March 17, 1959 V. ELKINGTON 2,877,696

MANHOLE COVERS AND FRAMES

Filed June 9, 1953 4 Sheets-Sheet 1

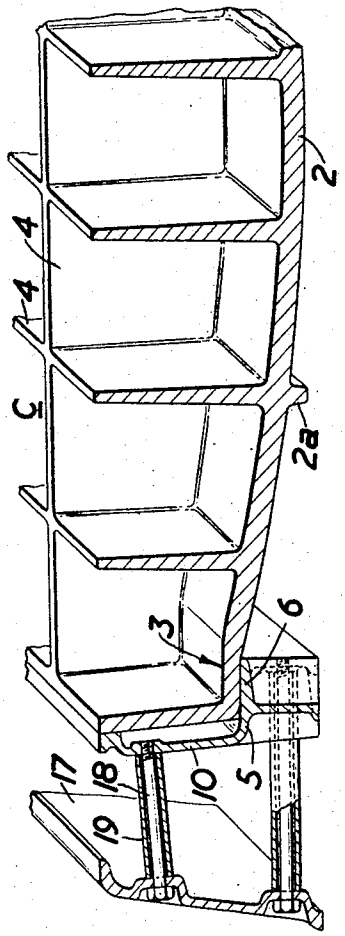
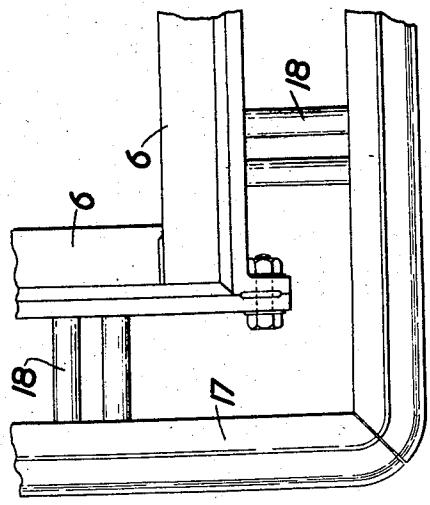


FIG. 1.

FIG. 2.



INVENTOR
VIVIAN ELKINGTON
BY Frederick L. Hartz
ATTORNEY

March 17, 1959 V. ELKINGTON 2,877,696

MANHOLE COVERS AND FRAMES

Filed June 9, 1953 4 Sheets-Sheet 2

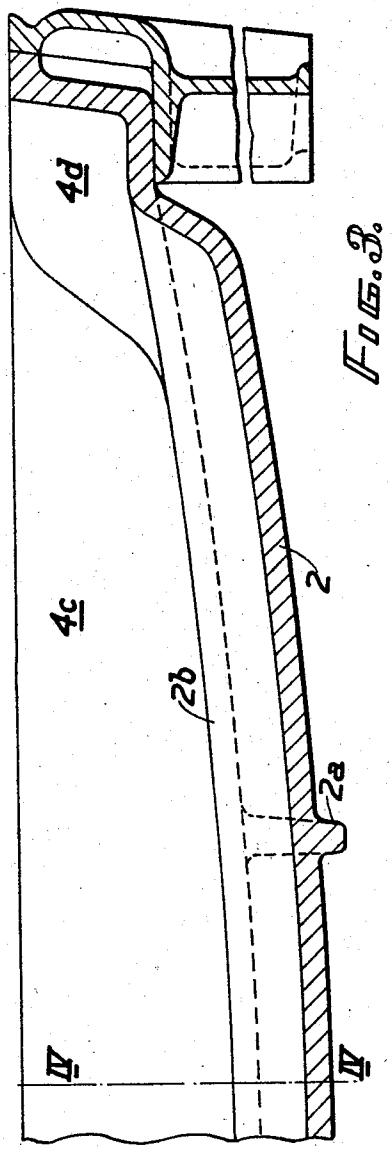


FIG. 3.

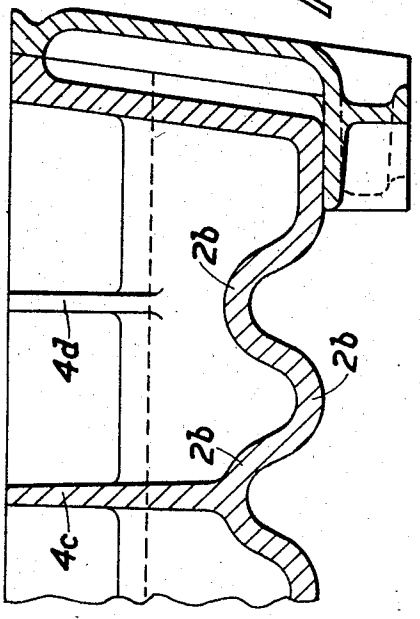


FIG. 4.

INVENTOR
VIVIAN ELKINGTON
BY Frederick L. Hartz
ATTORNEY

March 17, 1959 V. ELKINGTON 2,877,696

MANHOLE COVERS AND FRAMES

Filed June 9, 1953 4 Sheets-Sheet 3

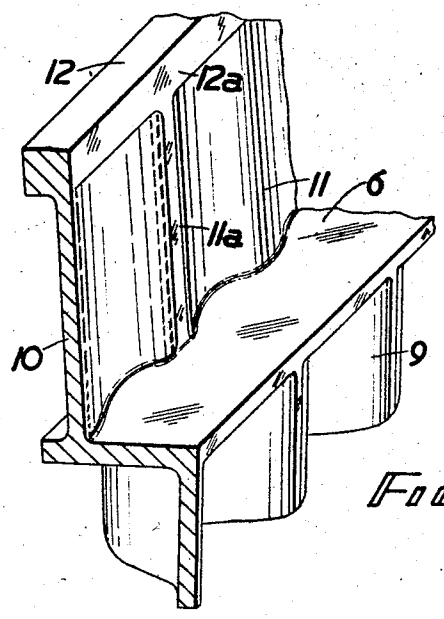


FIG. 5.

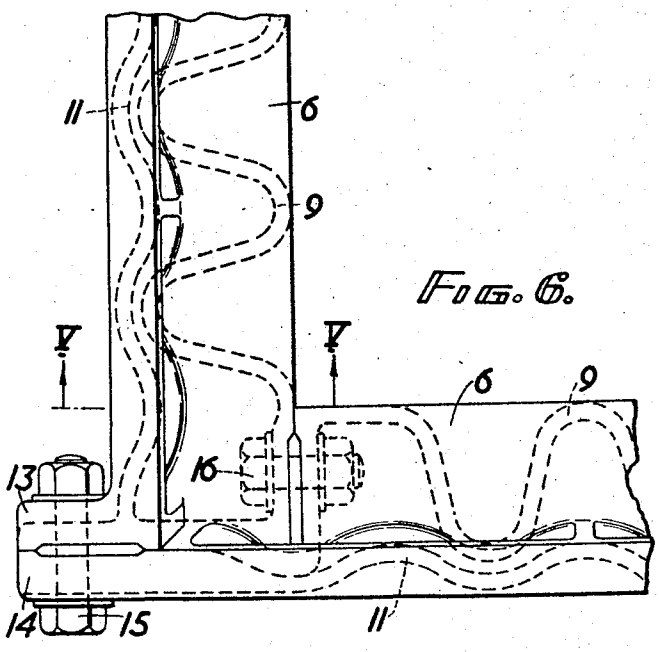


FIG. 6.

INVENTOR
VIVIAN ELKINGTON
BY Frederick L. Hays
ATTORNEY

March 17, 1959 V. ELKINGTON 2,877,696

MANHOLE COVERS AND FRAMES

Filed June 9, 1953 4 Sheets-Sheet 4

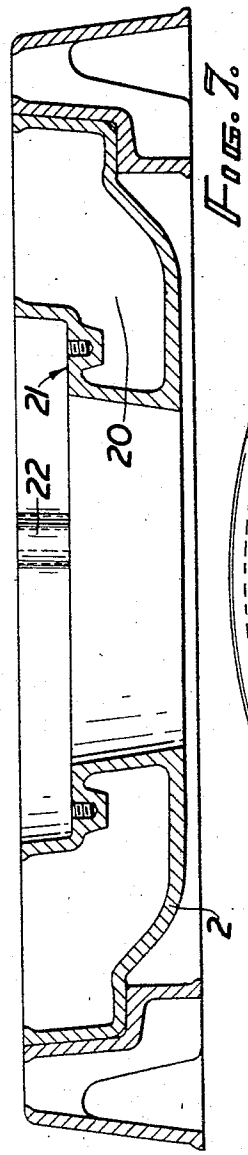


FIG. 7.

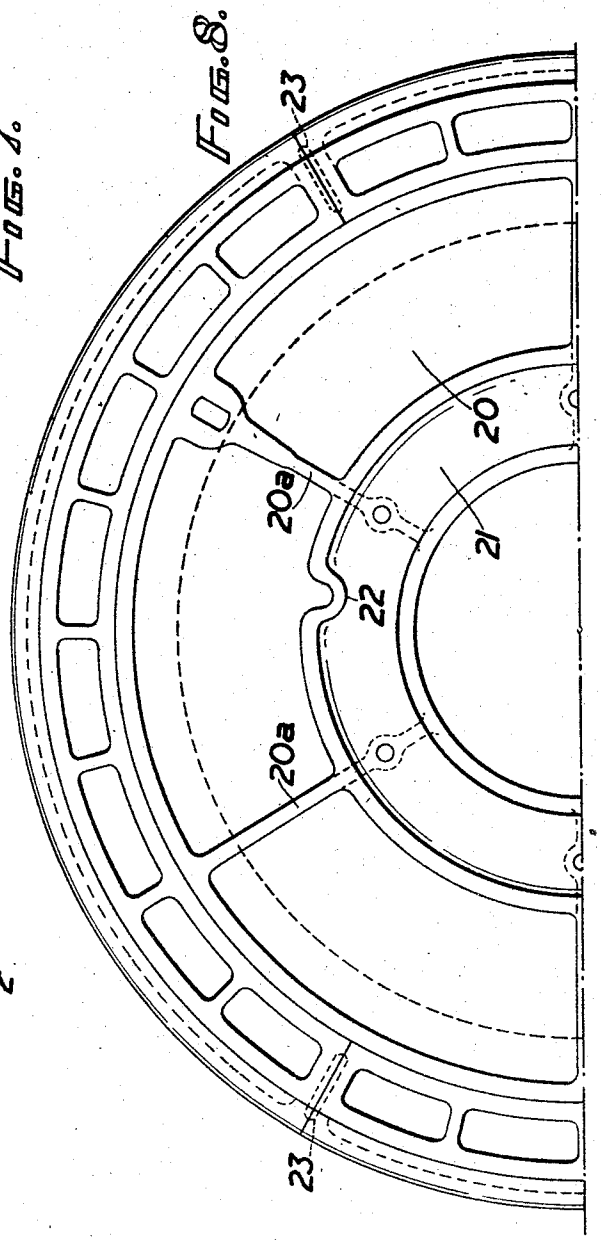


FIG. 8.

INVENTOR
VIVIAN ELKINGTON
BY Frederick E. Haug
ATTORNEY

United States Patent Office

2,877,696

Patented Mar. 17, 1959

2,877,696

MANHOLE COVERS AND FRAMES

Vivian Elkington, Dover, England, assignor to The Dover Engineering Works Limited, Dover, England

Application June 9, 1953, Serial No. 360,429

2 Claims. (Cl. 94—34)

This invention relates to manhole covers and frames and has for its object to provide manhole covers which will be economical in the use of metal and will stand up to heavier loads than covers of ordinary construction using the same weight of metal.

I have in my earlier work provided a construction of rectangular cover where additional strength is attained by the provision of webs extending from both faces of the casting. I have now discovered by experiment that considerable additional strength can be attained by giving the underside or base of the cover a downward or convex curvature with webs of lengths varying in accordance with the curvature extending upwardly from the upper concave side or face. Good results have already been obtained on loading tests with a rectangular cover having the foregoing characteristic supported as a beam slung between two supporting ledges. The advantages of the invention are also attained with a circular cover the underside of which is of convex or domed curvature and it is probable that the addition of webs extending from the underside of either rectangular or circular covers may still further enhance the strengthening effect, and still further strength may be obtained by the use of corrugations in the base of the casting.

The invention consists broadly of a manhole cover having the underside of its base convexedly curved downwardly between flat surfaces adapted to seat on a flat ledge or ledges of the frame.

In order that the invention may be more readily understood reference is hereby made to the accompanying drawings, wherein:

Figure 1 is an isometric cross section of a half of one form of frame and cover the other half being precisely similar.

Figure 2 is a plan view of a part of the supporting frame of Figure 1,

Figure 3 is a section of parts of a modified construction of the cover and frame shown in Figure 1,

Figure 4 is a section taken on line IV—IV of Figure 3,

Figure 5 is an isometric section showing a special construction of frame-bar,

Figure 6 is a plan of the corner of a frame built up from bars of the construction shown in Figure 5,

Figure 7 is a diametrical section of a circular cover according to the invention and

Figure 8 is a plan of half this cover the other half being similar.

Referring to these drawings and particularly to Figures 1 and 2 the rectangular cover C is upwardly concave and further shaped to give a downwardly or convexedly curved bottom or base 2 the curvature running from flat edge portions 3 which seat upon flat surfaces or ledges 6 of the frame. Thus in effect the cover is slung as a beam between supporting ledges on either side. Strengthening webs 4 extend upwardly from the curved base and run in both directions forming a number of upwardly opening rectangular cells which in practice are

filled with concrete or other material. These crossing webs extend upwardly to varying extents depending on the curvature of the base so that they all terminate in the same plane but not necessarily at the top surface of the cover.

The base may be provided with downwardly projecting ribs indicated at 2*a* to constitute runners for facilitating sliding movement of the cover as it is drawn off from the frame and to give added strength to the structure. A cover of the foregoing construction measuring 36 inches square clear opening weighing 7 cwts. of which 3¾ cwts. is cast iron and balance is concrete filling supported in the manner described has been shown by tests to be capable of sustaining a load of 100 tons applied to an area of 12 inches diameter located at its centre. It follows that in order to support such a load in non-rocking condition the framing 5 having flat seating ledges 6 needs to be of adequate strength and in practice the frame is preferably constructed of bars having a corrugated supporting structure 9 proceeding downwardly from the flat seating ledges 6 (see Figures 5 and 6). The enveloping walls 10 of these bars extend upwardly and may also be corrugated but preferably with corrugations 11 of a greater radius than the corrugations of the supporting structure 9. These upstanding corrugated walls 10 terminate in a top rail 12, having a flat inner surface 12*a* and the apices of the corrugations 11 are flattened to provide surfaces 11*a* coplanar with the surface 12*a*, so that the cover can be closely fitted to provide air and watertight conditions. This close fitting is of great importance apart from the advantage of air and watertightness ensured thereby in that in order to ensure non-rocking characteristics it is necessary, not only that the covers seat firmly on the ledges 6, but that they are restrained from any side or endways movement which unless they fit closely, is liable to occur particularly when heavily loaded vehicles pass over them. The corners where the side and end elements of these bars join when connected up to constitute the rectangular frame are formed in the manner best shown in Figure 6 the side bars being provided with flanges 13 and the end bars with cooperating flanged parts 14 so that the elements can be rigidly secured by bolts 15 and further rigidity can be effected by bolts 16 shown in Figure 6. It should be mentioned that these frame sections are the subject of a separate application and form no part of the present invention except in so far as they form part of a combination which includes the special cover the subject of the persent invention.

In order to give adequate support to the side and end walls of the frame as a whole an outer casing 17 (see Figures 1 and 2) may be provided so as to provide for a concrete surround. This casing is preferably constructed of side and end elements which are coupled to the cover enveloping walls 10 of the frame by bolts 18 passing through spacer sleeves 19 and the channel thus formed between the outer casing and the frame is filled with concrete.

A modification of the cover hereinbefore described with relation to Figures 1 and 2 is shown in Figures 3 and 4. In this modification the downwardly convexedly curved bottom wall or base 2 of the casing is provided with corrugations 2*b* with the upstanding strengthening webs 4*c* proceeding upwardly from the centre line of some of the corrugations and short intermediate webs 4*d* extending inwardly from the end walls of the cover. In this modified construction the downwardly projecting ribs 2*a* not only resist rocking movement of the cover upon the convex bottom surface thereof, but also serve to bridge the space between spaced apart corrugations, thereby facilitating the slid-

ing movement of the cover as it is drawn off from the frame.

In Figures 7 and 8 a circular cover is shown in accordance with the invention. In this case the downwardly convexedly curved bottom or base **2** of the cover is constituted by a dome. The particular cover shown in Figures 7 and 8 is specially designed for housing lighting equipment such as is used on aerodromes and aircraft landing surfaces arranged above a compartment which needs to be lighted. The cover consists of a hollow upwardly opening annulus **20** adapted to be filled with concrete and has a central opening designed to accommodate a secondary cover (not shown) which carries the lighting equipment. As will be seen from the drawing the casting **20** had an annular ledge **21** to provide an annular seating for supporting the secondary cover carrying the lighting equipment, a ridge **22** being provided for cooperation with a groove in the wall of the secondary cover to ensure correct positional registration of the secondary cover with the main cover which latter is provided with radiating strengthening webs **20***a*. Thus on any failure of the lighting equipment the secondary cover carrying the lighting equipment can be removed and replaced. The construction of the cover as a whole renders them interchangeable and thus a fresh cover complete with its lighting equipment can be taken from store to replace the cover in use and the latter taken away for repair ready for replacement in any other frame the lighting equipment of whose cover has failed.

With these circular covers the requirement for the non-rocking and air and water tight characteristics, is of course, as important as with rectangular covers and for this reason accuracy of fit of the cover in its frame is important and this demands accuracy in the circularity of the frame. In order to ensure this the frame is cast in arcuate sections fitted together as indicated at **23** in Figure 8. In practice these sections are all interchangeable and a frame can be constructed by taking the requisite number of sections—usually three—and joining them up to constitute a complete circular frame. By the means above described a circular cover and frame can be economically produced and being of circular form any necessary grinding to remove roughness and ensure firm seating and close fitting can be easily accomplished.

I claim:

1. A manhole assembly comprising, in combination, a rectangular manhole cover having a base with a downwardly facing flat marginal portion and a convexly curved downwardly extending middle portion, upstanding strengthening webs extending upwardly from the downwardly curved base portion, said strengthening webs running in two directions to form cells adapted to be filled with a filler material and terminating in the same horizontal plane defining an upper surface; and a frame for supporting said cover, said frame having a flat seating ledge to seat thereupon said flat marginal portions of the cover and a wall portion enveloping the peripheral rim of said cover and upstanding from the outer edge of said seating ledge, said cover abutting against the inner face of said upstanding wall, said upstanding enveloping wall portion terminating at its upper edge in a top rail, the wall portion between said rail and the flat seating edge of said frame being corrugated, the peripheral surface of the rail facing the cover and the apices of the corrugations facing the cover being flattened, the respective sides of the cover fitting said flattened surfaces.

2. A manhole assembly comprising, in combination, a rectangular manhole cover having a base with a downwardly facing flat marginal portion and a convex middle portion having a concavely curved upper surface, upstanding strengthening webs projecting upwardly from said concave upper surface of the middle portion defining cells for receiving a filler material; and a frame supporting said cover, said frame having a flat seating ledge supporting said flat marginal portions of the cover, a wall portion upstanding from the outer edge of said seating ledge and enveloping the peripheral rim of said cover, said wall portion terminating at its upper edge in a top rail and having corrugations between said rail and the flat seating ledge of the frame, the peripheral surface of the rail facing the cover and the apices of the corrugations facing the cover being flat, and the respective sides of the cover fitting said flat surfaces.

References Cited in the file of this patent

UNITED STATES PATENTS

149,246	Price et al.	Mar. 31, 1874
636,722	Gregor	Nov. 7, 1899
979,182	MacDonald	Dec. 20, 1910
1,032,503	Rapp	July 16, 1912
1,087,366	Haase	Feb. 17, 1914
1,820,127	Elkington	Aug. 25, 1931

FOREIGN PATENTS

282,946	Germany	Mar. 26, 1915
375,814	Great Britain	July 1, 1932
447,063	Great Britain	May 11, 1936
535,177	Great Britain	Apr. 1, 1941