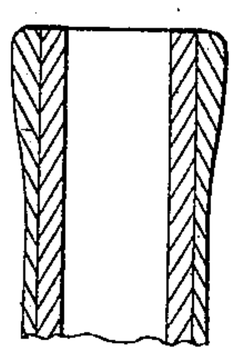
(No Model.)

J. A. LONGRIDGE.

ORDNANCE.

No. 431,270. Patented July 1, 1890.



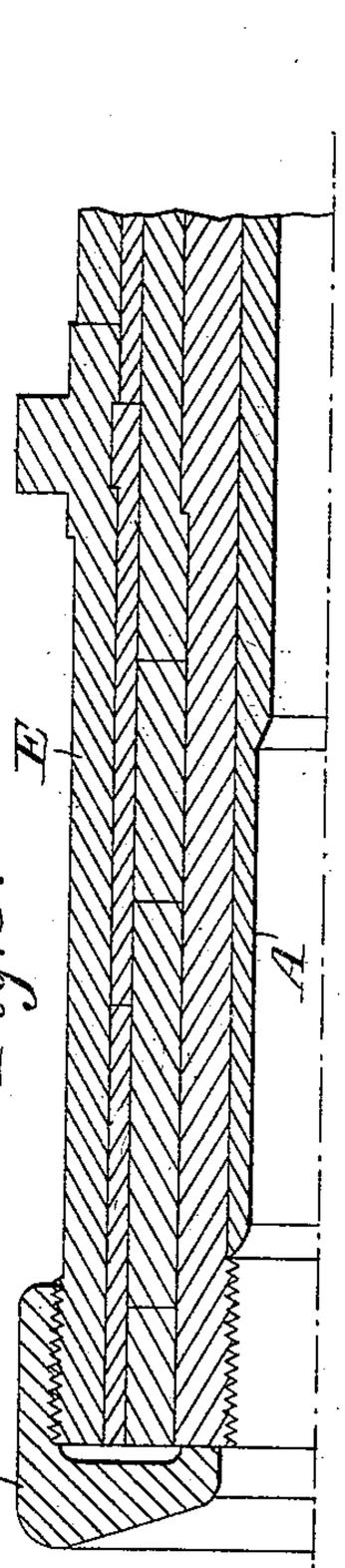


Fig. 3.

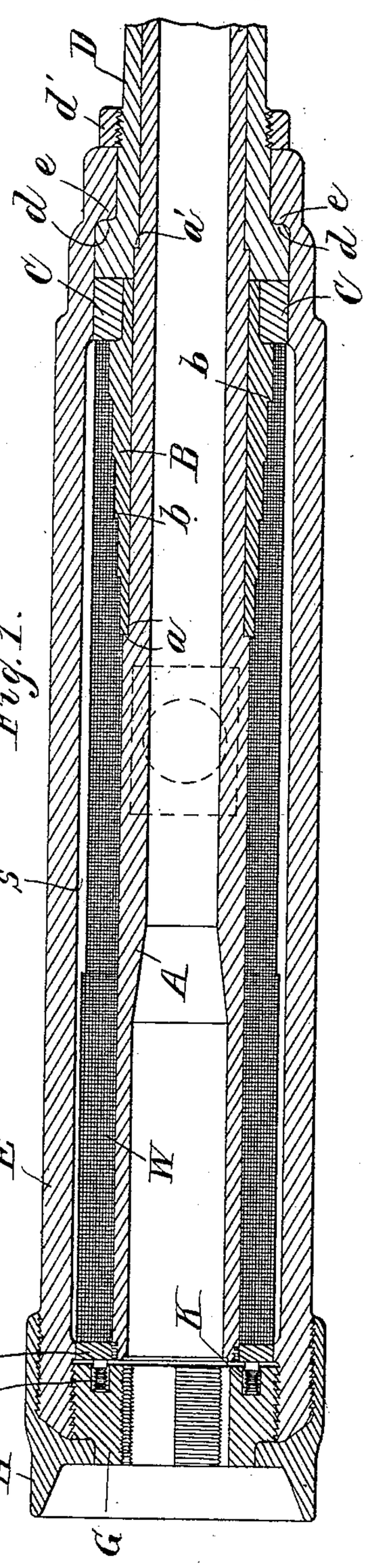


Fig. 1.

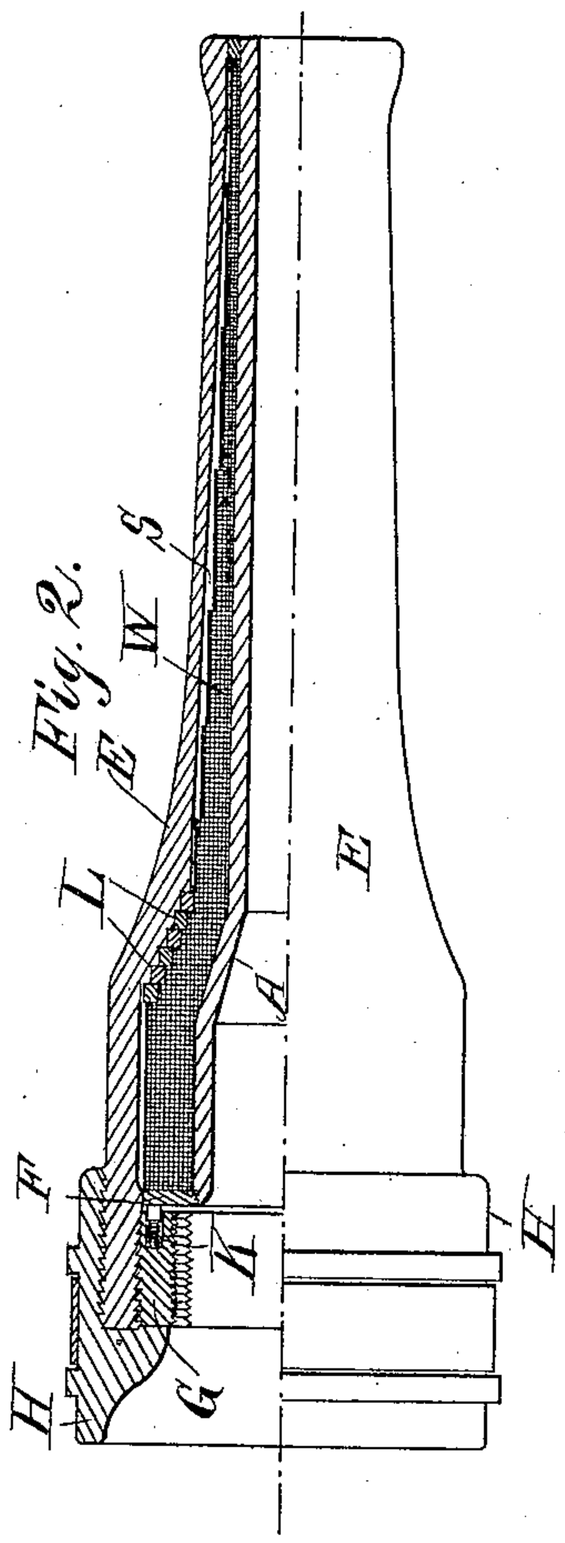


Fig. 2.

Witnesses;
J. Henry Rebrath.
C. Sedgwick

Inventor.
J. A. Longridge
By Munn & Co
Attorneys.

UNITED STATES PATENT OFFICE.

JAMES ATKINSON LONGRIDGE, OF GRÈVE D'AZETTE, ISLE OF JERSEY, GREAT BRITAIN.

ORDNANCE.

SPECIFICATION forming part of Letters Patent No. 431,270, dated July 1, 1890.

Application filed October 25, 1889. Serial No. 328,164. (No model.) Patented in England June 11, 1885, No. 7,127, and July 18, 1885, No. 8,693; in France July 25, 1885, No. 170,321; in Belgium July 27, 1885, No. 69,723; in Germany August 5, 1885, No. 35,349; in Italy September 30, 1885, XIX, 18,727, and XXXVII, 194, and in Austria-Hungary October 9, 1885, No. 29,228 and No. 53,153.

To all whom it may concern:

Be it known that I, JAMES ATKINSON LONGRIDGE, civil engineer, of Grève d'Azette, Jersey, Great Britain, have invented new and useful Improvements in Ordnance, (for which I have obtained Letters Patent in the following countries, namely: in Great Britain, dated June 11, 1885, No. 7,127, and dated July 18, 1885, No. 8,693; in France, dated July 25, 1885, No. 170,321; in Belgium, dated July 27, 1885, No. 69,723; in Germany, dated August 5, 1885, No. 35,349; in Italy, dated September 30, 1885, Vols. 19 and 37, Nos. 18,727 and 194, and in Austria-Hungary, dated October 9, 1885, No. 29,228 and No. 53,153,) of which the following is a full, clear, and exact description.

When a gun is fired the part of the gun which lies between the breech and the trunnions (or the point at which the gun is attached to its carriage) is ordinarily subjected not only to the radial or bursting strain, but also to the longitudinal strain, tending to tear the gun transversely asunder between the breech-plug and the trunnions. The last-mentioned strain is not uniformly distributed over the sectional area of the material, but, like the bursting strain, it is greatest in that portion which is nearest to the longitudinal axis of the gun. Consequently the longitudinal and transverse disruptive strains act simultaneously at their respective maxima on the same material. There are, moreover, certain strains set up in the inner tube which tend to alter its longitudinal dimensions. These strains, which are compressive in some parts and tensile in other parts of the tube, are due partly to the expansion of the tube by heat and partly to the friction of the projectile and of the gases of combustion acting on the inner surface of the said tube. In a wire gun as ordinarily constructed these strains are resisted by the outer casing or jacket of the gun in such a way as to cause stresses in the jacket which are prejudicial to the gun.

The object of my invention is to obviate these prejudicial strains, which may be divided into two classes—namely, first, those affecting principally the jacket; second, those affecting principally the inner tube. The first class of strains may be subdivided into (*a*) radial or bursting strains arising from the jacket being an exact fit on the inner tube or coil or being shrunk on; (*b*) longitudinal strains arising from the transmission of the gas-pressure on the breech-plug to the trunnions or saddle which replaces the trunnions in some guns.

Reference is to be had to the accompanying drawings, forming part of this specification, wherein—

Figure 1 is a central longitudinal section of a "wire" gun constructed according to my improvements. Fig. 2 is a longitudinal section of a modified form of wire gun. Fig. 3 shows the application of one of my improvements to a built-up gun.

The same letters of reference indicate the same parts in all the figures.

Referring to Fig. 1, A is the inner or lining tube.

W is the wire coil, formed of steel wire or ribbon wound in successive layers around the tube A.

E is the jacket or casing inclosing the wire coil.

G is the breech-ring screwed into the breech end of the jacket E, and into which the breech-plug (not shown) screws in the usual manner.

H is a straining hoop or ring screwed onto the outside of the jacket E and bearing against the breech-ring G.

In order to avoid the radial or bursting strains on the jacket E, a clearance space S is left between the outside of the coil W and the inside of the jacket E, so that the coil is free to expand diametrically and take up the whole of the bursting strain without transmitting any portion of it to the jacket. The gas-pressure on the breech-plug is usually transmitted wholly to the internal screw-thread on the jacket, and it is therefore borne chiefly by the material of the jacket nearest to its inner surface, and only in a rapidly-decreasing ratio by the exterior material. In order to equalize this longitudinal strain on

the jacket, a straining ring or hoop H is screwed on the breech end of the jacket E and abuts against the breech-ring G (into which the breech-plug screws) in such way that it tends to force the breech-ring G forward, and therefore to put the metal of the jacket nearest to the inner surface into a state of initial compression and the metal nearest to the outer surface of the jacket into a state of initial tension. It is obvious that the backward force on the breech-plug is transmitted to the ring G, and (except for the action of the hoop H) the entire strain would come upon the screw-threads connecting the ring G to the jacket. By means of the hoop H part of the strain may, however, be transmitted to the exterior of the jacket, and thus the backward force may be distributed equally or to any desired extent over the cross-sectional area of the material of the jacket.

It is obvious that the same straining-hoop may be applied to a built-up gun, as shown in Fig. 3. The functions of the ring H may be put into action either by screwing it up or by simultaneously heating the outer surface of the jacket and cooling the inner surface of the jacket or of the inner hoop of a built-up gun (as the case may be) and then screwing up the ring H.

The second class of strains—namely, those due to the elongation of the inner tube A—are provided against by allowing freedom for the inner tube to elongate. This is accomplished by rigidly connecting the inner tube A to the jacket E at one point only, this point being situated at about the middle of the length of the tube A and at the front end of the jacket E, the tube A being supported so that it shall be quite free to expand or contract in either direction from the point at which it is held by the jacket. This connection is effected as follows: B is a short tube made separate from and fitting onto the tube A, which has a slight shoulder at *a* for the tube B to abut against. The tube B has a series of steps or shoulders *b* in its circumference, whereon the wire W is wound in a successively diminishing number of layers. This tube B is encircled by a hoop C, against which and against the end of the tube B abuts the rear end of the tube D, which incloses the forward part of the tube A. The tube D is shouldered at *d*, and this shoulder is embraced by an internal shoulder *e* on the front end of the jacket or casing. Tube A is also shouldered at *a'*, and the rear end of tube D is internally shouldered to correspond. Thus all forwardly-directed strains are transmitted from the tube A through the shoulders *a a'* and the rear end of the tube D to the jacket E.

d' is a nut screwed on a threaded part of the tube D and abutting against the front end of the jacket E. The forward part of the tube A is quite free to expand and contract longitudinally within the tube D.

By making the shouldered tube B separate from the inner tube A internal initial strains in the metal of the tube A are avoided.

The tube A may be stepped or shouldered at the point where the layer of coils is diminished; or the tube A may be of nearly uniform thickness and be re-enforced by a separate short stepped or shouldered tube B to receive the coils of wire and form an abutment for transmitting the longitudinal strain from the inner tube A to the jacket E. The wire coil W abuts at the rear end against a flange F, screwed on the breech end of the inner tube A, provision being made in the depth of the screw-thread for radial expansion of the tube A. This flange F is not connected to the jacket E, but merely rests within it so as to support the weight, while permitting freedom for longitudinal expansion and contraction of the rear part of the tube A, a space being left, as before described, between the wire coil W and the jacket E. The breech-plug is in connection with the inner tube A, and sufficient space is left between the breech-ring G and the flange F to permit free longitudinal expansion of the rear portion of the tube A, springs K (preferably of the kind known as the "Belleville spring") being inserted in cavities bored in the front end of the breech-tube G, said springs projecting therefrom and bearing against the flange F for the purpose of holding the tube A against its forward abutment at the front end of the jacket E, and yet permit the rearward longitudinal expansion of the tube A. Such springs are not, however, essential in the form of gun shown in Fig. 1 and may be dispensed with.

Referring to Fig. 2, (in which the wire coil and jacket E extend to the muzzle of the gun, or nearly so, although this is immaterial,) it will be observed that the tube A is reduced in external diameter at the front end of the chamber, and that the jacket E is reduced in internal diameter by a series of shoulders at about the region of the trunnions, and that the wire coil is decreased in external diameter at the same point by a series of steps or shoulders formed by successive reductions in the number of layers of wire. Upon these steps are fitted thrust-rings L, which abut against internal shoulders on the jacket E.

The construction at the breech end of the gun is precisely similar to that described with reference to Fig. 1.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A wire gun consisting of a combination of elements whereof the breech portion is constructed of an inner tube, superimposed coils of wire wound thereon, and of a jacket inclosing the coils and receiving the breech-closing plug, and in which the inner tube abuts only at about the middle of its length against the forward end of the jacket and is supported at the rear end within the jacket,

but has no other connection therewith or with the breech-plug, and in which a space is left between the wire coil and the jacket, so that the inner tube is free to expand and contract longitudinally in opposite directions from the point of abutment, as described, and all bursting strain will be supported by the inner tube and coil and none by the jacket and all longitudinal strain will be supported by the jacket and none by the inner tube, as described.

2. In a wire gun whereof the breech portion is constructed of an inner tube, superimposed coils of wire wound thereon, and of a jacket inclosing the coils and receiving the breech-closing plug, the combination, with the inner tube and with the jacket, of an externally stepped or shouldered tube separate from and fitting on the inner tube and abutting rearwardly against said tube and forwardly against the front end of the jacket, said shouldered tube serving to diminish the number of wire coils and to transmit forwardly-directed strains from the inner tube to the jacket, as described.

3. In a wire gun constructed as described, whereof the inner tube abuts only at about the middle of its length against the outer jacket, as described, and is free to expand longitudinally and rearwardly from the point of abutment within the jacket, the combination, with the said inner tube and with the breech-plug-holding ring, of springs applied between the said tube and ring, so as to hold the tube against its forward abutment against the jacket and yet permit free rearward longitudinal expansion of the rear part of the inner tube, as specified.

4. The combination, with the outer jacket of a gun and the breech-plug ring, of a straining hoop or ring screwed on the jacket and abutting against the ring or part in which the breech-plug is received, so as to relieve the inner material of the jacket of part of the longitudinal strain and transmit the same to the outer material of the jacket, as described.

5. The combination, with the outer jacket of a gun and the breech-plug ring, of a straining hoop or ring screwed on the jacket and abutting against the ring or part in which the breech-plug is screwed, said straining-hoop being applied and screwed up when the jacket is heated externally and cooled internally, so as, on the cooling of the structure, to put the outer material of the jacket into a state of initial tension and the inner material into initial compression and so cause the longitudinal strain to be distributed more equally over the cross-sectional area of the jacket, as described.

The foregoing specification of my improvements in ordnance signed by me this 26th day of September, 1889.

JAMES ATKINSON LONGRIDGE.

Witnesses:
T. J. OSMAN,
W. J. NORWOOD,
Both of 17 *Gracechurch Street, London, E. C.*