

- 1 -

Manufacturing Manhole Cover Frames

This invention relates to the manufacture of manhole cover frames.

In this specification, the term "manhole cover" is to be understood as embracing covers for inspection
5 and access openings, ducts, service trenches and the like whether formed as a solid top or as a grating and whether or not sized to permit the passage of a person through the opening spanned by the cover.

The most commonly produced type of frame is
10 cast in one piece of cast iron or cast steel and separately from the cast iron or cast steel covers with which it is to be used. Such frames and covers are not generally given machined surfaces, and the manufacturing process is such that the cover does not fit sufficiently
15 closely against the frame with the result that a gas and liquid tight seal is not obtained between them without the introduction of a separate deformable gasket or seal.

Frames are also known which are assembled from
20 components made of cast iron or steel and are generally constituted by four perimeter bars, namely (and these are terms of the art) a front end bar, a back end bar, a left hand side bar and a right hand side bar, which are bolted, fixed or welded together at the corners of
25 the frame so as together to form a rigid structural unit.

If one wishes to ensure that the joints between the four perimeter bars are gas tight, the faces which abut when the bars are bolted together are each recessed and the mating such recesses are filled with a molten material, preferably molten lead. Each perimeter bar is of generally L cross-section, and the bars are arranged so that the frame essentially is constituted by a generally L perimeter section which provides a well into which a removable cast iron cover may be sunk to seat on the base of the L cross-section well and seal both on that base and against the upstanding side faces of the well. To promote such a gas and liquid tight seal, the faces of each perimeter bar which contact the cover are machined as by milling, and the corresponding faces of the cover are also machined as by grinding. Frames are matched to covers to ensure that the respective machined surfaces fit closely against one another to make the required gas and liquid tight seal and so that the cover and frame make substantially one solid unit with the cover being stable within the frame and not rocking therein when subjected to a moving loading as in the case of fast traffic passing thereover.

In accordance with the present invention, a method of manufacturing a manhole cover frame comprises forming a mould cavity having a configuration desired of the frame, using the periphery of a manhole cover to define part of the mould cavity, and introducing a hardenable material when in a flowable condition into the mould cavity so that it will constitute the frame when solidified and have a contour conforming to those peripheral regions of the manhole cover which define said part of the mould cavity, said regions of the manhole cover being those regions which seat against a manhole cover frame in use by which said contour of the manhole cover frame will conform to those seating regions, the manhole cover together with means constituting the remaining

part of the mould cavity being removable from the solidified frame.

The invention also includes a manhole cover frame manufactured by the above method.

5 Practise of the method in accordance with the invention of manufacturing a manhole cover frame reduces the number of operational steps necessary in its production and results in a frame of simpler structure as compared with the aforesaid machined multi-bar construction. Preferably, the surfaces of a cover which
10 are to seat against a frame in use are machined as by grinding before the cover is used in the moulding process, and when such a cover is paired to the frame moulded against it we have found, surprisingly, under test, that
15 the cover and the frame with the latter moulded of reinforced concrete stand up to a much greater loading before destruction than either of the aforesaid conventionally made manhole cover and frame assemblies. The reason for this is believed to be the much closer
20 fit obtained between the cover and the frame as a result of the moulding technique adopted, and the effect of the increased strength thus obtained should enable a thinner cross-section to be used than hitherto with a consequent saving in cost and reduction in operating
25 weight. The frames as manufactured in accordance with the invention can be produced with relatively unskilled labour as compared with that required to produce the milled, multi-bar construction of frame. Moreover, such frames may be produced in a factory or actually on site
30 using simple "throw-away" moulding jigs.

In order that the invention may be well understood there will now be described one embodiment thereof, given by way of example, reference being had to the accompanying drawing, in which:

Figure 1 is a sectioned elevation of a jig illustrating the use thereof in the manufacture of a frame; and

Figure 2 is a plan view, partly broken away,
5 of the same jig when in use.

Briefly, in this embodiment of the invention a frame is moulded in one piece of a hardenable or settable material. The settable material is poured into a jig and is actually moulded against those surfaces of
10 a finished cover with which it is to interfit in use. Therefore, the frame is matched automatically to the cover when being made.

More particularly, a jig 1 includes a base 2 which is rectangular in plan and which has upstanding
15 marginal stepped sections 3 around its periphery which provide a ledge 4 and, inwardly thereof, a generally vertical locating surface 5 which is slightly inclined in a direction away from the ledge.

The marginal stepped sections 3 as formed
20 above are designed to accept and locate a cast iron cover C which has been machined at its surfaces which will seat against the frame in use. In this instance, the inverted cover C is of the open top type formed by a honeycomb rib structure r upstanding from a bottom
25 plate p with its perimeter bend defined by side and end flanges f also integral with the bottom plate. Accordingly, it is the external surfaces s and s1 of the flanges f and the marginal region of the bottom plate p, respectively, which are machined. It is to be
30 understood that the frame could be moulded to other configurations of cover C with the jig base 2 being suitably configured to locate positively the cover in position.

Suitably affixed, as for example by hinging
35 at 6 to the bottom edges of the base 2, are four side

shutters 7 with mitred ends. When hinged fully upwardly as shown the shutters form a continuous frame around the base and slope outwardly away from the base at an angle determined by the correspondingly inclined sides 8 of the base. Any suitable means may be provided for holding the shutters in that moulding attitude, such as a quick release mechanism taking the form of spring clips (not shown). On the inner side, each shutter 7 is provided with an inwardly extending protuberance 9. Additionally, each shutter 7 has its protuberance 9 provided with transverse recesses 10 (see Figure 2).

The jig 1 is completed by a top shutter 11 which locates on vertical pins 12 carried by the base 2 to seat on the plate p of the cover C and which is held against the cover by any suitable means such as taper wedges 13 as shown. A packing 14, which may be of neoprene, is provided between the top shutter 11 and the cover plate p to take up any irregularities there might be in the plate surface. The packing 14 would be bonded to the top shutter 11.

When the jig is so completed, there is provided a continuous cavity 15 defined between the top shutter 11 and the four side shutters 7 down to the ledge 4 of the jig base 2 and adjacent the machined surfaces s and s1 of the flange f and the margin of the plate p of the cover C. A setable material m is introduced into that cavity 15 to fill it, and when that material is sufficiently solidified, the top shutter 11 is removed and the side shutters 7 hinged downwardly, thereby to permit the frame F moulded from the setable material m in the cavity to be removed together with the cover C. Since the frame F has been moulded to the surfaces of the cover C which are to seat against it, a perfect match is made and no further finishing operations are necessary.

As will be seen, the moulded one-piece frame F comprises four perimeter bars b each of which has a U-section base s formed by the corresponding protuberance 9 which moulds a recess into the bar and from which is upstanding a marginal flange l. Transverse strengthening ribs (not shown) would be moulded into each frame bar b by the recesses 10 in the shutter protuberances 9. In use, the frame F would, of course, be inverted from the orientation shown, and the base s would be suitably permanently secured around the mouth of a pit opening in a floor or the like. The matching cover C would be laid into the frame F so that its machined surfaces s and sl seated against the correspondingly moulded surfaces of the frame base s and flange l to make a closely mated interface therewith to prevent the ingress of extraneous matter therebetween.

The setable material would conveniently be concrete preferably reinforced as by glass fibre, steel fibre or epoxy resin. Instead of the reinforcement being incorporated in the liquid concrete, reinforcement such as a steel grid could be laid in the cavity to reinforce the concrete in situ.

The top and hinged shutters and jig base could conveniently be of wood or any other material, for example melamine, suitable for forming a mould wall with respect to concrete. To assist removal of the shutters from the moulded frame and to ensure that the moulded external surface of the frame has a clean, unbroken profile, any suitable parting agent may be applied to the moulding surfaces.

Frames may be moulded one at a time or in multiples using a number of jigs positioned adjacent one another. It is contemplated that a single jig could be sub-divided to mould a number of frames simultaneously or to mould a multi-span frame seating a plurality of

covers, each of which would be used in the moulding process. Whilst the side shutters are shown hinged to the jig base, other means of securing may be equally appropriate. It is to be emphasised that the illustrated frame having a U-section base is but one configuration amongst many which may be moulded using the technique described. That technique enables a frame to be made from but a single operation, namely by moulding, and matched during the moulding process with the cover to be used with the frame. Although such optimum matching is preferred to ensure a closely mated interface, a set of covers may be maintained for moulding purposes, and frames moulded from those covers matched subsequently to other covers.

Whilst reinforced concrete is preferred as the moulding material, other materials which can be cast or moulded such as metal alloys or synthetic plastics may be utilized, and the process and moulding apparatus adapted as may be necessary.

The moulding process may be performed away from site in a factory or frames could actually be moulded in position on site by means, if wished, of "throw-away" simple shutter jigs.

Provision may be made within the reinforced concrete frame for metal or plastic inserts designed to receive fasteners that will securely locate the manhole cover to the frame.

Frames moulded in reinforced concrete have been put under test. Unexpectedly, the resulting matched cover and frame showed a much greater resistance to loading than a multi-bar construction of frame. It is thought that this is because of the closer fit between the cover and the frame which can be achieved with the described moulding technique which enables gaps between those components of no more than $1\frac{1}{2}$ thou to be

obtained whereas with the conventional machined multi-bar frame and cast iron cover the manufacturing tolerances are of the order of 10 thou. As a result, whereas with the latter construction a cover failed
5 under a loading of around 30 tons, with the cover and frame of the present embodiment, the cover and frame still held good at 60 tons. The inference is that thinner cross-sections of cover and frame can be
10 utilized than hitherto with attendant cost savings adding to those obtained by the simpler manufacturing technique together with reductions in the operating weight of the cover.



CLAIMS

1. A method of manufacturing a manhole cover frame, comprising forming a mould cavity having a configuration desired of the frame, using the periphery of a manhole cover to define part of the mould cavity, and introducing a
5 hardenable material when in a flowable condition into the mould cavity so that it will constitute the frame when solidified and have a contour conforming to those peripheral regions of the manhole cover which define said part of the mould cavity, said regions of the manhole cover
10 being those regions which seat against a manhole cover frame in use by which said contour of the manhole cover frame will conform to those seating regions, the manhole cover together with means constituting the remaining part of the mould cavity being removable from the solidified frame.
- 15 2. A method as claimed in claim 1, wherein said manhole cover is used only once in said method and is matched to the manhole cover frame manufactured thereby so that there results a paired manhole cover and frame having contours which conform with each other where the cover seats in the
20 frame.
3. A method as claimed in claim 2, wherein said regions of the manhole cover are machined prior to use of said cover to define part of the mould cavity so that the frame manufactured in said cavity will have surfaces
25 closely mating with the machined regions of the cover to prevent the ingress of extraneous matter therebetween when the frame is paired to the cover.
4. A method as claimed in any of the preceding claims, wherein the frame is manufactured at the site of the manhole to
30 be covered.



5. A method as claimed in any of the preceding claims, wherein said means defining the remaining part of the mould cavity is constituted by a jig which is removed together with the manhole cover when the hardenable material has solidified.
6. A method as claimed in claim 5, wherein a parting agent is applied to those surfaces of the jig defining the mould cavity.
7. A method as claimed in claim 5 or claim 6, wherein the jig defines a plurality of intercommunicating cavities in conjunction with a plurality of manhole covers, the hardenable material being introduced into the intercommunicating cavities to form a one-piece frame contoured to conform to the regions of the respective covers serving as walls of the respective cavities.
8. A method as claimed in any of claims 5 to 7, wherein the jig comprises a base formed to provide a seat for an inverted manhole cover, side shutters connected to the base, and a top shutter mounted on the central portion of the inverted manhole cover.
9. A method as claimed in any of the preceding claims, wherein the hardenable material is liquid concrete.
10. A method as claimed in claim 9, wherein the liquid concrete incorporates reinforcement.
11. A method as claimed in claim 10, wherein the reinforcement is glass fibre, steel fibre or epoxy resin.
12. A method as claimed in claim 9, wherein reinforcement is introduced into the mould cavity prior to the introduction of the liquid concrete therein to reinforce the concrete when solidified.



- 13. A method as claimed in claim 12, wherein the reinforcement is a metal grid.
- 14. A method as claimed in any of claims 1 to 8, wherein the hardenable material is a metal alloy or a
5 synthetic plastics material.
- 15. A method of manufacturing a manhole cover frame substantially as herein described with reference to the accompanying drawing.
- 16. A manhole cover frame manufactured by a method as
10 claimed in any of claims 1 to 15.
- 17. A paired manhole cover and frame resulting from the method as claimed in claim 2.

The text of the specification has been reproduced by photocopying the applicants original typescript. It may contain a few amendments which are difficult to read. The original typescript containing these amendments may be inspected on the premises of the Patent Office