

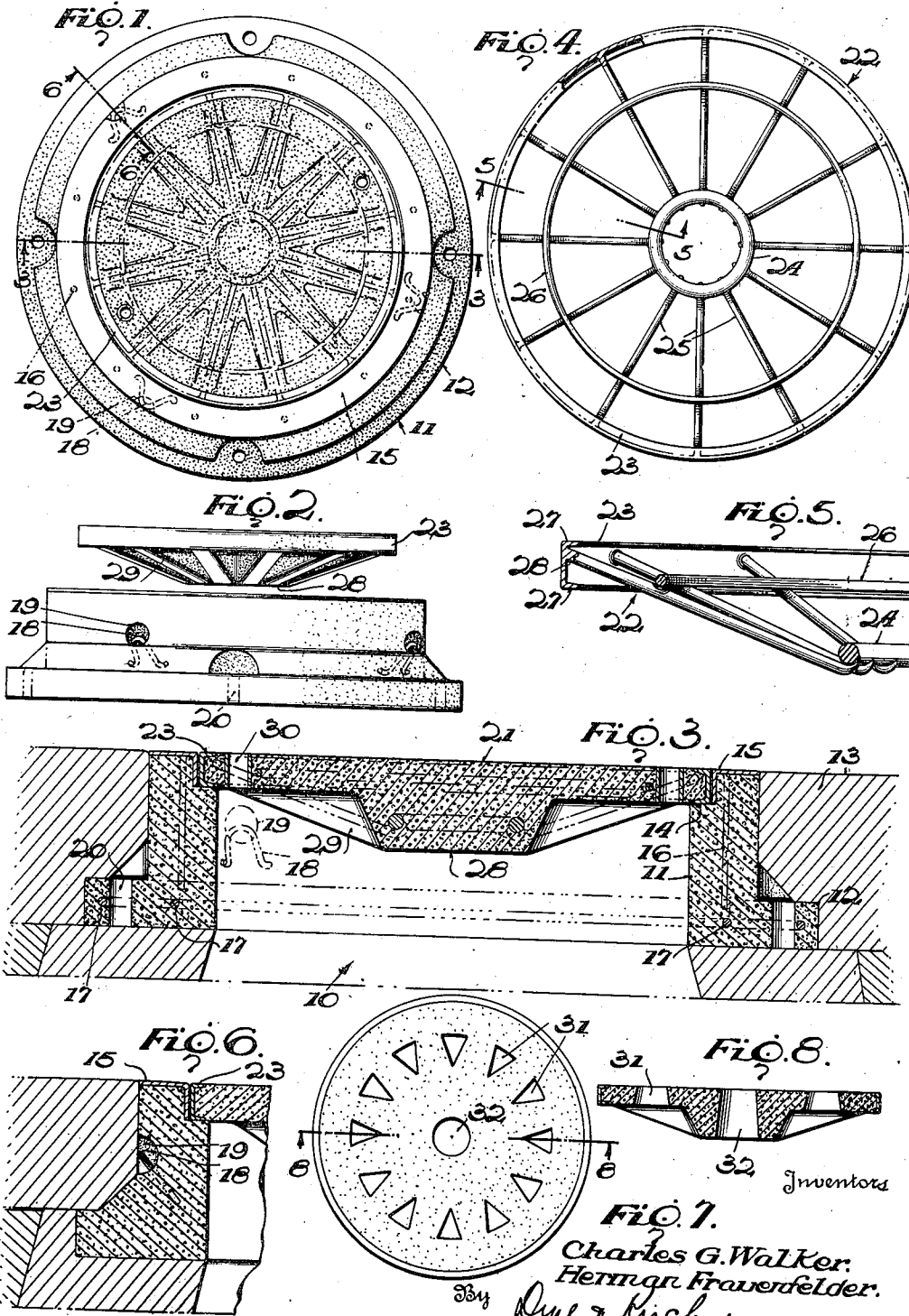
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COVER FOR MANHOLES OR THE LIKE

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COVER FOR MANHOLES OR THE LIKE

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Our invention relates to covers for manholes and the like and more especially provides certain improvements by which such covers may be made with a minimum of metal without sacrificing strength, durability, economy of manufacture, ease of handling, lightness of weight, and a desirable minimum of bulk.

Generally speaking these and other important objects are accomplished by fashioning the cover mainly from concrete or the like and providing it with an outer metallic rim and an inner skeleton metallic reinforcing assembly of novel type which cooperates with the concrete and the rim in such a way that the rim and concrete take all loads in compression while the inner metal takes all loads in tension.

In addition to the saving of metal as compared with conventional all-metal covers or the best composite metal and concrete covers of the prior art known to us, our new construction possesses certain important advantages which give it structural and functional superiority. Reference to some of these advantages has been made hereinabove, and others will be apparent to those skilled in the art from a consideration of the following specification taken in conjunction with the annexed drawing which illustrates the invention in certain embodiments which have been reduced to actual practice, thoroughly tested and found to be entirely satisfactory, so that they are at present preferred by us.

In the drawing,

Figure 1 is a top plan view of a cover constructed in accordance with the principles of the present invention, with its reinforcing assembly shown in broken lines. The cover is shown mounted in place in a manhole frame.

Fig. 2 is a side elevational view of the frame and cover, these two parts being shown vertically separated.

Fig. 3 is a diametric vertical section through the associated frame and cover taken on the line 3-3 of Fig. 1, showing the parts in a portion of pavement.

Fig. 4 is a top plan view of the reinforcing frame or assembly used in the cover.

Fig. 5 is a perspective view of part of the reinforcing frame or assembly with one edge of the view cut along the section line 5-5 of Fig. 4.

Fig. 6 is a detail sectional view taken on the line 6-6 of Fig. 1.

Fig. 7 is a top plan view of a modified form of cover.

Fig. 8 is a diametric section taken on the line 8-8 of Fig. 7.

Referring to the drawing, and first to Fig. 3, the reference numeral 10 designates any conventional vault or chamber in a street, sidewalk or the like, surmounted by a manhole frame 11, here shown as of generally hollow cylindrical

shape but provided in its lower portion with an outwardly radial base flange 12 overlaid by a paving surface 13. The top inner margin of this frame is formed with a seat indentation 14 for a manhole cover, as is conventional in these constructions. The frame may be made mainly of concrete or the like and details of its construction may include a protective edging of metal for its top, metal reinforcing means, embedded eyes for engagement by lifting hooks, vertical holes in its bottom flange, etc. In the illustrated frame the top edge is protected by a hoop or ring 15 of angle iron with its two flanges set respectively in the vertical wall of the cover seat 14 and in the extreme top surface of the frame which is approximately flush with the pavement surface 13. If desired, this edging may comprise merely a flat annulus for protecting only the top surface of the frame, or it may be of U-shape in cross section to protect not only the extreme top surface of the frame but also the vertical surface of the cover seat, or it may be of Z-shape in cross section to protect also the horizontal surface of the seat.

In the illustrated construction vertical reinforcing stirrups 16 depend at circumferentially spaced intervals from the ring 15 and annular bar reinforcing members 17 are embedded in the lower portion of the frame. Stout wire eyes 18 project from cavities 19 in the outer side of the frame, and holes 20 are cored through the base flange. All these details may be varied widely.

The cover, to which this invention particularly relates, comprises essentially a unitary or monolithic slab 21 of concrete or other cementitious or plastic material which can be cast and caused to harden. Hereinafter specific suggestions for a practical material will be given, but it is to be understood that a very considerable choice is available and that the invention is not to be considered limited to the use of any specific substance. Let it be assumed for the purposes of this illustration that the slab 21 is a Portland cement concrete mix of the general type used for paving.

Embedded in the slab 21 is the reinforcing framework or assembly generally designated 22 and best shown in Figs. 4 and 5. The illustrated cover is of circular shape, and consequently the reinforcing frame is generally wheel-like in pattern. As will be observed, its principal elements include an outer ring or rim 23, an inner ring 24, and radiating, circumferentially spaced rod 25 which are fixed at their inner ends to the ring 24 and at their outer ends to the ring or rim 23. An intermediate ring 26 may if desired be included, in which case the rods are secured to such ring as by welding.

The inner ring or the inner and intermediate rings are concentric with the outer ring, here-

inafter called simply the rim, and the inner ring is spaced below the plane of the rim. The rods may be made fast to the rim and to the inner ring in any practical way, as by the welds indicated in the drawing. A convenient connection between the rods and the inner ring consists in hooking the ends of the rods around the ring and welding the metal, as shown in Fig. 5.

In the illustrated embodiments of the invention the rim is made of channel stock, formed into a ring with the channel opening inwardly. It could be made of strap iron, in which case the rim would not have either of the inwardly directed flanges 27 but would have only its web 28, or it could be made of angle stock, in which case it would have its web and one flange. We prefer to use channel stock and to affix the rods to the web of the channel, as shown.

To make the cover, the reinforcing framework 22 is placed in a mold (not shown) whose cavity is shaped with surfaces to engage snugly and seat the web 28 and the bottom flange 27 of the rim. The remainder of the mold cavity is formed to produce the casting shape shown possessed by the cover slab in Fig. 2. That is to say, the cavity has a depressed circular center with walls sloping up therefrom to about the level of the surface on which the lower flange 27 rests so that the center of the mold cavity is a pocket of inverted frusto-conical or frusto-pyramidal shape to give the casting the central boss 28. Between this pocket and the outer wall of the cavity, the mold bottom is channeled radially upwardly and outwardly to form on the casting the stout ribs shown at 29.

The mold cavity is so proportioned with respect to the reinforcing framework 22 that when the framework is set in the cavity, with the lower flange 27 resting on the cavity seat formed to receive it, the inner ring 24 of the framework will be spaced somewhat above the mold bottom which forms the central pocket and each of the rods 25 will be aligned along the center of one of the mold channels which will form the ribs 29. A suitable mix is then poured into the mold and leveled off flush with the top flange 27 of the framework. Preferably the mold is vibrated or otherwise treated to minimize voids and make the casting as dense as possible. Upon hardening of the casting the mold is stripped and if necessary the casting is cured in any suitable way. The result is a unitary slab as shown in Fig. 2, having a generally flat top, or one that is slightly crowned if desired, edged by the rim 23, and having a bottom configured by ribs 29 and a central boss 28 encasing respectively the rods 25 and the inner ring 24 of the reinforcing framework. This is the complete cover of Figs. 1, 2 and 3, except for such incidental details as the lift openings 30 which may be formed by inserting short pipe lengths in the mix to serve as liners.

In place in a pavement as shown in Fig. 3, the action of the cover in response to traffic loads is analogous to that of a king post truss. That is to say, a vertical load on the cover is resisted by the concrete slab acting vertically in compression, by the inner ring 24 acting in circumferential tension, by the rods 25 acting in axial tension, by the rim 23 resisting contraction, and by the body of concrete positioned inwardly of the rim acting in compression to resist the tendency of the rim to compress it. Since the metal, which is preferably iron or steel, has inherently high tensile strength, while the

concrete has inherently high compressive strength, it will be appreciated that the composite structure is exceedingly strong and resistant to load strains.

The structure shown in Figs. 7 and 8 differs from the previously described embodiment in that certain limited areas of the slab are cored out between rods 25 to provide openings 31 and the center is similarly provided with an opening 32, so that this cover may serve as a grating or drain, or it may be used as a ventilating manhole cover or a catch basin cover. It will be appreciated that the skeletonized arrangement of the reinforcing framework is well adapted to permit such openings as these to be formed in the casting, while the fact that the concrete reacts in compression to loads encountered in service means that the strength of such a cored out construction is not appreciably impaired. In cases where the intermediate ring 26 is omitted, the openings 31 may be made considerably larger than as shown in Figs. 7 and 8.

While of course specific dimensions and proportions are no part of the inventive concept, we think it will be helpful to this disclosure to state some of the principal dimensions to which we have made and tested certain commercial embodiments.

In a cover for a 24 inch opening, the external diameter of the rim 23 is 23 $\frac{3}{8}$ inches. The channel stock from which this rim is formed is 1 $\frac{1}{2}$ inch overall between outer surfaces of the flanges 27, so that the outer edge thickness of the cover is 1 $\frac{1}{2}$ inch. The center thickness is 4 inches and the boss 28 is 6 $\frac{1}{2}$ inches in diameter at its bottom face. The rods 25 are twelve in number as shown and are made of $\frac{3}{8}$ inch bar stock. The inner ring 24 is of $\frac{3}{4}$ inch stock, 6 inches in diameter. These dimensions will indicate the approximate proportions in which a thoroughly practical commercial embodiment of the invention may be made.

We have used with success as the material for the slab a mix known as 7500 pounds per square inch concrete, which consists of 4 parts accurately graded aggregate, 1 part Portland cement, and $\frac{5}{8}$ part water, all by weight. This casting was cured by keeping it damp for 21 days.

In the illustrated embodiments the covers are shown as of circular shape, but it will be obvious that other shapes may be designed without departing from the principles of the invention. Hence the terms "ring" and the like used in this specification and in the appended claims are not to be taken as necessarily implying circular shape.

Since it is possible to incorporate in the new cover a peripheral edge thinness which is, we believe, unprecedented in concrete manhole covers, the new construction is well adapted to replace cast iron and other all-metal covers, which are commonly made with edges approximately 1 $\frac{1}{2}$ inch thick. Frame seats already in place made to receive such covers will of course equally well receive the new covers.

The essential principles of the invention are defined by the appended claims. The specific features of construction explained hereinabove and shown in the drawing may be modified within those principles, and all such modifications to the extent that they are within the spirit of the invention as pointed out by the claims are to be deemed within the scope and purview of the claims.

We claim:

1. A cover for a manhole or the like comprising a reinforcing structure including a continuous outer metallic rim, an inner metallic ring concentric with the rim and below the level thereof, and a plurality of circumferentially spaced radial metallic rods inclined upwardly from the ring to the rim rigidly connected at their opposite ends to the rim and ring respectively, and a filling of concrete covering the ring and rods and adapted to be placed in compression by loads on the cover.

2. A cover for a manhole or the like comprising a reinforcing structure including a continuous outer metallic rim, an inner metallic ring concentric with the rim and below the plane thereof, and a plurality of circumferentially spaced radial metallic rods rigidly connected at their opposite ends to the rim and ring respectively, and a filling of concrete covering the ring and rods and peripherally bounded by the rim, said filling having a substantially plane upper surface and being appreciably thicker at its central portion than at its periphery, whereby the rods are tensioned and the filling is compressed by loads on the cover.

3. A cover for a manhole or the like comprising a reinforcing structure including a continuous outer metallic rim, an inner metallic ring concentric with the rim and below the plane thereof, and a plurality of circumferentially spaced radial metallic rods rigidly connected at their opposite ends to the rim and ring respectively, and a filling of concrete covering the ring and rods and peripherally bounded by the rim, said filling having a substantially plane upper surface and being appreciably thicker at its central portion than at its periphery, each rib enclosing one of the rods of the reinforcing structure, whereby the rods are tensioned and the filling is compressed by loads on the cover.

4. A cover for a manhole or the like comprising a reinforcing structure including a continuous outer circular metallic rim of channel shape, an inner metallic ring concentric with the rim and below the plane thereof, and a plurality of circumferentially spaced radial metallic rods having their inner ends secured to the ring to resist outward pull and having their outer ends welded to the web of the rim, and a filling of concrete covering the ring and rods and extending into the rim, said filling having a substantially plane upper surface and being appreciably thicker at its central portion than at its periphery and including ribs outstanding from its under surface, each rib enclosing one of the rods of the reinforcing structure, whereby the rods are tensioned and the filling is compressed by loads on the cover.

5. A cover for a manhole or the like comprising a unitary concrete slab having a thickened central portion, a relatively thin peripheral edge, a substantially flat upper surface and a plurality of ribs on its under surface radiating from the central portion upwardly and outwardly to said peripheral edge, in combination with a metallic reinforcing framework comprising a continuous rim bounding and seating said edge of the slab, a ring embedded in the central portion of the slab below the plane of the rim, and circumferentially spaced radiating rods fixed to the ring and to the rim and each embedded in a rib, whereby a load on the upper surface of the slab

places the concrete in compression both axially and radially and places the rods in tension.

6. A cover for a manhole or the like comprising a unitary concrete slab having a thickened central portion, a relatively thin peripheral edge, a substantially flat upper surface, and portions of its under surface upwardly and outwardly inclined from the central portion to said peripheral edge, in combination with a metallic reinforcing framework comprising a continuous rim bounding and seating said edge of the slab, a ring embedded in the central portion of the slab below the plane of the rim, and circumferentially spaced radiating rods fixed to the ring and extending upwardly and outwardly to fixed engagement with the rim, whereby a load on the upper surface of the slab places the concrete in compression both axially and radially and places the rods in tension and the rim in compression.

7. A skeleton metallic reinforcing framework adapted to be embedded in a concrete cover for a manhole or the like comprising a continuous outer rim, an inner ring concentric with the rim and below the plane thereof, and a plurality of circumferentially spaced rods rigidly connected at their inner ends to the ring and radiating outwardly and upwardly to the rim with their extreme outer ends welded to the rim so as to resist separation from said rim and ring when subjected to tension.

8. A skeleton metallic reinforcing framework adapted to be embedded in a concrete cover for a manhole or the like comprising a continuous outer rim in the form of an endless inwardly facing channel, an inner ring concentric with the rim and below the plane thereof, and a plurality of circumferentially spaced rods rigidly connected at their inner ends to the ring and radiating outwardly and upwardly to the rim with their outer ends welded to the inner face of the web of the rim.

9. A cover for a manhole or the like comprising a concrete slab having a thickened central portion and a relatively thin peripheral portion and a skeleton reinforcing framework embedded in the slab, said framework including a continuous rim defining the outside of the framework and embedded in the peripheral portion of the slab, a plurality of metallic rods rigidly secured to the rim and extending inwardly generally toward the geometrical center point of the cover and inclined downwardly from the plane of the rim, and means forming part of said framework securing said rods rigidly together in a zone of said thickened central portion around said center point.

10. A cover for a manhole or the like comprising a concrete slab having a thickened central portion and a relatively thin peripheral portion and a metallic reinforcing assembly embedded in the slab between its peripheral edge and a zone surrounding and spaced from the geometrical center of the cover, said assembly comprising a continuous rim defining the outside of the assembly and a plurality of rod portions rigidly connected together in said zone below the plane of the rim and inclined upwardly and outwardly with their outer ends rigidly secured to the rim, whereby loads on the central portion of the slab are resisted by tension in the rod portions and compression in the slab.

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