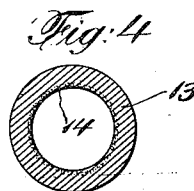
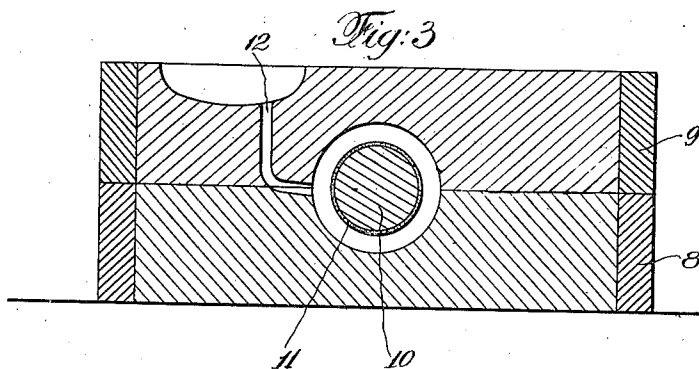
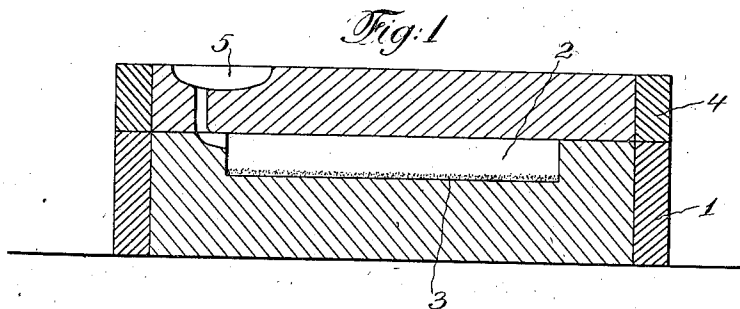


C. B. JACOBS.
RESISTANT SURFACE.

APPLICATION FILED FEB. 3, 1908. RENEWED APR. 8, 1911.

1,014,967.

Patented Jan. 16, 1912.



Witnesses:
Wm. J. Dolan
John Conahay

Inventor
Charles B. Jacobs
By his Attorney J. H. Freeman

UNITED STATES PATENT OFFICE.

CHARLES B. JACOBS, OF PORT CHESTER, NEW YORK, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO MURRAY AND JACOBS MANUFACTURING COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

RESISTANT SURFACE.

1,014,967.

Specification of Letters Patent.

Patented Jan. 16, 1912.

Original application filed April 21, 1906, Serial No. 312,967. Divided and this application filed February 3, 1908, Serial No. 413,949. Renewed April 8, 1911. Serial No. 619,886.

To all whom it may concern:

Be it known that I, CHARLES B. JACOBS, a citizen of the United States, and a resident of Port Chester, Westchester county, State of New York, have invented certain new and useful Improvements in Resistant Surfaces, of which the following is a specification.

My invention relates to surfaces adapted to resist abrasion, and more particularly to an article adapted to resist abrasion by the impact of particles of abrasive material moving at high velocity.

Objects of the invention are to provide a surface adapted to resist abrasion in dredging pumps and pipes, and other conduits; and also to provide such surfaces of the desired shape and dimensions and which may be produced easily and cheaply.

These and other objects of the invention will in part be obvious and in part be more fully explained by the following description.

The invention consists in the novel products herein set forth.

Heretofore much difficulty has been experienced by the rapid wearing away of surfaces subjected to the impact abrasion of abrading materials in a fine state of division. For example, the inner surfaces of centrifugal pumps employed in hydraulic dredging wear so rapidly that it is necessary to construct said pumps with lining plates which may be removed and renewed from time to time. Even then it is difficult to maintain the efficiency of the pumps owing to the rapid wearing away of the surfaces and the consequent increase in the clearance spaces. The pipes through which the mixture of water and sand or rock fragments are conducted require frequent renewal owing to the abrading action of the materials. Similar difficulties are experienced in other apparatus wherein the surfaces are subjected to abrasion by the impact of abrading materials.

I have discovered that a practically indestructible surface may be produced by forming it of elements harder than the abradant to which the surface is subjected, providing that the said elements are at the least in substantially as fine a state of division as the abradant to the impacts of which the

surface is subjected, and so closely arranged as to protect the binding material from the action of the abradant. The binding material should be of such a character and so disposed as to hold the surface elements against the impact of the abradant.

While a surface of the character described may be produced of various materials and in various ways, preferably it is composed of the materials and in the proportions set forth in the following description of the preferred method of producing the article, said method being set forth as a convenient and desirable way of describing the article itself in its preferred composition.

I have discovered that a surface of the character specified may be produced by forming a mold for the article, covering a mold surface which is to form a resistant surface of the article with a layer of the harder elements which is to give the surface its resistant quality, said elements being at least in substantially as fine a state of division as the abradant to the action of which the surface is to be subjected, and then introducing into the mold a liquid which will penetrate the said layer without destroying the elements thereof and which will thereafter become sufficiently rigid to effectively resist displacement of said harder elements by the abradant. For example, where it is desired to produce a surface adapted to resist the abrading action of sand or rock fragments moving at a high velocity, as in a dredging pump or conduit, I form a sand mold such as those employed for making iron castings. I then cover such of the mold surfaces as are to form the resistant surface of the article with a layer of corundum, carborundum, alundum, or a similar natural or artificial material which is harder than the sand or rock which is to be dredged, said harder material being comminuted, preferably somewhat finer than the sand or rock fragments. This layer should cover the surface of the mold so that the interstices between the particles or elements should at the least be as small as the particles of the abradant. The layer may be and preferably is given a substantial thickness, as say from a thirty-second to an eighth, or even a quarter of an inch, where the coarser grades are employed. Where the surface of the mold

which is to receive the layer of the hard material does not occupy such a position in the mold that the material will rest thereon by gravity, the material may be mixed with
 5 and temporarily held by any suitable material. Preferably, a binding material is employed which will be displaced by the liquid which is introduced into the mold. In the example given, a paste, such as that
 10 employed by coremakers, may be used and a coating consisting of the hard material and the paste may be applied either directly to a mold surface or to a sand core and then afterward introduced with the core
 15 into the mold. The layer of harder material having been applied to the desired surface or surfaces of the mold, the latter is filled with molten iron which will penetrate the layer of harder material so that when it
 20 cools, it will firmly unite them and hold them in such close relation that the iron will be protected from the action of the abradant and at the same time effectively resist displacement of the elements of the
 25 harder material by the abradant. Where the layer of harder material includes a binding material, such as the paste referred to, molten iron will destroy the same and take its place in the layer, thus uniting the elements of the harder material as in the case
 30 where no binding material is employed.

In order that my invention may be more fully understood, I have in the accompanying drawing which is referred to herein and
 35 forms a part hereof illustrated two products made in accordance with certain features of my invention together with the molds with which the same were made.

Of the drawings, Figure 1 is a vertical
 40 section of a mold for casting a bar or flat plate with a resistant surface; Fig. 2 represents a section of the article cast in the mold of Fig. 1; Fig. 3 is a view similar to that of Fig. 1 illustrating another form of mold;
 45 and Fig. 4 represents a section of an article cast in the mold of Fig. 3.

Referring to the drawings in detail, the mold of Fig. 1 comprises a drag section 1 in which a mold recess 2 is formed. The
 50 lower horizontal surface of this mold recess is represented as having applied thereto a layer 3 of a suitable hard material, the elements of the layer being represented as completely covering the mold surface and as
 55 having a substantial thickness or depth. The mold is completed by the cope section 4 in which is formed the gate 5 through which the mold may be filled with molten iron.

In Fig. 2 the plate or bar 6 cast in the mold in Fig. 1, which plate may be a lining plate for a centrifugal dredging pump, is represented as having embedded in the lower
 60 part thereof and forming its lower surface, a layer 7 of the hard material.

In Fig. 3 the mold recess is formed partly in the drag section 8 and partly in the cope section 9, and the recess is partly filled with a core section 10. In this case the layer of
 70 hard material is represented as a coating 11 around the core 10, the elements being held by suitable binding material. The gate through which the mold is filled is represented at 12. The article cast in this mold, which article may be a pipe, is represented
 75 in section in Fig. 4. As there shown, the article 13 is provided on its inner surface with a layer 14 of the hard material, the molten iron having displaced the binding material and serving to so firmly unite the
 80 elements of the hard material as to effectively resist their displacement by the action of the abrading material passing through the pipe.

It will be seen that by reason of my invention an article is supplied which forms
 85 a resistant surface which may be accurately formed and the article itself produced at only a slight expense in addition to that of an ordinary iron casting.

It is to be observed that various materials may be employed both for the surface and
 90 the body of the article, the materials selected being those best adapted or suitable for the particular use to which the article is
 95 to be applied.

It is to be understood that in this application I do not claim the method for producing the article herein claimed, the same forming the subject-matter of Patent No.
 100 954,965, dated April 12, 1910, this application being a division of my application for said patent.

In its broader aspects my invention is not limited to the particular materials herein
 105 specified by way of example, as many variations may be resorted to without departing from the main principles of the invention and without sacrificing its chief advantages.

I claim:

1. A conduit adapted to resist abrasion, said conduit consisting of a shell of cast metal, said shell having its inner surface provided with a layer of granular mineral
 110 elements, said elements being of such material and size that they will not be injured by the heat of the molten metal when casting the same and said elements being so closely arranged as to protect the shell from abrasion.

2. A conduit adapted to resist abrasion, said conduit consisting of a shell of cast iron having its inner surface provided with a layer of granular corundum, the particles
 115 of the corundum being so closely arranged as to protect the iron in which they are embedded from abrasion.

3. A conduit consisting of a metallic matrix and particles of hard mineral elements embedded therein, such particles be-
 120 125 130

ing distributed with substantial uniformity in the matrix on the inner surface thereof.

4. A conduit consisting of cast iron and particles of highly refractory hard mineral elements embedded in the inner surface thereof, such particles being distributed with substantial uniformity so as to protect the inner surface of the conduit from wear by the impact thereon of abrading materials.
5. A conduit adapted to resist wear by particles of abrasive material moving at a high velocity, said conduit consisting of a

shell of cast metal having embedded in its inner surface a layer of hard mineral elements so closely arranged as to protect the metal in which they are embedded from the action of the abrasive materials. 15

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

CHARLES B. JACOBS.

Witnesses:

H. B. YOUNKIN,
WM. J. DOLAN.
