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METHOD AND APPARATUS FOR REMOVING DENTS FROM CONTOURED OBJECT BY USE OF REDUCED PRESSURE ABOVE DENT COMBINED WITH TAPPING FORCES

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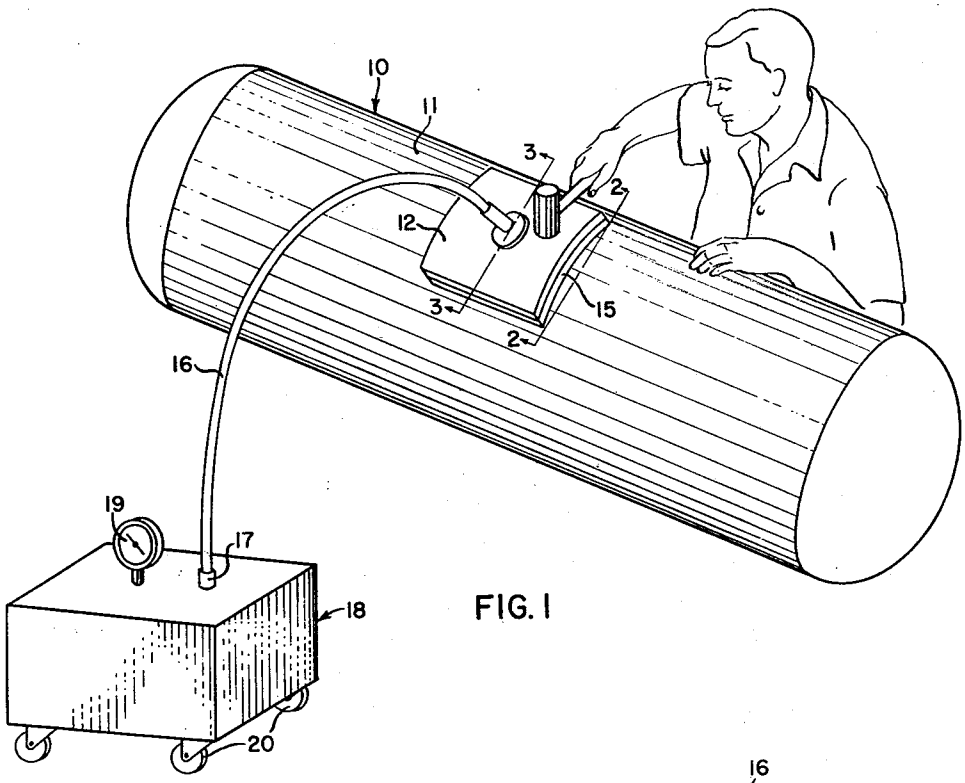


FIG. 1

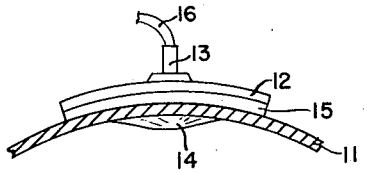


FIG. 2

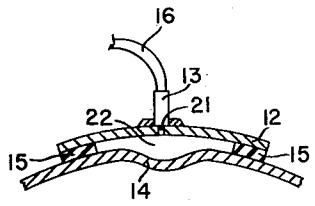
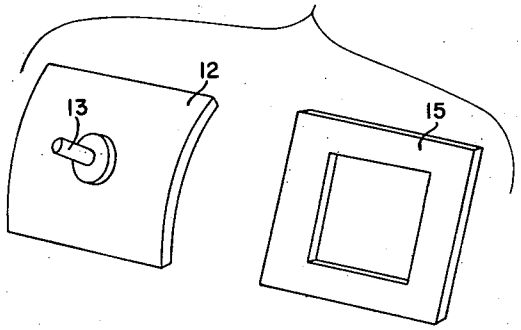


FIG. 3

FIG. 4



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METHOD AND APPARATUS FOR REMOVING DENTS FROM CONTOURED OBJECT BY USE OF REDUCED PRESSURE ABOVE DENT COMBINED WITH TAPPING FORCES

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2 Claims. (Cl. 153—32)

This invention relates to a tool and a method for removing dents, and in particular to a pneumatic tool and a method for removing concave dents from sheet material and the like.

The method most frequently employed for removing dents from objects or structures made of sheet material involves the use of conventional hammers and portable anvils. This involves the placing of the anvil on one side of the sheet in contact with or in close proximity to the dent while the hammer is repeatedly struck against the remaining side of the dent.

In removing concave dents in tanks, door panels, and other structures made of sheet material wherein only one side of the sheet material is accessible, it is necessary to disassemble the structure before the conventional method may be employed. It is obvious that in these structures the conventional method is costly in terms of time and money because of the additional work that must be done prior to and subsequent to the actual removing of the dent. Another disadvantage is the inability to always reassemble the structure to its original form.

The present invention provides a means and a method for economically removing concave dents from sheet material structures or objects wherein the sheet material may be metallic or nonmetallic. Although a saving is often realized through the use of the invention where both sides of the sheet material are readily accessible, the greatest saving occurs when a dent is to be removed where one of the sides of the sheet is not readily accessible.

Through the use of the present invention, a structure having a continuous side that is contoured to substantially correspond to the contour of the sheet that surrounds the dent is placed over the dented portion of the sheet on the side opposite to the direction of protrusion of the dent. A resilient gasket of relatively soft material is placed between the plate and the sheet to effect a seal between the edges of the plate and the sheet when a partial vacuum is created therebetween. A vacuum pump may be attached to the plate so that when the pump is operated to produce a partial vacuum between the plate and the sheet, the dent is removed by the force that is produced on the dent by the difference in air pressures existing on both sides of the sheet.

It is an object of the present invention to provide a pneumatic tool and a method which will readily permit the removal of dents in sheet material.

Another object of this invention is to provide a tool and a method for the removal of dents in sheet material wherein a structure is placed in airtight relationship with respect to the sheet material surrounding the concave side of the dent so the air between the structure and the sheet may be exhausted to thereby cause the dent to be removed.

A further object of this invention is to provide a pneumatic tool and a method for removing concave dents from structures of sheet material wherein the side containing the convex side of the dent is inaccessible.

A still further object is to provide an improved dent removing tool that is simple in design, inexpensive to construct and durable in nature.

Referring to the drawings:

Fig. 1 is an isometric view illustrating the use of the invention for removing a dent from a tank;

Fig. 2 is a sectional view taken through the line 2—2 of Fig. 1 to illustrate the contour shape of the tool to substantially conform to the contour of the tank;

Fig. 3 is a sectional view taken through the line 3—3 of Fig. 1 to illustrate the cavity formed by the tool and the tank; and

Fig. 4 is an isometric view of the plate and gasket used in Figs. 1 through 3.

Referring in particular to Fig. 1, a sheet metal tank **10** has been used to illustrate the use of the invention on a structure wherein one side of the sheet material **11** is inaccessible. A rigid plate **12** containing an aperture **21** and a fitting **13** has been placed over a dent **14** (the dent **14** and the aperture **21** are shown in Fig. 3). The aperture **21** passes through the plate **12** to the side thereof that is closer to the dent **14**. The fitting **13** is joined in an airtight manner to the other end of the aperture **21**. A sponge-rubber gasket **15**, whose inner dimensions are sufficiently large to encompass said dent **14**, has been placed between the plate **12** and the sheet **11**. The gasket **15** is picture-frame shaped in order to provide the continuous sealing action necessary at the periphery of the plate **12**. A tube **16** joins the fitting **13** to a fitting **17** on a pump **18**. The pump **18** can have a vacuum gauge **19** mounted thereon to indicate the operation of the pump **18**, and can be mounted on a set of casters **20**.

In operation, the gasket **15** is placed in position on the tank **10** to surround the dent **14**. The plate **12** is placed over the gasket **15** and the pump **18** is activated. The partial vacuum created in cavity **22** by the pump **18** causes the atmospheric pressure on the plate **12** to force it toward the tank, thereby compressing the gasket **15** to effect a good seal. The inside of the tank **10** should be at a pressure greater than that of the partial vacuum as it is the difference in pressures existing on both sides of the tank wall that causes dent **14** to be removed. Normally, the inside of the tank **10** will be at atmospheric pressure, as at least one opening generally exists for inserting or removing whatever the tank **10** is to store.

In the drawings and the aforegoing discussion, a tank was employed as an example of a structure on which the invention may be used. It is evident that the invention is not limited to removing dents from tanks, for various repairs have been made to objects or structures other than tanks through the use of the invention. These repairs have included the removal of dents from the bodies and wings of airplanes. Even when both sides of a piece of sheet material are exposed such that conventional hammer and anvil means may be used, it has been found possible in many instances to effect a savings by using the invention, as the peen marks that are left by the hammer are not present and consequently less time is needed to refinish the surface of the material.

The invention has been illustrated for use on a sheet metal tank but it is not meant to limit the invention to sheet metal structures. Other types of sheet material, such as plastic sheets, may also be repaired through the use of the invention.

Although the gasket **15** was stated to be made of sponge rubber material, other types of resilient material may be used to produce the seal between the plate **12** and the sheet **11**. It has been found that the gasket **15** should be sufficiently resilient to provide a good seal while permitting the plate **12** to be brought into close proximity with the desired contour of the dented portion of the sheet **11**. If this degree of resilience is not present, the

sheet 11 might tend to blister because of the sharp hard edges of the gasket 15 and the depth of the cavity 22. For convenience, the gasket 15 may be permanently attached to the plate 12.

The pump 18 may be any form of a vacuum-creating device. Where sources of air pressure are available, it has been found that venturi type exhausting devices, commonly referred to as jet exhausters or jet ejectors, are capable of producing a sufficient vacuum to be used in practising the present invention on some materials. These devices are lighter in weight and smaller in size than conventional vacuum pumps, therefore the advantages in being able to use them are realized when it is considered that air pressure sources are relatively common in industrial plants.

The difficulties encountered in removing dents vary as functions of material, material thickness and the sizes, depths and shapes of the dents. It may be desirable in the removal of dents to tap the plate 12 with a hammer. This provides a jarring effect to the sheet 11, which in some instances is adequate in cooperation with the use of the invention to cause the dent 14 to be removed. Another expedient, if the structure may be sealed such as the tank 10, is to increase the pressure within the structure. This increases the aforementioned pressure difference which causes a greater force to be exerted on the dent. A still further expedient when the structure is capable of holding a liquid and the dent is below the watertight level of the structure, is to fill the structure with a liquid. This causes a greater force, because of the weight of the liquid, to be exerted against the reverse side of the dent, thereby increasing the pressure difference. Obviously, combinations of these expedients may be utilized to obtain the desired results.

While the invention has been illustrated as a means for removing dents from tanks, it is obvious, as set out in the aforegoing discussion, that it is not limited thereto. The tool is particularly useful in repairing dented objects or structures which have one side that is inaccessible for repair purposes, but it is not restricted to this use as the invention may be used on materials that have both sides exposed for repair purposes.

What is claimed is:

1. A pneumatic device for removing a dent in an object constructed of sheet material comprising a plate having an underside contoured to correspond to the contour of said object in the vicinity of the concave side of the dent, gasket means fitted about the periphery of said underside of said plate to enable said plate to be placed surrounding said dent in airtight relation against said object, said plate having an aperture therein so that air exhausting means may be employed to exhaust air contained between said object and said plate, said plate also presenting an upper surface of substantial area so that the plate momentarily may be deflected downwardly into jolting contact with said object upon being struck, whereby said dent can be removed by the combined effect of the reduced pressure above the concave portion of the dent and the striking of the plate at points directly above the periphery of the dent.

2. A method for removing a dent in an object constructed of sheet material comprising the steps of placing a cavitied structure surrounding the dent and fitting closely against said object, thereby to form an airtight chamber enclosing the concave side of said dent, evacuating air from the chamber formed between said structure and said object so as to lower the pressure on the concave side of said dent, and tapping the upper surface of said structure at locations directly above the periphery of said dent so as to cause said dent to snap out, then to be drawn toward its original position by the reduced pressure.

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