J. W. HYATT & T. S. CRANE.

HYDRAULIC PRESS.

No. 180,133. Patented July 25, 1876.

Fig. 1

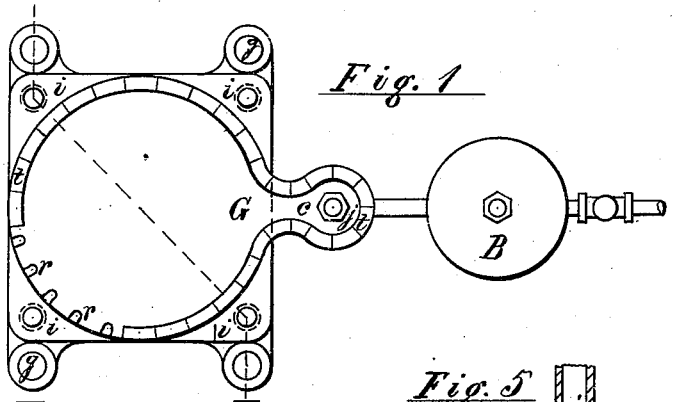

Fig. 5

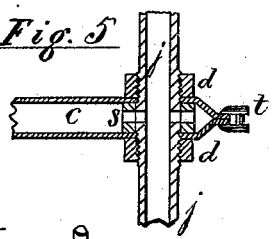

Fig. 2

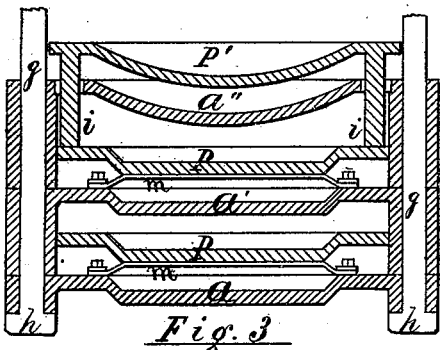

Fig. 3

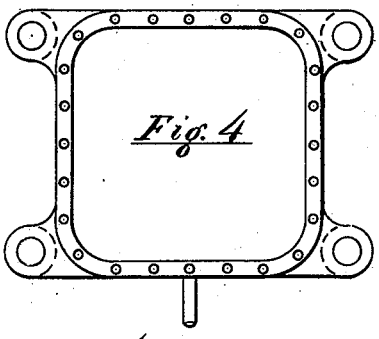

Fig. 4

Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN W. HYATT AND THOMAS S. CRANE, OF NEWARK, NEW JERSEY.

IMPROVEMENT IN HYDRAULIC PRESSES.

Specification forming part of Letters Patent No. **180,133**, dated July 25, 1876; application filed July 28, 1875.

To all whom it may concern:

Be it known that we, JOHN W. HYATT and THOS. S. CRANE, of the city of Newark, in Essex county, New Jersey, have invented certain Improvements in Hydraulic Presses, of which the following is a specification:

Our invention consists in combining the forces of two or more presses together in a novel manner, and in modifications of the hydrostatic press, adapting it especially to be used with low pressures, and in the combined form mentioned. It is also adapted to the use of steam as well as water, and will be fully understood by reference to the annexed drawings, of which—

Figure 1 is a plan taken in the line *x y*. Fig. 2 is a side elevation; Fig. 3, a partial section at the center of the plates A, A′, and A″; and Fig. 4, a plan of plate A, and Fig. 5 the ear on bag G.

A is a plate of metal, (shown in section in Fig. 3.) It is depressed for the greater part of its area, a raised margin being left all around, to which is attached, by a suitable joint, a sheet of elastic material, as canvas or rubber packing. This plate we call a "diaphragm-plate." At intervals of a few inches above this plate are supported a series of other plates, A′, A″, and A‴. At C are seen pipes for introducing fluid under the diaphragms. These are all connected together, and, when the press is operated by aqueduct or other water pressure, to the aqueduct-connection. After making a stroke the aqueduct-connection is shut off, and the water under the diaphragms runs into a waste-pipe. If steam is employed, a steam-boiler is required, and an intermediate chamber or tank, B, upon which the pressure of the steam acts, thus avoiding the communication of the heat of the steam to the press.

It is obvious that if steam-pressure be admitted to the tank above the water the latter will be forced under each diaphragm with a pressure corresponding to that of the steam. Above each diaphragm-plate is placed a pressure-plate, P, which is connected to each adjoining plate P by suitable projections *e e′*, and the topmost by similar projections to platen D. Through the corner of each diaphragm-plate is passed a rod, *g*, which may terminate below in a head, *h*, and at the top is extended through the cap H of the press, where it is secured by a nut or key. When pressure is applied to the water in the tank, it is plain that all the diaphragms will be affected simultaneously, and the pressure upon the platen will be equal to the combined forces exerted by all the diaphragms; and to release the platen from such pressure it is only necessary to shut off the steam from the tank, and liberate the inclosed vapor, when the weight of the platen and pressure-plates upon the diaphragms will discharge their contents into the tank.

Where the press is of small size it is more convenient to place the tank B under the press, forming a base or stand for the same. The cock to liberate the steam is placed near the top of the tank, and will therefore act as an overflow at each stroke, if the condensation of the steam has produced any surplus of water.

While the strain upon each pressure-plate is limited to the force exerted by one diaphragm, the pressure on the projections increases from the bottom to the top of the press until the platen is reached, which transmits the accumulated power of the press. The pressure upon a diaphragm twenty inches square would be ten tons, at a pressure of fifty pounds per square inch, and ten such diaphragms can be included in a vertical space of forty-five inches, and at a pressure of one hundred pounds, easily obtained from a steam-boiler, a total pressure of two hundred tons can be secured. Of course no tank would be required if the steam be allowed to act directly upon the diaphragms, and this can be done where the absorption and radiation of the heat are not objectionable.

At G is shown another mode of utilizing low pressures by the accumulating process described above. A bag, G, is made of two flat pieces of material suitable for a diaphragm, joined strongly at the edges, and provided with a hole to admit the pressing-fluid. The edges can be joined by a double-headed rivet, as shown in Figs. 1 and 5, arranged to cover the whole edge of the bag. *r r* are notches cut in the edge of the bag, and *t t* the rivets. We have also made a bag by placing a con-

tinuous welt of rubber or mixed fabric between the two flat surfaces, and properly securing it to both sides. This hole may be made in some flat surface on the bag, and connect with a hole drilled in the flat surface of the bag-plate A″, communicating with a pipe similar to C; but as the chief advantage of using a bag is in its ready removal from the press for repairs, or to be replaced by a new one, we have devised the form of connection shown in the drawing, where C, Figs. 1 and 5, represents a projecting ear formed on the bag, and provided with a hole in both its top and bottom surfaces. Within this hole a metallic ring, S, is compressed between the two thicknesses of the bag by lock-nuts *d d* on a pipe, *j*.

The ring is pierced from its rim to the central hole, and the pipe also, thus furnishing a transit for the water or steam from the pipe into the bag.

When a series of bags are to be connected, short sections of pipe can be interposed between the various bags, and the whole compressed by a rod passing loosely through the pipe and secured by a nut at the end, whose pressure clamps all the bags and pipes tightly together, while the water or steam, when admitted to the pipe or pipes at any point, can circulate freely within them all.

The bag, of course, when exposed to pressure, as that of steam, exerts its force in lifting the pressure-plates P, the diaphragm-plates A′ and A being stationary.

It will be perceived that the mode in which the bag as well as the diaphragm is used exposes only the margin of the same to the bursting tendency of the internal pressure, almost the entire area of pressure being fully supported by the flat resisting-surfaces above and below the same.

A margin of one and one-half inch around the edge of the pressure-plate has proved sufficient to secure a stroke of two inches, the substance of the diaphragm descending readily one inch into the recess in the plates A A′, &c., and rising one inch out of it; and while there are many purposes for which a longer stroke is required, there are still a great number for which a stroke of two inches is ample, as the pressing of material into molds, &c.

In addition to the means described above for multiplying the power of hydraulic presses, a series of pistons working in ordinary hydraulic cylinders arranged on the same axial line, similarly to the diaphragms described above, can be connected together by projections upon cross-heads, thus combining the power of any desired number of cylinders. At A‴, Fig. 2, is shown such a cylinder-plate, the piston for which is attached to the lower side of platen D, or, if in a series, to the proper pressure-plate. This arrangement requires less metal than a cross-head with projections, but necessitates the taking apart of the press when repairs are needed. The advantages of this arrangement will be apparent when the great difficulties of making joints and packings tight at high pressure is considered, as well as the cheapness with which a larger area can be employed at a pressure of fifty to one hundred pounds per square inch, from the great difference between the thickness of metal required to sustain such pressure and that of two to three thousand pounds per square inch, often employed in hydraulic presses. Ordinary castings, moreover, will sustain a low pressure without penetration by the water, while hydraulic cylinders employed under high pressures have generally to be lined with copper to make them water-tight.

In case of damage to a bag, G, employed as described above, it can be disconnected from the pipe C and another introduced in a few minutes, when the press will be again ready for work.

To facilitate the construction of a press composed of a series of diaphragms, *m*, and diaphragm-plates, A, as well as to repair the diaphragms readily, we construct the pressure-plates P with the projections at *e* much shorter than those at *e′*, regulating the depth of them by the open space between two diaphragm-plates, and alternating the arrangement of them in such a manner that the pressure-plates can be pulled from the diaphragm-plates half from one side of the press, and one-half of them from the other side.

By any other arrangement of solid castings it would be necessary to disconnect the whole machine from the top to remove any pressure-plate, and gain access to a whole diaphragm.

In a press constructed entirely with bags G, the pressure-plates would not need the arrangement of projections *e e′*, required to uncover the diaphragms readily, but would take less room constructed with studs *i i i i*, cast on the four corners of the pressure-plate (see Fig. 1 and Fig. 3) P′, and reaching to the pressure-plate P below it through openings in the diaphragm-plate A″.

A similar mode of transmitting power from one pressure-plate to another could be used with a series of such hydraulic cylinders as are shown at A‴, Fig. 2.

From the above description it will be seen that our invention may be termed a "compound hydraulic press," and that it furnishes a means of exposing an immense area to a low pressure, such as is readily obtainable from city water-works, steam-boilers, &c., and that it presents a cheap and effective mode of transmitting the combined pressures without extraneous parts or the occupation of large space; a two-hundred-ton press, composed of ten diaphragms, measuring twenty-four by thirty-two inches externally by five feet in height externally, and only requiring one hundred pounds pressure to the square inch.

This mode of construction also dispenses with either a hand or power pressure-pump, which often costs as much as the press to

which it is attached, and which, as well as an accumulator, often used in a reservoir of liquid under pressure, is far more likely to get out of order than the simple apparatus described above.

When a press is constructed entirely with bags or diaphragms, a certain saving of metal can be secured by making the pressure-plate P′ and the plate that supports the bag or diaphragm of section uniformly curved, like a segment of a sphere's external shell. This form is shown in Fig. 3, where A″ represents a supporting-plate for a bag, G, and P′ the pressure-plate for the same.

This form, it is well known, possesses greater strength with the same amount of material than a flat plate, as is shown in the shell of an egg.

It will be seen that the action of the diaphragm and bag described above are precisely similar, and might be termed the action of a flexible piston moving alternately in and out of the space in which it is confined.

Having shown and described above several modes of constructing such a piston for a hydrostatic press, we do not wish it understood that we limit ourselves to those forms of construction only, but claim the right to combine any other form or forms of flexible piston in a compound hydraulic press. We wish it also understood that we do not limit ourselves to the use of water or steam in such a compound press as we have described, but claim the right to use any agent suitable for transmitting the pressure.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The intermediate chamber or tank B, located between the boiler B′ and compound hydraulic press, and connected to both, for the purpose described, and operating in combination with both, to prevent the heat of the steam from communicating to the press, substantially in the manner shown and described.

2. In a compound hydraulic press, the pressure-plates P, with projections *e* and *e′*, constructed and operating in combination with pressure-chambers contained in diaphragms *m* or bags G upon the platen D, substantially in the manner shown and described.

3. The arrangement of diaphragms *m*, two or more operating on the same axial line, operating in combination with diaphragm-plates A, pressure-plates P, platen D, cap H, and connections *g g*, from plates A to cap H.

4. The hydraulic press consisting of a bag, G, operating in combination with the plate A, pressure-plate P or platen D, cap H, and connections *g g*, from plate A to cap H.

5. The pipe-connection to bag G, formed by compressing the sides of the bag, or a connection thereto, against a perforated washer, S, substantially in the manner described, to be used in a hydraulic press, as claimed.

6. In combination with bag G, the curved supporting-plate D and pressure-plate P, for supporting and transmitting the pressure in the bag with the least expenditure of metal.

7. The studs *i i*, connecting the pressure-plates P and P′, for transmitting and adding the pressure of one to the other, through or past the intervening supporting-plate, substantially as described.

8. The pressure-plate P′, furnished with studs *i i i i*, operating in combination with pressure-plate P, bag G, and bag-supporting plate A″, for transmitting the pressure of the bag G from one plate to the other through the plate A″, substantially in the manner shown and described.

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