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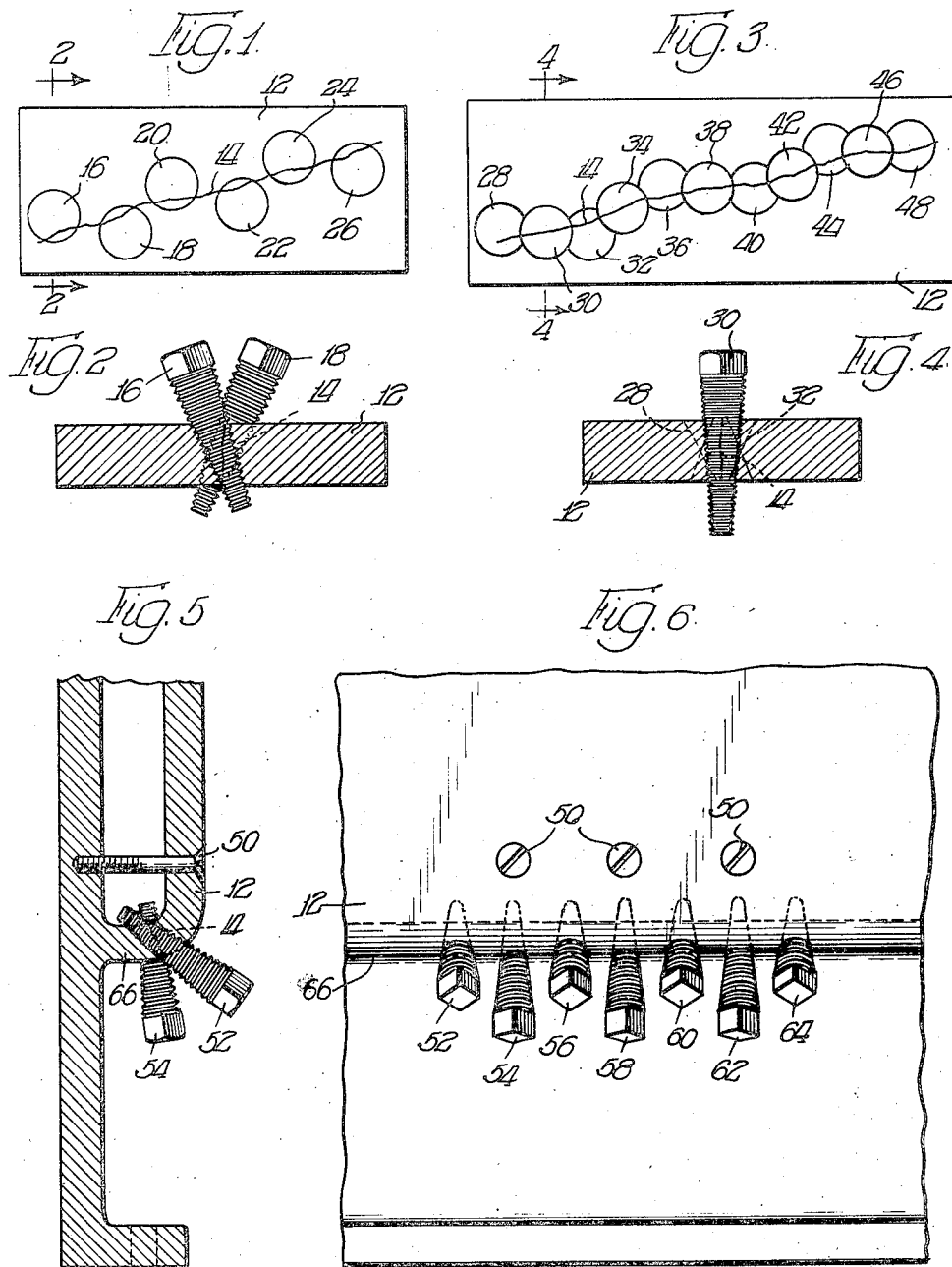
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METHOD OF REPAIRING METAL CASTINGS

Filed Jan. 10, 1948

2 Sheets-Sheet 1



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Fig. 7

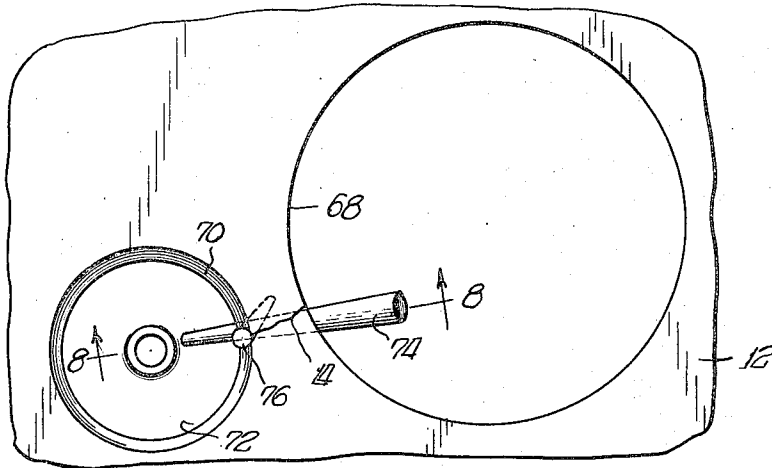


Fig. 8

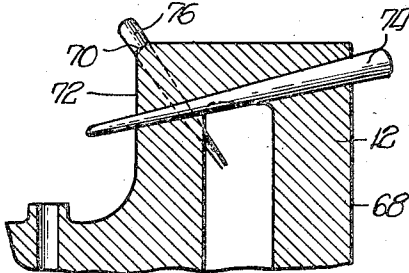


Fig. 9

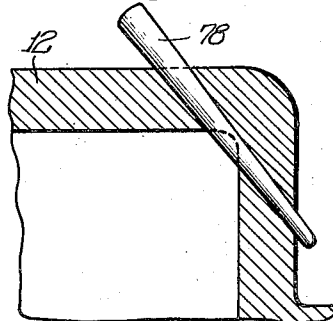
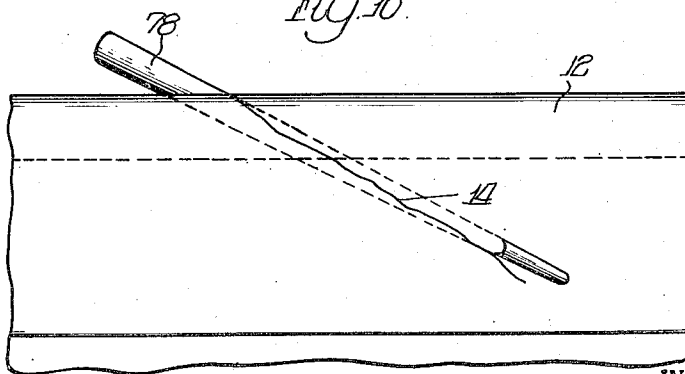


Fig. 10



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UNITED STATES PATENT OFFICE

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METHOD OF REPAIRING METAL CASTINGS

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4 Claims. (Cl. 29—148)

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This invention relates to a new and improved method of repairing metal castings, such as cracked motor blocks, boiler sections and the like.

It is an object of the present invention to provide a method for repairing cracked castings without the use of a sealing compound. The use of such compounds, particularly in engine blocks, has a tendency to clog the cooling system with the result that the engine may run hot causing the crack to open or causing another crack.

Another object is to provide a method of repairing cracked castings wherein the use of heat is eliminated. The use of heat will frequently cause a distortion or warping of the casting. Pre-heating a casting may leave a built-up strain or stress which may crack later when the casting is used.

A further object is to provide a method of repairing cracked castings without putting any strain or stress in the crack while repairing it. This strain or stress may remain in the casting with the result that it may open up when subjected to high temperatures or a wide range of temperatures.

It is another object to provide a method of repairing cracked castings wherein the crack is made rigid so that the casting will expand and contract as one piece rather than two.

It is a further object to provide a method of repairing cracked castings wherein the casting is locked adjacent the crack against expansion and contraction in all directions.

With these and various other objects in view, the invention may consist of certain novel features, as will be fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings, in which like reference characters are used to designate like parts—

Fig. 1 is a top plan view of a cracked casting with tapered screws;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a top plan view of a cracked casting with tapered screws;

Fig. 4 is a cross section taken on the line 4—4 of Fig. 3 showing a tapered screw in position with the positions of the screws on either side of it indicated in broken lines;

Fig. 5 is a fragmentary cross section of a cracked casting showing the tapered screws in position;

Fig. 6 is a side elevation of the casting shown in Fig. 5;

Fig. 7 is a fragmentary plan view of a cracked cylinder block with tapered pins in position;

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Fig. 8 is a sectional view taken on the line 8—8 of Fig. 7;

Fig. 9 is a sectional view of a cracked casting with a tapered pin in position; and

Fig. 10 is an elevational view of the casting shown in Fig. 9 with the position of the tapered pin indicated in broken lines.

In the drawings, the casting 12 has a crack 14. In Fig. 1 the tapered screws 16, 18, 20, 22, 24 and 26 are screwed into tapered threaded openings in the casting. The screws 16 and 18 are shown more clearly in Fig. 2. In repairing a casting, as shown in Figs. 1 and 2, tapered holes are drilled and threaded. The axis of opening 16 starts at one side of the crack 14 and crosses the crack coming out of the casting 12 on the other side of the crack. The axis of adjacent opening 18 starts on the opposite side of the crack from 16 and crosses the crack coming out on the opposite side of the crack from opening 16. These openings are uniformly spaced from each other and extend substantially the length of the crack. Alternate openings such as 16, 20 and 24 start on one side of the crack and 18, 22 and 26 start on the other. The angle and position of these openings is such that the axis of the openings and that of the screws that are subsequently inserted therein cross the crack at a point substantially midway through the casting. No two adjacent openings cross the crack at the same angle. The threads of the screws engage the casting on both sides of the crack all the way through the casting.

The size of the hole and screw may vary, but for longer cracks the hole and screw should be larger. The distance between the openings depends on their size and the spacing should be such that, if necessary, additional holes may be made between them as illustrated in Figs. 3 and 4. The openings 28, 32, 36, 40, 44 and 48 are drilled in the same manner as described in connection with openings 16 to 26 in Fig. 1. In Fig. 3, the openings 30, 34, 38, 42 and 46 are drilled and tapped after the tapered screws have been inserted in openings 28, 32, 36, 40, 44 and 48 and the openings 30, 34, 38, 42 and 46 are drilled into the crack 14, substantially in the center of it, and overlap each of the adjacent screws. Care should be taken in drilling holes 28, 32, 36, 40 and 48 so that they are not drilled straight with the crack, as unnecessary spreading of the crack may result when the tapered screws are inserted. If a tapered screw is first inserted straight into the crack, it will tend to spread it or put a strain into it so that it may spread when put into use.

Referring to Figs. 1 and 2, tapered screw 16 is

screwed tightly into the casting at an angle and crossing the crack 14; this will exert a downward pressure on the casting on the left side of the crack as viewed in Fig. 2, the upper side in Fig. 1. It will exert an upward pressure on the right side of the crack Fig. 2, the lower side Fig. 1. Screw 18 will exert pressures in the opposite directions and screw 20 will be the same as 16. As each of the subsequent screws are inserted and evenly tightened, they produce a binding action against each other and lock the crack without spreading it and leave no strain in the casting.

When the screws are inserted in the holes they should be evenly tightened as much as possible without stripping or damaging the threads in the casting or on the screws. After the screws have been initially tightened as described, the casting is vibrated adjacent the crack with a heavy corking tool. This vibration will bring out any slack in the crack, and it is important that the whole area of the crack be vibrated.

In vibrating the casting, the corking tool should be about one-half inch from the crack and the casting on both sides of the crack should be vibrated evenly. The screws are then tightened a second time in the manner previously described, after which the vibrating is continued with the corking tool closer to the crack with each step. When further vibration no longer enables the screws to be tightened, it is because the casting adjacent the crack has become rigid. The last step of the vibrating should be done with the corking tool on the crack, as the corking around the screws and the crack will tend to seal the crack. This completes the repair and the outer projecting ends of the screws may be ground flush with the surface of the casting.

It is desirable that the screws should have expansion and contraction characteristics similar to that of the casting, although it has been found that any relatively soft metal will make a successful repair. It is necessary that the screws go all the way through the casting, and they should have sufficient taper to start a binding action against adjacent screws before too much of the screw has passed through the casting. Care should be taken that the portion of the screw projecting from the inner side of the casting does not strike any obstacles that will stop it, as this will cause a failure of the repair.

After the crack has been made rigid and the outer ends of the screws have been ground down even with the casting, as previously described, it may be found that the crack was originally opened up too much to be closed by corking between the screws. As shown in Figs. 3 and 4 openings 30, 34, 38, 42 and 46 are drilled between the screws 28, 32, 36, 40, 44 and 48 which were inserted in the manner described in connection with Figs. 1 and 2. These holes extend into each of the adjacent screws. While these holes are centrally disposed with respect to the crack, the screws are not tightened sufficiently to put any strain on the casting, and the casting is not vibrated at this time.

Figs. 5 and 6 show a portion of an engine water jacket having a crack at the bottom. If such a crack was caused by freezing the water, the casting will undoubtedly have been forced outwardly and it is, therefore, necessary to bring the casting back to its original shape. This may be done by exerting pressure on the casting such as by placing a chain around the engine block with a jack between the chain and casting. The casting should be vibrated as the sides of the crack

are being forced back into alignment, so that the crevices of the crack will be in approximately their original position. While pressure is maintained, holes are drilled and anchor screws 50 are inserted through the casting and secured to the inner wall of the water jacket. The anchor screws are evenly spaced and extend the length of the crack. They are also spaced from the crack sufficiently for the insertion of tapered screws 52 to 64. The holes for these screws are drilled and tapped in the same manner as described in connection with Figs. 1 and 2, and the casting is vibrated and the screws tightened as described. The tapered screws are spaced as described, and the anchor screws are so spaced that alternate tapered screws are opposite anchor screws.

Tapered screws 52, 56, 60 and 64 should be inserted before 54, 58 and 62, as they produce a binding action against the supported side of the casting 66 and push up on the weak side so that no strain is put on the anchor screws 50. If tapered screw 54 were inserted first, it would put a strain on the anchor screws 50 and would tend to open the crack.

Figs. 7 and 8 show a crack 14 which extends from the cylinder 68 to the valve seat 70 and down into the valve port 72. In repairing this crack, a tapered hole is drilled in the cylinder wall 68 at one side of the crack. This hole crosses the crack and comes out on the other side of it in the valve port 72. Care should be taken that the hole is not drilled in the crack and that it does not follow the crack. The hole is then machined to a perfect taper corresponding to the tapered pin 74.

The tapered pin is driven into the hole as tightly as possible and the casting is vibrated in the manner previously described. The pin is then driven again. These steps are repeated until the pin can be driven no farther. A hole is then drilled to accommodate locking pin 76. This hole is drilled in the crack, but goes at an angle into the solid metal of the casting and partly into the pin 74. The lock pin 76 is driven into the hole locking the pin 74. The protruding portions of the pins are then ground off. The ends of the pin 74 are in solid metal effecting a seal and also making the casting rigid adjacent the crack. Pin 74 acts to prevent any working of the crack in a vertical direction, whereas the locking pin 76 prevents horizontal movement. The pin 76 also effects a repair of the valve seat 70.

Figs. 9 and 10 show a crack 14 which runs over a bend in the casting. The tapered pin 78 is installed in the same manner as pin 74 in Figs. 7 and 8. In cracks of this type, both ends of the pin 78 are subjected to substantially the same conditions and a lock pin such as 76, shown in Figs. 7 and 8, is not necessary as there is not the pressure that is found in a cylinder or valve seat.

In cracks of the type shown in Figs. 7 to 10 where the metal has become crystallized or brittle from electric welding or other causes, a successful repair can, nevertheless, be made by inserting a tapered pin to the side of the weld and going under the weld to cross the crack and coming out on the other side of the weld, the pin being inserted as heretofore described.

It is to be understood that this invention is not to be limited by the exact disclosure of the method shown, which is merely by way of illustration and not limitation, as various other ways

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of practicing the method will be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

I claim:

1. A method of repairing cracks in metal castings consisting of forming threaded tapered holes through the casting, said holes being evenly spaced from each other and having their axes starting at one side of the crack, passing through the casting and coming out on the opposite side of the crack, adjacent holes having their axes starting on opposite sides of the crack, screwing tapered screws into the holes, said screws extending through the casting, tightening said screws evenly, vibrating the casting adjacent the crack, repeating the tightening and vibrating until the screws can be tightened no farther, grinding off the excess portions of the screws on the outside of the casting, forming threaded tapered holes in the crack between said first named screws, said holes extending partly into adjacent screws and screwing tapered screws into said last named holes.

2. A method of repairing cracks in metal castings where the casting has been forced outwardly on one side of the crack consisting of exerting pressure on the outwardly forced portion of the casting and vibrating it until the casting is brought into its original alignment, drilling spaced holes along the crack and spaced from it in the outwardly forced portion of the casting, inserting anchor bolts in said openings and anchoring said bolts to another portion of said casting, drilling and threading tapered holes through the casting, the axes of alternate holes starting on the same side of said crack and terminating on the opposite side, alternate holes being in alignment with said anchor bolts, inserting tapered screws in the holes having their axes starting on the side of the crack formerly forced outwardly, tightening said screws evenly, vibrating the casting adjacent the crack and further tightening said screws, inserting screws in the other holes, tightening said screws evenly,

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vibrating the casting adjacent the crack and further tightening the screws.

3. A method of repairing cracks in metal castings consisting of forming a tapered hole through the casting, said hole having its axis starting on one side of said crack and terminating on the other side, inserting a tapered pin in said hole, the inner end of said pin extending through the casting, vibrating said casting adjacent the crack, driving said pin into the hole, repeating said vibrating and driving until the pin will not move farther into the hole, forming a second tapered hole through said casting, said hole starting in the crack and angling off through solid metal, a portion of said hole intersecting a portion of said first named pin and inserting a second tapered pin in said last named tapered hole.

4. A method of repairing cracks in metal castings consisting of forming a tapered hole in said casting, the axis of said hole starting at one side of said crack and terminating on the other side, said hole crossing said crack at substantially midway through the thickness of the casting, inserting a tapered member in said hole, said member extending through said casting, vibrating said casting adjacent the crack, inserting said member farther into said hole and repeating said vibrating and inserting until said member can be moved no farther into said hole.

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