Jan. 16, 1962 A. N. HALLIBURTON 3,017,307

PROCESS FOR ATTACHING PLASTIC TO METAL
AND ARTICLES PRODUCED THEREBY
Filed Sept. 26, 1957

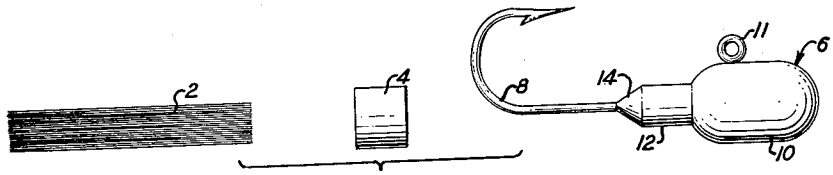



FIG. 1

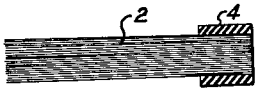



FIG. 2

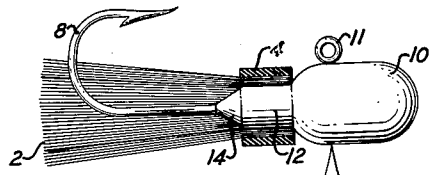



FIG. 3

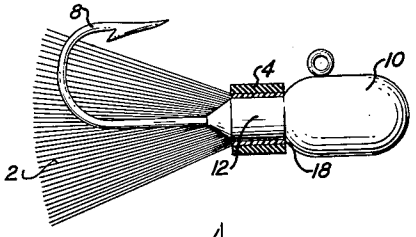
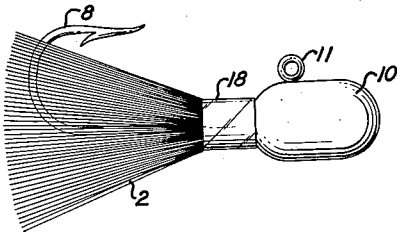




FIG. 4



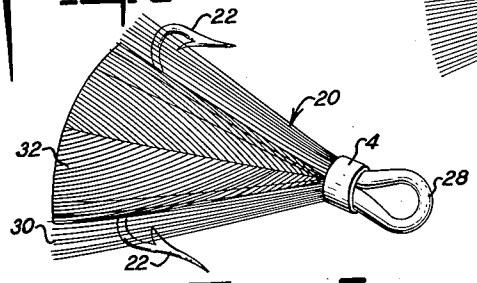




FIG. 5

FIG. 6

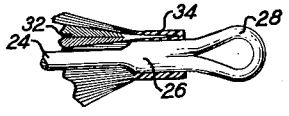



FIG. 7

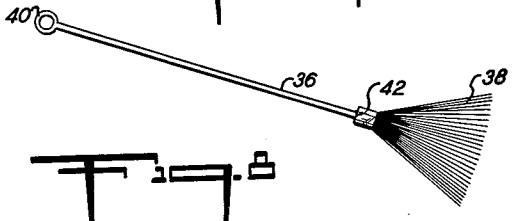



FIG. 8

INVENTOR
ALWYN N. HALLIBURTON

BY Swecker & Mathis
ATTORNEYS

United States Patent Office 3,017,307 Patented Jan. 16, 1962



3,017,307

# PROCESS FOR ATTACHING PLASTIC TO METAL AND ARTICLES PRODUCED THEREBY

Alwyn N. Halliburton, 3941 Porter Ave., Knoxville, Tenn.

Filed Sept. 26, 1957, Ser. No. 686,399
10 Claims. (Cl. 156—72)

This invention relates to a process for attaching plastic to metal and articles produced thereby, and more particularly to a process for attaching plastic, or plastic coated or impregnated, fibers and the like to metal bodies in the production of improved fish lures, brushes, and similar articles.

Although there are many types of articles which require the attachment of plastic to metal, reference will be made herein specifically to the production of fish lures and brushes for exemplary purposes. These articles are typical of many to which the process of the present invention may be applied advantageously, and a thorough understanding of the process may be gained by persons skilled in the art from a description of its application in the production of these articles. Moreover, fish lures and brushes constructed in accordance with the present invention have certain advantageous characteristics which deserve specific consideration.

It has long been a common practice to provide many types of fish lures with so-called "skirts." These skirts are assemblies of relatively stiff fibers and/or feathers, and they are intended to attract the attention of fish. If the lures are to be serviceable, it is of course necessary that these skirts be securely attached to the metal portions of the lures so that the fibers and/or feathers will remain in place when the lures are thrown through the air and drawn through the water in the customary manner.

Prior to the present invention, such skirts were attached to the metal body portions of fish lures by a tedious and time-consuming tying operation carried out by hand. According to this prior method, the fibers and/or feathers were arranged carefully with respect to the metal body of the lure so as to give the skirt the desired positional relationship, and then the skirt was held in such position while the workman wrapped and secured a thread around the lure to hold the skirt in place. In order to practice this method at all, it was necessary that the workman have special skills, and even so, it was not possible to produce lures of uniform quality.

The prior skirted lure constructions also have presented problems with respect to their durability. In these constructions, the tying thread alone is relied upon to hold the skirt in the desired position, and any displacement of, or injury to, this thread is likely to ruin the lure.

Similar problems are presented by the practices heretofore employed in the making of various kinds of brushes. In this field also attempts have been made to attach the fiber elements or "bristles" to the metal body portions of the structures by wrapping and tying procedures, but these have been subject to the disadvantages noted above.

It is an object of this invention to overcome the objections and disadvantages mentioned above and to provide an economical process for attaching plastic to metal in the manufacture of articles such as fish lures, brushes, and the like.

Another object of this invention is to improve the construction of articles of the type in which plastic elements are secured to metal elements, so as to simplify the connections between such elements and to enhance the durability of the articles.

A more specific object of this invention is to provide a novel fish lure construction in which a skirt is secured directly to the body of the lure without requiring the presence of a tying thread.



Yet another object of this invention is to provide an improved brush construction in which the bristles of the brush are attached directly to a metal body.

A typical embodiment of the process of this invention includes the steps of disposing a flexible elastic element, a thermoplastic body and a metal body in such positional relationship that the elastic element yieldingly presses the plastic against the metal; elevating the temperature of the thermoplastic material sufficiently to cause it to flow; and then cooling the thermoplastic material to produce a solid plastic body attached to the metal. The specific conditions under which these steps are carried out may vary somewhat depending upon the particular requirements of a given application. However, it may be helpful to explain briefly at this point the manner in which the method may be carried out in attachment of a skirt of thermoplastic fibers to the metal body portion of a fish lure.

For example, in the making of a jig-type lure by the process of the present invention, a cylindrical rubber band or collar may serve as the elastic element. A bundle of thermoplastic fibers, which is to form the skirt of the lure, first is inserted into the elastic band, and then the body portion of the lure is threaded into the bundle of fibers through the elastic band, so as to position the several elements properly. At this point in the process, end portions of the several fibers are disposed in a layer about the circumference of a portion of the metal body of the lure, and the elastic band is in a distended or stretched condition about the fibers.

When the parts are in such relative positions, the portions of the thermoplastic fibers disposed in contact with the metal surface are heated sufficiently to cause the thermoplastic to flow under the influence of the pressure exerted thereon by the elastic band. The amount of flow produced at this step in the process should be sufficient to destroy the identity of the individual fibers and to form a layer of thermoplastic material about the metal body of the lure. Upon subsequent cooling, this layer of thermoplastic material sets or hardens to form a tight-fitting skin which adheres strongly to the surface of the metal. After the plastic has solidified, the elastic band may be removed from the lure, if desired.

A better understanding of the various features of the invention and an appreciation of its many advantages will be gained from consideration of the following detailed description of certain embodiments thereof illustrated in the accompanying drawings, in which:

FIG. 1 is a diagrammatic side elevational view showing three structural components which may be utilized in carrying out the process of this invention;

FIG. 2 is a vertical cross sectional view illustrating the positional relationship between two of the components of FIG. 1 after completion of a first step in the process;

FIG. 3 is a diagrammatic vertical cross sectional view illustrating the positional relationships assumed by the three components of FIG. 1 after completion of a second step in the process and illustrating the manner in which a third step in the process may be carried out;

FIG. 4 is a vertical cross sectional view illustrating the structure which results from a fourth step in the process;

FIG. 5 is a side elevational view illustrating the completed fish lure which results from the carrying out of a fifth and last step in the process;

FIG. 6 is a perspective view of another form of fish lure according to the present invention;

FIG. 7 is a partial cross sectional view of an end portion of a fish lure similar to that shown in FIG. 6, but with one of the parts removed therefrom; and

FIG. 8 is a perspective view of a brush produced in accordance with the present invention.

FIG. 1 illustrates three structural components necessary for the production of a lure of the type referred to in the trade as a "jig" by the process of the present invention. These are a cylindrical bundle of fibers **2**, an annular elastic band **4**, and a metal component **6** of suitable shape. As illustrated, the component **6** includes a hook **8** embedded in a generally cylindrical head **10**, with its eye **11** extending laterally from a side wall of the head **10** and with its shank protruding from a cylindrical neck portion **12** of the head **10**.

The fibers **2** ultimately form the skirt of the completed lure, and they may vary widely as to composition. However, it is necessary, in order to permit their use in the present invention, that they either be of thermoplastic material or be coated or impregnated at one of their end portions with thermoplastic material. As specific examples of suitable thermoplastic fibers, reference is made to polyamide resin fibers, such as nylon, and to vinylidene chloride-vinyl chloride copolymer fibers, such as saran. Both of these materials have chemical and physical characteristics which make them desirable for use in fish lures, and both have been employed successfully in the practice of this invention.

The composition of the metal head **10** of the lure also may be varied widely. It is customary to form such heads of a lead alloy, because lead is easily molded. However, the present invention is in no wise restricted to the use of such lead alloys. As far as the process of this invention is concerned, it is necessary only that the metal or alloy employed be one which melts or softens at a temperature substantially above the temperature at which the thermoplastic material flows. Fibers of both nylon and saran have been successfully attached to lead, aluminum, copper, iron, galvanized iron, steel, and various alloys of these materials.

The elastic band **4** preferably is a short section of rubber tubing of the type commonly employed in medical and dental applications. However, any other easily deformable elastic material that will retain its elasticity at the temperature at which the plastic material flows may be used if desired.

The first step in the method illustrated in FIGS. 1 through 5 involves the positioning of the elastic band **4** about the bundle of fibers **2**. This may be accomplished by simply moving an end of the bundle into the interior opening in the elastic band **4** to produce the arrangement illustrated in FIG. 2. However, some refinements in this aspect of the invention are possible.

Usually the fibers **2** are purchased from a manufacturer in the form of an elongated strand suitable for making a number of the illustrated bundles. In quantity production operations, it has been found desirable to fuse the fibers at one end of the strand so as to produce a coherent body which may be passed easily through a plurality of the elastic bands **4**. The bands **4** then are spaced along the length of the strand at intervals corresponding to the lengths of the bundles, and the fibers are cut adjacent one end of each of the bands **4** to produce a plurality of the assemblies illustrated in FIG. 2. Of course, the fused end portion of the strand must be later cut away, but the convenience of this procedure greatly out-weighs any disadvantage inherent in the small amount of wasted material.

The assembly of FIG. 2 may be retained in position during the next step in the process by simply gripping the exterior of the elastic band **4**. The small amount of pressure exerted upon the band **4** by the fingers of the workman will suffice to clamp the bundle of fibers **2** so as to prevent substantial amounts of relative movement between the fibers **2** and the band **4**.

The assembly of FIG. 2 and the metal component **6** may be brought into the required positional relationship illustrated in FIG. 3 by threading the free end of the hook **8** through the central portion of the bundle of fibers **2** disposed within the band **4**, swinging the component **6** so as to bring the shank of the hook **8** into a coaxial relationship with respect to the band **4**, and then moving the component **6** axially to dispose its cylindrical neck portion **12** within the band **4**. As illustrated, the free end of the cylindrical neck **12** is provided with a conical tip **14** which minimizes the resistance offered by the fibers **2** to the insertion of the neck **12** into the center of the band **4**. Although tip **14** is not absolutely essential, it has been found in practice that some of the fibers **2** tend to be pushed out of the band **4** when the neck **12** of the head **10** is blunt.



In the assembly shown in FIG. 3 it will be noted that the fibers **2** are disposed about the neck **12** of the head **10** and that the elastic band **4** surrounds the fibers **2**. It will be noted also that in this view, the band **4** has a diameter greater than the diameter of the band **4** in FIGS. 1 and 2. In other words, the band **4** is distended during insertion of the neck **12**. Consequently, the elastic band shown in FIG. 3 exerts a substantial compressive force upon the fibers **2** surrounding the neck **12**.

The amount of this pressure, of course, is determined by the dimensional relationships between the bundle of fibers **2**, the elastic band **4**, and the neck **12**, and these factors may be varied as required in individual situations. As an example of one set of operative relationships, it may be mentioned that a bundle of nylon fibers **2** having a diameter of three thirty-seconds of an inch may be used in cooperation with a rubber band **4** having, when relaxed, an internal diameter of one-eighth of an inch and a metal neck **12** having an external diameter of one-eighth of an inch.

The next step in the process of this invention is to apply sufficient heat to the portions of the fibers **2** located between the neck **12** and the elastic band **4** to cause the thermoplastic material of which these fibers are made to flow. The actual temperature employed may vary considerably, but it must not be so high as to cause melting or softening of the head **10**, and it must not be so high as to destroy the elastic qualities of the band **4**. These factors may be evaluated easily, and persons skilled in the art will have no difficulty in establishing an operable temperature for use with any given set of materials in the components **2**, **4** and **6**.

One suitable procedure for carrying out this heating step is to apply a flame **16** directly to the surface of the body **10**. When this is done, heat is transferred by conduction through the body **10** and its neck portion **12** to the end portions of the fibers **2** disposed in contact with the neck **12**. Uniformity may be achieved by rotating the assembly of FIG. 3 relative to the flame **16** during this heating operation.

It will be understood, of course, that other suitable techniques for heating the fibers **2** may be employed when desired. In quantity production operations for example, it has been found to be convenient to accomplish the heating by immersing the head **10** in a body of molten metal for a brief period. This technique distributes the heat about the circumference of the head **10** uniformly, and the bath of molten metal may be maintained at the required temperature for substantial periods of time so as to permit the heating of a very large number of units.

During the heating step, the end portions of the fibers **2** disposed within the elastic band **4** are subjected to sufficient heat and pressure to cause them to flow together and lose their individual identities. Hence, at this stage of the process, the space between the metal neck **12** and the elastic band **4** is filled by an annular body of molten plastic material. The pressure exerted upon this body by the elastic band **4** brings the molten plastic into intimate contact with the exterior surface of the neck **12** and may even cause small quantities of the plastic material to ooze from the ends of the sleeve **4**.

Upon subsequent cooling, this body of plastic material solidifies and forms a skin or collar **18** rigidly adhered to the neck **12**, as shown in FIG. 4. In the preferred

embodiment of the invention, the skin 18 is a complete annulus, but this is not absolutely essential in all cases. The holding power of a complete annulus has been found to be superior to that of an interrupted skin, but, for many purposes, either is adequate.

The final step in the process of FIGS. 1 through 5 is an optional one in that it consists simply of the removal of the rubber collar 4 from the lure. Actually, this step may be omitted entirely, if desired, and the collar 4 may be left on the lure in the position illustrated in FIG. 4 without detracting from the effectiveness of the structure as a fish lure. If it is desired to remove the collar 4 for the sake of appearance or for some other reason, this can be accomplished by cutting the elastic band 4 or, if the band 4 is of some material which does not adhere to the thermoplastic material, it may be slipped over the ends of the fibers 2 and over the hook 8 of the lure.

When the elastic band 4 is slipped off the end of the lure, it may be re-used in the making of another lure according to the process of this invention.

It should be understood also that any suitable finishing operations may be applied to the lure in order to give it an appearance which will be acceptable to fishermen. For example, the body 10 of the lure may be painted and ornamental threads or metal bands may be secured around the neck portion of the lure. If a thread is wrapped around the neck portion of the lure, the completed article will have an external appearance substantially identical to the external appearance of the jig-type lures manufactured by prior techniques.

Not only is the completed lure shown in FIG. 5 easier to produce than the similar lures heretofore available, but also it has improved structural characteristics. In particular, it is pointed out that the skirt formed by the fibers 2 is more securely attached to the head 10 than are the skirts of the tied lures heretofore generally used. Moreover, there is no external attaching element, such as a tying thread, which might become damaged during handling or use of the lure.

As will be apparent, the principles of this invention may be applied in the production of many other types of skirted lures. FIGS. 6 and 7, for example, illustrate a lure 20 of the treble-hook type. Such lures include three hooks 22, the shanks 24 of which are disposed in contacting relation and are welded together near their upper ends, as indicated by the numeral 26 in FIG. 7. A single eye 28 extends upwardly from the joined shanks 24 to provide a means by which the line or leader may be attached to the lure. The skirt of the lure may be formed of fibers, feathers, or a combination of fibers and feathers. In FIGS. 6 and 7 a combination of fibers 30 and feathers 32 has been illustrated as an example.

In forming the lure 20 in accordance with the process of this invention, the fibers 30 and the feather 32 are disposed in a bundle similar to the bundle of fibers 2 shown in FIG. 1; an elastic band 4 is passed over the end of the bundle containing the tip of the feather 32, the eye portion 28 of the metal hook component is threaded through the assembly of fibers 30, feather 32, and elastic band 4, from the end thereof opposite the elastic band 4, to bring the welded portion 26 of the hook into position within the elastic band 4; sufficient heat is applied to the eye 28 to fuse the fibers 30 disposed between the distended elastic band 4 and the welded shank portion 26, and then the structure is cooled to form a solid collar or skin 34 of plastic material adhered to the welded portion 26 of the shank of the lure. It will be noted that, in FIG. 7, the inner end or tip of the feather 32 is embedded within the plastic collar 34, so that both the fibers 30 and the feather 32 are securely attached to the metal portion of the lure.

It will be observed that, in FIG. 6, the elastic band 4 has been illustrated, but that, in FIG. 7, this band 4 has been removed for purposes of clarity. Whether the collar is to be left in position on the completed lure or removed therefrom is entirely optional.

If the skirt of the lure is to be formed of a combination of thermoplastic fibers and feathers, it is not necessary that the tips of the feathers have any preliminary treatment. This, of course, is the situation illustrated in FIGS. 6 and 7. If desired, however, the tips of the feathers, i.e. the small ends thereof, may be coated with a thermoplastic material prior to their association with the elastic band 4. When this is done, the coating material merely fuses with the plastic material of the fibers during the heating step.

Coated feathers also may be used alone in forming the skirt of the lure. When applied to such a skirt, the process of this invention results in a product substantially as shown in FIG. 7, except that there are no fibers 30 protruding from the plastic skin or collar 34.

Additionally, it should be noted that other materials, such as non-thermoplastic fibers, may be adapted for use in the present invention by a dip coating process in which end portions of the fibers are coated with a suitable thermoplastic material. For example, Polar Bear hair, which is favored by many fishermen for use in the skirts of lures, may be coated with nylon by simply dipping it into a body of liquid nylon. When so coated, the Polar Bear hair may be used alone or in combination with other materials in practicing the present invention.

FIG. 8 illustrates still another embodiment of the invention, and it is intended to suggest to persons skilled in the art the many fields of utility of the invention. The embodiment of FIG. 8 is a simple pastry brush composed of a metal shank 36, thermoplastic bristles 38, and an eye 40 by which the brush may be suspended from a hook or the like. The bristles 38 are attached to the metal shank 36 by a plastic skin or collar 42 formed as explained above by fusing the ends of the bristles 38 while they are confined between a distended elastic band and the metal shank 36 of the brush.

Another variation which deserves special mention is that the plastic collar or skin formed in accordance with this invention may be utilized to secure two metal parts together, as well as to secure a plastic member to such parts. For example, double hook lures may be constructed merely by disposing the shanks of two single hooks adjacent to each other and then attaching a skirt around these shanks. The plastic collar formed by the process of this invention will serve not only to hold the skirt in position, but also to hold the two hooks in the proper relationship with respect to each other.

Although several embodiments of this invention have been illustrated and described in detail, still other variations and modifications will suggest themselves to persons skilled in the art. It is intended, therefore, that the foregoing description be considered as exemplary only, and that the scope of this invention be ascertained from the following claims.

I claim:

1. A process for attaching to a metal body an element having a surface portion of a plastic material which will flow at a temperature below the melting point of the metal body, which comprises disposing said portion of said element between and in contact with a distended elastic element and the metal body, elevating the temperature of the plastic material sufficiently to cause it to flow under the pressure exerted thereon by said elastic element, and then cooling the plastic material to produce a skin adhering to the metal body.

2. A process for attaching a plurality of elongated elements having end portions containing thermoplastic material to the surface of a metal body which comprises disposing said end portions only of said elongated elements between and in contact with the surface of the metal body and a distended flexible elastic band surrounding said body, elevating the temperature of the thermoplastic material in said end portions of said elements

sufficiently to cause it to flow, and then cooling the thermoplastic material to form a skin adhered to the surface of the metal body and from which said elongated elements project.

3. The process of claim 2 wherein at least some of said elongated elements are thermoplastic fibers.

4. The process of claim 2 wherein at least some of said elongated elements are fibers the end portions of which are coated with thermoplastic material.

5. The process of claim 2 wherein at least some of said elongated elements are feathers and wherein the tips of said feathers are coated with thermoplastic material.

6. The process of claim 2 wherein other elongated elements are associated with said elongated elements having end portions containing thermoplastic material prior to said disposing step and wherein end portions of said other elongated elements are embedded in said skin upon the cooling of said thermoplastic material.

7. The process of claim 2 wherein said metal body is a composite structure made up of a plurality of separable metal components disposed in side by side relation and wherein said skin adheres to all of said components.

8. A process for attaching a plurality of elongated elements having end portions containing thermoplastic material to the surface of a metal body comprising positioning said end portions within a flexible elastic band, inserting the metal body into the elastic band so that said end portions are disposed between the surface of the metal body and the elastic band and so that the elastic band is distended, elevating the temperature of the thermoplastic material sufficiently to cause it to flow, and then cooling the thermoplastic material to produce a solid skin adhered to the surface of the metal body and from which said elongated elements project.

9. A process for making a fish lure comprising arranging a plurality of elongated elements having end portions containing thermoplastic material in the form of a skirt, positioning said skirt upon a metal portion of the lure with said end portions of said elements in contact with the surface of said metal portion and disposing a distended elastic band around said end portions to hold them in position and to press them against said surface, heating said thermoplastic material sufficiently to cause it to flow, and then cooling said thermoplastic material to form a skin adhered to said metal portion of the lure and from which said elongated skirt elements project.



10. A process for making a brush comprising assembling a plurality of elongated bristle elements having end portions containing thermoplastic material in substantially parallel relation, inserting an end of a metal shank element into the end of the assembly of bristle elements containing said end portions and disposing a distended elastic band around said end portions to hold them in position and to press them against the surface of said shank, heating said thermoplastic material sufficiently to cause it to flow, and then cooling said thermoplastic material to form a skin adhered to said shank and from which said bristle elements project.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 1,640,599 | Conn | Aug. 30, 1927 |
| 1,741,700 | Hart et al. | Dec. 31, 1929 |
| 2,315,304 | Upperman | Mar. 30, 1943 |
| 2,391,077 | Sticht | Dec. 18, 1945 |
| 2,562,716 | Hervey | July 31, 1951 |
| 2,664,316 | Winslow et al. | Dec. 29, 1953 |
| 2,708,325 | Dillon | May 17, 1955 |
| 2,740,226 | Arff | Apr. 3, 1956 |
| 2,938,238 | Gewecke et al. | May 31, 1960 |