July 18, 1939. J. M. HARDESTY ET AL 2,166,632

METHOD OF CONSTRUCTING CONCRETE MANHOLES

Filed Dec. 5, 1936 2 Sheets-Sheet 1

FIG. 1

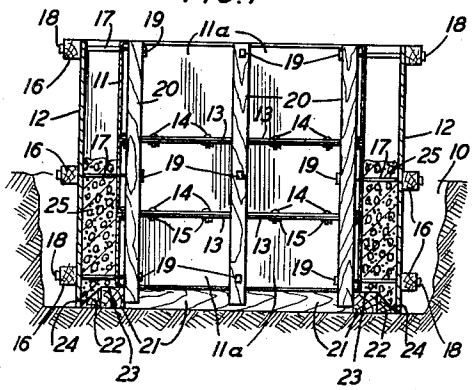

FIG. 2

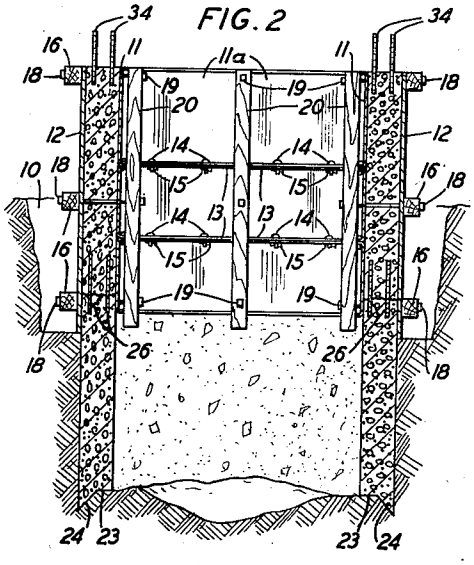

FIG. 3

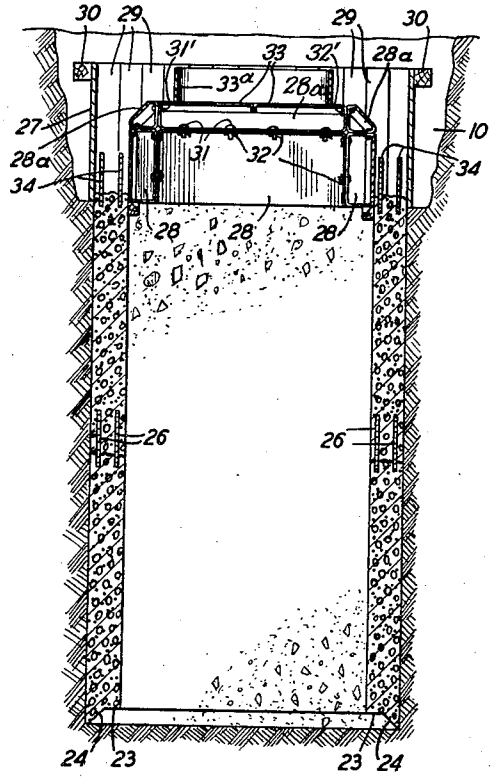

FIG. 4

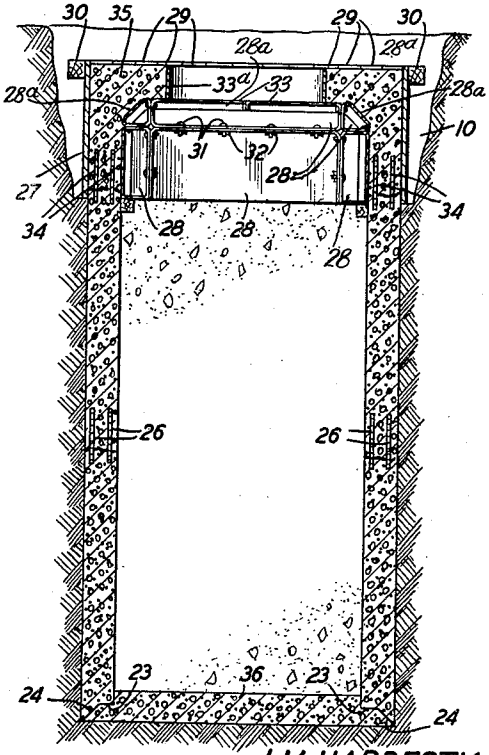

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FIG. 5

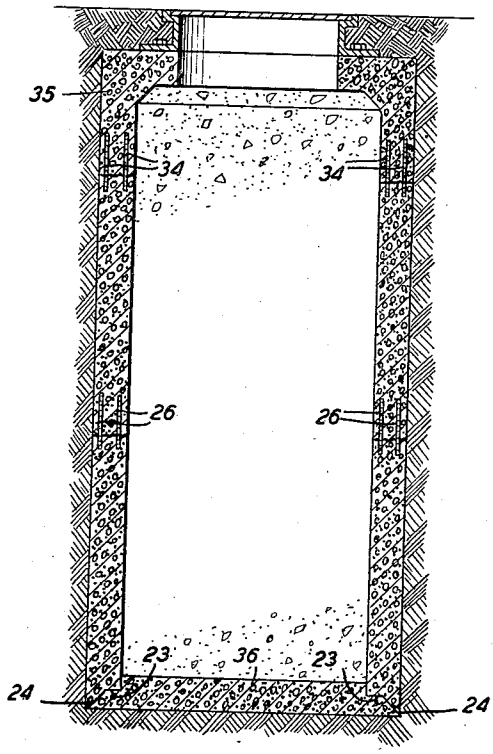


FIG. 6

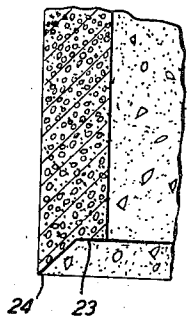
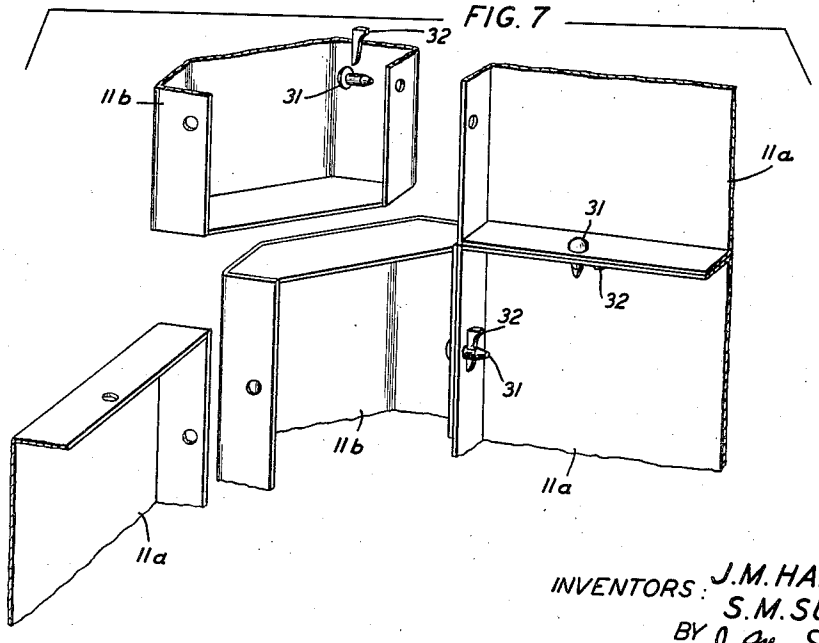


FIG. 7



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Patented July 18, 1939 2,166,632

UNITED STATES PATENT OFFICE

2,166,632

METHOD OF CONSTRUCTING CONCRETE MANHOLES

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Application December 5, 1936, Serial No. 114,388

3 Claims. (Cl. 61—40)

This invention relates to manholes and more particularly to the method for constructing manholes from concrete or other suitable cementitious material.

The object of the present invention is to provide a method of constructing concrete manholes where the type of soil is such that it is impossible to excavate to the proper depth without the danger of cave-in.

Another object of this invention is to provide a method of constructing concrete manholes which is readily adaptable for use in soil where there is a large amount of water.

A further object of this invention is to provide a method of constructing concrete manholes which provides a working space in the excavation with a minimum of obstructions and cross braces.

A still further object of this invention is to provide a method of constructing manholes which requires a minimum amount of form material, arranged in units that are convenient to handle and remove from the finished manholes.

In the construction of concrete manholes it is customary, first, to excavate to the proper depth to accommodate the proposed manholes. It is a common practice to erect in said excavation an inner form or a set of inner and outer forms for the reception of the concrete and, lastly, to pour the concrete mix for the entire manhole structure. Another practice in common use involves building the concrete floor prior to erection of the form work for the wall and roof structure and then pouring the concrete for the walls and roof in one operation. A still further practice involves pouring the floor, walls and roof in three separate operations at adequately spaced intervals.

Under any of these procedures a considerable amount of form material is needed, as the forms must be erected to the entire height of the proposed manhole and a considerable amount of cross bracing must be used. The forms may be fabricated from lumber cut on the job or may be factory built in sections that can be assembled on the job and disassembled to permit removal after the concrete has set. In the former case the forms must be individually built for each manhole and in the latter case the forms permit no variation in the shape of a manhole, such as may be dictated by subsurface obstructions, and must be supplied complete in as many sizes as are required by field practice.

Under favorable conditions; that is, when the soil is clay or is other wise fairly firm, any of the above procedures result in a satisfactory manhole, although where locally cut form material is employed it has practically no re-use. However, under unfavorable soil conditions such as loose sandy soil or where water is encountered in the excavation, it is necessary not only to provide sheeting and shoring around the excavation walls to prevent the soil from caving in during the digging operation and while the forms are being set, but when water is encountered, it is necessary to provide additional means for keeping the water out of the excavation.

Unfortunately, in the construction of underground conduit lines it is not always practicable or permissible to select a location for the manhole which is entirely suitable from a construction viewpoint, as the position of the manhole is generally determined by other conditions.

Confronted with this problem applicants have provided a method of constructing concrete manholes which is particularly adaptable for use in soils the character of which makes the customary practices both very expensive and very difficult to use.

In accordance with this invention, applicants have provided a method of constructing concrete manholes which contemplates casting the wall section of the manhole in successive horizontal units, at ground level or partly below the surface of the ground. After the first unit or section has been poured and has hardened, the forms are removed and the soil excavated from the inside of the wall section. This permits the initial section or unit to settle down as the excavation proceeds. When the initial section has reached the proper depth the forms are again positioned and a second section is cast on top of and integral with the first section. The forms are again removed and the earth excavated to allow the combined first and second sections to settle further into position. Sections are built up successively in this way until the specified wall height of the manhole has been constructed. The roof and floor sections of the manhole are formed after the manhole wall structure has settled down to its final position. In some cases it is necessary to employ pumps to keep the water level down in the excavation, the cast sections of wall serving as a caisson in the process.

Referring now to the drawings:

Fig. 1 is a view in cross-section and illustrates the first step in the casting of the first unit with the forms in place in a shallow excavation and the space between the forms partially filled with concrete;

Fig. 2 is a view in cross-section and shows the first unit completed and sunk partially below the surface with the inner forms repositioned for the second unit which is shown as having been poured;

Fig. 3 is a view in cross-section and shows the two sections sunk below the surface of the ground with the forms in place ready to form the remainder of the wall section and the roof section;

Fig. 4 is a view similar to Fig. 3, but includes the floor and roof sections;

Fig. 5 is a cross-sectional view of the completed manhole with the forms removed and the earth replaced;

Fig. 6 is a fragmentary view, in section, illustrating the lower edge of the first unit so shaped that it cuts readily through the earth as the earth is excavated from underneath the wall; and

Fig. 7 is a fragmentary perspective view of the corner and end sections of the forms which applicants have found desirable for use in their method of constructing concrete manholes.

In accordance with our improved method of manhole construction, we provide, as shown in Fig. 1, a shallow excavation **10**. While this is desirable it is not absolutely necessary, but applicants have found that where a slight excavation can be made it is desirable and more convenient.

Our forms, which comprise inner and outer sections **11** and **12**, are constructed out of metal and wood, respectively. However, either or both may be made of metal. The forms shown in the drawings and the material for constructing these forms, form no part of this invention, but were found by the applicants to be very satisfactory.

The form **11** comprises a number of sheet steel sections **11***a* which are provided with flanges **13** and held together by means of pins **14** and wedges **15** similar to the pins **31** and wedges **32** shown in Fig. 7. The wood form or outer form **12** is composed of a number of vertical boards **29**, see Fig. 3. These are secured to the horizontal stringer members **16** which are located on all four sides of the form. The inner and outer forms **11** and **12** are secured in spaced relation by means of the spacer bars **17**, which have threaded apertures on each end thereof and which are engaged by the studs **18** which pass through the horizontal members **16** and by the studs **19** which pass through the vertical members **20** on the inside of the steel form **11**.

Located between the forms **11** and **12** and at the bottom thereof are the wooden members **21** and **22**. These members are so shaped that a shoulder **23** and a knife edge portion **24**, as shown in the various figures and in detail in Fig. 6, are provided. The shoulder portion **23** provides a keying means for the floor section of the manhole when it is poured in place, as shown in Figs. 4 and 5. The knife edge portion **24** permits the concrete wall section to settle down into the earth as the earth within the four walls is removed, by providing a cutting edge which offers a minimum amount of resistance to the earth.

As the forms **11** and **12** are being erected, metal reinforcement for the concrete wall structure so positioned as to provide against excessive tensile and compressive stresses in the concrete, may be provided if required. When the forms **11** and **12** have been secured in place, as shown in Fig. 1, the concrete **25** is poured therebetween until a sufficient amount to fill the space has been introduced. When the concrete has reached its proper height, that is, to the top of the forms **11** and **12**, a series of iron dowel pins **26** are embedded in the soft concrete and allowed to project above the surface thereof a short distance. This is for the purpose of tying the next succeeding section or layer of concrete to the previously formed section.

When the concrete between the forms **11** and **12** has hardened these forms are removed and also the strips **21** and **22**. This leaves the cutting edge **24** in contact with the earth in the depression **10**. After all the forms and strips have been removed the earth on the inside of and under the walls is removed. As the earth is removed the cutting edge **24** will bite into the earth and will work itself downwardly thereby permitting the wall section of the manhole to travel downwardly as the hole is deepened. When the hole has been the desired depth and the structure has settled down, the forms are again placed in position and the next succeeding layer of concrete is poured, as shown in Fig. 2.

As shown in Fig. 3, the hole has been further excavated to permit the increased height of wall section to be lowered into the hole. There is no limit as to the number of sections which may be constructed, one upon the other, but for simplicity the applicants have illustrated only two and, as shown in Fig. 3, the second section is below the surface of the ground and the forms **27**, **28** and **28***a* and **33** for forming a short side wall section and the roof section are in place. Like the other forms, the forms for constructing the short side wall section and the roof are constructed of wood and steel, respectively, the outer form **27** comprising a number of vertical boards **29** held together by means of the stringers **30**, while the inner wall form **28** comprises a number of unit sections held together by means of the pins and wedges **31** and **32**. A circular member or collar **33***a* is positioned on the roof form **33**, which in turn is secured to forms **28** and **28***a* by pins and wedges **31**, **32**, **31′**, **32′** to provide an aperture for access to the manhole. As in the previous section, dowel pins **34** are provided for tying the roof section **35** to the wall.

As shown in Fig. 4, both the roof section **35** and the floor section **36** have been poured and after the concrete has hardened the forms **27** and **28**, **28***a*, **33** and the collar **33***a* may be removed and the soil replaced as shown in the completed manhole structure. See Fig. 5.

Applicants have found that an inner form made of steel, and in sections, as shown in Fig. 7, not only is very convenient to use due to its ease of handling, but provides a sectional form in which the various sections may be interchanged to meet the necessary requirements. As shown in Fig. 7, which is a portion of a corner section, the members are held together by means of pins and wedges **31** and **32**, the sections **11***a*—**11***a* being the side plates and the portions **11***b*—**11***b* constituting the corner sections.

While the applicants have shown and described a particular type of form, it is not their intention to limit their method of constructing concrete manholes to any particular type of form as it is readily apparent to any one skilled in the art that various other types of forms may be used.

What is claimed is:

1. A method of constructing manholes and similar sub-surface structures of concrete which comprises positioning on top of the ground two sets of forms, one within the other and spaced apart from each other, securing a roof form to

the top of said inner form, filling the space between the inner and outer forms with concrete to provide a wall section and covering the roof form with concrete to provide a ceiling for said manhole, removing the forms after the concrete has hardened and then removing the soil from within said wall section and from underneath the edges thereof to permit the structure to settle down into the soil.

2. A method of constructing manholes and similar sub-surface structures of concrete which comprises positioning on top of the ground two sets of forms, one within the other and spaced apart from each other, securing a roof form to the top of said inner form, filling the space between the inner and outer forms with concrete to provide a wall section and covering the roof form with concrete to provide a ceiling for said manhole, removing the forms after the concrete has hardened, removing the soil from within said wall section and from underneath the edges thereof to permit the structure to settle down into the soil and forming a floor for said manhole by pouring concrete into the interior thereof.

3. A method of constructing manholes and similar sub-surface structures of concrete which comprises positioning on top of the ground two sets of wall forms, one within the other and spaced apart from each other, filling the space between the forms with concrete to provide a wall section, allowing the concrete wall section to harden, removing the forms from said section, removing the soil from within said wall section and from underneath the edges thereof to permit the wall structure to settle, positioning another set of forms on said hardened section, filling the space between said forms with concrete to form another wall section, allowing the concrete wall section to harden, removing the forms from said section, removing the soil from within said wall section and from underneath the edges thereof to permit the wall structure to settle, positioning another set of forms on said hardened section, filling the space between said forms with concrete to form another wall section, securing a roof form to the top of the inner wall form, filling the space between the roof form and the outer form and covering the roof form with concrete, allowing the concrete to harden and removing the forms therefrom.

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