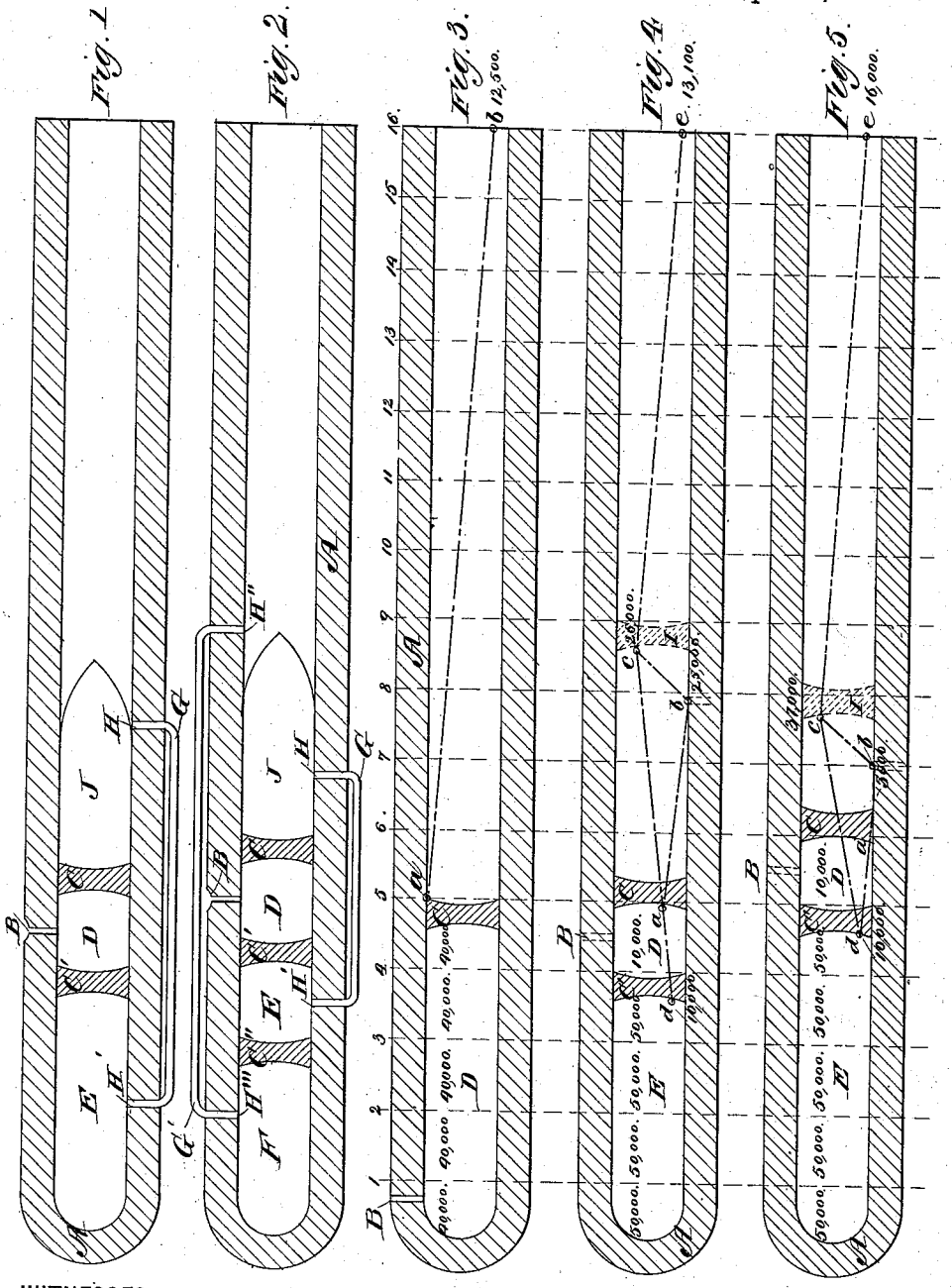
(No Model.)

# C. M. VAN TINE.

## ORDNANCE.

No. 380,368. Patented Apr. 3, 1888.

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# UNITED STATES PATENT OFFICE.

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## ORDNANCE.

SPECIFICATION forming part of Letters Patent No. 380,368, dated April 3, 1888.

Application filed April 12, 1887. Serial No. 234,550. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES M. VAN TINE, a citizen of the United States, residing at Matteawan, in the county of Dutchess and State of New York, have invented a new and useful Improvement in Ordnance and Fire-Arms, of which the following is a specification.

My invention relates to improvements in ordnance and fire-arms, by which there is fired in succession in a gun two or more charges of powder or other material suitable to produce the required propelling force; and the objects of my improvements are, first, to make a more effective gun more economically; second, to increase the velocity of projectile with lower initial pressure; third, to overcome the enormous initial pressure other guns are forced to resist in order to obtain high velocity of projectile and to prevent the upsetting of the shot; fourth, to use two or more charges of the material producing the propelling force and have the forces of all the charges act in the line of the bore of the gun; fifth, to accomplish all this with guns now in use with only slight changes, and, sixth, to accomplish all this in guns of approximately-straight tubes, so that in their manufacture and after firing the danger of strain caused by unequal expansion and contraction in cooling shall be as small as possible. I attain these objects by firing in the bore of the gun two or more charges of the material it is desired to use to produce the propelling force (and which hereinafter I shall call the "charge") successively, a light charge nearest the projectile being the first, and by so arranging tubes that the explosion of the first charge of powder or other suitable material will fire the next, and so on, and so that all the charges may be exploded successively and at determined moments, regulated by the length of the tubes.

My improvements are illustrated in the accompanying drawings, in which—

Figure 1 shows a sectional view of a cannon with my improvements as it appears loaded with two charges. Fig. 2 is a similar view of a cannon with my improvements as it appears loaded with three charges. Fig. 3 is a similar view of a cannon as it appears loaded with one charge in the usual manner, hereinafter used for the purposes of explanation. Fig. 4 is a similar view of a cannon as it appears loaded with two charges, hereinafter used for the purposes of explanation. Fig. 5 is a similar view of a cannon as it appears loaded with two charges, hereinafter used for the purposes of explanation.

Similar letters refer to similar parts throughout the several views.

A is the wall of the cannon; B, vent; C C′ C″, wads; D, first charge; E, second charge; F, third charge; G G′, connecting-tubes; H H′, open ends of G; H″ H‴, open ends of G′; I, position of C at one time after D has been fired; J, projectile; *a b c d e*, used to mark places for the purposes of explanation.

The operation of my improvements are illustrated by the drawings, as follows:

Reference first being had to Fig. 1, the first charge, D, which is a light charge, is first fired. The propelling force of this charge overcomes the inertia of the wad C and of the projectile J, and, being but a light charge, there is but low initial strain on the wall A of the cannon. After J is in motion in the cannon, the second charge, E, separated from D by wad C′, is fired through a tube by D, and an increased pressure is brought to bear on J. This pressure acts gradually as J is in motion, and the propelling forces of D act as a cushion for the propelling forces of E. To further illustrate my improvements for firing charges of powder or similar explosive successively, I consider that powder is used in firing the cannon. D is exploded through vent B in any usual manner. The gases arising from the explosion overcome the inertia of C and J with but low initial strain on A. C and J are pressed forward in the cannon until C is past the opening H, when the gases from the explosion of D enter the opening H of the connecting-tube G, pass through G and out at H′ in E, and ignite E, and an increased pressure is brought to bear on J. This pressure acts gradually as J is in motion, and the gases from the explosion of D act as a cushion for the pressure of the gases from the explosion of E. When three charges are used, reference now being had to Fig. 2, as just shown, the gases from D, after J is in motion, pass through G and ignite E, and then when C is pressed by the gases from D past H″ they enter H″, pass through G′, out at H‴, and ignite the third charge, F, which is separated from E by wad C″. The

gases already in the bore of the cannon act as a cushion for the pressure of the gases from F. In some cases I find it best to charge the connecting tube or tubes with a very fast burning powder. In the same manner a gun may be arranged to have as many charges as desired. When more than three charges of powder or similar explosive are desired, more connecting-tubes similarly arranged can be used. When only two charges are desired, the second should be much heavier than the first. As the charges are fired directly in the bore of the gun, the propelling forces all act in the line of the bore, and as the first charge is light and the pressure of the others is gradual the projectile cannot be upset. It is well known that in guns as now used, when heavy charges have been fired, the projectile has been upset—that is, has shown a difference in form after leaving the gun and has even been wedged in the bore.

My improvements apply as well to rifle as smooth-bore guns, and as they are applied to guns of approximately-straight tubes there is but slight danger of strain in their manufacture and after firing from unequal expansion and contraction in cooling.

By my improvements no great sudden pressure is brought to bear on the wall of a gun.

By still further lowering the initial pressure by a light charge of slow-burning powder or otherwise, by means of my improvements I am enabled to use afterward large charges of any material used for the propelling force to throw shells containing nitro-glycerine, melinite, or other high explosives. Any known method of igniting the first charge may be used. The charges may be inserted into the bore of the gun in any known way, as a cartridge or otherwise, care being taken that when inserted the proper charges shall communicate at the right place with the proper openings of the connecting-tubes. The charges should be separated, in any known suitable manner, by wads strong enough to resist any material compression from the explosion of a charge in front, and which should be made of a material and so fit the bore as to prevent the too rapid passage of gases through or around their sides, arising from an explosion when gunpowder or similar material is used. In the drawings I show an arrangement of the connecting-tubes. They are shown passing outside of the gun, so, if so wanted, and preferably, they can be made easily detachable. In some cases it may be required to have any suitable device for holding them tight to the gun and which allows of their being easily detached. They may also be wholly within the wall of the gun, and where a large wad at the base of the projectile or shot or projectile with groove is used they may be fastened to the inside of the wall of the gun or to the base of the gun and perforated, where necessary. To use other than similar materials to gunpowder—as compressed air—supplemental suitable devices will be required.

Reference now being had to Figs. 3, 4, and 5, in order to partially illustrate the advantages of my improvements approximately, I consider that the rear end of the projectile comes against the outer side of C. Fig. 3 is a sectional view of a cannon single-charged, as in general use. D occupies five spaces and is charged with a material whose initial pressure when fired is forty thousand pounds per square inch, owing to the inertia of projectile. When D is fired the pressure per square inch is expanded from *a* to *b* (muzzle of gun)—in all sixteen spaces—to twelve thousand five hundred pounds per square inch, the breech of the gun sustaining the full force of the propelling forces. Fig. 4 is a similar view of a cannon with my improvements. D occupies one space and is charged with a material whose initial pressure is ten thousand pounds per square inch. E occupies four spaces and is charged with a material whose initial pressure is fifty thousand pounds per square inch. When D is fired, the pressure rises to ten thousand pounds per square inch, and when the projectile is pressed forward to *b*—four spaces—the pressure is expanded to twenty-five thousand pounds per square inch. Then E is fired, raising pressure at *c* to twenty-six thousand pounds per square inch. I will suppose that when E is fired the pressure is raised to ten thousand pounds per square inch, as at *d*, before C′ commences to move, when C′ is pressed forward to *b*, compressing the propelling forces between C′ and C to twenty-six thousand pounds per square inch, as shown by line *d c*, then again expanding from *c* to *e*, (muzzle of cannon,) with a pressure of thirteen thousand one hundred pounds per square inch. Although I have used charges whose initial pressure was ten thousand pounds per square inch greater than in Fig. 3, the greatest pressure brought to bear on the wall of the cannon is twenty-six thousand pounds per square inch. Fig. 5 is a similar view of a cannon with my improvements. D occupies one space and is charged with a material whose initial pressure is ten thousand pounds per square inch. E occupies five spaces and is charged with a material whose initial pressure is fifty thousand pounds per square inch. When D is fired, the pressure rises to ten thousand pounds per square inch, when C and projectile are pressed forward to *b*—one space—the pressure expanding to five thousand pounds per square inch. Then E is fired, whose initial pressure is fifty thousand pounds per square inch. I will suppose that when E is fired the pressure is raised to ten thousand pounds per square inch before C′ commences to move, when C′ is pressed forward until pressure is gradually raised to thirty-seven thousand pounds per square inch, as shown in line *d c*, which expands again to muzzle of gun at *e*, with a pressure of sixteen thousand pounds per square inch, as shown in line *c e*. In this case, although I have used one-quarter more material and with an initial pressure of ten thousand pounds per square inch greater, the greatest pressure brought to bear

on wall of cannon is thirty-seven thousand pounds per square inch, or three thousand pounds per square inch less than shown in Fig. 3.

I do not limit my improvements to cannons and mortars, as it is applicable to all pieces of ordnance and fire-arms.

Having fully described my invention, what I desire to claim and secure by Letters Patent is—

1. A piece of ordnance or fire-arm having a tube connected by two openings with the bore for firing successively directly in the bore two charges of the material used to produce the propelling force, the charge nearest the projectile being first fired, which charges are separated by a wad in any known suitable manner, the forward opening of the tube into the bore being at a place which it is determined the projectile and wad at its base shall have just passed when the first charge has been fired, before the supplemental charge with which the tube is connected shall be fired, and the rear opening into the bore being at a place nearer the breech and where it can be connected with the supplemental charge, and mechanism for firing the first charge, all substantially as shown, for the purposes specified.

2. A piece of ordnance or fire-arm having two or more tubes, each connected by two openings with the bore, for firing successively directly in the bore three or more (according to the number of tubes) charges of the material used to produce the propelling force, the charge nearest the projectile being first fired, which charges are separated by wads in any known suitable manner, the forward opening of each tube into the bore being at a place which it is determined the projectile and wad at its base shall have just passed when the first charge has been fired, before the supplemental charge with which the tube is connected shall be fired, and the rear opening into the bore being at a place nearer the breech and where it can be connected with a supplemental charge to be fired by it, the tubes having their front openings nearest the first charge to have their rear openings farthest from the breech, and mechanism for firing the first charge, all substantially as shown, for the purposes specified.

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