

N. KOCH.  
PNEUMATIC RECUPERATOR FOR RECOIL GUNS.  
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904,967.

Patented Nov. 24, 1908.

Fig. 1.

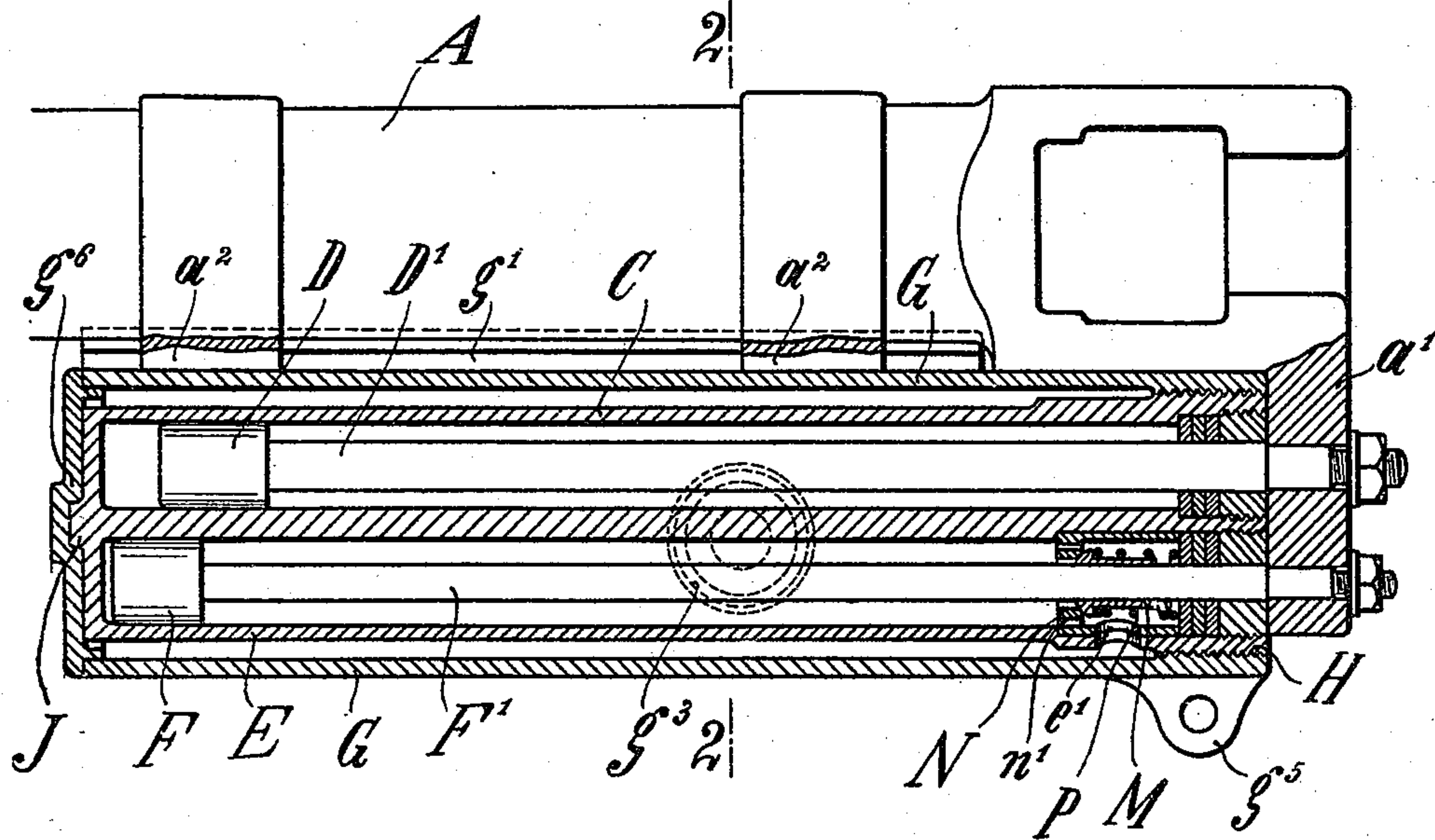
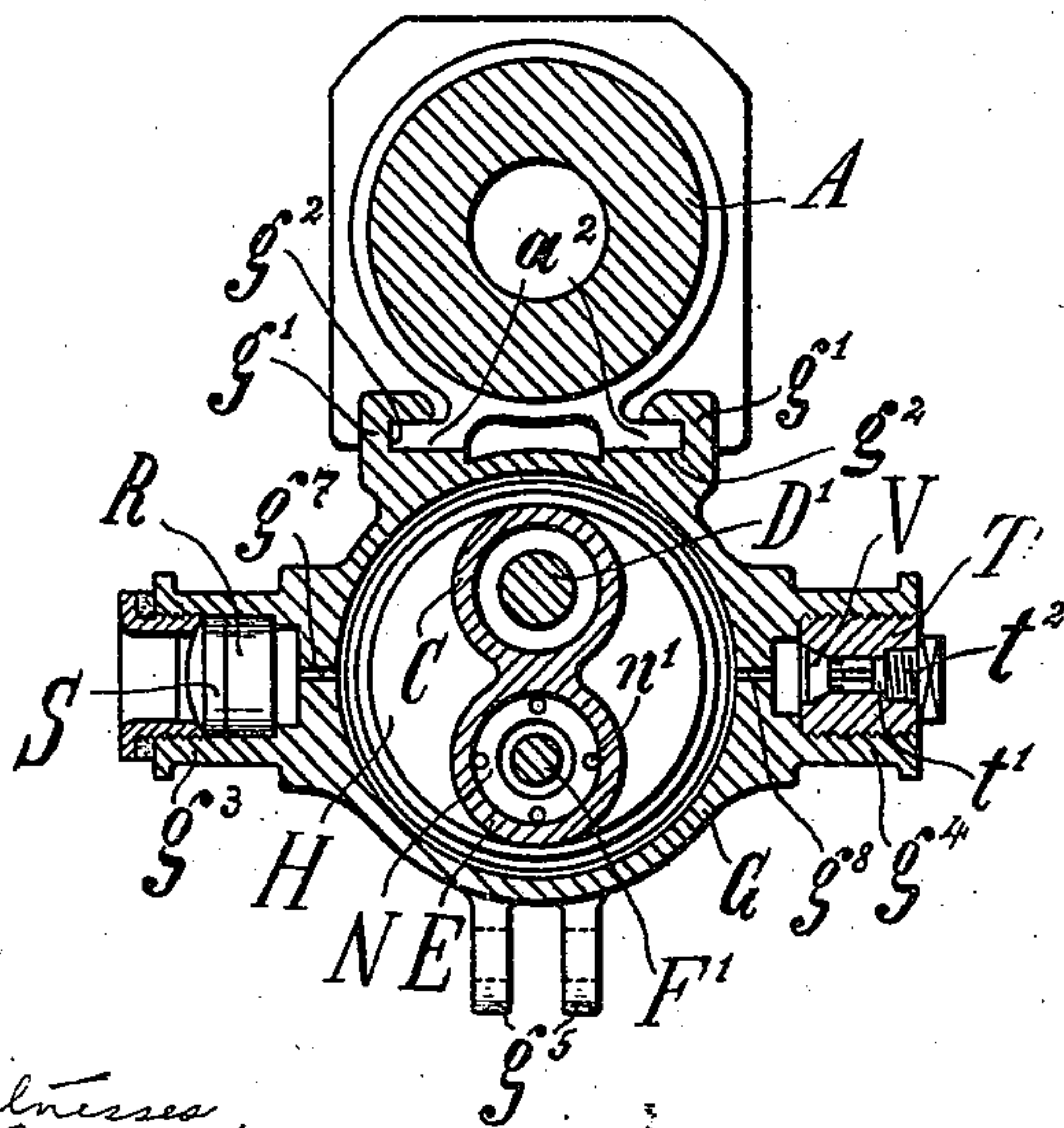
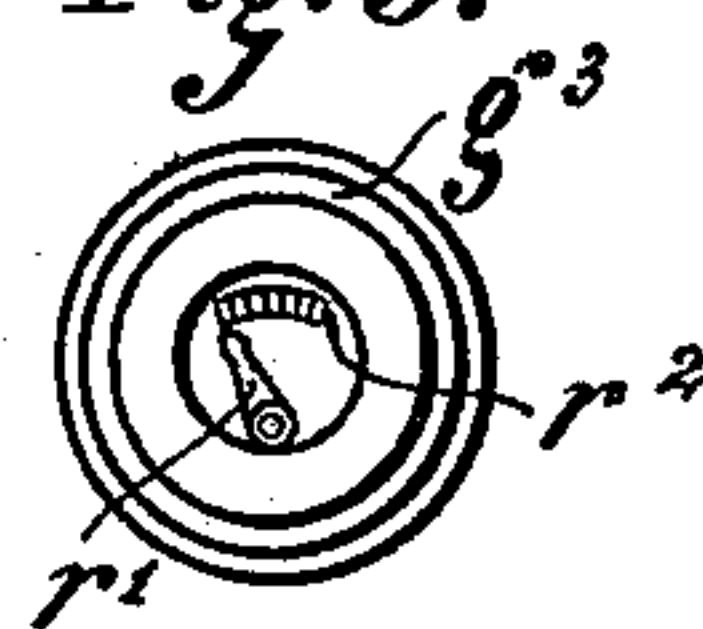


Fig. 2.



Witnesses  
J. M. Wynne  
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Fig. 3.



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# UNITED STATES PATENT OFFICE.

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## PNEUMATIC RECUPERATOR FOR RECOIL-GUNS.

No. 904,967.

Specification of Letters Patent.

Patented Nov. 24, 1908.

Application filed December 14, 1907. Serial No. 406,494.

*To all whom it may concern:*

Be it known that I, NORBERT KOCH, a subject of the Emperor of Germany, and a resident of Essen-on-the-Ruhr, Germany, have invented certain new and useful Improvements in Pneumatic Recuperators for Recoil-Guns, of which the following is a specification.

The present invention relates to recoil-guns of the type set forth in the Patent No. 886,615 to Otto Lauber and Norbert Koch, and the object of the invention is to simplify the construction and decrease the weight of such guns.

The accompanying drawing shows, by way of example, an embodiment of the invention.

Figure 1 is a view, partly in vertical longitudinal section and partly in elevation, of the parts of a gun to which the invention relates. Fig. 2 is a section on line 2—2, Fig. 1, looking from the left, and Fig. 3 is a part of the left-hand side view corresponding to Fig. 2.

The gun is provided with a fluid-brake and with a pneumatic recuperator comprising a displacer and a compressed air receptacle.

The compressed air receptacle G is in the form of a cylinder and contains the fluid-brake and the displacer. The fluid-brake is of usual construction and consists of the brake-cylinder C, the piston D and the piston-rod D'. The displacer consists mainly of the displacer cylinder E having piston F and piston-rod F'. The displacer cylinder E is integral with the brake cylinder C, the cylinders being made from a single piece of material and on the end remote from the muzzle of the gun-barrel the cylinders are provided with a trunnion J which engages in a cap  $g^6$  closing the compressed air receptacle G and centers the cylinders C E in the compressed air receptacle. On the end nearest the breech of the gun-barrel the cylinders C E are provided with a circular exteriorly screw-threaded flange H which is screwed into the compressed air receptacle. The piston-rods D' and F' are rigidly connected with the horn  $a'$  of the gun-barrel A. The compressed air receptacle G communicates with the interior of the displacer cylinder E through the medium of an opening  $e'$  in the cylinder E. Near this opening a

check-valve M N is arranged in the cylinder E, the valve having its valve body M guided on the piston-rod F' and held on the seat N by a spring P. The closed valve does not, however, entirely cut off the displacer cylinder as passages  $n'$  of small diameter are provided in the valve seat N. The compressed air receptacle is at the same time formed as slide-track for the gun-barrel A, thereby doing away with the necessity of a special slide track carrier. To that end the compressed air receptacle G is provided with two ribs  $g'$  which form the slide track  $g^2$  for the claws  $a^2$  of the gun-barrel. Furthermore the compressed air receptacle G is provided with the horizontal trunnions  $g^3$   $g^4$  which are journaled in the mount in the usual manner. Two eyes  $g^5$  arranged on the compressed air receptacle serve for connecting the receptacle with the elevating mechanism of the gun (not shown in the drawing).

A pressure meter R, which communicates with the interior of the compressed air receptacle through an opening  $g^7$  is mounted in one of the trunnions ( $g^3$ ) behind a thick glass disk S. The index-hand  $r'$  and the scale  $n^2$  (Fig. 3) of the pressure meter are visible from the outside and it can therefore be ascertained at any time whether there is the required tension in the compressed air receptacle. A screw-threaded plug T having a bore  $t'$  is arranged in the other trunnion ( $g^4$ ). The bore  $t'$  contains a valve body V and communicates with the interior of the compressed air receptacle through the medium of a bore  $g^8$ . The plug T forms the seat for the valve body V and the valve V T is arranged in such a manner that it is held closed by the pressure in the compressed air receptacle G. A smaller plug  $t^2$  is screwed into the outer end of the bore  $t'$  to close the bore towards the outside. By reason of this arrangement air can be pumped into the compressed air receptacle G by means of an air-pump which is attached to the plug  $t^2$ .

When the gun barrel is in the position of rest the several parts of the fluid brake and of the recuperator assume the relative position shown in Fig. 1. The piston rods D' F' and the pistons D F, which are rigidly secured to the gun barrel, take part in the recoil movement and return movement of



the gun barrel, while the compressed air receptacle G, the brake cylinder C and the displacer cylinder E remain stationary.

It need not be explained in detail how the fluid brake acts during the recoil and return movement, it being sufficient to state that during the recoil and return movement of the gun barrel the brake-fluid passes from one side of the piston D to the other through grooves or channels (not shown in the drawing) which are provided in the piston D or in the wall of the cylinder C.

During the recoil and return movement the recuperator works as follows: At the start of the recoil the liquid in front of the piston F and in the displacer cylinder E opens the valve M and is forced into the receptacle G through the opening  $e^1$ , the compressed air in the receptacle G being thereby further compressed. When the recoil-energy of the recoiling parts is exhausted the compressed air expands and forces the liquid out from the receptacle G. As the check-valve M N is closed when the liquid flows back the liquid must pass into the displacer cylinder E through the narrow passages  $n^1$ , and the liquid is consequently throttled to a considerable extent and acts with considerable braking effect on the return movement of the gun barrel, the return movement being effected by the liquid forcing the displacer piston F back to its position of rest.

Having thus described the invention what is claimed and desired to be secured by Letters Patent is:

1. In a recoil gun, a brake cylinder, a displacer cylinder, and a receptacle for com-

pressed air surrounding both of said cylinders and forming the slide-track for the gun-barrel.

2. In a recoil gun, a brake cylinder, a displacer cylinder, a receptacle for compressed air surrounding both of said cylinders and forming the slide-track for the gun-barrel, and trunnions carried by said receptacle and forming the horizontal trunnions of the gun.

3. In a recoil gun, a brake cylinder, a displacer cylinder, a receptacle for compressed air surrounding both of said cylinders and forming the slide-track for the gun-barrel, trunnions carried by said receptacle and forming the horizontal trunnions of the gun, and a pressure meter arranged within one of said trunnions and communicating with the interior of said receptacle.

4. In a recoil gun, a brake cylinder, a displacer cylinder, a receptacle for compressed air surrounding both of said cylinders and forming the slide-track for the gun-barrel, trunnions carried by said receptacle and forming the horizontal trunnions of the gun, one of said trunnions having a bore communicating with the interior of said receptacle, and a member normally closing said bore and removable to permit the attachment of an air-pump to the trunnion.

The foregoing specification signed at Düsseldorf, Germany, this eleventh day of October, 1907.

NORBERT KOCH.

In presence of—

M. ENGELS,  
C. G. HECKMANN.