E. JAMES.

METHOD OF AND APPARATUS FOR INTERIORLY COATING TUBES.

APPLICATION FILED JUNE 27, 1908.

938,489. **Patented Nov. 2, 1909.**

2 SHEETS—SHEET 1.

Fig. 1

Fig. 2

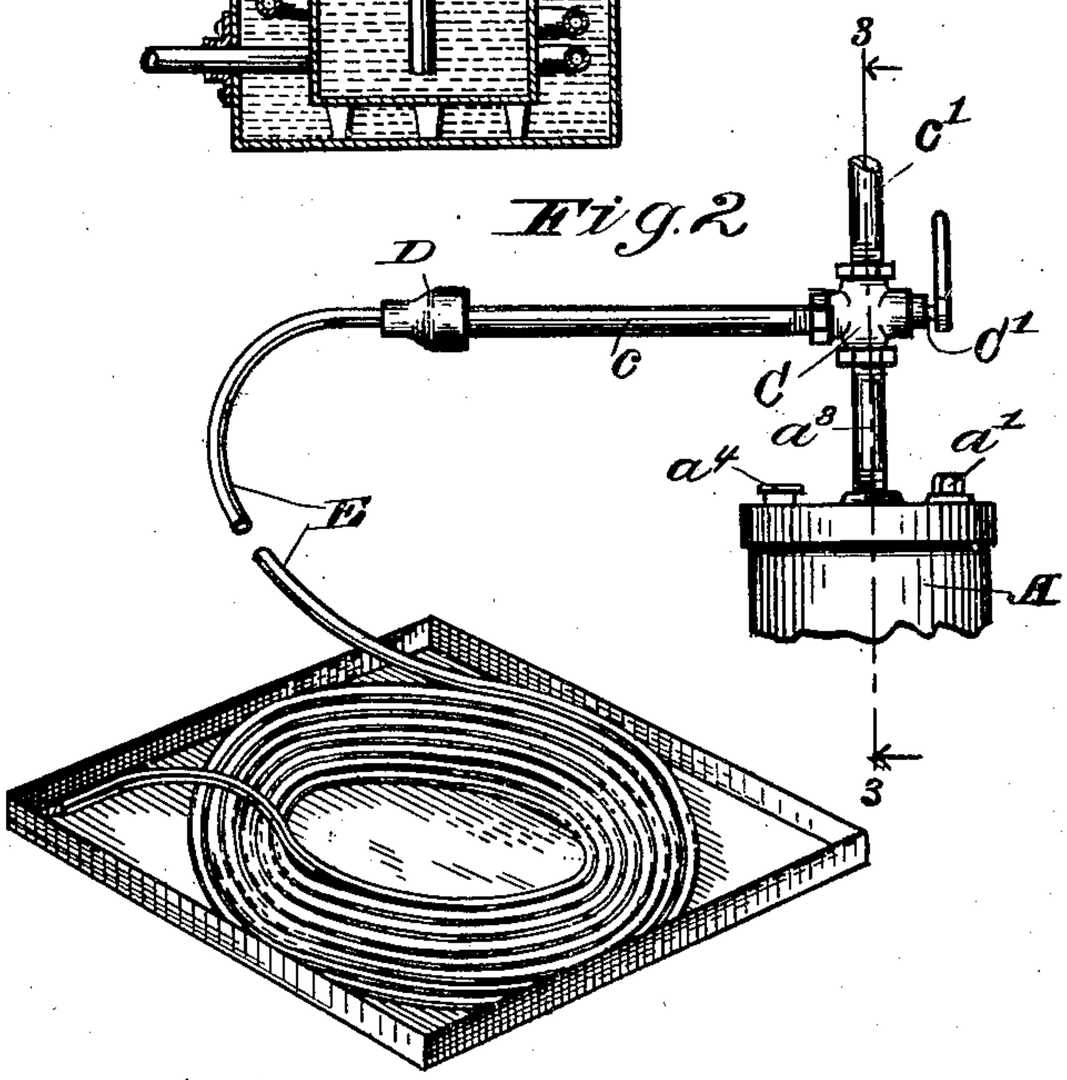
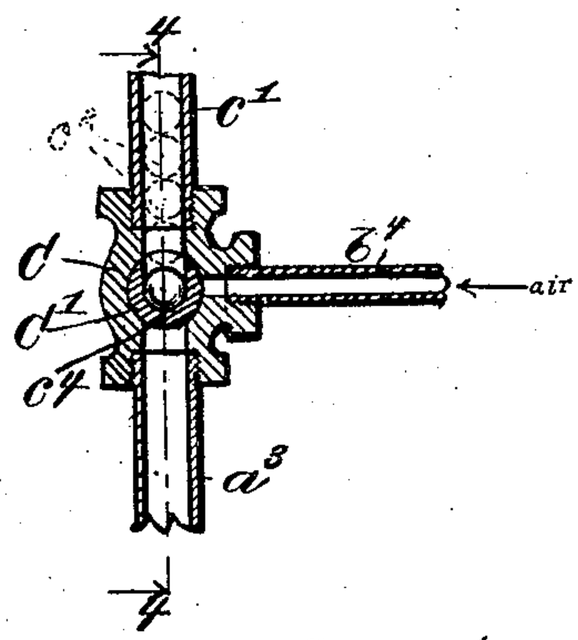


Fig. 3



Witnesses:

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Fig 5

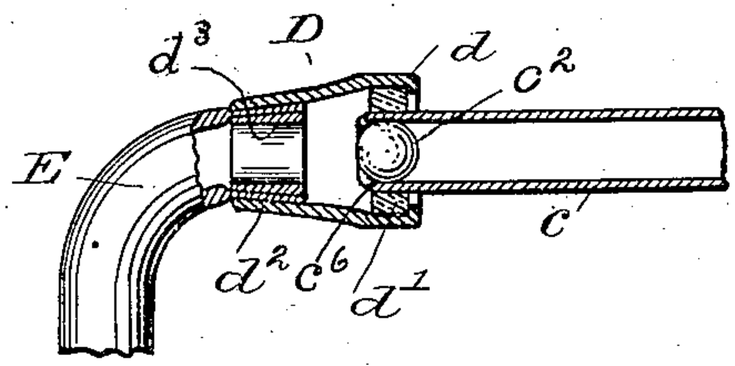

Fig. 4

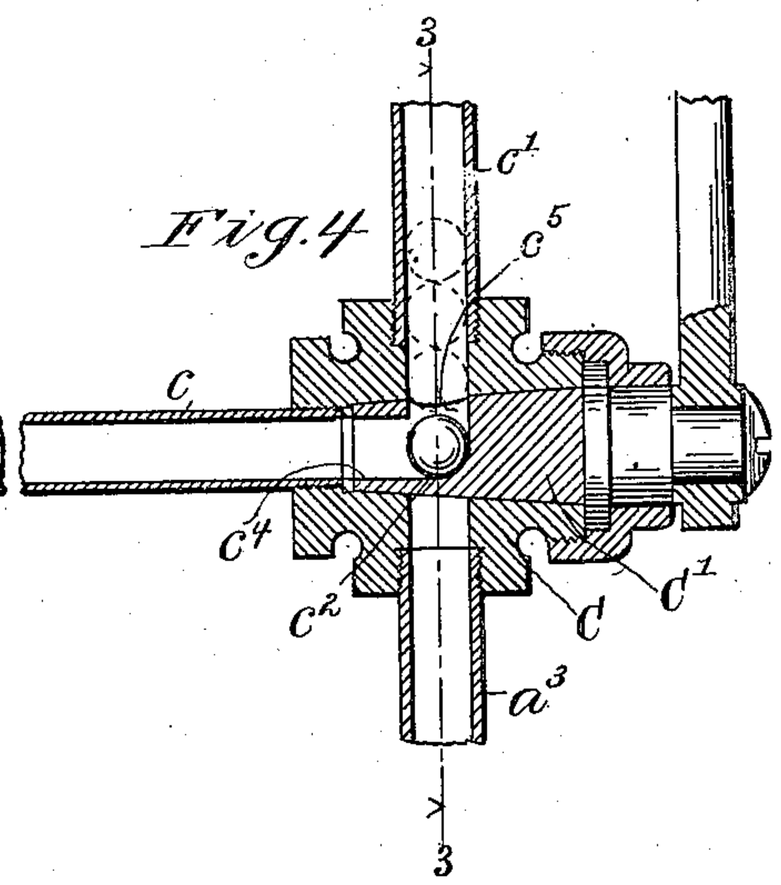

Fig. 7

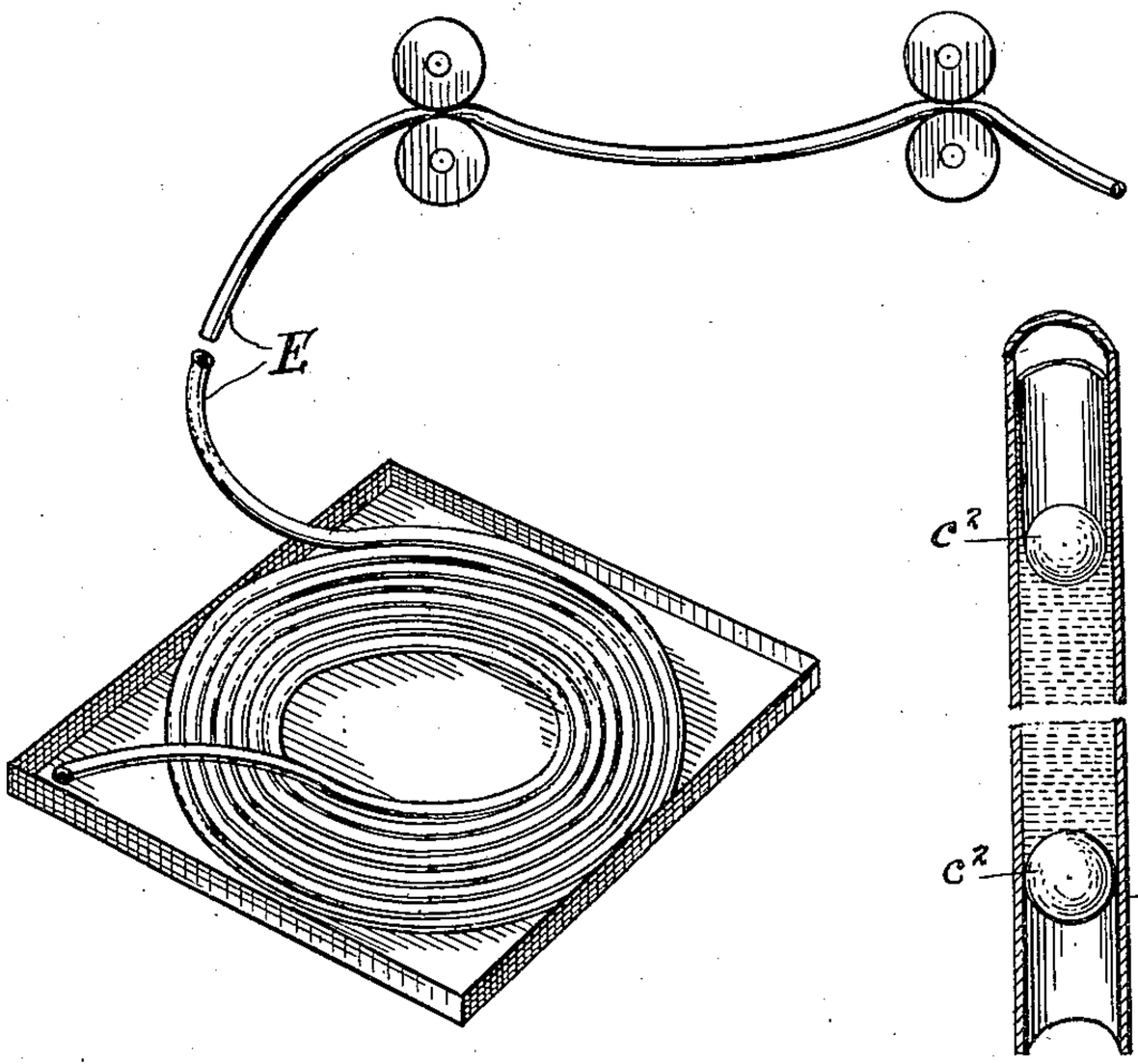

Fig 6

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METHOD OF AND APPARATUS FOR INTERIORLY COATING TUBES.

938,489. Specification of Letters Patent. Patented Nov. 2, 1909.

Application filed June 27, 1908. Serial No. 440,642.

To all whom it may concern:

Be it known that I, EDWARD JAMES, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Methods of and Apparatus for Interiorly Coating Tubes, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The present invention relates in general to the manufacture of flexible tubing for use in the conduction of illuminating or other gases, and has more particular regard to the coating or lining of such tubing with glue composition, or gelatin, or other like coating material in order to render the same impervious to the gas or its fluids. The desirability of thus coating or lining tubing for illuminating gas has long been appreciated; for even where the tubing is made of rubber the gas will escape through its pores, creating an objectionable odor, if not leading to more harmful results, unless such pores are closed in the manner indicated. This coating may be applied in various fashions; the tube may be interiorly lined with a coating of gelatin or the latter may be externally applied, or it may be included between two constituent layers of the body, proper, of the tubing. While tubes constructed in each of the three ways noted are known, the exteriorly coated, type of tube, with or without a further protective coating of fibrous or like material, alone has gone into extensive use, not for the reason that it affords the best construction, but because of the difficulty of interiorly applying the coating to tubes of the character in hand. As a matter of fact, so far as I am aware the only method available for the purpose has been to pour the glue or gelatin into the tube to be coated so as to fill it, and, after the tube has stood long enough to permit the formation of a film or coating of the desired thickness, the rest is poured out. Aside from the difficulty and tediousness of such a process, the further disadvantage, that of an unequal thickness of coating, may be cited against it.

The present invention has as its object the provision of a simple, efficient and rapid method of interiorly applying coatings, whether of the character in hand or other material, to tubes of various kinds, particularly the flexible tubes, usually of rubber, employed in the connection above remarked.

To the accomplishment of this object, said invention, then, consists of the steps and means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism and modes of operation exemplifying the invention, such disclosed means constituting, however, but several of the various mechanical forms and modes of operation in which the principle of the invention may be used.

In said annexed drawings: Figure 1 represents a side elevation, with parts in section, of one approved form of apparatus for carrying out my method of interiorly coating tubes; Fig. 2 is a part side elevation and perspective view of such apparatus; Fig. 3 is a transverse section of a valve forming one of the details of such apparatus; Fig. 4 is a section of the same detail at right angles to the plane of the section in Fig. 3; Fig. 5 is a sectional view, corresponding to Fig. 4, of another detail of the apparatus: Fig. 6 represents in more or less diagrammatic fashion, the method of coating exemplified in the foregoing apparatus; and Fig. 7 represents a modification of such apparatus and method.

Reference will be had first of all to the type of apparatus illustrated in Figs. 1 to 5 inclusive; afterward will follow a brief discussion of the method of operation exemplified therein. Such approved apparatus, then will be seen to comprise, Fig. 1, a chamber or receptacle A for the coating material, which in the case in hand will be gelatin, or of similar mucilaginous character. In order to preserve the same of proper fluid consistency I provide heating means in the form of an inclosing chamber A′ adapted to contain water and through which a steam coil *a* is passed in order to maintain such water at the proper temperature. Any other suitable heating means may be employed as found convenient. Chamber A is sealed, being provided with a suitable inlet opening, *a′* shown in Fig. 2, for admitting the coating composition, an air inlet a^2 by means of which suitable pressure may be maintained upon the surface of the body of liquid in the

chamber, and a liquid outlet, a^3 by means of which such liquid may be discharged from chamber A by the pressure aforesaid. In addition to the foregoing openings a fourth opening a^4, normally sealed by a safety plug in the form of a disk a^5, is provided so that should, at any time, the air pressure in the chamber reach an abnormal degree, such plug will be broken and blown out. The air pressure in question may be derived from any suitable source, as for example a pump, but is more conveniently secured from a compressed air tank B. As the pressure in such tank will ordinarily be considerably higher than that desired for present purposes, a reducing valve b is introduced in the line b' leading therefrom to the coating apparatus proper. This line b' is branched, and in the one branch b^2 which leads to the air inlet a^2 in the chamber containing the coating composition, a second reducing valve b^3 is introduced whereby a lower pressure is maintained in such chamber than is available through the other branch b^4 of the air line. Indicators b^5 are provided in connection with the respective reducing valves that the desired pressure may be maintained in lines b^2 b^4. Such other branch b^4 leads directly to a valve casing C that is interposed in the liquid discharge pipe a^3 leading from chamber A. The construction of this casing and of the valve C′ inclosed therein clearly appears in Figs. 3 and 4; the casing will thereby be seen to be provided, in addition with the liquid and air connections already referred to, with a horizontally disposed tube c forming a discharge passage therefrom, and with a vertically disposed tube c' designed to form a receptacle for plug members c^2 preferably spherical in form, the use of which will presently appear. These may be introduced at the top of such receptacle through a suitable lateral opening c^3 therein. The valve C′ within the valve casing C is of the plug type and is provided with a longitudinal opening c^4 at all times in register with the discharge passage C, and with a transverse opening c^5 adapted in one position to admit a ball C^2 from receptacle C′ to such passage, and in other positions to connect said passage with chamber A through tube a^3 or with the fluid pressure supply as desired. The outer end c^6 of the discharge tube c thus connected with valve casing C is flattened a trifle, or otherwise made of slightly reduced diameter whereby a ball or plug c^2, admitted in the manner described, will be retained against the reduced pressure applied thereagainst when the liquid is admitted through the valve to passage c, but will be released under the greater pressure when the air line is connected direct with such passage.

Since the tubing to be interiorly coated is, as has been explained, designed for use in drop light or other connections for conducting illuminating gas, such tubing will require to be fitted with connections or couplings for attaching the same to the fixture, lamp, or other article. I, accordingly, show such a coupling or connection as the means for attaching the tubing to the discharge tube leading from the valve casing, Figs. 2 and 5, without however, implying any limitation to this particular means of attachment; for, obviously, various devices may be thus utilized, the one illustrated being preferred by reason of its convenience, since it forms a part generally required in the final product. This connection or coupling D, Fig. 5, will be seen to comprise a funnel shaped metallic casing, the large end d of which is flanged to retain therein a rubber washer d' adapted to fit over the pipe wherewith connection is to be had, while the small end d^2 has secured thereto the end of the hose or other tubing E. To attach such hose end thereto I introduce within the same an annular member or sleeve d^3 and then expand the latter outwardly, uniformly about its entire periphery, so as to wedge the tubing tightly between the same and the small end of the casing, thereby forming an air-tight joint. Instead of thus expanding the sleeve I may employ a sleeve of diameter equivalent to that produced when thus expanded and project the end of the tube into the body of the casing before introducing such sleeve. Upon then drawing the tubing into the position illustrated the same wedging effect will be had, especially if such smaller end of the casing D be made slightly tapering, as illustrated.

Having thus described the preferred apparatus for the carrying out of my improved method of coating tubes, the mode of operating such apparatus may be briefly described. A tube E of any desired length is affixed to the end of the discharge passage of the valve casing of the apparatus as shown in Fig. 2. Such tubing, it will be understood, ordinarily comes in flat boxes, being coiled up therein in one or more superposed layers. It is not necessary for the carrying out of my process to remove the tubing from the box; simply connecting one end as described, to discharge passage C, and resting the other outside the box, will suffice. After the tubing has been thus connected, the valve plug C′ is turned as shown in Fig. 3, in which position a ball c^2 will drop into the opening c^4 in such valve and be admitted into the discharge passage. It is thus forced into the latter and a measured quantity of the coating composition thereafter upon the valve being turned so as to connect the supply chamber A with the passage. The plug will then be returned to its first position and a second ball dropped therein, after which, reversing the previous

movement, connection is made with the air line b^4. It has been indicated that the pressure in such air line is greater than that maintained in the liquid supply chamber; hence the foremost ball which was arrested in its movement at the outer end of the discharge passage is now forced on into the tubing, followed by the body of coating composition, and the second ball that was dropped in behind the latter. The air pressure thus introduced is gaged so as to not only force the balls and the body of liquid contained between the same into the tube, but along the latter until they are discharged at its farther end. This operation is accomplished very quickly, as should appear, and turns in the house or tubing offer no resistance to the passage of the balls and material so long as the tubing is not kinked.

Preferably the balls, or at least the rearmost thereof, will be made a trifle smaller in diameter than the diameter of the tube (see Fig. 6) thereby gaging the thickness of the film or coating left in the tube. By the foregoing means a perfectly even, uniform, coating is secured throughout the entire length of the tubing providing a sufficient amount of coating material be admitted in the first instance. Since the film cools as fast as it is deposited there will be no difficulty in preserving the uniform character of such layer, and, in fact, the operation is entirely completed in the instantaneous fashion described; at its conclusion the box may be covered and the tubing placed away ready for use. The expansion of the compressed air or gas, it may be noted, assists in cooling the coating.

It need scarcely be remarked that simpler means than the apparatus described may be employed in the carrying out of the process exemplified in the operation of such apparatus, if not with so much expedition, at least with substantially equal thoroughness. For instance, the body of coating composition once introduced may be manually moved or forced along the tube. So too, short lengths of tubes may be simply suspended vertically as indicated in Fig. 6 (which at the same time serves to illustrate the operation of the foregoing apparatus) and the body of coating composition passed therethrough either under the influence of gravity merely, or by admitting suitable pressure behind the same. In certain cases it is contemplated that the balls or plug members may be omitted entirely. Other mechanical means applied externally may take the place moreover of such plug members as is illustrated in Fig. 7, where, the body of coating composition being placed in the tube, such tube is merely passed between rollers and such body thus carried or forced along the same in a fashion similar to that secured by the means previously described.

The advantages of having a tube for the conduction of illuminating gas interiorly coated have been previously adverted to and so need not be again noted, except to state that where such coating is applied in the uniform manner secured by my improved method a perfectly smooth opening or bore is left, much reducing the friction that otherwise opposes the flow of gas or like fluid therethrough. It will be understood that in place of air any other suitable pressure fluid may be employed; for instance, carbonic acid gas might, in certain localities be more readily and cheaply available than compressed air. Accordingly the term as herein used is employed in its general significance. The same remark may be made as regards the use of the term "liquid" in describing the character of the coating composition; this will ordinarily be of a gelatinous or viscous character, and the term referred to is employed to connote these several characteristics. It will likewise be understood that plugs other than spherical can be utilized to retain the body of coating composition together as it is being passed through the tubing. Where a coil of wire is used to strengthen the tube, this may be introduced either before or after the coating operation although it will be preferably done subsequently since otherwise a heavier coating will be necessary to insure impermeability.

It is sometimes found desirable to dust the interior of the tube after it has been coated with the gelatin. For this purpose suitable comminuted material as soapstone is employed and I find that the process just described is as readily adaptable to the handling of this powdered soapstone as the gelatin. Obviously, such soapstone cannot be injected into the tube in the same fashion as the liquid, but once introduced whether manually or by suitable apparatus (not here disclosed) the actual operation of coating is effected in the same way as herein set forth by forcing the body of powder contained between balls along the tube under pneumatic pressure.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the process and apparatus herein disclosed, provided the steps or means stated by any of the following claims or the equivalent of such stated steps or means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. The method of interiorly coating tubes, which consists in placing a quantity of the coating material in the tube to be coated in front of a relatively solid member, and then admitting a fluid under pressure behind said member, whereby the latter and such material are forced along such tube.

2. The method of interiorly coating tubes, which consists in placing a quantity of the coating material in the tube to be coated in front of a ball, and then admitting a fluid under pressure behind said ball, whereby the latter and such material are forced along such tube, the diameter of the ball being gaged to leave a coating of the desired thickness.

3. The method of interiorly coating tubes, which consists in placing a quantity of the coating material in the tube to be coated in front of a relatively solid member, and then admitting a fluid under pressure behind said member, whereby the latter and said member are forced along such tube, the diameter of the member being gaged to leave a coating of the desired thickness.

4. The method of interiorly coating tubes, which consists in confining a quantity of the coating material in the tube between relatively solid members, and then passing said members and confined material along such tube, said members being freely movable with respect to each other.

5. The method of interiorly coating tubes, which consists in confining a quantity of the coating material in the tube between relatively solid members, and then passing said members and confined material along such tube, said members being freely movable with respect to each other, and the diameter of the rearmost thereof being gaged to leave a coating of the desired thickness.

6. The method of interiorly coating tubes, which consists in confining a quantity of the coating material in the tube to be coated between disconnected relatively solid members, and then forcing such members and confined material along such tube under pneumatic pressure.

7. The method of interiorly coating tubes, which consists in confining a quantity of the coating material in the tube to be coated between two balls, and then admitting air under pressure behind one of the latter, whereby such balls and confined material are forced along such tube.

8. The method of interiorly coating tubes, which consists in confining a quantity of the coating material in the tubes to be coated between two balls, and then admitting air under pressure behind one of the latter, whereby such balls and the confined material are forced along such tube, the diameter of such rearmost ball being gaged to leave a coating of the desired thickness.

9. In apparatus for interiorly coating tubes, a supply chamber for the coating material, means for transferring a predetermined amount of such material from said chamber to such tube, and means for admitting fluid pressure behind the material thus transferred.

10. In apparatus for interiorly coating tubes, a supply chamber for the coating material, fluid-pressure actuated means for transferring a predetermined amount of such material from said chamber to such tube, and means for admitting fluid pressure behind the material thus transferred.

11. In apparatus for interiorly coating tubes, a supply chamber for the coating material, means for connecting the tube to be coated with said chamber, means for transferring a quantity of such material from said chamber to such tube, and means for admitting fluid pressure behind the material thus transferred.

12. In apparatus for interiorly coating tubes, a supply chamber for the coating material, such material being held under pressure therein, a passage adapted to connect said chamber with the tube to be coated, a fluid pressure supply adapted to be connected with said passage, valve means controlling the connection of said chamber, and fluid pressure supply with said passage, respectively.

13. In apparatus for interiorly coating tubes, a supply chamber for the coating material, means for connecting the tube to be coated with said chamber, means for transferring a quantity of such material from said chamber, to such tube, means for introducing balls into said tube, and means for admitting fluid pressure behind the material transferred to said tube.

14. In apparatus for interiorly coating tubes, a supply chamber for the coating material, such material being held under pressure therein, a passage adapted to connect said chamber with the tube to be coated, a fluid pressure supply adapted to be connected with said passage, means for introducing balls into said passage, and valve means controlling the connection of said chamber and fluid pressure with said passage, respectively.

15. In apparatus for interiorly coating tubes, a supply chamber for the coating material, such material being held under pressure therein, a fluid pressure supply, a valve casing provided with a discharge passage and connected with said chamber and fluid pressure supply, respectively, means for connecting the tube to be coated with such discharge passage, and a valve in said casing adapted to connect the same with said chamber, or fluid pressure supply, as desired.

16. In apparatus for interiorly coating tubes, a supply chamber for the coating material, such material being held under pressure therein, a fluid pressure supply, a valve casing provided with a discharge passage, and connected with said chamber, and fluid pressure supply, respectively, a receptacle for holding balls likewise connected with said casing, and a valve in the latter adapted in one position to admit a ball from said

receptacle to said passage, and in other positions to connect said passage with said chamber, or fluid pressure supply, as desired.

17. In apparatus for interiorly coating tubes, a supply chamber for the coating material, such material being held under pressure therein, a fluid pressure supply, a valve casing provided with a discharge passage, and connected with said chamber and fluid pressure supply, respectively, a receptacle for holding balls likewise connected with said casing, and a valve in the latter adapted in one position to admit a ball from said receptacle to said passage, and in other positions to connect said passage with said chamber, or fluid pressure supply, as desired, the pressure of said supply being greater than that in said chamber, and the outer end of the discharge passage of said casing being of slightly reduced diameter, whereby a ball will be arrested until such greater pressure is applied.

Signed by me this 22nd day of June, 1908.

EDWARD JAMES.

Attested by—
CHRISTINE ARNS,
JNO. F. OBERLIN.