G. P. HARDING.

Ordnance.

No. 62,266.

2 Sheets—Sheet 1.

Patented Feb. 19, 1867.

Fig. 1.

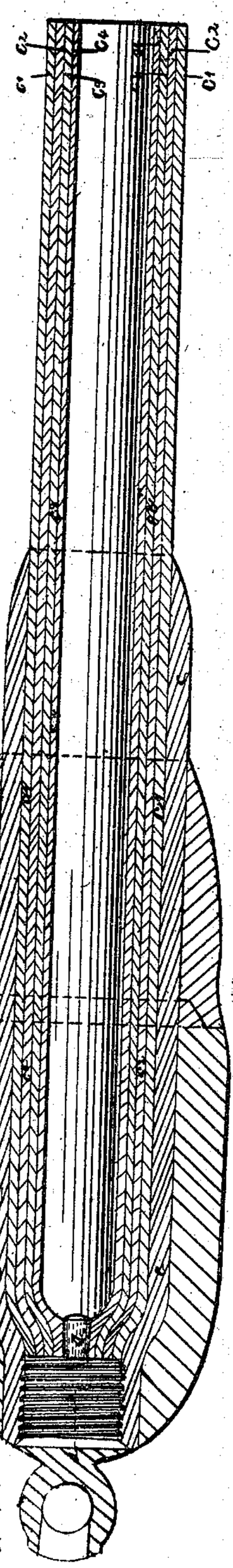


Fig. 2.

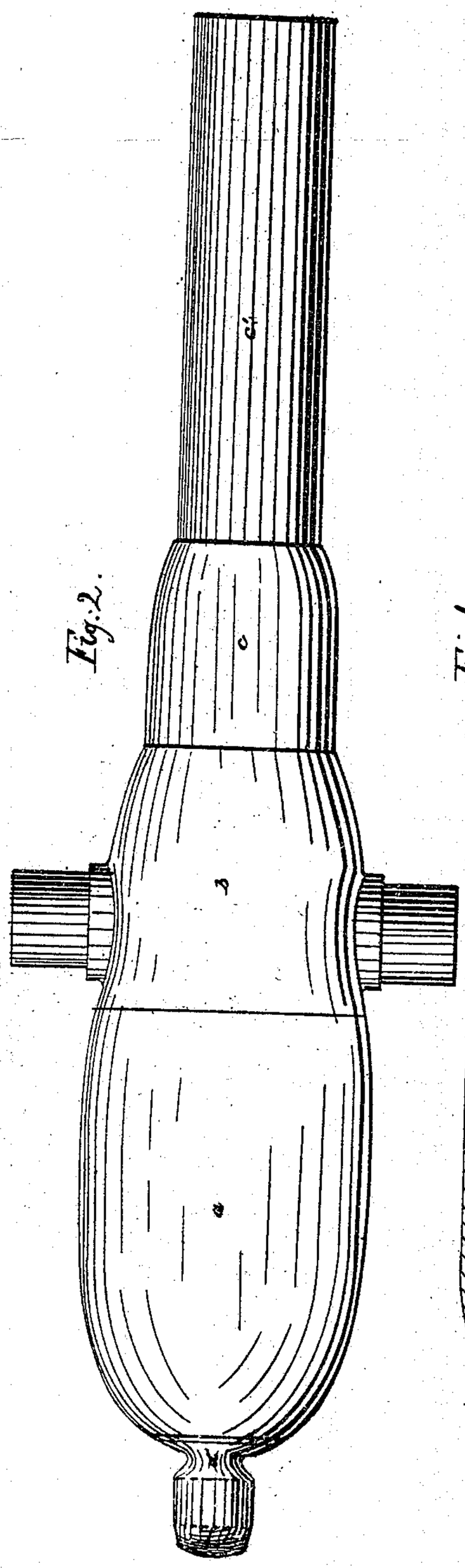
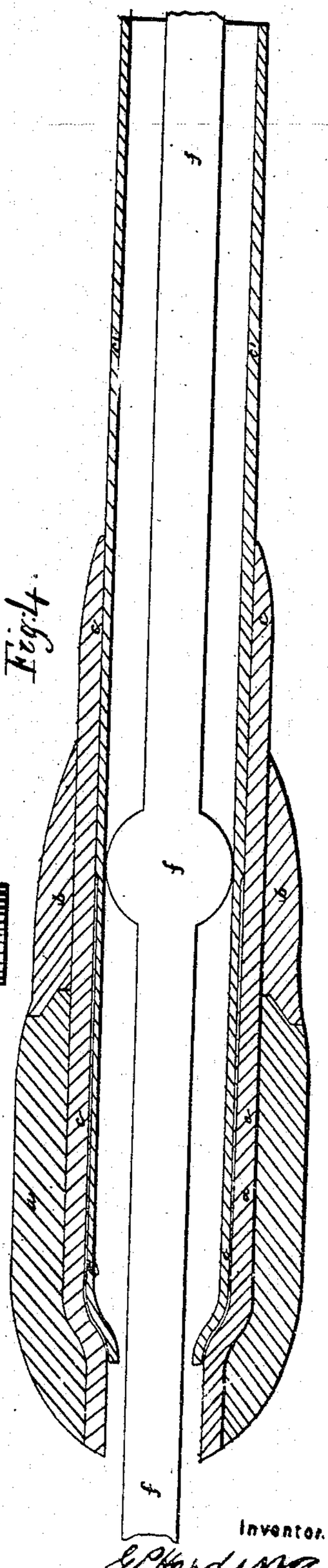


Fig. 4.



Witnesses.

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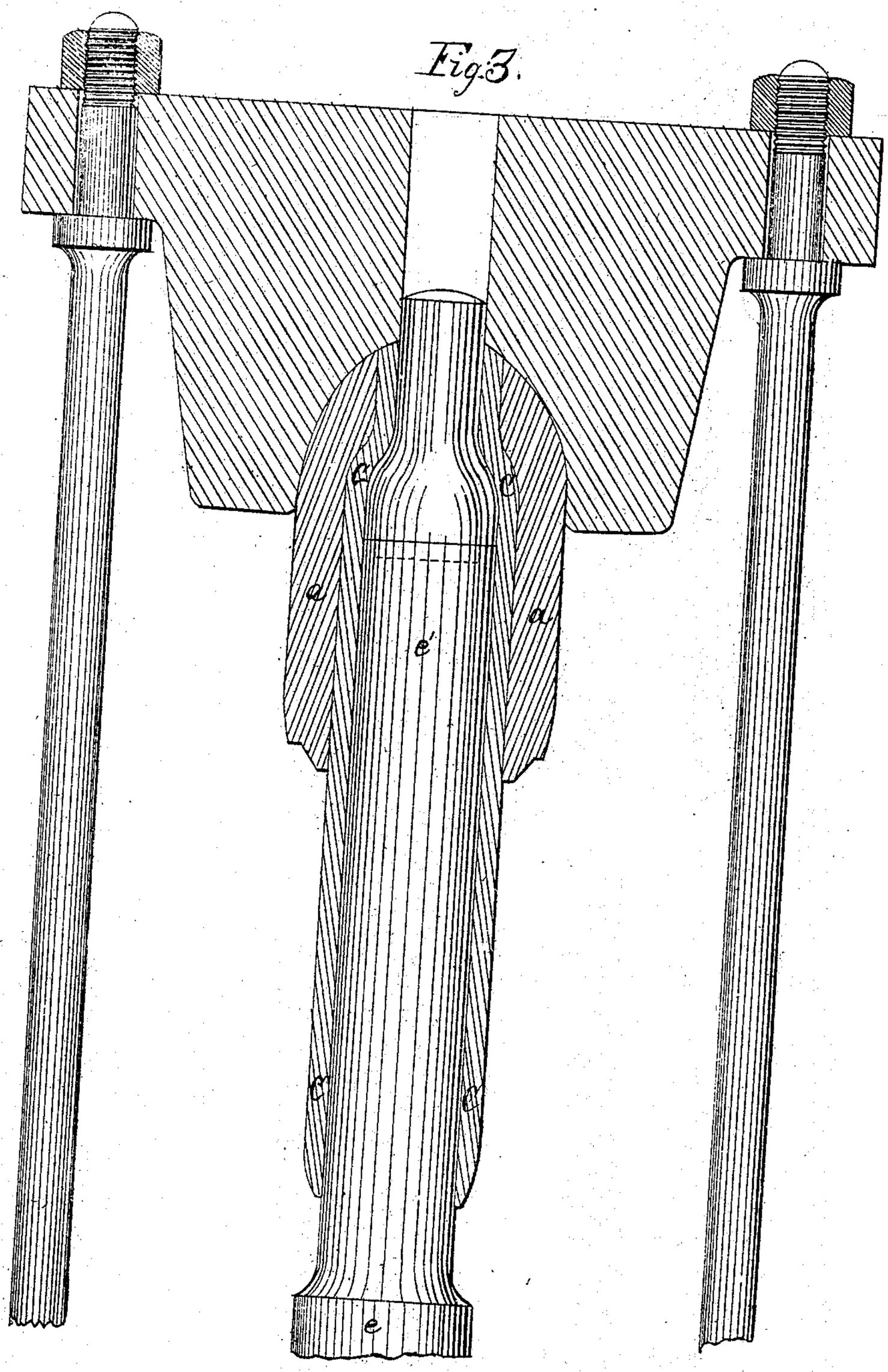
Ordnance.

No. 62,266. Patented Feb. 19. 1867

2 Sheets—Sheet 2

Fig. 3.



Witnesses.

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United States Patent Office

GUSTAVUS P. HARDING, OF BOHEMIA HOUSE, CHISWICK, ENGLAND.

Letters Patent No. 62,266, *dated February* 19, 1867.

IMPROVEMENT IN THE MANUFACTURE OF ORDNANCE.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL TO WHOM IT MAY CONCERN:

Be it known that I, GUSTAVUS PALMER HARDING, of Bohemia House, Chiswick, in the county of Middlesex, England, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in the Manufacture of Guns and Ordnance; and I, the said GUSTAVUS PALMER HARDING, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof, that is to say—

This invention has for its object improvements in the manufacture of guns and ordnance. For these purposes each gun or piece of ordnance is composed of two, three, or more thicknesses of metal, which thicknesses may be of like or of different descriptions of metal. It is preferred, however, that in all cases the interior thickness should be of comparatively hard metal, whilst the outer ones are of relatively soft metal. In constructing a gun or piece of ordnance, it is preferred that there should be used a breech-piece, extending any desired length from the rear end towards the fore end of the gun or piece of ordnance, and that this breech-piece should be forced on to the end of the first or inner lining by a hydraulic press, the first lining being then on a mandrel or core, so as to cause the rounding or conical end of the first lining to be compressed between the interior of the breech-piece and the conical or rounded end of the mandrel. The first lining is next to be expanded into the sides of the breech-piece, so as to complete the fitting, and at the same time it has its own interior formed correctly of a size to receive the next lining, and so on until the required number of linings or thicknesses of metal have been brought together and expanded one into the other. The linings in all cases consist of drawn tubular metal without seam or joint, and the breech end of each of the linings is partially closed or coned by drawing or otherwise to nearly the form of the interior breech end of the breech-piece or previous lining, and it is to be brought to the precise form at its rear end by being placed on a mandrel or core, and by having the exterior covering forced on by a hydraulic press. In order to expand these tubular thicknesses or linings one into another, other mandrels are used, each consisting of a strong stem, having intermediate of its length an enlargement or bulb, corresponding in size (at its largest part) to the intended interior diameter of the lining. The stem of the mandrel passes through the rear end of the gun or piece of ordnance, and the bulb or enlarged portion of the mandrel is made to pass, by preference by hydraulic machinery, from the fore end to rear end of the lining, by which, as already mentioned, such lining will be expanded and caused to fit the exterior covering, whether it be a previous lining or a breech-piece. The mandrel having been passed from end to end of the tubular lining, is moved back out of such lining. The passage through the rear end of the gun or piece of ordnance is to be closed by a screw or other suitable plug, which, when the piece of ordnance is for muzzle loading, is preferred to be introduced from the muzzle. It is preferred in all cases that the whole process should be performed on the metal when cold. These improvements are also applicable in expanding linings into old guns and ordnance.

And in order that my invention may be most fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

Description of the Drawings.

Figure 1 is a sectional view; and

Figure 2 a plan of a gun constructed according to my invention.

It will be seen that the gun is composed of a breech-piece, *a*, trunnion ring, *b*, and tubes or inner linings, *c* c^1 c^2 c^3 c^4, the breech end being closed by a conical plug, *d*, and a screw, *d'*. The mode in which I proceed to construct a gun is as follows: I form a breech-piece, *a*, in any convenient manner, preferring for that purpose to weld and forge it into form, and to bore the interior thereof in such manner as to obtain a truly cylindrical surface, the rear end thereof being formed as shown in Figure 3, in which view is shown the mode of putting the breech-piece on to the first inner lining *c*, such inner lining *c* being placed over a mandrel, *e'*, formed on or fixed to the end of a ram, *e*, the breech-piece *a* being forced thereon by the rising of the ram *e* forcing the inner lining upwards towards the head of the press, which is formed as a die or mould to receive the rear end of the breech-piece *a*. By these means close contact is obtained between the interior of the breech-piece *a* towards the end thereof and the exterior of the first inner lining *c*, and in order to complete the union of the two surfaces around the opening through the rear end, I sometimes draw a mandrel through such part, the bulb on

which is somewhat larger than the opening through the inner lining *c*, and when drawn therethrough it expands that part of the inner lining *c* into close contact with the breech-piece *a*,,a similar mandrel being drawn through the length of the first inner lining *c* to effect close union between it and the breech-piece *a*. The inner lining *c'*, after being drawn to a size to fit the interior of the lining *c*, is placed therein, and by means of a mandrel, *f*, being drawn therethrough, as shown at Figure 4, is expanded into the lining *c* in such manner as to effect a close union of the adjacent surfaces, the other inner linings being expanded therein in a similar manner. Motion is given to the mandrél by hydraulic power. When the gun has been thus built up to the desired internal diameter, the opening in the rear end has formed therein a screw-thread, as shown at fig. 1, to receive a screw-plug, *d'*; there is also formed therein a short conical hole to receive a conical plug, *d*, placed therein from the muzzle end of the gun. A trunnion ring, *b*, is forced on to the gun by a hydraulic press, or fixed thereto by other suitable means. It is preferred that the interior thickness should be of comparatively hard steel, whilst the outer ones are of relatively softer and softer metal. If desired the gun may be rifled.

Having thus described the nature of my invenion, and the manner of carrying the same into effect, I would have it understood that I do not confine myself to the precise details herein shown and described; but what I do claim, is—

The combined arrangement of the parts *a b c* c^1 c^2 c^3, the interior parts *c* c^1 c^2 c^3, being formed as explained, and expanded by a mandrel, *f*, substantially as herein described.

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Witnesses:

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