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REINFORCED PIPE JOINT

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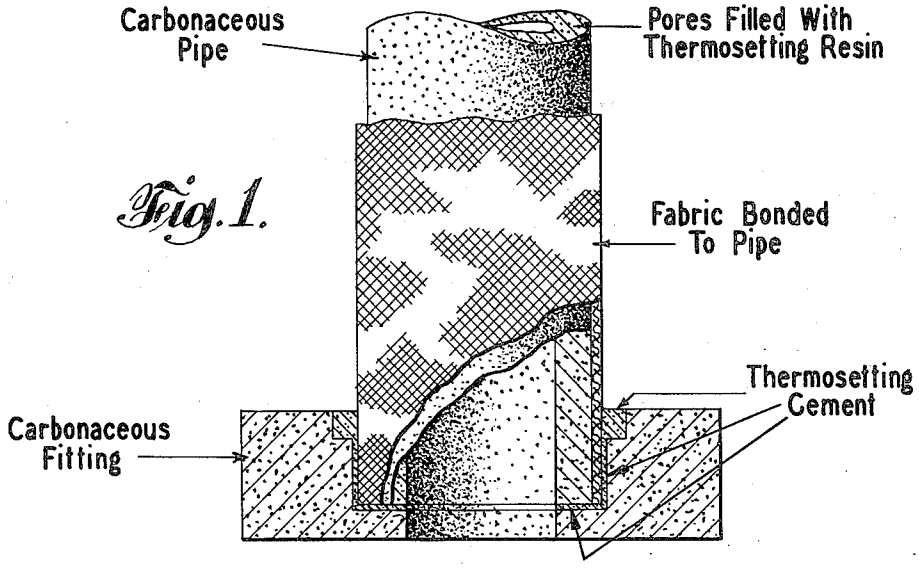


Fig. 1.

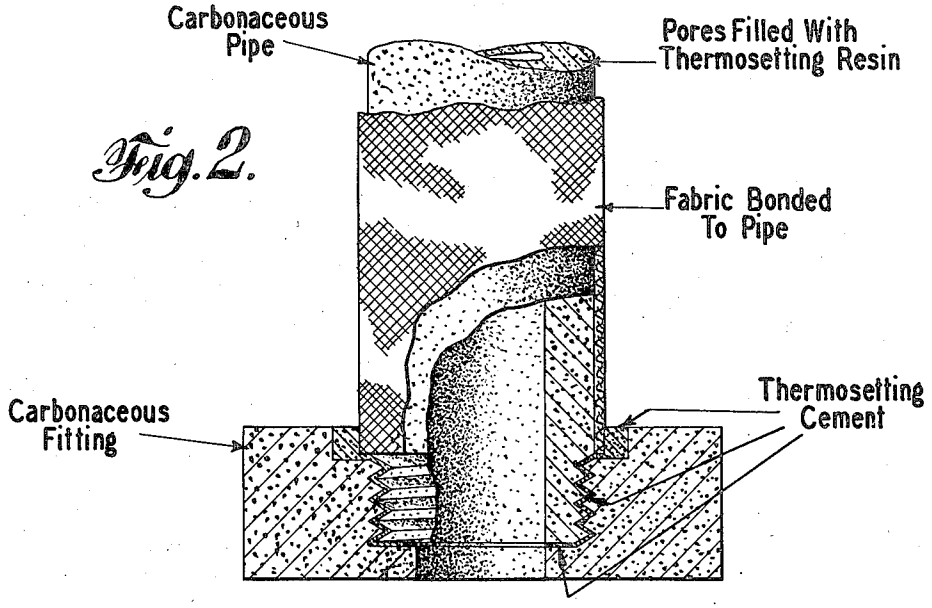


Fig. 2.

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REINFORCED PIPE JOINT

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9 Claims. (Cl. 138—76)

This invention relates to a high strength connection between carbonaceous articles. More particularly, this invention relates to reinforced assemblies of fabric-bonded, resin-impregnated carbonaceous pipe and resin-impregnated carbonaceous fixtures.

Fragile pipe or tubing such as carbonaceous piping of the amorphous or crystalline carbon type, is known in industries where advantage may be taken of its properties of heat resistance and corrosion resistance. However, these advantageous properties are accompanied by two disadvantageous properties, fluid perviousness and low mechanical strength, that necessarily restrict the application and use of such pipe. Of these two disadvantageous properties, the fluid perviousness has been overcome by introducing resins into the pores of the pipe and converting such resins into solids, as is known in the art. But, in the present status of the art, there still remains the low mechanical strength, for although the mechanical strength is somewhat improved by such resin treatment, the resulting product is brittle and susceptible to shattering from a shock or blow. This inherent fragility presents a problem thus far unsatisfactorily solved.

Further, this inherent fragility manifests itself particularly at the joints between the pipe and fixtures such as flanges, elbows, etc. The normal practice is to join the pipe and fixture by means of threading and a cementing agent. The joints however are of unsatisfactory strength for it is well established in the theory of stress concentrations that irregularities in a loaded member such as holes, notches, grooves, etc., are points of localized stress at which the stresses are considerably greater than the average stresses. While these particular stresses are undesirable in stronger materials, they become critical in brittle carbonaceous products. In the example set forth above, the critical area is the base thread. In the assemblies of the invention, the ultimate strength advantage is gained from the high tensile strength of the bonded fabric covering.

In our copending application, Serial No. 410,930 filed February 17, 1954, and assigned to the assignee of this invention, we have described and claimed an article, and the method of its fabrication, comprising, in combination, a carbonaceous pipe, a closely fitting fibrous sleeving, and an infusible bonding resin, or resins, the article having fluid impreviousness and high mechanical strength.

It is an object of this invention to provide assemblies between resin-impregnated, fabric-bonded, carbonaceous pipe and resin-impregnated carbonaceous fixtures, said assemblies being fluid-impervious and of high mechanical strength.

The invention by means of which these objects are achieved comprises, in combination, assemblies of fabric-bonded, resin-impregnated carbonaceous pipe fitted into a resin-impregnated carbonaceous flange, and a cementing agent. The assemblies may be constructed without the use of threads, the flange being counterbored to receive the pipe, in which construction the fabric bonding extends to the bottom of the counterbore; alternatively

the assembly may be constructed with the pipe and flange threadably joined, in which case the fabric bonding extends into the counterbore only to the depth where the threaded portion begins.

In the accompanying drawing:

Fig. 1 is a partially cut-away, vertical section of an assembly embodying the invention.

Fig. 2 is a partially cut-away, vertical section of another embodiment of an assembly according to the invention.

With reference to the drawing, the assemblies of the invention comprise, as shown in Fig. 1, one embodiment of the invention, a fabric-bonded, resin-impregnated carbonaceous pipe fitted into a counterbored, resin-impregnated carbonaceous flange, the fabric bonding extending to the bottom of the counterbore, the assembly being held together with an infusible, resinous, carbonaceous cementing agent, said cementing agent being present at all mating surfaces; an annular space may be provided at the upper end of said flange, providing a reservoir for said cementing agent. Another embodiment of an assembly according to the invention, as shown in Fig. 2, comprises a fabric-bonded, resin-impregnated carbonaceous pipe threadably fitted into a counterbored, resin-impregnated carbonaceous flange, the fabric bonding extending into the counterbore to the depth where the threaded portion begins, all mating surfaces being held together with an infusible, resinous, carbonaceous cementing agent; an annular space may be provided at the upper end of said flange, providing a reservoir for said cementing agent.

A preferred method of making assemblies of fabric-bonded, resin-impregnated carbonaceous pipe and resin-impregnated fittings such as flanges according to the invention, is set forth as follows:

A length of resin-impregnated, carbonaceous pipe is threaded into a threaded, counterbored resin-impregnated carbonaceous flange, the threaded areas of each being first painted with a wetting agent, for example, furfuryl alcohol, and then coated with a cementing agent containing a synthetic resin capable of being converted to an infusible solid. A cementing agent that has given satisfactory results has the composition, by weight: 100 parts thermosetting, phenol-formaldehyde resin and 30 parts coke flour. A section of woven, fibrous glass sleeving is slipped over the pipe and brought down approximately even with the base thread of the pipe, the sleeving being held in place at either end of the pipe by means of hose clamps. A cement head is then laid in the flange counterbore, after which the lower hose clamp is removed. The sleeving-encased pipe is then brushed until saturated with a thermosetting resin washcoat. A coating that has given satisfactory results has the composition, by weight: 100 parts thermosetting, phenol-formaldehyde resin, 1 part lampblack, and acetone sufficient to form a thin brushing solution. The assembly is aged for about 4 hours at room temperature, then cured for about 12 hours at about 80° C., the heat being provided by infrared lamps.

An alternate method that has given satisfactory results comprises the same steps as set forth above except that the pipe and flange are not threaded. In this alternate method the sleeving extends down the full length of the pipe to the bottom of the counterbore.

The resin-impregnated, carbonaceous pipe and the resin-impregnated carbonaceous flange used in the assemblies of the invention may be any of the commercially available resin-impregnated carbonaceous pipe and flanges.

It should be noted that preferably the fibers of the sleeving are at about 45° angles with reference to the longitudinal axis of the pipe.

It is to be noted that the present invention is not confined to the use of glass sleeving nor of phenol-formal-

dehyde resins. Sleeving of forms other than woven and of mateials other than glass may be used, as may any resin capable of binding the sleeving to the carbonaceous pipe. Other materials will readily be suggested to those skilled in the art, all coming within the scope of the invention.

Demonstrating the success of the invention, when cantilever loads are applied to 2 inch (1½ inches inside diameter) resin-impregnated carbonaceous pipe, having the conventional threaded, cemented connection, typical failures occur at loads from 200–500 pounds applied 6 inches from the joint. Joints of the invention, threadably assembled, raised the breaking load up to 700 pounds, an increase of 50%. When the fitting is assembled without the use of threads, the fitting did not fail at loads of 1200 pounds. As an added demonstration, the fittings were repeatedly dropped to a cement surface from a height of twenty feet without developing fractures. Final breakage was achieved only when the fittings were fixed in a vise and struck repeatedly with a hammer, the fracture then occurring only at the point of impact.

From the above description it will be seen that high strength characteristics may be imparted to a carbonaceous fitting comprising a carbonaceous pipe and a carbonaceous flange, which under ordinary circumstances would be readily subsject to fracture. This is accomplished by bonding a fabric covering to the pipe and inserting the pipe end into the flange. The flange and pipe are loosely fitting, and may or may not be provided with loosely engageable thread parts. A cementitious material is then introduced into the clearance space between the pipe and the flange to hold them in assembled relation.

It is to be understood that the term "carbonaceous" or "carbon" as used in this specification is intended to include graphite as well as amorphous carbon.

What is claimed is:

1. An assembly for carbonaceous pipe comprising, in combination, a fabric-bonded, resin-impregnated, carbonaceous pipe; a resin-impregnated carbonaceous flange member having opposite faces and a stepped-diameter boring having a relatively large diameter section and a relatively small diameter section axially aligned therewith, said relatively small diameter section passing through said flange member, said relatively large diameter section adapted to receive said carbonaceous pipe in a relatively loose fitting thereby providing a small annular space between said carbonaceous pipe and the internal surface of said large diameter section of said boring; and an infusible, resinous cementing agent in said annular space to firmly hold said carbonaceous pipe therein.

2. An assembly for carbonaceous pipe comprising, in combination, a fabric-bonded, resin-impregnated carbonaceous pipe; a resin-impregnated carbonaceous flange member having opposite faces and a stepped-diameter boring having a relatively large diameter section and a relatively small diameter section axially aligned therewith, said relatively small diameter section passing through said flange member, said relatively small diameter section and said pipe being correspondingly threaded to interfit loosely and define therebetween a clearance space, and an infusible, resinous cementing agent in said space to firmly hold said pipe and flange in fixed relation.

3. An assembly for carbonaceous pipe comprising, in combination, a fabric-bonded, resin-impregnated, carbonaceous pipe; a resin-impregnated carbonaceous flange member having opposite faces and a stepped-diameter boring having a relatively large diameter section, a relatively smaller diameter section and a relatively small diameter section, said relatively small diameter section passing through said flange member, said relatively smaller section adapted to receive said carbonaceous pipe in a relatively loose fitting thereby providing a small annular space between said carbonaceous pipe and the internal surface of said smaller diameter section of said boring, said relatively large diameter section forming an annular trough between said carbonaceous pipe and the internal surface of said large diameter section of said boring; and a carbonaceous cementing agent in said annular space and in said annular trough.

4. An assembly for carbonaceous pipe comprising, in combination, a fabric-bonded resin-impregnated, carbonaceous pipe; a resin-impregnated carbonaceous flange member having opposite faces and a stepped-diameter boring having a relatively large diameter section, a relatively smaller diameter section and a relatively small diameter section, said relatively small diameter section passing through said flange member, said relatively smaller section and said pipe being correspondingly threaded to interfit loosely and define therebetween a clearance space, said relatively large diameter section forming an annular trough between said carbonaceous pipe and the internal surface of said large diameter section of said boring; and an infusible, resinous cementing agent in said space and in said annular trough.

5. A heat resistant, corrosion resistant fitting having relatively high strength characteristics, said fitting comprising a carbonaceous tube, a carbonaceous flange loosely receivable on said tube and defining a clearance space therebetween, a fabric sheath disposed around said tube in fixed and adjacent relation thereto, said sheath having a portion thereof extending into said clearance space, and a cementitious material filling said clearance space and being in contact with portions of said tube, sheath and flange, thereby holding said fitting in assembled relation.

6. In the fitting of claim 5, the portion of said tube in contact with said cementitious material and the cement-contacting portion of said flange having complementarily formed threads.

7. In the fitting of claim 5, said tube and sheath terminating flush with each other and in spaced relation to said flange.

8. In the fitting of claim 6, the threaded portion of said tube extending beyond said sheath portion.

9. A high strength fitting comprising a tube of normally fragile material, a flange of normally fragile material loosely receivable on said tube and defining a clearance space therebetween, a fabric sheath disposed around said tube in fixed and adjacent relation thereto, said sheath having a portion thereof extending into said clearance space, and a cementitious material filling said clearance space and being in contact with portions of said tube, sheath and flange, thereby holding said fitting in assembled relation.

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