

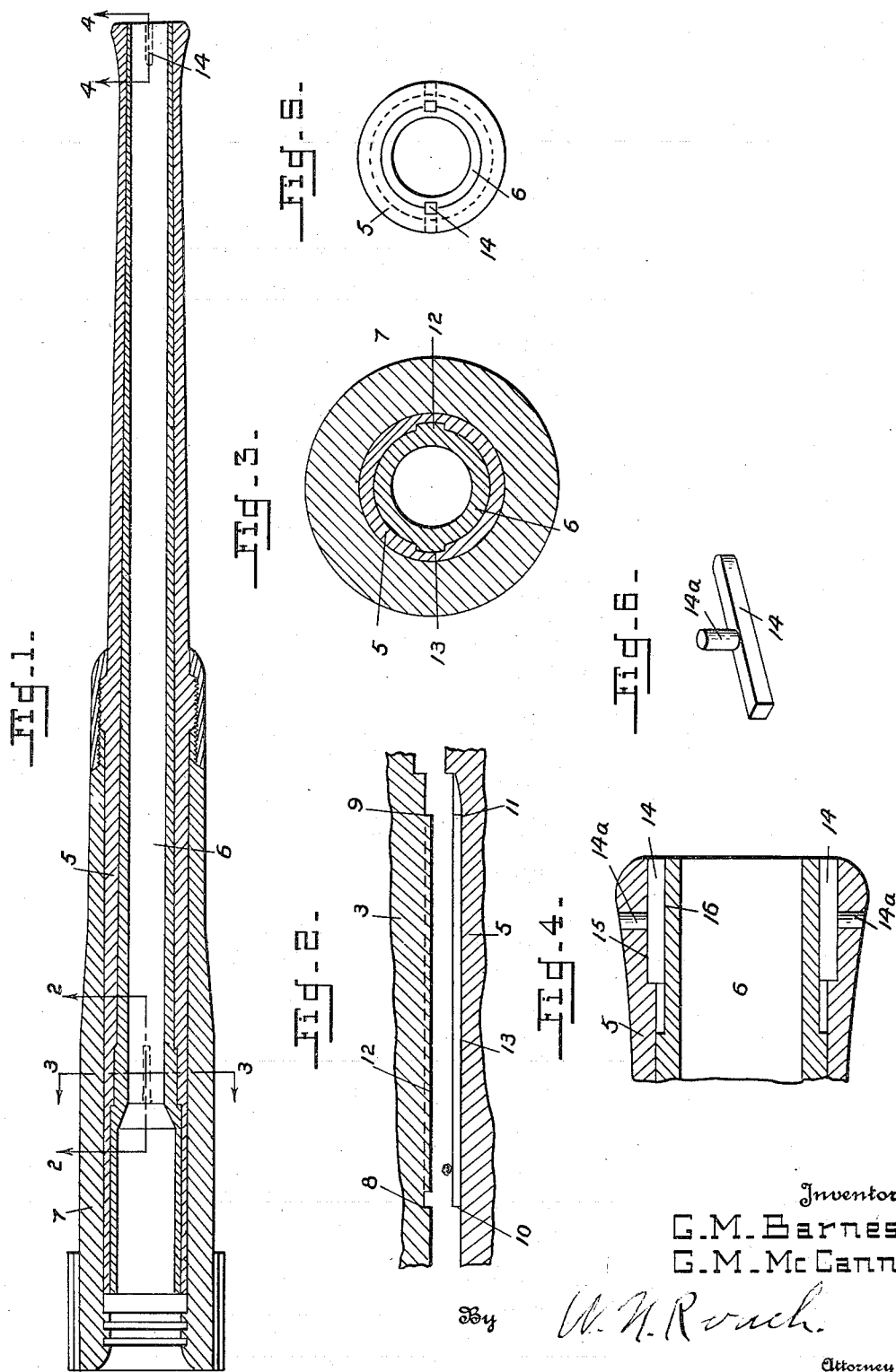
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ORDNANCE

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ORDNANCE

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This invention relates to ordnance and more particularly it has reference to a removable liner for a gun tube.

In anti-aircraft firing the errors inherent in and incident to fire control systems for predicting the future position of the target increase proportionately to the total time elapsing between the determination of the data and the instant of burst, because, manifestly, the opportunity for the target to alter its course is greater. The time element, consisting principally of the time of flight of the projectile, is then, the most vital factor in determining the efficacy of anti-aircraft fire. The only solution for materially reducing this time interval is to increase the muzzle velocity of the gun. Heretofore the compelling consideration of the life of the gun has been a controlling factor in deciding on the muzzle velocity, and this for the reason that, as at present constructed, the gun must be returned to an arsenal or specially equipped depot for relining when worn to an extent which impairs its accuracy.

The present method of relining guns consists principally in boring out the worn lining or heating the tube sufficiently to remove the liner.

The present development contemplates the construction of a gun in which the liner may be quickly and easily removed in the field and a new liner inserted without the necessity of dismounting the gun from its carriage.

To this end the liner and tube are so constructed and correlated that the liner is free, when the gun is fired, to expand and contract longitudinally and to undergo an initial expansion diametrically which expansion is then continued in conjunction with the tube, and reverse such operation on diametrical contraction, first contracting with the tube and then continuing such contraction alone.

To these and other ends, our invention consists in the construction, arrangement and combination of elements, described herein-after and pointed out in the claims forming a part of this specification.

A practical embodiment of the invention

is illustrated in the accompanying drawings, wherein:

Fig. 1 is a longitudinal sectional view of a gun provided with a removable liner;

Fig. 2 is an enlarged sectional view on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view on the line 4—4 of Fig. 1;

Fig. 5 is an end elevation view of the muzzle; and

Fig. 6 is a detail perspective of the muzzle locking key.

Referring to the drawings by numerals of reference:

The gun embodying the principle of the invention comprises a tube 5 within which is a liner 6 made of steel having a high elastic limit. Surrounding the rear portion of the tube is the customary breech hoop 7 which in no way interferes with the insertion or removal of the liner. In the preferred form the interior of the tube is slightly tapered from rear to front and the exterior of the liner is correspondingly tapered to facilitate its insertion and removal in the tube. Between the walls of the tube and liner a slight clearance is maintained and this clearance is so calculated that the liner will not exceed its elastic limit when the gun is fired.

The liner when inserted in place is held against longitudinal displacement by means of a pair of annular shoulders 8 and 9 formed thereon which abut against corresponding shoulders 10 and 11 provided in the interior of the tube.

The liner is supported and also held against rotational displacement by means placed at the breech and preferably also at the muzzle. The provision at the breech consists of a pair of fixed keys 12—12 preferably located on the portion between the shoulders 8 and 9 and receivable in keyways 13 in the tube, while at the muzzle a pair of loose keys 14—14 are inserted in registering grooves 15 and 16, respectively, in the tube and liner. Each loose key is formed with a laterally extending stud 14^a receivable in an aperture in the tube and serving to hold the key in place. It will be

noted that the groove 16 in the liner extends some distance in rear of the key and this provision is made to permit of longitudinal expansion and contraction of the liner without disturbing the keys. The contraction of the
5 liner is made possible by establishing the clearance between the liner and the tube. This contractile feature is not present in guns where the tube is shrunk on the liner.

10 When the gun is fired, the liner, under the action of the powder gases, expands until it comes in contact with the tube whence both of these members expand together until equilibrium is reached. After the projectile issues from the bore and the internal pressure
15 in the gun is relieved the liner, which has not been stretched beyond its elastic limit, returns to its original dimensions.

In removing the liner from the bore any
20 simple contrivance, such as a screw mechanism, small enough to be carried with the piece, may be used to initiate withdrawal. With the tapered type of liner the same may then be easily removed from the tube and a
25 new liner inserted without dismounting the gun from its carriage.

We claim:

1. A gun embodying a tube having a tapered interior wall, and a tapered liner inserted in the tube and having clearance therefrom at all points.

2. A gun embodying a tube having a tapered interior wall, a tapered liner inserted in the tube and having clearance therefrom at
35 all points, and means adjacent to the breech to limit displacement of the liner.

3. A gun embodying a tube, and a liner having a high elasticity inserted in the tube and having clearance therefrom at all points.

40 4. A gun embodying a tube, a liner having a high elasticity inserted in the tube and having clearance therefrom at all points, and means adjacent to the breech to limit displacement of the liner.

45 5. A gun embodying a tube having a plane, unbroken interior surface forward of the ammunition chamber, and a liner having a similar exterior surface forward of the ammunition chamber inserted in the tube and having
50 clearance therefrom at all points.

6. A gun embodying a tube, a breech hoop encircling the rear portion of the tube, a liner freely insertable in and removable from the tube with the breech hoop in place, said
55 liner having clearance from the tube at all points.

7. A gun embodying a tube, a breech hoop encircling the rear portion of the tube, a liner freely insertable in and removable from
60 the tube with the breech hoop in place, the liner having clearance from the tube at all points, and means adjacent to the breech to limit displacement of the liner.

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