United States Patent [19]

Freiheit

[11] **3,736,640**

[45] **June 5, 1973**

[54] **METHOD OF FORMING A METAL VALVE SEAT**

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[73] Assignee: **FMC Corporation,** San Jose, Calif.

[22] Filed: **Dec. 15, 1970**

[21] Appl. No.: **98,221**

[52] **U.S. Cl.**.....**29/157.1 R,** 29/156.7 A, 251/365

[51] **Int. Cl.**.....**B21k 1/20,** B21k 29/00

[58] **Field of Search**.....29/157.1, 156.7, 29/156.7 A; 251/365

[56] **References Cited**

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Primary Examiner—Charles W. Lanham
Assistant Examiner—D. C. Reiley, III
Attorney—F. W. Anderson, C. E. Tripp and A. J. Moore

[57] **ABSTRACT**

A metal valve seat and method of forming the same which includes providing an annulus having a thick annular body and a thin neck defining a sealing end of the body. After the annulus has been mounted in the valve body, a ball is placed on the neck and an impact force is applied to the ball thereby deforming the neck and forming an annular concave sealing surface which conforms to the contacted curvature of the ball.

6 Claims, 5 Drawing Figures

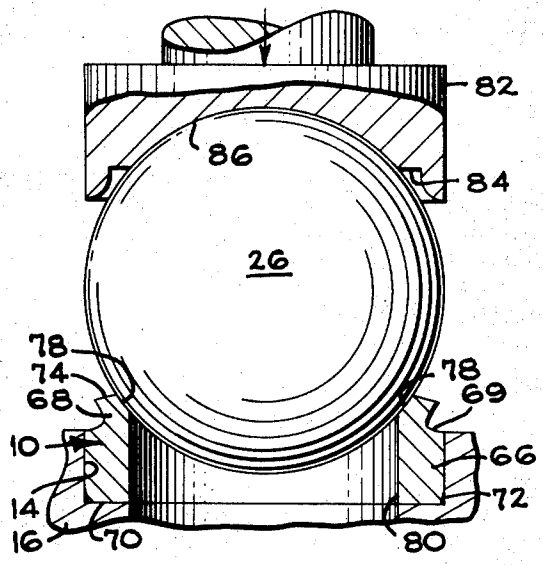


FIG_1

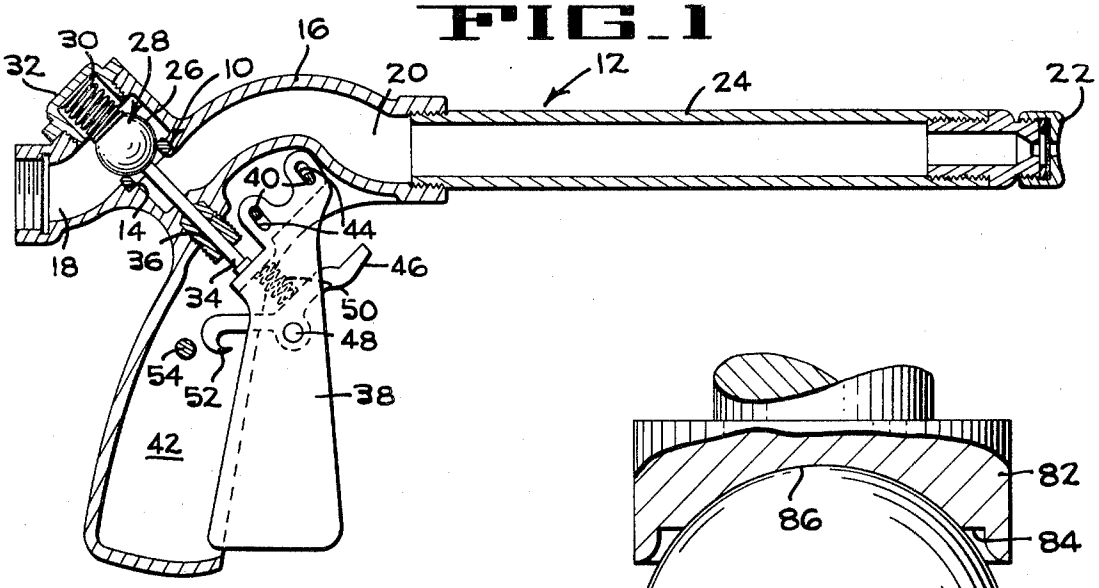
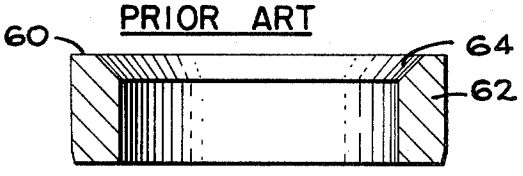


FIG_2
PRIOR ART



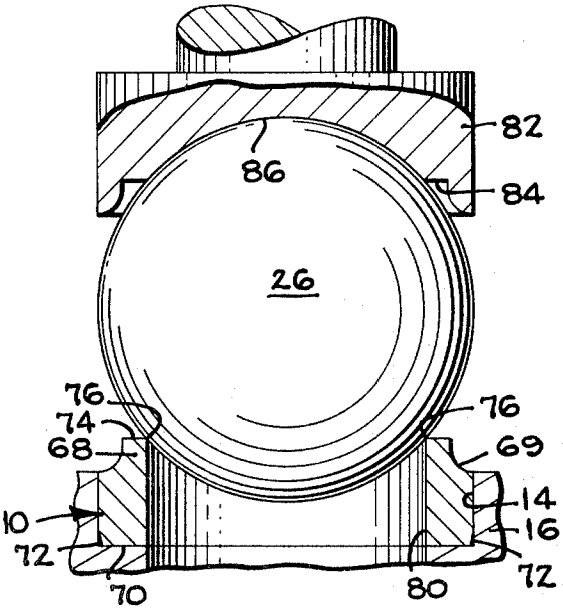


FIG_3

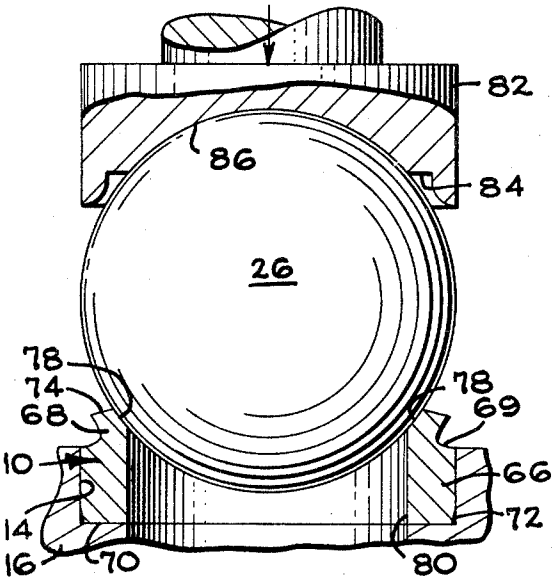
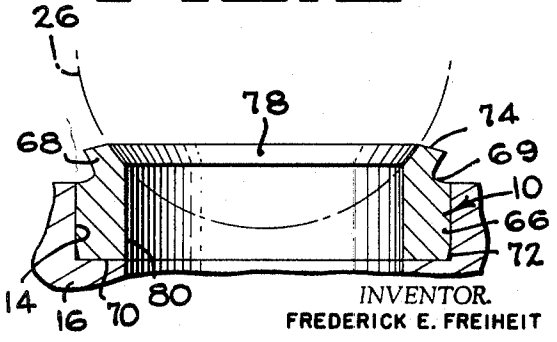


FIG_4

FIG_5



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METHOD OF FORMING A METAL VALVE SEAT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to the valve art and more particularly relates to an improved valve seat for a ball valve and method of making the same.

2. Description of Prior Art

A valve seat for a ball valve of the type disclosed herein is illustrated in U.S. Pat. No. 2,362,946 which issued to H.C. Stockdale on Nov. 14, 1944 and is assigned to the assignee's predecessor corporation. This prior art valve seat was used in a spray gun handling abrasive spray fluids, and accordingly, is made from hard abrasive resisting material such as stainless steel which is difficult to machine. Because of this difficulty in accurately machining the hard material, and because of the damage which frequently resulted when pressing the valve seat into the valve body after the machining operation was completed, leakage frequently occurred between the ball and the valve seat of this prior art device.

SUMMARY OF THE INVENTION

A leak-proof seal is formed between a sealing ball and the metal valve seat of the present invention by forming a relatively thin neck on the valve seat at the sealing end thereof. An annular concave seal is formed on the inner edge of the sealing end of the neck, after the valve seat has first been fitted in fluid tight engagement in the body of the valve, by applying an impact force to the neck with a ball which is the same size as the sealing ball.

An object of the invention is to provide an improved valve seat having an annular concave sealing surface.

Another object is to provide an improved method of forming an annular concave sealing surface in a metal valve seat.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a central vertical section through a spray gun employing the valve seat of the present invention.

FIG. 2 is an enlarged vertical central section through a prior art valve seat.

FIG. 3 is an enlarged vertical section of the valve seat of the present invention illustrating the seat after it has been pressed into the body of the valve but prior to having an impact force applied thereto by a seat forming ball.

FIG. 4 is a section similar to FIG. 3 but illustrating the valve seat after an impact force has been applied thereto.

FIG. 5 is a vertical central section through the completed ball valve seat, the location of the sealing ball being shown in phantom lines when in the sealing position.

DESCRIPTION OF PREFERRED EMBODIMENT

The valve seat **10** (FIGS. **1** and **3–5**) of the present invention is illustrated as being seated in a spray gun **12** of conventional design. The valve seat **10** is pressed into a bore **14** in the housing or body **16** of the spray gun **12** to provide a fluid tight seal between the outer walls of the valve seat and the housing **16.** The housing **16** includes an inlet passage **18** (FIG. **1**) connected to a supply of fluid under high pressure, and a discharge passage **20.** A spray nozzle **22** of conventional design

is connected to the discharge passage of the housing **16** by a tube **24.**

The valve seat **10** cooperates with a sealing ball **26** to define a ball valve **28.** A spring **30** is disposed between the ball **26** and a cap **32** screwed into the housing and normally urges the ball **26** into sealing engagement with the valve seat **10.** A valve stem **34** is slidably received in a packing gland **36** and has one end abutting the sealing ball **26** and the other end contacting a trigger **38.** The trigger **38** is mounted for swinging movement by two pins **40** secured to a hollow handle **42** of the housing **16** and passing through slots **44** in the trigger. A hooked latch arm **46** is pivoted about a pin **48** secured to the trigger and is urged in a clockwise direction by a spring **50.** If it is desired to latch the sealing ball **26** in an open position, the operator merely pulls the trigger **38** back and pivots the latch arm **47** counterclockwise so that the hooked end **52** of the latch arm **46** will engage a pin **54** in the handle **42** when the trigger **38** is allowed to move a short distance forward.

A valve seat **60** of the type used in the prior art is illustrated in FIG. **2** and includes an annulus **62** having its inner sealing edge machined to form a generally frusto-conical valve seta **64.** It was determined that such a sealing surface was subject to leakage as machined because it could not be held to close tolerances. It was also determined that after attempts were made to conform the frusto-conical sealing surface to the shape of its sealing ball by applying impact forces to the ball, that such attempts were ineffective to provide a leak-proof seal. It is believed that the stiffness of the thick upper portion of the prior art valve seat **60** prevented the annulus **62** from deforming sufficiently to conform to the curvature of the associated sealing ball.

In accordance with the present invention, the annular valve seat **10** (FIGS. **3** to **5**) includes a thick base **66** formed integrally with a neck **68** having a wall thickness approximately one-half that of the base **66.** The neck **68** is flared into the wide base **66** by an annular arcuately curved outer surface **69.** The base **66** includes a seating end **70** which may have its outer edge **72** chamfered, and the neck includes a sealing end **74** having an internal circumferential edge **76** which, prior to forming a sealing surface **78** thereon, is equal in diameter to the bore **80** through the valve seat **10.**

Prior to forming the circumferential edge **76** (FIG. **3**) into the annular concave sealing surface **78** (FIGS. **4** and **5**), the valve seat **10** is preferably press fitted into the bore **14** of the housing **16.** Any suitable tool may be used for this purpose. For example, a fluid operated pressure applying head **82** may be used, which head has surfaces **84** adjacent its periphery that conform in shape to the sealing end **74** of the valve seat **10.** Thus, the head **82** is lowered until the surface **84** engages the sealing end **74** of the valve seat and then applies sufficient force to move the valve seat **10** to the position indicated in FIG. **3** wherein a fluid tight relationship exists between the thick base **66** and the bore **14** of the gun housing **16.**

After the valve seat **10** has been seated in the housing **16,** the pressure applying head **82** is raised and a ball **26** is placed on the circumferential edge **76.** A curved surface **86** of the pressure applying head **82** is then rapidly moved against the ball **26** to impart an impact force to the ball and consequently to the edge **76** thus partially bending the neck and partially deforming the metal edge **76** by cold forging to conform to the shape

of the contacted portion of the ball as indicated in FIGS. **4** and **5** forming the annular concave sealing surface **78**.

Although the sealing ball **26** has been illustrated as being used both for the sealing function and the seat forming function, it will be understood that a separate seat forming ball or tool having a spherical segment which is identical in diameter to the sealing ball **26** is preferably used to form the sealing surfaces **78** on many valve seats. It will also be understood that in the claims, the term metal ball for forming the concave sealing surface is to be construed as being broad enough to cover any tool having a spherical segment formed thereon which has a diameter at its seat contacting surface equal to that of the sealing ball **26**.

It will also be understood that the valve seats may be pressed into the spray gun housings as above described, and that the impact force may be applied to the ball by another tool at a later time such as by a hand operated hammer. Thus, a purchaser of the spray gun may reface defective or worn sealing surfaces at any time by merely removing the cap **32** (FIG. **4**) from the gun and applying an impact force to the ball **26** by means of a hammer with the aid of a punch or the like. It will further be understood that the use of the valve seat is not intended to be limited to use only in spray guns but may also be used in other types of valve housings.

From the foregoing description it will be apparent that the metal valve seat of the present invention and the method of making the same contemplates reducing the thickness of a portion of the valve seat and, after first mounting the seat in its valve housing, applying an impact force of sufficient strength to the seat with a ball identical in size to the sealing ball used in the valve assembly so as to partially bend and partially deform the metal to form an annular concave valve seat.

Although the best mode contemplated for carrying out the present invention has been herein shown and described, it will be apparent that modification and variation may be made without departing from what is regarded to be the subject matter of the invention.

What I claim is:

1. A method of forming a metal valve seat for a ball valve comprising the steps of forming an annulus having a seating end and a sealing end, reducing the thickness of the annulus at the sealing end, placing a metal ball against the inner surface of the annulus at the sealing end, and applying a force to the ball normally of the plane of said sealing end sufficient to deform the reduced thickness portion of the annulus to provide a sealing surface conforming in shape to that of the contacted surface of the ball.

2. A method according to claim **1** and additionally comprising the step of mounting the seating end of the annulus in fluid tight relation with a valve body prior to deforming the seating end thereof.

3. A method according to claim **2** wherein the mounting of the annulus is performed by a press fitting operation.

4. A method according to claim **1** wherein the deforming force applied to the ball is an impact force which partially bends and partially cold forges the sealing surface.

5. A method according to claim **1** wherein the thickness of the sealing end is reduced by reducing the outside diameter of the annulus of the sealing end thereof.

6. A method according to claim **2** wherein the reduction in the diameter provides an annular neck adjacent the sealing end of the annulus which is approximately one-half as thick as the body of the annulus.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,736,640 Dated June 5, 1973

Inventor(s) FREDERICK E. FREIHEIT

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 2, line 17, change "47" to --46--.
Col. 2, line 24, change "seta" to --seat--.

Signed and sealed this 4th day of February 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents