No. 713,559. Patented Nov. 11, 1902.

L. P. DODGE.

GAS TUBING.

(Application filed Dec. 26, 1901.)

(No Model.)

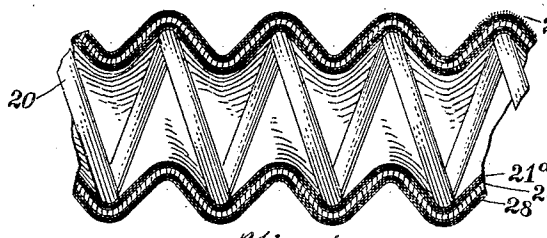


Fig. 1.

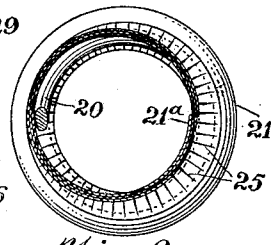


Fig. 2.

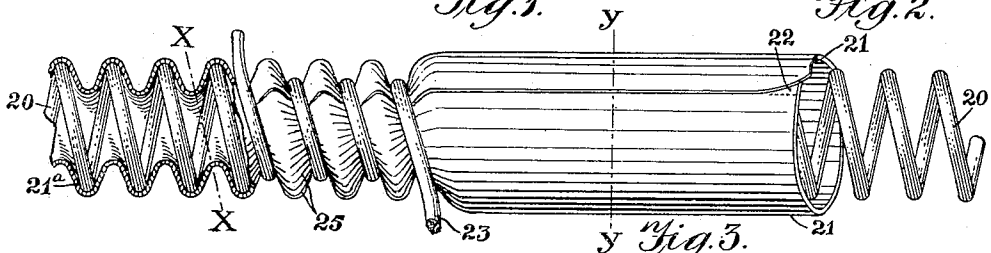


Fig. 3.

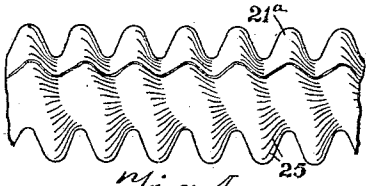


Fig. 4.

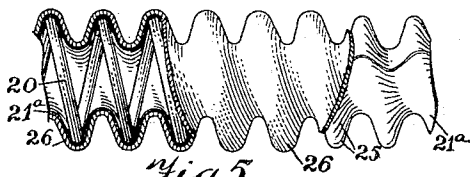


Fig. 5.

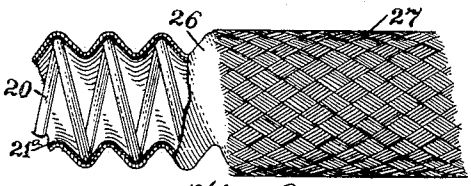


Fig. 6.

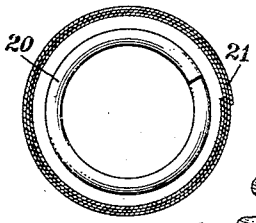


Fig. 7.

Fig. 8.

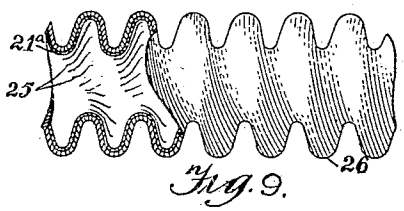


Fig. 9.

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UNITED STATES PATENT OFFICE.

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GAS-TUBING.

SPECIFICATION forming part of Letters Patent No. 713,559, dated November 11, 1902.

Application filed December 26, 1901. Serial No. 87,298. (No model.)

To all whom it may concern:

Be it known that I, LEMUEL P. DODGE, a citizen of the United States, residing in New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Gas-Tubing, of which the following is a specification.

This invention relates chiefly to that class of tubing which is used for conducting gas.

Heretofore gas-tubing has been formed by braiding, knitting, or weaving a sheath over a wire helix, so as to form a body, then coating said body with an impervious composition consisting chiefly of glue and glycerin, and finally braiding, knitting, or weaving an outer protecting sheath over the whole. The necessity of passing the tubing through two independent braiding operations involves considerable expense for labor, not to mention the large amount of capital which must be invested in braiding-machines. The expense of the material used in braiding is also considerable. It is the practice to form the inner sheath of a close or compact, and hence very expensive, braiding, so as to prevent the impervious coating, which is applied thereto in the form of a thin liquid, from soaking through and being wasted and perhaps clogging the interior of the tubing. Moreover, when the tube is flexed in use impervious coating becomes strained and gradually sets, making the bend permanent, so that the tube resists being restored to a straight condition. In bending the tube there is a tendency to produce cracks in the impervious coating, permitting the escape of gas, which is particularly noticeable after the tubing has been for some time in a bent condition. The usefulness of the tubing is further restricted because it is not adapted for elongation or contraction, as is desired in some instances.

The objects of my invention are to simplify the structure and the process of manufacturing gas-tubing, so as both to enable a small amount of machinery to yield a large product and also to reduce the cost of labor and material. I further aim to produce tubing having increased flexibility and also less liability to acquire a permanent set when maintained in a bent or cramped condition and, moreover, capable of elongation and contraction.

While certain novel features disclosed herein are shown as applied to the structure and process of producing gas-tubing, still these features are in nowise limited to such use, and it is my intention to cover them in whatever way or to whatever purposes they may be applied.

In the accompanying drawings, Figure 1 is a longitudinal section of a fragment of one form of gas-tubing made according to my invention. Fig. 2 is a transverse section taken on the line $x\ x$ of Fig. 3. Fig. 3 shows one method of crimping paper or papery material upon a helical wire form, so as to produce a rugose or plaited tube. Fig. 4 gives the appearance of a fragment of tubing after the operation shown at Fig. 3 is completed. Fig. 5 shows a thin coating or layer of an impervious mixture or proofing material applied to the Fig. 4 product. Fig. 6 shows the Fig. 5 product covered by a braided fabric sheath and forming a complete gas-conduit in its preferred form. Fig. 7 is a cross-section taken at the line $y\ y$ of Fig. 3. Fig. 8 shows how the product illustrated at Fig. 5 readily lends itself to flexure, and Fig. 9 shows the Fig. 5 product minus the form.

In the several views similar parts are designated by similar numerals of reference.

In the preferred mode of practicing my invention I employ a helical wire form 20, over or upon which I place or roll a tubing 21, preferably of manila rope paper. This is preferably wrapped in several plies, three plies being shown in this instance. The plies may be loosely wrapped, and the outer edge may be coated with glue, as indicated at 22, or otherwise. This paper tube is loose upon the helix 20, its internal diameter being by preference materially in excess of that of the helix, as clearly seen. By suitable means I tuck or crimp the material of the tube 21 between the whirls or ribs of the form 20. If said tube is of manila paper, I find it advantageous first to dampen or moisten the same, so as to render it limp or plastic, thereby enabling it to crimp with facility and

without injury and also causing it to acquire a permanent set in its crimped form. One way of crimping the material is illustrated at Fig. 3, in which it will be seen that a cord 23 may be wound over the tube with sufficient tightness to sink or crowd the material between the ribs of the form, the winding of the cord following the helical interval between the ribs or whirls. Widely variant methods of crimping or corrugating the tube may be resorted to within the scope of my invention, and it is not essential in all cases that the crimps be of the kind herein illustrated. The object in making the tube 21 of extra diameter is to furnish material for the depressed portions or flutes 24 of the corrugations or, in other words, to enable said flutes to be formed without danger of tearing the paper. As the forming of the conduit progresses the material of the tube 21 is used up in longitudinal direction, so that it is necessary for the original length thereof to be greater than that of the finished conduit. The paper when being tucked into the crevices between the wires is also caused to shir or wrinkle, as at 25. The conduit or tubing thus formed and illustrated at Fig. 4 may be used for a variety of purposes and possesses many valuable qualities, being highly flexible, capable of elongation or contraction, strong, durable, and simple, and, moreover, it may be constructed of inexpensive material in a simple manner and with great expedition and at low labor cost.

In the production of gas-tubing I preferably treat the Fig. 4 product with a coating 26 of material impervious to gas, such as a compound of glue or glycerin. Preferably the material is applied with substantially even thickness over the plaits of the tubing, as clearly seen at Fig. 5, so that the Fig. 5 product resembles the Fig. 4 product, except that the fine wrinkles or shirs 25 are somewhat filled up or evened by the material 26, which may be applied thereto in a heated-liquid form and then allowed to dry or cool and harden. The paper, it will be understood, forms a backing or body which is both inexpensive and also well adapted for receiving and protecting from injury the gas-proof material 26. Moreover, the tubing thus formed, owing to the corrugated or rugose formation of the gas-proof material, is rendered far more flexible than heretofore and may be also drawn out or compressed endwise without injury. Owing to this formation neither the gas-proof coating nor the paper is liable to take a permanent set when maintained for a long time in a flexed condition, thereby overcoming or at least minimizing a common fault in gas-tubing. My tubing is therefore more durable and superior than prior tubing and is also adapted for use in a variety of ways not hitherto found practicable. I prefer to use manila rope paper for the tubing, since it absorbs little or none of the proofing material. In fact, the paper itself is almost impervious to gas, and hence only a thin wash of proofing material is required. The proofing may be otherwise applied than as a coating upon the Fig. 4 product.

Fig. 8 illustrates the facility with which the Fig. 5 product may be flexed, the plaits at the outer portion of the bend separating, as at A, and those at the inner portion of the bend crowding together, as at B, this result being effected without appreciable tendency to injure either the paper or the proofing and without rendering either of them liable to acquire a permanent set.

Over the Fig. 5 product I preferably braid a sheath of fabric 27, Fig. 6, thus forming a complete gas-conduit which is serviceable, strong, phenomenally durable, highly flexible, and capable of lengthening and contraction within limits and which can be produced at greatly-reduced cost and in quicker time and by a less-expensive plant than tubing as heretofore constructed.

At Fig. 1 I show the proofed tubing sheathed with an outer plaited or crimped tube 28, which may be formed in like manner with the inner tube 21^a, thus protecting the proofed material from abrasion or other injury and forming an inexpensive and serviceable gas-conduit. Its outer surface may be finished by the application of flocks, as at 29, or otherwise, or if a tube of extra strength and capability of withstanding every rough usage is desired said sheath 28 may be itself covered by a braided or other textile sheath, such as illustrated at 27, Fig. 6. At Fig. 1 it will be observed that the pitch of the helix thread or wire is greater than at the other figures, and in practice my tubing may be made upon helices of greater pitch than heretofore employed in this class of tubing, since the crimping of the paper lends strength to the tubing, and hence such a close order of ribs is not required, whereby the cost of the forms may be materially reduced.

It will be perceived that one important feature of my invention consists in the corrugated flexible paper tubing 21^a, preferably backed up with a wire form, although the latter is not essential in all cases, in making either gas-tubing or other articles where great strength is not required for resisting collapse.

Having described my invention, I claim—

1. A corrugated or serrated fabric limber conduit having a wear-resisting distinct sheath.

2. A plaited manila-rope-paper conduit having a braided sheath.

3. A multiple-ply crimped paper limber tube provided with an uncrimped cylindrical sheath.

4. A tubular helically-plaited paper limber conduit having a distinct sheath.

5. A tubular helically-plaited multiple-ply limber conduit provided with a cylindrical textile sheath.

6. A corrugated or serrated fabric limber conduit having an extensible sheath.

7. A limber conduit comprising a succession of metal ribs, a paper tube deeply crimped between the ribs, and a textile sheath.

8. A limber conduit comprising a glued, crimped multiple-ply paper tube reinforced by a series of ribs and provided with a distinct limber sheath.

9. A conduit comprising a helix and a tube one within the other, said tube being formed of paper and crimped between the ribs or whirls of the helix, and a textile sheath.

10. A conduit comprising a helix within a crimped paper tube and a limber sheath upon said tube.

11. A conduit comprising a helix within a multiple-ply roll or tube of paper which is crimped between the whirls of the helix, and a textile extensible sheath upon said tube.

12. A crimped proofed limber paper conduit provided with a distinct sheath.

13. A glued, proofed, plaited, sheathed limber paper tube.

14. A limber conduit comprising a multiple-ply manila-rope-paper tube deeply crimped and shirred in the form of helical plaiting and having an outer coating of impermeable material incased in textile fabric.

15. A conduit comprising a succession of metal ribs, a proofed-paper tube which is crimped between said ribs, and a textile sheath.

16. A limber conduit comprising a glued, plaited multiple-ply proofed-paper tube reinforced by a series of ribs and a textile sheath.

17. A conduit comprising a helix and a tube one within the other, said tube being formed of proofed paper crimped between the ribs or whirls of the helix and provided with a textile sheath.

18. A conduit comprising a wire helix within a tube of multiple-ply manila-rope paper which is crimped between the whirls of the helix and is provided with a coating of proofing material and a textile sheath.

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