

(No Model.)

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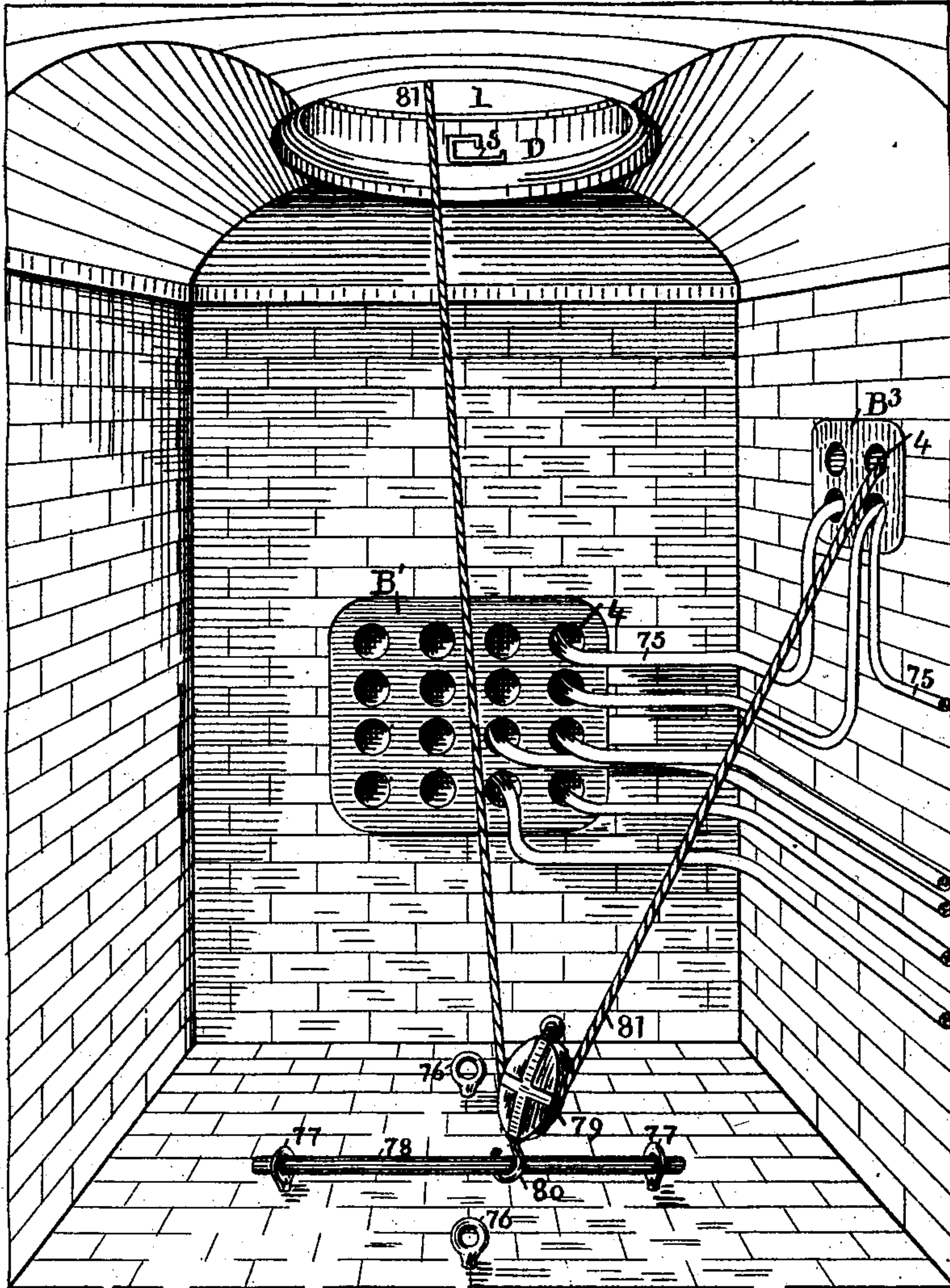
J. P. DAVIS.

UNDERGROUND SYSTEM FOR ELECTRIC WIRES.

No. 374,458.

Patented Dec. 6, 1887.

Fig. 1.



Witnesses.
Geo. Willis Pierce
C. W. Beckham

Inventor.
Joseph P. Davis
by A. J. O'Loach
his attorney

(No Model.)

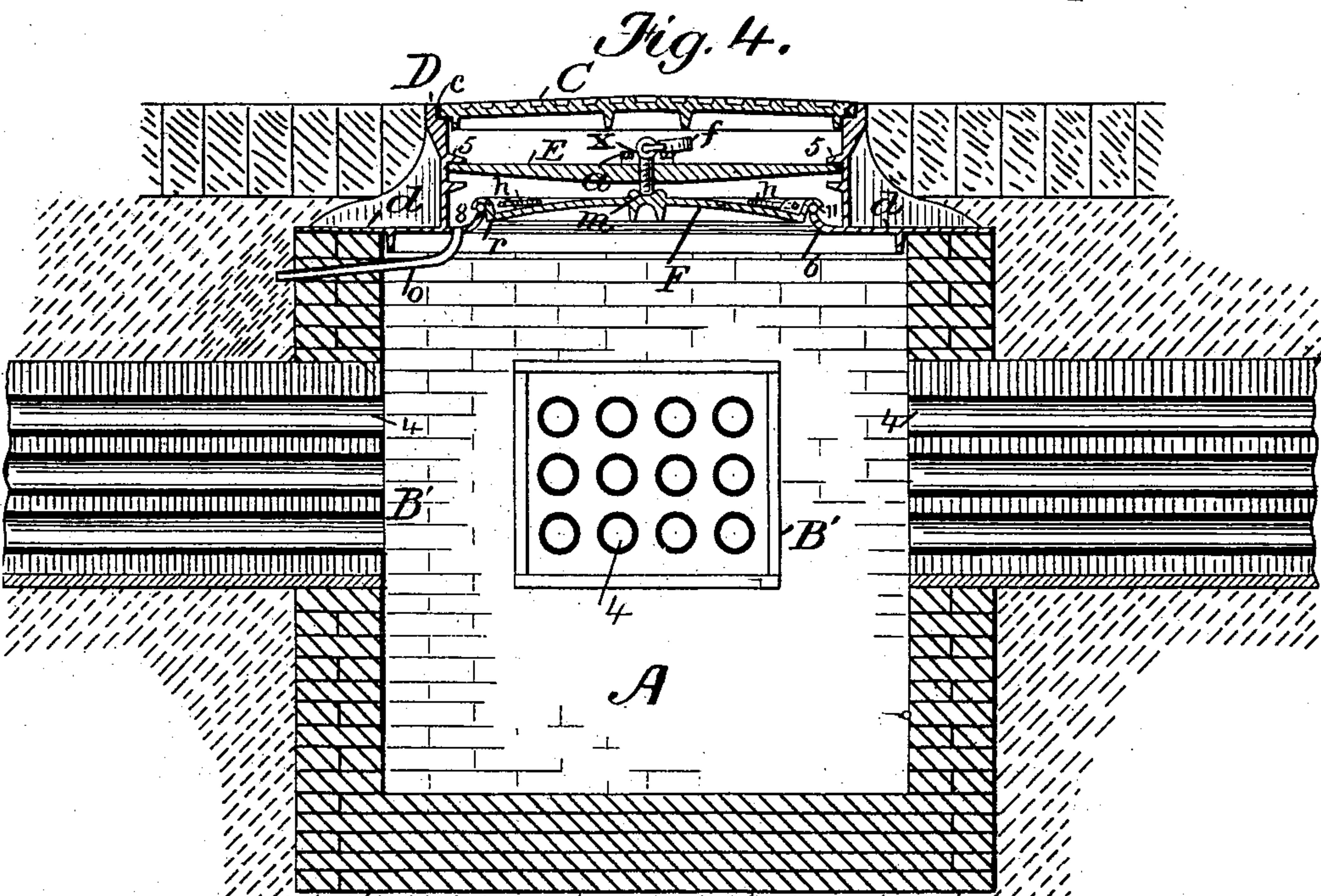
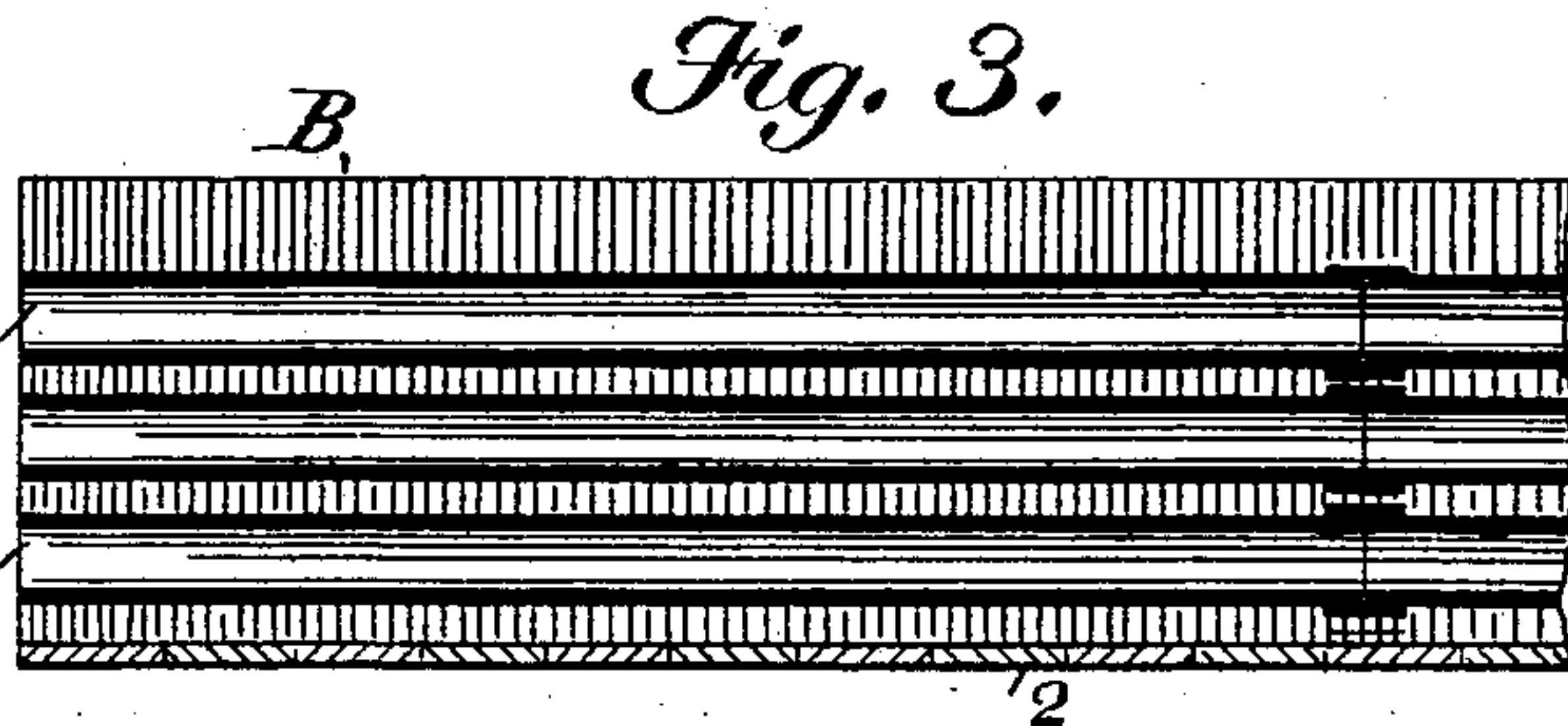
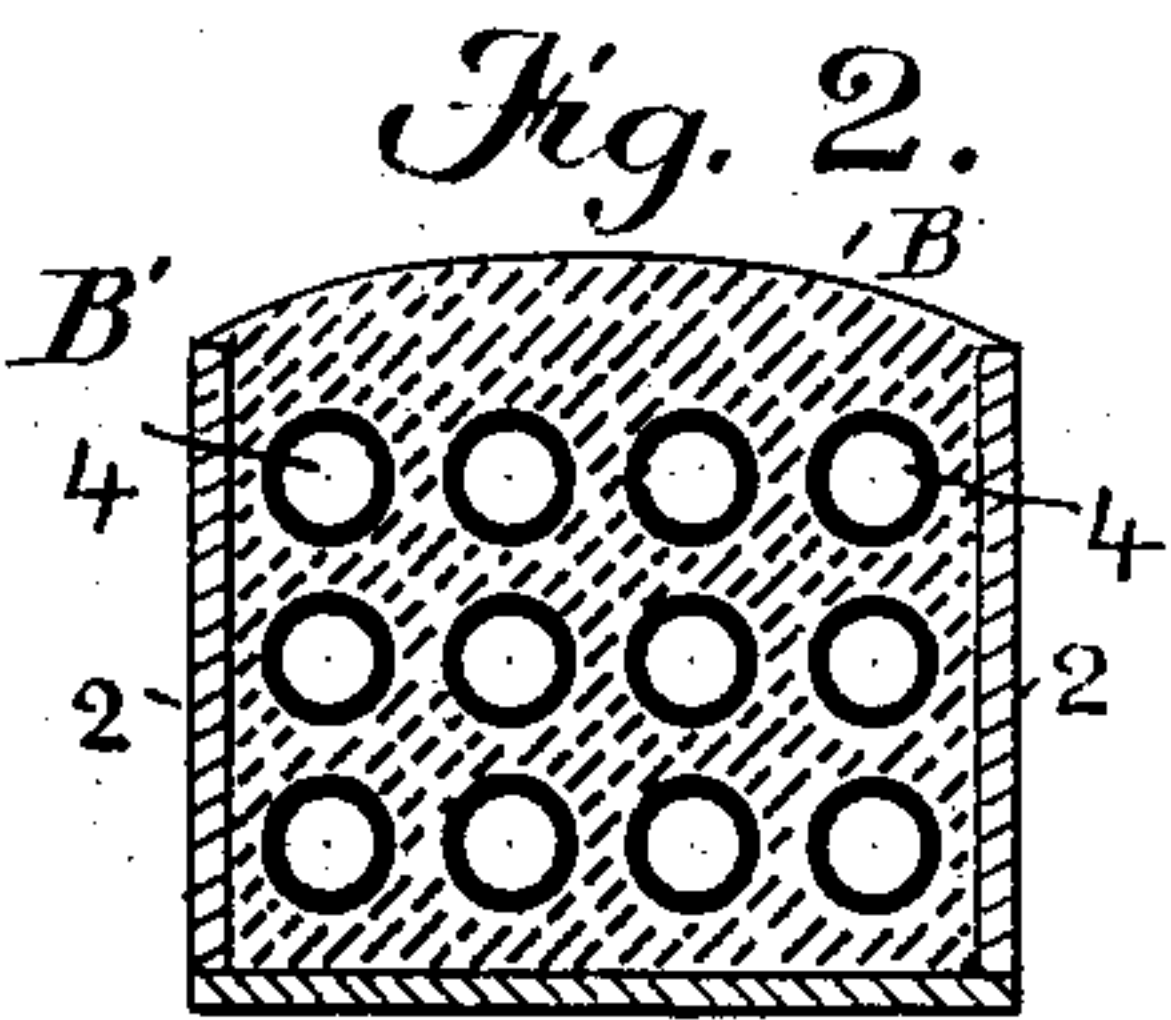
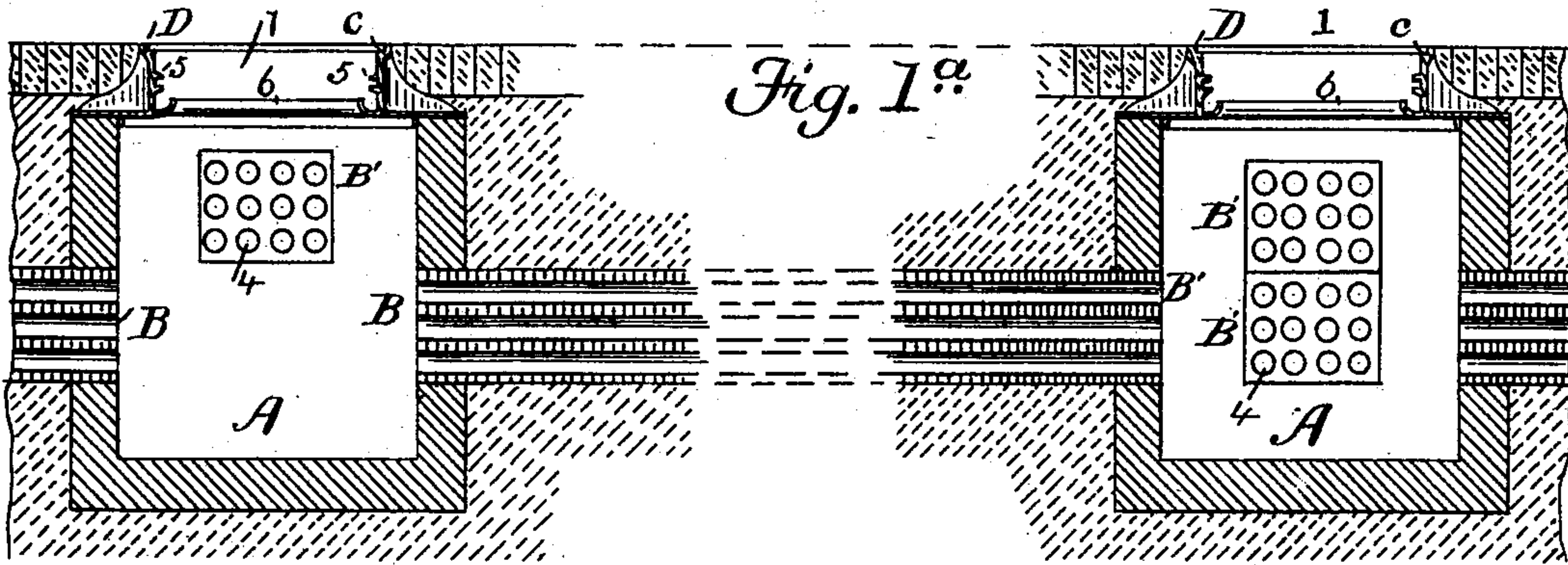
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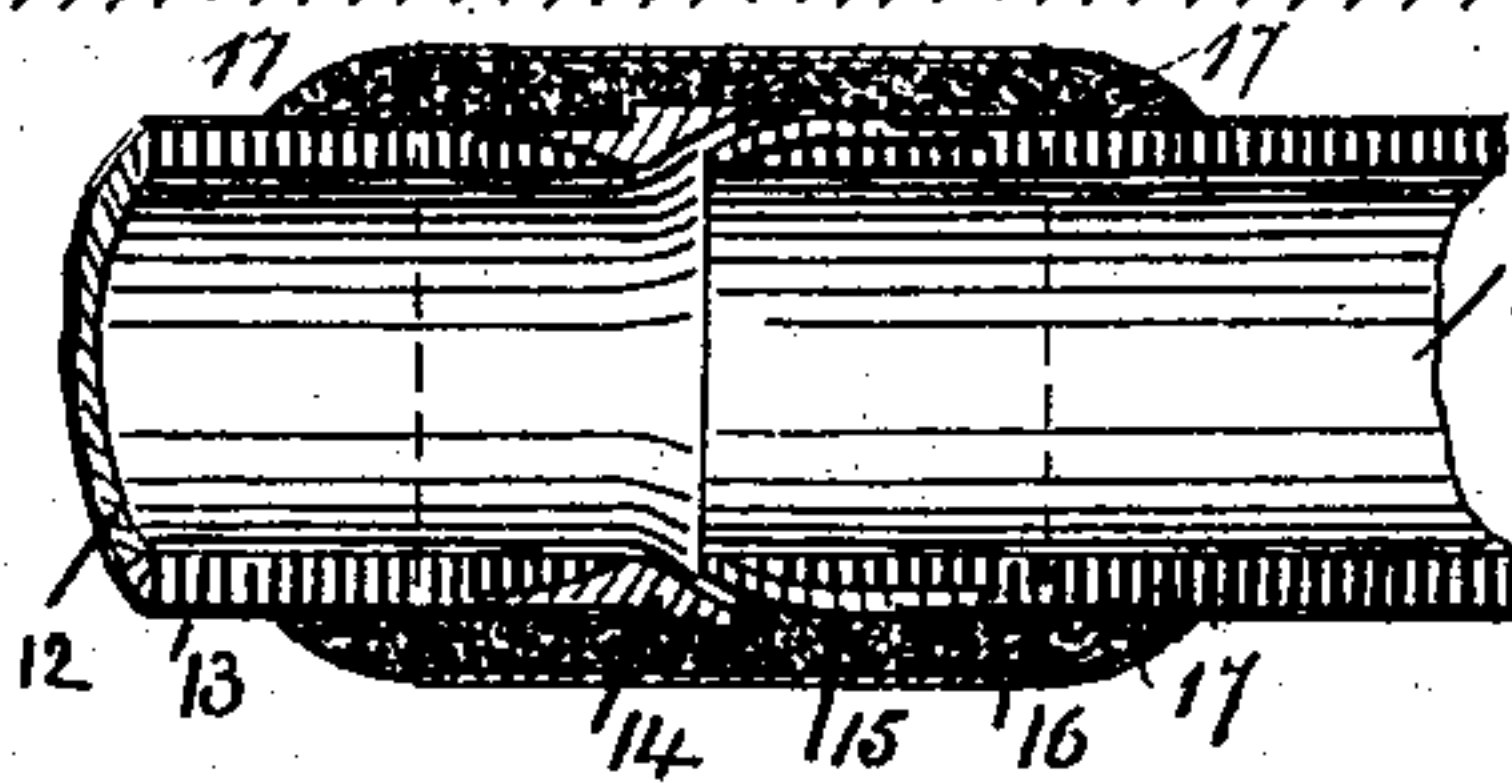


Fig. 3a Inventor:
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by A. H. K.
his attorney

(No Model.)

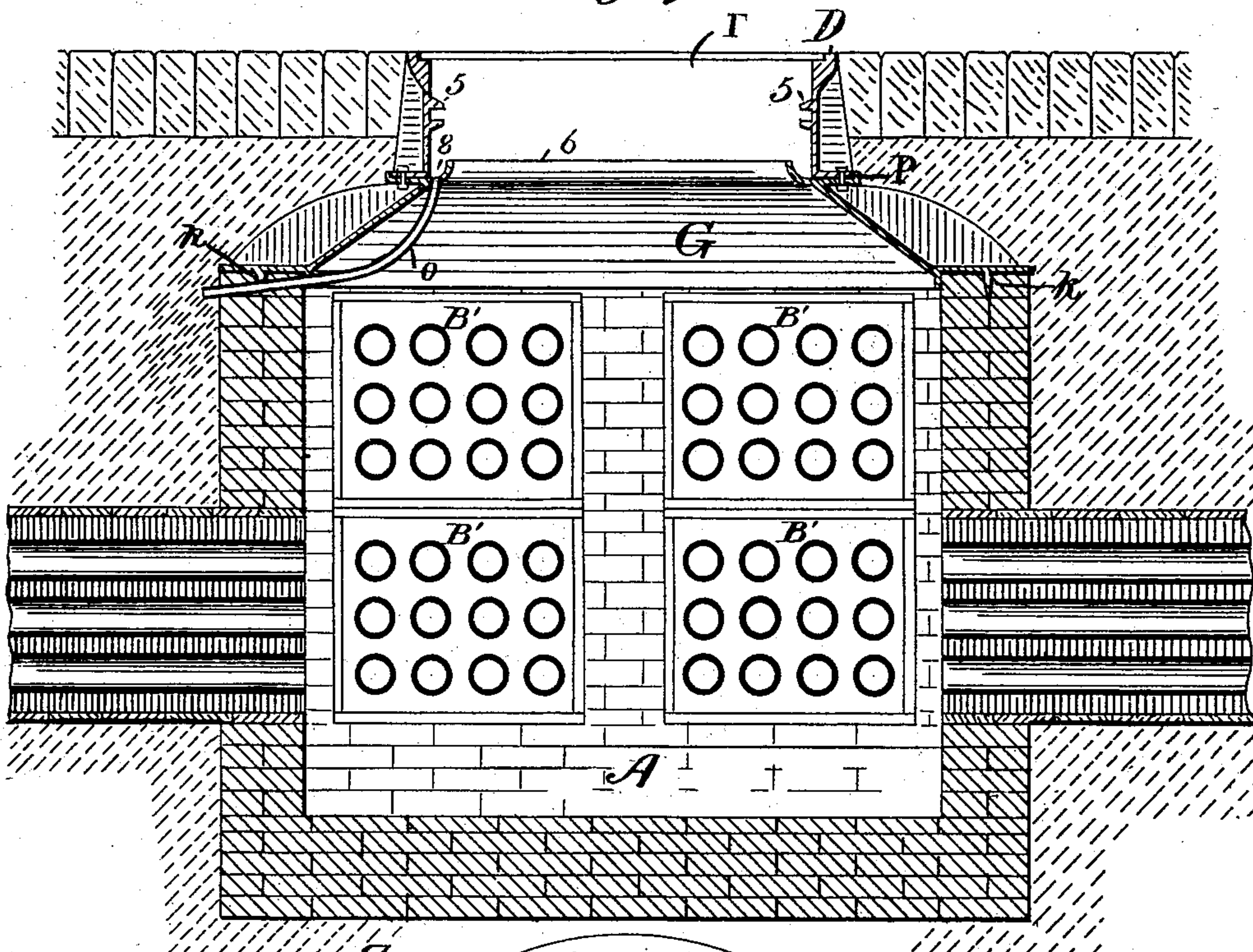
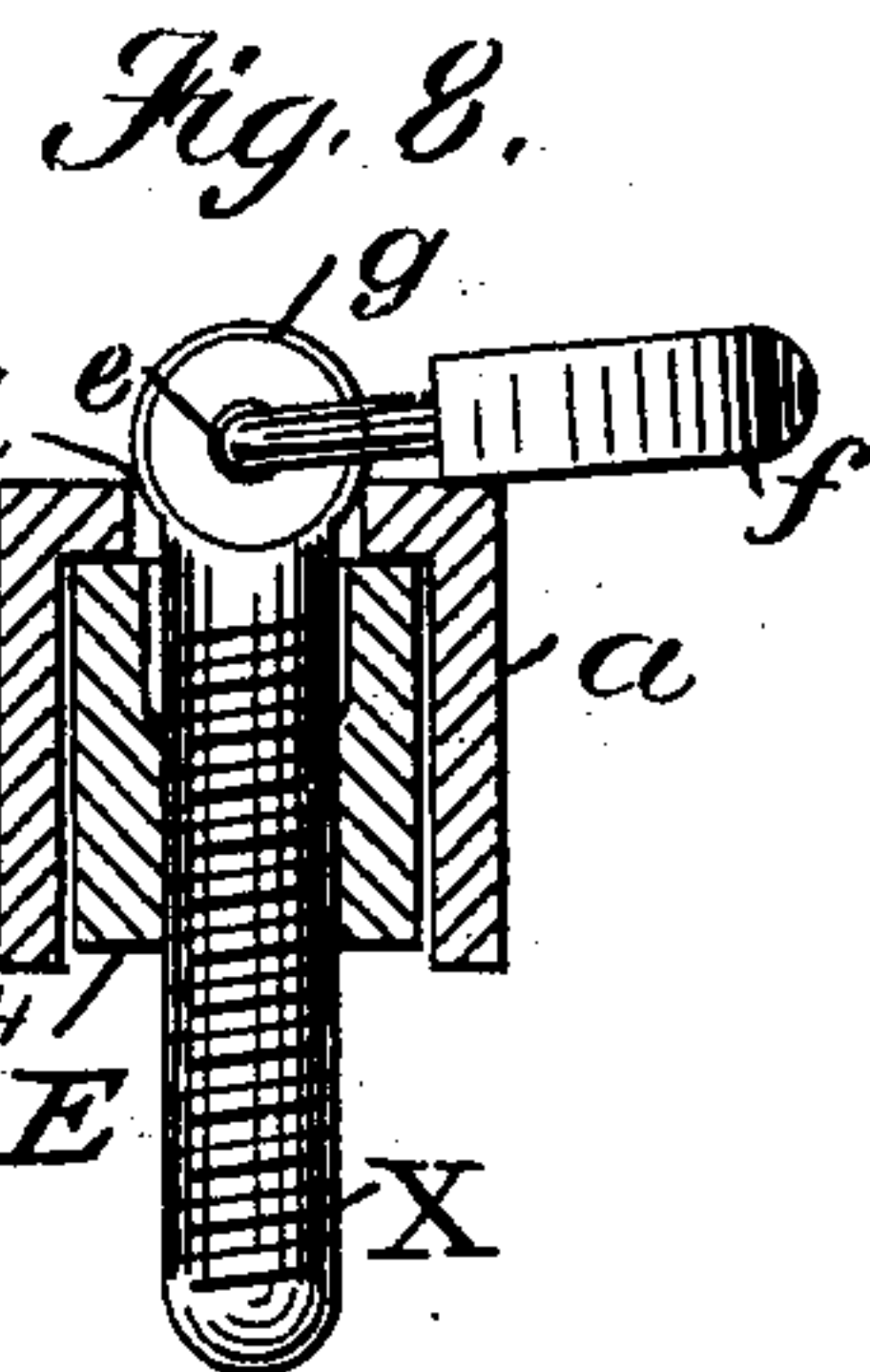
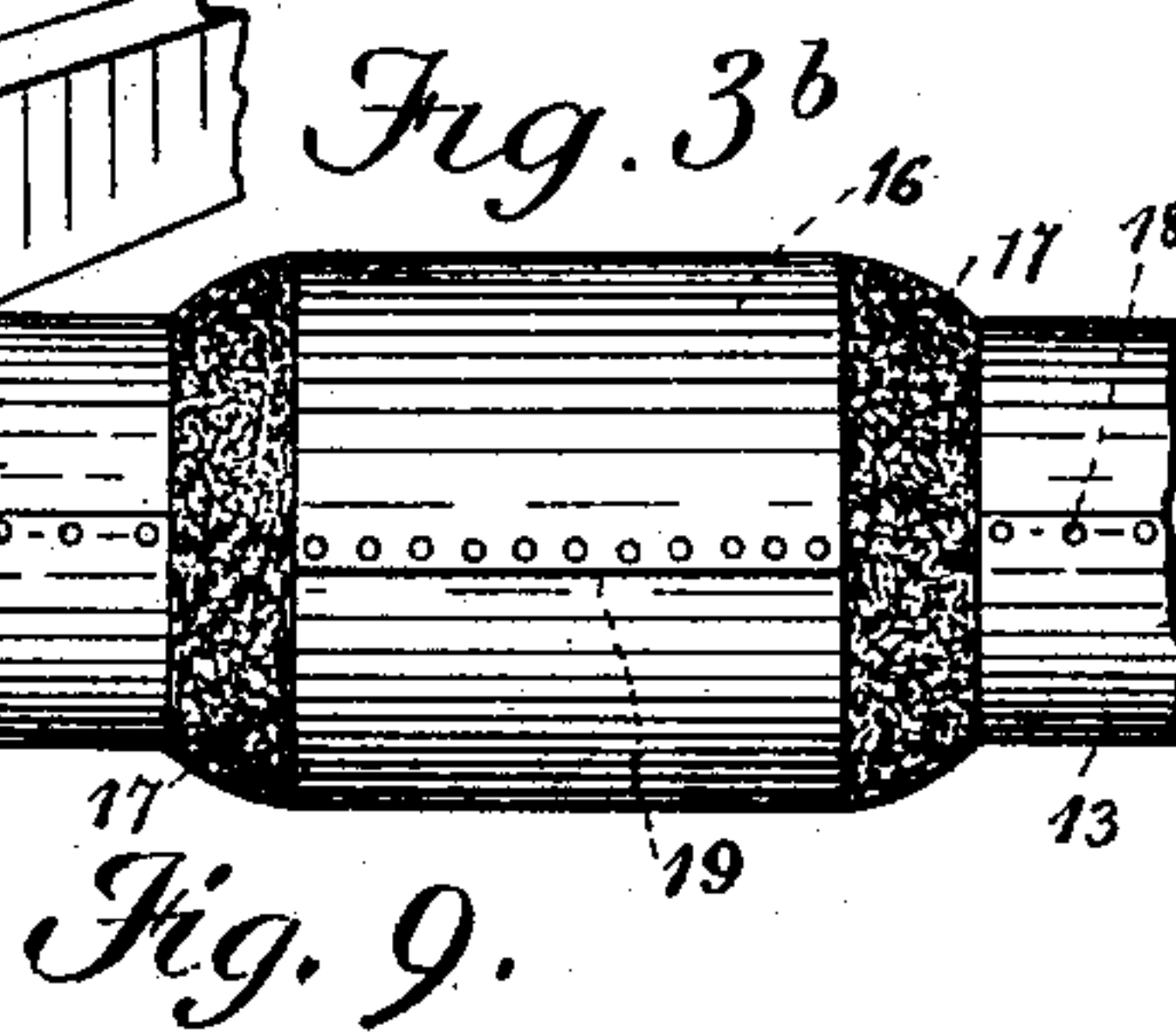
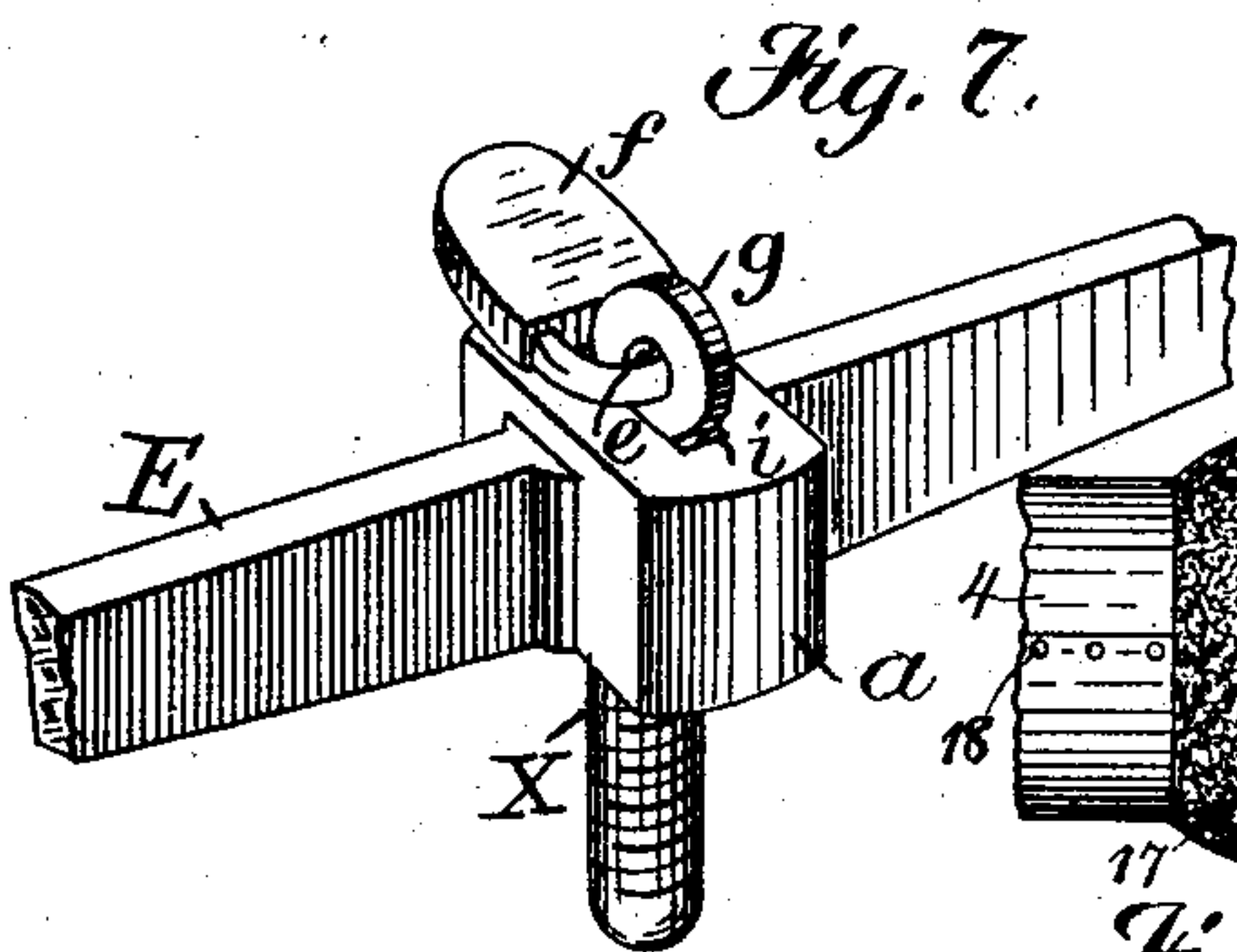
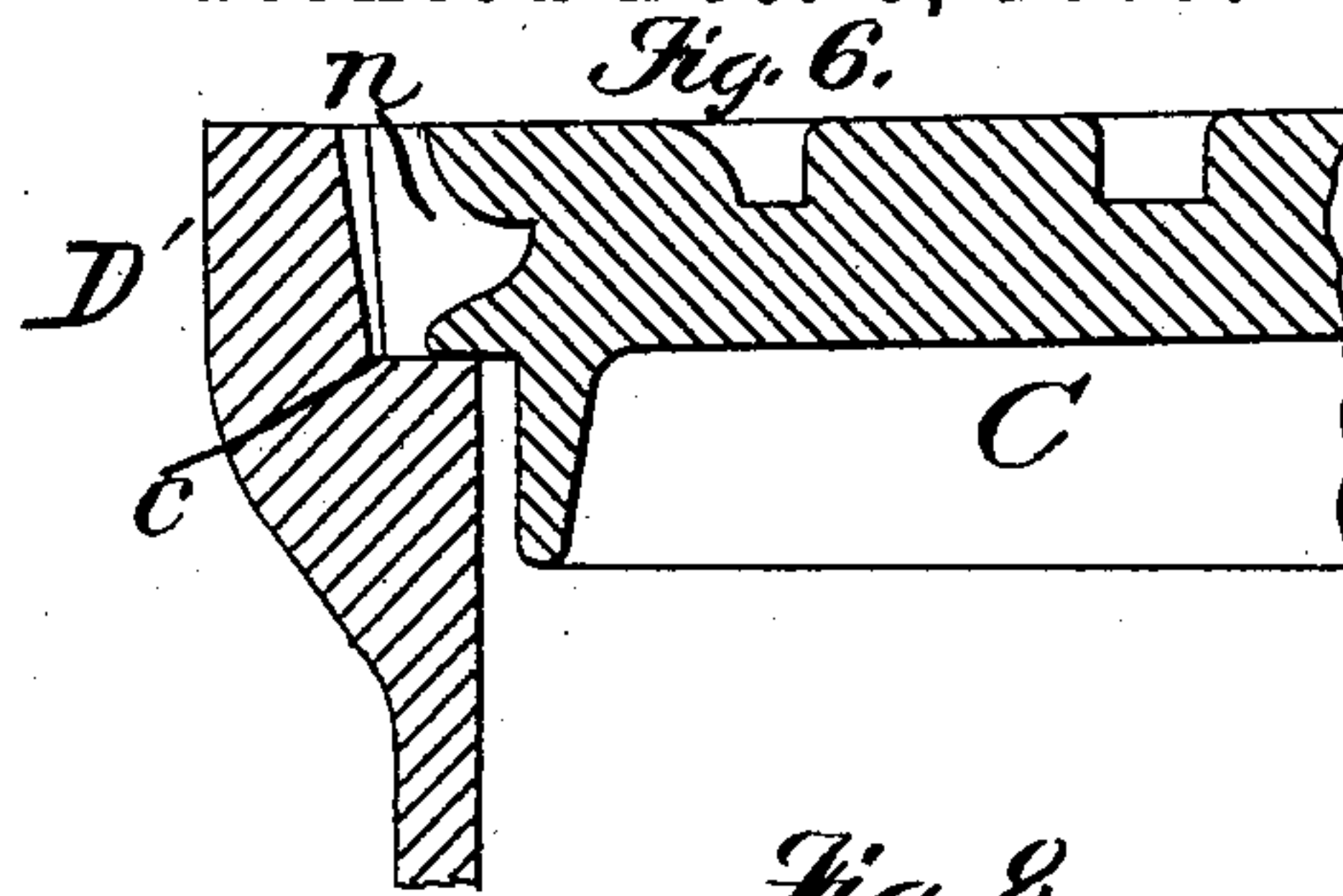
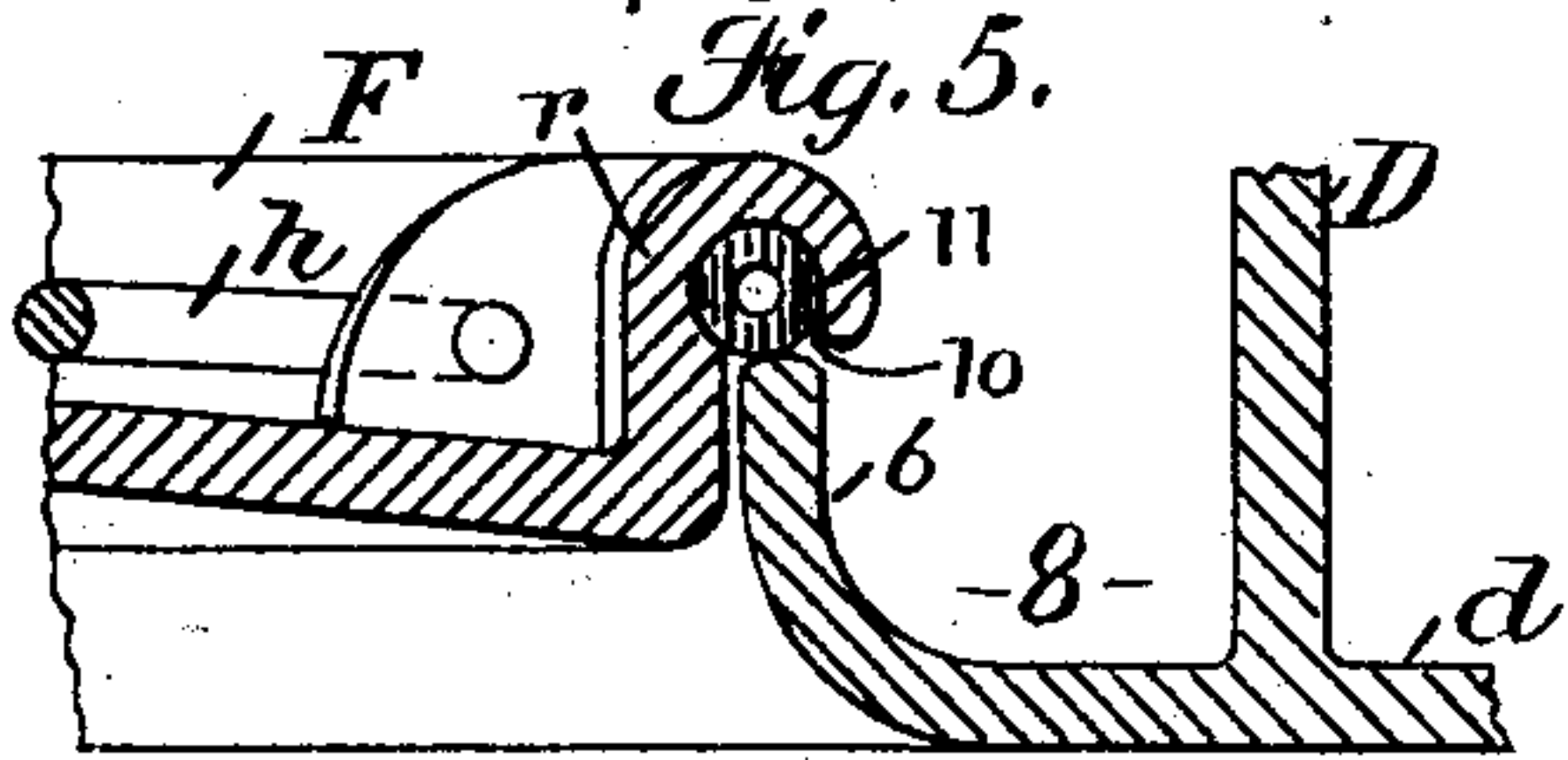
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Witnesses.
Geo. W. Pierce,
C. W. Beckham

Inventor:
Joseph P. Davis
by A. H. H. K.
his attorney.

UNITED STATES PATENT OFFICE.

JOSEPH P. DAVIS, OF NEW YORK, N. Y.

UNDERGROUND SYSTEM FOR ELECTRIC WIRES.

SPECIFICATION forming part of Letters Patent No. 374,458, dated December 6, 1887.

Application filed July 11, 1887. Serial No. 243,998. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH P. DAVIS, of New York, in the county of New York and State of New York, have invented certain Improvements in Underground Systems for Electric Wires, of which the following is a specification.

This invention relates to the construction of underground conduits and working chambers for the reception of electric wires; and it consists in certain improvements whereby an efficient, economical, and durable conduit can be made or built, and also in improvements in the construction and arrangements of the working vaults or chambers and the covers for the same, whereby they can be more efficiently and conveniently sealed to prevent the admission of moisture and secured against the ingress of unauthorized persons, while the manipulation of the said cover is by the use of suitable means facilitated.

It also consists in such a construction of the chamber-cover or man-hole casting as will dispense with the closing in or narrowing of the brick-work of said chamber, thus producing a chamber which is much more convenient to work in than has heretofore been built.

It finally consists in the combination of the above detailed improvements into a harmonious system complete in itself. It is not necessary to state specifically the object of this invention, since the said object is sufficiently indicated, and is implied by the statement of invention.

I am well aware that it is old in the art to construct a conduit or a series of parallel ducts for the reception of electric wires and to place at suitable points at desirable distances from one another chambers into which the several ducts from different directions are led, the said chambers being adapted for the ingress of workmen and designed for the purpose of connecting the several wires at junction-points, for the testing of wires, and for other analogous manipulations, such an organization having been shown, described, and claimed in Letters Patent of Great Britain issued December 22, 1854, to Felix Marie Baudouin, No. 2,710. My invention, however, comprises many detailed improvements which experience has demonstrated to be useful and convenient.

In the drawings which illustrate and constitute a part of this specification, Figure 1 is a perspective view of the interior of one of the underground working-chambers illustrative of a special feature of my system. Fig. 1^a is a general view, in longitudinal vertical section, of such a sufficient portion of the system as is requisite for illustration. Fig. 2 is a vertical cross-section, and Fig. 3 a vertical longitudinal section, of the construction of conduit which I employ, extending subterraneously from chamber to chamber; and Figs. 3^a and 3^b are enlarged views of a joint connecting two lengths of one of the pipes or tubes shown in Fig. 3. Fig. 4 is an enlarged view of one of the working-chambers with conduits entering, showing more especially the special points of construction in the cover and chamber-top which I regard as improvements. Fig. 5 is a detail showing the sealing-gasket and the plan I adopt of holding the same in position. Fig. 6 is a detail showing a portion of the outer cover and showing means for the ready raising of the said cover. Figs. 7 and 8 show perspective and sectional views of the means for securing the closing-bar of the inner cover. Fig. 9 is a sectional elevation of a vault, illustrating a modified form of cover-casting, whereby I am enabled to maintain ample room for work above the brick-work line and to dispense with closing the brick-work in at the top. Fig. 10 is a detail of the inner cover, showing in plan one of the lifting-handles therefor.

I will describe, first, the general construction of the system of conduit and working vaults, referring to Figs. 1, 2, 3, 3^a, 3^b, and 9, and will afterward describe the details which appear to require special consideration.

I construct the conduit-sections of hydraulic-cement pipes, each provided with an envelope of sheet-iron riveted longitudinally, as shown at 18, Fig. 3^b, and having cast-iron joint-pieces 15 and 14, Fig. 3^a, on the ends, (male and female,) over which joints are placed a sheet-iron collar, a wire-netting, or a base-work consisting of a sheet of textile fabric, which is filled with cement, 17, so as to make a perfect joint. These pipes are deposited in layers in hydraulic-cement concrete, which is thoroughly treated with hot asphalt, and the entire mass of cement pipes and the concrete matrix constitutes, in fact, a continuous mass

from each chamber to the next, the ends of each conduit being substantially flush with the inner surface of the chamber-walls.

The individual ducts 4 are made, as hereinbefore stated, of sheet-iron lined with hydraulic cement, and in practice are from two and one-half to three inches in inside diameter, with a thickness in the cement lining of five-eighths of an inch, and the thickness of the sheet-iron envelope 13 is conveniently No. 24 to No. 26 gage.

At the ends of each pipe-section is fitted a cast-iron jointing-piece, 14 and 15, male at one end and female at the other; whereby the bore is made continuous throughout the entire section. During the process of laying I use a sheet-iron collar or sleeve, 16, riveted on a seam, 19, Fig. 3^b, or alternatively a piece of fine wire-netting attached to the pipes over the joint with strong wires, so as to hold the ends of the pipe immovable. Either of these joint-envelopes is then filled in with pure cement concrete, which is thus caused to completely surround the joint and to closely adhere to the same, producing a practically-homogeneous length of duct; or in place of either I may spread the cement on a sheet of suitable textile fabric—such as linen, cloth, or canvas—and apply the same to the outside of the joint to form a complete conduit. The method adopted is to dig a trench of suitable depth, and after well ramming the bottom of the same to apply thereupon, first, a layer of the cement concrete, then a horizontal layer of pipes, jointing the pipes as they are laid, as hereinbefore described. Concrete is then rammed in between and over them to the required thickness, after which another layer of pipes is laid, and so on until the entire conduit is built up.

It is in many cases advisable to employ an external box, 2, in which to lay the conduit, as indicated in Figs. 2 and 3. This forms a compact bottom and lining for the trench, and serves as a form for the concrete mass containing and surrounding pipes. Where such a box is used, it may be made of rough spruce or hemlock of one to one and one-fourth inch thick. Before laying the concrete mass therein the inside of the box bottom and sides are well swabbed with hot asphalt, so that the concrete when put in sets against the waterproof coating. When completed, the top of the mass is coated with asphalt, also, before filling in the trench. If no wooden box be used, it is only practicable to swab or paint the top of the concrete with the hot asphalt, which will sink into the material and aid in preventing moisture in settling in from the top. It is well before painting with the asphalt to round off or arch the top of the concrete, as indicated at B, Fig. 2; but, if desired, the conduit may be covered with a rough plank. This, however, is not absolutely necessary.

The vault or working-chamber is, as indicated in Figs. 1, 4, and 9, usually constructed of masonry, and has vertical walls with suit-

able openings in their sides for receiving the ends of the conduits. The several conduits are connected at suitable intervals by these working-chambers, which are used for jointing, testing, and other necessary manipulations, and for convenience in the work of drawing wires or cables through the conduits from chamber to chamber. In the floor of the said chambers are embedded ring-bolts 76 and 77, within which is placed, during the process of drawing in, an iron bar, 78. This bar may of course, as circumstances shall require, be inserted either in the rings 76 or 77, which are arranged transversely with one another. In either case it forms a support for a snatch-block, 79, round which passes the rope 81, whereby the cables or conductors may be drawn through the conduit from one working-chamber to the next. In the drawings the rope is represented as being used to haul a cable through the duct 4 of the conduit B³ at the right side of the vault, the rope passing round the snatch-block and through the man-hole, and the power being applied thereto on the outside.

B' is the end of a conduit entering from another direction, and cables 75 are shown as entering from both directions and led round the sides of the vault to other conduits.

In the mouth 1 of the vault may be seen the man-hole casting, showing the recess 5 of the locking-bar.

Such a construction as is described presents numerous advantages. Used with a single envelope of sheet-iron having just thickness enough to protect the pure cement lining in transportation and handling until it is safely embedded in the hydraulic-cement concrete, it reduces the metal to a minimum, with corresponding electrical advantage, and gives a conduit consisting of a series of pure cement ducts, and affording an excellent smooth hard surface for the drawing in and out of cables, composed, moreover, of an imperishable material, the value of which increases with time. The cement free from moisture is a good non-conductor, and surrounded as is each duct by a thin metal envelope, thoroughly asphalted, the duct can be quite safely relied upon to be impervious to water or gas except at the joints of the pipe-sections. At these points the male and female joint-castings, arranged as hereinbefore described, produce a tight fit; and when the pipe and joints are embedded in a matrix of hydraulic-cement concrete asphalted hot on the sides of the mass the construction will be a strong, tight, and durable one.

I will now describe the man-hole castings and the special arrangements and devices associated therewith which I have devised.

The man-hole casting or working-vault cover used for vaults of ordinary size (that is, say, four feet cross-section) is illustrated in Figs. 1 and 4. It comprises a circular cast-iron frame, D, ribbed for strength and resting by a broad flange, d, upon the brick-work of the vault-walls below the surface of the earth, an

upper or outer street-cover, C, substantially flush with the surface of the street and resting upon a flange or recess, *c*, in the mouth 1 of the frame, an internal or sealing cover, F, resting on a projecting rim or upturned flange, 6, extending from the inner surface of the said frame, and a locking-bar, E, and attachments therefor. As shown more clearly in Fig. 5, the flange 6 projects inwardly from the lower edge of the frame on the same horizontal plane as the broad flange *d* and sweeps upward with a wide curve, as shown, thus forming a channel or annular trough extending round the base of the internal surface of the mouth 1. The sealing-cover F is slightly curvilinear in section, the convex surface being outward. It is so shaped for strength, and also to prevent the accumulation of water upon it which may get in from the street-surface under the joint of the upper cover. Any water which does get in flows over the sides of the cover to the annular trough 8, formed by the supporting-ring, from whence it may be carried off by a pipe, *o*, leading through the masonry to the surrounding sand or earth, the upper end of the said pipe being let into the bottom of the trough. The sealing-cover also is made with a raised rim, *r*, round it, forming a circular guide when it descends into place, and this rim, after extending upwardly, takes a downward curve, so as to form a recess, 10, into which fits a circular gasket or ring, 11, of india-rubber pipe.

Heretofore the gasket in man-hole castings has been allowed to lie free on an open flat or horizontal flange, or it has rested in a groove in a flanged support under the street-cover, or has been placed in a wide recess in the cover, beveled in both directions, so as to facilitate finding and fitting the cover upon the lower or seating flange. All of these forms of construction are liable to the same objection—namely, the difficulty and well-nigh impossibility of maintaining the gasket in a proper position to provide a constant and positive fit where it can fully perform its function. Moreover, in none of these forms of applying the gasket, so far as I am aware, has there been employed a tubular gasket which has the special advantage of elasticity.

In the construction which I have devised only gaskets with holes through them (such as pipe) should be used on account of the high degree of elasticity possessed by them when of such a construction. The gasket 11 is moreover made to fit tightly in the recess, the cross-section of which is in shape that of an arc of a circle of a proportion greater than that of a semicircle. I have found a two-thirds arc satisfactory. Under these conditions the gasket once pressed into the circular recess has no tendency to drop out or become misplaced, but is held in position, so that at all times, when the cover descends in place, the gasket receives on its entire circumference the upward pressure of the projecting rim and makes a

tight joint. Inasmuch as the gasket is made of elastic pipe or tubing, this positive hold or grip still leaves full play to the sealing action due to the upward pressure of the flange, thus constituting in practice a considerable improvement on any previous construction.

Heretofore, so far as my knowledge extends, both internal and external covers have had to be pried up and raised with a crow-bar—a most inconvenient operation. By reference to Figs. 4, 5, and 10, it will be seen that I obviate this inconvenience with respect to the inner cover by attaching a handle, *h*, to the lugs *j* and *j'* at two opposite points near the edge of the said cover, whereby it may be readily and easily raised when required.

Referring now to Figs. 4, 7, and 8, I will describe the means adopted for maintaining the requisite pressure on the sealing-cover. This is effected by combining the use of a cross bar, E, a screw-bolt, X, and a padlock, *f*, therefor in a mode which I shall now describe. The cross-bar E, which is of wrought-iron, has a threaded hole at its center, through which the bolt X is screwed, the said bolt finding a bearing and centering in a small recess, *m*, in the cover. When the bolt is screwed up, the ends of the bar are let into recesses formed by lugs 5 in the sides of the man-hole casting, and there find a counter-bearing, as shown in Fig. 4. The screw-bolt has a flattened head, *g*, with an eye, *e*, drilled through it. The flattened part of the bolt, when screwed down snug, rises above the upper surface of the cross-bar, and when the flattened sides of the bolt are at right angles to the sides of the cross-bar, as in Fig. 8, an iron saddle-piece, *a*, having a rectangular slot, *i*, cut through it, is let down over the rectangular head of the bolt, which passes through the slot so that it straddles the bar. A padlock, *f*, is then attached to the bolt X, the hasp passing through the eye thereof. When this is done, the screw-bolt cannot be unscrewed to allow the bar to be removed and the sealing-cover lifted, giving access to the man-hole to unauthorized persons, except by breaking the padlock or other part of the closing device, (which constitutes a burglarious act,) because as long as the saddle remains astride of the bolt and bar the turning of the bolt is prevented by the sides of the saddle impinging against the sides of the cross-bar. The outer cover, C, is, when in place, flush with the surface of the ground, and does not in form differ from the form usually employed. It may, however, at one or more points of its periphery be provided with a recess or notch, *n*, wherein a suitable bar or tool may be entered to raise it up.

Instances frequently occur where a large wide conduit or a number of separate conduits, B', Fig. 9, must gain entrance with their numerous ducts into a subterranean working-chamber, but near the street-surface. In such cases a vault, A, of unusually large size, is essential, and it is found convenient to in-

crease the cross-section to five feet in order to accommodate the increased number of ducts.

The side walls of the working-vault being so far apart, it is found that in order to use the 5 man-hole frame hereinbefore described, and illustrated in Fig. 4, the masonry would require to be drawn in from about three feet below the surface for the purpose of contracting its mouth to the proper size to be surmounted 10 by the said frame, which is intended for the ordinary vault, having a width, usually, of about four feet; but to so contract or narrow in the brick-work at the top of the vault is inconvenient in construction and circumscribes the 15 head-room or working-space. I have therefore devised an extension-frame, G, as in Fig. 9, underlying the upper frame, D, to which it is bolted, and resting upon the top of the brick-work, into which a vertical flange, k, 20 enters to prevent the ingress of water. Thus the entire advantage of the increased width of the vault is utilized, the head-room is enlarged, and the conduits near the street-surface are enabled to enter. It is not essential to furnish 25 this construction with the drain-pipe o, leading below the lower frame into the surrounding earth, as the drain may be caused to pass through the joint between the castings at P.

I have not described the introduction of 30 electric cables or wires into these conduits, and it is to be understood that any of the well-known cables may be introduced by any of the ordinary modes.

Having now described my invention, I 35 claim—

1. The combination, in a man-hole frame or crown-piece for subterranean vaults or working-chambers, of a circular frame having a flat base-plate or flange resting on the vault-masonry, an internal or sealing cover therefor 40 having a curved flange or rim incasing permanently and adapted to tightly grip an elastic gasket of rubber tubing or analogous material, and constituting also a guide for the 45 cover, an upwardly-curved flange projecting from the inner wall of the circular frame and forming an annular channel to receive waste water, and serving also as a seat for the cover-flange and gasket, and a waste-pipe leading 50 from the said channel downward and through the masonry, as described herein.

2. The combination, substantially as described, in a man-hole-frame casting, of the annular channel 8 for waste water, having the 55 curved and upturned flange 6, the inner or sealing cover F, with the upturned edge r and flange curved on itself, so as to form the recess

10, and the gasket of india-rubber pipe fitted in and gripped by said recess to form a permanent and undetachable gasket, which rests 60 upon and is pressed by the frame-flange 6, whereby the tightness of the said inner or sealing cover, when in place, is insured.

3. In a cast-iron framing for underground-conduit vault covers, the inner or sealing cover 65 having a recess or step in the center of its upper surface, a cross-bar adapted to bear, when in place, upon lugs at opposite sides of the frame and having a threaded hole through its center, a threaded eyebolt with flattened head 70 adapted to engage with the threaded hole in said bar and to center in and bear upon the step on the cover, the slotted saddle adapted to be slipped over the said eyebolt when the latter is screwed home and to bestride the bar, 75 and a padlock for attachment to the said eyebolt, all in combination and co-operating as described.

4. The combination, with a working chamber or vault built with approximately-vertical 80 walls of masonry, of an extension-frame therefor, the said frame being provided with ribbed flanges resting upon the top of the vault-walls, and provided also with a horizontal flange at its upper side, which flange curves upward at 85 its inner edge, and a surmounting frame provided, as hereinbefore described, with the inner and outer covers and their locking devices, which surmounting frame rests upon the horizontal flange of the extension or base frame, 90 surrounding the inner upwardly-curved edge thereof, as shown, thus constituting an annular canal for waste water and affording a construction giving a greatly-increased head-space, dispensing with the necessity of contracting 95 the masonry, and adjusting an upper man-hole-frame of standard size to an enlarged square section of vault, substantially as described.

5. The combination, with the working-chamber 100 in an underground system of conduits, of pairs of ring-bolts fixed in the floor parallel to the respective walls thereof or opposite the conduit ends, and a snatch-block bar adapted to be inserted in the two ring-bolts of a pair, 105 for the purposes specified.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 29th day of June, 1887.

JOS. P. DAVIS.

Witnesses:

THOS. D. LOCKWOOD,
A. J. WAGNER.