

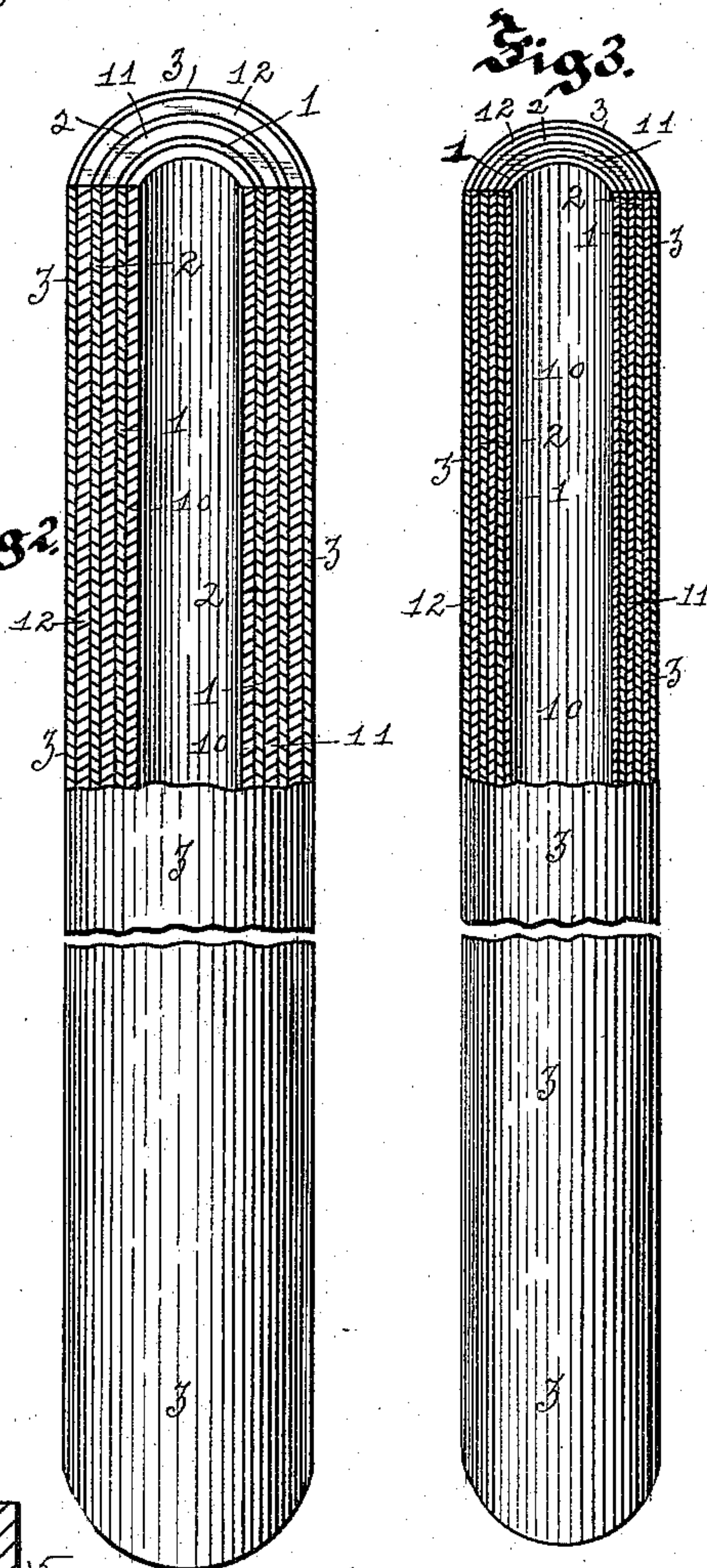
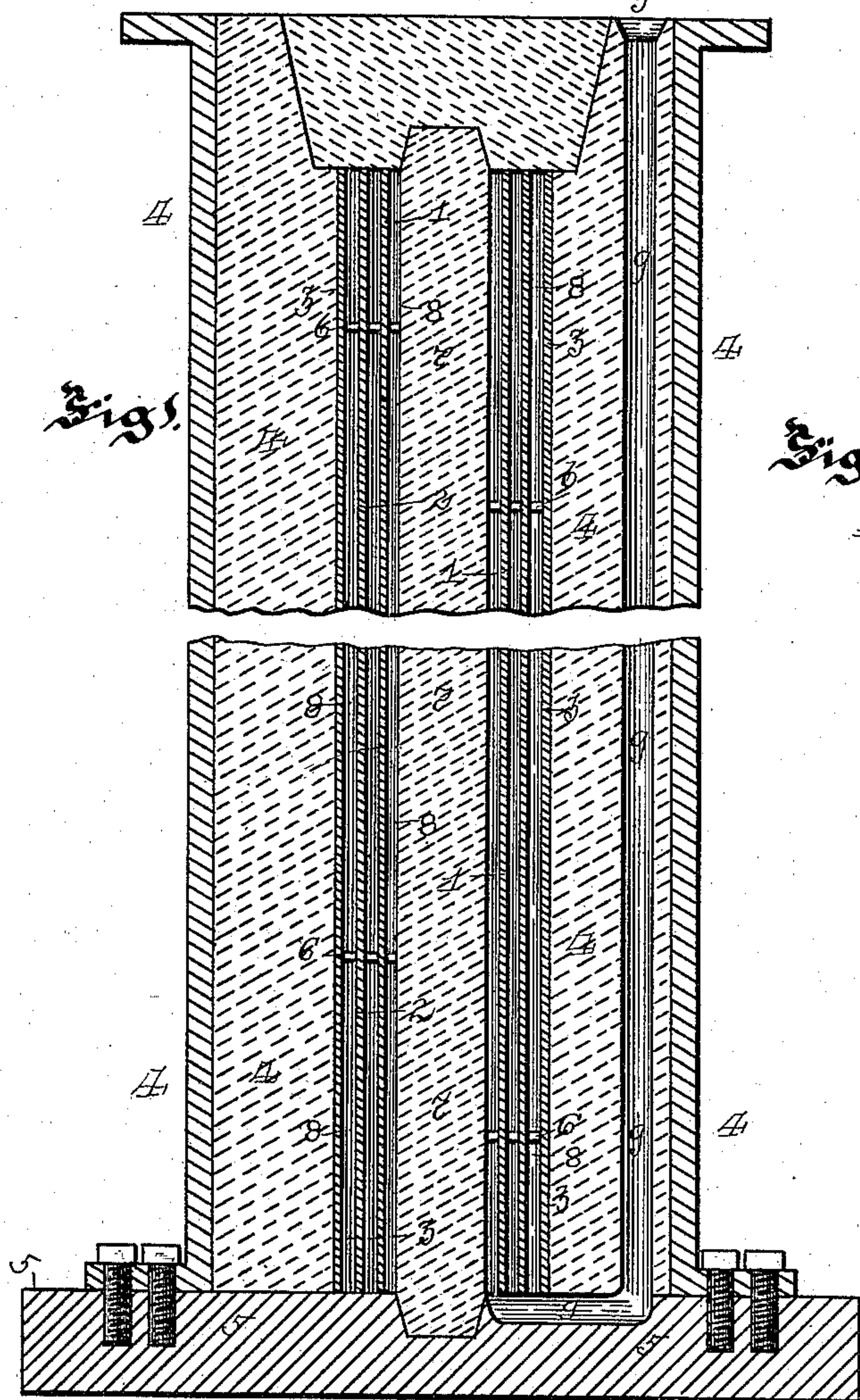
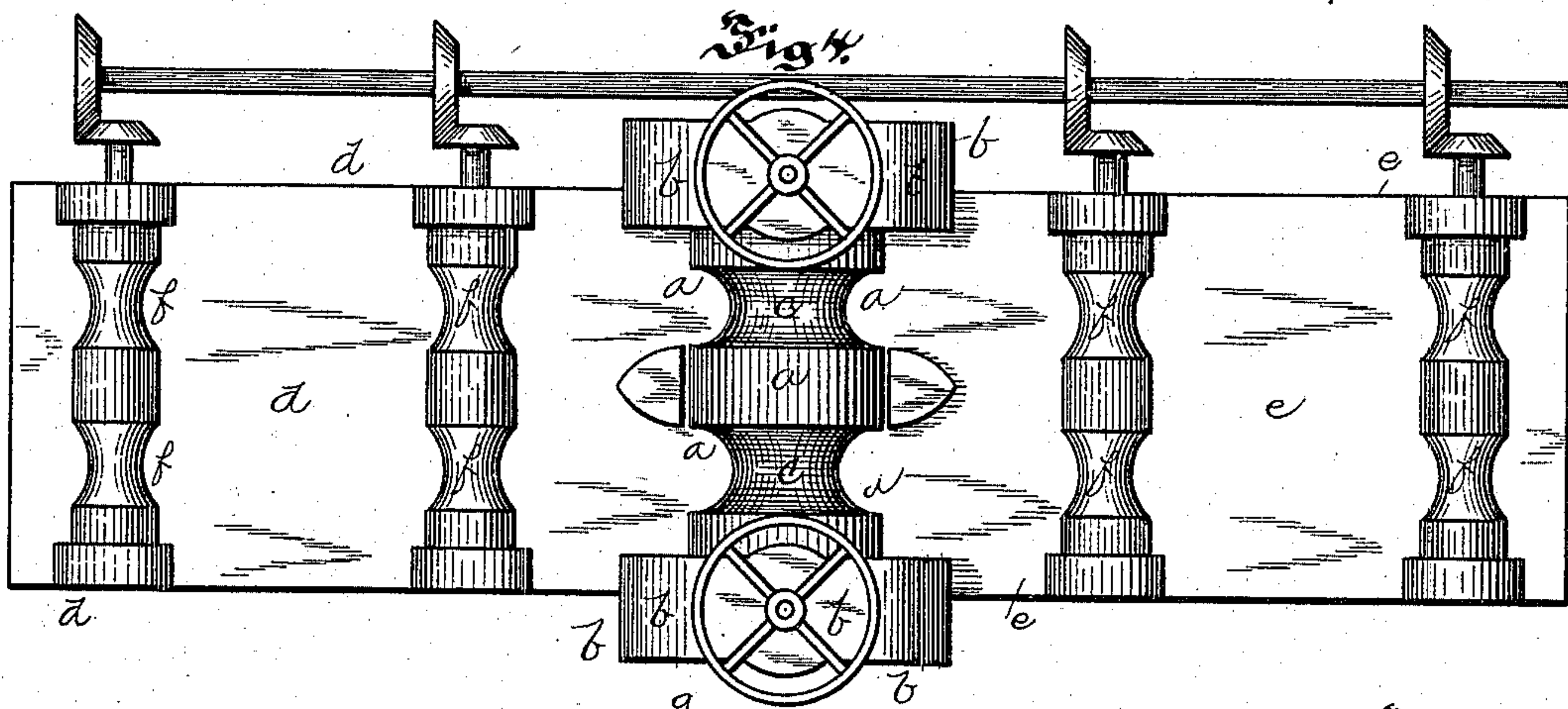
(No Model.)

J. H. FLAGLER.

MANUFACTURE OF SHAFTS AND ORDNANCE.

No. 385,049.

Patented June 26, 1888.



Witnesses  
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# UNITED STATES PATENT OFFICE.

JOHN H. FLAGLER, OF NEW YORK, N. Y.

## MANUFACTURE OF SHAFTS AND ORDNANCE.

SPECIFICATION forming part of Letters Patent No. 385,049, dated June 26, 1888.

Application filed May 25, 1887. Serial No. 239,273. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN H. FLAGLER, of the city of New York, in the county of New York and State of New York, have invented  
5 a new and useful Improvement in the Manufacture of Shafts and Ordnance; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to the manufacture of  
10 heavy shafts for vessels, mills, &c., and heavy ordnance, such as cannons, its object being to increase the strength of the shafts, to enable them to sustain great torsional strain and overcome the breaking of the marine-engine shafts,  
15 and to increase the resistance to bursting strain of the ordnance-tubes, as will be more fully hereinafter set forth.

In an application filed by me November 1, 1886, Serial No. 217,656, I have described a  
20 method of making and a form of gun-shell in which the article is produced by casting layers of steel around layers of metal tubing; and the special object of this invention is still further to increase the strength of the shafts and  
25 ordnance-tubes thus produced by imparting to the steel cast around the wrought-metal tubing-layers a more compact and fibrous structure.

To this end my invention consists in forming  
30 one or more tubular layers of wrought metal, casting around and between said layers a layer of soft steel, and finally rolling the tube or shell thus produced to impart a fibrous character to the steel and compact and harden  
35 the same, so as to increase its strength and resistance against the strains to which it may be subjected.

To enable others skilled in the art to make and use my invention I will describe the same,  
40 referring to the accompanying drawings, in which—

Figure 1 is a sectional view of the mold prepared for casting the gun or a heavy shaft in accordance with my invention. Fig. 2 is a  
45 view, partly in section, of the shaft or shell formed by casting. Fig. 3 is a view of the finished rolled shaft, and Fig. 4 is a view of a train of rolls for rolling the tubing.

Like letters refer to like parts in each of the  
50 figures of the drawings.

In practicing my invention I form one or more wrought-metal tubes or shells, these

shells being formed of wrought-iron or mild steel by bending to shape the plate from which the shell is formed and welding together the  
55 edges of the same to form a perfect wrought-metal tube or shell of the desired diameter and thickness; or the tube is made from a hollow ingot in a suitable manner, so as to obtain a  
60 weldless tube or shell. When two or more of these shells or tubes are used, the inner shell is of course of smaller diameter than the outer shells, the space between the tubes varying according to the amount of cast-steel which is  
65 to be introduced and the nature of the product desired.

In the drawings, 1 represents the inner wrought-metal tube, and 2 3 the tube or tubes employed around the same.

In forming heavy shafting or ordnance according to my invention I generally support  
70 these tubes within the mold 4 upon the metal bed-plate 5, any suitable pins or supports, as 6, being used to support the tubes in their proper relation with respect to each other and  
75 to the core 7 and mold 4.

In casting ordnance and ordnance-shells the tubes and core can be supported in like manner by any suitable skeleton frames or like devices. One or more pour-gates, 9, may com-  
80 municate with the spaces 8 between the tubes and the tubes and core or mold, and in case it is considered desirable in order to increase the strength of the finished article steel of different  
85 carbons may be cast between the several tubular layers, in which case separate pouring-gates communicate with each layer. The molten metal thus flows within and around the layers of wrought metal as desired, and as  
90 it is raised to a high heat fuses the exterior surface of the tubing and forms therewith a perfect union, giving a solid seamless shaft or gun-tube. The shaft shown in the drawings  
95 has three layers, 1 2 3, of wrought metal, and a like number of layers, 10 11 12, of cast-steel, the outer layer being formed of wrought metal. The layers of cast metal are supported by the tubular layers of wrought metal, and in case of any flaw or other imperfection in the body  
100 of the steel or metal tubing one serves to support the other and prevent these imperfections from spreading. After the shaft or tubular ingot has been thus formed it is heated to the proper temperature and subjected to a rolling



operation longitudinally, so as to condense and draw out the steel and give a fibrous grain to the metal layers, whereby a shaft or gun-tube is obtained. This rolling operation may be performed in any of the ordinary forms of machines now in use for rolling heavy ingots or hollow ingots; or a rolling-mill similar to that shown in the drawings may be used, which mill consists of an ordinary two or three high set of rolls, *a*, supported in housings *b*, and having suitable passes, *c*, therein, and each side of the set of rolls is provided with feed-tables *d e*, which are of the ordinary form, and have thereon feed-rolls having suitable grooves, *f*, therein to guide and direct the shaft or ingot into the pass of the rolls. The ingot or shaft after having been rolled longitudinally a sufficient number of times to be reduced to the proper diameter, and the proper fiber given to the steel, is completed. This rolling may be done over a mandrel; but this is not necessary, as the combined thickness of the layers is sufficient to sustain the pressure on the ingot and make it stiff enough to retain its shape during

the rolling operation. This rolling of the shaft or shell compacts and condenses the surface thereof, so as to require but little to be turned off before it can be used, and adds very materially to the strength of the shell or tube. In using the tube thus produced the breech-bands and pivot-bands may be shrunk around the tube in a similar manner to that described in my application, Serial No. 217,656, heretofore referred to.

Having now described my invention, what I claim is—

The method of producing shafting or tubing, which consists in casting steel around and between layers of wrought-metal tubing, then subjecting the ingot or tube thus formed to a rolling operation, substantially as described.

In testimony whereof I, the said JOHN H. FLAGLER, have hereunto set my hand.

JOHN H. FLAGLER.

Witnesses:

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