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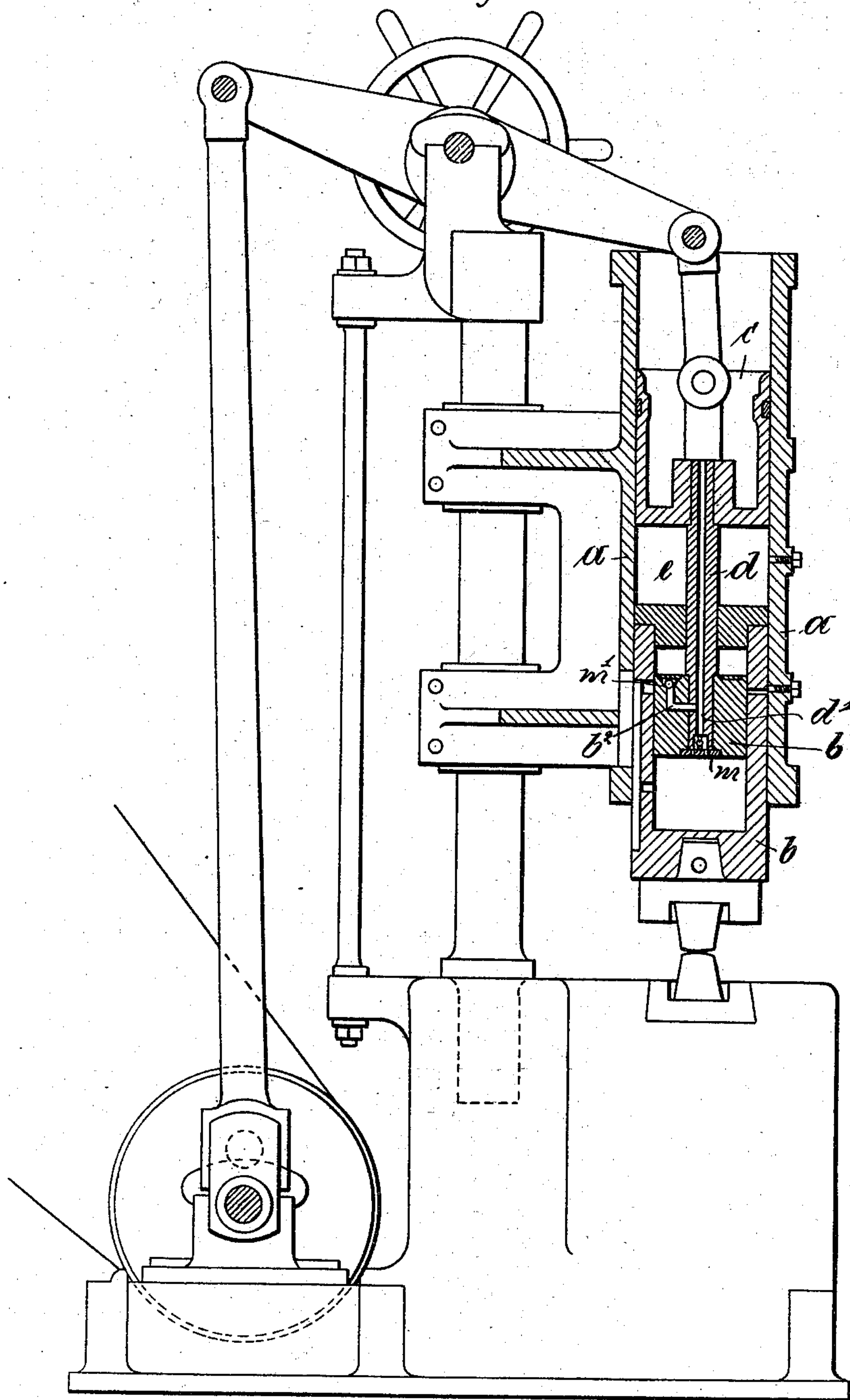
2 Sheets—Sheet 1.

J. BÊCHÉ, Jr.  
PNEUMATIC HAMMER.

No. 559,251.

Patented Apr. 28, 1896.

*Fig. 1.*



*Witnesses.*  
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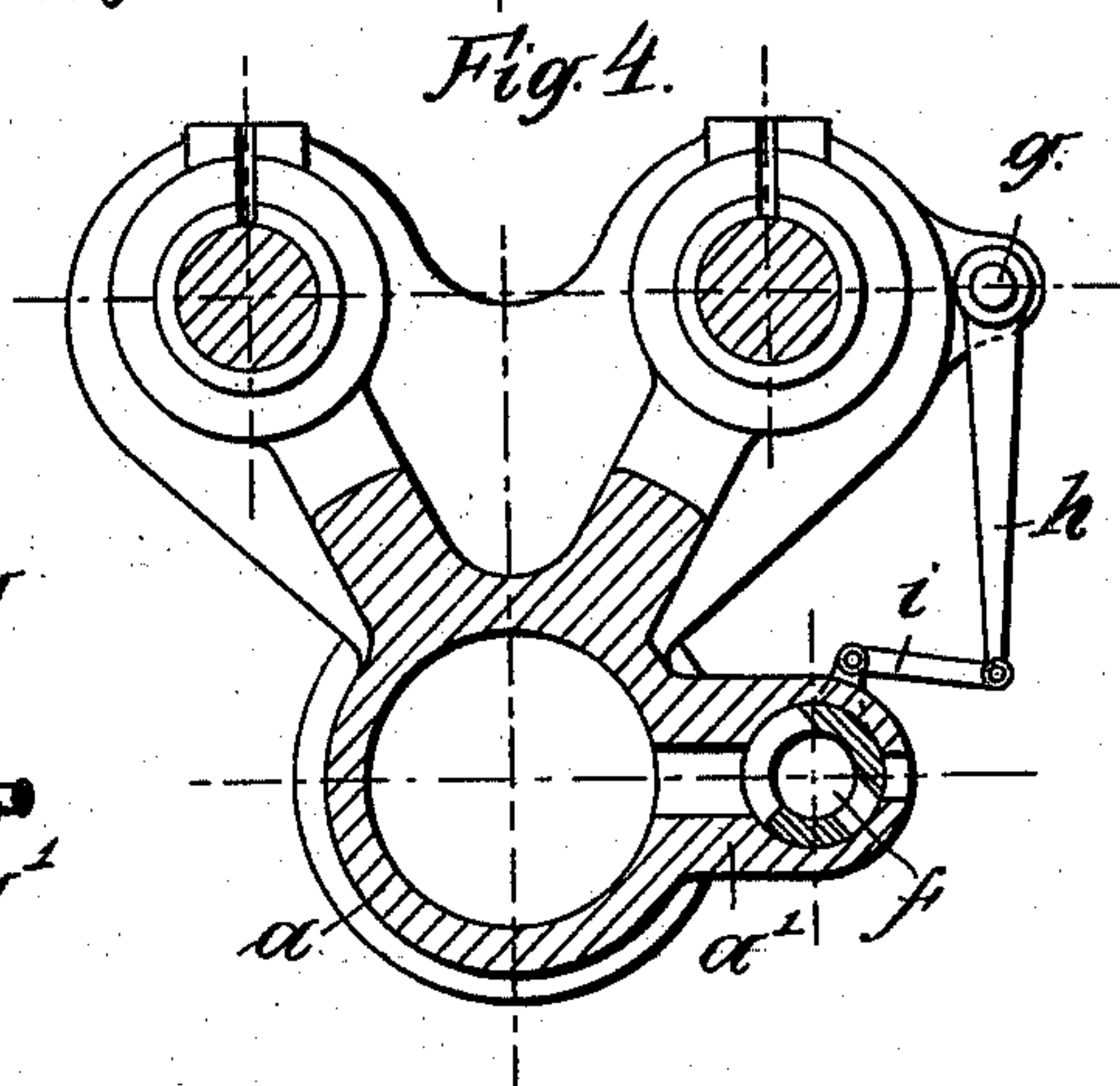
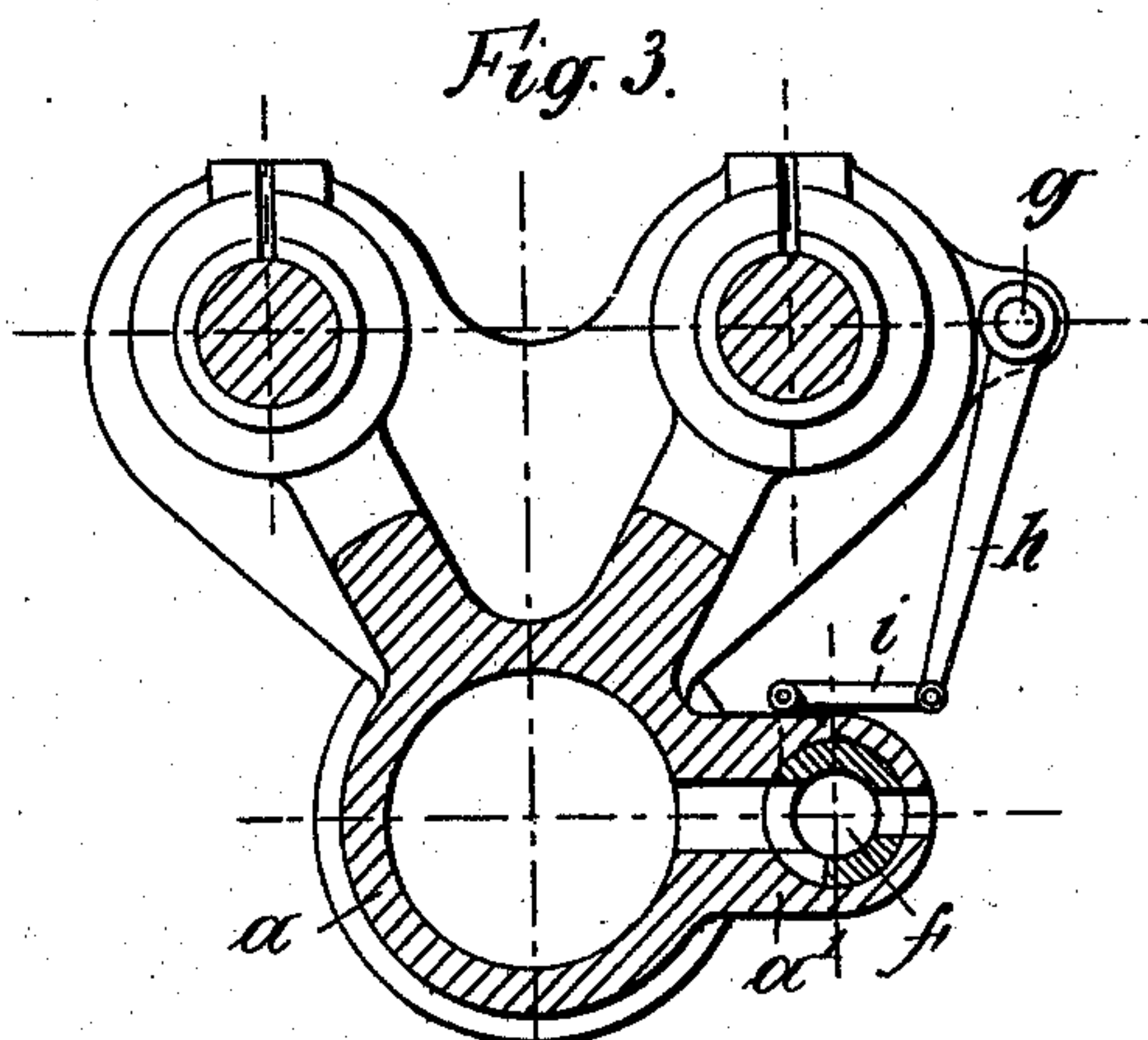
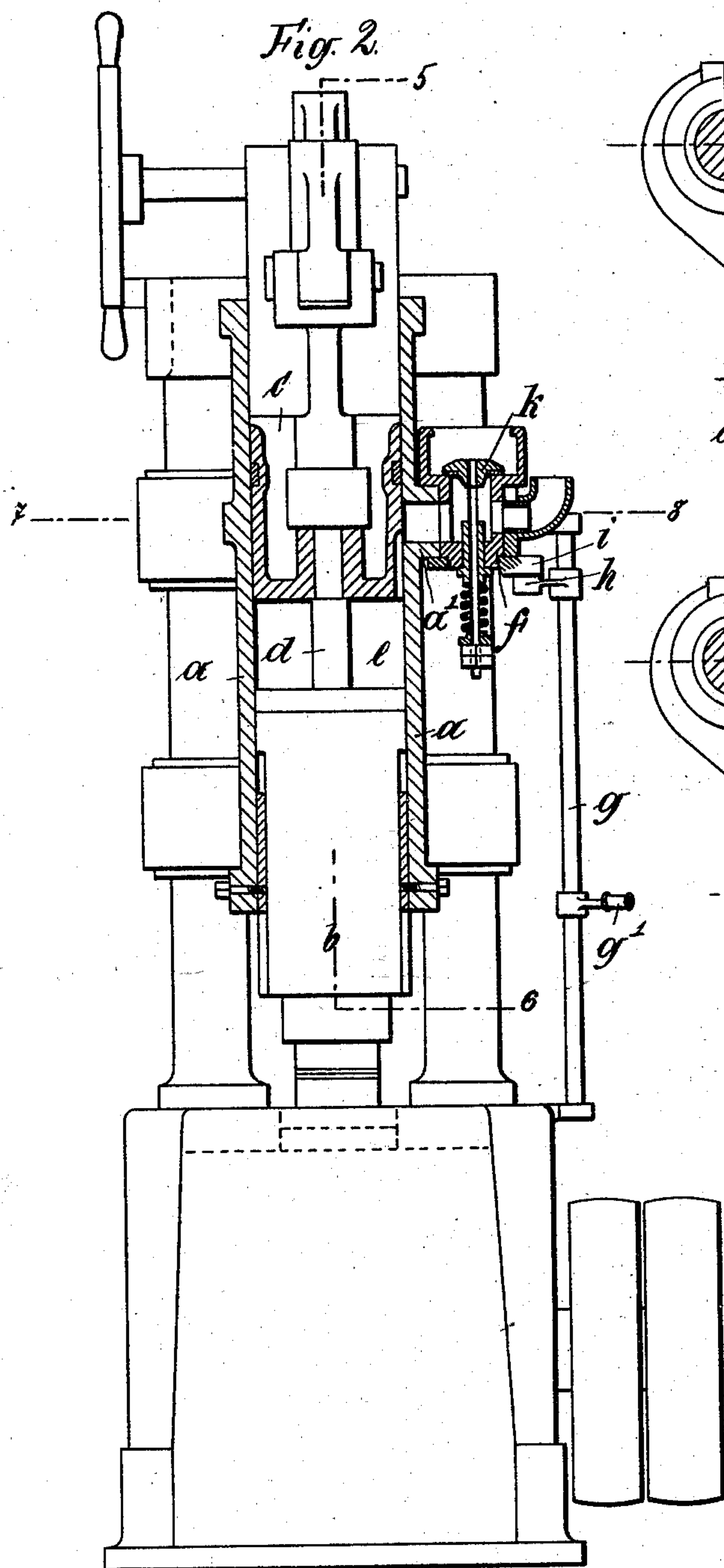
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# UNITED STATES PATENT OFFICE.

JEAN BÊCHÉ, JR., OF HÜCKESWAGEN, GERMANY.

## PNEUMATIC HAMMER.

SPECIFICATION forming part of Letters Patent No. 559,251, dated April 28, 1896.

Application filed December 17, 1895. Serial No. 572,483. (No model.)

*To all whom it may concern:*

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

This invention refers to pneumatic hammers of that kind in which the ram, rammer, or monkey is formed by a cylinder containing a piston, and in which said cylinder is operated from said piston by the mediation of air that is inclosed within the said cylinder above or below the said piston. There are in a hammer of said kind the movements or blows of the ram, rammer, or monkey—*i. e.*, of the cylinder—dependent on the movements of the piston, and the latter is to be set going or is to be stopped if the cylinder is to strike or is not to strike. Owing thereto the regulation of the number of blows and of their strength is in hammers of the said kind a difficult one.

My improvements in the machines in question relate to means for doing away with the drawbacks mentioned at the end of the foregoing paragraph, and I attain that object by the construction shown in the accompanying drawings, in which—

Figure 1 is a side view of my improved hammer, the main working parts being in vertical section, the latter being taken on line 5 6 of Fig. 2. Fig. 2 is a front view of said hammer, the main working parts being in vertical section. Figs. 3 and 4 are two horizontal sections taken on lines 7 8 of Fig. 2, and showing two different positions of the plug *f*.

The guide-piece *a* for the monkey *b* is constructed in the form of a cylinder, and the cross-head *c* of the piston-rod *d* is formed into a piston adapted to move up and down within said cylinder *a*. There are thus in my improved machine two pistons connected by a common rod and moving simultaneously upward and downward without altering their relative distance. The upper one, *c*, of said pistons forms, together with the monkey *b*, a chamber *e*. A lateral tube-like extension *a'*, Figs. 2 to 4, of the cylinder *a* serves as a casing for a plug *f*, which may

be turned from the shaft *g* by means of the lever *h* and the link *i*. The shaft *g* is for that purpose provided with a handle *g'*. The plug *f* forms in its upper part a seat for a valve *k*, which is acted upon by a spring constantly tending to close said valve. It is thus seen that air may be forced out of the chamber *e* at any time, but can be sucked in only if the passage through the parts *a' f* is open.

Suppose the passage be open. The monkey *b* will be raised and lowered—*i. e.*, caused to strike—at every stroke of its piston *b'*, as will be clear without further explanation to every one versed in the art in question. If, however, the monkey is to cease striking, the plug *f* is turned so as to close the outer end of the air-channel *a'*, when the further action will be as follows: The piston *c*, moving rapidly upward, causes the air contained within the chamber *e* to rarefy, whereas the air contained within the monkey *b* above the piston *b'* is compressed by this piston. Owing to the rapid movement of the piston *b'* the degree of compression of the air is very strong, and the monkey is suddenly thrown upward with considerable force, the more as the air within the chamber *e* is in a rarefied state. In consequence of the compression on one side and the rarefaction on the other side the powerful upward movement of the monkey continues after the same movement of the piston *b'* has ceased, and a corresponding part of the air contained within the chamber *e* is thus driven out through the valve *k*. The space finally remaining between the piston *c* and the monkey in the highest position of the latter is, in fact, only a seventh or an eighth of what it was in the lowest position of said two parts.

The piston *c*, and consequently the piston *b'* too, never stop in their reciprocating motion. There is, however, the difference that the strokes of said two pistons are invariably of the same length, whereas the strokes of the monkey become considerably shorter after the outer end of the channel through *a'* has been closed by the plug *f*, said latter strokes being then so short that a comparatively great distance remains between the anvil and the monkey in the lowest position of the latter. The space between the monkey and the piston *c* does not, as a matter of course, re-



main as small as described at the end of the foregoing paragraph; but, on the other hand, said space does not again become as large as it formerly had been, the rarefaction on one  
 5 side and the atmospheric pressure on the other side preventing the monkey from assuming its proper lowermost position. The monkey regains the latter position—*i. e.*, begins again to strike—as soon as the plug *f* is  
 10 opened. If said plug is fully or nearly fully opened, the strength of the blows of the monkey will be the greatest attainable. If, however, the plug is but slightly opened, the strength of the blows will be correspondingly  
 15 decreased, the degree of strength being dependent on the degree of opening of the plug. The monkey is governed by the movements of the plug *f* or of the handle *g'*, respectively, with remarkable exactness, and the number  
 20 of blows, as well as their strength, may be regulated perfectly at will.

The construction of the piston *b'* is old; but for the sake of completeness I will give a short explanation of the purpose of the chan-  
 25 nels and ball-valves arranged within said piston.

The piston-rod *d* contains a channel *d'*, which is at its lower end closed by a ball-valve *m*, the ball of which is preferably sup-  
 30 ported by a spring, and opens at its upper end by any suitable aperture (not shown) into the atmosphere. Said channel *d'* communicates by the angular channel *b<sup>2</sup>* with the chamber above the said piston *b'*; but said communi-  
 35 cation is normally interrupted by a valve *m'*, arranged in the upper part of said channel *b<sup>2</sup>*.

The purpose of the arrangements just described is to prevent the arising of a vacuum in either of the chambers of the monkey *b*.  
 40 If, for instance, the piston *b'* is caused to remain for a rather long time in its upper position, the air contained and compressed within the upper chamber of the monkey will slowly be forced away by the weight of the  
 45 latter. When thereafter the machine is to work again and the piston *b'* is to move away from the upper part of the monkey, there then occur in the proper working of the machine disturbances resulting from the vacuum in  
 50 the upper chamber of the monkey *b*. Such disturbances are effectively avoided by the use of the valve *m'*, in that in the case afore-  
 stated air may enter the empty space through the channels *d' b<sup>2</sup>*, but cannot leave that space  
 55 through these channels. This is also the case

with the lower chamber of the monkey *b* and the valve *m*, and I think I may, after the explanation above given, abstain from repeating the same.

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

1. In a pneumatic hammer having as a monkey a cylinder operated by a piston arranged within said cylinder, the combination with  
 65 the said cylinder or monkey, of a second cylinder forming a guide for said monkey, and of a second piston connected with the first piston, and moving within said second cylinder; and means for rarefying the air con-  
 70 tained within the space between the said monkey and said second piston, for the purpose as described.

2. In a pneumatic hammer having as a monkey a cylinder operated by a piston arranged  
 75 within said cylinder, the combination with the said cylinder or monkey, of a second cylinder forming a guide for said monkey, and of a second piston connected with said first piston, and moving within said second cylinder; a valve adapted to be automatically op-  
 80 erated by the air contained in the space between the monkey and said second piston; and means for controlling the operation of said valve compulsorily, for the purpose as  
 85 described.

3. In a pneumatic hammer having as a monkey a cylinder operated by a piston arranged within said cylinder, the combination with  
 90 the said cylinder or monkey, of a second cylinder forming a guide for said monkey, and of a second piston, connected with said first piston, and moving within said second cylinder; a valve or plug adapted to put the air  
 95 contained within the space between the said monkey and said second piston into communication or non-communication with the outer air; a second valve arranged within or upon  
 100 said first valve, and adapted to be actuated by the air contained within said space; and means for operating the said first valve compulsorily, substantially and for the purpose as described.

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

JEAN BÊCHÉ, JR.

Witnesses:

T. H. STRAUSS,  
 A. STRAUSS.