To all whom it may concern:

Be it known that I, CHARLES HENSON MARQUESS, a citizen of the United States, residing at Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Battery-Vaults and the like, of which the following is a specification.

My invention relates to battery vaults and the like. Ordinarily such vaults are buried in the ground when normally in use, with the open end or mouth projecting somewhat above the ground to admit of the entrance to the interior of the vault by an interested person, a removable cover being provided for the vault mouth. Within the vault, electric batteries are stored and connected with various signaling apparatuses along railroad lines. Herefore there have been serious difficulties, loss and danger incident to injury to such batteries from severe cold, the batteries often becoming entirely frozen and therefore unfit for use.

A prime object of the present improvements is to avoid such difficulties, danger and loss through the provision of a battery vault or the like having the interior thereof sufficiently insulated against the entrance of objectionable cold through the vault walls.

It is an object also to provide such a useful structure in a form which is strong and durable, which may be handled conveniently, and which may be made expeditiously and at reasonable cost. Further objects and advantages will appear hereinafter.

In the accompanying drawings, which form a part of this specification, I have illustrated these improvements in a preferred form and in association with a preferred type of means for manufacturing the same. In these drawings Figure 1 is a medial vertical section of the vault in inverted position resting on a rotatable support; Fig. 2 is a horizontal section of the vault of Fig. 1, as on the line 2—2 thereof; and Fig. 3 is a fragmentary view of vault parts with a lifting bail secured thereto.

The vault illustrated comprises a plurality of side walls 10, 11 and 12 of cementitious material concentrically arranged and spaced apart in radial directions of the vault. Such vaults are usually made in a form circular in horizontal cross section, but they may be of other shapes. There is also provided a bottom wall 14. I have shown metallic reinforcing for one of the side walls comprising upright bars 16 and cross bars or rings 17, and for the bottom wall cross bars 18 and 19. Any suitable form of reinforcing may be employed, and in some instances omitted.

The several side walls are connected together rigidly in their spaced-apart relation, as by cementitious material 20. I have shown these concreting masses of plastic material 20 as being isolated from each other and of relatively small bulk of cross area, but various modifications of the kind and material of such connecting pieces, and of their size and shape, and the division of the space between adjacent side walls into various compartments or shapes, may be made without departing from the spirit of this invention.

The spaces 22 are annular in shape in the device shown, being defined by the annular walls 10, 11 and 12. They extend from top to bottom of the vault illustrated, but it is not always necessary to extend them materially below the frost line of the ground. I prefer, however, to extend this general construction quite to the bottom of the vault, not only because the position of the frost line is a variable in any locality, and in some localities is quite low, but also because I am thereby enabled to provide exceptionally good insulation against the entrance of moisture in the normally lower part of the vault while obtaining the advantages of frost insulation in the upper part, a feature of importance in view of the desirability of a moisture-proof vault and the fact that such vaults are frequently positioned with the lower portions thereof in a subsoil which is very wet. In the normally lower part of the vault shown between the walls 10 and 11 I have illustrated such moisture-proofing in the form of several layers 24 of tarred paper or the like, and the same kind of material 24 between the bottom walls 14 and 15. Such moisture-proofing is of particular importance when the cement is applied otherwise than by a cement gun.

These improvements will be further understood from a description of my preferred method of making the vault. The support or platform 30 on which the vault rests is to be understood as being rotatable on the vertical axis of the vault. In my co-pending application, Serial Number 162,302, filed April 16, 1917, on apparatus for making concrete articles, to which reference is
made, I have illustrated and described vault rotating apparatus of which the support 30 is a part.

Upon the base 30 may first be positioned the metallic framework comprising the uprights 16 and cross rings 17, to which has been secured, as by wiring 31, the inner core or lining 32. Among other advantages this inner lining provides excellent first-aid proof properties. It is to be understood that bottom parts have not yet been applied and that the side wall framework and core are open at the vault bottom, which is at the top portion of Fig. 1. I next insert the post 34 having a dowel 35 adapted to enter a hole in the center of the rotatable platform 30 as shown. Upon the post 34 I place the flanged cap 36 having secured to it the cross bar 37, and upon the bar 37 a bottom rest 38, in disk form, but made up of three pieces hinged together, whereby the disk 38 may be folded upon itself and removed through the opening in the neck of the vault after the vault is formed. Thus a firm support is provided for the bottom walls 14, 15 while they are being formed and during the setting of the cement. Upon the rest 38 I preferably lay a disk 40 of the same material as the lining 32, which may be roofing felt, paper, fabric, metal or any other suitable material. I next position the reinforcing rods 18 and 19 for the bottom wall, and these may be secured to the upright 16, as by wiring, if desired.

With the parts so assembled, the operation of applying cementitious material to form vault walls may be begun. The most advantageous material for this purpose I consider to be Portland cement, sand and water, and the most advantageous way of applying it is by means of a cement gun, the nozzle 42 of which is shown as discharging a jet of cementitious material upon the vault. Such cement gun apparatus is well known and requires no detailed description, but in this connection reference may be had to the U.S. patent to C. E. Akley, Number 984,254 of February 14, 1911, describing such a device.

I begin by rotating the base 30, and with it the metallic framework, core and associated parts, and then spray the cementitious material upon the core or lining 32 and 40 until the framework is embedded, or until the inner walls 10 and 14 are formed. In this connection I may say that the side walls may be substantially completely formed before the formation of the bottom wall is begun, or vice versa, or the formation of both may go along practically simultaneously.

Assuming that the side wall 10 has been formed, I next take tarred paper or the like having good water-proofing qualities and wind it around the bottom portion of the vault, shown at 24, and then cut holes through the several layers of the paper at intervals, staggering such holes about, to provide access through the paper to the concrete of the wall 10 by additional concrete when the same is applied to form the wall 11, as shown at 20. I also apply to the normally upper portion of the wall 10, beginning substantially where the water-proofing material 24 conforms, a layer of corrugated paper board 45 in which holes have been punched at intervals to admit concrete therethrough, as at the concrete masses or connecting pieces 20. Thereupon I again apply the cementitious material, while rotating the vault, by means of the cement gun, until the wall 11 is formed. During the application of the cement a quantity of it passes through the holes of the tarred and of the corrugated paper forming these binding posts or projections 20, 20a between the walls 10 and 11, uniting these walls in substantially integral formation.

After the wall 11 has been formed I may add another layer of the corrugated board, as from end to end of the vault as shown, and then apply another coating by means of the cement gun, thus forming the wall 12 integrally connected by masses of concrete 20 with the wall 11. In order to hold the windings of paper, or whatever material may be employed, upon the walls during the application of the cement I pass wires, as 46, around the vault and twist the ends together, thus also providing additional reinforcing for the walls.

After forming the bottom wall 14 I preferably lay some of the water-proofing material upon the wall, cut holes in same, and then apply the cementitious second bottom wall 15.

It will be apparent that no particular order is required in following some of these various steps, and it is not essential that as many as three side walls be formed, or that a plurality of bottom walls be made. In practice a double side wall and a single bottom wall, when made by the cement gun, will be found highly advantageous.

The corrugated paper board to which I have referred comprises two sheets of paper 48, 49, Fig. 2, with the corrugated sheet 50 between them. Such board is well known. When used as described it acts as spacing means against which the cement may be projected and provides an air space between the walls. It actually provides a great number of very small vertically disposed air spaces one next to the other in annular arrangement, but, as the paper board is quite porous, the effect is to provide a continuous annular air space between adjacent inner and outer walls. The paper board has the further advantageous property of absorbing moisture which may be present in the cementitious material. It will be observed from Fig. 1 that these means providing the air...
spaces extend to the base 30, and therefore when the vault is placed in its normal position, with the neck up access is had to these interior spaces, shown at 22, by the outer air. By the provision of a suitable cover for the top edge of the neck wall these inner spaces may be maintained closed as tightly as may be desired for any given period of time, but from time to time may be opened to permit the absorbent material, shown as the corrugated board, to dry out. The operations of forming the vault may be carried on quite rapidly, and, as the cement issuing from the nozzle, as 42, produces a concrete which, when set, is exceedingly dense hard, and free from air bubbles or other voids, an exceedingly strong and tight vault structure results. Atmospheric air is probably the most satisfactory insulator for frost. I therefore preferably have the air chambers between the two walls continuous so that no materially large portion of the inner wall, as 10, is not surrounded by the protecting structure. However, where several concentric walls are formed with intervening spaces, it is obvious that should the air spaces be interrupted by any material width of concrete, the air space between such wall and an adjacent wall may be located so as to cover, interiorly or exteriorly, the space interrupting concrete referred to.

In some applications of these improvements it may be desirable to carry the waterproofing material throughout the entire, or substantially the entire, length of the side walls, as in places where the vault is to be placed in exceedingly wet earth. In many instances, the water-proofing material may be omitted. Heretofore there has been considerable difficulty in handling vaults of such size and weight. It has been suggested to secure projecting rings or loops to bottom reinforcing for engagement by hooks operated by tackle for lifting the vault. I have found that the most satisfactory means for handling such vaults comprises rings or loops secured in the normally upper portion of the vault whereby the center of gravity of the structure is below the points from which it is suspended. Efforts have heretofore been made to locate such lifting loops or rings but without success, owing partly to the fragility of the cementsitious material constituting the side walls of the vault, but mainly to the absence of reinforcement adapted to take the outwardly horizontal components of lifting strains developed when the vault swings in the air or when it is lifted from a position outside of the line of direction of the vault when it is suspended or when lifted from a horizontal into a vertical position. For example, when the vault is lying on its side and is desired to set it in its normal upright position, the lifting hooks of the hoisting apparatus exert their force in directions substantially at right angles to the longitudinal direction of the vault, tending to rupture the walls of the concrete by ripping through the walls the lifting balls or hooks embedded therein, splitting and spalling the concrete. I have found from practice and experiments that if suitable lifting devices comprising balls, rods, or other structures terminating preferably in an eye or loop be located in the upper portions of the vault, with suitable reinforcing close to the place where the lifting devices emerge from the walls, the reinforcing being adapted to take the horizontal components referred to, as, for instance, the rings 402, the danger of such breakage is avoided and an entirely satisfactory construction for the purpose is provided. The invention in this respect is not limited, however, to rings embedded in the structure as shown, but includes the provision of any suitable reinforcing located near the place where the lifting balls protrude from the upper walls and adapted to withstand lateral stresses of the character pointed out. Many other forms of such reinforcing will occur to persons skilled in the art. In my practice I employ balls or loops 52, inside the ring 465 and passing between the inner and outer rings 17, to which the balls 52 may be wired or otherwise secured, although the latter is a convenience in manufacture rather than a necessity. I may turn the ends of the ball 52, as at 526, or otherwise modify the end construction to secure better anchorage.

The invention is not limited to the details of construction or the arrangement of parts specifically illustrated and described, nor to the several materials employed and I contemplate all such changes and modifications as fall within the scope of the appended claims.

I claim:

1. Side wall structure for a battery vault adapted to be buried partially in the ground comprising in combination an inner lining, metallic reinforcing adjacent to the lining, a layer of concrete forming an inner wall against the lining and substantially embedding the reinforcing, a winding of corrugated board or the like upon the inner wall and open at intervals to the inner wall, and a coating of concrete upon said winding and cementously held to the inner wall through said interval openings.

2. The combination with a battery vault or the like having walls of cementsitious material in the upper portion thereof, of a lifting device partially embedded in the hardened cementsitious material and protruding therefrom in the upper portion of the vault, and reinforcing material associated with said lifting device near the place where it
emerges from the cementitious wall, said reinforcing material including a metallic ring lying closely adjacent to said lifting device and to the outside thereof with respect to the interior of the vault.

3. The combination with a battery vault or the like having walls of cementitious material in the upper portion thereof, of a lifting device partially embedded in the hardened cementitious material and protruding therefrom in the upper portion of the vault, and reinforcing material in holding engagement with said lifting device and extending from said lifting device into the vault walls from a place closely adjacent to the place where the lifting device emerges from the wall.

CHARLES HENSON MARQUESS.

Copies of this patent may be obtained for five cents each, by addressing the “Commissioner of Patents, Washington, D. C.”