(No Model.)

3 Sheets—Sheet 1.

H. EICHBAUM.

PNEUMATIC GUN.

No. 450,693. Patented Apr. 21, 1891.

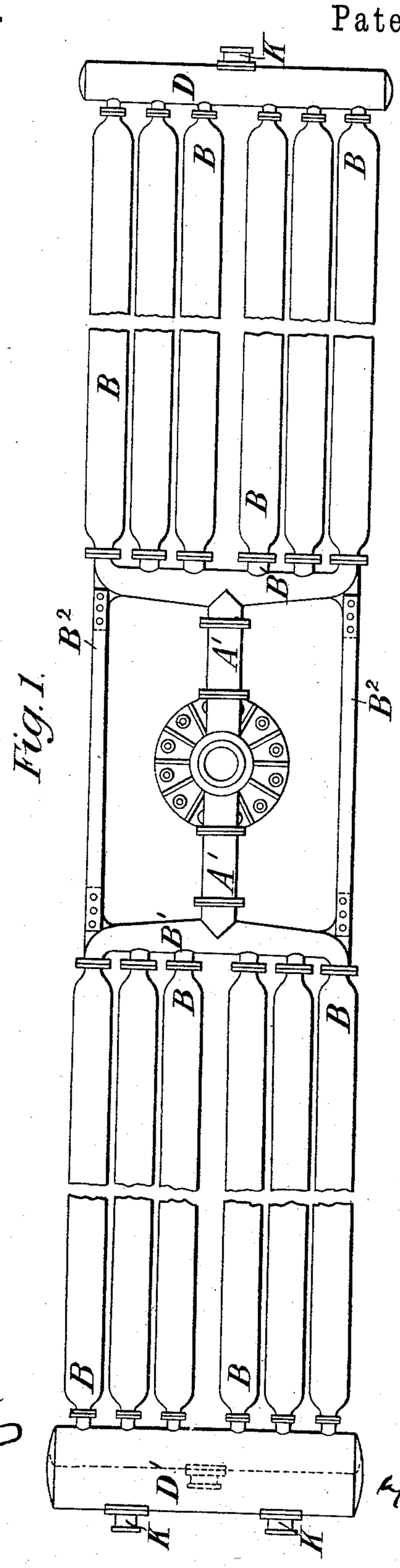

Fig. 1.

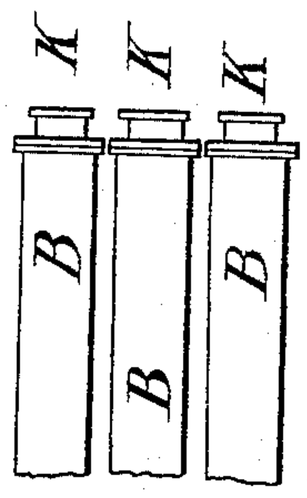

Fig. 2.

Witnesses:
H. S. McArthur
Jno. G. Hinkel

Inventor:
Henry Eichbaum
by Foster Freeman
Atty

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Fig. 4.

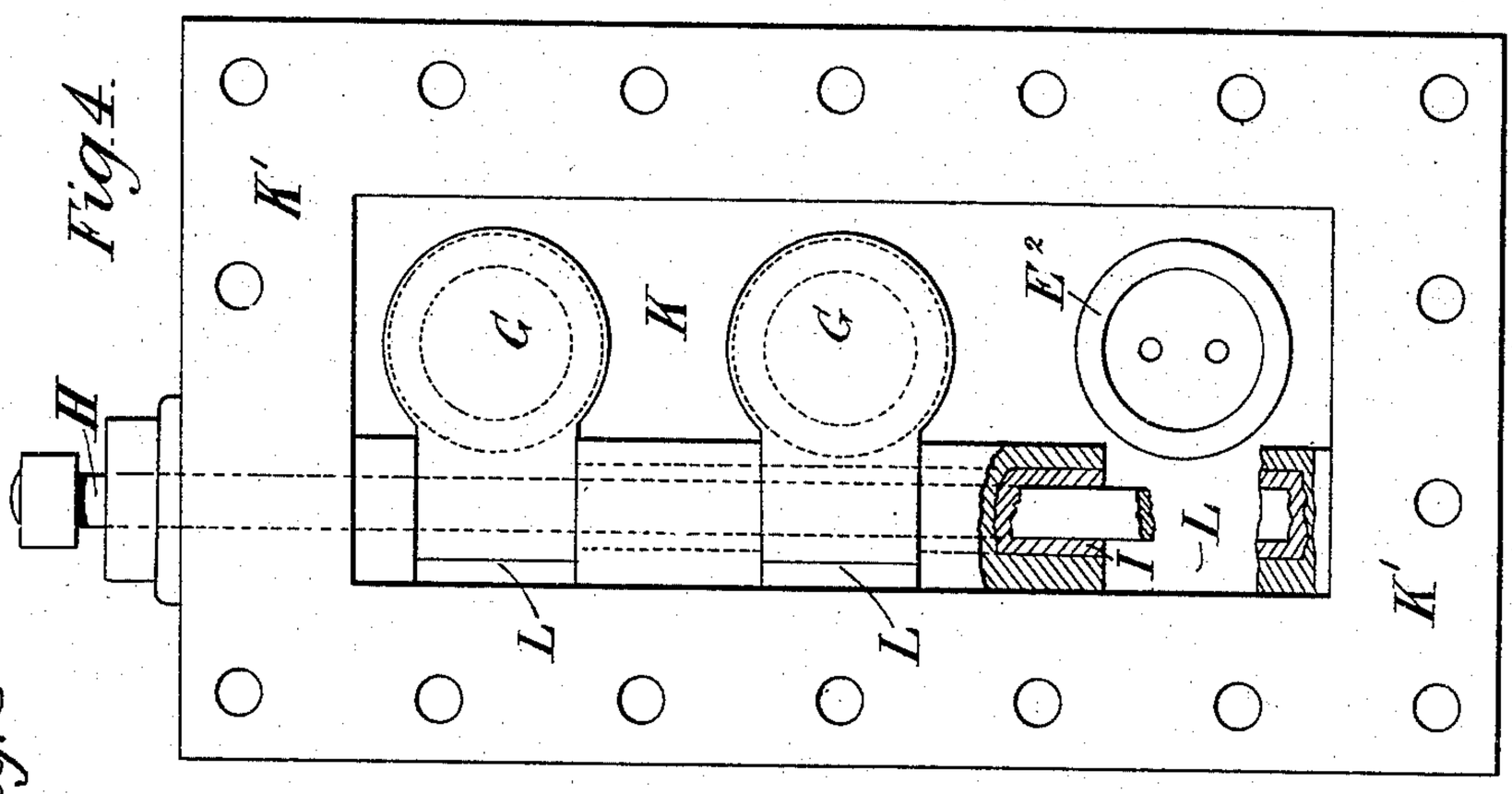

Fig. 8

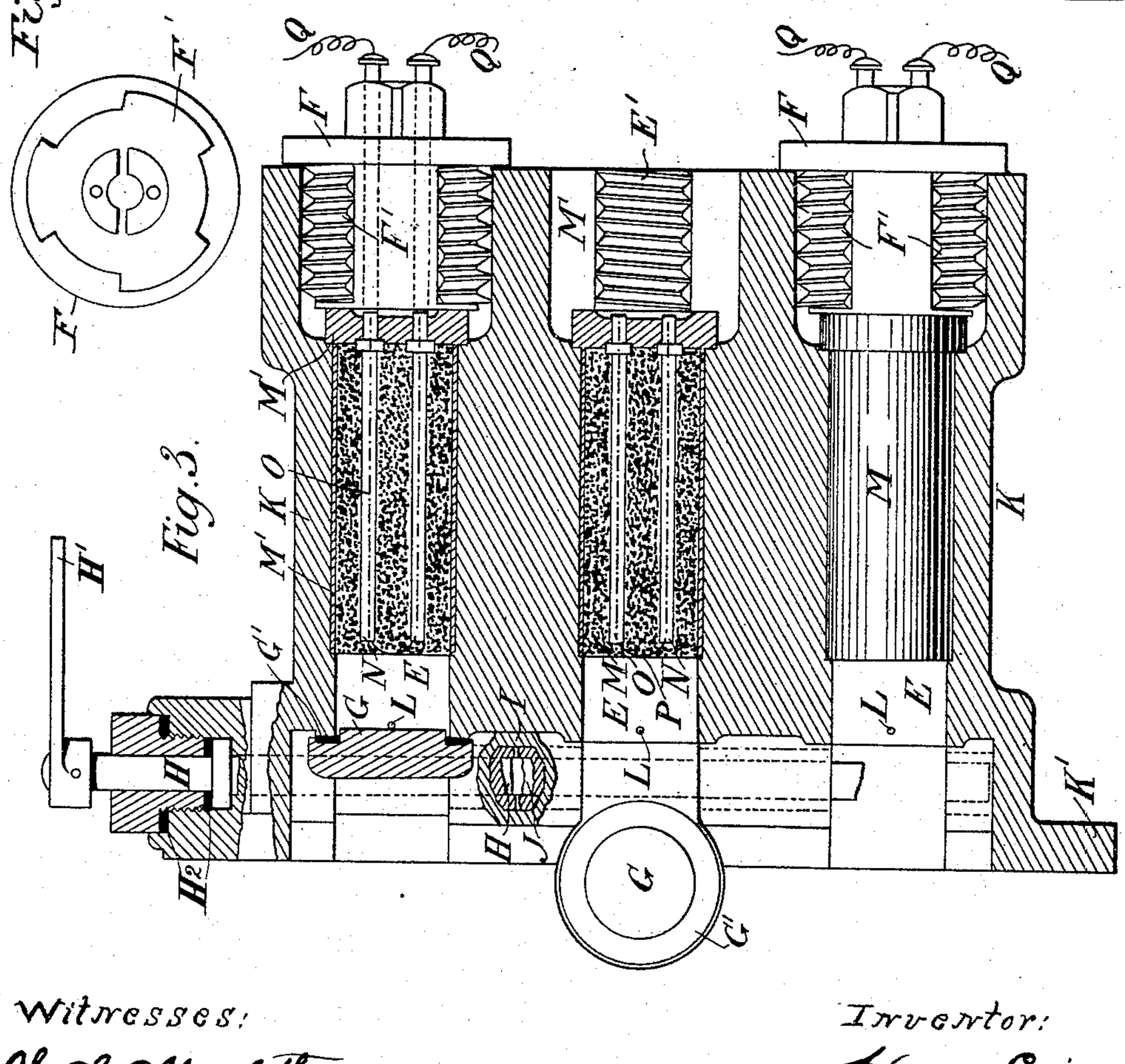

Fig. 3.

Witnesses:

H. S. McArthur

Jno. G. Hinkel

Inventor:

Henry Eichbaum

by Foster Freeman

atty.

(No Model.)

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H. EICHBAUM.

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Fig. 6.

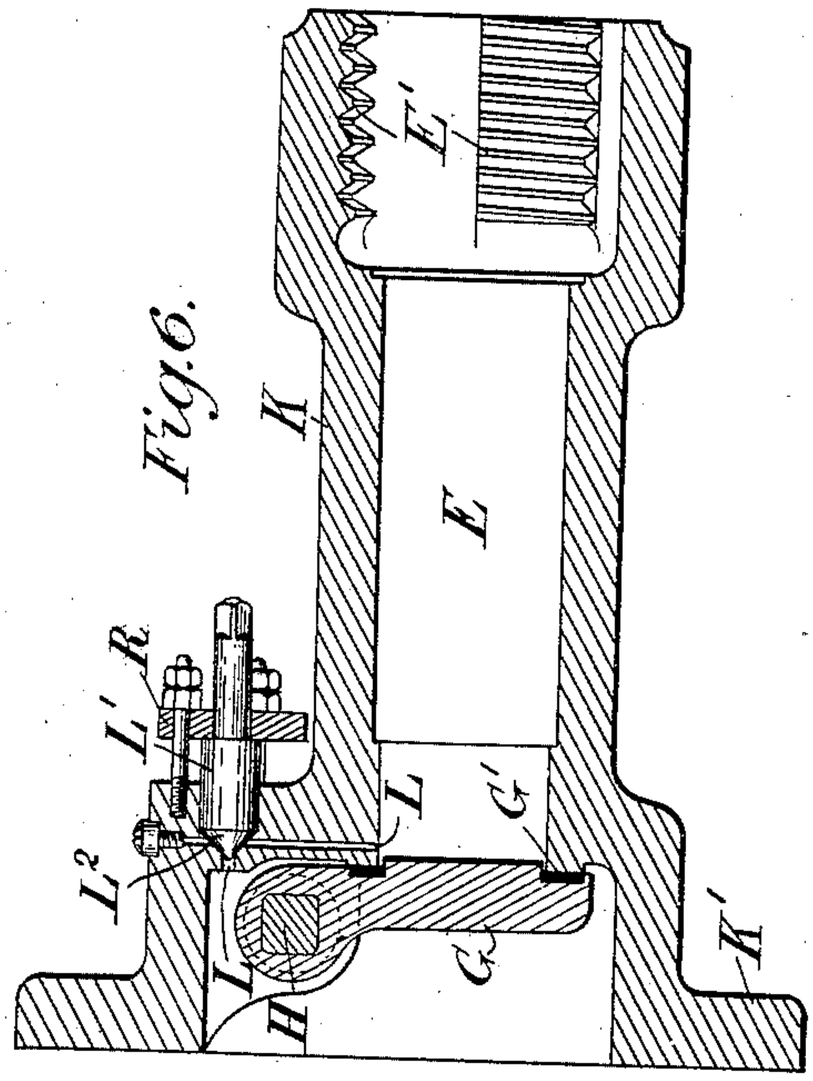


Fig. 7.

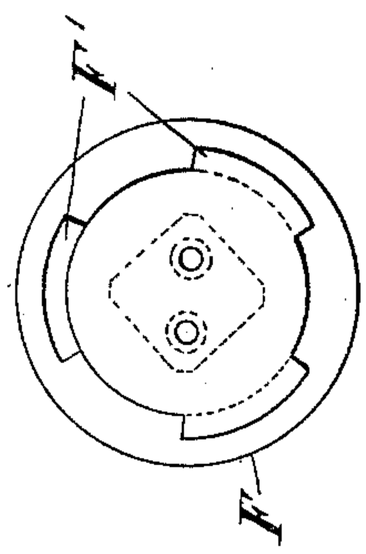
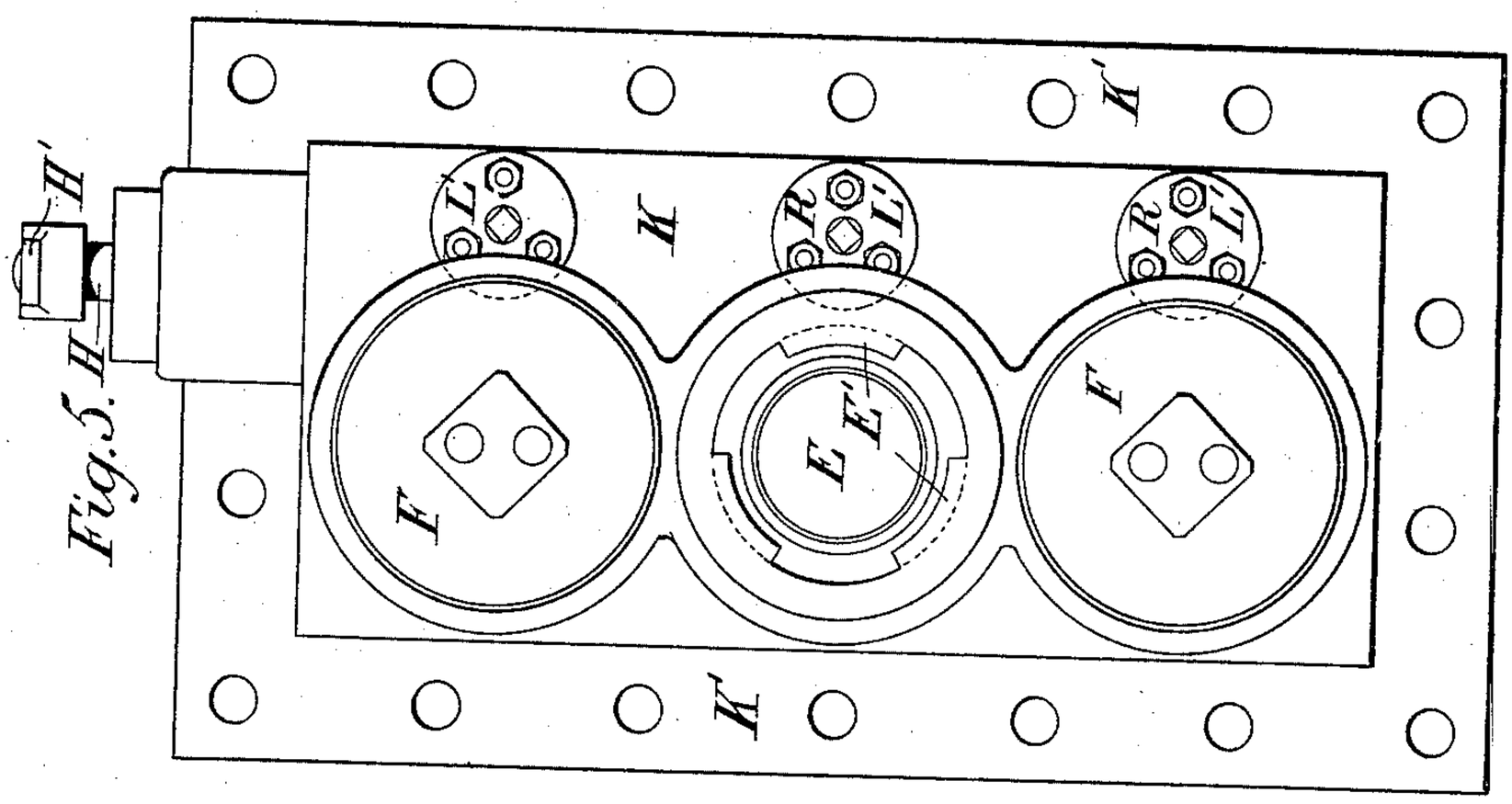


Fig. 5.



Witnesses:
H. L. McArthur
Jno. J. Kinkel

Inventor:
Henry Eichbaum
by Foster & Freeman
Attys

UNITED STATES PATENT OFFICE.

HENRY EICHBAUM, OF LONDON, ENGLAND.

PNEUMATIC GUN.

SPECIFICATION forming part of Letters Patent No. 450,693, dated April 21, 1891.

Application filed August 25, 1890. Serial No. 362,920. (No model.)

To all whom it may concern:

Be it known that I, HENRY EICHBAUM, a citizen of the United States, at present residing at London, in England, have invented certain new and useful Improvements in or Relating to Pneumatic Guns, of which the following is a specification.

This invention relates to that class of gun or cannon in which the projectile is "fired" or expelled from the tube or barrel by means of a charge of compressed air or gas instead of by the explosion in the barrel of a charge of powder or equivalent.

The present invention is particularly designed for the requirements of portable or semi-portable guns, although it may also be applied to fixed ones. A difficulty met with in the furnishing of portable pneumatic guns of this nature is that, excepting with the use of liquefied gas, which is attended with certain drawbacks—that of cost, for example—it is very difficult to carry any considerable number of charges of compressed air or gas. This difficulty I propose to surmount in the following manner: I employ powder or equivalent, which, upon exploding or igniting, generates or liberates gases, and by either generating or collecting these gases in a suitable reservoir or vessel I obtain the pressure required. From this reservoir by any suitable arrangement of valve mechanism I can admit the gas as needed to the gun-tube. When the pressure is reduced by firing, I discharge so many more cartridges or so much more of the powder and thus restore the pressure in the reservoir. The cartridges or powder may be discharged in any convenient manner, as by detonators or by an electric current, and their discharge or explosion may take place either in the reservoir itself or in a firing-chamber in connection therewith. For this purpose it is not necessary that the powder used should be such as explodes with great violence, and such as liberate fixed gases are preferable to those which (like common gunpowder) leave a residue, which might foul the interior of the reservoir or the firing machinery of the gun.

Figure 1 is a plan of one form of apparatus constructed according to this invention, and in which the pressure is obtained by the explosion of cartridges. Fig. 2 is a plan of a modified part of the same. Fig. 3 is a horizontal section; Fig. 4, an internal end elevation, and Fig. 5 an external end elevation, of apparatus suitable for obtaining pressure from the discharge of cartridges. Fig. 6 is a vertical section of one of the chambers shown in Fig. 3. Fig. 7 is a cross-section showing the interrupted screw arrangement of the breech-closing device of the chambers, and Fig. 8 is an end view of the breech-block.

Like letters represent like parts throughout the drawings.

In Fig. 1, A represents the hollow pintle by which the pressure is conveyed to the cannon, A′ being the conduits conveying it to the pintle from the reservoirs B, which in the drawings are shown as consisting of six tubular vessels on each side of the pintle and connected with cross-tubes B′, which are braced together by the tie-rods B^2. This particular form of reservoir is here shown, as it is that which I have fully described and illustrated in my British Patent No. 6,369 of 1889. This reservoir B is the intermediate gas reservoir or chamber employed between the barrel of the gun and the reservoir D. The reservoirs B are not independent, as they are connected by the conduits A′, which unite at the pintle A, so that a uniform pressure is obtained in both sets of reservoirs.

The reservoirs D are provided with means—such, for example, as the explosion-chamber K—for exploding in these reservoirs or conveying to them the products of the explosion or ignition of cartridges, powder, or the like for the purpose of raising the pressure in the reservoirs D and B. In Fig. 1 two of these reservoirs D D′ are shown—one connected with each set of the intermediate reservoirs B; but it is not absolutely necessary that more than one of the reservoirs D should be employed, though it is convenient to do so, and it will be understood that I do not limit myself to the number of reservoirs D that may be employed; also, in the case of the reservoirs D the presence of the intermediate reservoirs B is not essential, as they are in effect merely extensions of the reservoirs D, so that if these latter are made sufficiently capacious—as at D′, for example—the requisite supply of compressed gas may be obtained without the intervention of any intermediate

or supplementary reservoirs. If the apparatus represented in Fig. 1 were constructed complete, of course the two reservoirs D would be made of the same size, as indicated in dotted lines at D′; or a separate explosion-chamber K may, if preferred, be attached to each of the vessels B, as shown in Fig. 2, in which case the reservoirs D can be dispensed with.

The apparatus for containing the powder (which I prefer to use in the form of cartridges) and in which it may be exploded or ignited will be best understood by reference to the drawings, Figs. 3 to 7, which I will now proceed to explain. In Figs. 3 to 6 is illustrated the box or casing containing the cartridges and chambers in which they are exploded. This box K is shown provided with flanges K′, by which it may be bolted onto the reservoir D of Fig. 1; but it will be understood that so long as the cartridge-chambers communicate with the interior of the reservoir to which they appertain it is immaterial in what particular way they are connected with it. Each of the chambers E then, of which there may be any desired number, connects with, or enters into, or may be contained in this reservoir or conduit to another reservoir D, so that the products of the explosions in each chamber pass into D, being retained there for use as required. Each chamber E is provided with a breech-block F or equivalent means for closing its open end, and this block is preferably connected with the chamber by means of an interrupted screw E′ F′, so that the block may be inserted and then turned round sufficiently to firmly secure it in the chamber in the manner commonly adopted with breech-loading ordnance. At the inner end of the chamber E is a gate, valve, or equivalent device G, connected with a spindle H, which may be turned by a handle H′, so that by turning the spindle H all the gates G can be simultaneously opened or closed, as will be well understood by reference to Figs. 3, 4, and 6 of the drawings. These gates or valves normally remain closed, as in Fig. 6, and while they are in this position the breech-blocks F and cartridges can be removed and replaced at pleasure without loss of pressure in the reservoir D. Each gate is preferably provided with a packing-ring G′, adapted to fit upon the seating E^2, so as to make a tight joint and facilitate repairs. The spindle H passes through a stuffing-box containing packings H^2, by which a tight joint may be secured around it. This spindle H is preferably square throughout its length, and where it passes through the stuffing-box and gland it carries at those portions where it obtains a bearing in the metal surrounding the chambers E thimbles I, square inside, so as to fit upon and turn with the spindle H, but cylindrical or circular on their outer surface, so as to turn freely in the circular bearings provided for them. In Fig. 3 the spindle H is shown broken at J, the handle portion being shown in one position with the gate G of the chamber E nearest to the handle closed, while the other portion remote from the handle is shown at right angles to the handle portion, and this remote portion carries the gate G of the middle chamber E, which valve is shown in its open position. As it would be a difficult matter to open these valves G against the pressure in the reservoir D, it is desirable to equalize the pressure on both sides of the valve, and this may be accomplished in the following manner: A passage L is provided in the wall of the chamber, one end of the passage opening to the reservoir side of gate G and the other end into the chamber E. A plug L′, preferably tapered at its end, as shown, and provided with a curved passage L^2, adapted when in proper position to communicate with the passage L, controls these passages, so that by turning this plug the communication between the reservoir and the chamber can be either established or cut off. When this communication is cut off, the gate G remains closed with the full pressure of the reservoir upon it; but when the communication by the passage L is opened the pressure upon the two sides of the gate G is equalized, (the breech-block F being, of course, in position and closing up the chamber E at such time as this communication is open,) and the gate G can then be opened. Where the pressure is so great that even this balancing of the pressure on both sides of the valve is not sufficient, a different form of valve may be employed, preferably a form of piston-valve in which the areas may be suitably arranged, or an automatic valve may be employed adapted to open automatically, while the pressure in the chamber E due to the explosion is greater than that in the reservoir, closing again when the pressure in the reservoir exceeds that in E. The plug L′ may be held in its position by the cap R, and the end of the plug is tapered to effect a tight joint against the seating on which it works.

The cartridges M may be fired by any convenient means—as by a detonator, for example—but preferably an electric current which may be introduced as follows: Each cartridge is provided with two tubes N, containing a wire O, the two wires being joined at the inner end of the cartridge by a platinum wire P. The tubes N are carried in the base M′ of the cartridge, the wire extending sufficiently far through to make electrical contact with corresponding wires Q, carried in the breech-block F. If desired, the wires Q may terminate on the inner side of the breech-block in segmental contact-plates *q*, so that proper contact may be insured with the wires O, while allowing for the turning of the breech-block after it has been inserted in the chamber. By this arrangement of the wires the charge may be fired at any desired point, according to the length of the tubes N; but it would be desirable usually to fire the charge as near its inner end as possible, and this

would be accomplished by the arrangement shown in Fig. 3, where the heated portion of the wire P is brought close to the inner end of the cartridge.

The operation of this portion of the invention is as follows: It being desired to charge the reservoir, the cartridge-chambers are charged with the cartridges and the breech-blocks put in and screwed home, the gates G are opened, the circuit completed, and the cartridges, discharged, preferably in succession. The gates G are then closed, the breech-blocks and discharged cartridges removed, fresh cartridges inserted, and the breech-blocks replaced, when the process is again gone through, and so on until the required pressure is obtained or restored to its initial or normal limit. If automatic valves G were employed in place of the hand-operated gates, the opening and closing of the valves would not require to be attended to, the chief object of the gate-valve or other mechanical equivalent being to prevent the escape of pressure while the cartridges are being charged or other arrangements made for additional explosions or ignition. Therefore, if, for example, cartridges were so arranged as to successively expel the discharged ones while still preventing the escape of pressure that would represent the equivalent of the valve or gate G, it is preferable to employ more than one set of cartridge-chambers, so that the cartridges in one set of chambers may be discharged while those in another one are being replaced.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I wish it to be understood that I am aware that it has before now been proposed to obtain pressure in a reservoir by the explosion or ignition of gunpowder or the like, and that I make no general claim thereto. So far as I am aware, however, it has never before been proposed to renew the pressure thus obtained when reduced by use or leakage until the pressure has entirely gone, nor can I find that any apparatus has been devised for this purpose, whereas by this present invention the pressure can be renewed at any time and with any pressure short of the top limit existing in the reservoir.

What I claim is—

1. In a pneumatic gun, the combination, with the pintle by which the pressure is supplied to the gun, of a reservoir connected to the pintle and explosion-boxes connected to the reservoir, whereby the pressure in said reservoir is maintained by successive discharges, substantially as described.

2. In a pneumatic gun, the combination, with the pintle by which the pressure is supplied to the gun, of a conduit connected to the pintle, a cross-tube connected to the conduit, and a reservoir connected to the cross-tube supplying air to the gun, the said reservoir being provided with explosion-boxes whereby the pressure is maintained by successive discharges, substantially as described.

3. In a pneumatic gun, the combination, with the pintle by which the pressure is supplied to the gun, of conduits connected to the pintle on either side, a cross-tube connected to the conduits, reservoirs connected to the cross-tubes, tie-rods between the cross-tubes, and explosion-boxes arranged in the reservoirs, which reservoirs supply the air or gas for firing the gun, substantially as described.

4. The combination, with the reservoir of a pneumatic gun, of an explosion-box connected to the reservoir and provided with one or more explosion-chambers for the reception of the explosive cartridge, each chamber having a removable breech-block at one end and a valve at the other end, and a pressure-equalizing device for equalizing the pressure on both sides of the valve, substantially as described.

5. The combination, with the explosion-chamber of a pneumatic gun adapted to receive a cartridge, of a valve at one end of the chamber and a removable breech-block fitting the other end of the chamber, the said breech-block being provided with electric conductors terminating in contact-plates on the inner face of the breech-block, substantially as described.

6. In a pneumatic gun, the combination, with a reservoir, of an explosion-box having a number of explosion-chambers formed within it and provided with a corresponding number of valves between the explosion-chamber and the reservoir, a spindle connected to the valves operated from the outside, pressure-equalizing devices for the valves, and breech-blocks fitting the outer ends of each explosion-chamber, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of the two subscribing witnesses.

HENRY EICHBAUM.

Witnesses:
ALFRED J. BOULT,
HARRY B. BRIDGES.