(No Model.)

C. DETRICK.

CONTINUOUS UNDERGROUND PIPE AND METHOD OF MAKING THE SAME.

No. 245,283. Patented Aug. 9, 1881.

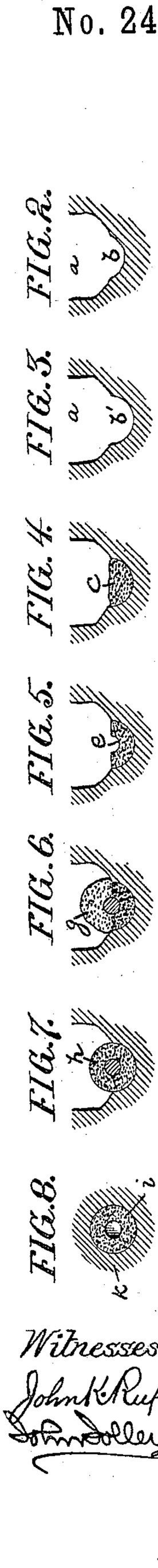

FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6. FIG. 7. FIG. 8.

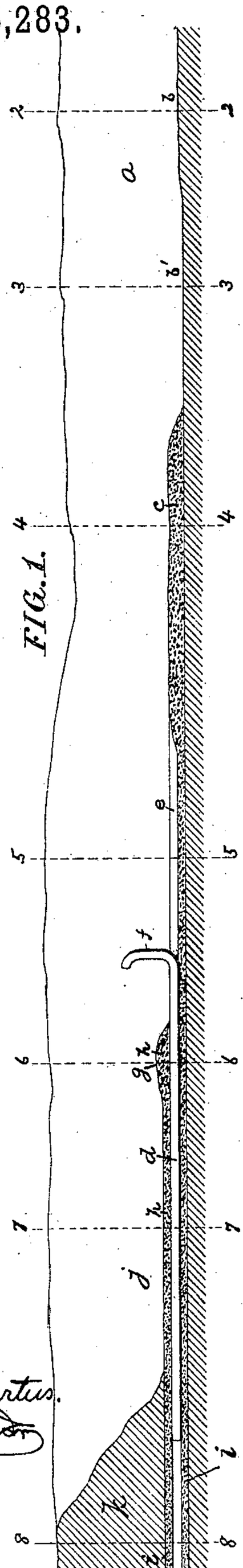

FIG. 1.

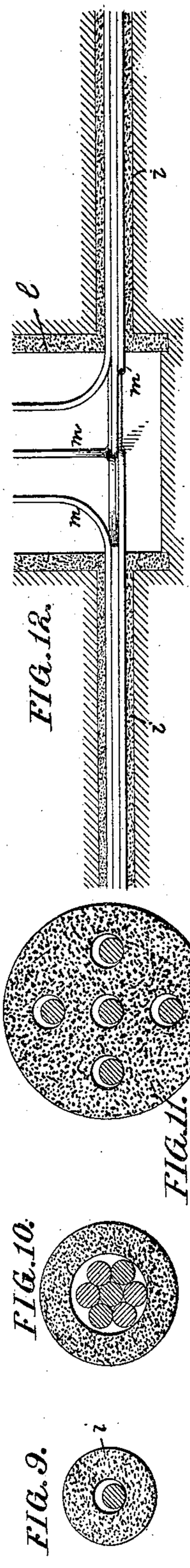

FIG. 12.

FIG. 11.

FIG. 10.

FIG. 9.

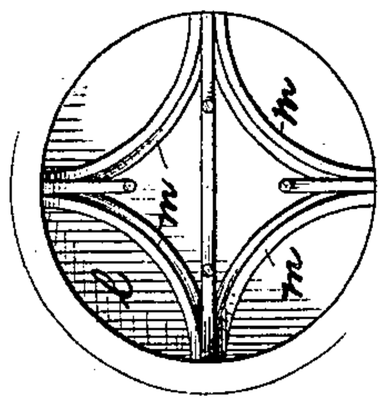

FIG. 13.

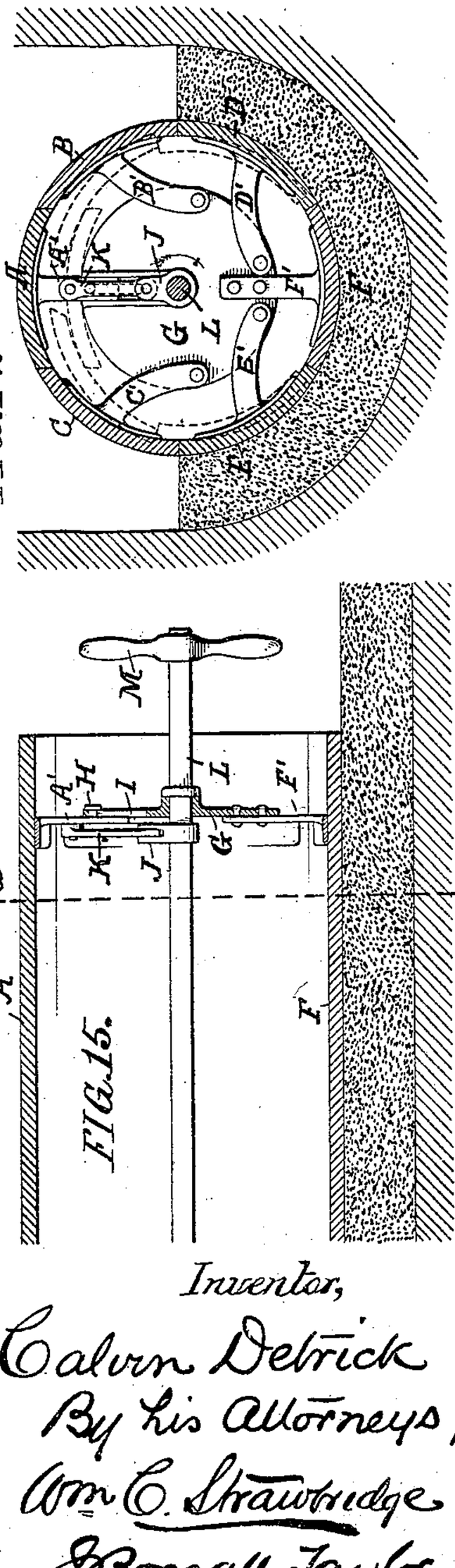

FIG. 14.

FIG. 15.

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UNITED STATES PATENT OFFICE.

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CONTINUOUS UNDERGROUND PIPE AND METHOD OF MAKING THE SAME.

SPECIFICATION forming part of Letters Patent No. 245,283, dated August 9, 1881.

Application filed April 20, 1881. (No model.)

To all whom it may concern:

Be it known that I, CALVIN DETRICK, of Philadelphia, Pennsylvania, have invented an Improvement in Continuous Underground Pipes and in Methods of Making the Same, of which the following is a specification.

My invention relates to such tubing, pipes, or underground conduits or passages as are employed for purposes of drainage, sewerage, water-supply, gas-supply, inclosure of electric, telegraphic, or telephonic wires, and other kindred uses.

The object of the invention is the construction of a wholly continuous seamless pipe adapted, by virtue of the method of its construction, to be formed of any required length and of any desired exterior dimensions and configuration and interior arrangement, and to be constituted of any suitable plastic or readily-molded substance adapted to harden into a rigid and impervious mass of a predetermined configuration.

To the above ends my invention consists in the method of laying and forming continuous pipe hereinafter set forth and claimed.

In the accompanying drawings, Figure 1 represents, in longitudinal sectional elevation, a trench in which, in its successive stages, is being conducted my method of making pipe. Figs. 2 to 8, inclusive, represent, in transverse sectional elevation, views across the trench of Fig. 1, taken respectively on the lines whose numerals correspond with the numerals of the respective figures, the said Figs. 2 to 8, taken in connection with Fig. 1, representing as fully as is possible by means of pictorial representations the method by which my pipe is formed and laid. Figs. 9, 10, and 11 are end sectional elevations of three forms of pipes conveniently embodying my invention, Fig. 9 representing a pipe with a small central bore, adapted to contain, for instance, a single electric wire, Fig. 10 representing a pipe of such dimensions and with a bore of such size as to contain several distinct wires or a twisted cable, and Fig. 11 representing a pipe formed with a series of independent and unconnected bores or continuous passage-ways. Fig. 12 represents, in side sectional elevation, a man-hole or the like, into which pipes constructed according to my invention center, and into which wires represented as emerging from said pipes can be conducted and led off to a telephonic or telegraphic station. Fig. 13 is a top-plan view of the man-hole of Fig. 12. Fig. 14 is a transverse sectional elevation on the line *a a* of Fig. 15, looking from the left-hand side of said figure, of a form of collapsible core or former which I find it convenient to employ in the practicing of my invention in the formation of pipes of large bore, and Fig. 15 a longitudinal sectional elevation of the same.

Similar letters of reference indicate corresponding parts.

My pipe is laid and made in the following manner:

A trench, *a*, is first dug in the ground to the required depth and in the required direction from the point of departure of the intended pipe to the point at which such pipe is to terminate. The bottom of the trench is then, by suitable means—as by tamping, ramming, or by impress with a mold or stamping device—solidly compacted or formed into, for instance, a central semicircular longitudinally-extending gutter of the character represented at *b b'* in Figs. 2 and 3 and at lines 2 and 3 of Fig. 1, or into a channel (lengthwise of the trench) of such interior configuration as it is desired the exterior of the pipe should assume. After the above groove or channel has been formed in the trench it is suitably hardened by pressure, percussion, or impact, (unless the firm consistency of the ground through which the trench is cut renders hardening unnecessary,) and the groove is then filled or nearly filled with such soft or plastic material as it is desired to form the pipe of, firmly compacted, as by pressure, impact, or kindred means, thereinto, as represented in Fig. 4 and at line 4 of Fig. 1.

It is proper here for me to state that the plastic material of which my pipe may be composed is variable in character. Broadly speaking, any composition or substance capable of being molded and adapted subsequently to harden will answer the purposes of my invention, while, specifically considered, many artificial-stone compounds, or asphalt, asphalt concrete, or the like, will answer the purpose. I find a compound of clean sharp sand, cement, and any chemical solution adapted to cause subsequent hardening of the same well fitted for my purpose.

When employed the above elements are to be intimately commingled and molded while in a damp state. The compacted mass of plastic material *c* is then, while in a damp and easily-molded state, in readiness to receive a core or former, *d*, Figs. 1, 6, and 7, designed to impress a portion of the bore *e* thereinto. This core or former is an internal solid or hollow mold or die of the exact exterior shape and size of the desired interior of the bore of the pipe, and it best has its forward extremity bent up at a right angle to form a hook, *f*, by means of which the former can be withdrawn from the formed pipe as the process of pipe formation continues, whereof hereinafter. The first effect of the laying and pressing of the former upon the compacted mass is to produce the impress of a semi-bore along the central length of the plastic mass within the groove of the trench, as shown at *e* in Fig. 5 and at 5 in Fig. 1. The former is embedded to the extent (when circular) of half its breadth, and the operation is then in readiness for its next step, or that of covering the former or embedding it under a further mass of the plastic pipe-forming material *g*, which is superimposed upon it and the previously-formed plastic material, as indicated in Fig. 6 and at the line 6 in Fig. 1, and which is then compacted by means of any suitable stamp, mold, die, or kindred instrumentality, or by any other method, until the former is enveloped by a mass of plastic material, *h*, Fig. 7, and line 7, Fig. 1, which, when hardened and freed from the core or former, constitutes a continuous seamless stone, concrete, or composition pipe, *i*, Fig. 8, and line 8, Fig. 1, of uniform exterior contour, and having a smooth, uniform, and continuous bore of such exact interior sectional shape as is desired from the exterior configuration of the former. The former is then withdrawn from the mass of plastic material surrounding it by hand or other fit means, such withdrawal being best gradual—that is to say, the former not being entirely withdrawn, but being left partially in the previously-formed pipe, as at *j* in Fig. 1, so that its forward portion only is exposed to be surrounded by fresh covering of plastic material. After the pipe so as above formed has hardened sufficiently, the time depending upon the character of the composition employed, the trench is filled in, as at *k*, Fig. 1, and the ground surface restored.

When it is desired to terminate one or several lines of pipe in a common junction, a manhole, *l*, or the like, is constructed as shown in Figs. 12 and 13, and the pipe or pipes caused to enter or terminate therein. In said figures, *m* indicates electric wires contained in the pipes and emerging therefrom into the manhole. Such forms of pipe as are shown in Figs. 9 and 10 are formed in the manner above described. When, however, it is desired to construct a pipe with more than one independent bore, the method is to be modified by employing the steps of the above-described process *seriatim* as to each bore—that is to say, by making several pipes, so to speak, in the given manner in one pipe, the molding of the plastic material about the separate bores being accomplished by the use of as many separate (although, if desired, connected) formers as there are desired to be bores, and the whole being conducted upon the principle of construction employed with a pipe of a single bore.

The resultant product of carrying out the process as last above described with five formers will be a pipe of the character shown in cross-section in Fig. 11.

For bores of ordinary diameter a solid metal rod constitutes a good core or former, and is easily withdrawn by traction, so as to leave a smooth interior to the resulting bore. When, however, the bore of the tube is to be of large diameter, the area of frictional contact between former and bore, being increased, will prevent the endwise tractional withdrawal of the former and render the employment of a collapsible former requisite.

In Figs. 14 and 15 I have represented a convenient form of collapsible former, in which A B C D E F are segmental pieces of the same and the required length, which, when placed together, as shown in full lines in Fig. 14, constitute the exterior of the former. The segmental pieces are respectively supported upon sets of bracket-arms A′ B′ C′ D′ E′ F′, of which the arms B′, C′, D′, and E′ are pivoted to disks G, set in a plane transverse to the axis of the former, while the arms F′ are affixed thereto, and A′ are arranged to move inward toward the center of the disk by means of pins H, working in radial slots I formed in the disks, through the medium of crank-and-link connections J K, the links being attached to the bracket-arms A′ and the cranks to a central shaft, L, journaled through the disks and provided with a cross-handle, M, through the medium of which the shaft is revolved, and the segmental piece A, through the crank-and-link connections and its sliding bracket-arms, is caused to approach the shaft or recede from the position which it previously occupied. Upon the withdrawal of the piece A the pieces B, C, D, and E readily move about their pivots toward the center of the composite former, as indicated in dotted lines in Fig. 14, thus collapsing the former and enabling its ready withdrawal in its collapsed condition from the pipe which has been formed about it. When it is desired to construct the pipe about a curve or corner it is simply necessary to curve the trench, groove, and plastic material in the desired direction, and to employ either a curved former or one of pliable material adapted to conform to the desired curvature.

From the description of my invention hereinbefore given it will be readily comprehended that the invention is contradistinguished from continuous pipes or continuous methods of forming pipes *per se* to be subsequently laid in the fact that it is of the essence of my invention

that the pipes should be continuously formed and laid beneath the ground in such position and relation thereto as it is intended that it should permanently occupy.

It is obvious that my invention enables the dispensing with of all pipe joints or couplings and of all handling or transportation of sections of pipe, and provides a means whereby seamless pipe of any desired configuration and extension can be simultaneously manufactured and laid in position for its subsequent permanent use.

Having thus described my invention, I claim—

1. The method of forming continuous seamless pipe hereinbefore described, which consists, first, in excavating to the required depth, shape, and extent, and in the required direction, a trench or channel in the ground in which it is desired that a pipe should be laid; second, in progressively laying within said trench a layer, stratum, bed, or continuous mass of plastic material adapted to subsequently solidify; third, in superimposing upon or embedding in said layer of soft plastic material one or more cores or formers of exterior shape corresponding with the desired interior shape of the bore or bores of the pipe; fourth, in superimposing upon said former or formers superimposed upon or embedded in said layer or mass of soft plastic material, and upon said soft plastic material, a covering, layer, or continuous mass of plastic material adapted to subsequently solidify; fifth, in removing the former or formers and replacing the excavated substance of the trench, substantially as described.

2. The method of forming continuous seamless pipe hereinbefore described, which consists in progressively forming in a trench about one or more formers or cores, substantially in the manner hereinbefore set forth, continuous pipe of plastic material, and in progressively advancing said former or formers, substantially in the manner and for the purposes shown and described.

In testimony whereof I have hereunto signed my name this 16th day of April, A. D. 1881.

CALVIN DETRICK.

In presence of—

JOHN JOLLEY, Jr.,

W. C. STRAWBRIDGE,

J. BONSALL TAYLOR.