May 12, 1931. S. P. MONSCH 1,804,888

PIPE COILED WITH STEEL WIRE FOR PRESSURE CONDUITS AND VESSELS UNDER PRESSURE

Filed Nov. 25, 1927 2 Sheets-Sheet 1

Fig. 1.

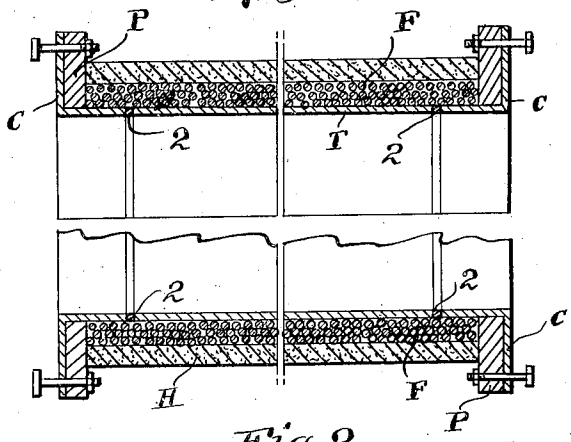


Fig. 2.

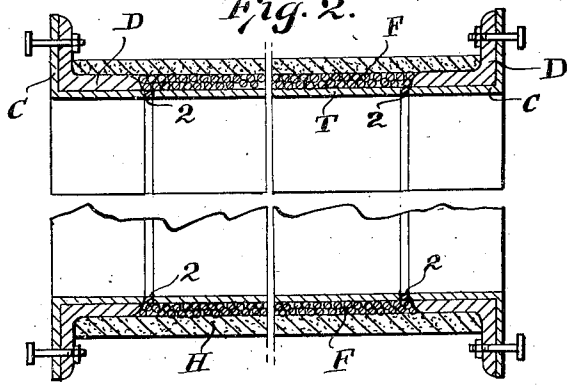


Fig. 3.

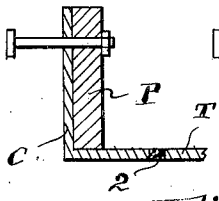


Fig. 4.

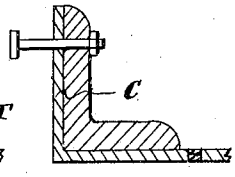


Fig. 5.

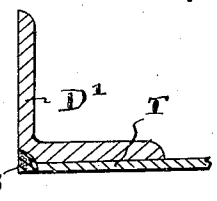


Fig. 7.

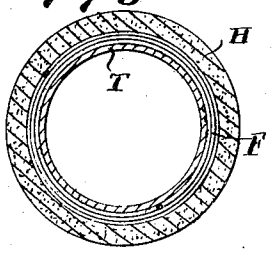


Fig. 8.

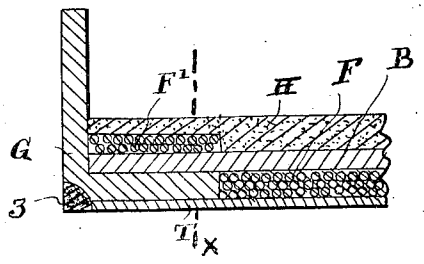
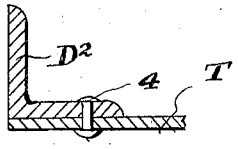


Fig. 6.



INVENTOR.
S. P. Monsch
BY: Marks & Clark
ATTORNEYS.

May 12, 1931. S. P. MONSCH 1,804,888

PIPE COILED WITH STEEL WIRE FOR PRESSURE CONDUITS AND VESSELS UNDER PRESSURE

Filed Nov. 25, 1927 2 Sheets-Sheet 2

Fig. 9.

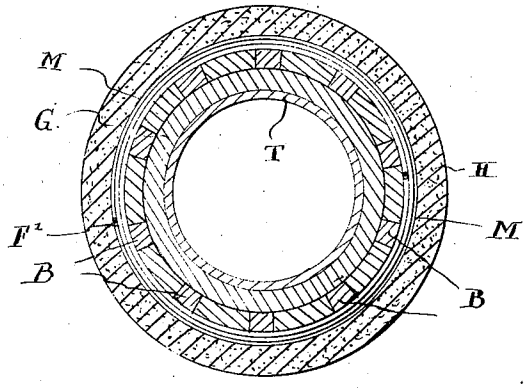


Fig. 10.

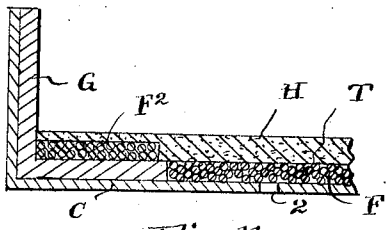


Fig. 11.

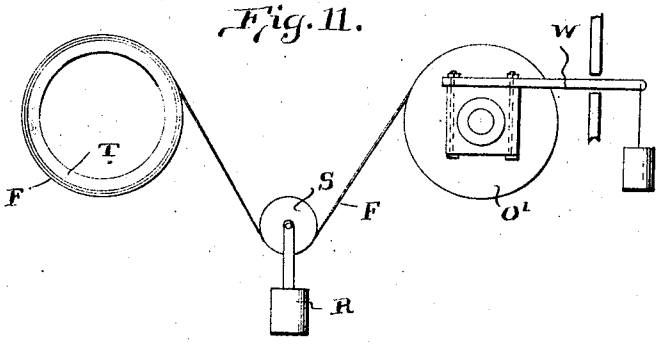
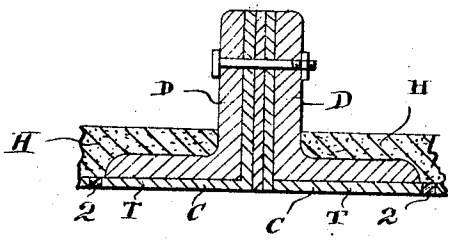


Fig. 12.



INVENTOR:
S. P. Monsch
BY: Marks & Clark
ATTORNEYS:

Patented May 12, 1931 1,804,888

UNITED STATES PATENT OFFICE

SIMON PIERRE MONSCH, OF PONTEZER, NEAR GUINGAMP, FRANCE

PIPE COILED WITH STEEL WIRE FOR PRESSURE CONDUITS AND VESSELS UNDER PRESSURE

Application filed November 25, 1927, Serial No. 235,666, and in France December 2, 1926.

As is well known the pipes for pressure pipe lines must be able to resist the highest static inner pressures and violent water-hammer to which they may be subjected. Besides, they must be perfectly rigid and fluid-tight.

Steel satisfies these conditions, but, up to now, in the construction of these pipes, this metal was solely used in the form of sheet iron plates coiled as elementary ferrules fitted into each other, with the junction lines overlapping and then riveted or welded together.

This mode of construction calls for the following remarks:

1—The maximum resisting work which can be demanded from steel is from 6 to 8 kilograms per square millimeter.

2—By using steel in the form of sheet iron plates, the resistance of the metal is not entirely utilized. The intensity of the stresses to which the various layers of the metal are subjected in a straight section of the sheet iron plates rapidly decreases from the inner wall to the outer wall; in the layers adjacent to this outer wall the metal works much below its limit resistance and the increase of resistance which might be sought for by increasing the thickness of the sheet iron plate rapidly reaches a limit beyond which the additional thickness becomes of no utility.

3—The riveting of the elementary sheet iron plates diminishes the resistance of the pipe.

4—The overlapping of the ferrules, the lines of riveting and the changes of the diameter determine losses of head, the effects of which are very prejudicious since pressure conduits are under consideration.

On the other hand, the difficulties of construction and, consequently, the cost, rapidly increase with the thickness of the sheet iron plate to such an extent that it is not possible to practically reach a thickness greater than 4 centimeters. It is then necessary to diminish the diameter of the ferrules and to use several conduits instead of a single one or a conical conduit. Serious inconveniences result therefrom: namely, aggravation of the water-hammer, high cost of construction, etc.

The pipe forming the subject-matter of the invention does not present these various inconveniences. It is capable of resisting any pressure and any outflow and it has other advantages such as ease of construction.

In this pipe, the desired resistance is obtained by winding under variable tension a steel wire, on a tube constituting the inner wall of the pipe.

This pipe comprises as essential elements:

(*a*) A tube formed of a thin steel plate, curved and welded according to a generating line so as to constitute the inner wall of the pipe;

(*b*) Layers of a steel wire preferably having a circular or rectangular cross section, wound on the tube under a variable tension according to the order of the layer, so as to constitute a rational coiling;

(*c*) Annular flanges formed by a thin steel band soldered to the sheet metal tube and reinforced by a flat or band iron, or an angle iron, this device constituting the flanged joint between two pipes;

(*d*) Steel bars of rectangular or circular cross sections as at P, Figs. 1 and 3 for preventing the bending of the pipe from external pressures, or longitudinal tensions, in case the sheet metal of the tube would not be sufficient for resisting these various stresses;

(*e*) A coating made of cement concrete, asphalt concrete, or the like, adapted to protect the metal against external agents.

The tube formed of a thin curved and welded steel plate (the inner wall of the pipe) has for its function to constitute a firm bearing base for the steel wire coil to ensure the fluid-tightness of the pipe and finally to provide a flange joint between two consecutive pipes.

This tube must resist the compression exerted on the same by the coiling and this essential condition determines its thickness. By its presence it prevents bending of the pipe under the external pressures to which the latter may be subjected, but it participates only in a slight extent in the resistance to internal pressures.

This resistance entirely resides in the steel wire coiling.

The coiling is composed of steel wires wound in successive layers throughout the pipe from one flange to the other.

The tension of the wire is variable from the inner layers, that is to say those adjacent to the tube, to the outer layers, as determined by calculation.

This variation which exists from one layer to the other is such that, under the static pressure existing in the pipe, the wires are all given one and the same tension which is precisely equal to the maximum stresses to which the steel wire may be subjected.

The wires used are made of high resistance steel, obtained by drawing, which is a guaranty of the quality. The steel chosen has a high limit of elasticity, much greater than that of the tube. The wires are of any suitable section such as circular, square or rectangular cross section; their dimension is of about 1 to several millimeters. The coiling is therefore composed of a series of very thin superposed coils with an accurate and predetermined tension, all these coils being made of a high resistance metal. The cross section of the wires, the number of coils and the tension are, in each layer determined by calculation for satisfying the above-mentioned condition. It is thus possible to obtain the maximum utility of the quantity of metal used, which metal has a high resistance and the quality of which is guaranteed by the drawing operation.

In order that the invention may be clearly understood, various practical forms of carrying it out have been illustrated in the accompanying drawings. It is obvious that these examples do not constitute in any way limitations and that they can receive modifications which all remain within the scope of the invention if they make use of the principle which has just been set forth.

Fig. 1 is an axial section of the pipe which can resist internal pressures, this pipe being provided with flanges reinforced by a flat iron band.

Fig. 2 shows the same pipe provided with a flange reinforced by an angle iron.

Fig. 3 is a detail section of the assemblage element composed of a flange reinforced by a flat iron band and welded to the sheet metal of the tube by autogenous or like welding.

Fig. 4 is a detail section of the same assemblage by flange and angle iron.

Fig. 5 shows the angle iron directly secured to the tube by autogenous or like welding.

Fig. 6 shows the angle iron secured to the tube by rivets.

Fig. 7 shows a section of the pipe at right angles to its axis.

Fig. 8 is a section of the pipe, along its axis, with longitudinal bars secured to the flanges by steel wire.

Fig. 9 is a section made along line X—X of Fig. 8 at right angles to the axis of the pipe and showing the longitudinal bars with separating members.

Fig. 10 shows a right angle flange reinforced by layers of steel wire.

Fig. 11 diagrammatically illustrates a device for winding the steel wires under a variable tension, by variation of a tensioning weight.

Fig. 12 shows the assemblage of two pipes with interposition of a rubber packing.

Figs. 1 and 2 show the thin steel plate T curved and welded along its adjacent edges according to a generating line 1, so as to form the tube, that is the inner wall of the pipe and the support for the coils. The two end flanges shown in the example of Figs. 1 and 2 consist of flanges C having approximately the same thickness as the sheet metal of the tube and are welded to the latter as indicated by the rings 2. The flange C and the tube T having approximately the same thickness, the autogenous welding of these two parts being quite satisfactory and resistant. The flanges are reinforced either by flat iron bands P (Figs. 1 and 3), or by angle irons D (Figs. 2 and 4), these flat and angle irons being bolted on the flanges upon assemblage of the pipes.

It is also possible to use only an angle iron D^1 directly welded to the sheet metal tube as indicated at 3 (Fig. 5), or riveted on this tube (Fig. 6) at 4.

The coiling in layers of steel wire is shown at F in the various figures.

For executing this coiling, the device diagrammatically illustrated in Fig. 11 can be used. The steel wire F unwinding from a supply drum O^1 (which is subjected to a braking action, of suitable intensity, for instance by means of a Prony brake W), passes under a pulley S the axis of which is loaded with a tensioning weight R; the wire winds on the tube T and coils this tube under a tension which can be varied for each layer, by changing the tensioning weight.

When right angle flanges are used, it may be necessary to reinforce them by a steel wire coiling. In this case (Fig. 10) angle irons G will be employed, around which will be wound the coiling F^2.

When the longitudinal bending or the external pressure exceeds the resistance of the tube, the latter is reinforced by rectangular steel bars B distributed throughout the periphery of the pipe from one flange to the other by taking a bearing against these latter. For holding the bars together, wooden or metal members M are frictionally inserted between each of them. The bars are secured to the right angle flanges by means of layers of steel wire F^1 wound under tension, the

bars being thus perfectly secured in position.

On the pipe thus obtained is poured a coating H (having a thickness of 1 or 2 centimeters) of cement or like concrete; this coating protects the metal against external agents. It is to be understood that this is applicable by rational coiling of a steel wire, so as to utilize to its maximum of resistance a metal of good quality, not only to the elements of pipes but also to any vessels within which high pressures may exist.

It will be seen that in the pipe which has been described under various forms of execution, as well as in the pressure vessels devised according to identical rules, the resistance to each of the stresses to which the pipe or the vessel may be subjected, is to be a distinct element of the pipe: such as tube, coiling, longitudinal reinforcement, connection flanges.

Claims:—

1. A pressure tube comprising a cylindrical metal member, and a plurality of continuous wires wound convolutely on said member, the tension of said wound wire varying with each successive wind.

2. A pressure tube comprising a cylindrical metal member, and a plurality of continuous wires wound convolutely on said member, the tension of said wound wire increasing with each successive wind.

3. A pressure tube as claimed in claim 2, in combination with a flanged ring welded to the end of the pipe, said wire being wound around a portion of said ring.

4. A pressure tube as claimed in claim 2, said wires being so wound that the tension is uniformly distributed throughout the wire when the tube is subjected to static pressure.

5. A pressure tube as claimed in claim 2, in combination with longitudinally disposed reinforcing members, and a second series of convolutely wound wires adjacent each end of said tube, said reinforcing members being disposed between said first and said second mentioned wires.

The foregoing specification of my "pipe coiled with steel wire for pressure conduits and vessels under pressure" signed by me this 15th day of November 1927.

SIMON PIERRE MONSCH.