

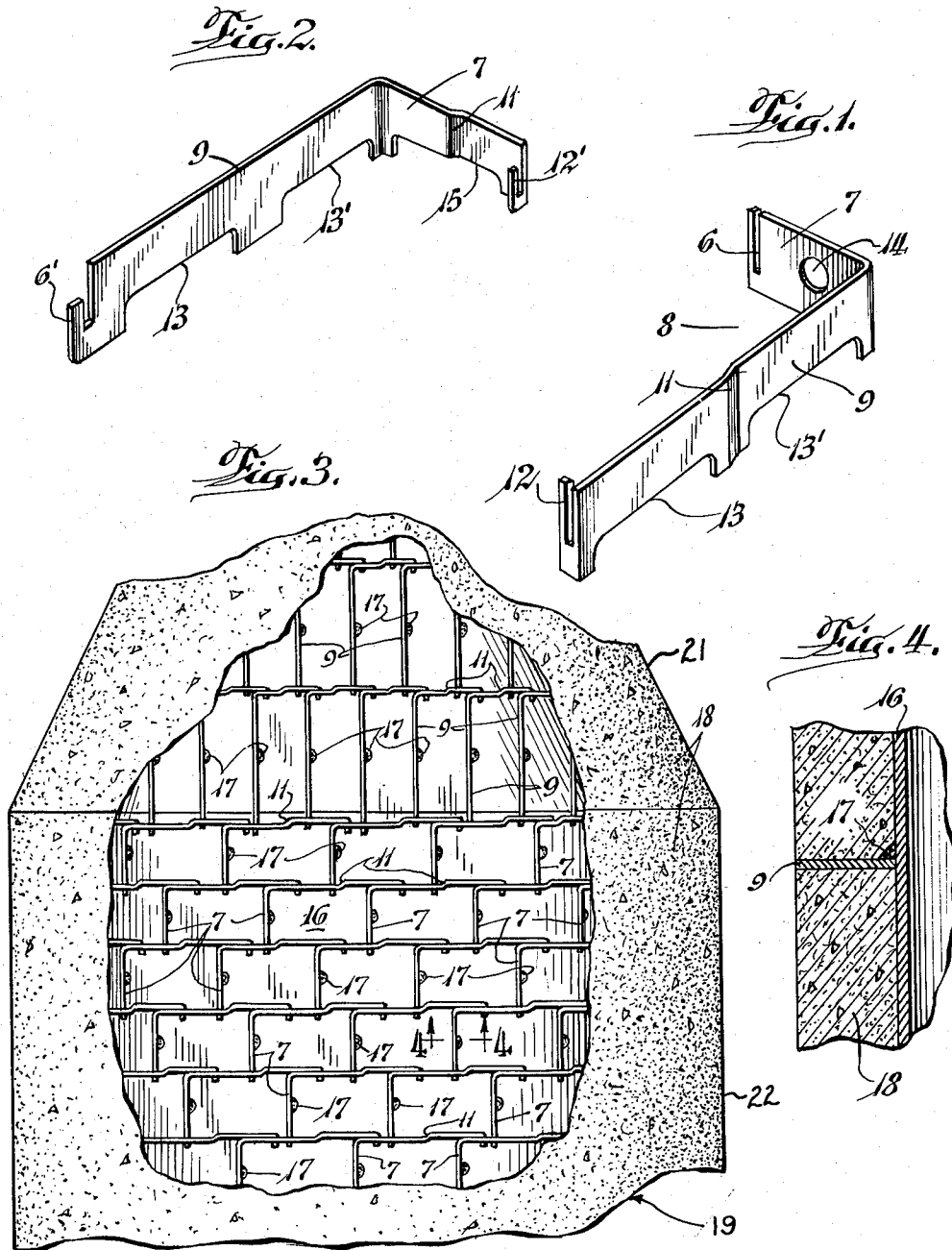
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INTERLOCKING UNIT ANCHORS FOR CONCRETE LINING

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INTERLOCKING UNIT ANCHORS FOR
CONCRETE LINING

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This invention relates to improvements in anchorages for concrete linings and particularly to an anchorage for erosion resistant concrete liners in processing equipment.

In catalytic cracking units of the petroleum industry, erosion of the equipment by moving particles of finely divided catalyst results in a rapid deterioration of many pieces of valuable equipment. The severity of erosion is dependent upon a number of factors such as the velocity of the moving catalyst particles and the angle at which the particles strike the surface. It is known to line particularly vulnerable areas with concrete which can be more easily repaired and replaced than the metal of which the equipment is formed. The practice is to anchor the concrete to the metal surface with welded studs, wire mesh, sections of expanded metal, various forms of floor grating and the like. The purpose of such anchors being to support the concrete while curing and to prevent the lining from breaking away from the surface later as a result of thermal stresses, vibration and flexure resulting from operating stresses. Certain of the above anchorages have been found to be superior to others in increasing the service life of the liner, the anchor pattern and continuity of the anchor structure being of considerable importance.

The more desirable types of anchorage such as hexagonal steel gratings are difficult or impossible to use satisfactorily on irregular surfaces, where access openings in the equipment are small and where small areas of existing liners are to be replaced. This is because the grating must be cut to size and machine formed to the correct contour, then placed into the equipment and oftentimes jacked into its final position in order to secure a proper fit for attachment to the metal surface. Available unitary anchors do not provide satisfactory performance and service.

It is an object of this invention to provide an improved unitary interlocking anchor for concrete linings which are required to have good resistance to deterioration by erosion, corrosion and vibration. Another object is to provide a structure of a number of interlocking anchors attached to a surface to be lined with concrete. Still another object is to provide a vessel or a conduit lined with concrete anchored to the wall by a network of interlocking metal articles each attached to the wall of the vessel or conduit. A further object is anchorage means that is easily handled and installed, and possesses flexibility so as to be readily used in lining intricate shapes. A special object is an anchorage which can be used for the partial replacement of existing linings so as to integrate the replacement with the rest of the already installed lining.

Other objects and advantages of the invention will be apparent from the following description and by referring to the accompanying drawings which form a part of this disclosure wherein,

FIGURE 1 is a perspective drawing of one embodiment of unit anchor,

FIGURE 2 is a perspective drawing of another embodiment of unit anchor,

FIGURE 3 is an elevation of an inside wall of a vessel (or conduit) with a concrete lining anchored to the wall by an interlocking network of unit anchors and,

FIGURE 4 is a cross-section of such a wall at 4-4 of FIGURE 3 lined with concrete anchored to the wall.

Referring to the drawings wherein is shown a preferred embodiment of the invention, in FIGURE 1 a

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hook element 6 is provided on a leg 7 of a unit anchor 8. A second leg 9 is at approximately right angles to the first leg 7; the angles may be varied to suit the particular situation. The second leg 9 is provided with an offset 11 which serves to maintain the linearity of a number of interlocking anchors upon installation. The leg 9 is provided with a hook 12 which extends approximately perpendicularly to the leg 9 and approximately parallel to and in the same direction as leg 7. The leg 9 is offset by a distance about equal to the thickness of the anchor material, so that the opening in the hook 12 provided at the end of the leg is approximately in alignment with that portion of leg 9 which is not offset. Two recesses 13 and 13' are provided in the edge of leg 9 adjacent to the backing surface 16. These recesses 13 and 13' are of a depth substantially equal to the depth of the hooks 6 and 12, so that when engaged with a hook of another interlocking anchor the open end of the adjacent anchor is maintained securely against the surface to be lined. These recesses may also be a single long recess, one or more notches or the like to fit the particular application. In addition, the recesses serve to improve the anchorage of the concrete. These recesses thus have a dual function, and variations of the shape and location may be employed to achieve this purpose.

In a preferred form the unit anchors are formed from strips of metal about $6\frac{1}{2}$ " long by $\frac{3}{4}$ " wide by $\frac{1}{16}$ " thick. A bend of about 90° is made across the strip so as to divide the anchor into a long leg approximately 4" in length, and a short leg approximately 2" in length. The anchors may be constructed of any metal having the properties required for fabrication and attachment to the wall and suitable for service at approximately 1000° F. The preferred material of construction is mild carbon steel, however, other alloys such as the low chrome alloys, stainless steels and more corrosion resistant alloys may be used. A hole 14 may be placed in one or both of the legs to allow the concrete to flow between the openings of the structure thereby improving the anchorage. For best erosion resistance it is desirable that the spacing between anchors in the short direction be parallel to the direction of fluid flow. For some applications it may be desirable to place recesses in both legs 9 and 7 so that leg 9 has a recess 15, as shown in FIGURE 2, and to offset the short leg, rather than the long leg. The latter arrangement may be preferred where fluid flow is circumferential rather than longitudinal, as in a cyclone separator. The hooks 6' and 12' may be shortened as shown in FIGURE 2 or in various other ways to interlock with another anchor.

In installing the anchors of FIGURE 1 on a vessel (or conduit) wall 16 one leg, e.g., 7 of an anchor is affixed to the wall, preferably by tack-welds 17. Then a second anchor is interlocked therewith by engaging the hook 12 in the recess 13 between the first anchor and the wall. The second anchor is then adjusted laterally to best fit the surface and then tack-welded to the wall. These lateral additions may be continued to the boundary of the area to be lined. Following this, other rows of anchors are added above the first row by engaging the recess 13 with a hook 6 of an anchor in the preceding row, tack-welding leg 7 to the wall and adding laterally in the manner described to the row above. This manner of installation provides an interlocking network of unit anchors as shown in FIGURE 3 wherein the anchors of the invention are attached to the inside wall of a circular vessel 19 having a conical section 21 and a straight section 22. In FIGURE 3 the anchors of FIGURE 1 are installed in the vessel to line the straight section thereof and the anchors of FIGURE 2 are employed to line the conical section thereof. Following the installation of the anchors, con-

crete 18 is applied to the surface to fill the openings in the network as shown in FIGURE 4.

Laboratory tests capable of determining comparative service performance were conducted on test panels of concrete anchored by a number of types of anchorages. These tests consisted of controlled particle blasting, impact and vibration by mechanical means and heating to operating temperatures of approximately 1000° F. followed by subsequent cooling to ambient temperatures in order to simulate thermal shock. All these tests were controlled in order to duplicate testing conditions for each test panel.

The standard of performance used to compare the various types of anchorages was conventional hexagonal steel grating. The concrete applied to the L-shaped interlocked anchor system showed better erosion resistance with less tendency to spall and break away from the anchorage than with other unitary anchors, and perform at least as well as the convention hexagonal steel grating.

As a result of these tests and plant tests it was determined that a particularly suitable spacing of the anchors for general vessel lining in the direction and parallel to the flow is about 2". Considerably greater spacing decreases the resistance to erosion and closer spacing decreases economies. Non-continuous type of unit anchorage units were found to be less resistant to erosion than the interlocking unit anchors. Where a concrete lining is to be used under other conditions, to provide protection from corrosion for instance, L's of other proportions may be advantageously employed.

Thus having fully described the invention, what is claimed is:

1. A metal article, substantially L-shaped, and adapted for interlocking with a number of other like articles to provide anchorage for concrete applied to a surface, said article being formed from a metal strip having a top edge and a bottom edge and comprising a first leg; a first hook element connected to said first leg at the extremity thereof and extending therefrom in the direction of said first leg, said hook opening toward the top edge of said article; a second leg at an angle to said first leg, said second leg provided with an offset along its length; a second hook element connected to said second leg at the extremity thereof and extending therefrom substantially perpendicularly thereto and in the same direction as said first leg, said second hook element opening toward the top edge of said article and the opening therein being in substantial alignment with that portion of said second leg which is not offset; at least a portion of said second leg being recessed along the bottom edge thereof so as to receive a hook element from another like article and maintain said other article against said surface when attached thereto.

2. The metal article of claim 1 wherein said first leg is recessed along the bottom edge thereof so as to receive a hook element from another like article and maintain said other article against said surface when attached thereto.

3. The article of claim 1 wherein the openings of said hook elements extend from the top edge of said article

to a point substantially the same as the depth of the recess in the bottom edge of said leg.

4. The article of claim 1 wherein the width of the opening of said hook elements is substantially the same as the thickness of the strip forming said article and adapted to receive edgewise another like article.

5. The article of claim 1 wherein said hook elements are extensions of the strip forming said article and having recesses in said strip.

6. A structure comprised of a surface and a plurality of interlocking metal articles each affixed to the surface to provide anchorage for concrete, each of said articles being formed from a metal strip having a top edge and a bottom edge and comprising a first leg; a first hook element connected to said first leg at the extremity thereof and extending therefrom in the direction of said first leg, said hook opening toward the top edge of said article; a second leg at an angle to said first leg, said second leg provided with an offset along its length; a second hook element connected to said second leg at the extremity thereof and extending therefrom substantially perpendicularly thereto and in the same direction as said first leg, said second hook element opening toward the top edge of said article and the opening therein being in substantial alignment with that portion of said second leg which is not offset; at least a portion of said second leg being recessed along the bottom edge thereof so as to receive a hook element from another like article and maintain said other article against said surface when attached thereto.

7. A lined structure comprised of the structure of claim 6 provided with a concrete lining.

8. The structure of claim 6 wherein said surface is a curved surface.

9. The article of claim 1 wherein said second leg is offset by a distance about equal to the thickness of the metal strip forming said article.

10. The structure of claim 6 wherein said hook elements are extensions of the strip forming said article and being recessed in said strip to a point substantially the same as the depth of the recess in the bottom edge of said leg, the width of the opening of said hook elements being substantially the same as the thickness of the strip forming said article, and wherein said second leg is offset by a distance about equal to the thickness of said strip.

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