(No Model.)

A. H. WALKER.

PLUMBER'S AIR CUSHION.

No. 381,731. Patented Apr. 24, 1888.

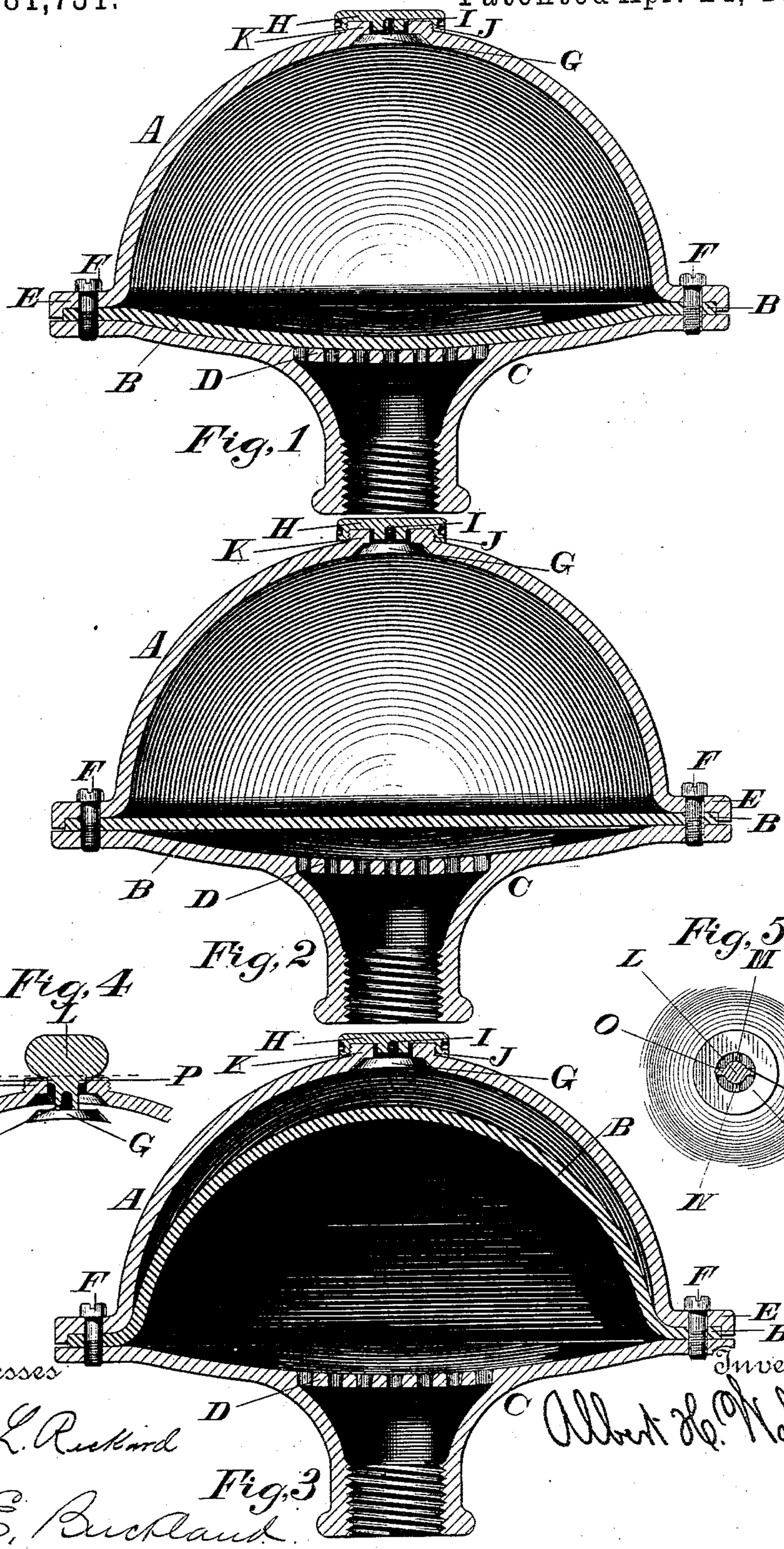

Fig. 1

Fig. 2

Fig. 4

Fig. 5

Fig. 3

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PLUMBER'S AIR-CUSHION.

SPECIFICATION forming part of Letters Patent No. 381,731, dated April 24, 1888.

Application filed January 25, 1888. Serial No. 261,840. (No model.)

To all whom it may concern:

Be it known that I, ALBERT H. WALKER, of Hartford, Connecticut, have invented a new and useful Plumber's Air-Cushion, of which the following description and claims constitute the specification, and which is illustrated by the accompanying sheet of drawings.

This air-cushion consists of a hermetically-sealed shell, the interior of which is divided by an elastic diaphragm into an air-chamber and a water-chamber, and the air-chamber of which is provided with a hermetically-sealable opening for the admission of air under pressure, and the water-chamber of which is divided into two parts by a perforated metallic diaphragm, and the outer one of which parts is adapted to be connected by a water-tight joint with the interior of a water-pipe; and the function of the apparatus consists in furnishing an elastic cushion against which the water in a water-pipe may press and secure additional room for itself when the pressure on that water is suddenly increased by cutting off its egress from the pipe in which it is contained when a faucet that furnishes that egress is suddenly closed.

Figure 1 of the drawings is a central vertical section of the apparatus when its air-chamber is filled with air under a high pressure, and when the outer part of its water-chamber is filled with air at normal pressure, and when the elastic diaphragm is therefore pressed by the air in the air-chamber down upon the perforated diaphragm which separates the two parts of the water-chamber. Fig. 2 is the same sectional view when the air-chamber is filled with air and the water-chamber is filled with water at an identical pressure, and when, therefore, the elastic diaphragm occupies its normal flat horizontal position. Fig. 3 is the same sectional view when the pressure of the water in the water-chamber is five times greater than its pressure in Fig. 2, and when, therefore, the elastic diaphragm is forced upward into the air-chamber, thus condensing the air in that chamber to one fifth of the space it occupies in the last-mentioned figure. Fig. 4 is a vertical section of a fragmentary segment of the upper part of the air-chamber, showing the valve by means of which the compressed air is retained in the air-chamber after that chamber has been filled and before it is finally hermetically sealed. Fig. 5 is a horizontal section on the dotted line of Fig. 4.

The letter A represents the hemispherical shell, which, together with the diaphragm B, constitutes the air-chamber. The upper wall of the water-chamber is also constituted by the elastic diaphragm B, while its other walls consist of the shell C, divided into two parts by the perforated diaphragm D. The upper surface of its upper part, together with the upper surface of the perforated diaphragm, is in the form of a segment of a hollow sphere of large radius, while the lower part of the shell C is provided with an internal screw-thread for union with a water-pipe or other receptacle of inelastic fluid. The elastic diaphragm B is circular in outline, and its border is fastened between the flange E of the shell A and the upper border of the shell C by means of any suitable number of screws, F, passing at intervals through all three of the parts mentioned, so as to unite the two shells together and cause the outer border of the elastic diaphragm to constitute an air and water tight packing between them. The valve G is held in its seat in the upper part of the interior of the shell A by the compressed air within that shell, and also by the screw-cap H, the axis of which is provided with a screw-threaded recess for the reception of the stud I, which projects upward from the center of the valve G, and the interior of the flange J of the screw-cap H is provided with a screw-thread for engagement with the periphery of the annular projection K of the shell A. The butterfly-nut L is provided with a screw-threaded axial recess in its lower end for temporary engagement with the stud I, and is provided, also, with the arms M and N, which serve, together with its shoulders O and P, to keep its axis, and therefore the axis of the valve G, exactly central to the valve-seat of that valve.

The shell A is made of cast-iron or other suitable metal, and is glazed throughout its interior to prevent the leakage of air through the metal. The diaphragm B is made of pure

vulcanized soft rubber and the shell C is made of cast-iron or other suitable metal. The under side of the valve G is also glazed and its diagonal periphery and upper border are accurately fitted into the adjacent valve-seat. Before the shell A is fastened to the diaphragm B or the shell C, the valve G is placed in its interior and temporarily held there in the position shown in Fig. 4 by means of the butter-fly-nut L.

After the two shells and the elastic diaphragm are permanently fastened together by the screws F, the air-chamber is filled with compressed air from any suitable air-pump, which pump may be connected with the air-chamber by means of a rubber tube, the outer end of which is provided with one member of a hose-coupling screwed over the annular projection K of the shell A. Compressed air is thereupon forced into the air-chamber until the pressure of air in that chamber reaches fifty-four pounds to the square inch, and thus forces the diaphragm B from the position shown in Fig. 2 to that shown in Fig. 1. Thereupon the connection with the air-pump is discontinued, and the pressure of the air in the air-chamber forces the valve G into its seat. Then the butterfly-nut is unscrewed from the projection I, and the screw-cap H, the threads of which are preferably covered with red lead, is screwed down upon the annular projection K, so as to receive the projection I within its axial threaded recess and to increase the rigidity with which the valve G is held in its seat. When the air-chamber is thus filled with compressed air, the apparatus becomes an article of commerce and will receive no injury by the passage of time, because the diaphragm B, which would otherwise be unduly stretched by the compressed air, is supported by the upper surface of the shell C and of the perforated metallic diaphragm D.

When the apparatus is attached to a water-pipe containing water under a pressure of sixty pounds to the square inch, that water enters the outer part of the water-chamber, and thence passes through the perforations in the diaphragm D and presses the diaphragm B upward from its position shown in Fig. 1 to that shown in Fig. 2. This change of position of the diaphragm B reduces the size of the air-chamber to nine-tenths of its former capacity, and therefore increases the pressure of the air therein from fifty-four pounds to sixty pounds to the square inch. Thus the diaphragm remains in the unstretched position shown in Fig. 2 at all times when the pressure of the water in the water-pipe continues at the normal degree of sixty pounds to the square inch. When the pressure in the water-pipe is suddenly increased by suddenly closing a faucet or other outlet therefrom, the elastic diaphragm B is pressed more or less upward from its position shown in Fig. 2 toward that shown in Fig. 3, according to the degree of the suddenly-increased pressure of the water. If that pressure rises from sixty pounds to three hundred pounds to the square inch, the diaphragm B will be raised to the position shown in Fig. 3, thus condensing the air in the air-chamber above that diaphragm to one-fifth of its former volume and correspondingly increasing its pressure. When the suddenly-increased pressure of the water is relieved, the diaphragm B returns to the position shown in Fig. 2, ready to act again, with the air in the air-chamber, as a cushion to relieve the sudden strains which might otherwise burst the water-pipe.

Manufacturers of quantities of this apparatus may inflate the air-chambers thereof to variant degrees, so as to adapt the different specimens to be attached to water-pipes containing water at variant pressures, and may permanently mark the exterior of each apparatus with the number of pounds of the pressure of the air contained within it. When a plumber is about to apply these air-chambers to any particular water-pipe or system of water-pipes, he can select those which contain condensed air at a pressure about one-tenth less than the pressure of the water in the pipes to which they are to be applied, and can thus so adjust the apparatus that the diaphragm B will remain flat and unstretched at all times, except when a temporarily increased or decreased pressure of the water causes it to be temporarily stretched in one direction or the other.

By means of filling the air-chamber with compressed air instead of with air at atmospheric pressure the capacity of the apparatus is much increased in proportion to its size, and the active life of the elastic diaphragm is greatly lengthened, because it is thus enabled to remain nearly all of the time of that life in a substantially flat unstretched position, and these ends are still more accurately secured by regulating the degree of pressure in the air-chamber according to the normal pressure of the water in the particular water-pipes to which any particular specimen of the apparatus is to be applied.

I have accurately indicated the forms, proportions, dimensions, and degrees of the different parts and contents of this apparatus as proper examples, and not as limiting myself to any particular degree, dimension, proportion, or form.

I claim as my invention—

1. The combination of the shell A, the diaphragm B, and the shell C, provided with the perforated diaphragm D, the three parts being hermetically united together, so as to have an air-chamber within the shell A above the diaphragm B and a water-chamber provided with the perforated diaphragm D below the diaphragm B, all substantially as described.

2. The combination of the shell A, provided with the valve G, the diaphragm B, and the shell C, provided with the perforated dia-

phragm D, all hermetically united together, so as to have a chamber for compressed air within the shell A above the diaphragm B and a water-chamber provided with the perforated diaphragm D below the diaphragm B, all substantially as described.

3. The combination of the shell A, the valve G, provided with the stud I, and the screw-cap H, all united together to hermetically seal the shell A, substantially as described.

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