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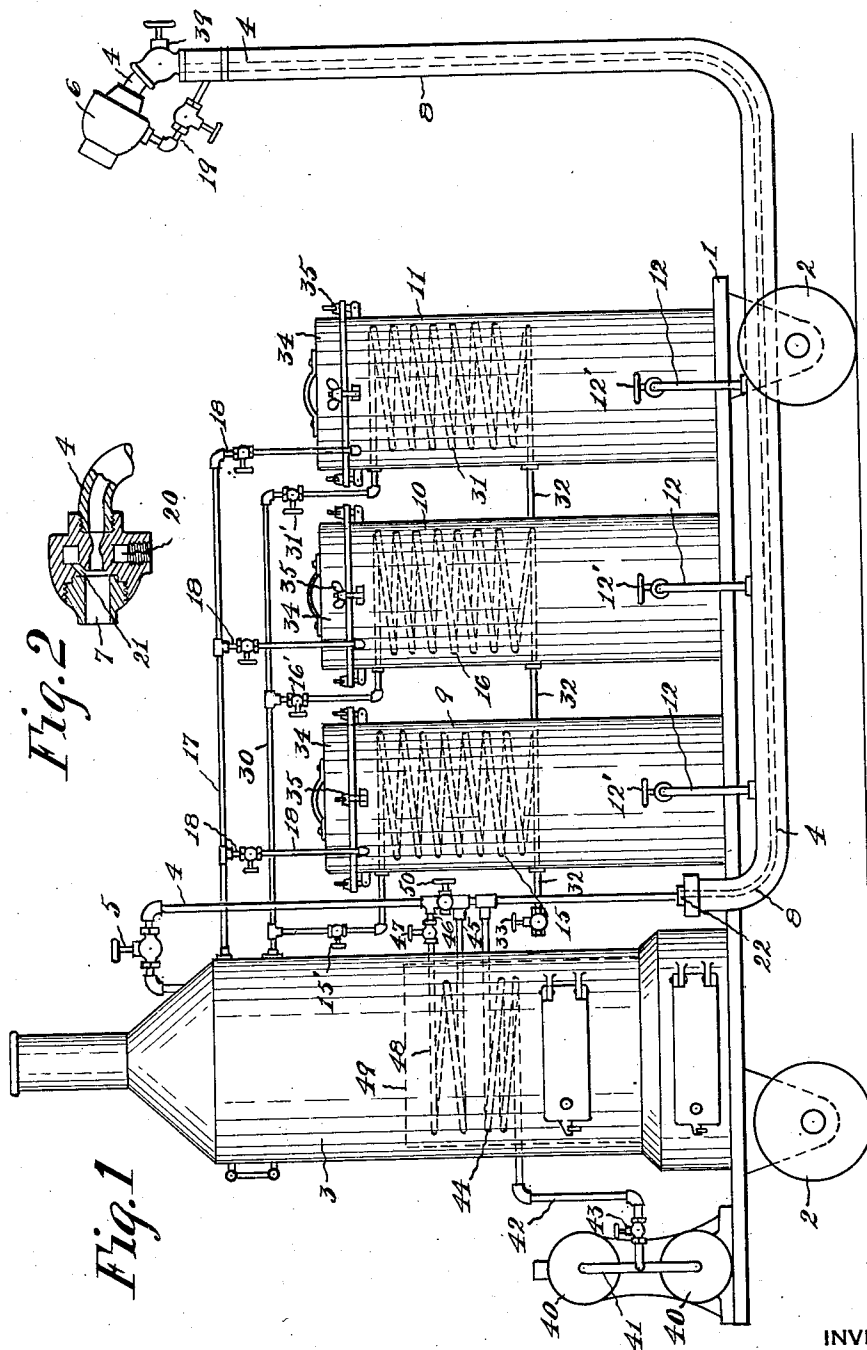


Fig. 2

Fig. 1

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METHOD OF IMPREGNATING MATERIALS

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Our present invention relates to an apparatus for, and method of, impregnating materials with protective, preservative fluids, and more particularly to methods of impregnating construction or other materials with protective substances against all forms of attack, weather, pest proofing, as the case may be, through the medium of a vaporized fluid applied thereto under pressure.

Impregnation of materials with protective liquids has been done by a variety of methods. Among these, the tank, immersion and vacuum chamber methods have been most generally used. One of the grave disadvantages in these methods is the fact that materials to be treated must be transported to the impregnating plant, due to the bulk and non-portability of the latter.

Another inherent disadvantage of these present known methods is the limited use to which they can be put. For instance, stone in a building, parts of trees, or timber erected in a construction project can hardly be impregnated by these methods since, in treating, it is not practical to remove them from their positions and thereafter replace them. Again, the tank immersion, vacuum chamber, or other impregnation methods, cannot economically be used to impregnate with protective substances certain materials such as stone, brick and the like.

We have discovered and applied a method of economically impregnating porous or cellular materials such as stone, brick, stucco, wood, tile, artificial stone and other materials, with protective substances, regardless of where they may be located or erected. For example, our method lends itself as easily to treating exposed timber in a pier, building or the like, erected posts, fences or telegraph poles, bridges or the like in situ, as it does to the components thereof during manufacture.

Fundamentally, our method takes advantage of the increased capillary action of materials when subjected to a high degree of heat, and the fact that fluids under high pressure can be forced into the heated substratum of the hardest material. We have also found that when a heated liquid protective substance is subjected to a blast of hot pressure fluid, such as steam or hot air, that the substance is effectively dispersed throughout the blast zone in a physical state between that of a colloid and a suspension.

Due to the use of a heated pressure fluid stream, carrying the materials herein specified, singly or in combination, as above noted, we regard the substitution of a stream of air, under

high pressure and temperature for, and at, the pressures and temperatures hereinafter set forth in our preferred, herein, embodiment to be a full equivalent of the herein disclosure and method.

Further, we have found that when such a blast is applied to the surface of a material being treated, that the heat of the blast stimulates the capillary action of the material which creates an expansion of the pores or cells permitting ready entrance of the impregnating substances, and then, reinforced by the pressure in the applying stream, the impregnating liquid is forced deep into the substratum of the material.

It will be obvious that such a method lends itself to economical and efficient use. The preferred apparatus for carrying out our method being portable, it becomes easy to impregnate materials erected in a construction project, or parts of trees and other uses to be later described.

Accordingly, one of the main objects of our invention is to provide an apparatus for, and a method of, impregnating materials with protective substances, which method is flexible in use, the apparatus being portable, a blast of hot pressure fluid being utilized to force the protective substances into the substratum of the material being treated.

Another object is to provide a method of weatherproofing, waterproofing, sterilizing and preserving materials of diverse nature by impregnating them with substances possessing such above noted properties, which substances are injected into the materials by hot pressure fluid.

Another object is to provide a method of, and apparatus for, cleaning, preheating and sterilizing material infested with decay-causing pests, by subjecting the materials to a blast of steam or hot air under pressure, the same carrying sterilizing substances, thus destroying germ and fungi-encouraging conditions, insects and insect larvae.

Another object of our invention is to treat materials subject to decay-causing organisms and moisture which comprises the steam cleaning of such materials, and the impregnation of such materials with weather or waterproofing and toxic substances, thereby eliminating the future development of such deleterious factors.

Another object of our invention is to subject the surfaces and substrata of materials, such as stone and wood, to weatherproofing substances, thereby enabling the materials to repel moisture and prevent such moisture from entering the materials from the exterior or weather surfaces

thereof, thereby to preserve said surfaces from a too rapid deterioration.

Another object of the invention is to provide an apparatus and method to accomplish the
5 the aforescribed objects and to have means associated therewith, whereby a hot pressure fluid, at normal steam or superheated temperatures, toxic substances, waterproofing and weatherproofing materials, and fireproofing, cleaning or coloring
10 substances may be selectively ejected therefrom independently or jointly by the operator.

Other objects of the invention are to improve generally the simplicity and efficiency of such devices and to provide a device which is eco-
15 nomical, durable and reliable in use and economical to manufacture.

Many of the features of the invention may be used without employing all of them, as some of those which are non-essential may be omitted
20 without departing from the spirit of the invention, though such omission may, to a greater or less extent, affect the quality of the result.

Moreover, the apparatus for accomplishing the methods of this invention is capable of receiving
25 various mechanical expressions without departing from the spirit of the invention itself; and, for the purpose of describing the invention, there is illustrated in the accompanying drawing, the preferred form of apparatus in which:

30 Fig. 1 is a diagrammatic view of the apparatus used to accomplish the method.

Fig. 2 illustrates one form of a material educating spray nozzle in section.

Referring more specifically to the drawing, a
35 wheeled truck comprising a base 1, carried on wheels 2, supports thereon a conventional vertical steam boiler 3. This manner of mounting the apparatus insures portability and ease of transportation of the apparatus from place to
40 place during use. Thus, when treating material, such as ties, telegraph poles, bridge timbers, etc., in situ, considerable transporting and handling charges are saved, as the apparatus may be brought to the location instead of the treated
45 material being carted to and fro.

A steam line 4, valved as at 5, leads from the boiler 3 to a pressure fluid applying nozzle 6. Steam is preferably generated in the boiler at about 150 lbs. pressure and at about 358 degrees
50 Fahrenheit. Obviously, other temperatures and pressures may be used. At the stated pressures and temperature however, optimum results are obtainable.

Spaced from, and enclosing the steam line 4,
55 there is arranged a duct 8 which is adapted to carry the various liquid impregnating materials, singly, or in combination. The steam line 4 and the enclosing material conducting duct 8 are made of suitable flexible hose material and are
60 joined by a suitable steam and liquid tight coupling 22 at said point. Thus, between these points 22 and 6, the hose comprises an inner tubing 4 to carry the hot pressure fluid, and an outer material carrying tubing 8 concentric therewith for
65 carrying the impregnating substances. It will be observed that the substances flowing through line 8 are constantly maintained in a hot condition by transfer of heat, by contact, from the hot pressure fluid flowing through the inner steam line 4.

Three material holding and treating tanks 9, 10
70 and 11 are mounted on the truck base 1. Tank 9 may contain a waxy or oily substance which has waterproofing, weatherproofing and non-oxidizing properties, and which is readily absorbed by
75 materials to be impregnated. Such a material

may have moisture repelling qualities. Among many materials which are suitable in this respect is paraffin wax, paraffin oil, aluminum stearate, thick oils, waxes, petroleum bases containing
5 slight amounts of aluminum stearate, fish oils and other oils of like nature.

A steam heating coil 15, leading from the boiler connection 30, valve controlled at 15', and disposed in tank 9 supplies sufficient heat to the contents thereof to maintain it hot and in liquid
10 condition for application.

In tank 10 there may be placed a toxic material. We use toxic in the broad sense of the word, that is to say, a material detrimental and fatal to bacteria, insects, fungi, and all similar
15 parasitic and destructive organisms. Materials of this nature are toxic arsenic compounds as arsenate of calcium, lead, soda, zinc or the arsenites of these metals; toxic copper compounds as Paris green and Bordeaux mixture; lime; sulfur and
20 lime sulfur combinations; zinc chloride, boric acid, nicotine-sulfate solutions; toxic aniline dyes or other toxic substances or solutions that have insecticidal, germicidal and fungicidal value.

Preferably, these materials should be in liquid
25 condition in the tank, and may be used singly or in combination. Their use depends, at any time, on the material being treated and the pest to be destroyed. This applies as well to any material in tank 9.

A steam coil 16 leads from boiler connection 30, valved at 16', into the tank 10 and maintains the contents thereof in a hot and liquid state for application.

The tank 11 may carry a fireproofing, cleaning
35 substance, or coloring dye, depending on the use to which the apparatus is to be put. In this tank, also, there is a steam coil 31, tapped from line 30, under control of valve 31'. The coils 15, 16 and 31 have a common blowoff 32, valved as at 33, to
40 maintain circulation of steam therein. Obviously, as many tanks as desired may be used in accordance with the types and kinds of materials to be utilized.

A steam line 17 leads from the boiler 3 and
45 has three valved branches 18 tapped therefrom and leading into each one of the tanks 9, 10 and 11. The purpose of these branch connections is to place the material in the tanks under discharge pressure whereby to insure positive flow of material therefrom to the nozzle 6.

Each tank is further supplied with a removable clamped-on cover 34, having means 35 between the covers and tanks so clampably hold the covers on in leakproof manner, and to permit
55 filling with treating materials and solutions.

Each tank is tapped at its bottom by a valved discharge duct 12 leading to the nozzle duct 8, and controlled by a hand valve 12'. A valved by-pass
60 19 taps the line 8 near the nozzle 6, and guides the impregnating material flowing through feed pipe 8 into the education chamber 20 of the nozzle, Fig. 2. Operation of the valve 19' feeds or cuts off material to the nozzle 6, as desired.

The pressure fluid, flowing from duct 4 into the nozzle 7, due to its expansion in passing out of nozzle 4, draws material from duct 8 into education chamber 7 by induction, and, plus the pressure of the boiler upon the materials within the tanks, the materials are ejected from nozzle 6 in
70 an intimately mixed atomized jet of high velocity and temperature. A hand valve 39, associated with nozzle 6, controls the supply of steam (pressure fluid) from duct 4, thus giving local control of steam supply at the nozzle position.
75

In the treatment of wood and some forms of stone it is sometimes desirable to superheat the steam supply to the duct 4, and to this end we have provided a superheating coil 48, located within the fire box of the boiler, the fire box being indicated by the dotted lines 49. Hand valves 47—50 control the coil so as to by-pass steam from duct 4, by opening valve 47, and closing valve 50. When this is done, all steam from the boiler 3 passes through coil 48 to nozzle 6 and becomes superheated.

Further, we also provide for a supply of superheated, compressed air, which may be mixed with the steam supply in duct 4, this mixture being also passed to the nozzle 6. Thus, by the structure now to be described, a stream of hot air is injected into pipe 4. On the truck base 1 there is disposed, against the boiler 3, a steam engine driven compressor 43 of conventional design. The rear view, more or less diagrammatic of the air and steam cylinders is shown, since this type of means is well known. A pipe 42, valved as at 43, taps the common compressor discharge pipe 41 of the air cylinders 40 of the compressor.

The pipe 42 passes air from the compressor into the superheater coil 44, shown in dotted lines. An external connection 45 joints the coil 44 with the main steam line 4. Thus, the compressed air issuing from line 45 is superheated and flows through line 4 as a hot gas under high pressure and admixes with the steam flow to the nozzle 6. Thus, hot pressure fluid is ejected from the nozzle, the hot pressure fluid serving not only to forcibly educe materials in line 8 from the nozzle, but to maintain the latter materials in fluid condition, when required, and ready for application and impregnation.

It is possible, also, to change our apparatus into a superheated air device for the herein purposes, without the use of steam as a direct means for impregnating. For instance, valves 18 may be opened, admitting steam pressure upon the tank contents. Valves 15', 16' and 31' may be opened, also drain valve 33, and cause controlled coil heating of the tank contents. Then with valve 5 closed shutting off the steam from duct 4 and, possibly, closing valve 47, the running of the compressor 40—40 passing the compressed air therefrom to and through coil 44, with valve 43 opened, superheated compressed air alone is passed through coil 44, duct 4 to nozzle 6, there to perform in a manner similar to that described for the steam impregnation of materials indicated.

We will now describe the manner of use of the apparatus disclosed above, and the various applications that the method lends itself to, with the understanding that many other uses and applications are possible. Assuming that exposed wooden piles, normally subject to the action of borers, dry rot and fungus decay, are to be treated, our method consists in first cleaning the wood thoroughly by means of a blast of steam or superheated hot air. In some cases the steam cleaning thus described may be eliminated, such as, for instance, in the treatment of new wood.

For steam cleaning, the valves on pipes 12 are all closed thus cutting off liquid impregnating supply from the tanks 9, 10 and 11, from duct 4. Valve 19 is kept closed at all times except when line 8 is actually delivering material. The valve 39 is opened and a blast of high pressure steam at normal or superheated temperatures is played over the wood being treated. This results in a literal scalding and sterilizing of all the growth and organisms on the surface of the wood. An-

other result of this preliminary heat treatment is that the cells, fibres, vessels, ducts and pores of wood are made pregnable for the subsequent reception of impregnating materials.

The valve or valves 12' are then opened and the materials from any or all of tanks 9, 10 and 11 are passed into duct 8, and thence to nozzle 6, such materials being heated during transit by the steam passing in duct 4. Thus if the wood is to be first impregnated with toxins, then the outlet valve associated with tanks 10 is opened, permitting the particular toxin in tank 10 to flow through line 8 to the nozzle 6.

Again, if a mixed stream of paraffin, toxins and fireproofing material is to be used, then all the outlet valves associated with tanks 9, 10 and 11 would be opened. The valves 19 and 39 at the nozzle 6 are manipulated to allow the combined stream of hot pressure fluid and impregnating liquids to be ejected.

When the hot stream under pressure strikes the surface of the material being treated, the contents of the pores, cells, fibres, vessels and ducts, if any, is displaced by the vapor under forced pressure. The vapor condenses in the pores and cells of the material, thus filling them with condensed waterproofing, toxic and fireproofing materials.

It should be noted that the impregnating material rendered molten and liquid, and ejected into the blast of hot pressure fluid in the mixing nozzle, issues therefrom in a phase which is between the colloidal state and a suspension. In other words, an efficient and thorough impregnation of the wood occurs because the impregnating materials are atomized into minute particles, and forced into the wood under high pressure, thus filling the substratum of the wood with the protective material.

Another fact is to be noted. The pressure fluid at 385 degrees Fahrenheit is hot enough to stimulate and induce a maximum of capillary action in the wood, when it strikes the same. In fact, we attribute the successful operation of our method, and deep impregnation secured thereby, to the combined action of the capillary action in the material being treated induced by the heat of the pressure fluid, and the great force exerted by the latter upon the particles of the impregnating substances dispersed throughout the pressure fluid.

Hot compressed air can be used as readily as steam in the above application of our method, and the materials that may be impregnated by our herein disclosed method are numerous. For instance, we have impregnated sandstone, hard pine, Celotex, concrete, porous stones such as chalk, lime, wood materials as compressed artificial lumber and board, brick, stone, stucco, mortar, unglazed tile and various other manufactured or natural construction or building materials.

In every one of these cases, the degree of penetration depends on the pressure of the pressure fluid, the temperature of the fluid, the porosity of the material being treated and the nature of the impregnating materials used. But the best results are obtained at the pressure fluid temperature given above. Wood, stone and artificial composite board are impregnated by our method in quicker time, with less expense and to a greater extent than with the tank immersion method of impregnation. Further, such penetration is done without recourse to an air lock or closed receptacle.

The above method allows the use of stone as a veneer to buildings much thinner than is used in present practice. Consequently, building costs may be cut, and stone used half as thick as is used at present, or even thinner. Stone treated by our method, after a half hour or so of blast treatment shows as much as a quarter to a half of an inch of impregnation. This impregnation is so thorough and deep seated that the stone enclosed within its protective bounds is preserved for long periods of time.

The portability of this method enables it to be effectively used in combating the ravages of pests on railroad ties, telegraph poles, bridge timber, piles and other construction materials in situ, in locations infested with destructive and decay-promoting organisms and growths.

Another use to which our method is adapted for is in agricultural developments. For example, tree wounds due to removal of large limbs, or to injury from any cause, as by rabbits, mice, plows etc., around the base of trees can be promptly sterilized and impregnated with the waterproof, weatherproof and sterilizing materials. Thus, attack by fungi, or wood boring insects is effectively countered.

Again, frequently decayed cavities in the trunks and limbs of trees are infested with wood boring larvae, or are the retreat of different species of ants. Such cavities are objectionable, for not only do they favor gradual decay and weakening of the trees, but they afford an excellent winter harbor for such insects as the codling moth. In such cases the rotten sections of trees are steamed out and removing mechanically, in some cases, the rotted wood as far as is necessary. The remaining cavity or diseased parts are then sterilized and the poisoned paraffin materials injected into the parts to arrest further rot and protect it from the weather and the insects.

Thus, it is apparent that our present method and apparatus are applicable to a multitude of uses, some in construction materials in situ, others in agricultural fields, and still others in numerous ways that will readily suggest themselves to those using the method.

We claim:

1. A method of impregnating which consists in subjecting the exterior surface of a material, such as stone and wood, to heat, and simultaneously forcing a substance having toxic, weatherproofing and waterproofing properties into the sub-strata of said material, said substance being dispersed throughout and applied directly to said surface by a blast of hot vapor.

2. The process of treating an exposed surface of construction material in situ for waterproofing, preservative and fireproofing purposes, which consists in directly projecting against such an exposed surface a blast of highly heated gas under high pressure, and simultaneously feeding substances to accomplish said purposes into said blast whereby the combined action of the blast pressure and the increased capillary action of the material result in thorough impregnation of the sub-strata of the material with such substances.

3. A method of waterproofing a stone wall with an apparatus which includes a movable steam delivering nozzle, consisting in directing the nozzle against one part of said wall to heat the substratum of said part, mixing waterproofing material with the steam during its delivery to impregnate the heated substratum, and moving

said nozzle with its steam and waterproofing material over the other parts of said wall.

4. A process of impregnating wooden and stone structures, said process comprising applying to said structure a high pressure dynamic superheated blast of hot fluid, paraffin, toxins and fireproofing materials, whereby said materials are finely atomized and mixed and said mixture is highly heated, liquefied and disrupted; and directing said blast upon said structure, whereby said structure is highly heated thereby to render the structure absorbent to the highly heated materials, and whereby said materials are tamped by the dynamic stream into said structure and absorbed into the pores of the hot structure.

5. A process of impregnating building structures with preservatives, said process comprising applying to such structure a high pressure dynamic blast superheated to about 385° F., consisting of a mixture of steam, molten paraffin, toxin and fireproofing materials whereby said materials are mixed, highly heated, liquefied and disrupted by the released latent heat of the steam and finely atomized to a state intermediate between colloidal and suspension and rendered absorbable into the pores of the structure; and directing said blast upon said structure, whereby said structure is highly heated by further released latent heat of the steam thereby to render the structure absorbent to the highly heated materials, and whereby said materials are tamped by the dynamic stream into said structure and drawn into the pores of the structure by the condensation of said stream.

6. A process of impregnating wooden and stone structures, said process comprising applying to said structure a high pressure dynamic blast of superheated gaseous fluid, substantially free of other materials; then introducing into said blast, a heated impregnating material absorbable in the pores of the structure; and directing said blast upon said structure, whereby said structure is further highly heated thereby to render the structure absorbent to the highly heated material, and whereby said material is tamped by the dynamic stream into said structure and absorbed into the pores of the hot structure.

7. A process of impregnating wooden and stone structures, said process comprising applying to such structure a high pressure dynamic blast of superheated gaseous fluid at about 385° F., substantially free of other materials, applying said blast alone sufficiently long to clean the structure, sterilize living organisms therein, to heat the structure sufficiently to render the capillaries and pores of the structure pregnable to subsequent impregnating materials; then introducing into said blast by induction of the blast, substantially at the point of liberation, heated molten paraffin, whereby said paraffin is highly heated, liquefied and disrupted and finely atomized to a state intermediate between colloidal and suspension and rendered absorbable into the pores of the structure; and directing said blast upon said structure, whereby said structure is further heated to render the structure absorbent to the highly heated materials, and whereby said materials are tamped by the dynamic stream into said structure.

8. A process of impregnating, with preservatives, unenclosed large wooden structures in situ, said process comprising applying to said structure a high pressure dynamic blast of superheated steam at about 385° F. substantially free of other materials and having latent heat there-

in, applying said blast alone sufficiently long to clean the structure, sterilize living organisms therein, to render the cells, fibers, vessels, ducts, pores and capillaries of the structure pregnable to subsequent impregnating materials and to fill the pores with steam; then introducing into said blast by induction of the blast, substantially at the point of liberation of the blast, a heated molten mixture of paraffin, toxins and fire-proofing materials whereby said materials are mixed, highly heated, liquefied and disrupted by the released latent heat of the steam and finely atomized to a state intermediate between colloidal and suspension and rendered absorbable into the pores of the structure; and directing said blast upon said structure, whereby said structure is highly heated by further released latent heat of the steam thereby to render the structure further absorbent to the highly heated materials, and whereby said materials are tamped by the dynamic stream into said structure and drawn into the pores and capillaries of the structure by the partial vacuum therein caused by the condensation of said steam therein.

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