No. 883,194. PATENTED MAR. 31, 1908.

K. O. GUTHRIE.

SEWER MOLD.

APPLICATION FILED NOV. 19, 1907.

3 SHEETS—SHEET 1.

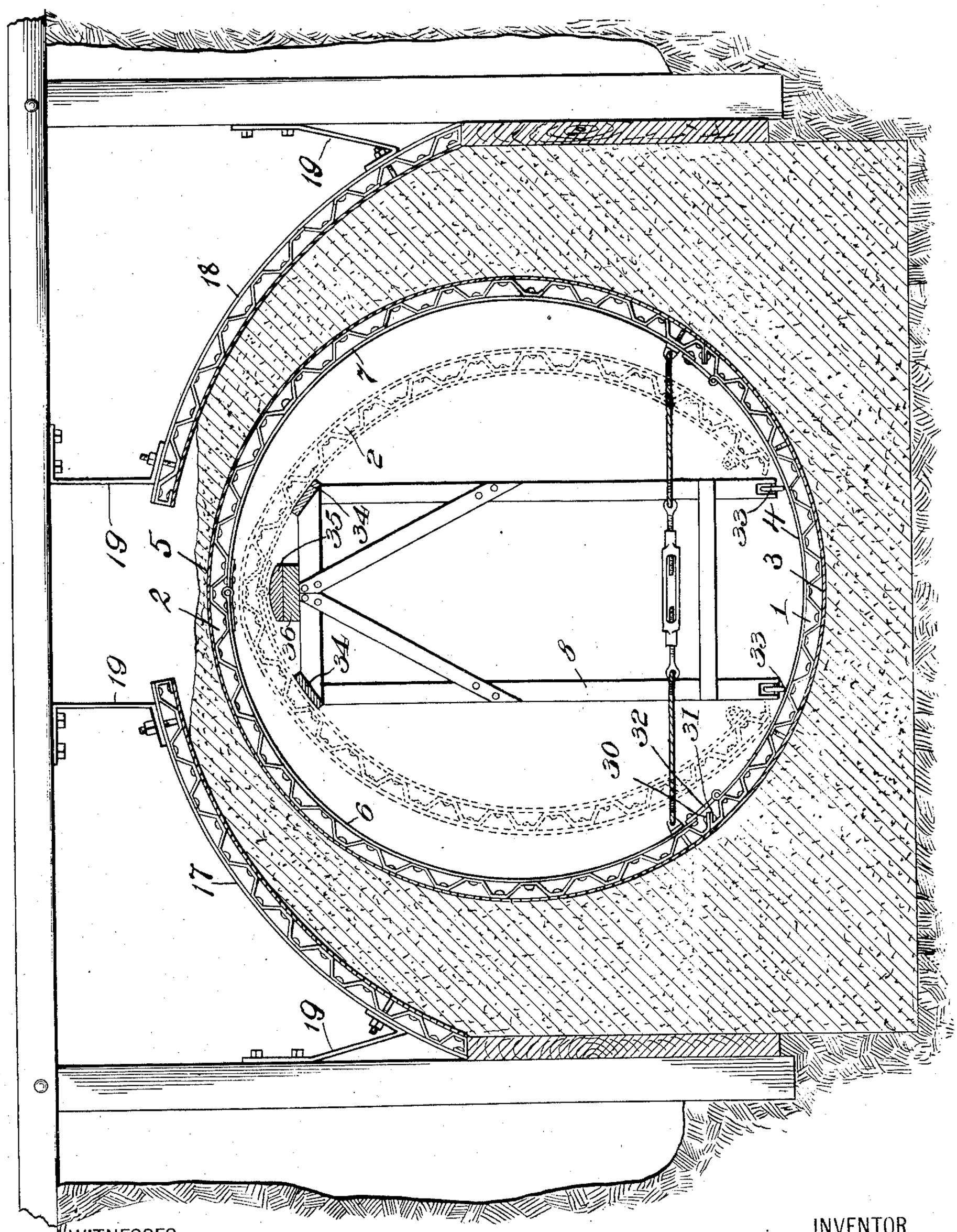


Fig. 1.

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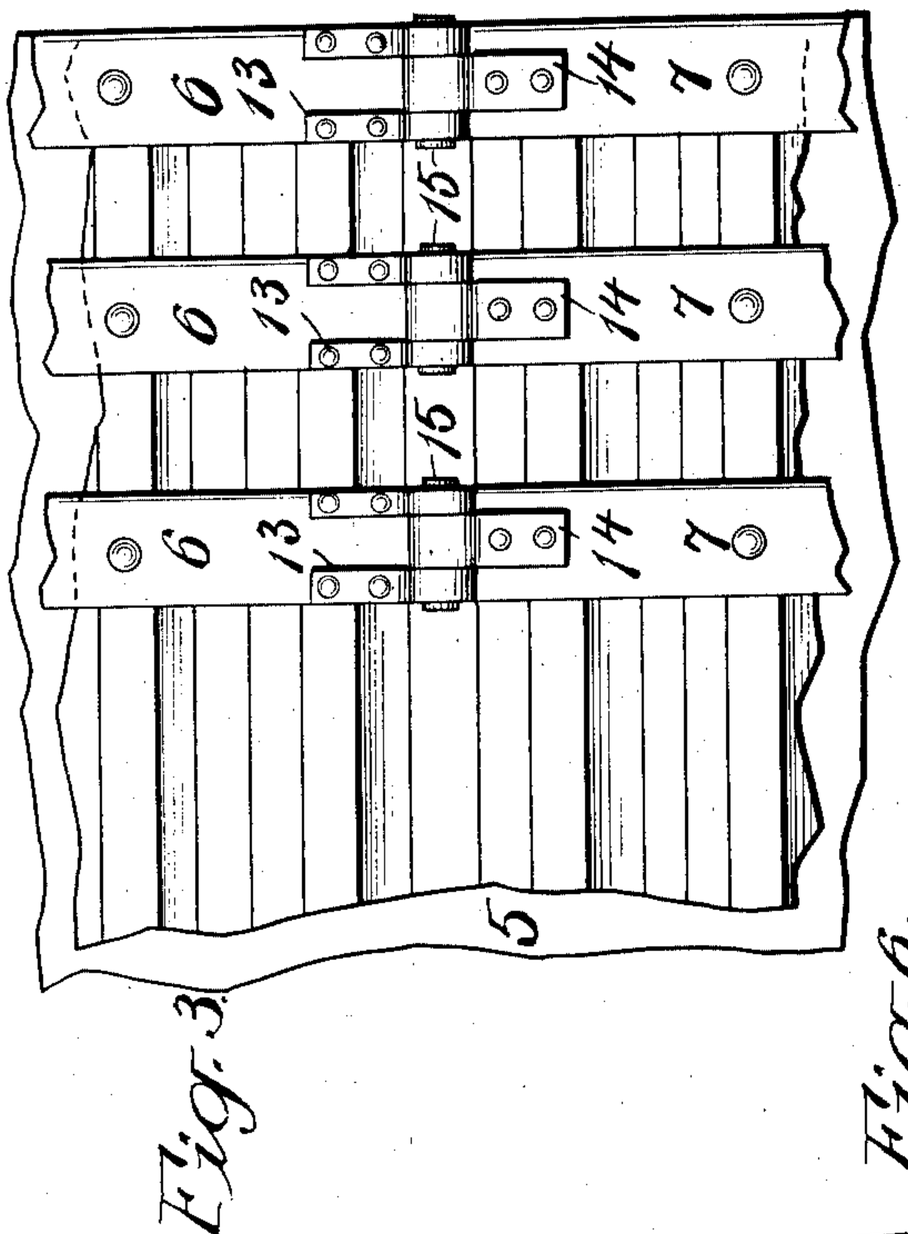


Fig. 3.

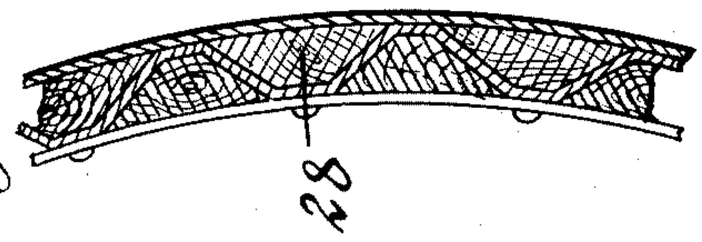


Fig. 5.

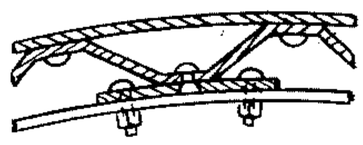

Fig. 4.

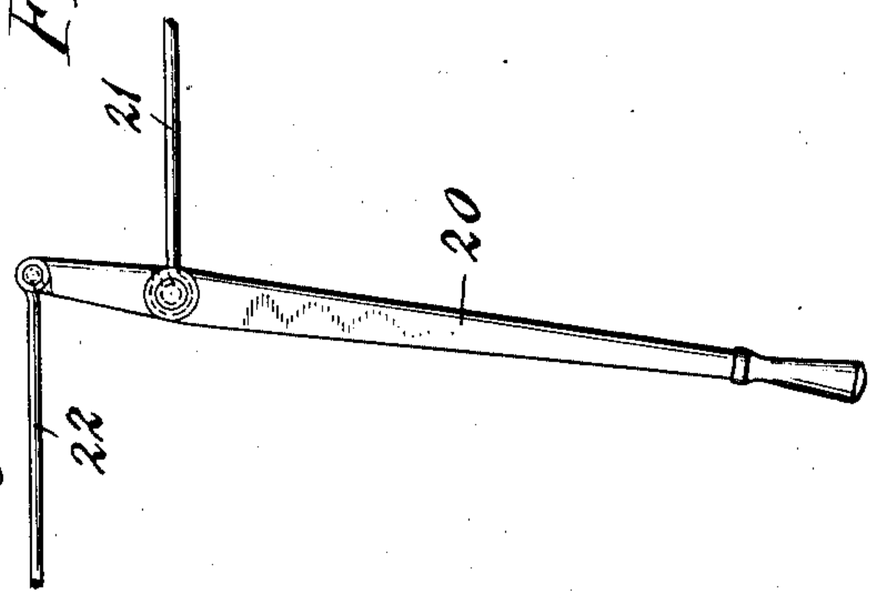


Fig. 6.

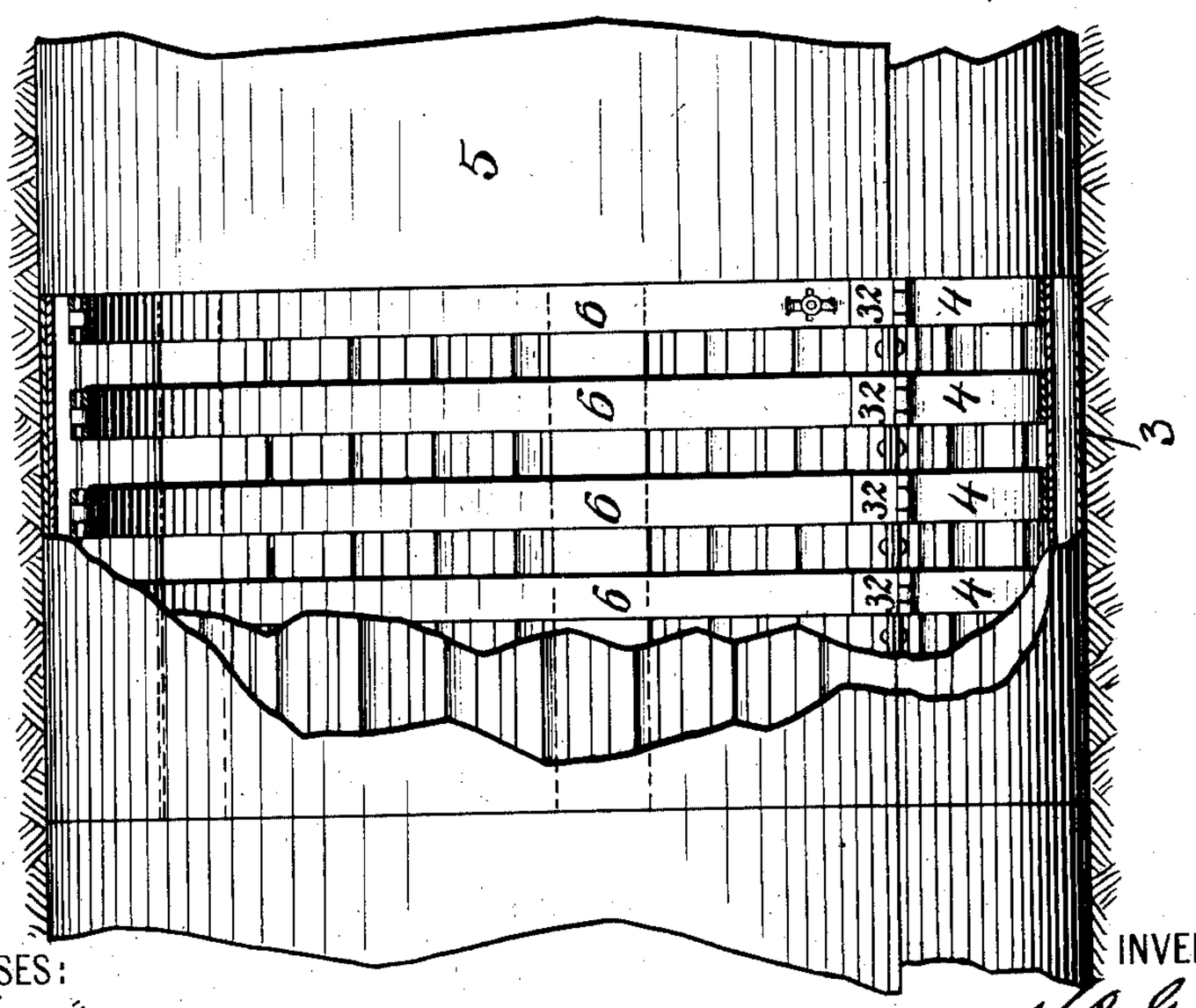


Fig. 2.

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3 SHEETS—SHEET 3.

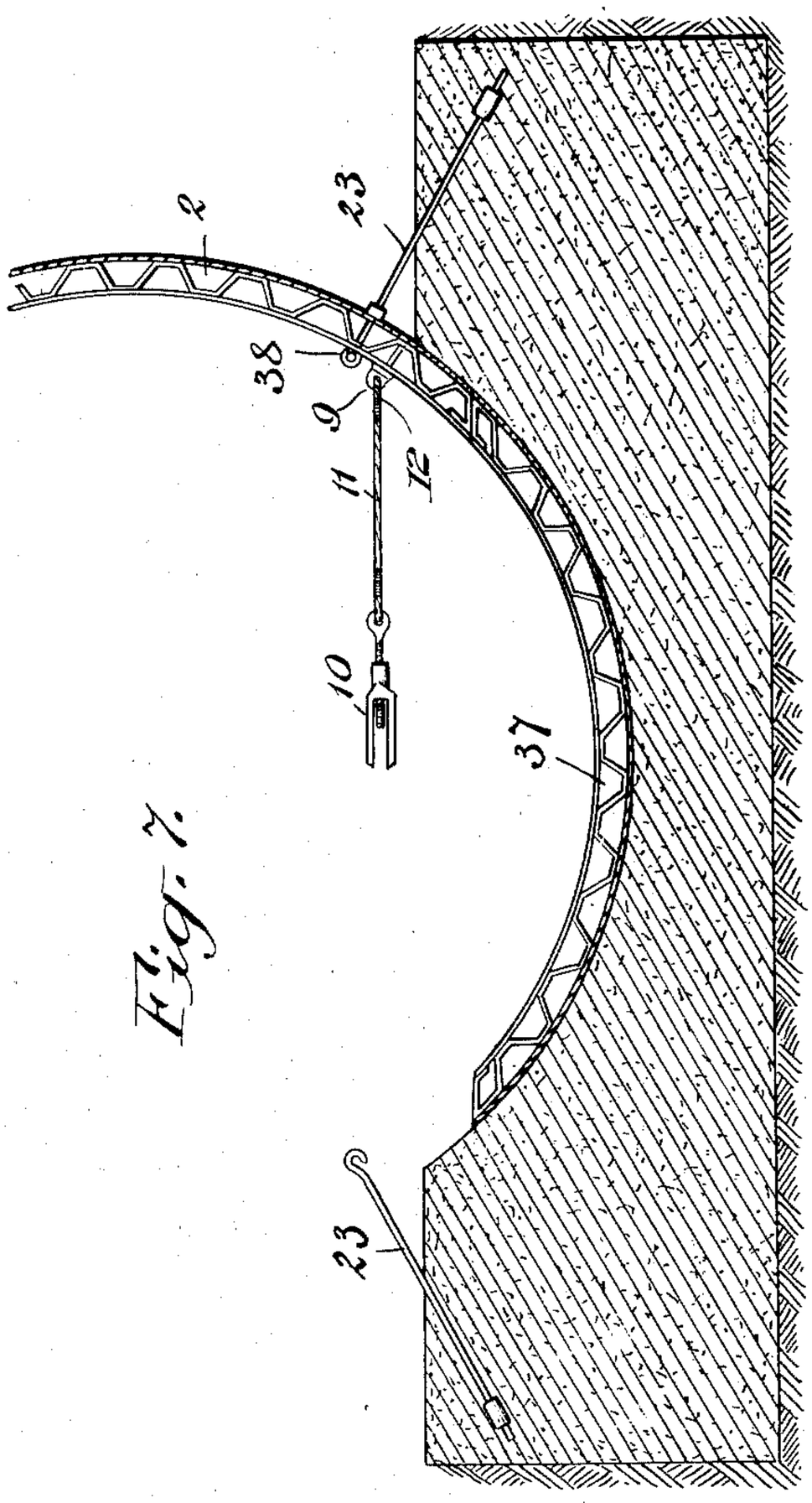


Fig. 7.

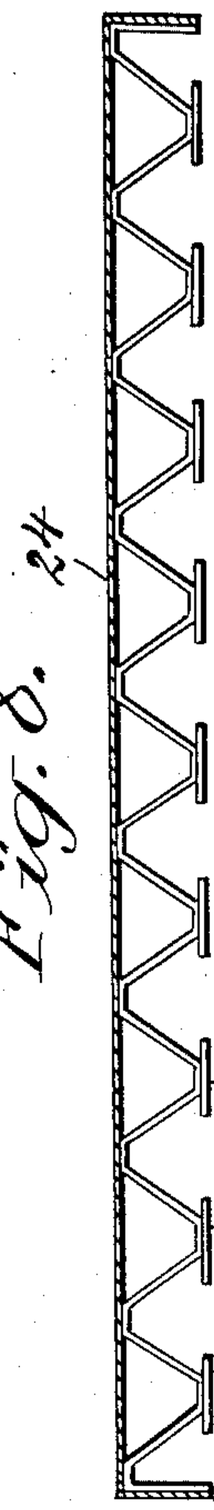


Fig. 8.

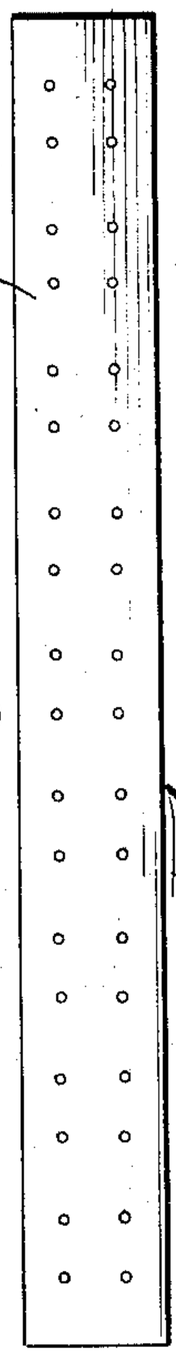


Fig. 9.

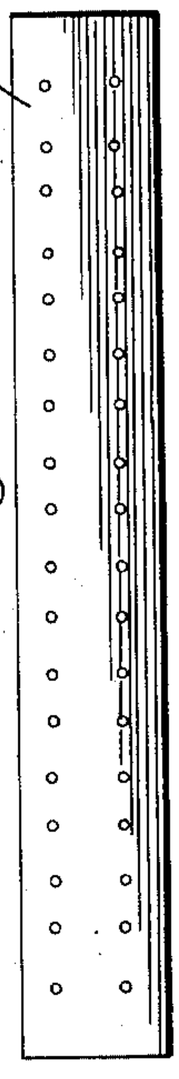


Fig. 10.

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# UNITED STATES PATENT OFFICE.

KEITH O. GUTHRIE, OF BROOKLYN, NEW YORK.

## SEWER-MOLD.

No. 883,194. Specification of Letters Patent. Patented March 31, 1908.

Application filed November 19, 1907. Serial No. 402,903.

*To all whom it may concern:*

Be it known that I, KEITH O. GUTHRIE, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Sewer-Molds; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to simplify and cheapen the construction of concrete sewers and the like, and the means by which this object is accomplished will be understood from the following description and accompanying drawings in which like reference numerals are applied to like parts throughout.

In the drawings, Figure 1 is a cross section of a sewer in process of construction, and in which my improved molds are employed. Fig. 2 illustrates a longitudinal portion of a mold, the parts being broken away to disclose the interior construction. Fig. 3 is a detail view of that portion of the interior construction which lies at the top of the mold. Fig. 4 is a detail of a modified form of the mold material in section. Fig. 5 is a similar view of another modification. Fig. 6 illustrates an available means for collapsing the mold. Fig. 7 illustrates a modified means for supporting the main mold section in place, and Figs. 8, 9 and 10 are detail views of the modification illustrated in Fig. 4 showing the parts of the mold material before they are assembled.

The interior cylindrical mold of Fig. 1 is made up of a shallow invert supplemental section 1 laid to form the bottom of the mold, and an independent parti-cylindrical main section 2 which extends over considerably more than half of the interior of the cylinder and together with the supplemental invert section 1 forms the completed mold.

The invert section of the mold is made up of an external flexible face-plate 3 which is supported and reinforced by a metallic structure consisting, in the particular embodiment illustrated, of a metallic sheet bent in the manner shown to form flattened portions which are riveted or otherwise secured to the flexible face plate, and diagonal reaches extending to similar flattened portions which are secured to a strengthening bar or chord 4 bent to the curvature of the mold. The whole forms a truss structure in which the flexible face plate is one chord, the bent metallic sheet corresponds to the web portion, and the stiffening member 4 constitutes the other chord. It will be observed that the face plate and the supporting and reinforcing metallic structure are themselves flexible and only become rigid when the stiffening member is secured in place, and that the diagonally extending reaches act, in the direction of the length of the mold, as plate girders. The whole forms a light, but extremely rigid, structure for forming the mold wall and at the same time a structure which lends itself readily to the formation of different curves, as will be more fully described hereinafter. The independent main section of the mold is similarly constructed of a flexible face plate 5, supported and reinforced by an arched metallic structure, similar to that of the invert section, stiffened by the stiffening members 6 and 7, but it extends over a considerably greater portion of the cylinder than does the invert section.

The main arched section of the mold may be secured to the supplemental section in the manner shown in Fig. 1 in which the supporting and reinforcing metallic portions of the two sections 1 and 2 terminate in flanges 30 and 31, which are temporarily bolted together when the mold is in place, and the stiffening member 4 has the hinged extensions 32 adapted to be temporarily bolted to the ends of the stiffening members 6 and 7. When the mold is to be collapsed these temporary bolts are removed. For the purpose of collapsing this main section of the mold there are secured to the inner surfaces thereof near the lower edges the projecting perforated studs 9 and when the mold is to be collapsed the turnbuckle 10 is fixed in the position shown by passing hooks 12 at the end of the ropes 11 through the perforations in the studs 9 and the turnbuckle is then screwed up to collapse the mold. To render the mold thus collapsible, the stiffening member must in effect be broken at the point of bend, and to this end the members 6 and 7 are provided with hinge members 13 and 14 which, when the mold is in position, are locked together by the pin 15 and when it is desired to collapse the mold, are unlocked by knocking out that pin, whereupon on the tightening up of the turnbuckle 10 the outer flexible plate and the supporting

and reinforcing metallic structure bend, while the stiffening member breaks at the hinge, thus causing the mold to fall away from the interior of the sewer structure. It will be observed that while the sewer is being formed the mold comprises merely a cylindrical wall of very inconsiderable thickness as compared with the total diameter of the inside of the sewer and it is, therefore, possible to remove the lower section, and the collapsed upper section, of the mold used to form a finished portion of the sewer, through an erected mold forming a portion of the sewer in which the cement has not yet been put in place or has not yet completely set. It is thus possible with my improved mold to carry out a continuous cycle of operations without interrupting the process while the cement sets. That is to say, a sewer may be built by supplying, let us say, a sufficient amount of mold to cover the work for five days without any interruption of the work. Then the first day's section of mold is set up and filled with the concrete and then the next day's section, and so on until at the end of the fourth or fifth day the first day's section will have set, whereupon the mold may be removed from the interior of that section and run through the sections of mold set up on the following days, and then set up again for the sixth day's work, and so on.

For the purpose of carrying and handling the main mold section after it is collapsed I prefer to employ a carriage like that shown in Fig. 1, in which the carriage 8 made up of the braced upright and transverse members, as shown, and having the rollers 33, supports the carrying frame made up of the longitudinally extending members 34 and 35 so placed and shaped as to support the main mold section when it is collapsed into the position shown in dotted lines. The member 35 rests on supporting blocks 36 and should preferably be blocked up to within about one inch of the under surface of the mold section when in place, so that when the section is first collapsed it will be caught by the member 35 without injury. Afterward the blocks should be knocked out to bring the member 35 down to the position shown in Fig. 1, when the carriage with the mold section carried thereby may be rolled through the subsequently set up sections to a new position of use.

It is sometimes desirable to set up an entire cylindrical mold, as shown in Fig. 1, suitably supporting it in position, and then fill in the concrete about the entire mold in one operation. Sometimes, however, it is preferable to first form a shallow trough of concrete, using for that purpose suitable mold sections like the invert sections 1, for example, but of slightly greater extent, and filling in the concrete to form the lower portion of the sewer, as shown in Fig. 7. The invert mold sections may then be removed and invert brace plates laid in the trough to support the ends of the main mold section. Such a brace plate, made of reinforced material of the kind hereinbefore described, is shown at 37. Such brace plates are made a foot or so in width and are laid at intervals in the trough, and their ends take under the edges of the main arched mold section to support it. As a supplemental or alternative means for holding the main arched mold section in place I may employ the tie wires or rods 23 having one end embedded in the concrete, and the free end passing through the wall of the main mold section and temporarily secured by a wedge or pin 38.

In Fig. 1 I have shown further arch-shaped sections 17 and 18 of mold forms, of a construction similar to that already described, but having a concave face instead of a convex face, and supported a sufficient distance above the cylindrical mold by the braces 19 extending from the structure which is ordinarily erected in the cut in which the sewer is formed. The purpose of these additional sections, as will readily be understood, is to form a curved upper surface for the cement structure of the sewer.

In Fig. 6 I have shown a lever for collapsing the mold instead of the turnbuckle arrangement shown in Fig. 1. In this figure the lever 20 has the rods 21 and 22 connected to it in the manner shown and these rods terminate in hooks such as 12, which may be placed in the perforations in the studs 9 and then the lever moved to the left, as illustrated in Fig. 6, to collapse the mold.

In Figs. 4, 8, 9 and 10 I have illustrated a modified construction of adjustable panel or mold section in which the face plate 24 is supported by a bent metallic structure which is similar to that already described, excepting that the flattened portions which are not attached to the face plate instead of being attached directly to a stiffening member, as shown in Figs. 1 and 2, for example, have attached to them the small foot plates 25 by countersunk rivets, or other appropriate means which will give a flat under surface to these plates. These plates have bolt holes suitably arranged therein and when it is desired to form a panel or mold section of a given curvature a stiffening member such as 26 or 27, shown in Figs. 9 and 10 is selected or manufactured having corresponding bolt holes so spaced with relation to each other that when these stiffening members are bolted to the plates 25 the desired curvature shall be given to the face plate 24. It will be understood that by this means any degree of concave or convex curvature may be given to the face plate and that a single plate may be used for different curvatures by changing the stiffening member. The

panels so formed may be closed at their lateral edges by bending down the face plate and supporting truss-structure as shown.

In Fig. 5 I have shown a modification applicable to any of the wall structures above described, the object of which is to add stiffness to the wall for particularly severe work. To this end wooden blocks 28 may be inserted within the wall structure so as to fill the spaces between the face plate and stiffening member and the diagonally extending reaches.

For ordinary service I prefer the specific embodiment of my invention in which the supporting and reinforcing metallic structure comprises a bent metal plate continuous in a longitudinal direction, and the stiffening members are in the form of ribs extending around the interior cylindrical surface and secured to the supporting and reinforcing metallic structure, as illustrated in Figs. 1 and 2, and placed close enough together to give the desired strength. I appreciate, however, that the supporting and reinforcing metallic structure may be interrupted at intervals, that is, may be made of strips instead of a continuous plate, and that on the other hand the stiffening members may be consolidated into a single interior plate instead of the ribs, as shown and described.

What I claim is:

1. In a mold for tubular concrete structures, a collapsible mold section comprising a flexible face-plate supported and reinforced by a flexible metallic web-section, in combination with a divided stiffening chord attached to the intermediate web-section to form the whole into a continuous truss structure except at the point of division of the chord, and means for temporarily uniting the parts of the divided stiffening chord to complete the continuity of the truss structure throughout, whereby when the parts of the stiffening chords are united the truss structure is complete and when the said parts are not united the mold section may be bent at the point of division and thereby collapsed, substantially as described.

2. In a mold for tubular concrete structures, a collapsible mold section comprising a flexible face-plate supported and reinforced by a flexible web-section of thin metal bent to form diagonally extending reaches and intermediate connecting portions, alternate connecting portions being secured to the face-plate, in combination with a divided stiffening chord secured to the other alternate connecting portions to form the whole into a continuous truss structure except at the point of division of the chord, and means for temporarily uniting the parts of the divided stiffening chord to complete the continuity of the truss structure throughout, whereby when the parts of the stiffening chord are united the truss structure is complete and when the said parts are not united the mold-section may be bent at the point of division and thereby collapsed, substantially as described.

3. In a mold for tubular concrete structures, a main collapsible mold-section comprising a flexible face-plate supported and reinforced by a flexible metallic web-section having a divided stiffening chord forming the whole into a continuous truss structure except at the point of division of the chord, and means for temporarily uniting the parts of the divided stiffening chord to complete the continuity of the truss structure throughout, in combination with a supplemental invert mold section adapted to support the edges of the main mold section and complete the mold, whereby there is formed a light tubular mold having an open interior through which other collapsed mold-sections may be carried, substantially as described.

4. In a mold for tubular concrete structures, an upper arched mold section comprising a flexible face-plate supported and reinforced by a flexible metallic truss web-section of thin metal bent to form diagonally extending reaches and intermediate connecting portions, alternate intermediate portions being secured to the face-plate, and a stiffening chord attached to the other alternate intermediate portions, to form the whole into an arched truss structure, in combination with means for supporting the lower edges of the said section in an invert mold, whereby there is formed a tubular mold having an open interior through which other collapsed mold sections may be carried, substantially as described.

5. In a mold for tubular concrete structures, an upper arched mold section comprising a flexible face-plate supported and reinforced by a flexible metallic truss web-section of thin metal bent to form diagonally extending reaches and intermediate connecting portions, alternate intermediate portions being secured to the face-plate, and a stiffening chord attached to the other alternate intermediate portions, to form the whole into an arched truss structure, in combination with a supplemental invert member adapted to support the lower edges of the upper mold section, whereby there is formed a tubular mold having an open interior through which other collapsed mold sections may be carried, substantially as described.

6. In a mold for tubular concrete structures, an upper main mold section extending over considerably more than half the mold and comprising a flexible face plate supported and reinforced by an arched metallic web-section made up of thin metal bent to form diagonal circumferentially extending reaches and intermediate connecting portions, alternate connecting portions being secured to the face-plate, and circumferentially extending

stiffening ribs, secured to the other alternate connecting portions, in combination with a supplemental invert mold section, the abutting edges of the mold sections having engaging flanges adapted to be secured together, whereby there is formed a self-supporting tubular mold through which the collapsed sections of previously set-up molds may be carried; substantially as described.

7. In a mold for tubular concrete structures, an upper main mold section extending over considerably more than half the tube and comprising a flexible face plate supported and reinforced by sheet metal extending in the direction of the axis of the mold section and bent to form diagonal reaches extending circumferentially of the mold section and intermediate connecting portions, alternate connecting portions being secured to the face plate, a series of two-part stiffening ribs extending circumferentially of the mold section and secured to the other alternate connecting portions and terminating near the upper central line of the mold section, and means for temporarily connecting the ends of the two part ribs, in combination with a supplemental invert mold section having a flexible face plate supported and reinforced by a like bent sheet-metal structure and continuous circumferentially extending stiffening ribs, the abutting edges of the mold sections having engaging flanges adapted to be secured together, and means for connecting the two-part ribs of the main section to the ribs of the invert section, whereby there is formed a self-supporting tubular mold through which the collapsed sections of previously set-up molds may be carried; substantially as described.

8. A mold section of the character described comprising a flexible metallic face-plate supported and reinforced by a flexible web-section of thin metal bent to form diagonally extending reaches and intermediate connecting portions, alternate connecting portions being secured to the face-plate, in combination with a series of flat plates, having bolt holes, secured to the other alternate connecting portions, and a stiffening flange, having properly spaced bolt holes detachably secured to the flat plates, whereby the stiffening flange may be removed and replaced by a similar flange having differently spaced bolt holes to change the curvature of the panel; substantially as described.

9. A mold section of the character described, comprising a flexible metallic face plate supported and reinforced by a flexible web-section of thin metal bent to form diagonally extending reaches and intermediate connecting portions, alternating connecting portions being secured to the face plate, in combination with a stiffening flange secured to the other alternate connecting portions, and blocks interposed between the web-section and the flanges and face plate; substantially as described.

10. A mold section of the character described, comprising a flexible metallic face plate supported and reinforced by a flexible web-section of thin metal bent to form diagonally extending reaches and intermediate connecting portions, alternate connecting portions being secured to the face plate, in combination with a stiffening flange and means for detachably connecting the stiffening flange to the other alternate connecting portions in such manner as to impose a curvature upon the face plate and supporting web-section, whereby the stiffening flange may be removed and replaced by a similar flange having differently arranged attaching means to change the curvature of the panel; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

KEITH O. GUTHRIE.

Witnesses:
WILLIAM H. DAVIS,
L. B. PENFIELD.