

No. 642,537.

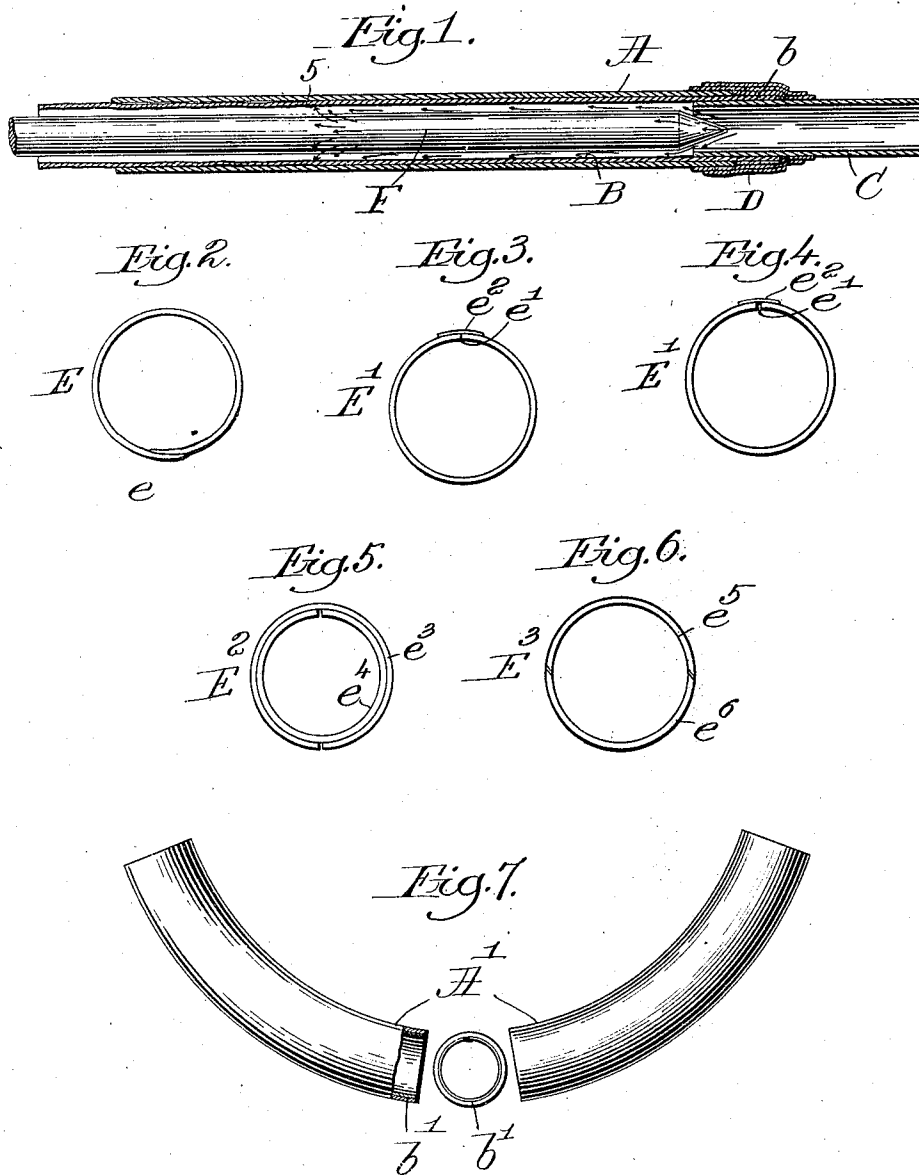
Patented Jan. 30, 1900.

A. THOMA.

METHOD OF APPLYING LINING MATERIAL TO CONDUITS, PIPES, OR THE LIKE.

(Application filed Nov. 30, 1898.)

(No Model.)



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UNITED STATES PATENT OFFICE.

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METHOD OF APPLYING LINING MATERIAL TO CONDUITS, PIPES, OR THE LIKE.

SPECIFICATION forming part of Letters Patent No. 642,537, dated January 30, 1900.

Application filed November 30, 1898. Serial No. 697,833. (No model.)

To all whom it may concern:

Be it known that I, ANDREW THOMA, of Cambridge, county of Middlesex, State of Massachusetts, have invented an Improvement in
5 Methods of Applying Lining Material to Conduits, Pipe, or the Like, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

10 In the installation of electric wires and for many other purposes it is necessary to utilize a conduit or pipe which shall possess insulating properties to a high degree, shall resist chemical and mechanical injury, shall be indestructible by a considerable degree of heat
15 or moisture, and which shall be capable of flexure without injury and without deterioration with respect to any of the properties set forth, an especial requisite being freedom
20 from liability to injury *in situ* or by careless manipulation in the course of installation. In such conduit the inner diameter must be as large as possible consistent with proper provision for insuring the various properties noted
25 and must be simple in construction and inexpensive.

Various conduits have been placed upon the market from time to time, but none of these embody the properties essential to a satisfactory conduit, and in order that my invention may be readily understood and its value appreciated I will indicate briefly some of the particulars in which prior conduits have been found wanting.

35 Various linings or inner tubes have been utilized to give properties of insulation and moistureproofing to the conduits, and much effort has been expended in the attempt to adapt paper to this purpose, but without complete
40 satisfaction, for the especial reason, among others, that the paper is lacking in the requisite degree of strength and almost completely wanting in flexibility. In fact, rigid tubes, whether of paper, wood, or other fibrous material, are open universally to this objection
45 and to the additional objection that it is difficult to unite them properly to the armor-tube, which in commerce is rarely of uniform diameter interiorly, so that at various regions
50 the walls of the armor and insulating mem-

bers are liable to be separated, with a consequent liability to injury in various ways, as will be readily understood by those skilled in the art. Furthermore, inner tubes, whether united directly to the armor or whether an intervening binding agent of considerable
55 thickness is employed, diminish the inner diameter of the conduit to an undesirable extent. To avoid this diminution and still provide for suitable adherence to the armor-tube, 60 linings of oil-cloth and other fabrics have been employed, and to a certain extent a tube of larger working diameter has been obtained; but even with these the tube is still bulky
65 in many instances, and a fabric whenever used exhibits a constant tendency to pull away from the walls of the armor-tube, provided the fabric is strong enough to retain its integrity under the bending strain; but
70 very frequently the temperature applied in securing adherence of an oil-cloth or similar lining and the very nature of the materials renders the fabric liable to a great weakening, so that its rupture ensues upon flexure
75 of the conduit. The evil effects and possibilities of such displacement or rupture of the inner member of the conduit are too well known to require setting forth in detail.

The assemblage of the lining or inner insulating-tube with the armor has been attended likewise with great dissatisfaction, owing to the expensive and elaborate methods employed and their unsatisfactory results—
80 notably in the instance of the linings, to which reference has been made, which while 85 more effectively joined to the armor-tube than were the inner tubes have been introduced only with great labor and the use of complicated expanding-tools or other elaborate devices.

90 The great difficulty encountered in producing successful conduits of the type noted above and their prohibitory expense, whether satisfactory or not, has favored the introduction to a considerable extent of pipes without
95 inner tubes or linings other than a coating of japan applied to the walls—an expedient which leaves a maximum diameter and reduces the bulk of the pipe, but utterly fails to meet the moisture, insulation, and other 100

tests to which the best conduits should be and are subjected, leaves also much to be desired in point of flexibility, and which is unequal to the demands of permanence and resistance to rough handling and manipulation in installation.

In general conduits at present on the market, if they are sufficiently flexible, lack proper capability of resistance to mechanical and chemical injury, while those possessing due resistance in the latter respects are not capable of flexure without injury.

Accordingly my invention is directed to the production of a conduit possessing in a high degree the properties which I have set forth as desirable, and the conduit or pipe and the novel method of its production, which I shall describe fully hereinafter, I do not limit to use as a conduit for electric conductors, but contemplate its utilization in any field for which it may be adapted by the improvements constituting my invention.

In accordance with my invention I provide an armor tube, pipe, or conduit of any suitable material and construction, preferably metal gas-pipe of commerce, with a lining preferably of or containing rubber, free from fabric, and in intimate union with the inner walls of the armor throughout the extent of the pipe, suitable provision being made for its permanent adherence thereto.

My novel method of applying the lining to the inner walls of the conduit has for its principal feature the use of a blast of air, live steam, or other suitable fluid under high pressure, which is directed into the tube after insertion of the lining and preferably with the blast substantially unconfined, the effect being that instead of setting up a pressure or tension uniform throughout the conduit a wave of pressure is set up which travels through the conduit, acting upon the lining progressively and crowding the latter against the inner walls of the conduit in such a manner that air-bubbles will be eliminated from between the lining and the inner wall of the conduit.

While my novel method is particularly adapted to the application of a lining of high flexibility and one which will retain its integrity under binding strain after its permanent assemblage with the armor, nevertheless it will be obvious that the method is capable of wider utilization, and such is contemplated by me.

The various features of my invention will be fully illustrated and described in the accompanying drawings and specification and set forth in the claims.

In the drawings, Figure 1 illustrates one means of carrying my improved method into effect. Figs. 2, 3, 4, 5, and 6 show different arrangements of linings at different steps in the process of application to the armor-tube; and Fig. 7 illustrates a portion of completed conduit manufactured in accordance with my method and thereafter bent cold in the form

of an elbow and cut through, the close adherence of the lining being illustrated at the cut portion.

In carrying my improved method into effect I introduce by any suitable means in any suitable manner the lining material within the armor-tube and then direct into the pipe or conduit a blast of such volume and under such pressure that it sets up a wave which is permitted free passage through the tube within the lining material and in its progress acts upon the lining, forcing each successive portion of the latter outward into contact with the inner walls of the armor-tube. By referring to Fig. 1 this operation will be understood readily. In Fig. 1 a suitable armor-tube, in this instance of gas-pipe, is designated by the reference-letter A. B designates a suitable lining—say of rubber—while the blast of air (indicated by arrows) is shown as directed within the lining by a nozzle or tube C, which merely forms one convenient means of introducing the blast and may be replaced by any other convenient and suitable device.

In Fig. 1 the material of the lining is shown as carried at b for a short distance over the tube C, a wrapping D serving as connecting means to hold the tubes and lining in place during the operation of applying the lining. F designates a mandrel-like member which may be used as one form of means to deflect the blast or aid in its effective application to the lining material if such means be found desirable. The crest of the wave and its effect upon the lining are indicated clearly at 5 in Fig. 1.

Referring to Figs. 2, 3, 4, 5, and 6, I have shown therein various convenient forms in which the lining material may be arranged before its introduction within the armor-tube, although I do not limit myself to any one of these, nor, in fact, to any particular forms or form so long as the lining material after its introduction will yield readily to the action of the blast and be capable of dilation into intimate contact with each portion of the walls of the armor-tube.

Fig. 2 illustrates in end elevation a ply of lining material in cylindrical form with a longitudinal lap-joint at e, which may be absolutely free, but preferably will be provided with a small portion of adhesive substance to cause temporary retention of the material in cylindrical form for convenience in introduction. The lining must be free in accordance with my invention to dilate against the walls of the armor-tube, and when the lips of the seam are caused to adhere in the manner stated if the material of the lining be not sufficiently elastic to permit distention the adhesive material should be of such a character as to permit the seam to start when properly treated. In fact, however the temporary adherence of the edges of the seam may be accomplished, and it may be accomplished in any suitable way without departing from the spirit of my invention, suitable provision

should be made for starting the seam in the absence of a lining material of distensible properties. In Fig. 3 a similar ply of material E' is formed with a butt-seam e', and a suitable closure for the seam may be provided, an additional ply e² serving such a function in the form illustrated in Figs. 3 and 4, in the latter of which the lining is shown after the seam has been started.

In some instances it may be desirable to use two plies, and these may be arranged as shown in Fig. 5, where the joints are broken and oppositely situated with respect to the diameter of the conduit, or the relation and number of the plies may be altered to suit convenience and the requirements of diverse situations.

In Fig. 6 the lining is made up of semiplies, and to facilitate the formation of the seams the plies may be beveled, respectively, at their edges, and such beveling or chamfering of the lining material may be adopted with the forms I have already illustrated or in any form where it may be required or desirable.

The intimate nature of the union between the lining and its armor when the former is applied in accordance with my invention will be obvious not only to those skilled in the art, but to even the casual reader of this specification, from the very nature of the method disclosed, and as I am the first to secure such intimate union I claim, generically, in another application, Serial No. 720,360, filed June 13, 1899, an armored tube or conduit consisting of an armor-tube having a lining in intimate union with the inner walls of the tube at every point throughout their common surfaces whether an additional adhesion be secured by the use of adhesive substances in or upon the lining or not. Such adhesive substances may be used with profit at times, and as one example I will mention asphalt, which may be applied to the outer surface of the lining before its introduction or to the inner walls of the armor, likewise before introduction, or to both, and at any suitable stage.

When asphalt is used, the application of heat during the operation of introducing and dilating the lining will be found desirable, and, in fact, heat may be used to advantage almost at every step of my improved method, and a high degree of efficiency will be gained in the use of the blast by utilizing air in a heated condition or live dry steam or other suitable fluid at a high temperature.

I am aware of the patent to Tatham, No. 417,688, dated December 17, 1889, in which oil is introduced behind a traveling piston-head to expand a metal lining against a layer of insulating material interposed between the metal lining and an outer pipe or casing. Obviously, however, both the metal lining and insulating layer, the latter of a flexible nature, are necessary, the piston-head being of unchanging diameter, for the wear of the piston-head would destroy a less durable material than metal, and without a layer of flexi-

ble material intervening between the metal lining and outer pipe spaces would be left therebetween at intervals, as commercial pipe is extremely irregular in inside diameter. Furthermore, in the absence of the metal lining the action of the piston-head directly upon the insulating-layer would tend to strip it from the armor-tube, or if a relatively narrow head were used the resilient material would give before it without being forced into intimate contact with the armor-tube. Inasmuch, therefore, as my improved conduit is composed of the armor-tube and its lining merely, it will be seen that I have dispensed wholly with an element without which the Tatham conduit and method would fail—viz., the metal lining—accomplishing the production of a conduit presenting the desirable features of the Tatham conduit in a simpler and less expensive form and omitting the undesirable feature of an inner lining of conductive material.

I desire it understood that I do not limit myself to the use of gas-pipe and rubber as materials in the construction of my conduit, nor to the means illustrated for carrying my method into effect, nor in general otherwise than as set forth in the claims.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The improved step in methods of applying linings to the inner walls of pipes or conduits, which consists in directing into said lining, after its assemblage within said pipe, a blast to act progressively on said lining at successive points throughout its length and force it into intimate contact with the inner walls of said pipe at every point throughout the area of the adjacent surfaces of said lining and pipe.

2. The improved method of applying linings to the inner walls of pipes or conduits, which consists in directing into said lining, after its assemblage within said pipe, a blast of air, live dry steam, or the like, said blast being free to move axially along said conduit and set up a wave of pressure acting progressively and continuously against successive portions of said lining to force the latter outwardly into intimate contact with the inner walls of said pipe at every point throughout the adjacent surfaces of said lining and pipe.

3. A blank of lining material for armored conduits comprising a ply of lining material having its longitudinal edges united in a seam adapted to start during the operation of application to the inner walls of the armor.

4. The improved step in method of applying linings to and within armor-tubes, which consists first in inserting said lining within its said armor-tube and thereafter projecting through said inclosed lining a free blast to act expansively progressively upon and within said lining throughout.

5. The improved step in methods of apply-

ing linings to and within armor-tubes, which
consists first in inserting said lining within
its said armor-tube with a deflecting member
arranged axially within said lining, and there-
5 after projecting through said lining between
the latter and said deflecting member a free
blast to act expansively progressively upon
and within said lining throughout.

In testimony whereof I have signed my
name to this specification in the presence of 10
two-subscribing witnesses.

ANDREW THOMA.

Witnesses:

ALEXANDER C. PROUDFIT,
GEO. W. GREGORY.