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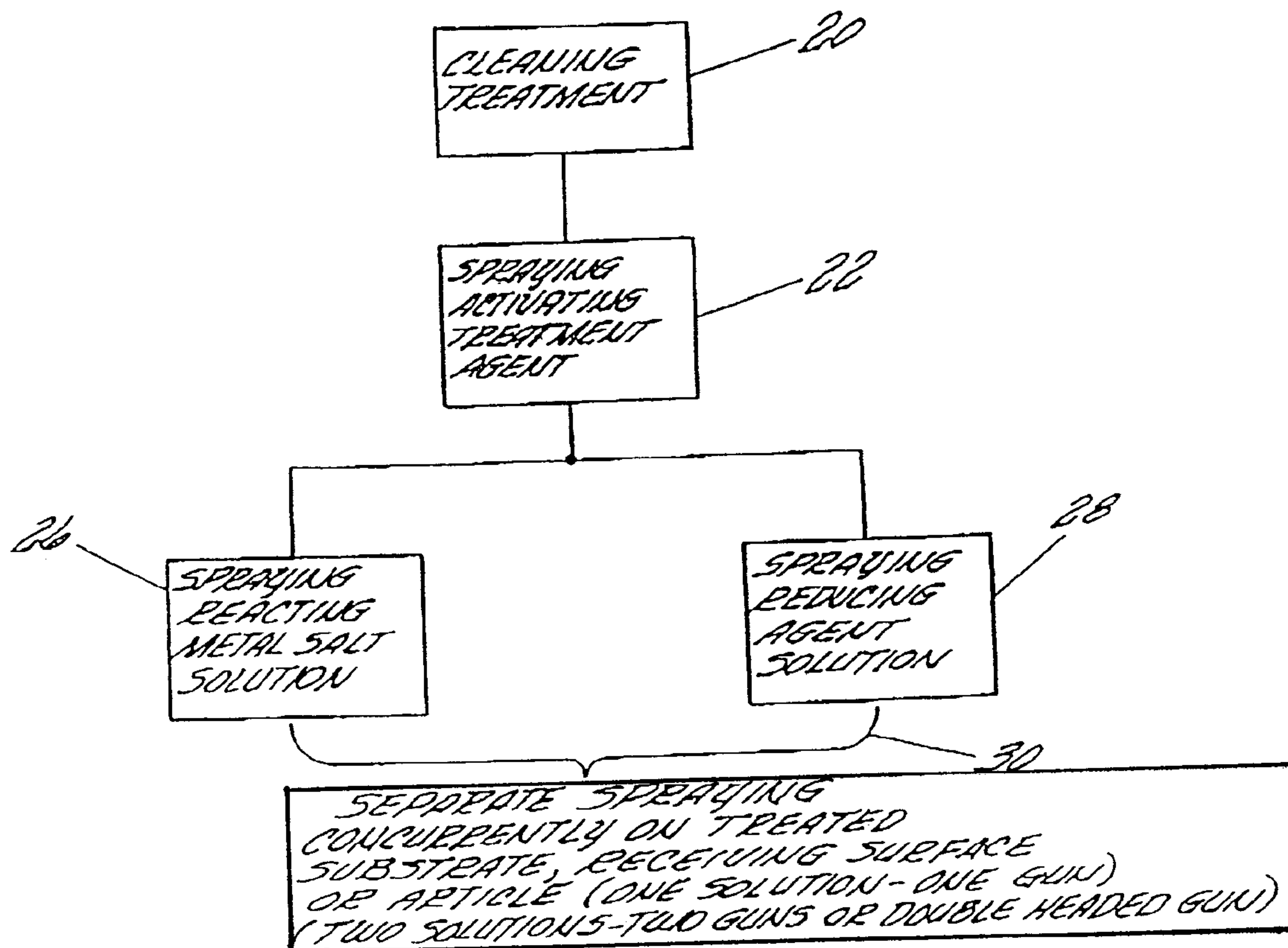
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(54) Titre : METHODE, SOLUTION ET PEINTURE POUR PRODUIRE UNE COUCHE METALLIQUE REFLECHISSANTE
OU UN ECLAT METALLIQUE

(54) Title: METHOD, SOLUTION AND PAINT FOR FORMING A METALLIC MIRROR SURFACE OR METALLIC
LUSTER



(57) Abrégé/Abstract:

A method for forming a metallic mirror surface on a receiving surface, substrate or article is shown. The method comprises the steps of cleaning the receiving surface; spraying on the receiving surface an activating treatment agent containing stannous



(57) Abrégé(suite)/Abstract(continued):

chloride and at least one precious metal salt of palladium, gold and silver or the like; and separately spraying concurrently on the receiving surface, a reacting metallic salt solution and a reducing agent solution to form the metallic mirror surface. The method may include the step of treating the receiving surface with a water wash treatment. The activating treatment agent may be in a solution form and contain about 10cc to about 44 cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water. The reacting metal salt solution may contain about 6.0g to about 25g of sodium hydroxide, about 20g to about 20g of silver nitrate per 1 liter of water. The reducing agent solution may containing about 1g to about 4.5g of tartaric acid, about 10g to about 50g of glucose and about 0.05g to about 3.5g of formaldehyde. A coating process and a method of chemically treating an article are also shown.

ABSTRACT OF THE DISCLOSURE

A method for forming a metallic mirror surface on a receiving surface, substrate or article is shown. The method comprises the steps of cleaning the receiving surface; spraying on the receiving surface an activating treatment agent containing stannous chloride and at least one precious metal salt of palladium, gold and silver or the like; and separately spraying concurrently on the receiving surface, a reacting metallic salt solution and a reducing agent solution to form the metallic mirror surface. The method may include the step of treating the receiving surface with a water wash treatment. The activating treatment agent may be in a solution form and contain about 10cc to about 44 cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water. The reacting metal salt solution may contain about 6.0g to about 25g of sodium hydroxide, about 20g to about 20g of silver nitrate per 1 liter of water. The reducing agent solution may containing about 1g to about 4.5g of tartaric acid, about 10g to about 50g of glucose and about 0.05g to about 3.5g of formaldehyde. A coating process and a method of chemically treating an article are also shown.

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METHOD, SOLUTION AND PAINT FOR FORMING A METALLIC MIRROR SURFACE
OR METALLIC LUSTER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method for forming a metallic mirror surface on a receiving surface, substrate or an article which may be used, as coated, as a decorative object, for making interior decoration ornaments, automobile parts, household electronic appliances, Buddhist altar fittings, furniture, personal accessories and the like and more particularly relates to a method and process employing a spraying based method or process for forming a metallic mirror surface on variety of materials such as metal, synthetic resin, rubber, glass, ceramic wares, wood, leather, stone, plaster, rattan, straw and the like. Solutions, such as activating treatment agent, reacting metal salts including reacting metallic salts and reaction agents are used in the method and processes as disclosed herein. This invention also relates to a method for forming a metallic mirror surface, solutions for the same and paint for forming a colored coating with metallic luster.

This invention is related to a method of forming a coating of, or paint for, a colored polyurethane coating with metallic luster.

2. Description of the Prior Art

Chrome plating or spraying of chrome paint on to a receiving surface, substrate or article is known in the art. One example of a known chromium plating process is disclosed in United States Patent 5,401,379 wherein the chromium plating process provides for cleaning and acid treating of a

metal article prior to electroplating the acid treated metal article in an electroplating solution. A wide variety of chrome/aluminum/gold spray paints are known in the art. Several examples of typical chrome and/or aluminum or gold spray paints and the chemical compositions thereof are set forth below in Table 1:

<u>Example</u>	<u>Chrome Paint Product</u>	<u>Chemical Composition</u>	
1	SKU Number 33873 00503 03-CHROME ALUMINUM-13	Pigment:	Aluminum Powder 1.88%;
		Vehicle:	Marine Oil, Petroleum Resin Varnish 7.12%
		Propellant	Propane Isobutane 35%
		Other:	Volatile 91%, Aliphatic & Hydrocarbons 29.5%, Methylene Chloride 26.50%

Table 1

<u>Example</u>	<u>Chrome Paint Product</u>	<u>Chemical Composition</u>	
2	Instant Chrome K-Mart Corporation	Pigment:	Aluminum Powder (Type II-Class B) 2.9;
		Vehicle:	Petroleum Resin 16.2%
		Propellant	Propane Isobutane 30%
		Other:	Aromatic Hydrocarbons 32.2%, Halogenated Hydrocarbons 30%
3	Hanks Best, Aluminum 1603/ Rust Inhibitor	Pigment:	Aluminum Powder 3.2%;
		Vehicle:	Keytones 15.40%
		Propellant	Propane Isobutane 23%
		Other:	Aromatic Hydrocarbons 51.50%, Xylol Solvent 100%

Table 1 (Continued)

<u>Example</u>	<u>Chrome Paint Product</u>	<u>Chemical Composition</u>	
4	Coast-to-Coast Metallic Silver S79-44078	Pigment:	3.16%; Standard Aluminum Powder 100%
		Vehicle:	None Disclosed
		Propellant	None Disclosed
		Other:	None Disclosed
5	Rust-Oleum 7270 Gold Rush Metallic	Pigment:	Gold Pigment None Disclosed
		Vehicle:	None Disclosed
		Propellant	None Disclosed
		Other:	None Disclosed

Table 1 (continued)

Conventional methods for chemical plating on plastics such as ABS resins and pretreatment methods for the same are also known in the art. These chemical plating methods involve procedures of first soaking the plastics in an etching solution for 15 minutes to 30 minutes to roughen, abrade or texture the

surface, then soaking the etched plastic in stannous chloride containing hydrochloric acid solution bath, washing using water, soaking in activation bath, washing again using water, soaking in plating bath for 5 minutes to 10 minutes, removing from plating bath, washing using water, and drying.

United States Patent 3,877,998 discloses a method for treating metal surfaces, preferably after phosphating, with an aqueous solution (preferably acidic) of a melamine-formaldehyde composition and are subsequently dried, preferably by heating. The treatment is a suitable substitute for a conventional chromate rinse.

Bellini Vernici, s.r.l located in Perugia, Italy, offers for sale and sells a wide variety of products for use in car body shops. Certain of these products, referred to as surface refinishing systems, are sold under the trademarks AUTO MAGIC, BODY MAGIC and CLAY MAGIC. These products include non-silicone dressing solutions, lubri-shine solutions, nonacid wheel cleaners, multi-purpose cleaners, body wash, transparent coating referred to a TRAPARENTE M.S., and other coating solutions identified as CATALIZZATORE M.S., DILUENTE M.S. and SOLVENTE ANTISILICONE, all of which are solutions for applying a colored or transparent coating on a motor vehicle or part thereof.

Numerous problems are associated with the known prior art chrome plating processes. One significant problem is the environmental considerations. For example, in known prior art chrome plating processes, ventilation and misting systems are require to protect the workers from and to prevent chrome fumes

from emanating into the working and surrounding environment. Further, workers are required to wear appropriate breathing masks or breathing apparatus when using the process. Elaborate rinsing and capture systems are required to control, capture and dispose of the by-products and spraying residue from a typical chrome plating process.

United States Patent 4,221,844 discloses a decorative coating of metal, such as a chrome plated cold rolled steel, which is accomplished through the use of a layout fluid used in tool and die work. The layout fluid comprises organic dyes, a wet nitrocellulose vehicle, denatured alcohol solvents, butyl alcohol solvents and a hydrocarbon propellant.

In the above described chemical plating methods for plating plastic or other material receiving surfaces, substrates or articles, the plastic material is soaked in a plating bath at each step of the process and large spaces are required to set up the plating baths. The entire process is also time consuming. Additionally, maintenance requirements and environmental considerations are a factor for driving up the processing costs.

Another problem associate with known prior art chrome/aluminum/gold spray paints is that the spray paints include pigments and vehicles for binding or capturing the pigment such as petroleum resins, and propellants. The quality of the resulting sprayed chrome coated surface is poor and is not metallic mirror like, the coatings contain the petroleum resins as impurities, the paint coating adhesion is minimal and the visual appearance of the spray paints do not rise to the

appearance levels attained by typical chrome plating processing of material, substrates or articles.

The use of transparent and colored coatings for motor vehicles and parts thereof wear off, are not permanent coatings and need to be periodically refreshed or replaced to maintain a desired luster coating.

The decorative coating of United States Patent 4,221,844 utilizes organic dyes suspended in a liquid vehicle formed of ingredients or elements completely different from the method, process, mixture or paint of the present invention.

Conventional methods for coloring metallic surfaces included the Precoremetal (PCM), electrodeposition and anodic oxidation process in a sulfuric acid bath (colored aluminum alloy method).

The PCM method mainly uses inorganic pigments and the coatings so produced lack transparent quality. It is difficult to achieve a finish with a metallic luster that comes from deep within through the application of this prior art PCM method to a lustrous metallic surface.

In electrodeposition, the water acts as the medium for dispersion and tends to corrode and discolor the metal surface. In addition, the use of a water-base paint incurs an enormous expenditure on processing of the drain water, which results in an increased cost.

The application of a clear acrylic resin topcoat over a metallic mirror surface causes a yellowing of the resin, which dulls the color. Vivid coloring is difficult to achieve. The

addition of metallic powder in the clear coat in an attempt to obtain a metallic coloring achieves a twinkling metallic coloring, but lacks an expensive and rich look of mirror-like luster.

SUMMARY OF THE PRESENT INVENTION

The present invention discloses and teaches a new, novel and unique method for forming a metallic mirror surface on a receiving surface. The method comprises the steps of (a) cleaning or otherwise preparing the receiving surface to be coated with a metallic mirror surface; (b) spraying on the receiving surface an activating treatment agent, which may be in solution form, containing stannous chloride and at least one precious metal salt of palladium, gold, silver or the like; and (c) separately spraying concurrently on the receiving surface having the activating treatment agent, a reacting metal salt solution and a reducing agent solution to form the metallic mirror surface.

In addition, a novel and unique hydrochloric acid solution is disclosed and taught herein wherein the solution includes about 10cc to about 44cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water for use as an activating treatment agent solution for forming a metallic mirror surface on a receiving surface formed by treating the receiving surface with the above described hydrochloric acid solution, as an activating treatment agent followed by a concurrent application of a reacting metal salt solution and

reducing agent solution to form a metallic mirror surface on the receiving surface.

In addition, a novel and unique metal salt solution is disclosed and taught herein wherein the metal salt solution includes about 6.0g to about 25g of sodium hydroxide, about 20g to about 70g of ammonia and about 2g to about 20g of silver nitrate per 1 liter of water for use as a reducing metal salt solution for forming a metallic mirror surface formed by treating receiving surface with an activating treatment agent containing stannous chloride and at least one precious metal salt of palladium, gold, silver and the like followed by a concurrent application of the above described reducing metal salt solution and reducing agent solution to form a metallic mirror surface on the receiving surface.

In addition, a novel and unique reducing agent solution is disclosed and taught herein wherein the reducing agent solution may containing about 1g to about 4.5g of tartaric acid, about 10g to about 50g of glucose and about 0.05g to about 3.5g of formaldehyde for use as a reducing agent for forming a metallic mirror surface formed by treating receiving surface with an activating treatment agent solution containing stannous chloride and at least one precious metal salt of palladium, gold, silver and the like followed by a concurrent application of a reacting metal salt solution and the above described reducing agent to form a metallic mirror surface on the receiving surface.

Also, novel and unique article is disclosed herein having at least a portion of the outer surface thereof coated with a

metallic mirror surface and, alternatively, having a primer coating located between the metallic mirror surface and the at least a portion of the outer surface of the article and wherein the silver metal surface comprises a reactant formed by reaction of an activating treatment agent solution containing stannous chloride and at least one precious metal salt of palladium, gold, silver and the like with a reacting metal salt solution and reacting a reducing agent solution.

The present invention discloses and teaches a new, novel and unique method for forming a colored coating with a metallic luster on a surface having a metallic luster. The method comprises the steps of: (a) preparing a paint containing a mixture of reacting polyol, reacting polyisocyanate and a coloring agent; (b) applying the paint onto a metallic luster surface; and (c) enabling the polyol and polyisocyanate to curingly react with each to hardness other forming on said metallic luster surface a colored polyurethane coating having metallic luster.

In addition, a novel and unique paint is disclosed for forming a colored coating with a metallic luster on a surface having a metallic luster wherein the paint comprises a mixture of acrylic polyol and polyisocyanate, a coloring agent comprising primarily of organic pigments and, alternatively, at least one of a disperser, solvent all of which are substantially uniformly dispersed throughout said mixture.

Also, a novel and unique article is disclosed having at least a portion its outer metallic surface coated with a

metallic mirror surface and wherein the at least a portion of the outer surface of the article has formed thereon a harden colored coating with a metallic luster. The metallic luster is formed by the curing reaction of a paint to hardness wherein the paint comprises a mixture of acrylic polyol and polyisocyanate, a coloring agent which comprises preferably primarily organic pigments.

According to one aspect of the invention there is provided a method for forming a metallic mirror surface on an underlay comprising the steps of:

adjusting the underlay;

applying an activating treatment agent in a solution to the underlay wherein said activating treatment agent solution contains about 10 cc to about 44 cc of hydrochloric acid, about 1.5 g to about 5 g of stannous chloride and about 0.001 g to about 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof; and

reacting a metallic salt with a reducing agent on the underlay having said activating treatment agent to form the metallic mirror.

According to a further aspect of the invention there is provided a method for forming a metallic mirror surface on a substrate comprising the steps of:

spraying the substrate with an activating treatment agent in solution wherein said activating treatment agent in solution contains 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and 0.001 g to 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof; and

simultaneously and separately spraying the substrate with metallic mirror reaction treatment agents comprising a reacting metal salt solution and a reducing agent solution.

According to another aspect of the invention there is provided a method for forming a metallic mirror surface on a receiving surface comprising the steps of:

cleaning the receiving surface;

spraying on the cleaned receiving surface an activating treatment agent solution wherein said activating treatment agent solution contains about 10 cc to about 44 cc of hydrochloric acid, about 1.5 g to about 5 g of stannous chloride and about 0.001 g to about 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof; and

separately spraying concurrently on the receiving surface having said activating treatment agent a reacting metal salt and a reducing agent to form the metallic mirror surface.

According to yet another aspect of the invention there is provided a hydrochloric acid solution including about 10 cc to about 44 cc of hydrochloric acid, about 1.5 g to about 5 g of stannous chloride and about 0.001 g to about 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof, for use as an activating treatment agent for forming a metallic mirror surface on a receiving surface wherein said receiving surface is treated with said hydrochloric acid solution as an activating treatment agent solution followed by a concurrent application of a reacting metal salt solution and reducing agent solution to form the metallic mirror surface on the receiving surface.

According to still another aspect of the invention there is provided a metal salt solution containing about 6.0 g to about 25 g of sodium hydroxide, about 20 g to about 70 g of ammonia and about 2 g to about 20 g of silver nitrate per 1 liter of water for use in forming a metallic mirror surface on a receiving surface wherein said receiving surface is first treated with an activating treatment agent solution containing stannous chloride and a precious metal salt which is palladium, gold, silver or platinum, or any combination thereof, followed by a concurrent application of the metal salt solution and a reducing agent solution to form the metallic mirror surface on the receiving surface.

According to a further aspect of the invention there is provided an article having at least a portion of the outer surface thereof coated with a metallic mirror surface comprising a reactant formed by reaction of an activating treatment agent reacted with a reacting metal salt and a reducing agent wherein said activating treatment agent is a solution containing about 10 cc to about 44 cc of hydrochloric acid, about 1.5 g to about 5 g of stannous chloride and said precious metal salt which is palladium, gold, silver or platinum, or any combination thereof.

Conventional methods for coloring metallic surfaces included the Precoremetal (PCM), electrodeposition and anodic oxidation process in a sulfuric acid bath (colored aluminum alloy method).

The PCM method mainly uses inorganic pigments and the coatings so produced lack transparent quality. It is difficult to achieve a finish with a metallic luster that comes from deep within through the application of this prior art PCM method to a lustrous metallic surface.

In electrodeposition, the water acts as the medium for dispersion and tends to corrode and discolor the metal surface. In addition, the use of a water-base paint incurs an enormous expenditure on processing of the drain water, which results in an increased cost.

The application of a clear acrylic resin topcoat over a metallic mirror surface causes a yellowing of the resin, which dulls the color. Vivid coloring is difficult to achieve. The addition of metallic powder in the clear coat in an attempt to obtain a metallic coloring achieves a twinkling metallic

coloring, but lacks an expensive and rich look of mirror-like luster.

United States Patent 4,221,844 discloses a decorative coating of metal, such as a chrome plated cold rolled steel, which is accomplished through the use of a layout fluid used in tool and die work. The layout fluid comprises organic dyes, a wet nitrocellulose vehicle, denatured alcohol solvents, butyl alcohol solvents and a hydrocarbon propellant.

A coating process, a metallic mirror surface coating process, a method for forming a metallic mirror surface on an article and a method of chemically treating an article using the teaching of the present invention are also disclosed herein.

The problem associated with the prior art processes, methods and spray paints are overcome by this invention which employs a method that involves preparing or cleaning the receiving surface or underlay, including, alternatively, coating the receiving surface with an appropriate primer coating material, to facilitate, enhance or promote high adherence or bonding of the metallic mirror surface to the receiving surface or underlay followed by an activating treatment, a water-wash treatment and the reaction of the activating treated with a metal salt solution and reducing agent solution to form a metallic mirror surface.

None of the known prior art anticipate, disclose, teach or suggest a method for forming a colored polyurethane coating having metallic luster comprising the steps of (a) mixing and stirring a mixture of acrylic polyol resin, polyisocyanate and a

coloring agent wherein parts by weight of said acrylic polyol resin is about five times parts by weight of said polyisocyanate; (b) spraying the mixture on to a metallic luster surface; and (c) enabling the polyol and polyisocyanate to curingly react with each other to hardness forming on the metallic luster surface a colored polyurethane coating having metallic luster.

In the preferred embodiment of the present invention, a metallic mirror surface is formed by an activating treatment that employs a spraying method to spray the activating treatment agent solution containing stannous chloride and precious metal salts of palladium, gold, silver or the like as well as the simultaneous but separate spraying of a metal salt solution and reducing agent solution which combine or react to form the metallic mirror surface.

None of the known prior art method, processes or spray paints anticipate, disclose, teach or suggest a metallic mirror surface being formed by an activating treatment that employs a spraying method to spray the activating treatment agent containing stannous chloride and precious metal salts of palladium, gold and silver or the like as well as the simultaneous but separate spraying of a metal salt solution and reducing agent solution which combined or react to form the metallic mirror surface.

Therefore, one advantage of the method for forming a metallic mirror surface on a receiving surface is that a spray method is employed instead of plating bath to produce a metallic

mirror surface on metal, synthetic resin, rubber, glass, ceramic wares, wood, leather, stone, plaster rattan, straw and the like.

Another advantage of the present invention is that problems associated with the prior plating process and spray paints are using in lieu thereof the method for forming metallic mirror surface on metal, synthetic resin, rubber, glass, ceramic wares, wood, leather, stone, plaster, rattan, straw and the like.

Another advantage of the present invention is that activating treating agents may contain about 10cc to about 44cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water

Another advantage of the present invention is that activating treating agents may be in form of a hydrochloric acid solution which includes about 10cc to 44cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water for use as an activating treatment agent solution for forming a metallic mirror surface on a receiving surface formed treated, which alternatively could be prepared with primer coating, wherein the receiving surface is treated with the hydrochloric acid solution as an activating treatment agent followed by a concurrent application of a reacting metal salt solution and reducing agent solution to form a metallic mirror surface on the receiving surface.

Another advantage of the present invention is that a metal salt may include about 6.0g to about 25g of sodium hydroxide,

about 20g to about 70g of ammonia and about 2g to about 20g of silver nitrate per 1 liter of water for use with a reducing agent solution for forming a metallic mirror surface on a receiving surface wherein the receiving surface is then treated with an activating treatment agent solution containing stannous chloride and at least one precious metal salt of palladium, gold, silver or the like followed by a concurrent application of a reacting metal salt and reducing agent solution having about 1g to about 4.5g of tartaric acid, about 10g to about 50g of glucose and about 0.05g to about 3.5g of formaldehyde to form a metallic mirror surface on the receiving surface.

Another advantage of the present invention is that a metallic mirror surface coating process using the teachings of the present invention may be used for forming a metallic mirror surface on part of a receiving surface or on the entire surface of a wide variety of materials such as metals, plastics, glasses, ceramics, woods, decorative items, furniture, motor vehicles, motor cycles, motor vehicle components and parts, or flat, curved or shaped objects, articles or the like.

Another advantage of the present invention is that the teachings of the present invention can be used for fabrication of an article having at least a portion of the outer surface thereof coated with a metallic mirror surface and, preferably having a primer coating located between the metallic mirror surface, the at least a portion of the outer surface of the article wherein the silver metal surface comprises a reactant

formed by reaction of an activating treatment agent containing stannous chloride and at least one precious metal salt of palladium, gold, silver or the like with a reacting metal salt and a reducing agent.

Another advantage of the present invention is that an article having a metallic mirror surface fabricated by using the teachings of the present invention may have a colored metallic luster formed on at least a portion thereof.

Another advantage of the present invention is that the paint is applied to a metallic mirror-like surface using a simple system, such as, a spraying method, all as disclosed and taught by the present invention.

Another advantage of the present invention is that the invention consists of a method, whereby a paint containing a mixture of polyol and polyisocyanate, as its main components, and an organic pigment and/or dye, as its coloring agent, is applied preferably, by spraying onto a surface of either a lustrous metallic material, or plated material. The polyol and polyisocyanate are subsequently allowed to curingly react with each other to hardness to form a colored polyurethane coating with metallic luster.

Another advantage of the present invention is that the invention consists preferably of a method of forming a colored polyurethane coating with metallic luster using a paint, comprising of a mixture of acrylic polyol and polyisocyanate, a coloring agent comprising organic pigments and/or dyes, dispersers, solvents, diluents or additives as desired.

Another advantage of the present invention is that the methods of forming a colored coating, and of the paints, subject of this invention, utilize polyol and polyisocyanate as a vehicle to form a polyurethane coating in a hardening reaction, as described previously.

Another advantage of the present invention is that the mixture or paint has a low viscosity before the hardening process starts. This has the effect of preventing the mixture or paint from sagging and reduces and/or eliminates clogged nozzles during the spraying process. The coating thickness is also uniform, paint adhesion to the painted article or object is good and this makes for a superior appearance.

Another advantage of the present invention is that the organic pigment or dye has a better transparency effect than an inorganic pigment. The transmission of light is reflected off of the lustrous metal surface through the aforementioned polyurethane coating when the pigment or dye is uniformly dispersed throughout the mixture or paint. As such, the yellowish discoloration is eliminated due to the yellowing of the coating. The effect of reflecting light from the luster of the metal surface adds a sense of depth to the hue. It also acts to protect the metal surface from oxidation and discoloration.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other advantages of this invention will be apparent from the following description of the preferred embodiment of the invention when considered with the

illustrations and accompanying drawings, which include the following Figures:

Fig. 1 is a pictorial representation of a receiving surface having a metallic mirror surface formed thereon;

Fig. 2 is a pictorial representation of a receiving surface having a primer coating located between a metallic mirror surface and a receiving surface to enhance adhesion therebetween;

Fig. 3 is a block diagram showing the steps of the methods, process and an article formed thereby using the teachings of the present invention;

Fig. 4 is a pictorial representation of an article having a metallic mirror surface and a colored metallic luster on at least a portion thereof formed using the teachings of the present invention;

Fig. 5 is a pictorial representation of a substrate having a metallic mirror surface formed thereon using the teachings of the present invention; and

Fig. 6 is a pictorial representation of a motor vehicle part in the form of a motor cycle cover having a metallic mirror surface formed thereon using the teachings of the present invention.

Fig. 7 is a pictorial representation of wheel cover having formed thereon a colored coating with a metallic luster using the teachings of the present invention;

Fig. 8 is a pictorial representation of the structure of the wheel cover of Fig. 7 showing the substrate, lustrous

surface formed on the substrate and the colored coating with a metallic luster formed on the lustrous surface of the wheel cover;

Fig. 9 is a pictorial representation of steel substrate formed in the shape of a pipe having a finished, mirror-like surface and that surface has formed thereon a colored coating with a metallic luster using the teachings of the present invention;

Fig. 10 is a pictorial representation of a Buddha formed on a synthetic wood substrate, made by low foaming ABS resin, plated with a lustrous surface and having formed thereon a colored coating with a metallic luster using the teachings of the present invention;

Fig. 11 is a pictorial representation of a decorative cup formed on a glass substrate plated with a lustrous silver surface and having formed thereon a plurality of colored coatings with a metallic luster using the teachings of the present invention; and

Fig. 12 is a pictorial representation of a decorative coffee cup formed on a ceramic substrate plated with a lustrous silver surface and having formed thereon a plurality of colored coatings with a metallic luster using the teachings of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention employs a method for forming a metallic mirror surface that involves adjustment of an underlay that forms the metallic mirror surface, applying an activating

treatment and then applying a water-wash treatment to the underlay, followed by a reaction to reacting metal salt and reducing agent to form the metallic mirror surface. An activating treatment, including an activating treatment agent solution, containing stannous chloride and precious metal salts of palladium, gold, silver and the like is sprayed on the substrate, surface or article which is to have a metallic mirror surface formed thereon. The method includes the simultaneous but separate spraying of separate solutions forming the activating reaction treatment agent as well as two separate solutions forming a metal salt solution and reducing agent solution.

Further, this invention discloses and teaches a hydrochloric acid solution which contains contain about 10cc to about 44cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water and which is employed as the activating-treatment agent in the method for forming a metallic mirror surface.

Additionally, the method may employ or utilize a metallic mirror reaction treatment agents comprising a metal salt solution containing about 6.0g to about 25g of sodium hydroxide, about 20g to about 70g of ammonia and about 2g to about 20g of silver nitrate per 1 liter of water and a reducing agent solution containing about 1g to about 4.5g of tartaric acid, about 10g to about 50g of glucose and about 0.05g to about 3.5g of formaldehyde.

Precious metal salts are well known to persons skilled in the art and include valuable metals such as gold, silver, palladium and members of the platinum group. The term "precious metal salts" and the term at least one precious metal salt of palladium, gold, silver and the like" as used herein is intended to include all precious metal salts formed from such precious metals. The color or hue of the metallic mirror is determined by the precious metal salt used in forming the same, and may be silver, gold or other appropriate color.

The method or process involves adjustment of or treatment of an underlay or receiving surface, such as by cleaning or otherwise preparing the underlay or receiving surface as required, or alternatively by applying a primer coating to the receiving surface, substrate or article, which is to have the metallic mirror surface formed thereon and applying an activating treatment and then a water-wash treatment to the underlay, receiving surface, substrate or article, followed by a reaction to metal salt and reducing agent to form the metallic mirror surface. The activating treatment is performed preferably by the step of spraying the activating-treatment agent in a solution form containing stannous chloride and precious metal salts of palladium, gold, silver and the like. However, it is envisioned that other known steps for applying a solution may be used herein, such as passing the receiving surface, substrate or article through a mist curtain or other known fluid distribution, treatment apparatus or processing procedures. This step is followed by the simultaneous but

separate spraying of metallic mirror reaction treatment agents comprising a metal salt solution and a reducing agent solution.

This invention also teach that: (i) the activating treatment agent, which preferably is an activating treatment solution, may contain about 10cc to about 44 cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water; (ii) the reacting metallic salt solution may contain about 6.0g to about 25g of sodium hydroxide, about 20g to about 20g of silver nitrate per 1 liter of water; and (iii) the reducing agent solution may containing about 1g to about 4.5g of tartaric acid, about 10g to about 50g of glucose and about 0.05g to about 3.5g of formaldehyde, all of which are employed as the metallic mirror reaction treatment agents in the method for forming a metallic mirror surface using the above described method steps.

In the pictorial representation of Fig. 1, a receiving surface 2, which may be a surface of a metal article, for example, is shown having a metallic mirror surface 12 formed thereon using the method, process, solutions and teaching of the present invention.

In order to obtain better adhesion between the metallic mirror surface and the receiving surface, which may be a substrate, an article or the like the receiving surface any first be treated, sprayed or otherwise coated or have formed thereon, by sputtering or vapor deposition as an example, a primer coating of an adhesion enhancing coating.

Fig. 2 represents in a pictorial representation of a receiving surface 10 having a primer coating 16 located between the metallic mirror surface 12 and the receiving surface 10 wherein the receiving surface is of a plastic article, as an example.

Fig. 3 is a block diagram showing the basic steps of the methods, process and an article formed thereby using the teachings of the present invention and the method or process includes the steps of: (a) cleaning the receiving surface to be coated with a metallic mirror surface as depicted by box 20 labeled "Cleaning Treatment"; (b) spraying on the receiving surface an activating treatment agent solution containing stannous chloride and at least one precious metal salt of palladium, gold, silver or the like as depicted by box 22 labeled "Spraying Activating Treatment Agent"; and (c) separately spraying concurrently on the receiving surface having the activating treatment agent a reacting metal salt solution and a reducing agent solution to form the metallic mirror surface as depicted by box 26 labeled "Spraying Reacting Metal Salt Solution" and 28 labeled "Spraying Reducing Agent solution", and the separate spraying concurrently on the treated substrate or receiving surface is shown as 30. The reacting metal salt solution and a reducing agent solution may be mixed as one solution, placed into a pressurized spray container or tank and sprayed on the receiving surface using a single spray gun. Alternatively, the reacting metal salt solution and a reducing agent solution may be maintained as two separate and

independent solutions each of which are placed into separate pressurized spray containers or tanks and which are sprayed on the receiving surface using two spray guns or a double-headed spray gun.

Fig. 4 is a pictorial representation of an article shown generally as 32 in the form of ceramic bear figurine 34 mounted on a base 36 after a metallic mirror surface has been formed on the outer surface of the ceramic bear figurine 34. The ceramic bear figurine 34 having the metallic mirror surface 38 formed thereon includes a decorative element in the form of a colored metallic luster 40 on at least a portion the metallic mirror surface formed using the teachings of the present invention.

The article 32 has at least a portion of its outer surface thereof coated with a metallic mirror surface 38. A primer coating, shown as 16 in Fig. 2, may be located between the metallic mirror surface 38 and the at least a portion of the outer surface of said article 32 to enhance adherence of the metallic mirror surface to the ceramic bear figurine 34. The silver metal surface 38 comprises a reactant formed by reaction of an activating treatment agent solution containing stannous chloride and at least one precious metal salt of palladium, gold, silver or the like with a reacting metal salt solution and a reducing agent solution.

The a decorative element in the form of a colored metallic luster 40 may be formed by subsequent method steps comprising the step of: (a) preparing a paint containing a mixture of polyol, polyisocyanate and at least one of an organic pigment

and dye as a coloring agent; and (b) spraying the paint onto a selected portion of the article 32 having the chemically treated metallic luster in the form of the metallic mirror surface 38 and permitting the polyol and polyisocyanate to curingly react with each other to hardness form a metallic luster a colored polyurethane coating having a metallic luster on the receiving surface having metallic mirror surface.

Fig. 5 is a pictorial representation of a substrate or article 50 having a metallic mirror surface 54 formed thereon using the teachings of the present invention. The substrate or article, or a portion thereof, may be used as a mirror, or as decorative element or the substrate or article could be cut into pieces which could be used directly as parts or be used as subassembly components that are used in the assembly of a product, or accessory or furniture, such as for example a desk, or the like enabling that the assembled product, accessory or furniture or article to have, on at least a portion thereof, a metallic mirror surface.

Fig. 6 is a pictorial representation of a motor vehicle part in the form of a motor cycle cover 60 having a metallic mirror surface 62 formed thereon using the teachings of the present invention.

As is evident from the above, the method, process and article formed thereby represents a significant improvement over the known chrome plating and chrome painting processes and methods. In the methods and processes disclosed herein, in the preferred embodiment, stannous chloride is used for activation

treatment. The stannous chloride turns into stannous ion, a reducer, in hydrochloric acid solution, while precious metal salts of palladium, gold, silver and the like turn into metallic ions in the solution.

When both solutions are sprayed on a receiving surface, substrate or article using a spraying or equivalent solution application processing step as described herein before, the precious metal ions are reduced and precipitate on to the receiving surface, substrate or article as metal deposits. Stannous ion is oxidized by the stannic ion. The metal deposits, especially palladium, are very active and they are excellent for making metallic mirror surface and adhere aggressively to the receiving surface, substrate or article.

Soaking the receiving surface, substrate or article in stannous chloride solution and the activation treatment that involves soaking in the precious metal salts solution are preferably carried out in two separate steps.

This invention teaches an extremely efficient method for forming a metallic mirror on a receiving surface in that it not only combines the two procedures into one, but the method and process also employs, preferably, a spraying method that allows instant reaction to take place and immediately deposits metals on the article, substrate or receiving surface.

Furthermore, by spraying a metal salt solution and a reducing agent solution using a spraying method, preferably, free metals reduced by the reducing agent solution will adhere to the article, substrate or receiving surface, which has been

activated by the aforementioned palladium, for example. In this case, the reaction is allowed to take place after spraying solutions on the article, substrate or receiving surface using spray method, as a preferred treatment step. The reaction takes place instantly, precipitating metal deposits on the receiving surface, substrate or article. This is significantly different than the reactions that take place consecutively in a prior art still solution in a plating bath.

The following are examples of materials, articles and objects which can be treated using the method for forming a metallic mirror surface. Substrates that can be used for having a metallic mirror surface formed thereon can be, without limitation, any one of the following articles, objects or materials, e.g. metal, synthetic resin, rubber, glass, ceramic wares, wood, leather, stone, plaster, rattan, straw and the like.

The underlay or receiving surface, substrate or article is adjusted or prepared by cleaning the same using detergent and then water is to remove any debris, oil residues or fingerprints. This also improves the wettability so that metallic mirror surface can be formed evenly.

If necessary, a layer of synthetic resin may be formed on the substrate surface by coating the substrate surface with synthetic resin such as urethane resin or acrylic resin using a spray method, preferably. Additionally, it may be desirable to roughen the surface of synthetic resin layer surface, by spraying it with etching solution, such as for example,

anhydrous chromic acid, sulfuric acid or phosphoric acid normally used the in pretreatment process for plastic plating in order to improve the adherence of the subsequent metal layer.

In the preferred embodiment, the activating-treatment agent may, as mentioned above, be a solution containing about 10cc to about 44cc of hydrochloric acid, about 1.5g to about 5g of stannous chloride and about 0.001g to about 0.005g of palladium chloride per 1 liter of water. It is desirable to use an appropriate concentration within this range. The optimum concentration is determined based primarily on the treatment temperature. Since the reaction takes place more rapidly in the summer, a low concentration of treatment agent is desirable, while a high concentration of treatment agent is preferable to off set the slow reaction rate in winter.

A conventional spray gun attached to a pressurized tank may preferably be used for spraying the activating-treatment agent solution. Spraying coats the entire area evenly and thoroughly. One or two layers of spray may be required, depending on the shape and surface condition of the article, substrate or receiving surface.

Alternatively, instead of using an one-solution type activating-treatment agent, a hydrochloric acid solution containing stannous acid and a hydrochloric acid containing palladium can each be placed in separate pressurized tanks for a simultaneous spray application using double spray guns or a two-head spray gun.

After spraying the activating agent, a water treatment washing is procedure is performed while the substrate is still wet. Spraying the receiving surface, substrate or article with clean water using a spraying process effectively removes residues from the previous process and avoids contaminating the activated surface formed in the previous process. It is desirable to use purified water that contains few minerals or, if possible, distilled water or ion-exchange water for cleaning.

After the cleaning process, the next step of applying the metallic mirror reaction agents, preferably by the spraying process which is performed while the substrate is still wet. The reacting metal salt solution and reducing agent solution may each be placed in separate pressurized tanks, and spray solutions are sprayed on the article, substrate or receiving surface simultaneously using a double-gun, a two-head gun or a sprayer.

As with the aforementioned activating treatment, it is desirable to select an appropriate formulation (concentration) for the solutions, it being noted that the given solution ranges disclosed hereinbefore are preferable. Additionally, substituting the solution containing silver nitrate, as described in the above formulation, with cupric sulfate or nickel sulfate solution will yield a copper or nickel metallic mirror surface (mirror surface). The related mirror surface forming method and cupric sulfate or nickel sulfate solution are also included as part of this invention.

The following EXAMPLE 1 teaches the use of the present invention in a method for forming a metallic mirror surface on a receiving surface.

EXAMPLE 1

The first layer is sprayed evenly from the bottom and is sprayed so as to coat the substrate surface until a silver color begin to appear and the spraying is finished at the top of the substrate. Furthermore, from a position a little further away from the substrate, repeatedly apply spray to the substrate from top to bottom at an interval of 10 seconds to 20 seconds for a total of four times. The numbers of layers of spray can be appropriately increased or reduced depending on the surface condition or the shape of substrate.

After the metallic mirror reaction treatment agents spraying process, clean the sprayed surface again to remove mist or solvent from the previous process. The residual moisture is removed by air jet, and the surface is dried using a heater for 10 to 20 minutes until it is completely dry.

The above are the primary processes for forming a metallic mirror surface. It is envisioned that a coat of transparent clear coating or transparent colored coating could be applied by spray method to the finished metallic mirror surface to yield a premium quality ornament as though it has received a color-gloss-plating. A transparent clear coating may include a UV blocking agent.

The following EXAMPLES 2 through 5 are representative working examples that illustrate the method of forming a

metallic mirror surface and metal salt solutions related to this invention. EXAMPLE 2 illustrates the preparation of activating-treatment agent solution. EXAMPLE 3 shows the preparation of metallic mirror reaction treatment agent solution.

Additionally, EXAMPLES 3, 4 and 5 are examples related to forming a metallic mirror surface.

EXAMPLE 2

Anhydrous stannous chloride is dissolved in appropriate concentration of hydrochloric acid to yield a stannous chloride hydrochloric acid solution. Next, the anhydrous palladium chloride is dissolved in an appropriate concentration of hydrochloric acid to yield a palladium chloride hydrochloric acid solution. The two hydrochloric acid solutions are mixed together right just prior to use and the mixture is placed into a pressurized tank for spraying. Alternatively, the two hydrochloric acid solutions may be each placed in a separate pressurized tank and sprayed simultaneously using a double-head gun or a double-gun.

EXAMPLE 3

A sodium hydroxide water solution is added to a silver nitrate water solution that has been added with ammonia to yield a metallic salt solution at the specified concentration. Formaldehyde is added to a mixture of tartaric acid and glucose water solution to yield a reducing agent solution. The two solutions, the metallic mirror reaction treatment agents, are each placed in a separate pressurized tanks and sprayed simultaneously using a double-head gun or a double-spray guns.

EXAMPLE 4

A steel substrate is cleaned by spraying the same with purified water and an activating treatment agent, prepared in Example 2 above is sprayed on to and activating the substrate surface. After washing the substrate surface with water, spray the metallic mirror reaction agent prepared in Example 2 is sprayed on the substrate surface to form a metallic mirror surface. The metallic mirror surface is washed with water and dried to yield a glossy metallic mirror surface.

An acrylic resin based clear coating may be spray coated on the metallic mirror surface to yield a glistening silver ornament.

EXAMPLE 5

An ABS resin substrate is roughed up using an etching solution consists of anhydrous chromic acid, sulfuric acid and phosphoric acid. The metallic mirror surface is then formed thereon in the same manner as in Example 4. A coating comprising a mixture of polyol and polyisocyanate, having added thereto an organic pigment as colorant, is sprayed on the metallic mirror surface. A colored polyurethane membrane is formed to yield an ornament with a brilliant metallic gloss.

The following EXAMPLE 6 discloses and teaches the procedure for preparing the various solutions for practicing this invention as well as the process steps to produce a desirable metallic mirror surface on a receiving surface, substrate or article. The following is an example of a metallic mirror surface coating process using pre-mixed solutions.

EXAMPLE 6

I. Prepare "Sensitizer" Solution

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
1	Prepare Sensitizer Base	Dissolve 0.1 gm of Palladium (II) Chloride with 20.0gm of Hydrochloric Acid
2	Add	5,000cc Aqua Purificate (Pure Water 99.9%) to Sensitizer

II. Prepare "Sensitizer -A"

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
1	Use Sensitizer Solution	Mix 100mg of Sensitizer Solution with 5000cc of Aqua Purificate (Pure Water 99.9%) and with the following amounts of Hydrochloric Acid depending on the season: (a) Summer- Temperature-over 26°C-25gm (b) Spring or Fall Temperature-over 20°C to 26°C -50gm (c) Winter Temperature-under 20°C-75gm

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
2	add Tin (II) Chloride Anhydrous	Mix 3.0gm of Tin (II) chloride Anhydrous (CAS#100265-69-1) into above mixture (1.000g); Shake Gently 3 or 4 times; Perform Step 2 mixing with 72 hours of use; when mixed, good for a maximum of 72 hours

III. Prepare "Formula Plating -A"

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
1	Prepare Plating-A Mixture	Mix 4,750cc of Aqua Purificate (Pure Water 99.9%) and with 12.5gm of Silver Nitrate (AgNO ₃) (CAS#7761-88- 8) and 240cc of Ammonia; Shake Well until completely dissolved
2	add Sodium Hydroxide	Add to above mixture 37.5gm of Sodium Hydroxide (NaOH); Shake Well until completely dissolved

IV. Prepare "Formula Plating -B"

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
1	Prepare Plating-B Mixture	Mix 5,000cc of Aqua Purificate (Pure Water 99.9%) and with 15gm of L(+) Tartaric Acid (CAS#50-99-7) and 150mg of D(+) Glucose; Shake Well Immediately
2	add Formaldehyde Solution	Add to above mixture the following amounts of Formaldehyde Solution (CAS#50-00-0) depending on the season: (a) Summer- Temperature-over 26°C-7.0gm (b) Spring or Fall Temperature-over 20°C to 26°C -9.0gm (c) Winter Temperature-under 20°C- 11.0gm; Shake Well

V. Metallic mirror Surface Coating Process

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
1	Cleaning a receiving surface	Clean the receiving surface by removing debris, dirt, fingerprints and the like
2	Adjusting underlay or receiving surface (Preparation Process)	a) Spray "Regular Primer"* on article or receiving surface to be coated with a metallic mirror surface [Regular Primers for various articles are available in the market];** b) Dry Naturally 10 min to 60 min; c) Spray "Adhesion Primer" to receiving surface, substrate or article;*** d) Dry with Air Blow for 2 hours (50°C); Cool for 60 min.

<u>Step</u>	<u>Description</u>	<u>Procedure</u>
3	Metallic mirror Coating Process [Applies to receiving surface, substrate or article, as the case may be]	a) Spray Sensitizer; b) Spray Washing with Pure Water; c) Spray "Plating-A" two or three times; d) Spray "Plating-B" one or two times; e) Dry with Air Blow for 10 min to 20 min (50°C); f) Spray "Protective Coating" (Sealant); g) Dry with Air Blow for 10 min to 20 min (50°C); h) Spray color clear coating (any color) i) Dry with Air Blow for 10 min to 20 min (50°C); j) Spray "UV cut Clear Coating" k) Dry with Air Blow for 60 min (50°C); l) Dry Naturally;

- * One Example of a "Regular Primer" is Micchakuron Multi", a multipurpose primer made by a Japanese company, TEROSON CORPORATION CO, LTD, 2100-79, Kamiyashiba, Satte City, Saitama, Japan 340-0121
- ** Materials are Steel, Plastic, Aluminum, ABS, P.P., Glass, Ceramic Wood [Ceramic and Wood must be percolate prevented/treated before applying primer; Ceramic must be glazed; Wood has to be treated with a polishing compound]; Any material that is treated and coated with two component polyurethane paint
- *** "Adhesion Primer" may be Kansai Paint Brand "Retan Clear 1" that will maximize adhesion between receiving surface, substrate or article and chrome base coating e.g. the metallic mirror surface; Source: Kansai Paint Co., LTD, 3-6 Fushimi-machi, 4-chome, Chuo-Ku, Osaka, Japan 541-8523;

The method and process disclosed and taught herein employs simple spraying devices, as described in the aforementioned spray method, and simplified procedures to yield a glossy metallic mirror surface in a short period of time. Bulky equipment as used in conventional plating and spraying steps are not required. Not only is the superior method economical, but the method also yields or provides an excellent result yielding a beautiful metallic mirror surface rich in gloss equivalent to that produced by plating method.

The present invention employs a method for forming a colored coating with a metallic luster on a surface. The method includes preparing a paint containing a mixture of reacting polyol, reacting polyisocyanate and a coloring agent, applying the paint onto a metallic luster surface; and permitting the

polyol and polyisocyanate to curingly react with each other to hardness forming on the metallic luster surface a colored polyurethane coating having metallic luster.

In Figs. 7 and 8, a pictorial representation and structural representation, respectively, of wheel cover shown generally as 110 is has a polycarbonate substrate 114 plated with a lustrous chrome plated layer 113 which plated layer 113 has formed thereon having a surface 112 which has formed thereon a colored coating with a metallic luster shown as coating 111.

Fig. 8 is a pictorial representation of an enlarged detail structure of wheel cover 110 showing the polycarbonate substrate 114, the chrome plated layer 113, the lustrous surface 112 of the chrome plated layer 113 and the colored coating with a metallic luster 111 formed on the lustrous surface 112 of the wheel cover 130.

Fig. 9 is a pictorial representation of steel substrate 120 formed in the shape of a pipe having a finished mirror like surface 122 formed thereon by buffing. Surface 122 has formed thereon a colored coating with a metallic luster 124 using the teachings of the present invention.

In Fig. 10, the pictorial representation of a Buddha shown generally as 130 is formed on a synthetic wood substrate 132, made by low foaming ABS resin, plated with a lustrous nickel coating 134. The plated nickel coating 134 has formed thereon a colored coating with a metallic luster 136 using the teachings of the present invention.

Fig. 11 is a pictorial representation of a decorative cup, shown generally as 138, formed on a glass substrate 140 plated with a lustrous silver plate layer 142 having a surface 143. Surface 143 has formed thereon a plurality of colored coatings with a metallic luster, shown as areas 144, 146, 148 and 150, using the teachings of the present invention.

Fig. 12 is a pictorial representation of a decorative coffee cup shown generally as 158 formed on a ceramic substrate 160 plated with a lustrous silver plated layer 162 having a surface 164. Surface 164 has formed thereon a plurality of colored coatings with a metallic luster, shown as areas 144, 146, 148 and 150, using the teachings of the present invention.

The mixture or paint of this invention is characterized by comprising primarily as a mixture of polyol and polyisocyanate and an organic pigment and/or dye.

Both polyol and polyisocyanate used in this invention are well known materials, and currently are popularly used as a two-part polyurethane resin paint. Polyol compounds that may be used include Polyester polyol (oil-free polyester resin, alkyd resin, etc.), polyether triol (obtainable by a reaction between glycerol and polypropylene glycol), acrylic polyol [a copolymer acrylic resin of acrylic monomer containing a hydroxyl group and acrylate (ester)] and epoxy polyol (such as a resin made of epoxy resin having a hydroxyl group pendent in the terminal group and in the macromolecule chain). Of these, acrylic polyol is especially desirable for its excellent adhesion to metals, luster, and weather resistance.

An organic pigment or dye is added and mixed in advance in the polyol and polyisocyanate. The pigment or dye to be added is not especially restricted to a certain type, but may be any organic pigment or dye that is normally used in a paint or plastic, as long as it offers transparency. For example, azo, insoluble disazo, phthalocyanine, achin, dioxane, quinacridon, mordant dye, anthraquinone and perinon types, and basic-dye lakes, acidic-dye lakes and metallic complex-salt type pigments, or any synthetic dyes may be used. In general organic-type pigments are preferable to dyes with respect to resistance to weather,

A disperser may be added to disperse the pigments or dyes uniformly in the mixture or paint, as required. In addition, a small amount of inorganic pigment may be added to reduce cost or to adjust the tone of the color.

A pigment is usually mixed with a vehicle using a disperser or kneader. An appropriate amount of a solvent or diluent, may be added alone or in combination, as required, to obtain the required viscosity for spraying. An ultraviolet absorber, stabilizer and ,the like may also be added for improved resistance to weather or heat.

The type, amount, and proportion of pigment or dye must be determined to suit the purpose. In the application of the clear top coat to a chromium-metallic mirror surface, a combination of 1 liter of clear (33% solid) with about 0.1g to about 0.5g of red organic pigment and about 2g to about 3g of blue organic pigment eliminates the yellowish discoloration due to the

yellowing of the paint, and yields a vivid and natural metallic luster. Similarly, a sprayed coating over a metallic mirror surface with a combination of 1 liter of clear mixture or paint with about 10g to about 30g brown organic pigment and about 3g to about 7g of maroon organic pigment presents a beautiful gold luster. For other colors, a pink, purple, green or other organic pigment that is compatible with the desired color may be used alone or in combination.

The coating thickness may be adjusted by the number of sprays or by the viscosity of the paint to a practical extent. Generally the number of sprays (or spray passes) is two times to six times, and the hardened coating thickness is adjustable to approximately about 0.1mm to about 0.5mm.

The curing reaction proceeds to hardness in 24 hours at a normal temperature, 30 to 40 minutes at 50°C or 20 to 30 minutes at 80°C. A normal temperature to 50°C is preferable to prevent discoloration and achieve a good finish. A polyurethane coating created by a three dimensional bridge offers a coating performance that is excellent in luster, appearance, and resistance to chemicals, water, and weather. The use of acrylic polyol especially results in a coating of excellent transparency and weather resistance thereby making it suitable for application on outdoor products.

The method is valuable because it can be used to apply a metallic mirror surface on a wide range of substrates such as metal, synthetic resin, rubber, glass, ceramic wares, wood, leather, stone, plaster, rattan, straw and the like.

Furthermore, it is envisioned that an additional step of applying a coat of transparent coloring coating or clear coating to the metallic mirror surface will yield an ornament and novel appearance that is extremely articulate and impressive. The metallic mirror surface prepared in accordance with the teachings of the present invention has high durability and an article or object coated therewith can be used in outdoor environment without significant deterioration.

Furthermore, it is envisioned that forming a colored coating with a metallic luster on a surface when applied to a silver-mirror surface and a coat of transparent coloring coating or clear coating is applied to the metallic mirror surface, such a process, method and paint used therein will yield an ornamental and novel appearance that is extremely articulate and impressive.

All such variations and incorporating of the teachings of the present invention are envisioned to be covered by and anticipated by the teachings set forth herein.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for forming a metallic mirror surface on an underlay comprising the steps of:

adjusting the underlay;

applying an activating treatment agent in a solution to the underlay wherein said activating treatment agent solution contains 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and 0.001 g to 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof; and

reacting a metallic salt with a reducing agent on the underlay having said activating treatment agent to form the metallic mirror.

2. The method of claim 1, after the step of applying said activating treatment agent, further comprising the step of:

applying a water-wash treatment to the underlay.

3. A method for forming a metallic mirror surface on a substrate comprising the steps of:

spraying the substrate with an activating treatment agent in solution wherein said activating treatment agent in solution contains 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and 0.001 g to 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof; and

simultaneously and separately spraying the substrate with metallic mirror reaction treatment agents comprising a reacting metal salt solution and a reducing agent solution.

4. The method of claim 3, wherein said reacting metal salt solution contains 6.0 g to 25 g of sodium hydroxide and 2 g to 20 g of silver nitrate per 1 liter of water.
5. The method of claim 3 or 4, wherein said reducing agent solution comprises 1 g to 4.5 g of tartaric acid, 10 g to 50 g of glucose and 0.05 g to 3.5 g of formaldehyde.
6. The method of any one of claims 3 to 5, wherein the activating treatment agent in solution includes a single solution type activating treatment agent.
7. The method of claim 6, wherein the step of spraying of the substrate with the activating treatment agent in solution includes using a single spray gun.
8. The method of any one of claims 3 to 5, wherein the activating treatment agent in solution includes a two solution type activating treatment agent, said two solution type activating treatment agent comprising a hydrochloric acid solution containing stannous acid and a hydrochloric acid solution containing palladium; and the step of spraying the substrate with the activating treatment agent in solution includes simultaneously and separately spraying two solutions of the two solution type activating treatment agent.
9. The method of claim 8, wherein the simultaneously and separately spraying two solutions step includes using two spray guns.

10. The method of claim 8, wherein the simultaneously and separately spraying two solutions step includes using a two headed spray gun.

11. The method of any one of claims 3 to 5, wherein the step of simultaneously and separately spraying the substrate includes using two spray guns.

12. The method of any one of claims 3 to 5, wherein the step of simultaneously and separately spraying the substrate includes using a two headed spray gun.

13. A method for forming a metallic mirror surface on a receiving surface comprising the steps of:

cleaning the receiving surface;

spraying on the cleaned receiving surface an activating treatment agent solution wherein said activating treatment agent solution contains 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and 0.001 g to 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof; and

separately spraying concurrently on the receiving surface having said activating treatment agent a reacting metal salt and a reducing agent to form the metallic mirror surface.

14. The method of claim 13, after the step of spraying on the receiving surface the activating treatment agent, further comprising the step of:

treating said receiving surface having said activating treatment agent with a water wash treatment.

15. The method of claim 13 or 14, wherein said activating treatment agent solution contains 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and 0.001 g to 0.005 g of palladium chloride per 1 liter of water.

16. The method of any one of claims 13 to 15, wherein said reacting metal salt is a reacting metal salt solution containing 6.0 g to 25 g of sodium hydroxide, 2 g to 20 g of silver nitrate per 1 liter of water to form the metallic mirror surface.

17. The method of any one of claims 13 to 15, wherein said reducing agent is a reducing agent solution containing 1 g to 4.5 g of tartaric acid, 10 g to 50 g of glucose and 0.05 g to 3.5 g of formaldehyde to form the metallic mirror surface.

18. The method of any one of claims 13 to 17, wherein the metallic mirror surface is formed on an article and further comprising the steps of:

preparing a paint containing a mixture of polyol, polyisocyanate and at least one of an organic pigment and dye as a coloring agent; and

spraying said paint onto a selected portion of said article having said metallic mirror surface and permitting said polyol and polyisocyanate to curingly react with each other to hardness to form a colored polyurethane coating having a metallic luster.

19. The method of claim 18 further comprising after said metallic mirror surface is formed on said article and before the step of spraying said paint the step of:

spraying the article with a water treatment.

20. The method of claim 18 or 19, wherein the step of preparing includes stirring and mixing the polyol and polyisocyanate in the presence of the coloring agent comprising the organic pigment.

21. The method of any one of claims 18 to 20, wherein parts by weight of said polyol is five times parts by weight of said polyisocyanate.

22. A hydrochloric acid solution including 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and 0.001 g to 0.005 g of a precious metal salt which is a silver nitrate, palladium chloride, gold chloride or platinum chloride per 1 liter of water, or any combination thereof, for use as an activating treatment agent for forming a metallic mirror surface on a receiving surface wherein said receiving surface is treated with said hydrochloric acid solution as an activating treatment agent solution followed by a concurrent application of a reacting metal salt solution and reducing agent solution to form the metallic mirror surface on the receiving surface.

23. A metal salt solution containing 6.0 g to 25 g of sodium hydroxide, 20 g to 70 g of ammonia and 2 g to 20 g of silver nitrate per 1 liter of water for use in forming a metallic mirror surface on a receiving surface wherein said receiving surface is first treated with an activating treatment agent solution containing stannous chloride and a precious metal salt which is palladium, gold, silver, or platinum, or any combination thereof, followed by a concurrent application of the metal salt solution and a

reducing agent solution to form the metallic mirror surface on the receiving surface.

24. An article having at least a portion of the outer surface thereof coated with a metallic mirror surface comprising a reactant formed by reaction of an activating treatment agent with a reacting metal salt and a reducing agent, wherein said activating treatment agent is a solution containing 10 cc to 44 cc of hydrochloric acid, 1.5 g to 5 g of stannous chloride and a precious metal salt which is palladium, gold, silver or platinum, or any combination thereof.

25. The article of claim 24, wherein said metallic mirror surface has a colored metallic luster formed on at least a portion thereof.

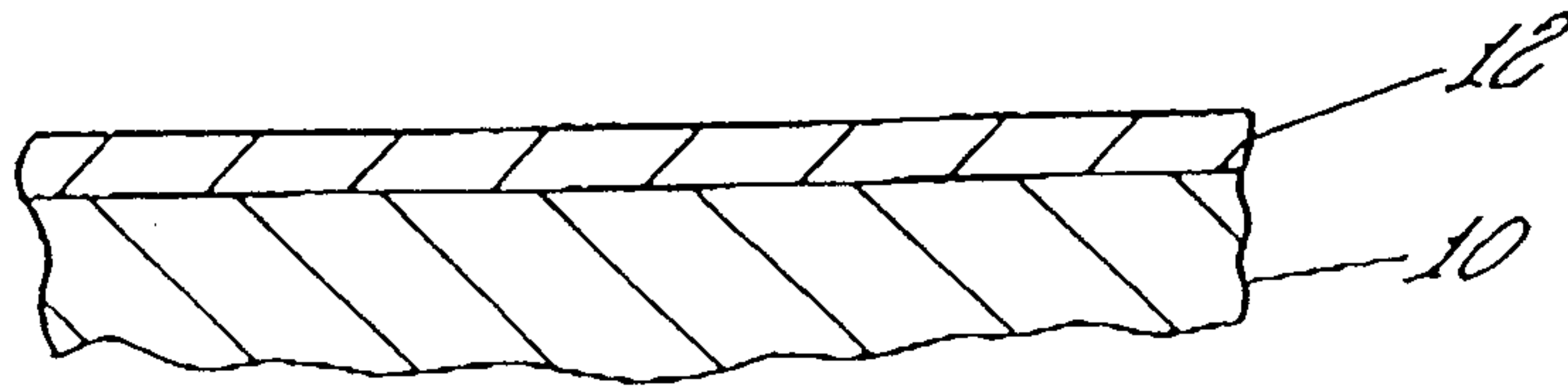


Fig 1

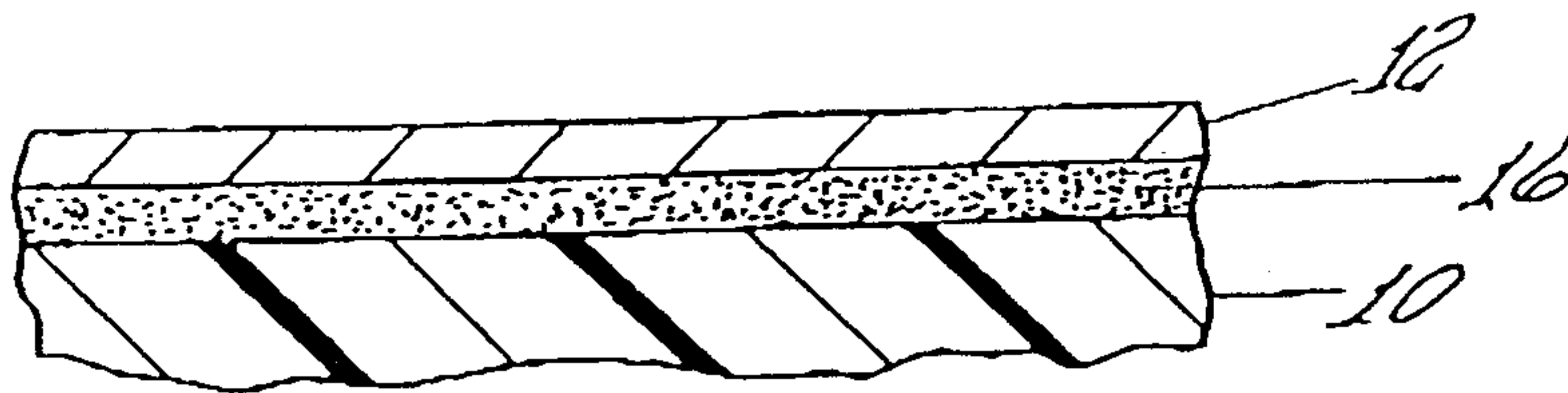


Fig 2

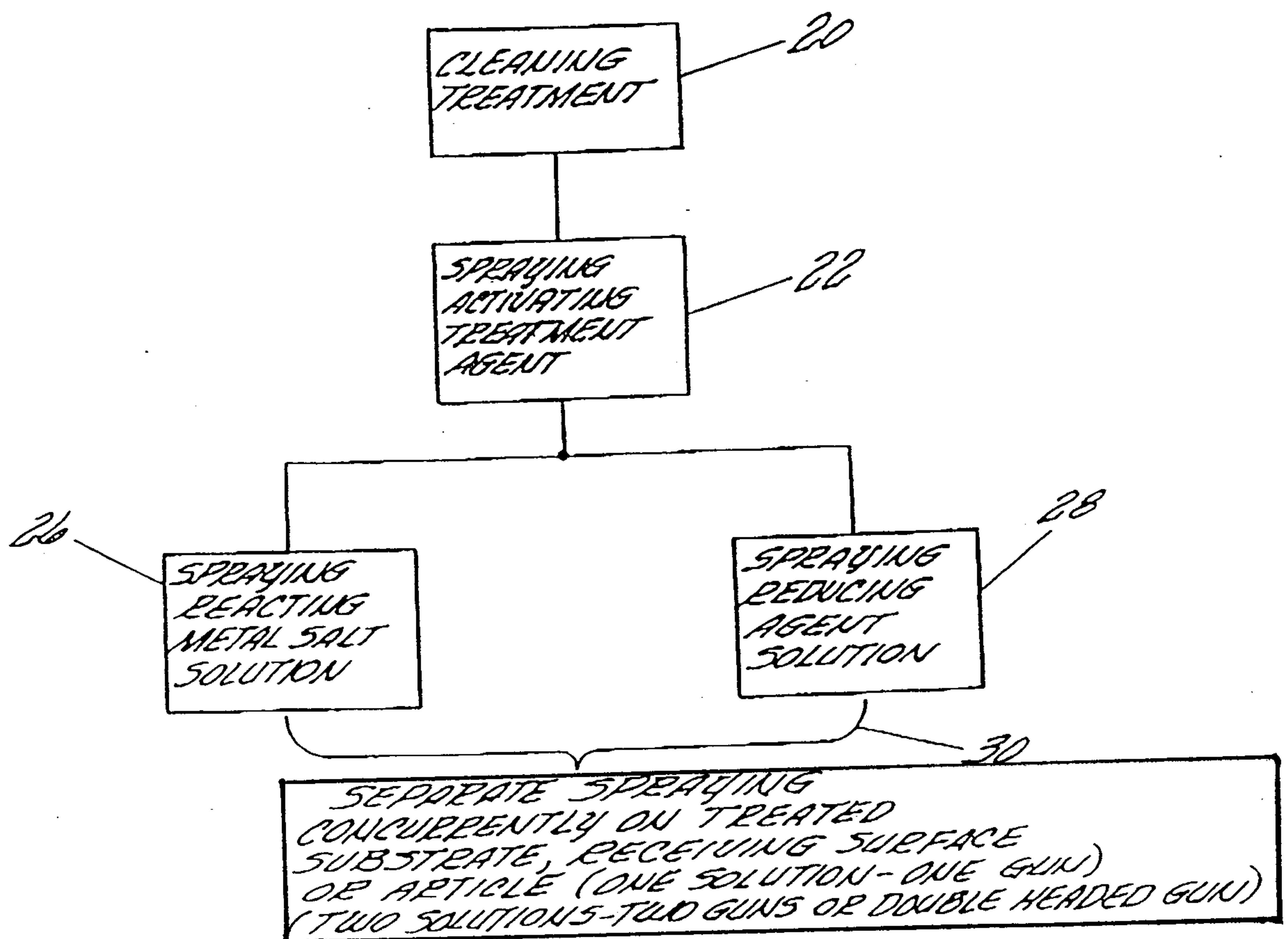
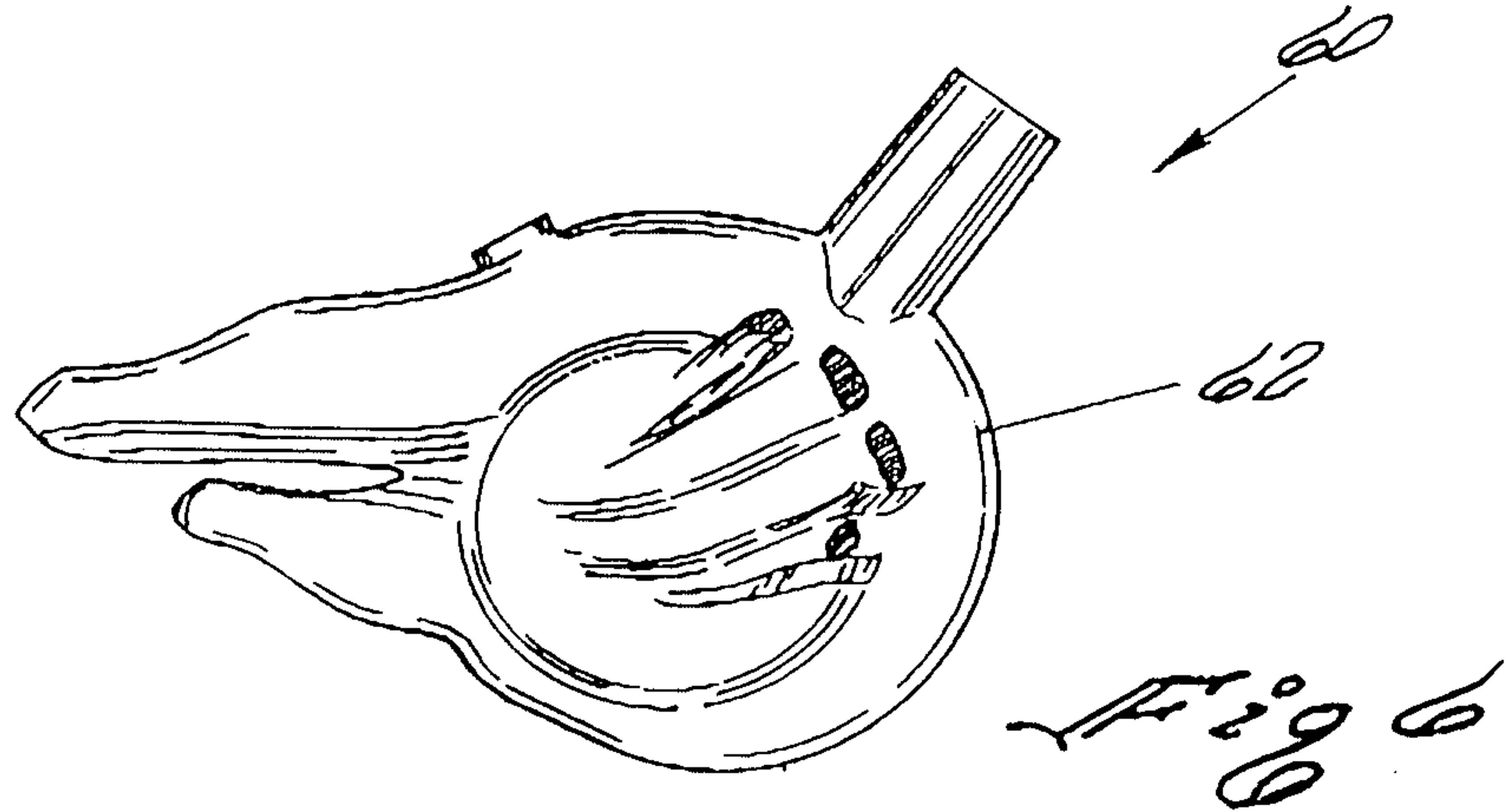
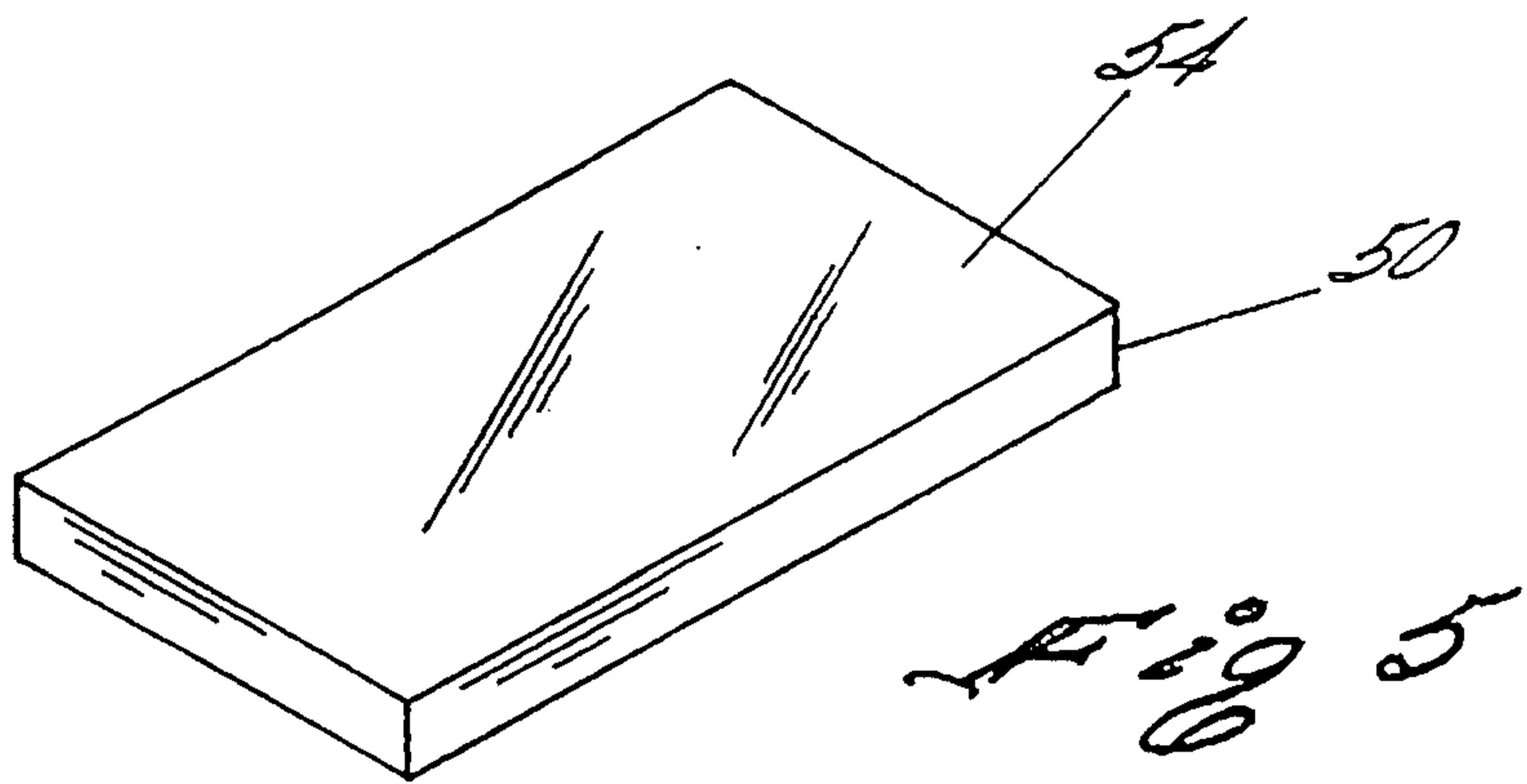
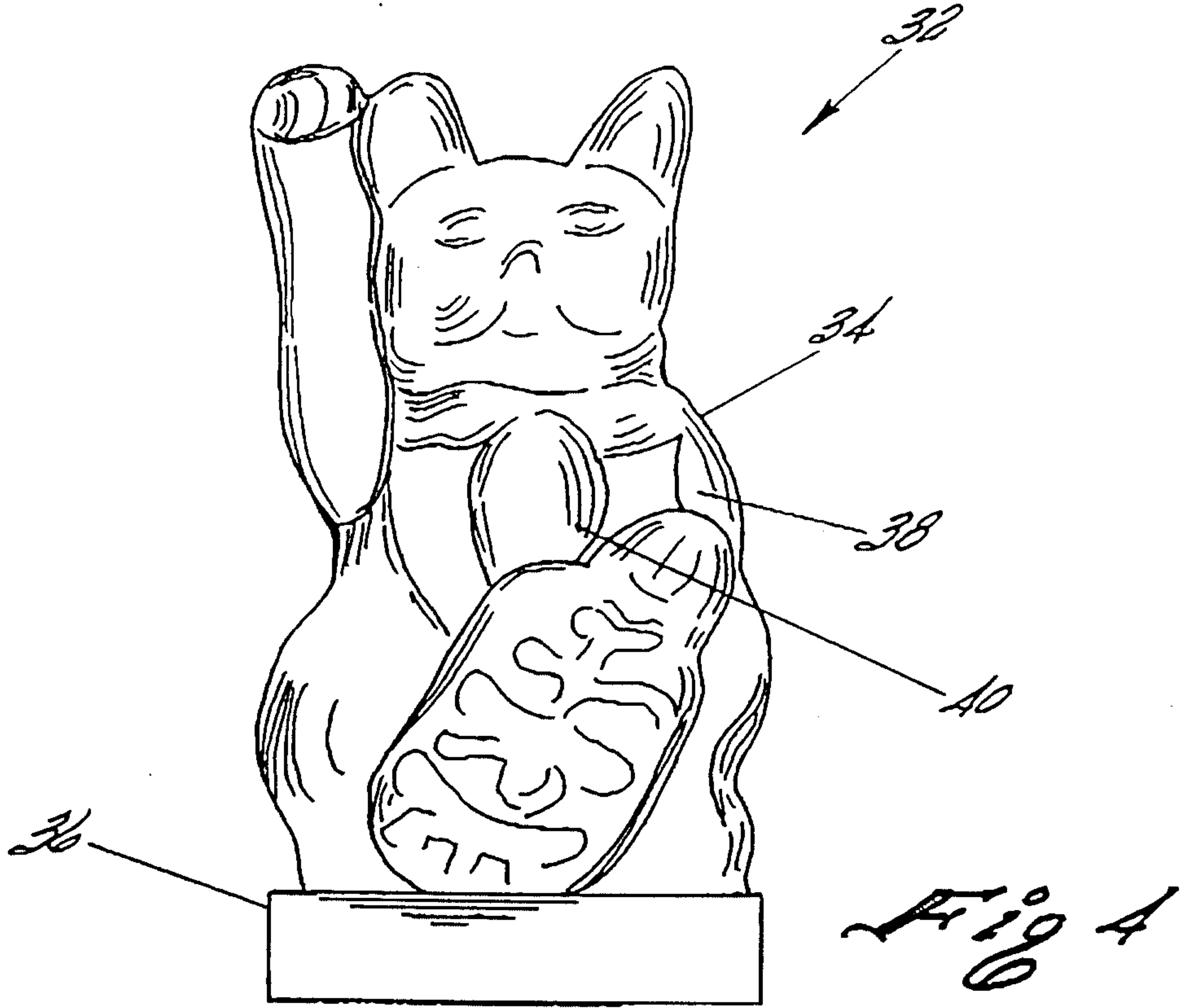


Fig 3



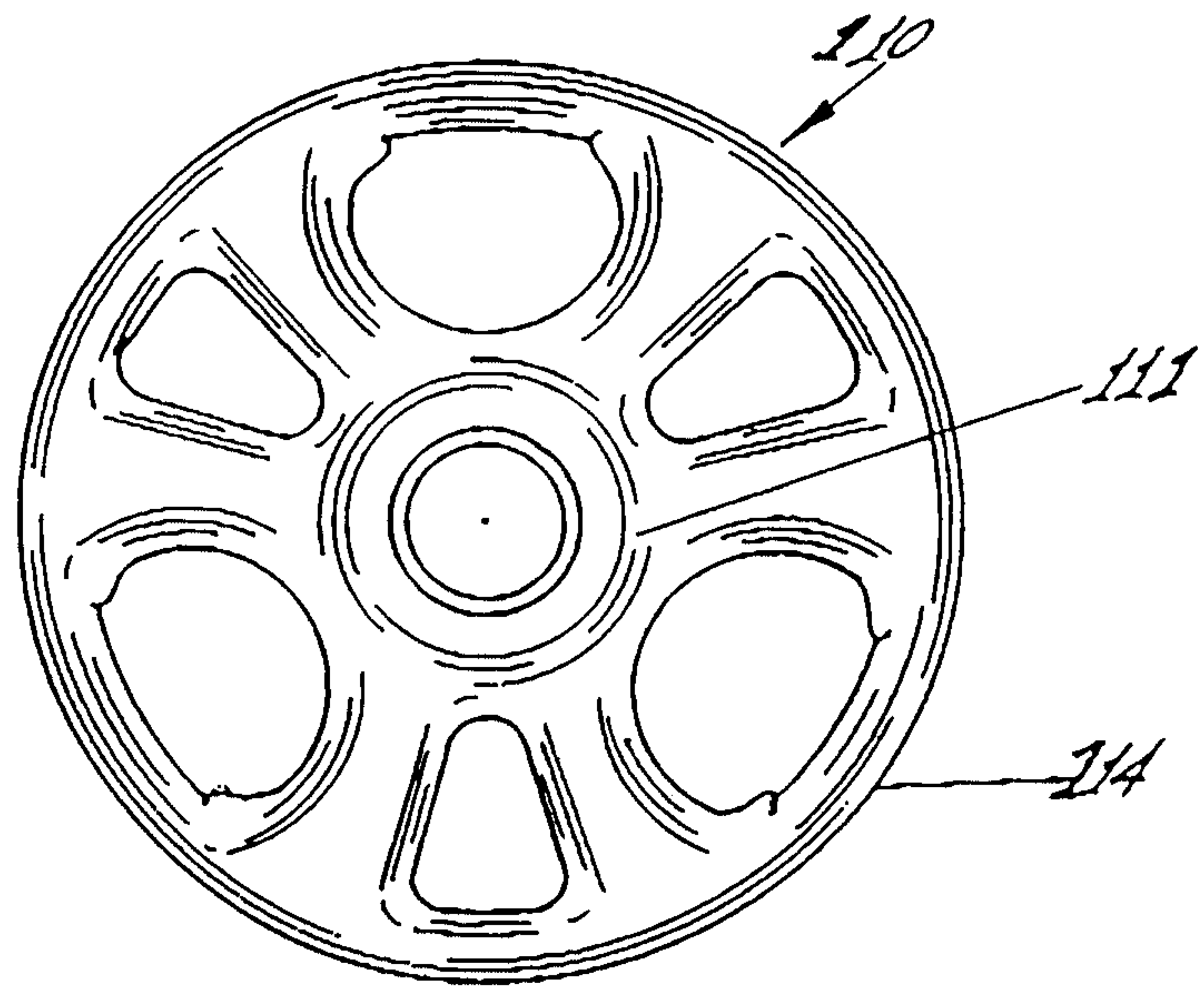


Fig 7

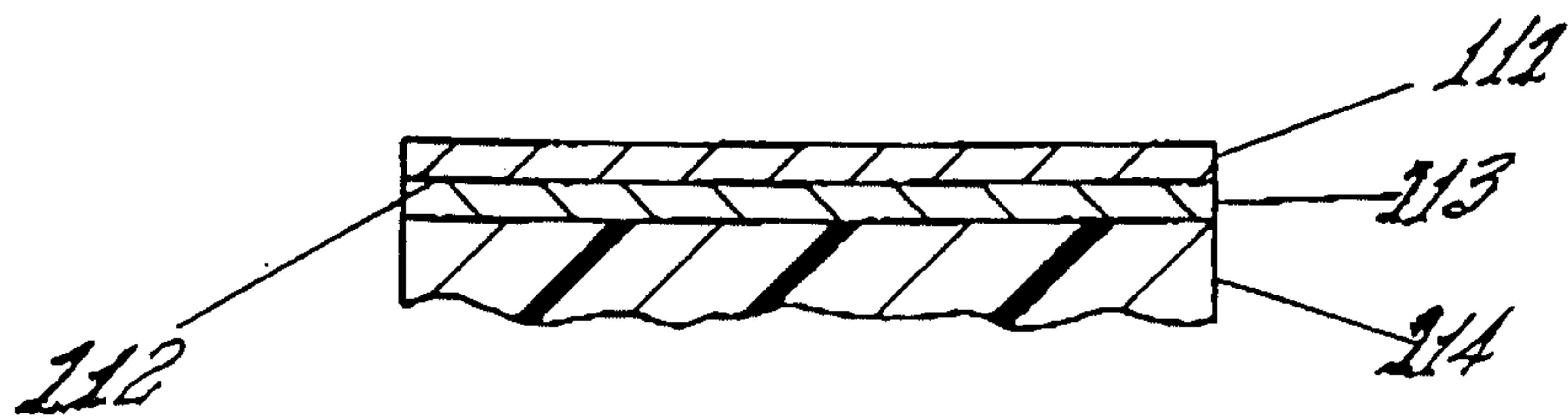


Fig 8

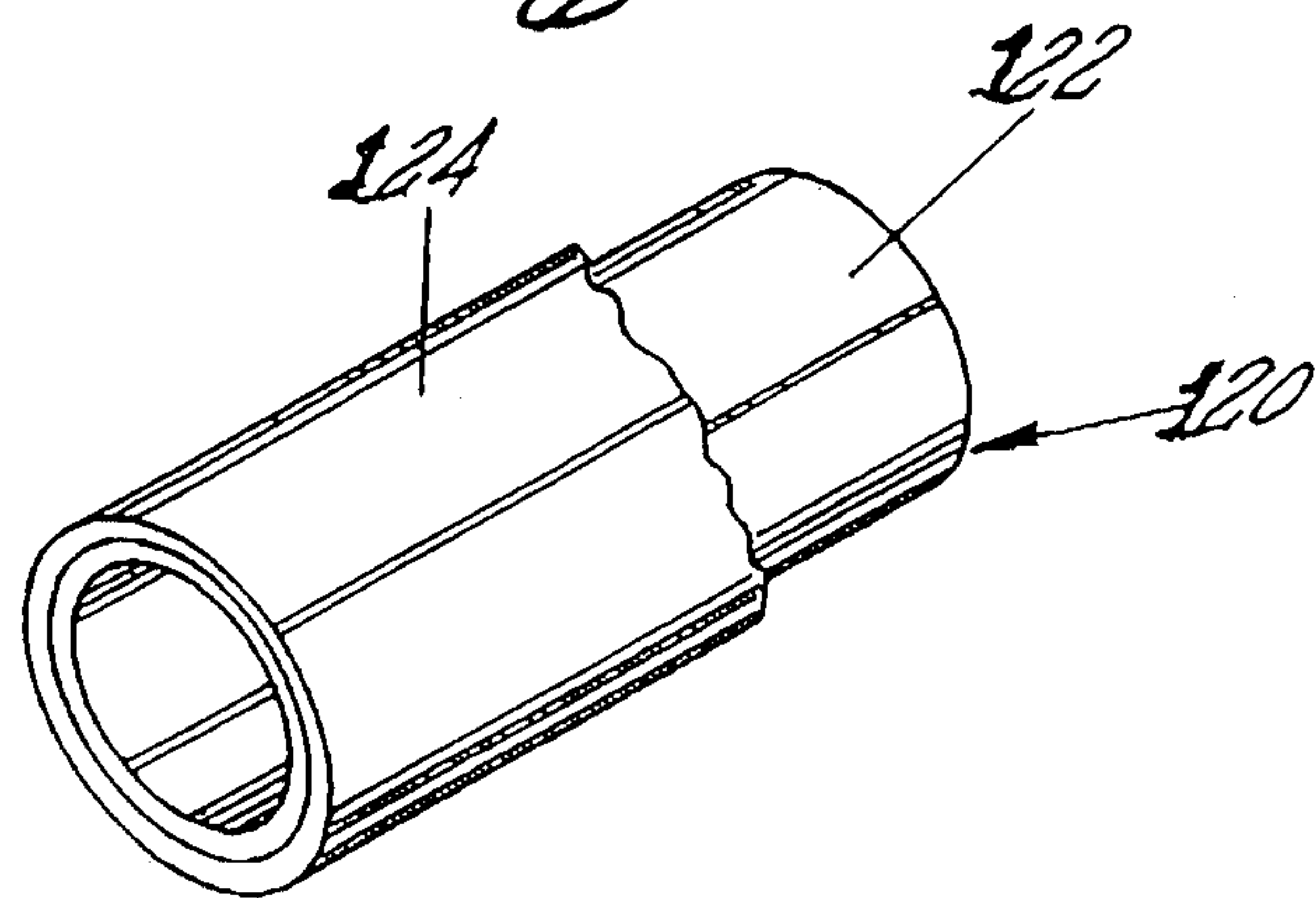


Fig 9

