

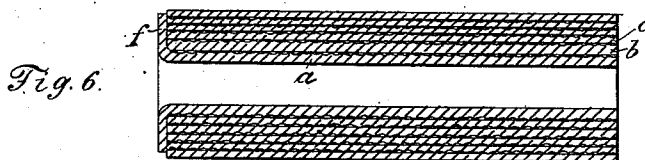
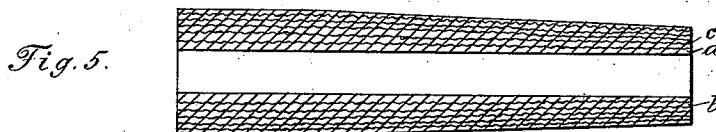
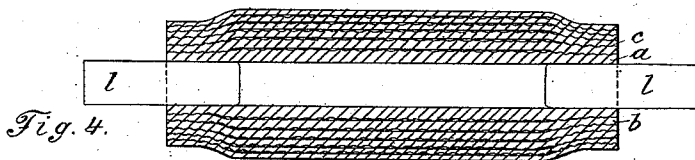
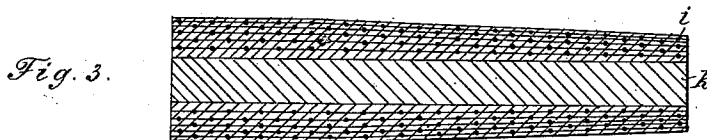
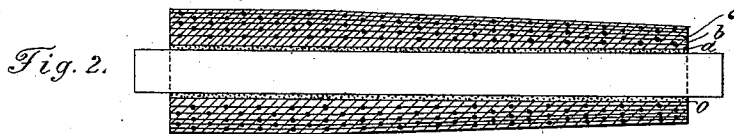
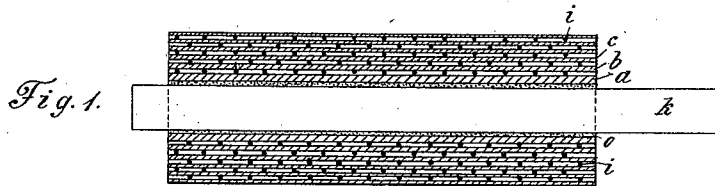
(No Model.)

R. MANNESMANN.

TUBULAR BODY AND THE ART OF CONSTRUCTING THE SAME.

No. 464,978.

Patented Dec. 15, 1891.



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UNITED STATES PATENT OFFICE.

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TUBULAR BODY AND THE ART OF CONSTRUCTING THE SAME.

SPECIFICATION forming part of Letters Patent No. 464,978, dated December 15, 1891.

Application filed July 21, 1890. Serial No. 359,381. (No model.) Patented in England January 16, 1890, No. 838; in Germany April 24, 1890, No. 54,696; in Belgium June 16, 1890, No. 90,918; in Switzerland June 16, 1890, No. 2,479; in France June 16, 1890, No. 206,402; in Italy June 30, 1890, XXIV, 27,700, LIV, 298, and in Austria-Hungary September 28, 1890, No. 27,492 and No. 48,746.

To all whom it may concern:

Be it known that I, REINHARD MANNESMANN, a subject of the Emperor of Germany, residing at Bliedinghausen, Remscheid, Germany, have invented certain new and useful Improvements in Tubular Bodies and the Art of Constructing the Same, (for which I have obtained Letters Patent in the following countries: in Belgium, No. 90,918, dated June 16, 1890; in Italy, No. XXIV, 27,700, No. LIV, 298, dated June 30, 1890; in Switzerland, No. 2,479, dated June 16, 1890; in France, No. 206,402, dated June 16, 1890; in Germany, No. 54,696, dated April 24, 1890; in Austria-Hungary, No. 27,492 and No. 48,746, dated September 28, 1890, and in Great Britain, No. 838, dated January 16, 1890;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Referring to the drawings, Figures 1 to 6 are longitudinal sections of gun-tubes, illustrating the manner of carrying out my invention, which relates to the construction of ordnance, and more especially to that class of ordnance known as "built-up" guns, in which the gun-tube is composed of a plurality of concentric tubes.

In the construction of these guns it has been the custom to unite the various concentric tubes by what is known as "shrinking," each tube being heated, applied to a tube of less diameter, and then allowed to cool, so as to contract or shrink on the tube contained therein, this operation being repeated until the gun is built up. In this process the work must be carefully conducted, the several tubes used for each gun prepared with the greatest care, so as to exactly fit into each other; besides which other technical difficulties present themselves. For instance, the several tubes must be of considerable thickness, and this renders the detection of flaws, if not impossible, at least very difficult.

The object of my invention is to avoid these difficulties, to facilitate the construction of this class of guns, and to increase their power of resistance to internal pressures; and the

invention consists in a novel process or method of construction, as will now be fully described, reference being had to the drawings, in which like letters indicate like parts wherever such may occur.

According to this my process or method of constructing built-up guns, the gun-tube is composed of a greater or less number of comparatively thin concentric tubes—in fact, of very thin tubes as compared with those heretofore used—thus affording the great advantage of being able to more readily detect flaws in the metal. Instead of shrinking the tubes one on the other, I subject the built-up gun-tube while in a heated condition to external pressure in order to more intimately unite the several tubes with one another, and to this end any suitable mechanical devices or appliances may be used. The union of the tubes may be effected by hammering, rolling, pressing, or drawing the "bundle" of concentric tubes, if I may use such expression, being of course properly heated previous to its being subjected to pressure, during which operation the tube is also given its proper form. In this mode of construction it is not necessary that the several tubes of which the gun-tube is composed should fit one into the other with great nicety, and to prevent endwise displacement of the more or less loosely-fitted tubes all of them may have their surfaces more or less roughened, and this may be effected in any desired manner, or said tubes may be wound with wire or provided with rings of metal, which will effectually prevent endwise displacement during the manipulations of the gun-tube, such wire or ribs or rings embedding themselves into the metal of the superposed tube during the operation of uniting the several tubes.

The method or process of constructing built-up guns may be varied in many ways. I prefer to use what are known as "twist-tubes"—that is to say, tubes in which the fiber of the metal follows a spiral direction—and the tubes are then so placed one into the other that the spirality of the fiber is reversed—that is to say, that in one tube the fiber will form a right-hand spiral and in the next succeeding

or preceding tube a left-hand spiral. In Fig. 1 I have shown such a bundle of tubes ready to be united. As shown in said Fig. 1, several tubes are of such interior diameter as to be readily placed one onto or into the other, and in order to prevent displacement of the several tubes during the various operations necessary to their union into a homogeneous or substantially homogeneous body, a wire *z* is wound spirally around each tube before they are inserted one into the other, which wire *z*, in the operation of uniting the several tubes, will embed itself into the same, as shown in Fig. 2.

The tubes *a b c*, &c., that compose the gun-tube, may all be of the same length, as shown; but, if desired, those portions of the gun-tube which require re-enforcing the re-enforced portion may be formed by shorter tubes, and in case of very long gun-tubes each individual tube, of which such is composed, may be made in sections of the same or of different lengths.

The operation of uniting the several tubes may be effected by mounting the gun-tube on a suitable mandrel *k*, which may be a revolvable or a stationary mandrel. When a mandrel *k* is used, as shown in Figs. 1 and 2, I prefer to interpose between said mandrel and the walls of the inner tube a lining of some fire-proof material *o*, preferably in a pulverized condition, so as to facilitate the removal of the mandrel after the operation of uniting the tubes. The mandrel *k* may also be left in the gun-tube, as shown in Fig. 3, and subsequently removed by boring, or the bore of the gun may be forced in said mandrel, which will then constitute the core of the gun-tube. In this case the fire-proof lining between the mandrel of the inner tube of the gun, hereinbefore referred to, cannot be used. On the contrary, the mandrel is preferably also wound with wire or its outer surfaces otherwise roughened for the purposes hereinbefore explained.

In Fig. 4 I have shown the several tubes *a b c*, &c., of which the gun-tube is composed, as provided with peripheral annular or spiral grooves, whereby corresponding ribs are formed that will be embedded into the inner wall of the superposed tube in the operation of uniting the several tubes, as shown in Fig. 5, whereby all danger of displacement in the various operations necessary to the union of the several tubes is avoided.

If the operation of uniting the tubes is effected upon a stationary mandrel, it will be found of advantage, before applying the external pressure by rolls or otherwise, to first compress the opposite ends of the bundle of tubes by forging or otherwise upon short mandrels *l*, as shown in Fig. 4, so that the outer tubes will not be drawn off by the friction between the inner tube of the bundle and the fixed mandrel. The same result may be attained by using an inner tube of greater length than the remaining tubes and upsetting one or both ends of said inner tube. In Fig. 6 I have shown the latter feature of construction,

one end *f* of the inner tube being upset against the ends of the outer tubes, or a flange *f* may be formed at one end of the inner tube *a* before the other tubes are placed therein.

In my method of constructing built-up guns by means of a series of comparatively thin tubes, it is possible to carefully test each tube, and flaws therein can thus be readily detected which is of great importance, especially in heavy ordnance. On the other hand, each tube may be tested under hydraulic pressure, which test is not available for testing the thick tubes usually employed in the construction of built-up guns. A selection of the proper metal or alloys may also be made as regards their resistance to pressure. Thus, for instance, the inner tube may be made of a metal that will offer the greatest possible resistance to the action of combustion of the charges, to abrasion, by contact with the projectile, &c., while the outer tubes may be made of a tougher metal. For the outer tubes I preferably use very soft cast-iron or tough bronze, so that in case of explosion of a gun where high explosives are used the fragments will not be scattered about, but held together by the outer expansive portion of the gun-tube. The interior portion of the gun-tube I preferably make of steel, so as to oppose a great resistance to the external pressure applied in the operation of uniting the tubes—as, for instance, of a very hard steel rich in carbon or manganese, or another alloy of steel.

If, on the contrary, an inner tube of a softer metal were used, it would yield more or less to the external pressure applied in uniting the tubes, thereby reducing the bore of the gun more or less. In firing, on the contrary, the softer inner tube will be more or less expanded by the internal pressure and heat, which expansion is transmitted to the entire gun-tube, which is not the case if a metal is used for the inner tube that is capable of resisting these pressures, or substantially so, and in the proper selection of metals a gun can be constructed that will not expand, or expand but very little. The gun may therefore be constructed of alternate hard and soft metal tubes—as, for instance, hard and soft steel or steel and bronze—thus rendering the advantages possessed by different metals available in the construction of guns.

As is well known, when certain metals are reduced in thickness by pressure or otherwise they are rendered more homogeneous, tougher, and stronger. It follows that a gun composed of a number of comparatively thin tubes reduced to this condition by pressure will be stronger and better able to resist internal pressure than a gun composed of a single tube or of tube-sections of comparatively great thickness.

I have described my invention in its application to the construction of ordnance. It will, however, be readily understood that it may be applied to the construction of tubes or barrels for small or hand fire-arms, and that a

gun-barrel composed of a plurality of concentric tubes, in which all the irregularities in the material are avoided, will perform better service than those of usual construction. As
 5 in the case of ordnance, the gun-barrel will have a greater resistance to internal pressure, thereby lessening the danger of explosion, and will have a less tendency to warp. Finally
 10 other hollow bodies that in use are subject to great internal pressure may be constructed according to my invention.

Having described my invention, what I claim is—

1. The improvement in the construction of
 15 tubular bodies which consists in forming a bundle by telescoping a plurality of tubes, preventing endwise motion of the concentric tubes by roughening the surfaces in contact, and uniting the bundle of tubes by heat and
 20 pressure, for the purpose set forth.

2. The herein-described improvement in the construction of tubular bodies, which consists in forming a bundle of previously-twisted tubes by telescoping the same, so that the
 25 twist in the contiguous tubes will trend in opposite directions, heating the bundle of tubes so formed, and uniting the same by the application of external pressure.

3. The herein-described improvement in the
 30 construction of tubular bodies, which consists in forming a bundle of tubes by telescoping a plurality of twist-tubes, so that the twist of one tube will trend in a direction the reverse of that of the adjacent tube or tubes, locking
 35 said tubes against displacement by wrapping wire around the same or otherwise corrugating or roughening the surfaces thereof, heating the bundle of tubes so formed, and subjecting the same to external pressure for the
 40 purpose of uniting the individual tubes.

4. The herein-described improvement in the construction of tubular bodies, which consists in forming a bundle of tubes by telescoping a plurality of such, locking the tubes against
 45 displacement by wrapping the same with wire or otherwise corrugating or roughening the surfaces thereof, heating the bundle of tubes so formed, and subjecting the same to external pressure for the purpose of uniting
 50 the tubes.

5. The herein-described improvement in the construction of tubular bodies, which consists in subjecting a bundle of tubes composed of a plurality of alternate soft and hard metal
 55 concentric tubes to external pressure while in a heated condition.

6. The herein-described improvement in the construction of tubular bodies, which consists in subjecting a bundle of tubes composed of alternate soft and hard metal tubes arranged
 60 so that the inner and outer tubes will be hard and soft metal tubes, respectively, and subjecting the bundle of tubes while in a heated condition to external pressure.

7. A tubular body composed of a plurality
 65 of concentric twist-tubes in which the direction of the twist trends alternately in reverse directions.

8. A tubular body composed of a plurality of thin concentric tubes having their surfaces
 70 corrugated or otherwise roughened to interlock the same, for the purposes specified.

In witness whereof I have hereunto set my hand in the presence of two attesting witnesses.

REINHARD MANNESMANN.

Witnesses:

ADOLF DEMELINS,
 GEORGE LOUBIER.