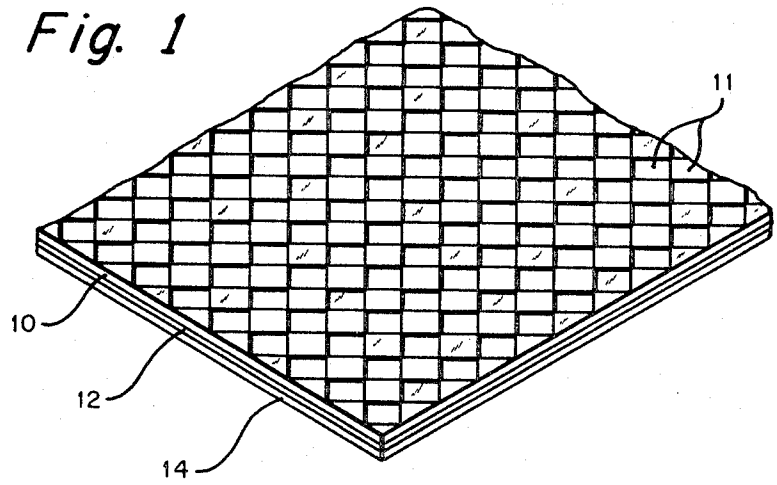
June 15, 1971 D. D. STRATTON ET AL 3,585,101

ADHESIVE-APPLIED KNURLING

Filed July 25, 1968

Fig. 1



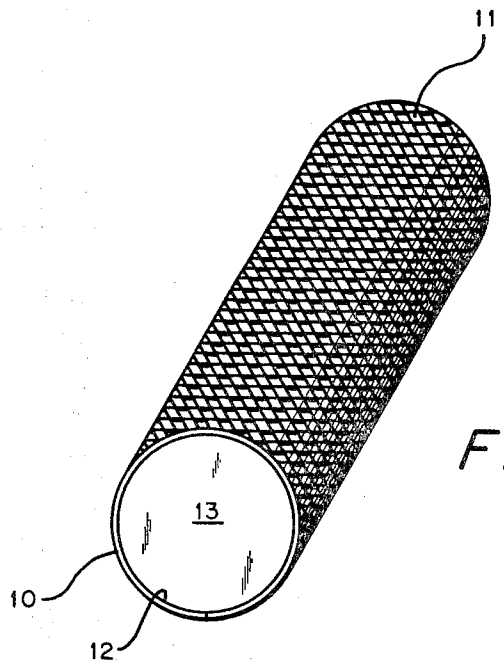


Fig. 2

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ADHESIVE-APPLIED KNURLING

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ABSTRACT OF THE DISCLOSURE

A thin sheet of a soft, flexible material having a knurled pattern embossed on its top surface is mounted on a solid, smooth object using a suitable adhesive bond material to provide an improved gripping surface therefor.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

The invention relates particularly to the application of a knurled gripping surface to smooth surfaces of various rigid materials such as metals, plastics and glass or the like, without the use of knurling tools, machining or other conventional means of applying knurled surfaces and without damaging or reducing the thickness of the underlying surface.

Presently, the common method of applying knurling to metallic or other rigid surfaces is by utilizing machine shop procedures employing special knurling tools which, when applied with considerably pressure to the surface to be knurled, cause flow of the metal resulting in the knurl. However, several serious disadvantages are inherent in the abovementioned method. Among the most common are that the knurling cannot be easily applied to flat surfaces or brittle materials and the pressure required for the knurling can, in some designs, cause deformation or weakening of adjacent metal. Also, the degree of coarseness cannot be closely controlled nor can conventional knurling be extended up to a shoulder. For example, one presently existing problem is how to improve grip-friction on the CO_2 cylinders being used in inflatable life jackets, so that tightening may be more easily accomplished. A logical solution to alleviate this problem would be to knurl the walls of the cylinder. However, this approach reduces the wall thickness of the cylinders which in turn weakens the walls and leads to subsequent failure of the cylinder. It is therefore an object of the present invention to provide a novel and improved method and article for applying a knurled gripping surface to a metallic or the like rigid object which is easily and quickly applied on a flat or curved surface without reducing the surface thickness thereof.

It is another object of the present invention to provide a novel and improved method and article which permits a machine part to be knurled without the use of special tooling and the high cost of machines and machine labor.

It is a further object of the present invention to provide a novel and improved adhesive-applied knurling which requires no pressure on or deformation of the base metal or other rigid material on which the knurling is mounted.

It is still a further object of the present invention to provide a novel and improved adhesive-applied knurling which is relatively simple in construction and operation and yet highly reliable in use.

Other objects and many of the attendent advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIG. 1 of the drawing is a perspective view of a sheet of adhesive knurling constructed according to this invention; and

FIG. 2 of the drawing is a perspective view of a cylindrical object showing the adhesive knurling applied to its surface.

Referring now to the details of the drawing, wherein like reference numerals apply to like parts throughout, it will be seen that the present invention comprises a thin sheet of a soft, ductile, flexible material **10**, such as aluminum, brass, plastic or the like, having a series of fine ridges or knurling **11** of a standard commercial pattern embossed on the top surface of the sheet material **10**. The knurling **11** is shown as being a diamond knurl but any straight or diagonal knurl may be utilized depending on the particular application therefor. The knurling **11** is applied to the sheet material **10** by stamping or pressing or by any other suitable conventional embossing method. A suitable bonding adhesive **12** is applied to the bottom surface of the sheet material **10** to enable the knurling **11** to be secured to or mounted on substantially any solid, smooth, rigid surface **13**, such as metal, wood, plastic, glass or the like. The knurling **11** may be applied to flat or curved surfaces of single curvature as shown in FIG. 2, or it may be applied to surfaces having compound curvature, depending on the thickness of the sheet material **10** which, for example, can vary between $\frac{1}{32}$ and $\frac{1}{8}$ of an inch to insure effective operation.

The bonding adhesive **12** may suitably be composed of any preferred liquid, solvent activated, silicate, epoxy resin, metal-plastic or pressure sensitive type adhesive which will provide the desired bonding strength and which does not react with the metals or other like materials to be joined. An excellent bonding adhesive **12** for this purpose, when bonding a metal sheet **10** to a metal object **13**, is any of the large variety of epoxy adhesive resins available in the market. If a solvent activated type adhesive **12** is utilized, a removable moistureproof cellophane or paper backing **14** is provided to protect the adhesive **12** prior to activation and application. For example, if a water-remoistenable adhesive is utilized, one similar to the gumming used on labels and the backs of envelopes, a thin cellophane backing **14** is provided and removed after soaking in water prior to application of the knurling **11**. If a solvent activated type of adhesive is utilized, such as Scotchcal (3M Co.), a paper backing **14** is provided to protect the adhesive and is removed prior to activation with the activator, which may be cyclohexanone or some other suitable ketone compound.

The sheet material **10** is preferably supplied in large sheets, so that it may be cut with shears or sawed to the desired size and shape before being applied. Also, if both surfaces **10** and **13**, are constructed from dissimilar metallic materials, a nonconductive conversion coating is preferably applied to the bottom surface of the sheet material **10**, or it may be applied to the surface of the base material **13**, to prevent corrosion caused by galvanic action. The coating, such as chromium plating, may be applied to the proper surface in any well known manner, as by means of an anodizing process, for example.

In operation, the knurled sheet material **10** is shaped and cut to the necessary and proper size wherein a suitable adhesive **12** is then applied to the bottom surface, or the previously applied adhesive is activated. The knurling **11** is then secured on the smooth surface **13** where increased grip-friction is needed. Knurled sheets made in accordance with this invention have been found to hold smoothly and durably to plastic and metallic surfaces alike, maintaining their original tight-fitting relationship over extended periods of use.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A knurled gripping surface on a smooth rigid base material which comprises:

(a) a sheet of soft, flexible material having a knurled pattern embossed on the top surface thereof; and

(b) a bonding adhesive provided on the bottom surface of the sheet material so that said material may be secured to a smooth, rigid base material which requires increased grip-friction thereon, said adhesive being a solvent activated type and having a removable moisture-proof paper backing to protect said adhesive prior to activation.

2. A gripping knurled surface as recited in claim 1 wherein the smooth, rigid base material is constructed from metal and wherein the adhesive is an epoxy type resin.

3. A knurled gripping surface which comprises:

(a) a sheet of soft, flexible material having a knurled pattern embossed on the top surface thereof;

(b) and a bonding adhesive provided on the bottom surface of the sheet material so that said material may be secured to a smooth, rigid base material which requires increased grip-friction thereon, said adhesive being a water remoistenable type and having a removable moisture-proof cellophane backing to protect said adhesive prior to activation.

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