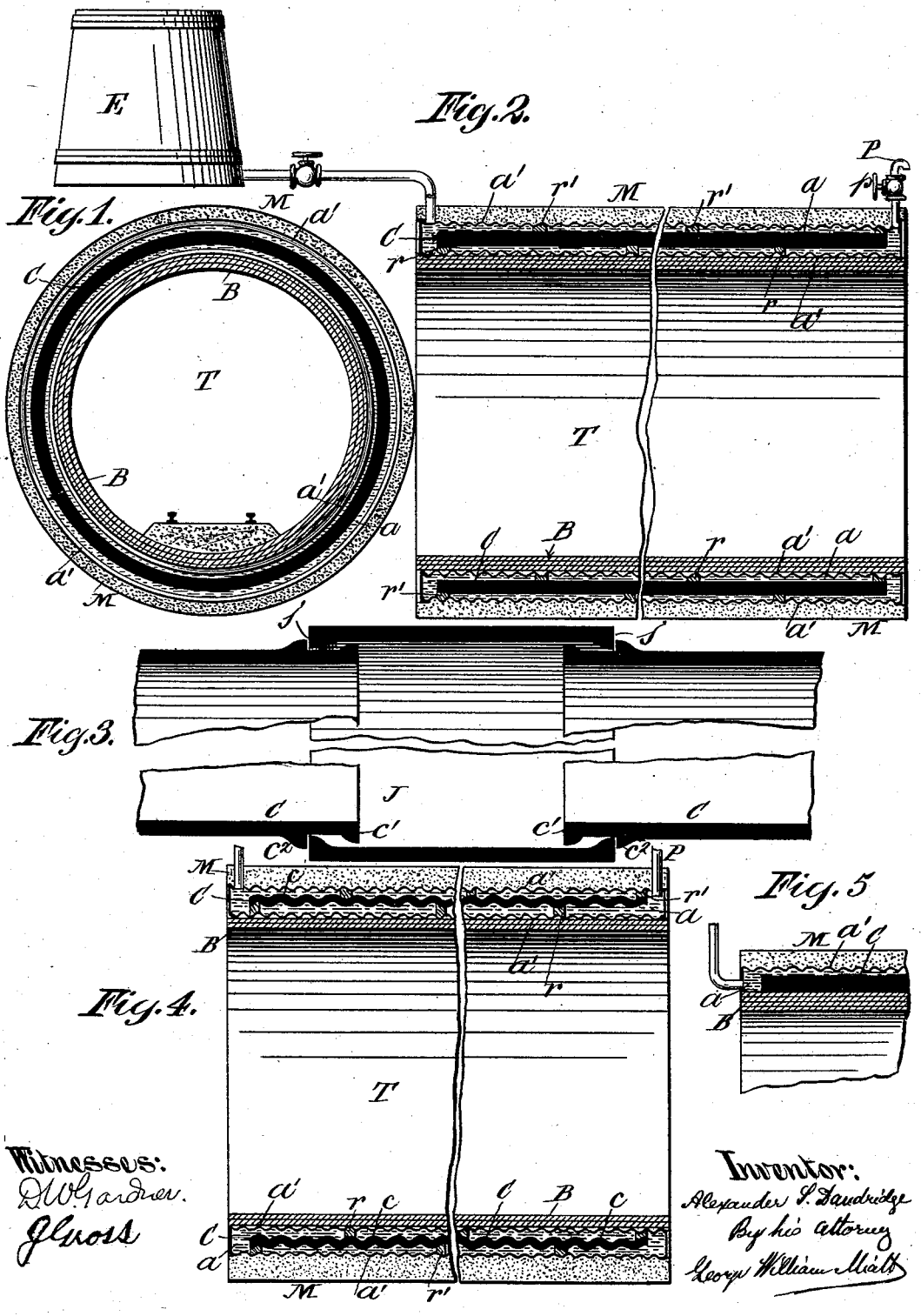
(No Model.)

A. S. DANDRIDGE.

TUNNEL.

No. 524,313. Patented Aug. 14, 1894.



UNITED STATES PATENT OFFICE.

ALEXANDER SPOTSWOOD DANDRIDGE, OF LEETOWN, WEST VIRGINIA.

TUNNEL.

SPECIFICATION forming part of Letters Patent No. 524,313, dated August 14, 1894.

Application filed December 7, 1893. Serial No. 492,980. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER SPOTSWOOD DANDRIDGE, a citizen of the United States, residing at Leetown, in the county of Jefferson and State of West Virginia, have invented certain new and useful Improvements in Tunnels, of which the following is a specification, sufficient to enable others skilled in the art to which the invention appertains to make and use the same.

My improvements are applicable to tunnels of various kinds, but are especially useful in the case of sub-aqueous tunnels, &c., where surrounding moisture has to be contended with.

The main object of my invention is to avoid the danger of chemical action upon and within the structure, and incidentally to utilize the shell of the tunnel as a means of conveying liquid hydro-carbons or other fluids from one extremity thereof to the other.

My invention therefore consists primarily in a tunnel shell the main core of which is protected by one or more longitudinal chambers containing a suitable liquid or semi-liquid, which protects the said main core against oxidation or other harmful chemical action; and secondarily, in combining with said longitudinal chamber or chambers means for supplying the same with a fluid at one end and for withdrawing the fluid at the other end of the tunnel.

My invention also includes the use of corrugated metal for the walls of the longitudinal fluid chambers, and for both of them and the main core of the tunnel also when desired, for the purpose of affording a certain degree of elasticity to the shell without endangering the structure as a whole. By this means the tunnel can safely be allowed to adapt itself to any slight inequalities in support along its length, and to compensate for expansion and contraction under variations in temperature, a result of no small importance when the tunnel is of considerable length.

My invention also includes a special form of joint between the sections of the main core which can be packed from the interior; and the combination with the main core and its protectory shell, of an exterior non-metallic covering, substantially as herein set forth.

In the accompanying drawings I illustrate diagrammatically the practical embodiment of my improvements in a tunnel of cylindrical form, although I do not confine myself to the exact construction and arrangement of parts shown, since it is obvious that various modifications may be made in meeting the requirements of special use and situation without departing from the spirit and intent of my invention.

Figure 1, is a transverse section through the main structure of my improved tunnel; Fig. 2, a central longitudinal section thereof, at both ends, the central portion being omitted. Fig. 3, is a view illustrating a special form of joint for use between the sections of which the main core is composed; Fig. 4, a central longitudinal section of both ends of the tunnel showing the main core corrugated as well as the protecting shell. Fig. 5, is a sectional detail indicating the arrangement of parts when only the outside of the core is protected by a chamber containing liquid.

The form of the tunnel T, in transverse section is of secondary importance, and may be varied as desired; it being shown circular in cross section in the accompanying drawings for convenience of illustration. The main metallic core C, is built up in any convenient manner. Wrought or cast iron may be used although I do not limit myself to the use of iron. The core C, may be either plain in surface as shown in Fig. 2, or formed with transverse corrugations *c*, as indicated in Fig. 4.

Preferably the core C, is protected both on the exterior and interior by a longitudinal chamber, or chambers *a*, *a*, containing a liquid or semi-liquid of a character that will protect the core from oxidation or other chemical action. Only one side of the core C, may be thus protected if desired, Fig. 5, showing the liquid chamber on the outside only of the core. In either case the longitudinal chamber *a*, is filled with oil or any other non-oxidizing fluid; or if preferred with a semi-fluid substance of like protecting properties. These chambers *a*, are designed to be continuous from one end of the tunnel to the other, so as to virtually form longitudinal passages for the flow of an oil or other liquid from one end of the tunnel to the other.

The chambers *a*, may thus be used not only as a means of protecting the core C, but also as a means of transporting hydro-carbon oils or other liquids, under pressure from one extremity of the tunnel to the other. Thus, in Fig. 2, an elevated tank E, is shown as supplying, say, kerosene to the annular passage *a*, surrounding the core C, at one end of the tunnel, while at the other provision is made for drawing off the oil through a pipe and valve P, *p*. In this arrangement the elevation of the tank E, insures the flow of the liquid through the passage *a*, but the liquid may be forced through by other means, as by pumping.

The outer walls *a'*, *a'*, of the chambers *a*, are preferably formed of copper, and are corrugated transversely although in so far as the mere provision of the liquid passages *a*, is concerned the corrugating of the walls *a'*, *a'*, is not essential. When however it is desired to afford a structure which will yield more or less both to lateral strain and to expansion or contraction, I propose to corrugate not only the walls *a'*, *a'*, of the chamber *a*, but also to corrugate the main core itself, as indicated in Fig. 4.

The interior of the tunnel is lined with brick-work B, or other suitable material; and the exterior is preferably protected by a suitable thickness of concrete or other suitable non-metallic covering M.

Where the core C, is made in sections, I propose to join these sections together by the form of joint shown in Fig. 3, although I do not limit myself exclusively to the use of that particular form of joint. The joint J, shown however has the advantage of accessibility from the interior from which it may be packed between the flanges *c'*, c^2, on the exterior of the core C, and the flange *j*, *j*, on the inner edges of the joint J. This joint and packing allows a slight degree of flexibility between the opposed ends of the adjoining sections of the core, which is of advantage in the work of construction.

The walls *a'*, *a'*, of the longitudinal passages are held supported at suitable intervals by rests *r*, *r'*, of any suitable size and shape, and preferably made of a material which is a poor conductor of electricity thus avoiding the possibility of galvanic action between the metals. These rests are comparatively small, and are arranged with relation to each other so as to break joints, and not to impede the flow of liquid.

As a means of transportation for oils and other liquids my improved construction of tunnel is of practical utility; while the protection which may be afforded to the core or shell against chemical action and deterioration is of still more importance.

The slight degree of flexibility of the structure is also a feature of importance in practical construction and use, especially in the case of long tunnels.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A tunnel formed with a metallic core or shell, and with a longitudinal chamber surrounding said core filled with a liquid or semi-liquid substance, for the purpose and substantially in the manner described.

2. A tunnel formed with a metallic core or shell, and with a longitudinal chamber on both the outside and inside of said core filled with a liquid or semi-liquid substance, for the purpose and substantially in the manner described.

3. In combination with a tunnel formed with a metallic core or shell, and with a longitudinal chamber surrounding said core, means for introducing a fluid under pressure into said longitudinal chamber at one end of the tunnel and for drawing off the fluid at the other end of the tunnel, substantially in the manner described.

4. A tunnel formed with a metallic core or shell, and with a longitudinal chamber surrounding said core having metallic outer walls which are corrugated, substantially in the manner and for the purpose described.

5. A tunnel formed with a transversely corrugated metallic core and with a longitudinal chamber surrounding said core having metallic outer walls which are corrugated transversely substantially in the manner and for the purpose described.

6. A tunnel formed with a metallic core or shell, with a longitudinal chamber surrounding said core filled with a liquid or semi-liquid substance, an outer metallic wall to said longitudinal chamber, and an exterior coating of a non-metallic substance, for the purpose and substantially in the manner described.

7. In combination with the metallic core C, of the tunnel, formed with the exterior flanges *c*, *c'*, the joint J, formed with the interior flange *j*, substantially in the manner and for the purpose described.

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Witnesses:
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