

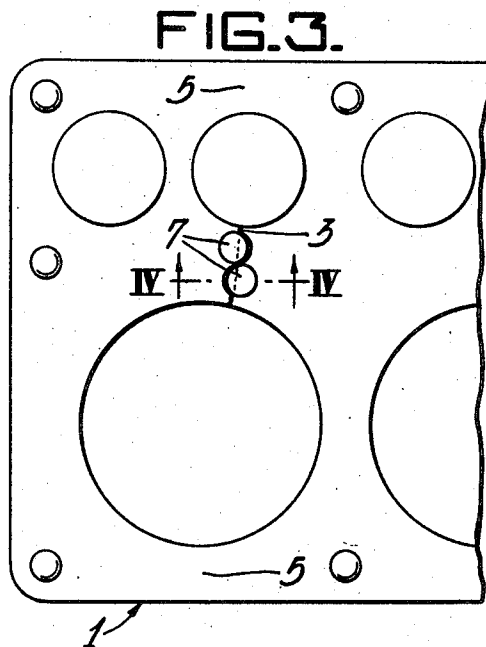
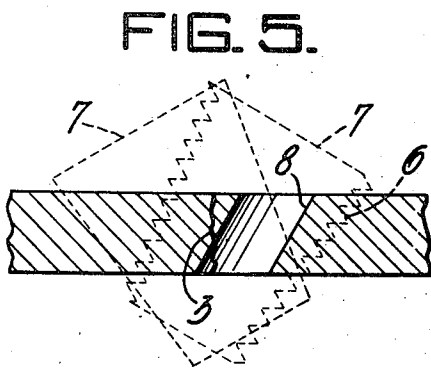
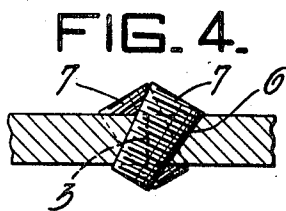
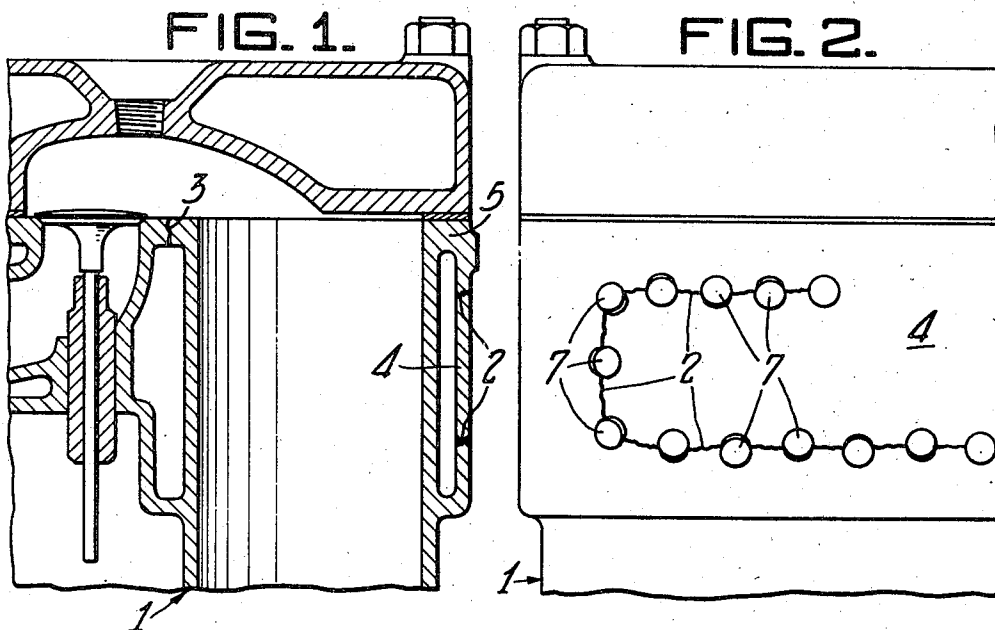
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REPAIRING AND REPAIRED CRACKED METAL WALLS

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REPAIRING AND REPAIRED CRACKED
METAL WALLS

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6 Claims. (Cl. 189-38)

1

This invention is concerned with the problem of repairing fractured cracks in metal walls, particularly the walls of metal castings, when the opposed crack faces have the irregularities common to fractured metal and are spaced distances less than the average heights of these irregularities by sound wall metal beyond the cracks. For example, this problem is encountered when internal combustion engine water-cooled cylinder blocks and cylinder heads are cracked by freezing of the water or by receiving cold water when heated by reason of being operated without adequate cooling water, providing the cracks are of the type having the opposed crack faces held together by the sound metal at the crack ends yet which permit leakage of the cooling water, at times, so as to require repairing.

Heretofore, repairs of this nature have been attempted by welding, brazing, etc., by the use of sealing compounds carried by the cooling water, and by various other expedients, but the prior art previously has not afforded a means for positively sealing such cracks in a fluid-tight manner and so that the repairs are permanent. The present invention does provide for fluid-tightly sealing such cracks in a permanent manner.

Examples of the invention are illustrated by the accompanying drawings, in which:

Figure 1 is a vertical section of a cracked casting;

Figure 2 is a side view of Figure 1;

Figure 3 is a top view of Figure 1; and

Figures 4 and 5 show details of the invention.

More specifically, these drawings show an internal combustion engine water-cooled cylinder block casting 1 with a fractured crack 2 through its outer wall and another crack 3 in its top wall between its cylinder and valve openings. These cracks may have resulted from either freezing of the cooling water or by suddenly filling the cooling chambers of the block with cold water when it was very hot from being run dry. In any event, the cracks 2 and 3 are to be considered as of the type that are almost invisible yet which leak either all the time or when the block becomes heated. Since the walls involved are made of cast metal, the opposed faces of the cracks 2 and 3 must exhibit the crystalline appearance common to fractured cast metal and have the irregularities common to such fractures. Both the cracks 2 and 3 have solid wall metal 4 and 5, respectively, beyond their ends which functions to space the opposed crack faces distances less than the average heights of these irregularities resulting from the crystalline fracture contours. Here-

2

tofore, it has been practically impossible to fluid-tightly seal cracks of this nature in a permanent manner, and it has been common to scrap such cylinder blocks. It is to be understood that such cracks may be encountered in other metal walls.

According to the present invention, such cracks, as are represented by the cracks 2 and 3, are repaired by forming at least one circular, tapered, screw-threaded hole 6 in the wall containing the crack with more than half the hole on one side of the crack and the remainder of the hole on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces. Then, by screwing a tapered metal screw 7 into this hole sufficiently tightly, the wall portions bounding the crack are laterally displaced to a degree fluid-tightly interwedging the irregularities of the crack faces. In most instances more than one of the holes 6 and screws 7 must be used, this being done by forming at least one other hole, similar to the first described hole, in the wall with more than half this hole on the other side of the crack and the remainder on the side where more than half the first hole is formed with the hole axis of this second hole inclined respecting the planes of the opposed crack faces in a direction opposite to that of the first hole, a similar screw 7 being screwed into this second hole, as previously described, to displace the wall portions as previously described but in opposite directions. In the case of the crack 3 two of the screws 7 are adequate, whereas in the case of a longer crack, such as the crack 2, many more of the screws may need to be used. The screws must be close enough together to adequately perform their function of interwedging the irregularities of the opposed crack faces and they are successively oppositely inclined, as mentioned, to provide what might be called "a knitting effect." The screws 7 may be made of metal having substantially the same coefficient of thermal expansion as the wall metal, although slight differences in these coefficients will not usually cause trouble. Cracks repaired in the manner described have been proven, in actual service, to be permanent for all practical purposes, the repaired cracks usually remaining fluid-tight throughout the service lives of the cracked parts.

The holes 6 are formed, in each instance, by first drilling a smaller hole 8 through the wall portions bounding the crack faces to expose the latter and enable the repairman to determine their plane angularities. This is necessary because external observation of fine cracks, of the nature with which the present invention is concerned,

does not permit accurate determination of the fracture planes. The hole 8 should be large enough to permit visual examination of the fracture planes thus exposed. In each instance, the hole 8 is made by enlarging the hole 7 while correcting the angularity of its axis respecting the crack faces, if this is necessary, so this axis is inclined respecting the crack faces, and it is also tapered and threaded so as to finish it for proper reception of the screw 7. The exact angularity of the axis of the hole respecting the fracture plane requires a certain amount of experience if the maximum sealing action is to be obtained, but any inclination of the hole axis exerts the sealing action to some degree.

In each instance, the screw 7 should be of materially greater length than the thickness of the wall being repaired and its larger diameter should be greater than the larger hole diameter, this permitting proper tightening of the screw 7 in the hole 8 with consequent lateral displacement of the wall portions bounding the crack, as required to produce interwedging of the crack face irregularities. Here again, experience is the best way of determining the exact degree of tightness to which the screw 7 should be turned, but any tightening action functions to produce the desired result to some degree. Care must be taken not to tighten the screw 7 so much as to deform unduly the irregularities which must laterally interwedge to fluid-tightly seal the crack.

Preferably, about two-thirds of the hole 8 is formed on one side of the crack so as to leave but about one-third on the other side of the crack, this being desirable to provide a firm socket for the screw, and the screw 7 should be tapered sufficiently to oppositely cam the wall portions on either side of the crack so as to effect their lateral displacement, without being so extreme a taper as to cause difficulty in the way of the screw being firmly gripped against its lateral displacement by one of the wall portions. In other words, one of the wall portions must function as a socket holding the tapered screw against lateral displacement, and due to the inclination of the hole axis respecting the fractured crack faces, another portion of the screw, necessarily having a different diameter, works against the wall portion on the other side of the crack, so as to exert the necessary laterally displacing forces on the wall portions.

It is to be understood that severely cracked parts, having their cracked faces more widely spaced than described herein, are not adapted to be repaired by the present invention. However, the majority of the cracked cylinder blocks and cylinder heads of automobile engines, for instance, are discarded because of relatively minor cracks which put them completely out of service, but which can be repaired permanently by the present invention.

I claim:

1. A method of fluid-tightly sealing a fractured crack through a metal wall when the opposed crack faces have the irregularities common to fractured metal and are disposed in spaced relation distances less than the average height of these irregularities by sound wall metal beyond the crack, the method comprising forming at least one circular tapered screw-threaded hole in the wall with more than half the hole on one side of the crack and the remainder on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces, and screwing a tapered metal screw into this hole

sufficiently tightly to laterally displace the wall portions bounding the crack to a degree fluid-tightly interwedging the irregularities of the crack faces.

2. A method of fluid-tightly sealing a fractured crack through a metal wall when the opposed crack faces have the irregularities common to fractured metal and are disposed in spaced relation distances less than the average height of these irregularities by sound wall metal beyond the crack, the method comprising forming at least one circular tapered screw-threaded hole in the wall with more than half the hole on one side of the crack and the remainder on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces, and screwing a tapered metal screw into this hole sufficiently tightly to laterally displace the wall portions bounding the crack to a degree fluid-tightly interwedging the irregularities of the crack faces, in conjunction with forming at least one other hole similar to the first named hole in the wall with more than half this hole on the other side of the crack and the remainder on the side where more than half the first named hole is formed but with the hole axis of this hole inclined respecting the planes of the opposed crack faces in a direction opposite that of the first named hole, and screwing a screw similar to the first named screw into this hole as previously described to displace the wall portions as previously described but in opposite directions.

3. A method of fluid-tightly sealing a fractured crack through a metal wall when the opposed crack faces have the irregularities common to fractured metal and are disposed in spaced relation distances less than the average height of these irregularities by sound wall metal beyond the crack, the method comprising forming at least one circular tapered screw-threaded hole in the wall with more than half the hole on one side of the crack and the remainder on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces, and screwing a tapered metal screw into this hole sufficiently tightly to laterally displace the wall portions bounding the crack to a degree fluid-tightly interwedging the irregularities of the crack faces, this screw being made of metal having substantially the same coefficient of thermal expansion as the wall metal.

4. A method of fluid-tightly sealing a fractured crack through a metal wall when the opposed crack faces have the irregularities common to fractured metal and are disposed in spaced relation distances less than the average height of these irregularities by sound wall metal beyond the crack, the method comprising forming at least one circular tapered screw-threaded hole in the wall with more than half the hole on one side of the crack and the remainder on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces, and screwing a tapered metal screw into this hole sufficiently tightly to laterally displace the wall portions bounding the crack to a degree fluid-tightly interwedging the irregularities of the crack faces, the hole being formed by first drilling a smaller hole through the wall portions bounding the opposed crack faces to expose the latter and enable determination of their plane angularities, and then enlarging and finishing this hole while correcting the angularity of its axis respecting the crack faces, if necessary, so that this axis is inclined respecting these faces.

5

5. A method of fluid-tightly sealing a fractured crack through a metal wall when the opposed crack faces have the irregularities common to fractured metal and are disposed in spaced relation distance less than the average height of these irregularities by sound wall metal beyond the crack, the method comprising forming at least one circular tapered screw-threaded hole in the wall with more than half the hole on one side of the crack and the remainder on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces, and screwing a tapered metal screw into this hole sufficiently tightly to laterally displace the wall portions bounding the crack to a degree fluid-tightly interwedging the irregularities of the crack faces, the screw being materially longer than the thickness of the wall and its larger diameter being greater than the larger hole diameter.

6. An article having a metal wall with a fractured crack through it and with the opposed crack faces having the irregularities common to fractured metal and disposed in spaced relation distances less than the average height of these irregularities by sound wall metal beyond the

6

crack, the wall having at least one circular tapered hole formed therethrough with more than half the hole on one side of the crack and the remainder on the other side of the crack and with the hole axis inclined respecting the planes of the opposed crack faces, with a tapered metal screw screwed into this hole and laterally displacing the wall portions bounding the crack to a degree fluid-tightly interwedging the irregularities of the crack faces.

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