July 1, 1941. E. W. SYLVESTER 2,247,420

MEANS FOR JOINING PIPE

Filed Dec. 15, 1937

FIG. 1.

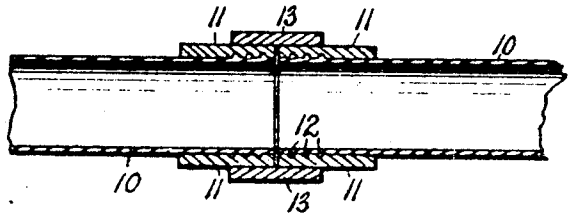


FIG. 2.

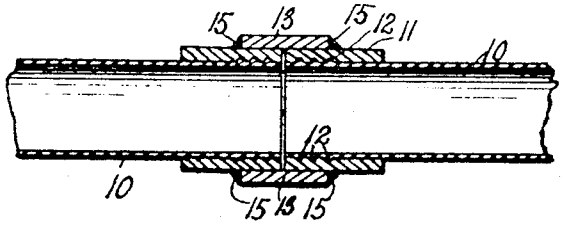


FIG. 3.

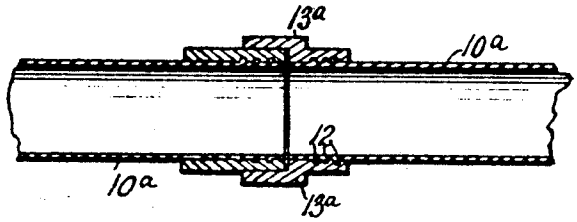
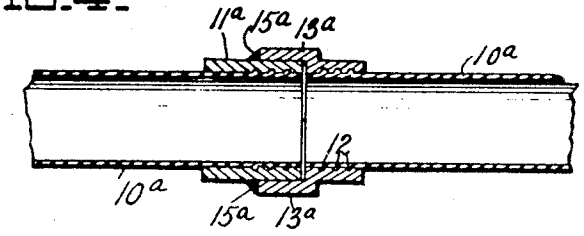


FIG. 4.



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MEANS FOR JOINING PIPE

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4 Claims. (Cl. 285—114)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

My invention relates generically to a method of and means for joining pipe, and more particularly to pipe of non-ferrous metals and alloys, and most specifically to pipes of austenitic stainless steel having a carbon content of above .08.

Such pipe is usually thin and by reason thereof and of other inherent characteristics of the metal or alloy thread coupling is disadvantageous and weakening of the pipe. Also such pipe, including brass and copper pipe, are more suitable for most enduring commercial use when their drawn or cold worked characteristics of increased tensile strength, resistance to fatigue and otherwise are preserved.

While cold drawing, cold rolling or other cold working substantially improves the tensile strength, resistance to fatigue and other characteristics of non-ferrous metals and alloys which may be advantageously employed for piping, in such stainless steel said strength may be attained to about 300,000 pounds per square inch by cold drawing, to about 250,000 pounds per square inch by cold rolling, and to about 150,000 to 200,000 pounds per square inch by other cold working with somewhat corresponding increased resistance to fatigue. This may be said to result from cold-treating. The advantages attained or attainable by cold-treating may be lost in areas of the pipe which may be subsequently heated and slow or air cooled, since brass, copper and said stainless steel all have the inherent property of being annealed by slow or air cooling following heating.

A further inherent usually disadvantageous property of said stainless steel is that in heating a part of the same to a welding temperature at least one adjacent area of said alloy usually is brought within what is known as a critical temperature range. This range may be typified as between about 900° F. and 1500° F. Such of said alloy as remains in said range for a substantial period of time becomes unhomogenous in that more or less of the carbon content (in said alloys of a carbon content of above .08) migrates from within to the boundaries of the metallic grains forming the alloy. In such migration each of carbon particles carry with them a large number of molecules of the chromium content of such grains. The result of such migration to harmful degree is that such an excess of carbon is present between grain boundaries in said area that undue brittleness results, together with the undue loss within the affected grains of the corrosion resisting property of the alloy, together with its non-magnetic property. Such results are more generally known as carbide precipitation to a harmful degree.

Since such piping normally is no stronger than its weakest part, and no more advantageous than its most disadvantageous part, it is an important object of my invention to provide an improved method of and means for joining pipe practically free from the before stated defects.

A further object of my invention is to produce pipe joints practically free from the before stated defects by reinforcing the thickness of the ends of the pipe and joining together the reinforced ends.

A still further object of my invention is to produce pipe joints practically free from the above defects by reinforcing the thickness of the ends of the pipe when necessary, telescoping one of said reinforcing ends at least partly over the adjacent reinforced end or telescoping a separate element at least partly over both said reinforced ends, and securing the telescoped end to the adjacent reinforced end or the separate element to said reinforced ends.

A still further object of my invention is to swage or otherwise secure a reinforcing gas and liquid tight over the ends of pipe portions to be joined together, and then joining together the reinforced ends.

The method, and the means for practicing the same, are related and dependent parts of the same invention, although the method may be practiced by other means.

The method will be rendered clear to those skilled in this art from the following description:

In the drawing, in which like characters of reference indicate the same parts, Fig. 1 represents a longitudinal central sectional view through adjacent portions of pipe solder joined in accordance with my invention;

Fig. 2 is a view similar to Fig. 1, but showing the joint welded.

Fig. 3 is a view similar to Fig. 1 of a modification of my invention, and

Fig. 4 is a view similar to Fig. 3, but showing the joint welded.

In said drawing 10 represents portions of pipe to be joined together at their ends. This pipe, in the most advantageous aspect of my invention, is of non-ferrous metals and alloys, such as brass and copper, as well as of an austenitic stainless steel alloy or alloys having a carbon content of above .08. Pipe of the above indicated types is usually much more expensive than pipe

of the ferrous alloys and is usually made quite thin.

The thinness of such pipe is such that in joining the ends of the same together by threaded connections requires that the threads be so fine and shallow that they have relatively little holding value, as well as substantially weakening the pipe throughout the extent of the threads and rendering the same readily breakable approximately at the inner end of the thread.

The joining of such pipe together by telescoping the ends of pipe directly into opposite ends of a thimble and then soldering or welding the thimble to the pipe is disadvantageous and weakening for the primary reasons, among others, heretofore stated in connection with the different kinds of pipe which are most advantageously joinable by my invention.

Another object of the invention is to overcome the disadvantages in solder joining with sleeve type joints any metal of which the commercially acceptable tolerance in outside diameter is greater than the maximum clearance between sleeves and tubing at which capillary distribution of soldering material will occur. In my invention the proper clearance for capillary distribution is determined by the calibration of the inside diameter of sleeves and the outside diameter of thimbles. Tubing of a wide range of variation in outside diameter can be satisfactorily rolled to the uniform external diameter to leave the required capillary attraction space therebetween when inserted into the thimbles. This feature of my invention permits the use of less accurately sized, and consequently cheaper, tubing in installations in which the sections thereof are to be joined with sleeve type soldered fittings.

Another object of my invention is to prevent actually burning through the walls of thin tubing when being joined by fusion welds. This object is accomplished by the location of the joining weld on the thimble reinforcing.

The foregoing and other disadvantages are overcome by my invention in the instance shown in Figs. 1 and 2, by providing each of the ends of pipe 10 (to be joined together) with a reinforcing thimble 11 of substantial length. Each of these thimbles 11 is secured gas and liquid tight over the ends of their respective pipes 10 in any desirable manner, preferably by forming a plurality of shallow recesses or grooves 12, in or about the interior of the thimbles 11. Preferably the thimbles 11 are telescoped completely over their respective pipes 10 so that the end of the pipe and an end of the thimble 11 are substantially flush with each other. Metal of the pipe 10 is then swaged snugly into each of said recesses or grooves 12 until a gas and liquid tight joint is obtained between the exterior of pipe 10 and the interior of thimble 11. This swaging operation may, as will be understood by those skilled in the art, be performed with well-known swaging tools.

With the ends of pipes to be joined together thus reinforced by thimbles 11, such ends may be telescoped into opposite ends of a continuous integral ring 13 to the desired extent. The internal diameter of ring 13 may snugly fit the external diameter of the continuous integral thimbles 11, whereupon the opposite ends of ring 13 may be arc-welded by weld fillet 15 or soldered to an intermediate portion of each of the thimbles 11, as shown in Fig. 2. Should the ring 13 be desired to be soldered to its contained thimbles 11, the internal diameter of ring 13 and the external diameter of its associated thimbles 11 may be so calibrated that a thin space may exist between them such as will invite, by capillary attraction, the uniform flow of solder within and throughout the extent of the joint between ring 13 and its associated thimbles 11.

In the heating essential to weld or solder said joint, and thus form a gas and liquid tight union of the pipes, it will be observed that the relative lengths of the ring 13 and its associated thimbles 11 are such that the thimbles 11 project a substantial distance inwardly from the pipe ends and from the opposite ends of the ring 13, such that no heat resulting from the making of such joint between the pipe ends may impair the inherent and acquired characteristics of the metal of the pipe 10 at any point not covered and substantially reinforced by the thimbles 11.

The term "impair the inherent and acquired characteristics" is intended to comprehend and include the preservation of the drawn or cold-worked characteristics of increased tensile strength, resistance to fatigue and otherwise, in the non-ferrous alloys, typically brass and copper pipe, as well as the avoidance of said characteristics in said stainless steel alloy, including the occurrence of carbide precipitation to a harmful degree.

The reinforcement of the pipes 10 by their respective thimbles 11 extending beyond the extent of any impairment of pipe 10 by the heat of said joining of the pipes together, insures that the pipes 10 extending beyond the thimbles 11 will possess all of their inherent acquired characteristics.

In the structure shown in Figs. 3 and 4 the thimble 11*a* on the end of one pipe corresponds in all respects to the thimble 11 on one of the pipes shown in Figs. 1 and 2. The difference of the structure of Figs. 3 and 4 over that shown and described in Figs. 1 and 2 comprises the special construction of the ring as well as the thimble upon the juxtaposed end of the other pipe. Such difference comprises the integral forming of the other thimble with the ring 13 so as to produce the integral thimble-ring 13*a* of Figs. 3 and 4, whose inner bore is swaged or otherwise secured air and liquid tight to the outer surface of its pipe 10, while its inner bore of larger diameter telescopes over a portion of the thimble 11*a*, as heretofore described, for the ring 13 in connection with Figs. 1 and 2. The telescoped end of thimble-ring 13*a* is welded by weld fillet 15*a* or soldered, as heretofore described in connection with Figs. 1 and 2.

The thimbles of this embodiment are provided with grooves 12 in the same manner and for the same purpose as those of the first embodiment.

In Figs. 1 and 3 the structure is such that the soldered joint is contemplated. In the soldered joint of Fig. 1 the capillary attraction relatively narrow space between the ring 13 and the thimbles 11 induces the ready, uniform flow of solder throughout the extent of such space, regardless of any departure from the horizontal.

In the structure of Fig. 3 the thimble-ring 13*a* is provided with a larger bore of a diameter slightly larger than the external diameter of the thimbled end of its receiving pipe 11*a*, so as to provide therebetween the capillary space for the film of heat joining metal or soldering, as heretofore described in connection with Fig. 1.

It will be understood from the foregoing that the volume of heated metal necessary to heat-

join the pipe is so small at any one time relative to the subsantial heat conductive area of the exposed portions of the thimbles or of the pipe adjacent the heat-join that the heat may be removed from the thimble or the pipe at such a rate that it may not attain the degree or the length of dwell requisite to harmfully affect the characteristics of the metal, especially of the exposed pipe.

It will also be understood that while the structure specifically disclosed in the drawing is particularly adapted to thin pipe of the general types indicated, that where such pipe of substantial thickness or of integral homogeneous thimbled ends may be employed without harmfully affecting the characteristics of the adjacent pipe by applying the joining heat progressively to very small volumes of metal at a degree no higher than necessary to effect an efficient joint, and at the same time enable the surrounding metal to dissipate the joining heat at such a rate that the same may not in degree or period of dwell harmfully affect the characteristics of the metal of the joined pipes.

It will be understood that my invention produces pipe of substantially reinforced ends of unusual rigidness and durability, and that the same may be joined together even by substantial heat of soldering, arc-welding or otherwise, without impairing in any substantial or appreciable extent the inherent or acquired characteristics of the pipe extending between the reinforced ends thereof as well as extending to appreciable extent within the reinforcements provided at opposite ends of each pipe length.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes, without the payment of any royalty thereon or therefor.

Having now so fully described my invention that others may therefrom advantageously make and use the same, what I claim and desire to secure by Letters Patent is:

1. Means for joining a pipe to a metal object comprising an inner sleeve member fitted with a tightly gripping fit over the end of said pipe, an outer sleeve extending from said object and surrounding a portion of said inner sleeve, said outer sleeve being secured to said inner sleeve by a ring-like seal of metal applied in the molten state, the location of said seal with respect to said inner sleeve and the dimensions of said inner sleeve being so selected as to dissipate the heat due to the application of said metal in the molten state without injury to the material of said pipe end.

2. Means as claimed in claim 1, there being between the inner surface of said outer sleeve and the adjacent outer surface of the portion of said inner sleeve covered thereby a clearance space of such size as to induce said metal in the molten state to flow by capillary action thereinto.

3. A pipe joint comprising a plurality of pipe ends in endwise abutting relationship, an individual reinforcing sleeve of metal or material of similar heat conducting characteristics fitted with a tightly gripping fit over the adjacent portion of each of said pipe ends and a common sleeve fitting over a portion of each of said individual sleeves, said common sleeve being secured to each of said individual sleeves by a ring-like seal of metal applied in the molten state, the location of each of said seals with respect to its underlying individual sleeve and the dimensions of said sleeve being so selected as to dissipate the heat due to the application of said metal in the molten state without injury to the material of said pipe ends.

4. A pipe joint comprising a pair of pipe ends in endwise abutting relationship, a reinforcing sleeve of metal or material of similar heat conducting characteristics fitted with a tightly gripping fit over the adjacent portion of each of said pipe ends, one of said sleeves having a portion of enlarged diameter fitting over and partially covering the other of said sleeves, said enlarged portion being secured to said other sleeve by a ring-like seal of metal applied in the molten state, the location of said seal and the dimensions of said other sleeve being so chosen as to dissipate the heat due to the application of said metal in the molten state without injury to the material of said pipe ends.

EVANDER W. SYLVESTER.