No. 838,694. PATENTED DEC. 18, 1906.

J. A. DEPORT.

PNEUMATIC RECOIL APPARATUS.

APPLICATION FILED JULY 10, 1906.

3 SHEETS—SHEET 1.

Fig. 1

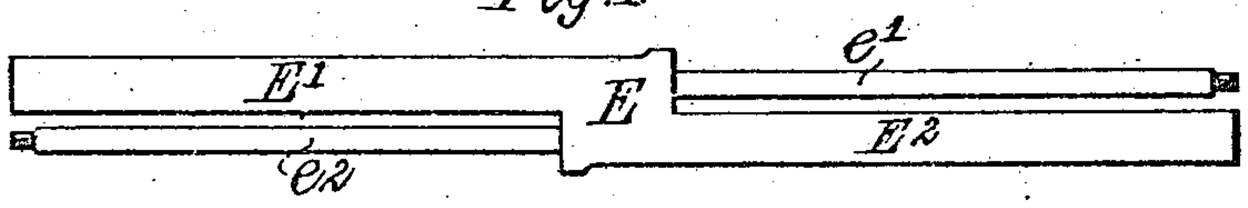
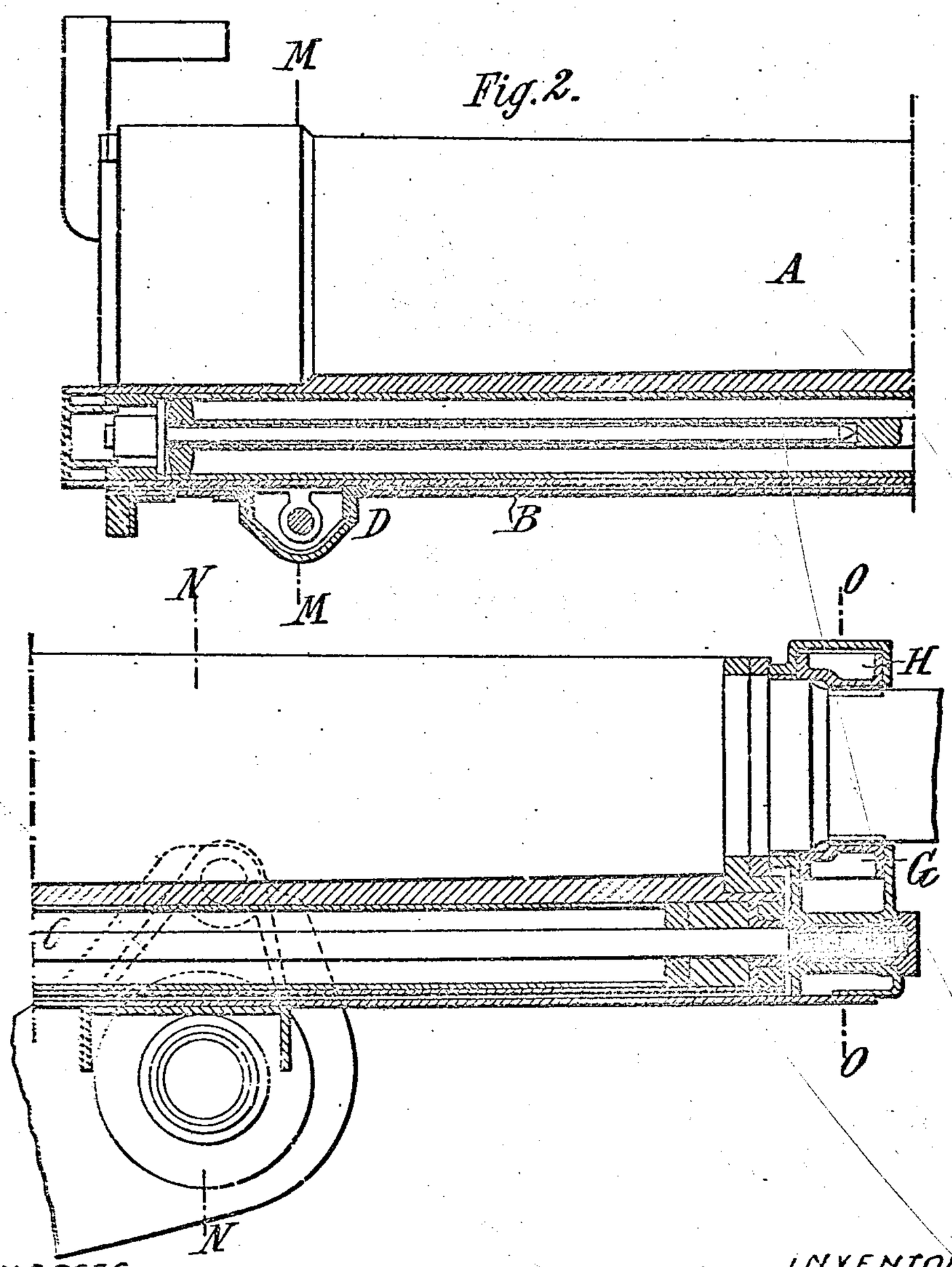


Fig. 2.



WITNESSES:

Fred Eckhardt

René Thirine

INVENTOR:

Joseph Albert Deport,

By his Attorneys

Arthur E. Fraser & Ussing.

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3 SHEETS—SHEET 2.

Fig. 3

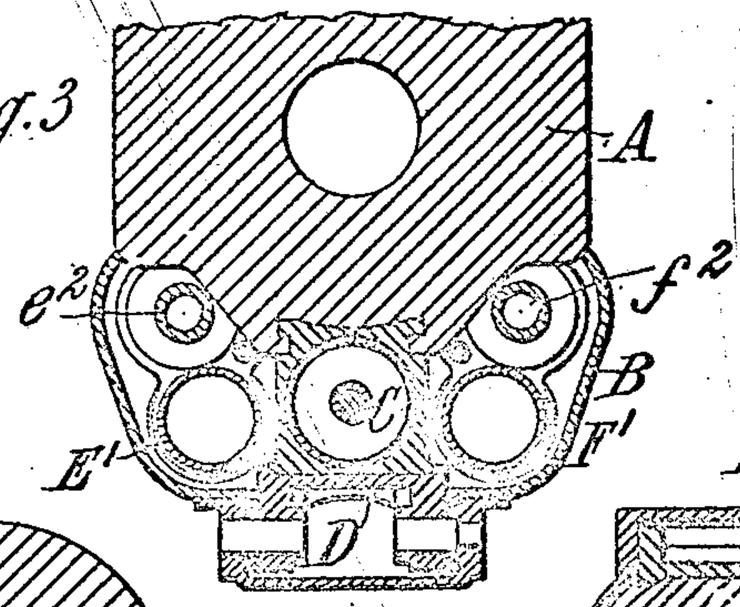

Fig. 4.

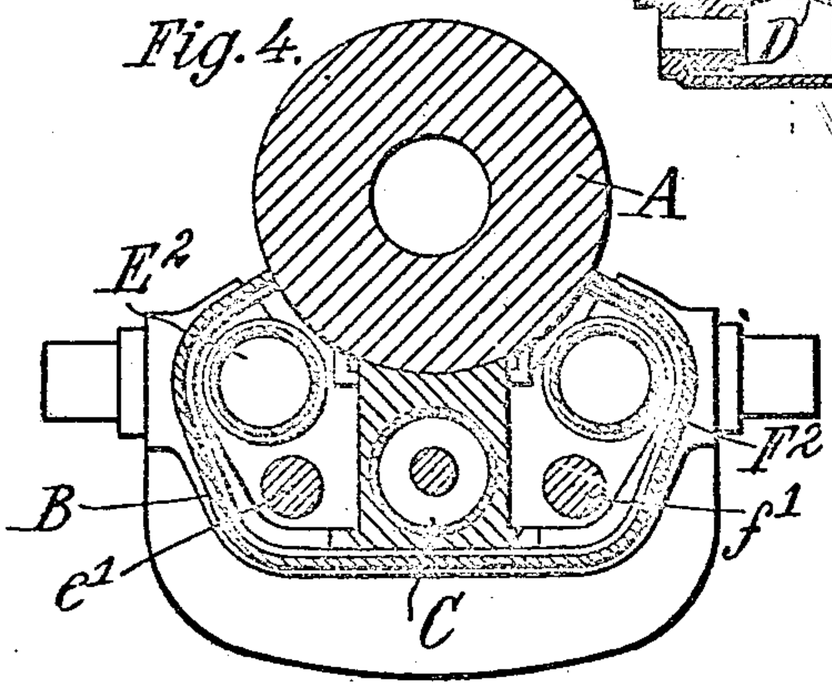

Fig. 5.

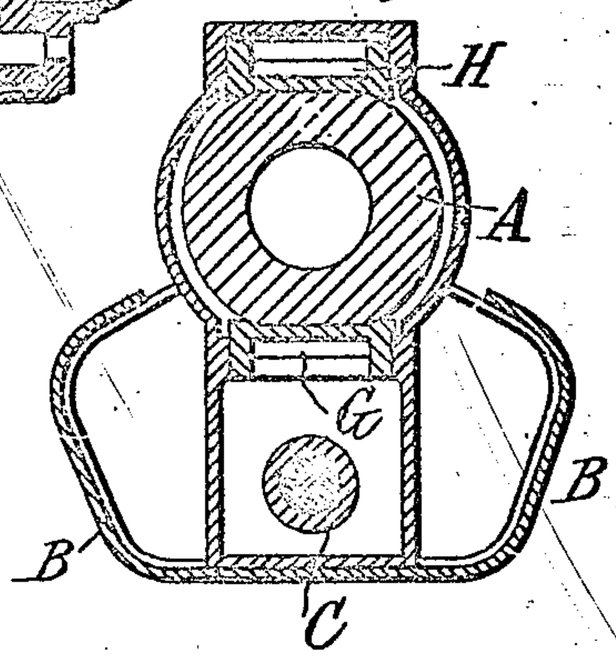

Fig. 6.

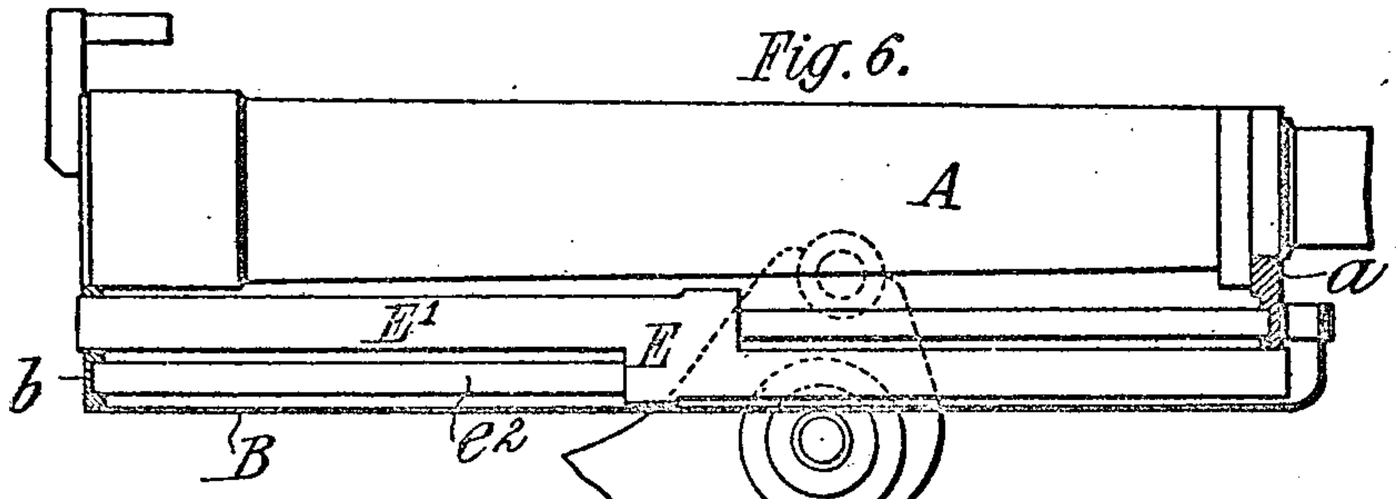

Fig. 8.

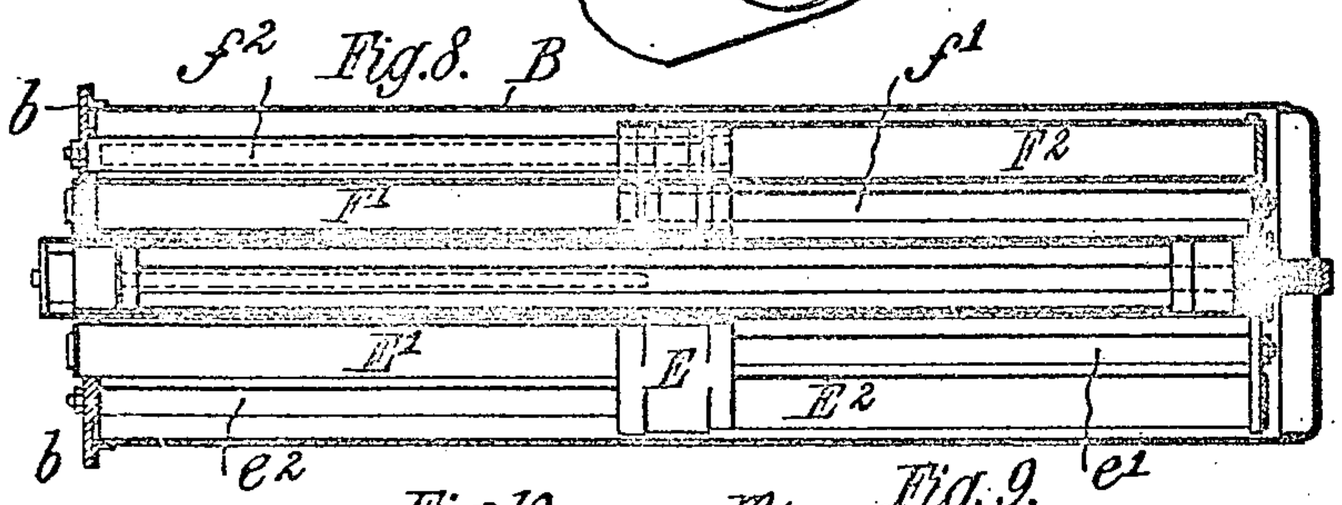

Fig. 10.

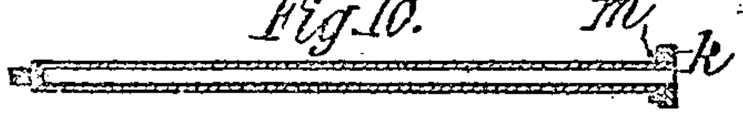

Fig. 9.

WITNESSES:

Fred White

Rene' Bruine

INVENTOR:

Joseph Albert Deport,

By his Attorneys

Arthur G Fraser & Usina

No. 838,694. PATENTED DEC. 18, 1906.

J. A. DEPORT.

PNEUMATIC RECOIL APPARATUS.

APPLICATION FILED JULY 10, 1906.

3 SHEETS—SHEET 3.

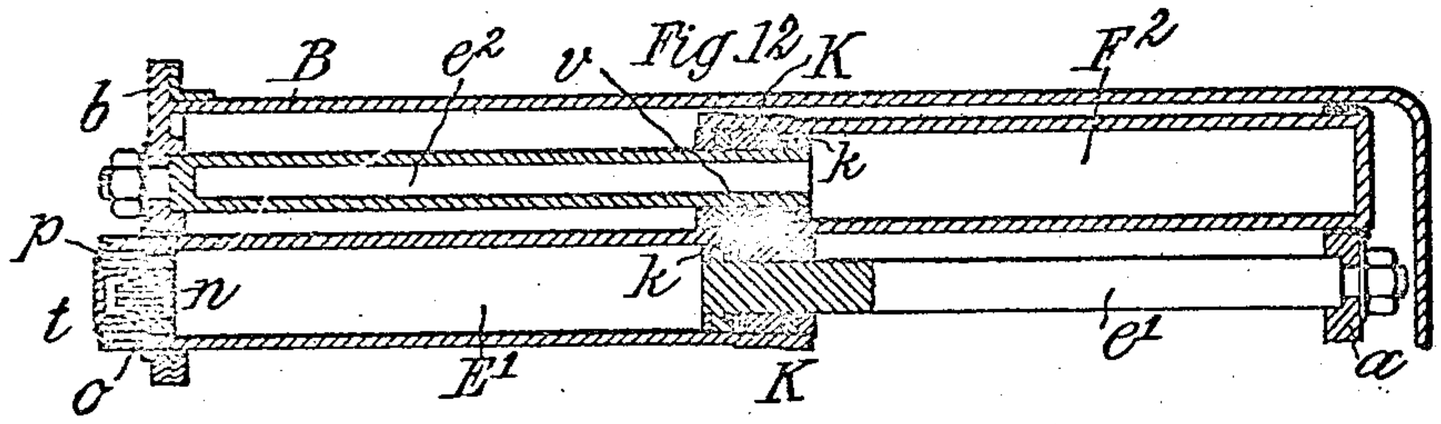

Fig. 12.

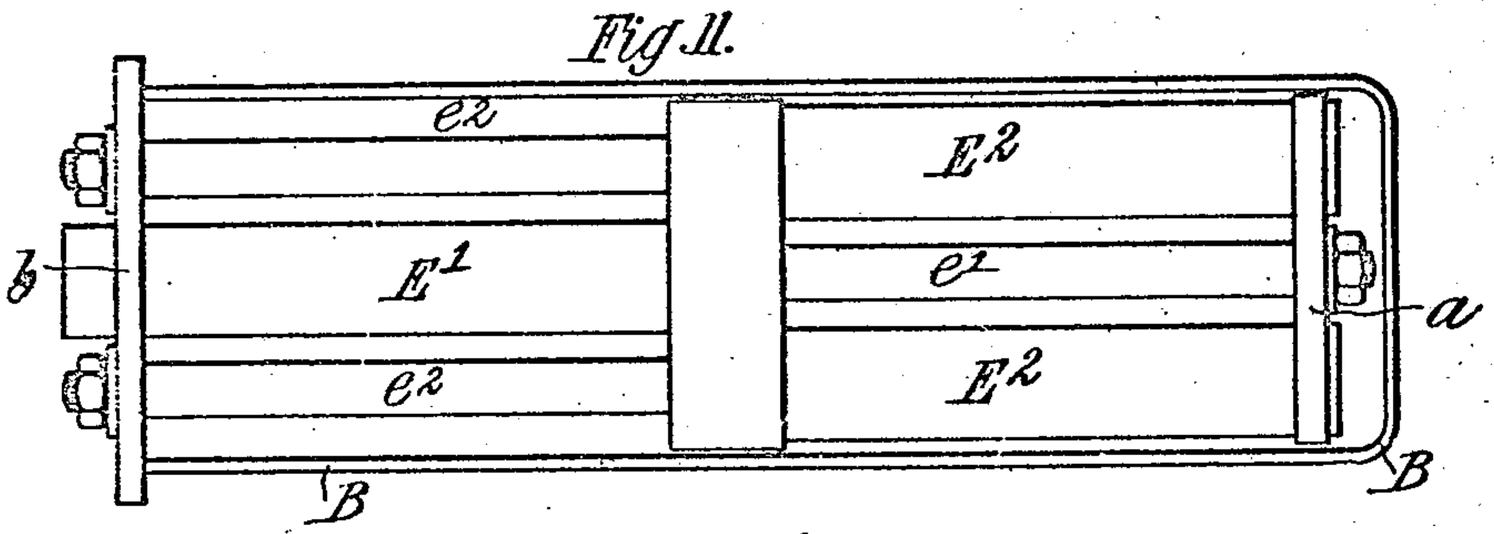

Fig. 11.

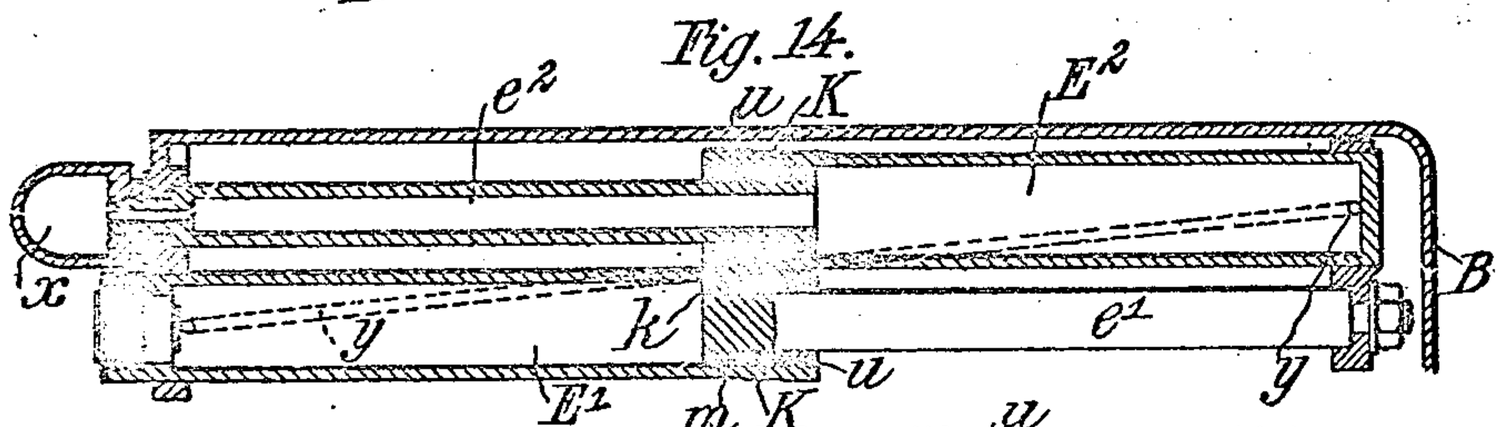

Fig. 14.

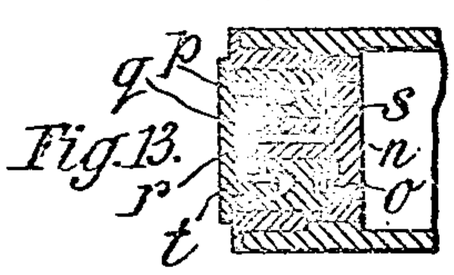

Fig. 13.

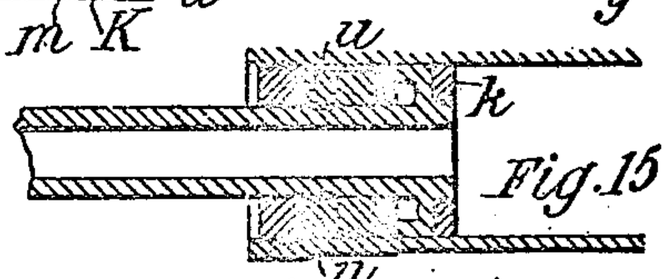

Fig. 15

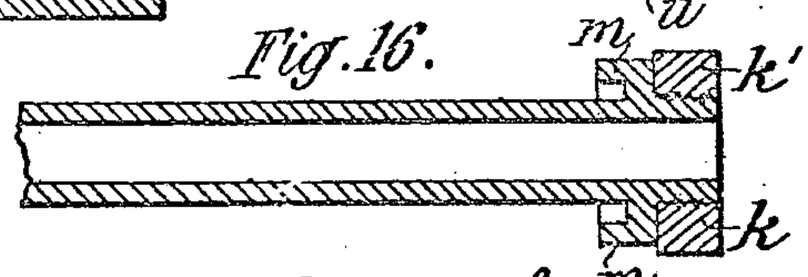

Fig. 16.

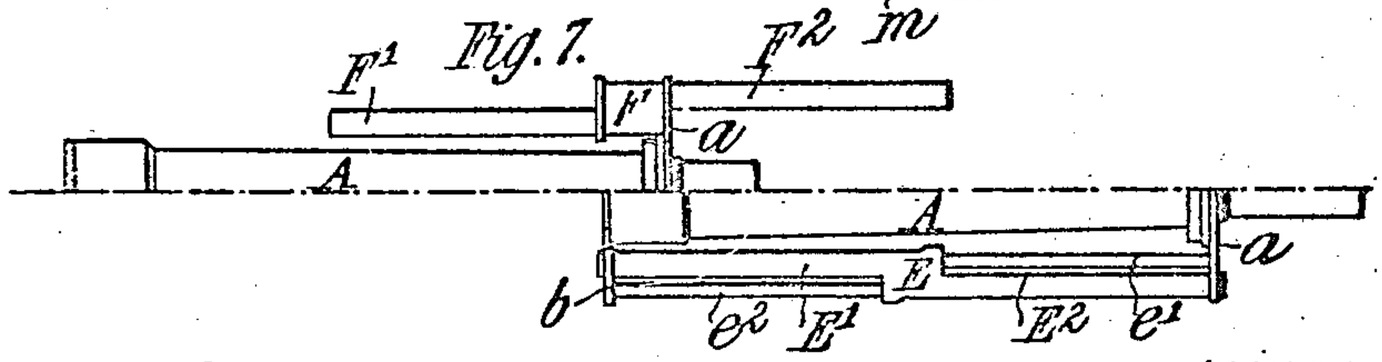

Fig. 7.

WITNESSES:

Fred Whitt

René Thuine

INVENTOR:

Joseph Albert Deport,

By his Attorneys

Arthur O. Fraser & Sons

UNITED STATES PATENT OFFICE.

JOSEPH ALBERT DEPORT, OF PARIS, FRANCE.

PNEUMATIC RECOIL APPARATUS.

No. 838,694. Specification of Letters Patent. Patented Dec. 18, 1906.

Application filed July 10, 1906. Serial No. 325,460.

To all whom it may concern:

Be it known that I, JOSEPH ALBERT DEPORT, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Pneumatic Recoil Apparatus, of which the following is a specification.

This invention relates to the construction of pneumatic recoil apparatus composed of cylinders containing compressed air or gas and operating by compression and expansion—that is to say, springs operating by pistons or plungers; and it consists of arrangements which have for their object to obtain a very long stroke relatively to the total length of the apparatus when at rest.

The invention is more particularly applicable in cases where the space available for containing the recoil apparatus is limited in extent, and in particular for guns that have a long recoil on the carriage, in which cases it is desirable to reduce as much as possible the length of the cradle which contains the recoil apparatus and on which the gun slides in recoiling and advancing.

The invention consists, mainly, in constructing the recoil apparatus of two or more cylinders arranged end to end in opposite directions, the piston-rods or plungers of which bear, on the one hand, against the movable part and, on the other hand, upon a fixed abutment, so that the total available stroke is composed of the motion of the rod or rods on which the movable parts bear and the motion of the pneumatic cylinders carried along by the moving parts and sliding over the plunger or plungers that bear against the fixed abutment. This double motion affords a length of recoil double that which could be obtained by means of a pneumatic apparatus having a single cylinder of the same length as the cylinders of the above-described construction and having when at rest, together with its plunger, a total length equal to that of the combined two inverted cylinders according to the present invention. I will describe the construction of the said apparatus and its application to guns recoiling on the carriage with reference to the accompanying drawings, which show, by way of example, a gun recoiling on the carriage having lateral recoil apparatus of the above-described construction combined with a central hydraulic brake contained in the cradle.

Figure 1 shows a side view of the said apparatus at rest, the body E of which is composed of two inverted cylinders E′ E² with their plungers e' and e^2. Fig. 2 shows in two halves a side elevation of the gun, with longitudinal section of the cradle and hydraulic brake, the body of which is fixed to the gun, while the piston-rod is fixed to the cradle. Fig. 3 shows a cross-section on line M M, Fig. 2, through the middle of the rear guide of the cradle, which guides the rear end of the gun, the brake-body constituting the sliding part. Fig. 4 shows a cross-section on line N N through the center line of the trunnions. Fig. 5 is a cross-section on line O O at the middle of the front guides of the gun. Fig. 6 shows a side elevation of the gun with its cradle, the carriage, and one of the pneumatic apparatus. Fig. 7 shows two half-plans of the gun in the position of rest and in that of the extreme recoil. Fig. 8 is a sectional plan of the cradle, the hydraulic brake, and the pneumatic apparatus. Fig. 9 shows an end view, to a larger scale, of the segmental head serving to guide the plunger in the cylinder. Fig. 10 is a longitudinal section of one of the plungers. Fig. 11 shows a plan of a modification in which the pneumatic apparatus is composed of three cylinders, two being on one side and the third on the other side in the opposite direction. In this figure the cylinders and plungers are shown of larger diameter relatively to their length than in the preceding figures. Fig. 12 shows a longitudinal section of a pneumatic apparatus, also of a less length than the previous arrangements, and it also shows a section of the valve serving to charge the air into the cylinders. Fig. 13 shows the valve to a larger scale. Figs. 14 and 15 show a modification in which the plunger is made to work fluid-tight and not the rod. Figs. 6, 7, 8, 10, 11, 12, and 13 are to a smaller scale than Figs. 1 to 5. Fig. 16 is a portion of Fig. 10 on a larger scale.

A is the gun, with its cradle B and the central hydraulic brake C, which is fixed to the gun. The rear guide D of the cradle guides the rear end of the gun, which embraces the plate by means of which the brake-body C

rests upon the guide. At the front the gun is guided by the cheeks G H.

On each side of the hydraulic brake are arranged two lateral recoil apparatus, (designated as a whole by the letters E and F, Fig. 7.) Each pneumatic apparatus E or F is composed of a central part fixed to two cylinders E′ E² F′ F², arranged end to end in opposite directions, and in each of these cylinders is a piston or plunger e' e^2 f' f^2.

The gun bears with a rigid arm *a* upon the movable plungers e' f' of each of the pneumatic cylinders. while the other plungers e^2 f^2 bear against a fixed abutment *b* at the rear end of the cradle B, which has openings for the passage of the rear cylinders E′ F′ of the apparatus during the recoil of the gun. The plungers can either be solid or hollow. As shown on the drawings, the one rod is solid and the other hollow, e' being solid, as shown at Fig. 12, so that when this rod passes into the cylinder E′ it effects the compression of the air contained therein, reducing its volume to that of the annular space formed between the plunger e' and the cylinder. In the case of a hollow plunger e^2 the air is compressed to a less degree.

On comparing the two half-plans at Fig. 7 it will be seen that the arm *a* of the gun acting upon the plungers e' f' of the pneumatic apparatus will force back these plungers into the cylinders E′ F′, after which the arm *a* carries back the cylinders, causing them to pass through the openings in the rear end of the cradle, while the cylinders E² F², which are also carried back, move over their plungers e^2 f^2, which bear against the abutment *b* of the cradle. The pneumatic apparatus may of course be arranged with their cylinders either in a horizontal plane, as shown, or in a vertical plane.

The plunger of each cylinder, whether it be solid or hollow, slides within the central part through a stuffing-box K, which forms a fluid-tight packing round the rods. The packing K comprises a number of elastic rings held in a slightly-enlarged socket by an annular nut at the outer end in the usual way and adjusted to the desired tightness by screwing this nut in and pressing them against the internal shoulder of the socket. On the inner end of each rod is a screwed collar *k*, the periphery of which is formed segmental, as shown at Fig. 9, and which serves to guide the rod in the cylinder, the recessed parts serving to allow a free passage of the air from the one side to the other of the collar as the plunger moves inward or outward. The collar *k* bears against a fixed collar *m* of the plunger, as shown at Fig. 16, which is formed with an axially-projecting rim, so as to bear against the soft packing of the stuffing-box K. When the pneumatic apparatus consists of three cylinders, as at Fig. 11, the plunger of the middle cylinder is preferably attached to the arm *a* of the gun, and when this plunger has moved to the inner end of the cylinder the two lateral cylinders are carried along over their fixed plungers, so that the gun has a recoil equal to the sum of the lengths of the middle and lateral cylinders.

One of the pneumatic cylinders is provided at its inner end with a valve for charging them with air under pressure. This valve is shown at Figs. 12 and 13. It consists of a disk valve *n*, having a projecting rim *o*, which bears against an annular packing *p* in the seat of the valve. The rod *q* of the valve has a central channel *r*, having a lateral opening communicating with the space *s* under the valve. A screwed cap *t* serves to protect the valve. For charging the pneumatic cylinders this cap is removed, and a screw-joint of the air-pump conduit is screwed in its place, so that in forcing in air the valve is raised from its seat by the air passing through the channel *r* and space *s*, whence it passes round the valve into the cylinder. A channel *v*, Fig. 12, may be provided by means of which the two cylinders can be made to communicate with each other for charging. When the arrangement at Figs. 14 and 15 is employed, in which the plunger-head is made to fit air-tight and not the opening of the cylinder, the plunger is provided with the packing K, which is pressed against the circular rim *m* by means of a collar *u*, screwed on the plunger. In this case the plunger e^2 is necessarily hollow, and it can communicate with a receptacle *x* for increasing the capacity of the cylinder E² containing the compressed air, if necessary. The two cylinders E′ E² can also be made to communicate with each other by means of an external conduit *y*, if desirable. Although the above-described pneumatic recoil apparatus is more particularly applicable to guns, yet it will be obvious that it may be applied to many other purposes.

I claim—

1. A pneumatic recoil apparatus including in combination two oppositely-directed sets of pneumatic cylinders and plungers therefor, and a valve for charging said cylinders with compressed air consisting of a packing seated in the end of the cylinder, a disk, a projecting rim on said disk bearing against said packing, the seat of said packing being provided with an opening, a screw-cap for closing said opening, and means for connecting said opening to the conduit of an air-pump when the screw-cap is removed, substantially as described.

2. A pneumatic recoil apparatus for guns, including in combination cylinders with plungers arranged in opposite directions, means for connecting one plunger with the

gun to cause said plunger to be moved to the inner end of its cylinder, the other plunger being fixed and the cylinders being free to move backward so that the second cylinder moves over its plunger, and means for providing communication between the cylinders to facilitate charging them with compressed air, substantially as described.

In witness whereof I have hereunto signed my name, this 25th day of June, 1906, in the presence of two subscribing witnesses.

JOSEPH ALBERT DEPORT.

Witnesses:
ARMENGAUD, Jeune,
AUGUSTUS E. INGRAM.