Feb. 7, 1950 W. B. HOOK 2,496,292

METHOD OF SECURING A SEMICYLINDRICAL LINER IN A PUMP BORE

Filed Dec. 5, 1945 3 Sheets-Sheet 1

FIG. 1.

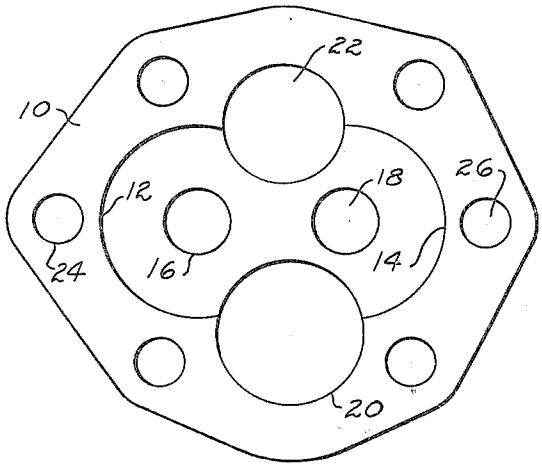


FIG. 2.

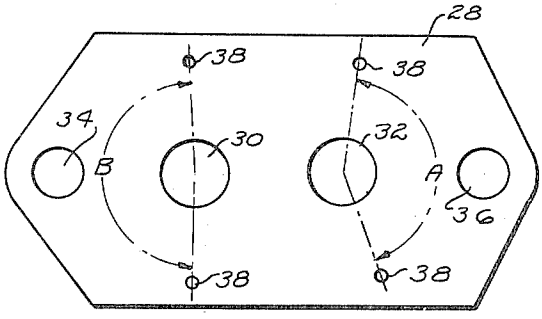
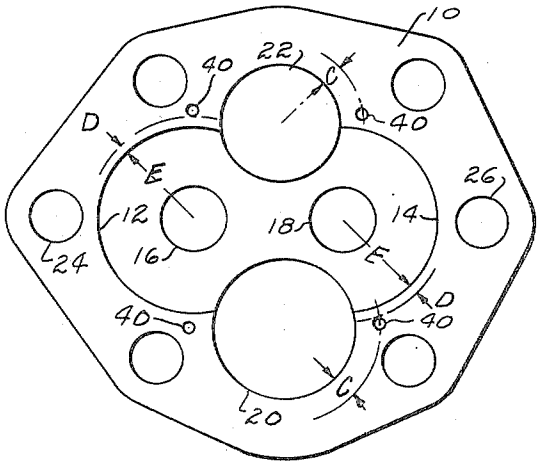


FIG. 3.



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Filed Dec. 5, 1945 3 Sheets-Sheet 2

FIG. 5.

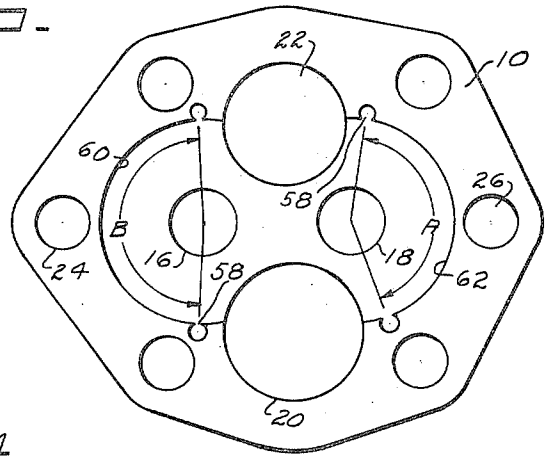


FIG. 4.

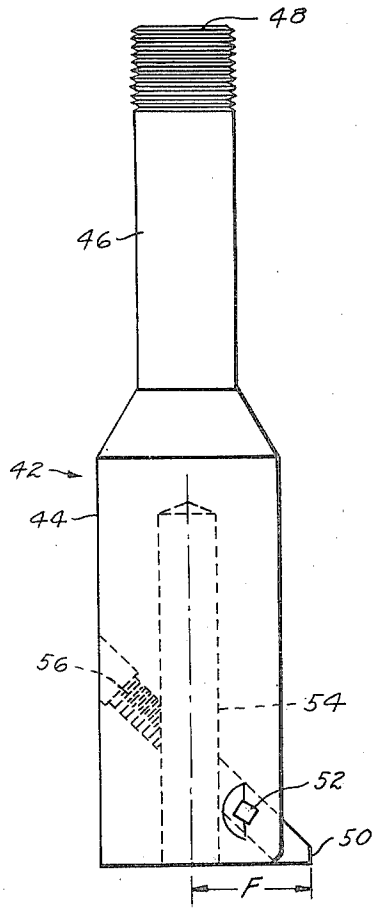
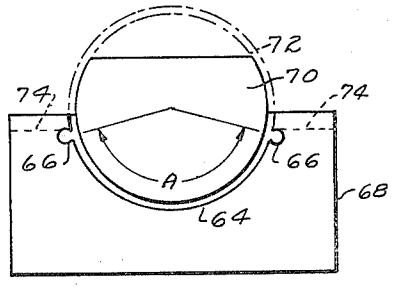


FIG. 6.



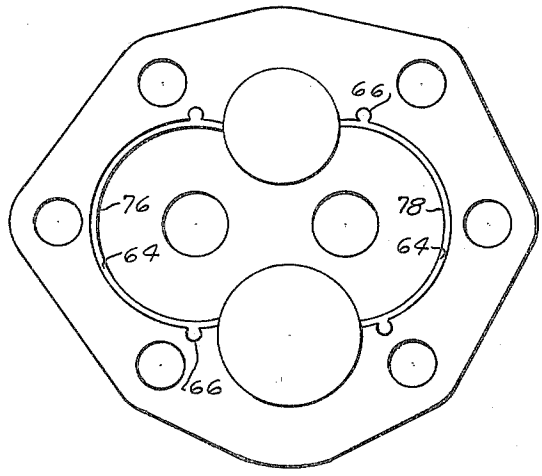
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Filed Dec. 5, 1945 3 Sheets-Sheet 3

FIG. 8



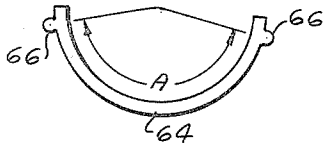


FIG. 7

FIG. 10

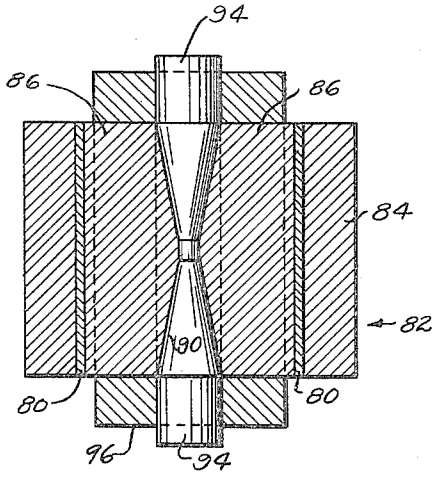
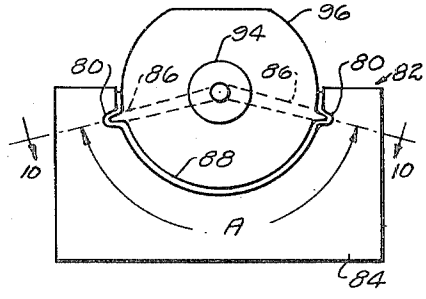


FIG. 9



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METHOD OF SECURING A SEMICYLINDRICAL LINER IN A PUMP BORE

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4 Claims. (Cl. 29—156.4)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

1

The invention described herein may be manufactured and used by or for the Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a method and means for reworking a pump of the gear or root type in which the bore has become scored or otherwise damaged. It is particularly applicable where one or more liners of less than a complete circumference are to be securely attached to the inner periphery of the bore.

Prior to this invention pumps of the above type, the bore of which had become worn, scored, corroded or mutilated, or for any reason had too great clearance between the rotating part and the bore, were discarded, resulting in a great loss where a large number of the pumps are used.

It is therefore an object of this invention to provide a method of procedure and the necessary means to rework and reline the pump cylinders and bring them back to their original dimensions, to the end that interchangeability of the bores and rotating elements may be maintained.

Another object is to provide a method and means whereby a semicylindrical liner of somewhat more or less than a half circumference may be securely attached to the inner periphery of a rebored pump body, the liner being then rebored to standard dimensions.

Other objects and advantages will become evident as the invention is described in detail and reference is had to the drawing, wherein

Fig. 1 is a plan view of a gear pump body showing the bore as it appears before it is reworked.

Fig. 2 shows a plate jig for locating certain holes, the drilling of which constitute the first step in my method.

Fig. 3 is a plan view of the pump body showing the holes which have been drilled with the aid of the jig, Fig. 2.

Fig. 4 is an elevational view of a boring tool employed in performing the second step of my method which changes the pump body from the condition shown in Fig. 3 to the condition shown in Fig. 5.

Fig. 5 is a plan view of the pump body after being bored to a larger diameter by means of the tool shown in Fig. 4 so as to receive a liner.

Fig. 6 is a locating fixture used in placing keys which are attached to the outside of the liner.

Fig. 7 is an end view of a liner after the keys have been attached thereto.

Fig. 8 is a plan view of a pump body after it has been reworked by my method.

Fig. 9 is an end view of a forming die whereby

2

the liner keys may be formed as an integral part of the liner.

Fig. 10 is an axial section of the forming die taken at 10—10 of Fig. 9.

Like reference characters refer to like parts throughout the several views.

Referring to Fig. 1, a pump body 10 is bored at 12 and 14, the bored portion being respectively slightly over and slightly under a semi-circumference. A shaft 16 for rotating the drive gear of the pump and a stud 18 upon which the idler gear may rotate, extend upward concentrically with the bored portions. Suction and discharge openings 20 and 22 extend axially through the body 10 and interrupt the continuity of the bored portions 12 and 14 of the body. Cover bolt holes 24, 26, etc., are provided for attaching the end cover. Let it be assumed that bored portions 12 and 14 of the body 10 have become roughened or scored or otherwise rendered unfit for holding pressure between the ends of the gear teeth and the bored surfaces.

The drill jig shown in Fig. 2 consists of a relatively thin plate 28 having two holes 30 and 32 which are spaced the same distance apart as the shaft 16 and stud 18 in Fig. 1 and are slidably fitted thereover. Holes 34 and 36 in the jig align with holes 24 and 26 in the body, whereby the jig may be bolted to the body through these holes.

The angles A and B between drill guide holes 38 of the jig are so selected that the centers of the drilled holes 40 shown in Fig. 3 will be set back a reasonable distance C from the perimeters of the suction and discharge openings 20 and 22 and with the perimeters of holes 38 of the jig a distance D, Fig. 3, from the perimeters of the bored surfaces 12 and 14. The dimension E, Fig. 3, represents the desired finished bore of the pump, and the dimension D represents the finished thickness of the liners which are to be secured to the surfaces of the bored portions 12 and 14. The axial depth of the holes 40 should be equal to the axial depth of these bored portions. The liner which is to be inserted will be enough thicker than the dimension D to allow for a finish cut after the liner is secured in the pump body.

Fig. 4 shows a boring tool 42 which is employed for removing metal equal to the thickness D from the surfaces 12 and 14. The tool comprises a body 44 and shank 46 with appropriate threaded portion 48 for holding the tool in the spindle of a machine. The bit 50 is held in an angular opening by the set screw 52. The bore 54 of the bit should fit slidably over the shaft 16 and stud 18 of the pump body and the radius F of the bit

should equal the dimension D plus the radius E of Fig. 3. A threaded opening 56 may be provided with a set screw (not shown) for setting the bit to the proper radius F, but this set screw must be removed to permit the bore 54 to pass over the shaft 16 and stud 18.

The tool 42 having been provided, the body 10 and the tool are secured in any appropriate machine which will impart relative rotation between the tool and the body, it being of course important that when the cut is being taken from the surface 12, the axis of the tool and that of the shaft 16 be coincident, and that when the cut is being taken from the surface 14, the axis of the tool and that of the stud 18 be coincident. If these conditions prevail, it is unimportant whether it is the body 10 or the tool 42 which revolves.

When the layer D has been removed from both the surface 12 and the surface 14, Fig. 3, and the wall between the bore and the small holes thus broken through and the sharp corners 58 which result where the rebored surfaces 60 and 62 cut into the holes 40 have been removed the body will appear as in Fig. 5 and be ready to have the liner 64, Fig. 6 secured in place over the surface 62. A similar liner will be provided by means of a fixture differing from the fixture 68, Fig. 6, only in that it will have the keys spaced to the angle B, Fig. 2, instead of to the angle A.

In order to securely hold the liner in position against the surfaces 60 and 62, the liners are provided with round keys 66, Fig. 6, the keys being silver soldered or similarly secured to the liners while they are held in the locating fixture 68.

The liners 64, Fig. 6, may be formed from flat sheet stock bent to semicylindrical shape, as shown, and held in the fixture 68 by a plug 70 while the keys are soldered thereto, or they may consist of a length of tubing as at 72, the surplus portion of which may be cut off and discarded, or in the case of the surface 62, Fig. 5, where the angular measurement A is considerably less than 180 degrees, one length of tubing will provide two liners 64. To facilitate soldering, the fixture 68, intermediate the ends, may be cut away as at 74.

When the assembly of liner and keys is removed from the fixture 68, Fig. 6, it will appear as in Fig. 7. This assembly is now press fitted into a pump body which has been prepared as in Fig. 5 to cover the surface 62 and a like liner assembly with angular spacing B will be pressed into the body over the surface 60, whereupon the body will appear as in Fig. 8. A light finish cut will now be taken off the surfaces 76 and 78, Fig. 8, with a tool similar to the tool 42, Fig. 4, and the reworked pump body will be complete.

To clarify the terminology herein, whenever the "ends" of the bore or of the liner are mentioned, it shall be taken to mean their termination in an axial direction, and when the "edges" of the bore or of the liner are mentioned, it shall be taken to mean their termination in a circumferential direction.

As an alternative to soldering round keys 66 to the outer surfaces of the liners, keys 80, Fig. 9, may be formed integral with the liners by employing a forming die 82. Die 82 consists of a die block 84 having angularly spaced axially extending grooves for the keys 80 with forming punches 86 for pressing the metal of the liner 80 into the grooves to form the keys 80. The forming punches consist of blades 86 having their inner edges 90 beveled, tapered plugs 94 being provided for forcing the blades outwardly to form the keys. The blades 86 are kept in position and guided in slots in a larger cylindrical plug 96 having an axial opening equal to the body of the small plugs 94.

Having described my method, I claim:

1. Steps in the method of securing a liner in a pump body having a bore of less than a full circumference which consists of drilling a series of small axially parallel holes back from the edges of the bore and with their perimeters at a distance from the perimeter of the original pump bore equal to the finished thickness of the liner, enlarging the pump bore until the perimeter of the bore cuts through into the perimeters of the small holes, burring the sharp corners where the bore cuts through into the small holes, securing a series of round pins to the outer surface of the liner back from the edges of the liner with their axes parallel to the axis of the liner and angularly spaced a distance equal to the angular spacing of said small holes, pressing the liner axially into the enlarged bore with the pins in said small holes, then boring the liner to the diameter of the original pump bore.

2. Steps in the method of fastening an arcuate section of a cylindrical liner into an arcuate portion of a cylindrical bore which consists of drilling a pair of circumferentially spaced small holes back from the edges of said arcuate portion and positioned radially to leave a wall between the perimeter of the bore and the perimeters of the small holes, enlarging the bore until its perimeter extends into said small holes, burring the corners where the perimeter of the bore cuts the perimeter of the small holes, securing a pair of axially parallel keys to the exterior of the liner back from the edges thereof and circumferentially spaced to conform to the circumferential spacing of said small holes, pressing the liner and keys axially into the bore and small holes respectively, then taking a light cut from the inside surface of the liner.

3. Steps in the method of fastening an arcuate section of a cylindrical liner into an arcuate section of a cylindrical bore, the liner and bore each comprising less than a full circumference, which consists of drilling a pair of axially parallel holes radially beyond the bore, one back from each edge of the arcuate section of said bore, enlarging the bore until it joins said holes, providing rounded keys on said liner back from the edges of the arcuate section of the liner and angularly spaced to correspond to said holes, and pressing said arcuate liner and its keys axially into said arcuate bore and said holes.

4. Steps in the method of securing a liner which is in the form of an arcuate section of a cylinder with circumferentially spaced axially parallel keys on the outside, one back from each edge of said section, to the inside of an arcuate section of a bore, which consists of drilling circumferentially spaced axially parallel holes corresponding to said keys near but not touching the section of the bore, enlarging the bore section until it merges with said holes, burring the corners at the juncture of said bore section and said holes, then pressing said liner and its keys axially into said bore section and its holes.

WESLEY B. HOOK.

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