March 21, 1967 D. D. BROWN 3,309,818

BLAST CLEANING MACHINES AND REMOVABLE PANELS THEREFOR

Filed June 5, 1964

FIG - 1

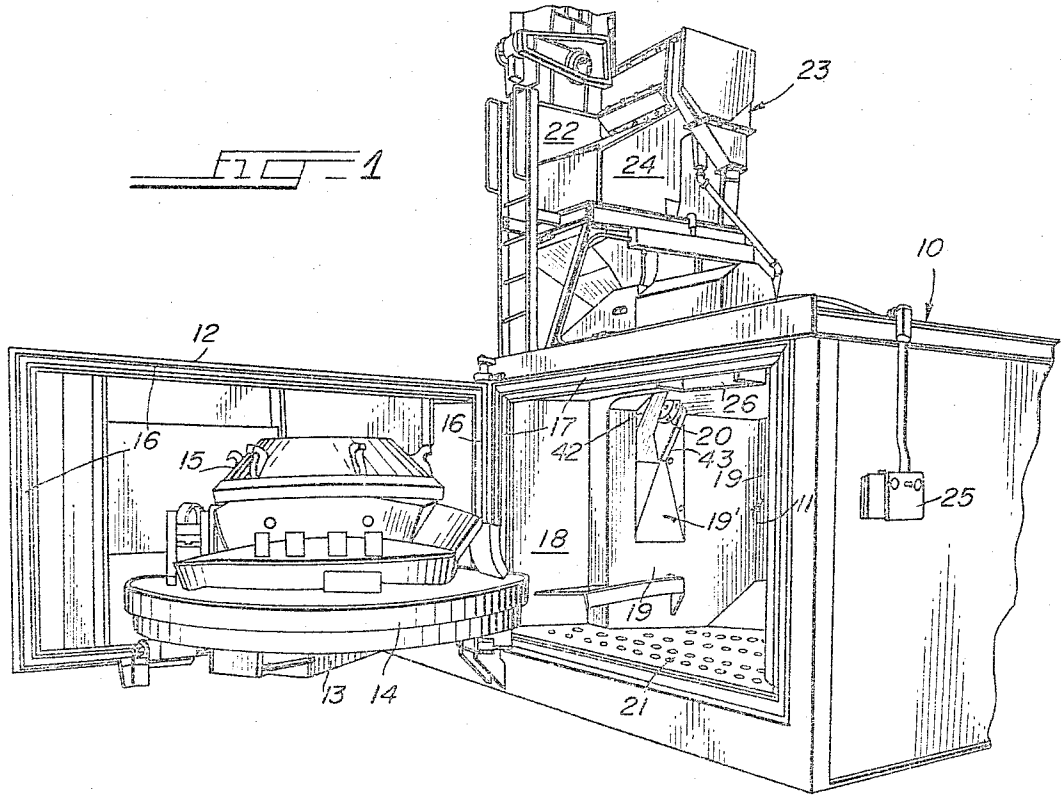


FIG - 2

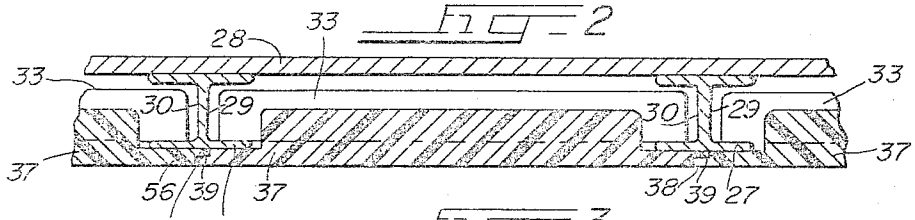


FIG - 3

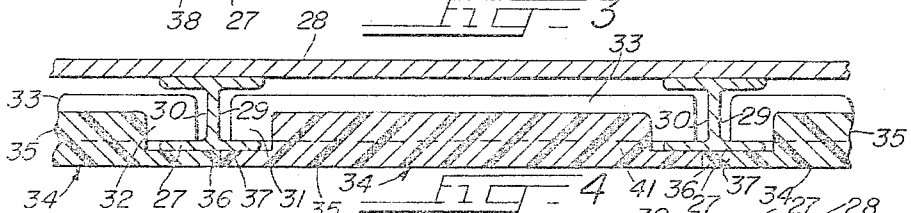
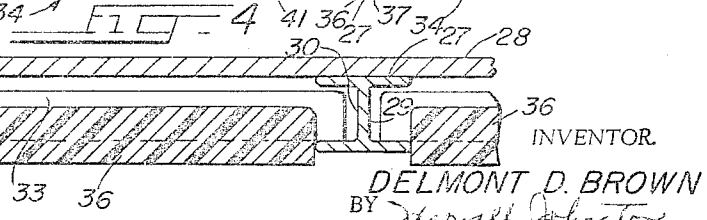


FIG - 4



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BLAST CLEANING MACHINES AND REMOVABLE PANELS THEREFOR

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This invention in general relates to panel structures and more particularly pertains to abrasion-resistant panel structures used in cleaning chambers of blast cleaning machines wherein small particles such as a natural or synthetic abrasive or metal shot is impelled at high velocity against the article to be cleaned, e.g., deburred, deflashed, descaled, etc.

Blast cleaning machines are effective machines for the removal of scale from steel plates, the removal of metal burrs on metal castings, the deflashing of aluminum castings and the like. The abrasive, e.g., sand or other natural abrasives or synthetic abrasives, or metal shot is impelled at high velocity in the closed cleaning chamber of the machine against the object or objects to be cleaned. It is inevitable in such machines that some of the abrasive or shot be impelled directly or by rebound against the side walls and top wall of the chamber. It has been the practice to make these walls from metal plate. The metal side walls and top wall, especially the latter, are eroded away by the pounding or abrasive or steel shot thereagainst and have to be replaced in a relatively short period of time in terms of the overall life of the machine.

This invention pertains to panel structures adapted to form the top wall, and one or more side walls, if desired, for the purpose of improving the aforesaid abrasion-wear problem. Briefly, the wall or walls, or even only the portions thereof subjected to the major portion of abrasive-wear, are composed of a series of side-by-side, removable panels slidably supported in opposing channels of channel members in turn supported by the machine frame. The panels preferably comprise a metal base such as a heavy cast iron base on which or in which abrasion-resistant, cured polyurethane elastomer is cast. The polyurethane forms the face of the panels against which the abrasive or metal shot strikes. The polyurethane may be molded in a manner to provide lips which extend over the otherwise exposed portions of the channel members to protect said portions against the abrasive-wear, or the exposed portions of the channel members may be left exposed or, preferably, protected by their own layer or coating of polyurethane elastomer applied thereto.

Besides improving the aforesaid abrasion-wear problem, the panel structures of the invention offer other advantages and improvements. The noise level of the operating blasting machine is reduced by the polyurethane strike surface or surfaces in the blasting chamber over the noise level in blasting machines wherein the same strike surfaces are metal. The use of a heavy cast iron base is a further advantage, especially in panel structures for the top wall of the blasting chamber, because the weight of the bases keeps the panels tightly seated on the channel members and thereby helps to make the panel wall more impervious at the joints between panel rows to penetration by metal fines, abrasive particles, etc., circulating in the blasting chamber during operation of the machine.

The invention, its objects, improvements and advantages will be further appreciated from the following description of embodiments thereof taken in conjunction with the drawings, wherein:

FIG. 1 is a perspective view of an embodiment of a blast cleaning machine embodying a panel structure of the invention as the upper or top wall thereof;

FIG. 2 is a section of a fragment of said panel structure taken in section; and

FIGS. 3 and 4 are similar sections of a fragment of other embodiments of panel structures of the invention, FIG. 4 showing lower surfaces of the panel-supporting channels with and without a protective coating.

Referring to the drawings, there is shown for purposes of illustration of the invention an embodiment of a blast cleaning machine of known structure excepting the wall panel structures hereinafter described. Briefly, this machine comprises a rectilinear cleaning chamber housing **10** having a cleaning or blasting chamber **11**. One side of the chamber **11** is open and has a heavy-duty door **12** hingedly mounted to swing between open and closed positions. The door has on its inner side an inwardly-extending, heavy-duty frame arm on which is rotatably mounted a work-support table **14**. The table **14** may be freely rotatable or may be rotatably driven by a motor and mechanical drive mechanism at a slow rate of rotation. The table **14** forms the work-support member on which a metal member to be cleaned, e.g., the metal casting **15**, is supported. When the door is closed, the casting **15** is positioned in the chamber in the path of the impelled abrasive particles or metal shot. The door joint is substantially dust-tight to keep the abrasive particles, metal grit, etc., confined in the machine by virtue of the door seal joints **16** and **17**. It is generally best to rotate the table **14** by the aforesaid power drive during the blasting of castings of the size and character shown in order to blast effectively all sides thereof.

The side walls **18** and **19** are made of metal plate, as is the side will not seen in FIG. 1. The wall **18** has mounted therein an abrasive impeller section **19'** provided with a power-driven abrasive or shot impeller wheel **20** adapted to rotate at high speed. Abrasive (or metal shot) is fed to the wheel and thrown at high velocity against the workpieces in the blasting chamber and, in some designs, in a narrow path across the chamber from top to bottom, including against the top wall **26**. The spent abrasive or shot falls through the perforated floor **21** of chamber **11**. The spent abrasive or shot, after falling through the floor **21**, is conveyed beneath floor **21** by a screw conveyor (not shown) to a bucket elevator in elevator housing **22** and raised to a louvered scalping drum and air-wash stratification type separator in the tower portion **23** of the machine. The clean shot or abrasive is fed to the wheel **20** from a hopper **24** in the tower portion of the machine. The electrical motor circuits of the machine are controlled by the push button control panel **25**.

The foregoing parts of the machine comprise the major, essential components of the machine. Further details of the essence of the instant invention, i.e., the panel structures for the top wall, and side walls (if desired), are shown in FIGS. 2–4.

The top wall **26** of the blasting chamber **11** comprises a series of parallel channel members. These channel members may be inverted T-bars or, as shown, I-bars **27** which are rigidly attached by welding, bolts or the like to a top plate or frame member **28** of chamber **11**. The I-bars **27** form opposing channels **29**, **30** in which are slidably seated the side edges **31**, **32** of cast iron shells or pans **33** forming the base part of the side-by-side, rectangular panels **34** which together form the top wall **26** of the chamber **11**. The shells or pans have abrasion-resistant, polyurethane elastomer panel sections **35** of about one inch thickness cast or molded therein. The curing of the polyurethane elastomer in the pan or shell creates a cohesive bond between the shell and the polyurethane section cast therein. If desired, however, the latter sections can be molded separately and then adhesively secured in the pan or shell.

In order to protect the bottom portions of I-bars **27** against abrasive wear, the polyurethane sections **35** may have along opposite edges thereof, lips **36**, **37** extending over the undersurface of I-bars **27**. These lips may abut or substantially abut as shown in FIG. 3, or they may have interfitting ears **38** and **39** along said edges, which ears overlap and add in making the joints more tight against penetration by abrasive particles, metal fines, etc.

The embodiment of FIG. 4 shows a panel structure similar to that of FIGS. 2 and 3. The primary difference in FIG. 4 is that the polyurethane panel bodies **36** do not have lips which cover the lower surfaces of the I-bars **27**. The side edges of the polyurethane bodies **36** abut or substantially abut the sides of the lower legs of the I-bars. The bottom surfaces of the polyurethane bodies are substantially flush with the bottom surfaces of the I-bars.

If desired, the lower surfaces of the I-bars may be left uncovered. The abrasive wear on these bars is not so serious a problem, and they can be replaced more readily than entire metal walls of prior art machines. However, the lower surface of each of I-bars **27** may have applied thereto its own protective coating **40** of abrasive-resistant polyurethane elastomer (FIG. 4).

A very suitable polyurethane elastomer for purposes of the invention is a polyalkylene ether polyurethane polymer glycol (preferably a polytetramethylene ether glycol) having a molecular weight of at least 750, an organic diisocyanate and a chain-extending compound containing active hydrogen atoms. The latter compound may be water or hydrogen sulfide or an organic compound containing active hydrogen atoms on two different atoms in the organic molecule.

The polyalkylene ether glycols are polyalkylene ethers containing terminal hydroxy groups. These compounds are ordinarily derived from the polymerization of cyclic ethers such as alkylene oxides or dioxolane or from the condensation of glycols. They are sometimes known as polyalkylene glycols, polyalkylene oxide glycols, polyglycols or polyoxyalkylene diols. They may be represented by the formula $HO(RO)_nH$, in which R stands for an alkylene radical and n is an integer greater than 1. In the polyethers useful in this invention, n is sufficiently large that the polyalkylene ether glycol has a molecular weight of at least 750. Not all the alkylene radicals present need be the same. Polyglycols formed by the copolymerization of a mixture of different alkylene oxides or glycols may be used, or the polyglycol may be derived from a cyclic ether such as dioxolane, which results in a product having the formula $HO(CH_2OC_2H_4O)_nH$. The alkylene radicals may be straight-chain or may have a branched chain as in the compound known as polypropylene ether glycol.

Any of a wide variety of organic diisocyanates may be employed in the reaction, including aromatic, aliphatic and cycloaliphatic diisocyanates and combinations of these types. Representative compounds include 2,4-tolylene diisocyanate, m-phenylene diisocyanate, 4-chloro-1,3-phenylene diisocyanate, 4,4'-biphenylene diisocyanate, 1,5-naphthylene diisocyanate, 1,4-tetramethylene diisocyanate, 1,6-hexamethylene diisocyanate, 1,10-decamethylene diisocyanate, 1,4-cyclohexylene diisocyanate, 4,4'-methylene-bis-(cyclohexyl isocyanate) and 1,5-tetrahydronaphthylene diisocyanate. Arylene diisocyanates, i.e., those in which each of the two isocyanate groups is attached directly to an aromatic ring, are preferred. In general, they react more rapidly with the polyalkylene ether glycols than do the alkylene diisocyanates. Compounds such as 2,4-tolylene diisocyanate in which the two isocyanate groups differ in reactivity are particularly desirable. The diisocyanates may contain other substituents, although those which are free from reactive groups other than the two isocyanate groups are ordinarily preferred. In the case of the aromatic compounds, the isocyanate groups may be attached either to the same or to different rings.

The chain-extender is usually water although other

chain-extenders of the type mentioned in U.S. Patent No. 2,929,800, may be used.

Another class of resins suitable for manufacture of the abrasion-resistant liners of the invention are the polyester urethane resins. These resins are produced by the reaction of organic diisocyanates with organic polyesters or organic polycarboxylic acids and polyhydric alcohols. Examples of said diisocyanates are hexamethylene diisocyanate and tolylene diisocyanate. The polycarboxylic acids may be adipic acid, phthalic acid, succinic acid and the like. The polyhydric alcohols may be dihydric or trihydric alcohols such as ethylene glycol, diethylene glycol, butylene glycol-1,3, glycerol, trimethylolpropane and the like. The organic polyesters may be those prepared by condensation of the foregoing acids and alcohols or may be an alkyd resin. Furthermore, the resins may be produced from polyisocyanates or polythioisocyanates and amino alcohols and dicarboxy acids; glycols, diamines and dicarboxy acids; glycols, amino alcohols and dicarboxy acids; amino alcohols, diamines and dicarboxy acids; amino acids, amino alcohols and dicarboxy acids; glycols, dicarboxy acids and hydroxycarboxy acids; or amino alcohols, dicarboxy acids and hydroxycarboxy acids. These resins are described in U.S. Patent 2,333,639, the disclosure of which is incorporated herein by reference.

As a general rule of thumb, it has been found that the more resilient polyurethane elastomers are the better ones insofar as abrasive wear is conceived.

In addition to blasting machines of the character of FIG. 1, the panel structures of the invention, in some cases with panel sections made entirely from polyurethane elastomer without the metal base, can be used to advantage for the side walls in narrow blasting chambers of metal plate descaling machines and the like.

If more than one panel member **34** is used in each row formed by opposing channels, the contiguous front and rear edges thereof on successive panel members in each row should be at least flush with or extend beyond the front and rear edges of the shells or pans **33** so that the polyurethane portions can be abutted. One way to do this is to provide lips **41** on the front and rear edges, said lips **41**, for example, being of the abutting character of lips **36** and **37** of FIG. 3 or of the interfitted character of lips **36** and **37** of FIG. 2.

The polyurethane panels may outlast steel plate commonly used in blasting machine cleaning chambers by about 2 to 3 times the period of service of the latter.

The foregoing embodiments exemplify the principles upon which the invention is found. Other embodiments of the invention are readily derived by the application of these principles without departing from the spirit and scope of the invention.

The invention is hereby claimed as follows:

1. A blast cleaning machine comprising walls defining a blast cleaning chamber adapted to receive a workpiece to be blasted, means in said chamber for impelling small, hard particles against said workpiece, the top wall of said chamber being made of removable panels, each panel comprising a heavy, metal base to which is bonded a layer of polyurethane elastomer, said layers of polyurethane elastomers facing downwardly and forming abrasion-resistant strike surfaces on said top wall, fixedly mounted, parallel channel members extending along the top wall of said chamber, and said panels being slidably removably supported in said channels with opposite edges of said respective metal bases of said panels resting on said channel members.

2. A machine as claimed in claim **1** wherein the lower surfaces of said polyurethane layers extend below the lower surfaces of said channel members, and said polyurethane layers have lips extending over and shielding said lower surfaces of said channel members in slightly spaced relationship to opposite edges of said metal bases, respectively, to provide channel-receiving slots in the respective opposite sides of said panels.

3. A machine as claimed in claim 1 wherein edges of said polyurethane layers substantially abut against contiguous edges of the lower portions of said channel members, and the lower surfaces of said channel members are exposed to striking by the impelled particles.

4. A machine as claimed in claim 1 wherein edges of said polyurethane layers substantially abut against contiguous edges of the lower portions of said channel members, and the lower surfaces of said channel members are covered with a protective layer of polyurethane elastomer.

5. A panel adapted to be mounted in a blast cleaning machine comprising a shallow, cast iron pan having a layer of polyurethane elastomer bonded in said pan by the curing of said polyurethane elastomer in said pan to provide a cohesive bond therebetween, said layer providing on said panel an abrasion-resistant, polyurethane elastomer strike surface.

6. A blast cleaning machine comprising walls defining a blast cleaning chamber adapted to receive a workpiece to be blasted, means in said chamber for impelling small, hard particles against said workpiece, the top wall of said chamber being made of removable panels, each panel comprising a heavy, shallow, inverted, metal pan with a

layer of polyurethane elastomer bonded in said pan, and said layers of polyurethane elastomers facing downwardly and forming abrasion-resistant strike surfaces on said top wall.

7. A machine as claimed in claim 6 wherein said metal pans are cast iron pans and said layers of polyurethane elastomer are bonded respectively therein by curing of said polyurethane elastomer in said pans to provide a cohesive bond therebetween.

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