

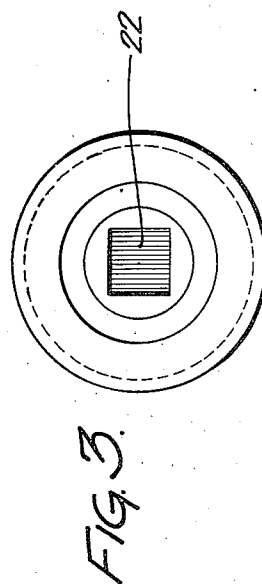
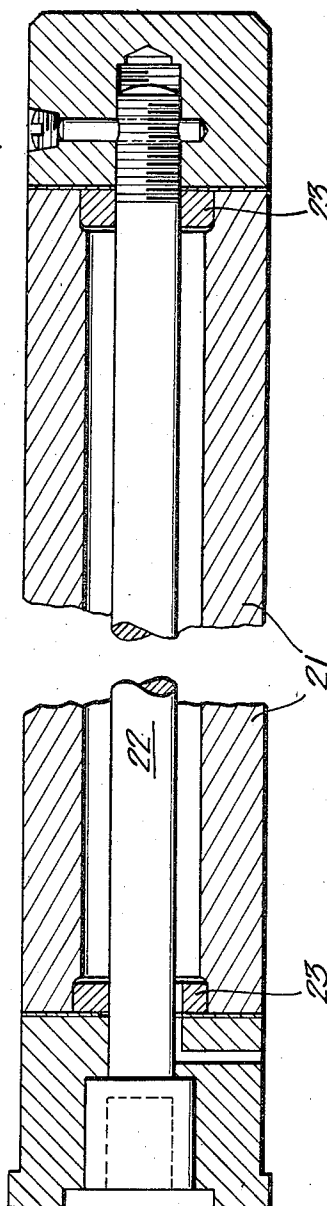
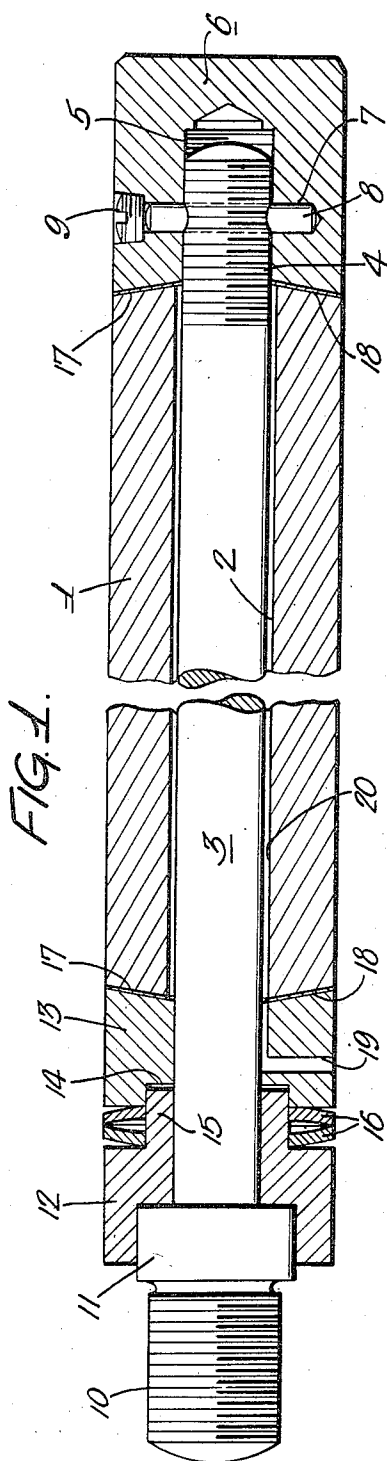
Dec. 31, 1946.

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2,413,347

PISTON CONSTRUCTION

Filed Feb. 8, 1945



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UNITED STATES PATENT OFFICE

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PISTON CONSTRUCTION

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Application February 8, 1945, Serial No. 576,774

3 Claims. (Cl. 309-4)

1 The invention relates to improvements in reciprocating pumps, and a principal object of the invention is to provide a pump capable, without damage, of handling acid and corrosive fluids under high heat and pressure conditions.

Heretofore, it has been conventional practice to employ metallic pistons in reciprocating pumps developing high pressures at elevated temperatures. Where the pump was required to handle acid and corrosive fluids, however, it has been necessary to employ pistons of rubber or china, and such pistons, while resisting corrosion, are not suitable for handling materials at high temperatures or at high pressures.

A further and primary object of the invention, therefore, is to extend the pumping art by providing a reciprocating pump capable of pumping hot and corrosive fluids at high pressures.

The invention further resides in certain structural details and arrangements hereinafter described and illustrated in the attached drawing wherein:

Figure 1 is a longitudinal sectional view of a pump piston made in accordance with the invention;

Figure 2 is a corresponding view illustrating a modification within the scope of the invention, and

Figure 3 is an end view of the piston illustrated in Figure 2.

To the aforesaid ends the invention contemplates a piston whereof the cylindrical body is composed of mullite, which may be made by inverting sillimanite, kyanite, or other aluminum silicate in known manner. We have discovered that fabricated mullite, by reason of its low coefficient of expansion, its strength and high shock resistance, and its inertness to commercial acid and acidulous liquids even at elevated temperatures, is well adapted for use in pump pistons and when so used is productive of a pump having novel and highly useful characteristics. It is possible, for example, when using mullite for this purpose, to grind the mullite body to close tolerance with the pump cylinder without danger of the piston sticking or binding in the cylinder when the pump is operated at high temperatures. High pumping efficiency is thus obtainable, together with the ability to operate the pump under relatively high temperature conditions. The strength of the fabricated mullite and its high resistance to shock permits its use under high pumping pressures without danger of fracture and resultant damage to the equipment. Since mullite is substantially inert to commercial acid

2 and acidulous liquids and resists corrosion from these sources, even at elevated temperatures, it is possible to use a piston built in accordance with this invention to pump hot acid solutions at elevated temperatures. Pumps made in accordance with the invention may be employed therefore, to bring about certain special chemical reactions and to develop a new line of products which heretofore have been unobtainable with the pumps as previously constituted.

With reference to Figure 1 of the drawing, a piston made in accordance with the invention may comprise a cylindrical body portion **1** of mullite, said body portion having a longitudinal bore **2** for reception of a through bolt **3**, the diameter of the bore **2** being somewhat greater than the diameter of the bolt as illustrated. The proximal threaded end **4** of the bolt **3** is received in a correspondingly threaded bore **5** in a plunger tip **6**, this tip being composed preferably of "Invar" or other metal of low coefficient of expansion and having acid resisting properties. The tip has a transverse recess **7** extending inwardly from the side thereof and intersecting the bore **5**, this recess being adapted to receive a pin **8** which passes through an aperture in the end of the bolt **3** and acts to positively lock the tip and bolt together. The recess **7** is countersunk at the outer end and is threaded for reception of a plug **9** which closes the end of the recess and confines the pin **8**.

The distal end **10** of the bolt **3**, which is formed for connection with the cross head of the associated pump, comprises a portion **11** of greater diameter than the stem of the bolt, and this portion **11** engages in a recess in the outer end of a plunger head adapter **12**, this adapter also being composed of an acid resistant material of low coefficient of expansion such as "Invar." The plunger head **13** is interposed between the adapter **12** and the proximate end of the mullite body **1** and is counterbored at **14** for reception of the reduced end portion **15** of the said adapter. Intermediate the adapter and the piston head **13** is an expansion member which may take the form of a washer or washers **16** and these washers serve to take up any lag or irregularity in expansion between the members constituting the piston as will hereinafter appear.

In assembly the parts are brought together on the bolt **3** and the bolt then turned in order to draw the heads **6** and **13** against the opposite ends of the mullite body member **1**. The ends of the body member **1** are chamfered as indicated at **17** and the opposed surfaces of the heads **6** and **13** are correspondingly and reversely

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chamfered so that the body member 1 is held between the heads coaxially with the bolt 3. Suitable gaskets 18 may be inserted between the opposed chamfered surfaces of the body 1 and the heads 6 and 13. Preferably, and as illustrated, the head 13 is provided with a channel 19 extending inwardly from the outer surface of the head and axially along the bore into communication with the clearance space 20 between the stem of the bolt 3 and the body 1. The purpose of this clearance space is to prevent any possibility of building up internal pressure within the piston member 1 which might be greater than the pressure on the exterior of the piston and thus tend to fracture the piston by excessive internal pressure.

In assembly, the bolt is tightened until the spring washers 16 are placed under compression whereby, as previously set forth, these washers may function to take up any inequalities of expansion which might tend to loosen the structure. It is to be noted, however, that the coefficient of expansion of the "Invar" portions of the assembly closely approximates the coefficient of expansion of mullite so that material relative expansions between these elements is avoided.

In Figures 2 and 3, we have illustrated a modification wherein the mullite body 21 of the piston is centered with respect to the axis of the bolt 22 by means of collars 23—23 which closely embrace the bolt 22 and fit within counterbored recesses in the opposite ends respectively of the said body. In other respects the construction of this piston

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is essentially the same as that shown in Figure 1 and described above.

We claim:

1. A piston comprising an intermediate body member of mullite, a terminal portion of other acid resistant material having a coefficient of expansion approximating that of said mullite, and resilient take up means between said body member and terminal portion to compensate for inequalities in expansion and contraction therein.

2. A piston comprising a hollow barrel of mullite, an acid resistant fitting overlying each end of the barrel and having expansion characteristics similar to mullite, means in the interior of the barrel for uniting said fittings, and a channel extending from an exterior surface of the piston to the hollow interior of said barrel to preclude build up of excessive internal pressures within the latter.

3. A piston comprising a hollow barrel of mullite, a fitting at each end of said barrel composed of other acid resistant material having substantially the same coefficient of expansion as mullite but greater strength and shock resistance, and means in the interior of said barrel for uniting said fittings, said piston exhibiting throughout a low coefficient of expansion coupled with high strength, acid, and shock resistance, and ability to operate under conditions of high temperature and pressure.

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