J. W. HYATT.

Pneumatic, Hydraulic, or Steam-Pressure Apparatus.

No. 200,914. Patented March 5, 1878.

Fig. 1.

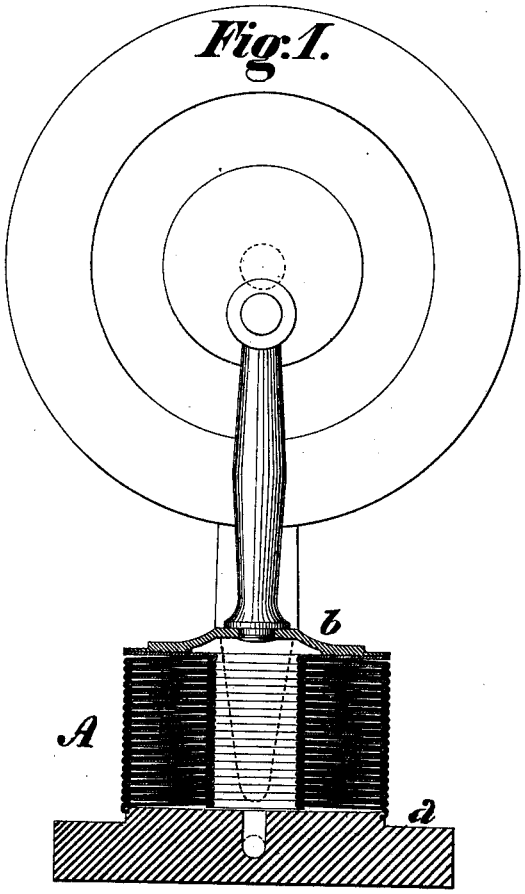


Fig. 2.

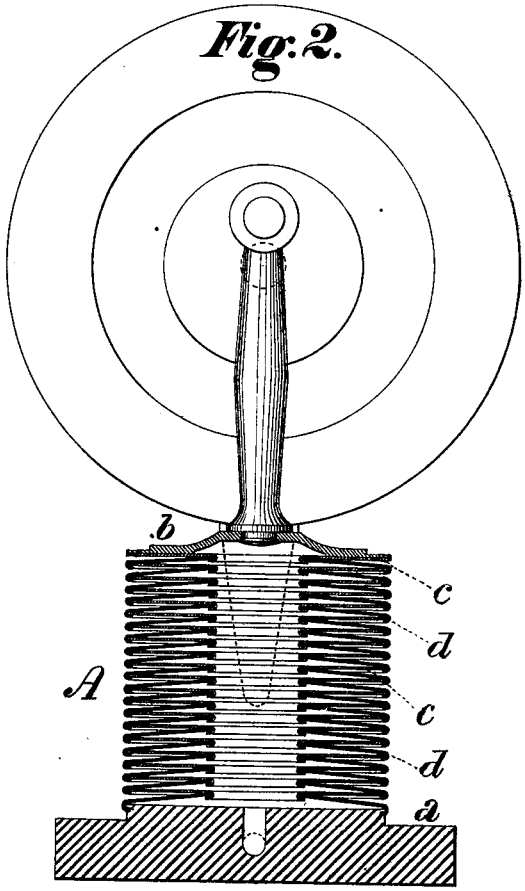


Fig. 3.

Fig. 5.

Fig. 4.

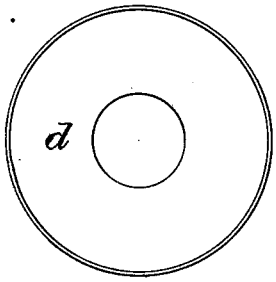
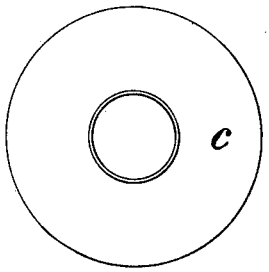


Fig. 6.



WITNESSES

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IMPROVEMENT IN PNEUMATIC, HYDRAULIC, OR STEAM PRESSURE APPARATUS.

Specification forming part of Letters Patent No. **200,914**, dated March 5, 1878; application filed August 25, 1877.

To all whom it may concern:

Be it known that I, JOHN W. HYATT, of Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in the Application of Pneumatic, Hydraulic, or Steam Pressure, of which improvements the following is a specification, reference being had to the accompanying drawings, which form part of this specification.

My improvements relate to that class of machines in which power is to be developed without the use of a piston; and it is the object of my improvement to obtain a simple and efficient engine applicable to a great variety of purposes, and not involving either the original cost or the cost of repairs attending the use and fitting of parts that are essential in the classes of machines to which my improvements relate, as heretofore constructed; and to this end my invention consists in a novel method of constructing the chambers and connecting the plates which constitute the cylinder.

In the drawings above referred to, Figure 1 is a longitudinal central section of a cylinder embodying my improvements contracted; Fig. 2, a similar section of the same extended; Fig. 3, a diametrical section of one of the externally-flanged plates with its flange upward; Fig. 4, a plan or top view of the same; Fig. 5, a diametrical section of one of the centrally-flanged plates with its flange upward, and Fig. 6 a plan view of the same.

The cylinder A consists of a solid bottom or bed plate, *a*, a top plate, *b*, which may be either flat or dished, as shown, and which affords attachment for a connecting-rod or platen, and a series of intermediate extending and contracting metallic chambers. To form these chambers, I use two series of circular plates, of strong elastic metal, one series being stamped or cut out of so much larger size than the intended outside diameter of the cylinder as to allow their outer edges to be turned down and overlapped, as will presently be described, and I use a second series of similar plates, except that they are of less diameter than the diameter of the intended cylinder by twice the thickness of the plate. I perforate the plates having the larger diameter centrally with a flush hole, the diameter of which is greater than the desired diameter of the opening within the finished cylinder by twice the thickness of the plate. The series of plates having the smaller diameter I punch centrally, so as to make a hole of the desired diameter through the finished cylinder, each of this series of plates being so punched as to have around the central perforation a depending flange, as seen inverted in Figs. 5 and 6. The flush holes are larger than the flanged holes by so much as is necessary to let the larger plates fit snugly around the central flanges of the smaller plates. The outer edges of these centrally-flanged plates are plane, as seen inverted in Figs. 5 and 6, while the outer edges of the larger plates are flanged and the centers plane, as seen inverted in Figs. 3 and 4.

Upon the upper surface of the bed-plate *a*, I turn a hub or boss, the diameter of which is less than that of the intended cylinder by twice the thickness of the metal of which the plates above referred to are composed. A circumferential groove is turned in this hub or boss, to afford a hold for the flanged edge of the adjacent flexible plate, which edge is to be overlapped and closed down in the groove to make a tight joint, as will be presently described. This will form between the bed-plate and the flexible plate a chamber; but this chamber will only have about one-half the movement of the other chambers, which are formed in the following manner:

A proper number of plates being prepared, as hereinbefore stated, one of the centrally-flanged plates, *c*, Fig. 5, is placed, with its flange downward, against the under side of the top plate *b*, and brazed or otherwise secured to the top plate, as seen in Figs. 1 and 2, its turned-down central flange being in the proper position for the addition of the next plate. An externally-flanged centrally-perforated plate, *d*, is next placed over the depending central flange of the plate *c*, the circumferential flange of the plate *d* being turned downward. The central flange of the plate *c* is now turned over upon the plane edge of the central opening in the plate *d*, and a tight overlapped joint or seam is thus formed all around the central opening. This plate *d* is the top of one flexible chamber of the cylinder. To complete this flexible chamber, another cen-

trally-flanged plate *c*, with its flange downward, is placed upon the plate *d*, its plane edge resting against the inner surface of the flange around the circumference of the plate *d*, and this flange is turned over upon the plane edge of the plate *c*, and a tight overlapped joint formed all around the cylinder. The plate *c* is the bottom of the flexible chamber of which the plate *d* is the top. This alternation of centrally-flanged and circumferentially-flanged plates and of tight joints around the central openings and the exterior of the chambers, respectively, is continued until the desired number of chambers are formed, when it only remains to complete the cylinder by connecting the top plate of the lowermost chamber to the hub or boss of the bed-plate *a*, as already described, so as to close the cylinder with a tight joint, as seen in Figs. 1 and 2.

It will be seen that in this construction all the chambers communicate with each other through the central opening, and permit such access of the admitted pressure to the central opening upon each of the surfaces of each chamber as will give the fullest effect to the exertion of the pressure upon the largest possible area within the cylinder, and bring into play, in a corresponding degree, the elasticity of the plates in extension and retraction.

The top plate is formed in such manner as to admit of the insertion in it centrally of a connecting-rod, or the application to it of a platen, according as the cylinder is to be used as a pump or engine or as a press, and provision is made for the regulated introduction of the motive fluid and the escape of the exhaust at one end of the cylinder, as shown in the bottom plate *a*, Figs. 1 and 2, and as is well understood.

In practice I contemplate using a central metallic core, made of conical form, and of as large dimensions as is consistent with the free supply of motive fluid to the chambers, said core to be attached to the under side of the top plate *b*, as shown in dotted lines in Figs. 1 and 2, for the purpose of preventing waste of motive fluid in the extension and retraction of the cylinder when in operation.

In the drawing I have shown the cylinder applied to a crank for imparting rotary motion, and it will readily be understood that a platen would be moved vertically upon being properly connected with the cylinder.

The operation of this cylinder is that, under pressure exerted by a motive fluid—as steam, compressed air, or water under pressure—admitted through the induction-pipe and acting upon the top plate *b*, the flexible compound chambered cylinder will extend in the direction of its length, more or less, according to the number of the chambers and the flexibility of the metal plates, and, upon the release of pressure by the escape of the motive fluid, the cylinder will contract with the resiliency of the metal plates, thus giving a corresponding movement to the connecting-rod or platen, or holding a platen until the pressure is released, where such operation is desired.

This cylinder has a construction which may be likened to that of an accordion, and, in addition to its longitudinal movement, this cylinder, like an accordion, will have such a range of lateral deflection that, if desired, a connecting-rod may, as in the instance shown, be attached directly to the top plate, and the angularity induced by the attachment of the connecting-rod to the crank is accommodated by the lateral flexibility of the cylinder.

In forming the joints at the center and circumference of the cylinder, as above described, I contemplate using any of the suitable well-known devices for bending, overlapping, and seaming sheet metal, and I propose to use, when necessary, solder, or brazing, or welding fluxes, according to the character of the metal employed. I also contemplate interposing rings of vulcanized rubber or other equivalent material between the plates, where, from the conditions of construction or operation, it may be necessary or more economical as a means of securing the requisite tightness of the joints.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

The flexible chambers composed of elastic metal plates connected alternately, centrally, and circumferentially, substantially as and for the purposes described.

JOHN W. HYATT.

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