C. Vogel,

Steam Hammer.

NO. 106,892. Patented Aug. 30. 1870.

Fig. 1

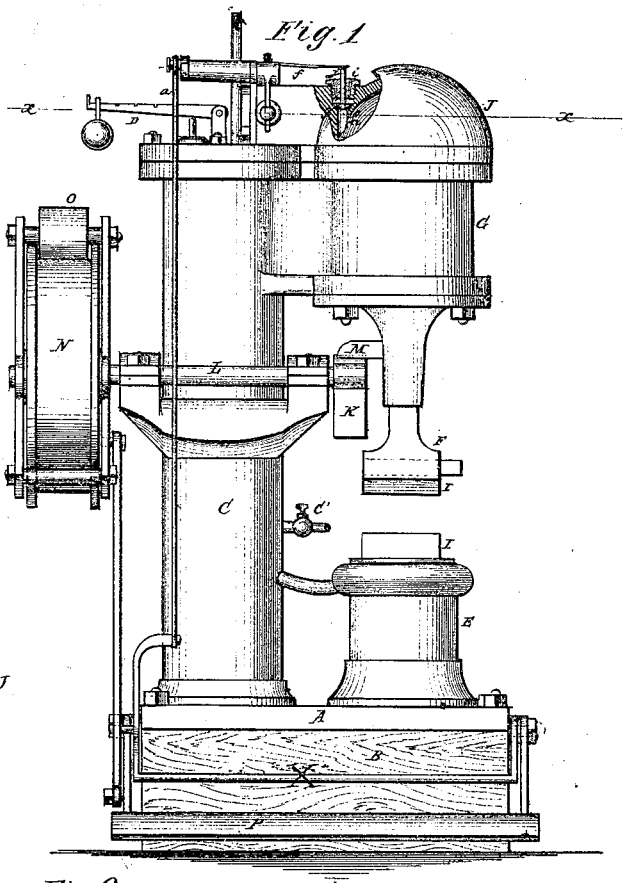


Fig. 6

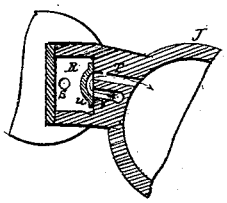


Fig. 7

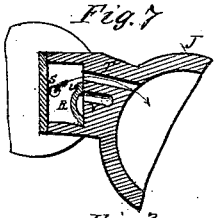


Fig. 3

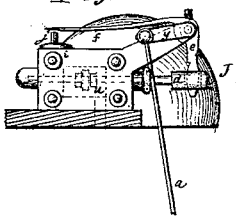


Fig. 2

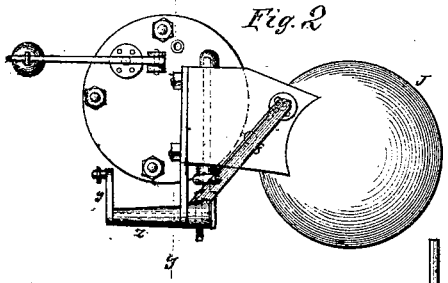


Fig. 4

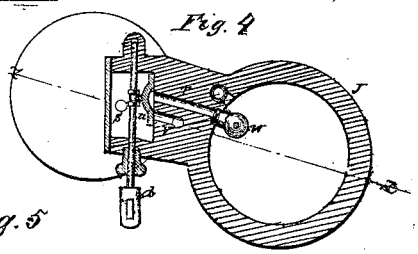
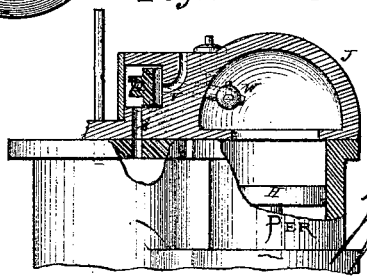


Fig. 5



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CHARLES VOGEL, OF NEW YORK, N. Y.

Letters Patent No. 106,892, *dated August* 30, 1870.

IMPROVED COMPRESSED-AIR FORGE-HAMMER.

The Schedule referred to in these Letters Patent and making part of the same.

To all whom it may concern:

Be it known that I, CHARLES VOGEL, of the city of New York, in the county and State of New York, have invented a new and useful Improvement in Compressed-air Forge Hammers; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable other skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification.

This invention relates to a new and useful improvement in hammers for forging iron and other metals, which are actuated or partially actuated by compressed air; and

It consists in the mode of controlling the air and regulating the stroke of the hammer, and arrangement and combination of parts, as hereinafter described.

In the accompanying drawing—

Figure 1 is a side elevation of the machine, with a portion of the air-chamber broken away to show the position of the valve connected therewith.

Figure 2 is a top view of fig. 1.

Figure 3 is a section of fig. 2 on the line *y y*.

Figure 4 is a horizontal section of fig. 1 on the line *x x*.

Figure 5 is a vertical section of fig. 4 on the line *z z*.

Figure 6 is a detailed view, showing the slide-valve and the air-passage for regulating the stroke; also, the aperture into the valve-chest, through which air is admitted from the air-reservoir.

Figure 7 represents the valve and valve-chest, with the former in position for giving a full stroke of the hammer.

Similar letters of reference indicate corresponding parts.

A is the bed-plate of the machine, which is supported on a suitable foundation, B.

C is the air-reservoir, into which the air is forced by means of a force-pump, actuated by a steam-engine, or other motive power, and condensed to any required pressure.

C′ is a small stop-cock in the reservoir C, through which a jet of air is discharged for blowing cinders from the anvil or die.

D is a safety-valve on this reservoir, for regulating the amount of pressure.

E is the hammer-block.

F is the hammer.

G is a cylinder bored out, to which a piston, H, on the hammer-shank is accurately fitted. The hammer and shank and piston H are forged or made in one piece.

I represents the dies on the hammer and hammer-block or anvil, fitted and fastened thereto in the usual manner.

J is the air-chamber, of about the same cubical contents as the cylinder G, so that, when the hammer is raised, the piston H will compress or force the air contained in the cylinder into the chamber, thereby doubling the density and pressure of the air in the chamber at each stroke of the hammer.

The hammer is raised at all times to a uniform height by a positive motion. This is accomplished by means of a cam, K, on the end of the shaft L.

The cam operates on the lug M, on the shank of the hammer.

The shaft is revolved by means of the pulley N and belt from the line or counter-shaft of the steam-engine or other motive power.

O is a tightening-pulley for the driving-belt, operated from the foot-treadle P, shown and described in a patent granted me by the United States, for improvement in "trip-hammer," dated February, 1868. By this arrangement of the cam, herein described, it will be seen that the hammer is raised to its full height at every revolution of the shaft.

The down-stroke blow is given by means of compressed air when a blow is required exceeding in force the weight of the hammer.

When a blow of less force than that is desired, a vacuum or a partial vacuum in the chamber J is produced by means of a valve arrangement, which, together with the principal operating valves, I will now proceed to describe.

R is the valve-chest, which is in communication with the air-reservoir, by means of the aperture S.

T is an air-passage or port, which opens direct communication between the chest and the air-chamber J. When this port T is open, as represented in fig. 7, the hammer gives a full stroke, the piston H receives the full pressure of the air in the reservoir.

U is a slide-valve, by means of which the port T is closed to the chest, and opened to the port V by the cavity in the valve, as seen in fig. 6. When the valve is in this position the cylinder G (as the piston descends) is filled with air at atmospheric pressure as the port V communicates with the atmosphere, as seen in fig. 5.

At the end of the port T there is a check-valve, W, which prevents the escape of air from the air-chamber through the port. Now, when the hammer is raised, the air in the cylinder and chamber, being at atmospheric pressure, cannot escape into the atmosphere through the passage formed by the connection of the valve U with the ports T V, by reason of the check-valve W, and will be reduced to half its bulk, and doubled in its pressure.

The slide-valve is actuated by the foot of the oper-

ator on the rod *x*, which is hinged to each side of the bed-plate in the form of a loose bail. This rod or bail is connected with the crank *y*, on a shaft in the sleeve-box *z*, by the rod *a*.

d is the valve-stem.

e is an arm on the crank-shaft, which enters the mortise in the valve-stem. By pressing on the foot-rod *x* the slide is drawn back and the main port T is opened. The back movement of the valve is produced by a spring, which operates upon the under side of the foot-rod *x*, not seen in the drawing.

f is a spring on one end of the crank-shaft of the sleeve *z*.

h is a passage leading from the chamber J out through the dome or top of the same. Midway of this passage is formed a valve-seat for the valve *g*, and thence outward the passage is gradually widened, being provided at its upper end with a screw-threaded cap, *i*. The latter has two perforations, which are constantly open for allowing the escape of air when the valve *g* is raised from its seat, by reason of the removal of pressure of spring *f* therefrom, and with a central perforation, in which the stem *j* of the said valve works. The object of the cap is to act as a guide for the valve-stem, which extends upward, so as to come in contact with the free end of the spring *f*.

The spring *f* is brought to bear upon the top of this valve-stem with more or less force, according to the pressure on the rod *x*. This valve *g* is always subject to the pressure of the air in the air-chamber J, which pressure has a constant tendency to raise it, and to consequently discharge air through the perforated cap. Hence the force of a blow is determined by the force with which this spring *f* is pressed upon this valve-stem, and this pressure is governed by the foot on the rod *x*.

For a full stroke of the hammer this pressure is sufficient to keep the puppet-valve closed. For less than a full stroke the pressure is diminished, so that, by properly managing and controlling the pressure of this spring and the movement of the slide-valve, a stroke of any required force may be given. A stroke much less forcible than would be given by the weight of the hammer alone may be delivered, and the hammer may be suspended by means of a partial vacuum, which would be formed by allowing the air to escape through the passage *h* and past the valve *g*, (the pressure of spring *f* on the valve-stem *j* being removed for the purpose.) When air is being admitted to chamber J the same movement of the treadle which draws back the slide-valve U for that purpose causes the spring *f* to exert corresponding pressure on valve *g*.

When the operator wishes to examine his work the cam K may be adjusted to support the hammer out of the way, by means of the arm M, or a vacuum may be formed in the chamber J, above the piston, for the same purpose as the hammer is raised, and then moving the slide-valve into the position seen in fig. 4, thus closing the part T.

From this arrangement it will be seen that the blow delivered by the hammer is varied in force only when required by the nature of the work being performed.

No movement of any valve is required for each separate stroke, nor required at any time, except when it is desired to vary the force of the stroke; that is to say, the amount of air having been admitted to the chamber J which is necessary to exert a given force upon the piston in its descent, the valve U will not require to be moved until different and heavier work is to be performed.

The check-valve W at all times prevents escape of air from chamber J through ports T and V, while it allows entrance of air by either port. The valve *g* can in no case admit air to, but may allow its escape from chamber J, when the pressure on the treadle is removed for the purpose.

Having thus described my invention,

I claim as new and desire to secure by Letters Patent—

1. The arrangement of the valve U, ports T and V, and check-valve W, with the chamber J and valve-chest R, as and for the purpose specified.

2. The arrangement with the chamber J and piston H, of the cam K, valve *g*, and spring *f*, as shown and described, for the purpose specified.

3. The combination of the rod *x*, connecting-rod *a*, crank-shaft, valve-rod *d*, valve *u*, spring *f*, and valve *g*, substantially as shown and described, for the purpose specified.

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