No. 730,720. PATENTED JUNE 9, 1903.

E. THOMAS.

EXPANSIBLE PISTON.

APPLICATION FILED OCT. 18, 1902.

NO MODEL.

Fig. 1.

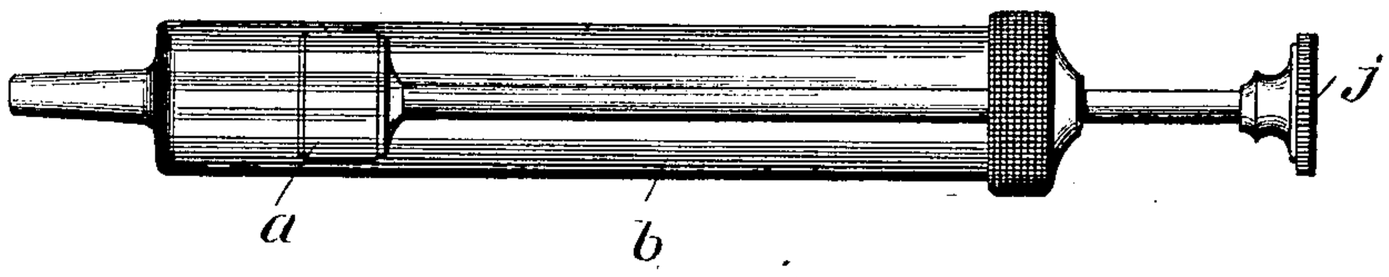


Fig. 2.

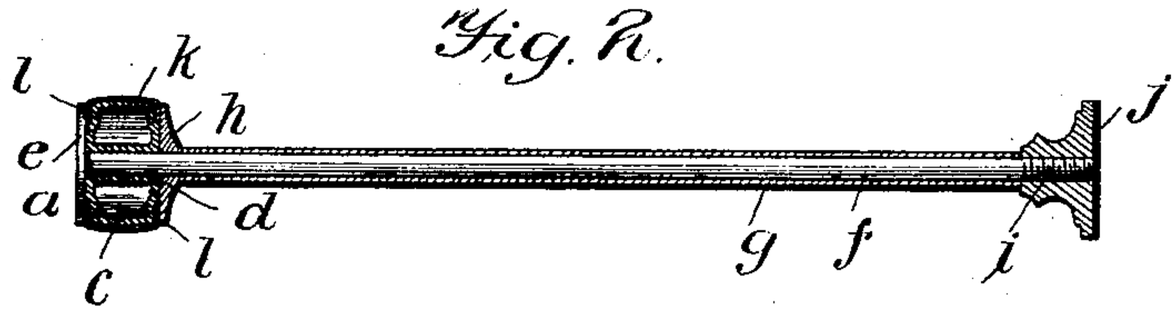


Fig. 3.

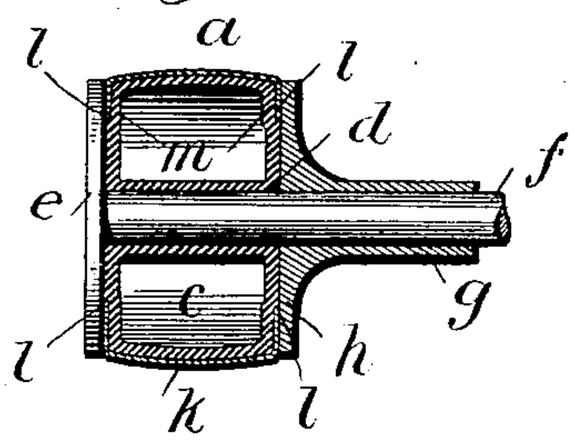


Fig. 5.

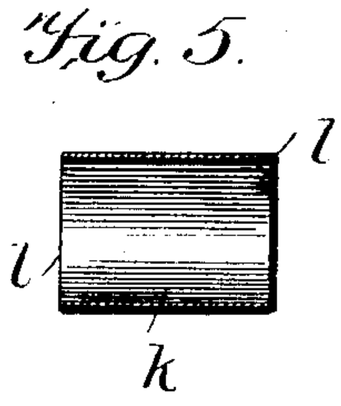


Fig. 6.

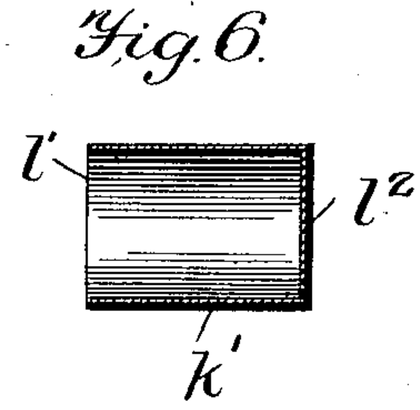


Fig. 4.

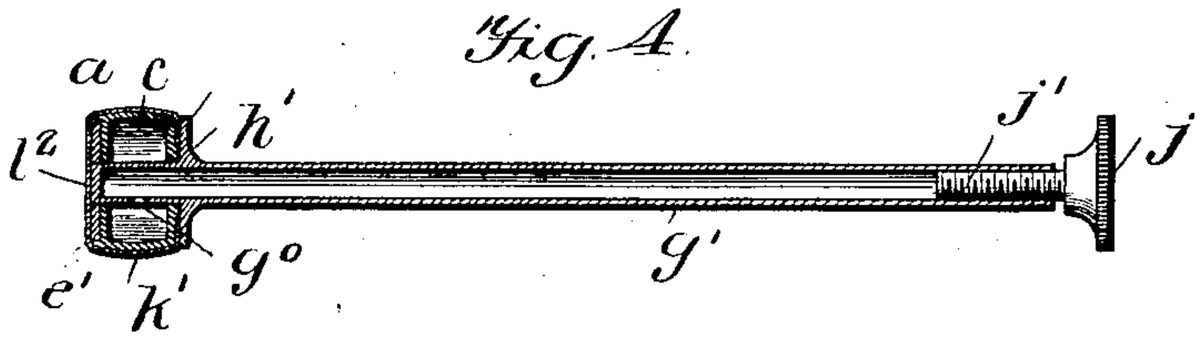
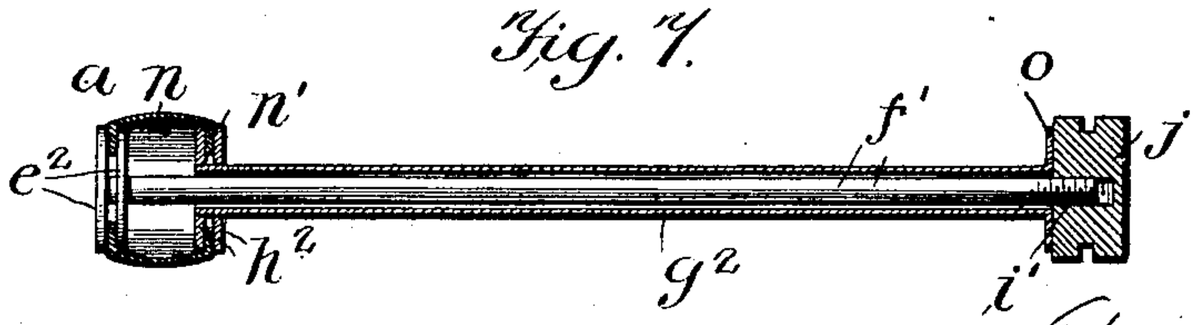


Fig. 7.



Witnesses

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No. 730,720. Patented June 9, 1903.

UNITED STATES PATENT OFFICE.

EDWARD THOMAS, OF FULTON, KENTUCKY.

EXPANSIBLE PISTON.

SPECIFICATION forming part of Letters Patent No. 730,720, dated June 9, 1903.

Application filed October 18, 1902. Serial No. 127,887. (No model.)

To all whom it may concern:

Be it known that I, EDWARD THOMAS, a citizen of the United States, residing at Fulton, in the county of Fulton and State of Kentucky, have invented certain new and useful Improvements in Expansible Pistons; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in expansible pistons, and is more particularly applicable to pistons of syringes, although it may be used in a much wider field whenever a tight-fitting piston is required.

My device has certain features of novelty, which will be pointed out in the specification and claims, the objects of which will be readily apparent.

In the accompanying drawings, illustrating my invention, and in which like letters designate like parts in the several views, Figure 1 shows a longitudinal elevation of my improved piston and operating-rod applied to a piston-syringe. Fig. 2 is a longitudinal section through the piston and operating-rod. Fig. 3 is a sectional detail view of the expansible piston and covering. Fig. 4 is a longitudinal section showing a modified means for expanding the piston. Fig. 5 is a longitudinal sectional view showing a tubular flexible metallic covering for the piston proper. Fig. 6 is a similar view showing the tubular cap or covering illustrated in Fig. 4, and Fig. 7 is a modified form of device particularly applicable to high-power cylinders.

a represents the piston, adapted to be operated in a suitable cylinder, *b* in the drawings representing a graduated glass syringe-barrel.

In Figs. 1 to 3 the piston *a* consists of a pneumatic hermetically-sealed rubber plunger having a suitable air-chamber *c* and a central aperture *d* therethrough. On the outer end surface of this rubber plunger is mounted the plate *e*, attached to the rod *f*, adapted to be passsd through the aperture *d* of the rubber plunger. A tube *g* envelops the rod *f* and is provided with a flange or plate *h* at its inner end, adapted to be seated against the inner end surface of the rubber plunger. The outer end of the rod *f* extends longitudinally beyond the tube *g* and is screw-threaded at *i* to receive an internally-screw-threaded milled cap *j*.

k represents a thin impervious sheet of flexible metal, preferably platinum, gold, silver, or other similar metallic foil or alloys of metal, adapted to be suitably affixed to the exterior of the piston or plunger, forming an interposed bearing between the piston proper and the cylinder-barrel, which admits of but little adhesion between the cylinder-barrel and piston, but at the same time insures a tight contact therebetween, a desideratum in devices of this character. In Fig. 5 this metal covering is represented as being of tubular form, the ends *l* of which are adapted to be bent inwardly and inserted between the rubber plunger *a* and the plates *e* and *h*, respectively, of the operating-rods, as clearly shown in Figs. 2 and 3. If desired, the rubber plunger may have a circumferential recess formed on its exterior surfaces, as shown at *m*, into which the bent-over ends *l* are snugly set; or, as shown in Figs. 4 and 6, this metallic covering may be in the form of a tubular cap *k'*, with the closed end l^2, the inner open end *l'* being adapted to be bent over and in fitted between the inner plate *h* and the rubber plunger, as before described, or this metallic covering may simply be in the nature of a strip of metallic foil affixed smoothly to the outer surface of the piston.

In the construction illustrated in Fig. 4 the rod *f* is dispensed with and the plates *e'* and *h'* are formed integral with or otherwise firmly secured to the tube *g'*; but it is preferable that the end of the tube *g'* be screw-threaded and the plate *e'* screwed thereon for facilitating the removal of the rubber plunger when desired. g^0 is an aperture through the inner end of the tube, opening into the chamber *c*, which in this construction contains a fluid under pressure regulated by the plunger-rod *j'*, secured to the milled nut *j*.

Fig. 7 shows a modified form of construction particularly adapted for use in high-power cylinders, such as the cylinders of air-pumps, machines for compressing gas, &c.

In this construction instead of using a rubber plunger coated with a metallic foil the piston comprises a tube of impervious highly-flexible metal n, having its ends n' securely clamped between suitable plates or supports e^2 h^2, forming the closed ends of the hollow piston. The supports h^2 are in the nature of spaced annular flanges integrally formed or otherwise adapted to be securely fastened to the inner end of the tubular stem g^2. The plates e^2 are similarly disposed on one end of the operating-rod f', screw-threaded at its other end i' to receive the milled nut j. It is preferable, however, that the outer members of these annular spaced plates e^2 h^2 be internally screw-threaded to engage corresponding threads on their supports f' g^2, so that the tube n may be securely fastened in place. In this form of device the piston is adapted to be filled with fluid, and as the tube g^2 opens into the piston in order that the fluid may not escape at the outer end of this tube g^2 the same is provided with the annular flange or shoulder o, against which the milled nut j is at all times in close contact, thus preventing leakage. In order to fill this form of piston with fluid after the parts have been assembled, the hollow piston is heated and the open end of the tube submerged in the fluid, the milled cap j being slightly moved away from the shoulder o.

The operation of my device is manifest upon an inspection of the drawings. In Figs. 1 to 3 the nut j is turned to the right or left, which operates the rod f in the proper direction for drawing the plates e h together or forcing them apart, thereby laterally expanding or contracting the contact-walls of the piston, as may be desired. In Fig. 4 the lateral expansion and contraction of the piston is caused by the screw-plunger j', operating in the tube g', compressing or relieving the pressure on the fluid therein, as is readily apparent, while in Fig. 7 when the plates e^2 are drawn toward the plates h^2 in the same manner as described in reference to Figs. 1 to 3 the fluid in the hollow metallic piston is correspondingly compressed, and being forced under great pressure against the flexible metallic tube, forming the contact-surface of the piston, expands the same laterally, as described. In this latter case it will be observed that the pressure against the interior walls of the metallic tube is gradually increased or decreased, as the case may be, which prevents the flexible tube from buckling when the plates e^2 h^2 are drawn together or forced apart from each other. Thus it will be observed that I have provided a means whereby the piston proper is free from contact with the fluid in the syringe, so that by using a covering of gold or platinum any kind of fluid can be used in the syringe. Further, this metallic covering prevents the piston from absorbing the fluid used and contaminating the same with germs which it might otherwise accumulate. It also permits of the frequent sterilization of the syringe by sucking in boiling water or other suitable antiseptic agents without damage to the piston, and it further permits of a tight contact with the least amount of friction when the piston is operated longitudinally of the cylinder-barrel.

Although I have described my invention with relation to the details as illustrated, it is obvious that many modifications might be made without departing from the spirit of my invention.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. The combination with a tubular piston closed at both ends and having its peripheral surface composed of flexible metal, of means for laterally expanding and contracting said peripheral metallic surface.

2. The combination with a rubber plunger, of an inclosing casing for said plunger, comprising a plate at each end thereof, and a sheet of metallic foil surrounding the peripheral surface of said rubber plunger, and means for laterally expanding and contracting said plunger and foil.

3. The combination with a rubber plunger, of a tube of metallic foil incasing the peripheral surface of said plunger, and end plates engaging said tube of foil and forming therewith a closed casing for said plunger, and means for laterally expanding and contracting said plunger and foil.

4. The combination with a rubber plunger, of a tubular cap of metallic foil incasing the working and peripheral surfaces of said plunger, means for retaining said cap in position on the plunger, and means for laterally expanding and contracting said plunger and metallic covering.

5. The combination with a tubular piston, comprising a plurality of alined annular plates and a flexible metallic tube supported between said annular plates and forming the peripheral contact-surface of said piston, of means for expanding and contracting said peripheral surface laterally.

6. The combination with a tubular piston, comprising a pneumatic hermetically-sealed rubber plunger, of plates located on the transverse faces of said plunger, a tube of metallic foil incasing the peripheral surface of said plunger and having its ends bent inwardly and held between said plunger and plates, and means for operating one of said plates for controlling the expansion and contraction of said plunger and foil covering.

7. In a syringe, the combination with the cylinder-barrel, of a tubular piston, operating in said barrel, comprising a plunger having an aperture longitudinally therethrough, a rod passing through said aperture screw-threaded at one end, and provided at its other end with an annular flange engaging the outer operating-face of said plunger, an elon-

gated tube, inclosing said rod, provided with an annular flange engaging the inner end face of said plunger, a tube of metallic foil incasing the peripheral surface of said plunger and having its ends bent inwardly and held between said plunger and annular plates, and a cap or nut on the screw-threaded end of said rod, engaging said elongated tube for controlling the expansion and contraction of said plunger and foil covering.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD THOMAS.

Witnesses:
SMITH FIELDS,
LEWIS FIELDS.