive applying means beyond said heater, a strip wrapping means for applying fibrous thermoplastic strip winding to said cylindrical metallic article beyond said adhesive applying means, and a plurality of heated adjustable press rolls revolving on a common axis for compacting and consolidating the strip winding on said cylindrical metallic article.

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