No. 788,876. PATENTED MAY 2, 1905.

J. BÊCHÉ.

PNEUMATIC HAMMER.

APPLICATION FILED MAY 13, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

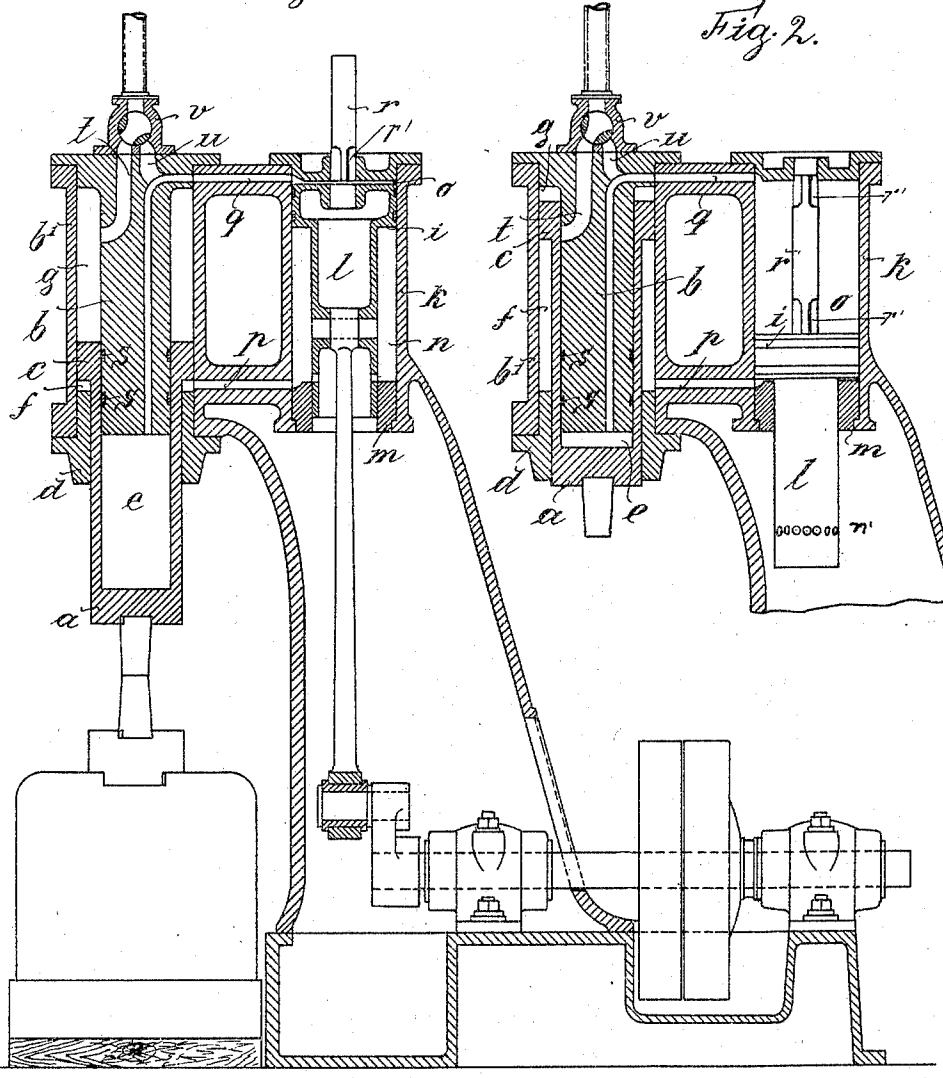


Fig. 2.

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By Baldwin & Peyton
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2 SHEETS—SHEET 2.

Fig. 3.

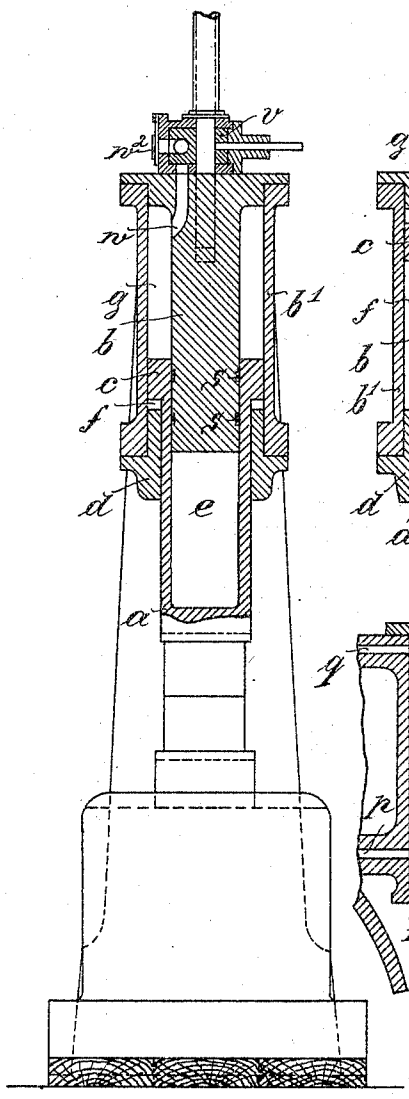


Fig. 4.

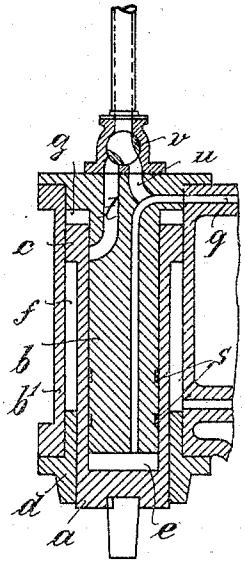


Fig. 5.

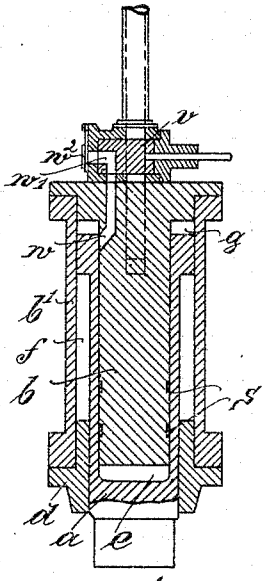


Fig. 6.

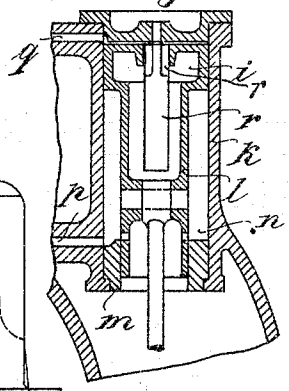
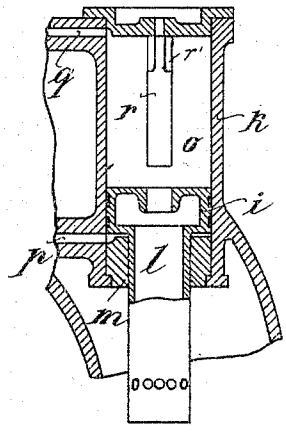


Fig. 7.



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No. 788,876. Patented May 2, 1905.

UNITED STATES PATENT OFFICE.

JEAN BÊCHÉ, OF HÜCKESWAGEN, GERMANY.

PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 788,876, dated May 2, 1905.

Application filed May 13, 1903. Serial No. 156,940.

To all whom it may concern:

Be it known that I, JEAN BÊCHÉ, a subject of the King of Prussia, German Emperor, and a resident of Hückeswagen, in the Province of the Rhine, German Empire, have invented certain new and useful Improvements in Pneumatic Hammers, of which the following is an exact specification.

My invention relates to improvements in pneumatic hammers, and more especially to such hammers in which two cylinders are provided, one of which cylinders forms the working cylinder proper, the other one being provided with the striking-block piston.

In order to make my invention more clear, I refer to the accompanying drawings, in which—

Figure 1 is a vertical section of a pneumatic hammer constructed according to my invention. Fig. 2 is a vertical section of the operating parts of the same in another position. Fig. 3 is partly a front view and partly a vertical section of the hammer at a right angle to the section shown in Figs. 1 and 2. Fig. 4 is a part of the section shown in Fig. 2, the regulating-valve standing in another position. Fig. 5 is a vertical section of the parts shown in Fig. 4, the section being taken at a right angle to the preceding one. Fig. 6 shows a modified construction of the working cylinder, and Fig. 7 shows this construction in another position of the piston.

As will be seen from the drawings, the striking-block of the hammer forms a cylinder *a*. In the cylinder *a* a fixed plunger *b* is situated. At its upper end the cylinder *a* is provided with an annular flange *c*, so that the cylinder has the outer shape of a differential piston. The flange *c* is fitted into the fixed cylinder *b'*. The lower cylindrical part of the cylinder *a* is guided in a socket *d*, fixed in the cylinder *b'*. By this arrangement three air-spaces *e*, *f*, and *g* are created. The space *e* is situated in the hollow striking-block cylinder and the spaces *f* and *g* are situated in the cylinder *b'*—that is to say, the space *g* is situated above and the space *f* below the ring *c*. The working piston *l*, situated in the cylinder *k*, is also provided with a flange-shaped ring *i*. The lower cylindrical part of the working piston is guided in a socket *m*, fixed in the cylinder *k*. By this construction two spaces of different cubical contents are formed—*i. e.*, a space *o* above the piston and a space *n* below the piston. The space *o* is connected, by means of a channel *q*, with the interior *e* of the striking-block. *u* is a small channel connecting the channel *q* with the valve *v*. The lower space *n* in the cylinder *k* is connected, by means of the channel *p*, with the space *f* in the cylinder *b'* underneath the ring *c*, fixed to the striking-block. *t* is a channel connecting the valve *v* with the space *g* above the ring *c*. The end of the channel *t* is situated in a certain distance underneath the upper end of the cylinder *b'*, so that after the striking-block having passed the end of the channel *t* an air-cushion is formed in the space *g*. As may be seen from Figs. 3 and 5, a second channel *w* leads from the valve *v* into the space *g*, which channel *w* ends also underneath the upper end of the cylinder, so that in case the channel *w* is opened—that is to say, stands in connection with the atmosphere—an air-cushion is formed in the space *g*. The channel *w* can be connected with the atmosphere by means of an angular bore *w'* of the valve *v*. The channel *w* is closed by means of a flap or a backflow-valve w^2, which flap or valve allows the air to leave the space *g*, but not to enter into the same.

To the working piston *l* a plunger-shaped part *r* is fixed, which passes through a cylindrical opening of the cylinder-cover. The part *r* is provided at its upper and its lower end with ribs *r'*, so as to connect the interior of the cylinder with the outside when the part *r* is in its highest or lowest position. The plunger-shaped part *r* is so formed that in case the working piston is situated in its highest position, Fig. 1, air can pass around the lower ribbed part of the part *r*, thereby effecting a compensation of the air-pressure in the space *o*, and that in case the working piston is situated in its lowest position, Fig. 2, also a compensation of the air-pressure in the space *o* takes place by the part *r* being in its lowest position. The lower part *l* of the working piston is provided with openings *n'*, which allow the entrance of air into the space *n* in

case the working piston is in its highest position.

The piston b is provided with tightening-rings s for tightening the striking-block. The arrangement of the tightening-rings at the piston b is very advantageous, as in case these rings are fixed to the striking-block piston these rings will very easily be damaged and wear out in consequence of the continuous shocks.

The effect of the above-described hammer is as follows: If the working piston goes downward from the position shown in Fig. 1, a compressing of the air in the space n takes place. This air compression is transmitted through the channel p to the space f. In the space o above the piston a rarefying of the air takes place. The rarefaction of the air is transmitted by the channel q to the space e within the striking-block. By the effect of the air compression and rarefaction the striking-block is lifted. If the movement of the working piston is reversed, an air compression takes place in the space o and the rarefaction of the air takes place in the space f. The compression and rarefaction are transmitted again through the channels p and q to the spaces f and e. The compression in the space e will push the striking-block downward, and the effect of this compression will be augmented by the rarefaction of the air in the space f in case atmospheric pressure prevails in the space g.

In hammers with two separate cylinders—that is to say, with a working cylinder and a striking-block cylinder—it is necessary that the effective spaces in the working cylinder be larger than the corresponding spaces in the striking-block cylinder. If this were not the case, it would not be possible to attain a quick movement of the air in the striking-block cylinder. Consequently a quick lifting and pushing down of the striking-block would not take place. In consequence hereof the space o must be considerably larger than the space e. If the working piston moves downward and the striking-block upward, a certain rarefaction of the air must be present in the space o and naturally also in the space e connected to the same. Now in order to attain that the working piston as soon as the movement of the same is reversed begins to operate the striking-block the rarefaction of the air must cease instantly, as otherwise the working piston would have to pass at first a deadway in order to do away with the rarefaction of the air by diminishing the cubical contents of the space o. In order to attain this purpose, the plunger-shaped part r is provided. It will be seen from Fig. 2 that in case the working piston arrives in the lower dead-point the space o is connected with the atmosphere by the bore in the cylinder-cover. It is, furthermore, very important to attain that in the upper dead-point of the working piston atmospheric pressure prevails in the space o, for it will be clear that the rising working piston has effected in the space e during the downward movement of the striking-block a certain air compression, especially in consideration of the cubical contents of the space o being larger than the cubical contents of the space e. This air compression must be done away with in order to avoid the working piston having to pass a deadway. The compensation of the air-pressure takes place in the upper dead-point by the plunger-shaped part r by the lower part of the same allowing the circulation of the air through the bore of the cylinder-cover, as may be seen from Fig. 1. During the working of the striking-block the valve v is in the position shown in Figs. 1, 3. The space e is then connected to the space o and the space f to the space n. The space g in the cylinder b' is connected by the channel t to the atmosphere. By the rarefaction of the air in the space e and the compression of the air in the space f the striking-block is thrown upward until it passes the opening of the channel t and compresses the air in the space g. The air-cushion thus formed then serves as a buffer for the striking-block. If it is desired to stop the operation of the striking-block, the valve v is brought into the position shown in Figs. 4 and 5. In this position of the valve v the channel t is closed, the channel u, however, which stands in connection with the channel q between the spaces e and o, is connected with the atmosphere. At the same time the channel w is brought in connection with the angular bore w' in the valve v. If the striking-block is lifted in the moment in which the channel t is closed, the striking-block will remain in its position by the rarefaction of the air in the space g, which arises in consequence of no air entering into the space g on account of the channel w, Figs. 3 and 4, being closed by the valve w^2. If the striking-block would begin to sink in consequence of the valve not being perfectly tight, it will always be brought back again into its position, as in each stroke of the working piston air is pressed into the space f. The striking-block must consequently remain in its raised position.

In the modification shown in Figs. 6 and 7 the plunger-shaped part r is not fixed to the working piston, but to the cover of the working cylinder k. The cover of the cylinder is perfectly closed; but the hollow piston is provided with a bore for the part r. The effect of this modification is the same as described above, as the interior of the piston l stands in connection with the atmosphere.

Having thus fully described the nature of this invention, what I desire to secure by Letters Patent of the United States is—

1. In pneumatic hammers, the combination of a working cylinder k, piston l, and a striking-block cylinder b' with a striking-block

consisting of a cylinder *a*, an annular flange *c* provided at the upper edge of the cylinder *a*, said annular flange being fitted into the striking-block cylinder *b'*, a fixed plunger fitted into the cylinder *a* and rigidly fixed to the striking-block cylinder *b'*, channels for guiding the air from the working cylinder to the striking-block cylinder and from the striking-block cylinder to the outer atmosphere, a valve for controlling the latter channel, substantially as described and for the purpose set forth.

2. In pneumatic hammers, the combination of a working cylinder *k* having an opening in one end, and a striking-block cylinder *b'*, with a striking-block consisting of a cylinder *a*, an annular flange *c* provided at the upper edge of the cylinder *a*, said annular flange being fitted into the striking-block cylinder *b'* a fixed plunger fitted into the cylinder *a* and rigidly fixed to the striking-block cylinder *b'*, a piston having a plunger *r* situated in the working cylinder and arranged so as to slide in said opening during a portion of the reciprocation of the piston, and means for guiding the air from the working cylinder to the striking-block cylinder and from the striking-block cylinder to the outer atmosphere, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JEAN BÊCHÉ.

Witnesses:
OTTO KÖNIG,
J. A. RITTERSHAUS.