Oct. 3, 1967 J. D. COWAN ETAL 3,344,567

VOID DRAIN FOR BOX BEAMS

Filed Feb. 19, 1965 2 Sheets-Sheet 1

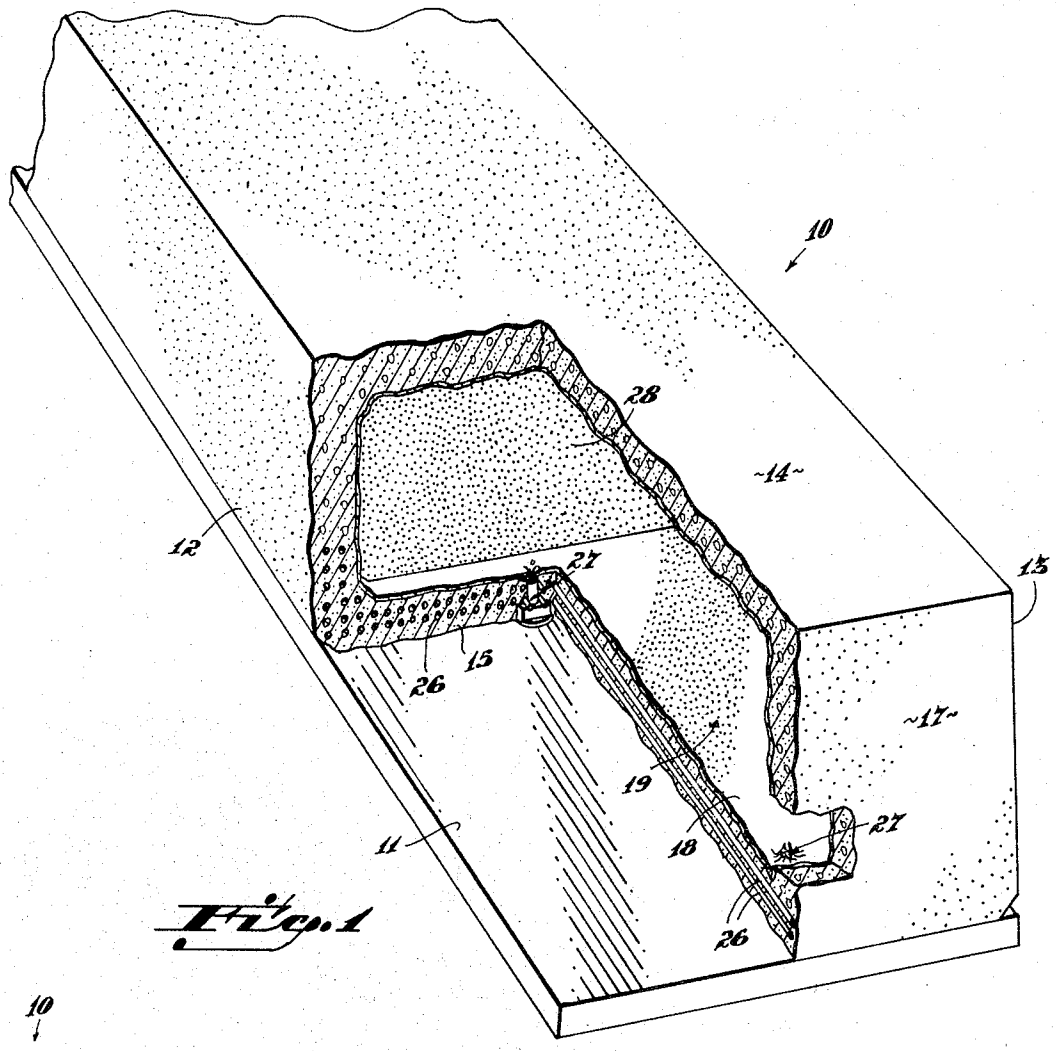


Fig. 1

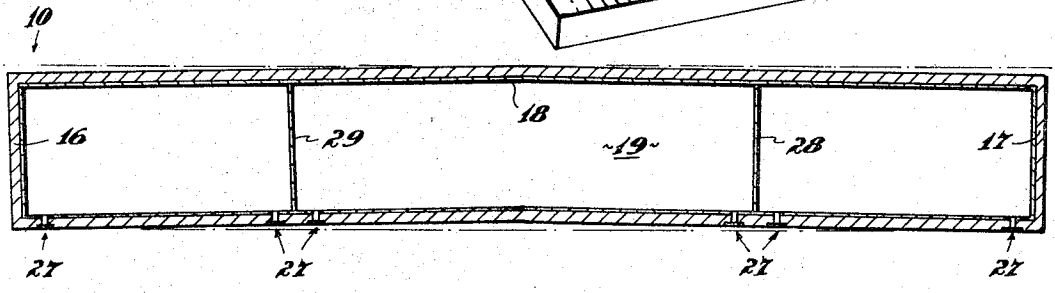


Fig. 2

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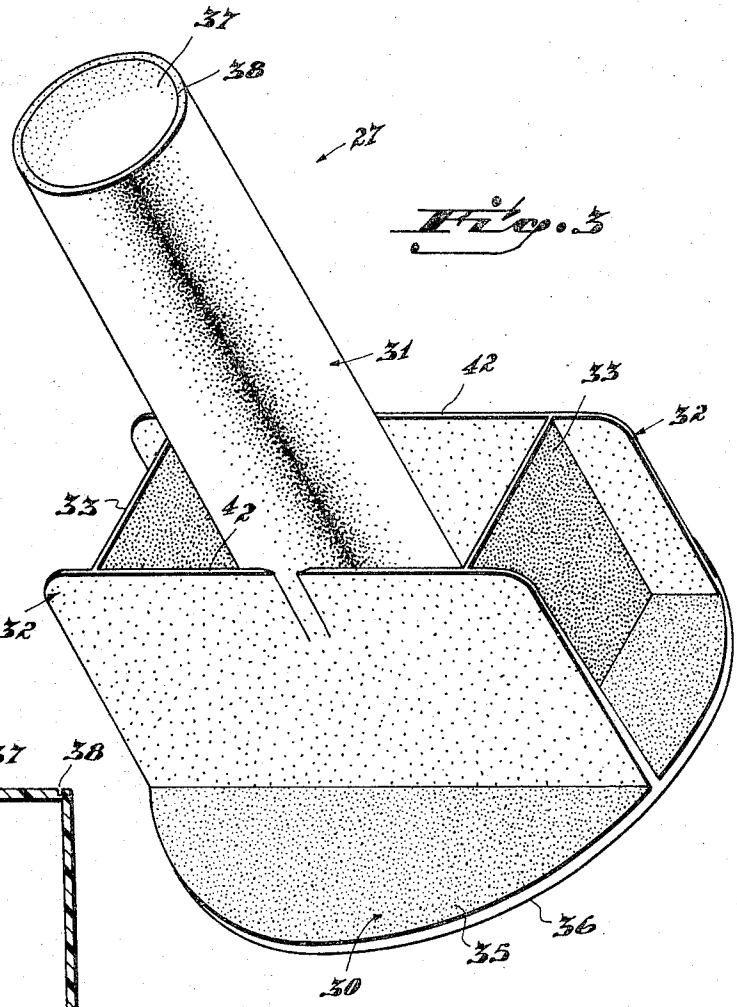


Fig. 3

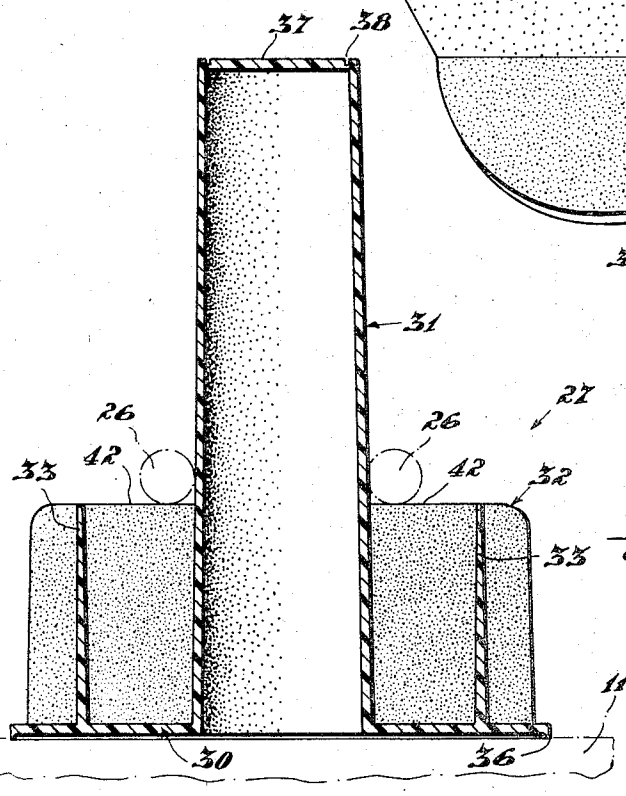


Fig. 4

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VOID DRAIN FOR BOX BEAMS

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ABSTRACT OF THE DISCLOSURE

A void drain for a pre-stressed concrete box beam, the void drain being tubular and having a base adapting it to rest upon a plate during the pouring of the concrete, the void drain also having shoulders intermediate its ends adapted to be engaged by the reinforcing steel wires to clamp the void drain against the plate during the pouring of the concrete.

This invention relates to a void drain for pre-stressed box beams.

A pre-stressed box beam is an elongated concrete beam which has been formed about an elongated hollow void forming element. The lower portion of the beam has a number of parallel steel wires or tendons embedded in it, the wires having been positioned and pre-stressed or tensioned before the pouring of the beam.

The beams are used as principal structural elements in large outdoor structures such as bridges, locks, dams and the like. It is a characteristic of the beams and the manner in which they are formed that the top wall of the hollow beam develops small cracks while the bottom wall and lower portion of the side walls are compressed due to the pre-stressing of the tendons. When exposed to the rain, the beams tend to fill with water over a period of time, the water seeping through the cracks in the upper surface of the beam. There are two important disadvantages to the accumulation of water within the hollow portion of the beam. First, the water adds to the dead load of the structure. This disadvantage is applicable wherever the beams are used that there is a likelihood that rain will be encountered. A second, and perhaps more important disadvantage occurs in those geographical areas where freezing conditions are encountered. The water accumulated in the beam will freeze, expand, and burst the side walls of the beam. When this occurs, it is necessary to remove the burst beam and replace it at considerable expense to say nothing of inconvenience and possible danger.

These disadvantages have been observed and attempts have been made to cope with the situation by providing void drains in the bottom wall of the beam, that is, by providing one or more holes in the bottom of the beam through which accumulating water can be drained. These attempts have largely been jury rigs, constituted for example, by lengths of garden hose having stoppers in their upper ends and connected in some fashion to the tendons before pouring the bottom wall. The thus fashioned void drains have in general provided a solution to the problem, but have themselves been subject to disadvantages. The materials of which they are formed are obviously inexpensive but the labor required to secure them to the tendons prior to pouring the bottom wall of the beam is appreciable. Further, in the pouring of the bottom wall, tremendous forces are encountered tending to dislodge the sections of tubing, for not only is the tubing engaged by the flowing concrete during the pouring of the bottom wall but also the plate upon which the concrete is poured is vibrated to facilitate the movement of the concrete and this vibration also tends to dislodge the tubing. Further, after the beam is formed, a tool must be driven from the outside surface of the bottom wall through the void drain

to poke out its stopper and to form a hole in the void forming member remaining inside the beam. When the void drain becomes even slightly dislodged so as to be covered with concrete, it is difficult if not impossible to find it in order to open it up so that it can perform its function of draining the hollow interior of the beam.

An objective of the invention has been to provide a void drain which can easily be positioned with respect to the bottom wall structure prior to pouring the bottom wall, the void drain being so securely positioned as to avoid any possibility of its moving laterally, upwardly or canting during the pouring of the concrete.

It has been another objective of the invention to provide a void drain constituted by a tube through which draining water can pass, a base at one end of the tube to assure proper orientation of the tube and a shoulder between the top of the tube and the base, the shoulder to be engaged by the pre-stressed tendons which serve to clamp the drain between the tendons and the form onto which the bottom wall of the beam is poured.

It has been still another objective of the invention to provide a base for a tubular void drain, the base being in the form of a flange having a peripheral lip which forms a substantially fluid-tight seal with the form onto which the bottom wall of the beam is poured, the seal preventing the seepage of concrete under the base of the drain thereby providing assurance against the covering of the void drain during the pouring of the bottom wall.

These and other objectives of the invention will become more readily apparent from the following detailed description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a perspective view of one end of a pre-stressed box beam, partially broken away to illustrate the void drain and its relationship with the beam structure,

FIG. 2 is a cross sectional view taken longitudinally through a pre-stressed box beam,

FIG. 3 is a perspective view of the void drain, and

FIG. 4 is a vertical cross section through the center of the void drain.

A pre-stressed, concrete, box beam **10**, illustrated in FIGS. 1 and 2, is shown on a soffit plate **11**. The soffit plate **11** provides the form for the beam bottom wall and is employed during the pouring of beam **10**, as will be described below, and is shown in the drawings to illustrate the manner in which it cooperates with the drain.

The pre-stressed beam **10** is constituted generally by two vertical side walls **12** and **13**, a horizontal top wall **14**, a horizontal bottom wall **15**, and end walls **16** and **17**. Contained within the walls **12–17** is a void forming member or core **18**, constructed from an asphalt impregnated fiber board, that supports the walls and forms a void **19**.

The bottom wall **15** has a plurality of wire cables or tendons **26** whose size, number and location is dictated by precalculated specifications. As shown in FIG. 1, tendons **26** are disposed substantially uniformly throughout the lower portion of the beam and are located at the lower portion of the side walls **12** and **13** as well as the bottom wall **15**.

One or more void drains **27** are embedded in the bottom wall **15**. Since the beam has a slight camber, it is preferred to locate void drains at least in the two ends of the beam. If the beam has intermediate transverse walls as at **28** and **29**, it is desirable to place a drain at each end of each section formed by the walls. This not only assures drainage regardless of the inclination of the beam but provides for air flow through the section.

Referring to FIGS. 3 and 4, the void drain **27** is molded as an integral unit and is constituted generally by a laterally projecting base **30**, a cylindrical drain tube **31**, and a

pair of upstanding risers **32** which are braced by stiffeners **33**. The risers brace the tube **31** with respect to the base **30** and provide laterally projecting shoulders which participate in clamping the drain in place during the formation of the beam as will appear below. It is preferred that a translucent plastic be used so that the drains do not appear as unsightly blemishes on the surface of the beam.

The base **30** is circular and has a flat upper surface **35**. A lip formed as a feather edge **36** projects downwardly around the periphery of the base **30**. This feathered annular edge will flare out under pressure to form a seal with the soffit plate and prevent the seepage of concrete under the base during the soffit pour, that is, during the pouring of the bottom wall.

The cylindrical drain tube **31** projects upwardly from the center of the base **30** and is capped at its upper end by a frangible closure in the form of a knock-out disc **37**. The disc is connected to the walls of the tube by an annular strip **38** which is substantially thinner than the disc and which is easily ruptured. It is necessary that the tube be sealed at the top to preclude the possibility of concrete pouring into the tube, but it is also imperative that the tube be uncapped after the beam is formed so that the tube can function as a drain. It is for ease in knocking-out the disc **37** that the thin, annular connecting strip **38** is formed.

The length of the tube is equal to the thickness of the soffit pour, that is, the bottom wall of the beam. If it is too long, it will project above the inner surface of the bottom wall and will not drain properly. If it is too short, concrete will set over the top of it which will be difficult if not impossible to knock-out. Because of the several possible thicknesses of the bottom wall, it may be desired to provide a selection of different types of void drains, each type having a different length of tube corresponding to the thickness of the bottom wall of the beam. Alternatively, one size can be stocked and shortened where required by the cutting to the necessary length and covering the cut end with masking tape. It can be lenghtened by removing the knock-out disk **37** and inserting an upwardly projecting cork.

The risers **32** have upper edges **42** which provide shoulders on either side of the tube intermediate the base **30** and the upper end of the tube to receive one or two tendons **26** as shown in broken lines in FIG. 4. The edges **42** of the risers are located at a height above base **30** greater than the height of the lowermost tendons **26** above the soffit plate **11** so that the tensioned tendons impart a compressive force to the risers, thereby clamping the drain between the tendons and soffit plate **11**. Secured in this manner, the drain is precluded from canting or shifting in any way during the soffit pour. Further, the compressing of the base against the soffit plate causes annular feathered edge **36** to flare out on the soffit plate **11**. The distance between the soffit plate and the lowermost tendon is normally approximately one and one-half inches. Therefore, the preferred distance between the riser edges **42** and the lower surface of the base is one and three-fourths inches.

The drain is designed for a one shot molding operation. That is to say, the inside diameter of the drain tube is tapered so that it is slightly larger at its base so that a core can be pulled. Similarly, the fins, webs, and the outside diameter of the drain tube taper inwardly at their tops so that the complete drain can be pulled from its mold.

In the operation of forming a box beam and using the void drain, the tendons **26** are unwound from reels (not shown) and extend through anchor members (not shown) at the ends of the soffit plate **11**. The tendons are then tensioned and secured as by swaged fittings to the anchor members. The drains are clamped at the desired locations between an adjacent pair of tendons of the lowermost layer, indicated at **43** in FIG. 1, and the soffit plate.

Each drain is positioned by first placing it on the soffit plate with the risers lying parallel to and between two tendons. The tendons are pried up, as by a crow bar, and the drain is rotated 90° to bring the riser's upper edges **42** under the tendons. Upon release of the tendons, the drains are clamped securely to the soffit plate.

Next, the side wall forms are secured on the soffit plate, concrete is poured to form the bottom wall of the beam, this being referred to as the soffit pour. As mentioned earlier, the thickness of this pour is equal to the height of the tube of the void drain. The void forming core **18** is then positioned on the pour, a cage of steel is placed over the core, forms are mounted, and a second pour is made to form the remainder of the beam.

After the concrete has been allowed to set or steam cure the tension is released from the tendons, the side and end anchor members removed from the soffit plate and the beam removed. Removal of the beam from the soffit plate exposes its bottom surface and the bases of all of the void drains. A rod is rammed through each void drain tube **31** to knock-out the disc **37** and to puncture a hole in the wall of the void forming core **18**.

We claim:

1. In a reinforced concrete box beam having bottom, top and side walls and longitudinally extending steel wires in at least the bottom wall and spaced upwardly from its bottom surface, a void drain for said beam comprising

an elongated tube extending transversely through said bottom wall,

a base integral with the lower end of said tube and projecting laterally therefrom,

shoulder forming means integral with said tube and projecting laterally therefrom at a location spaced above said base, said shoulder forming means engaged by and underlying at least one of said steel wires.

2. A void drain according to claim **1** further comprising a frangible closure at the upper end of said tube.

3. A void drain according to claim **1** in which said base includes a laterally extending substantially flat element lying substantially in the same plane as the bottom surface of said bottom wall.

4. A void drain according to claim **3** in which said base has a feathered sealing lip projecting downwardly from the periphery of said flat element.

5. A void drain according to claim **1** in which said shoulder forming means comprises a pair of parallel risers projecting upwardly from said base and presenting laterally projecting upper edges intermediate the ends of said tube, said upper edges being engaged by said steel wires.

6. In a reinforced concrete box beam having bottom, top and side walls and longitudinally extending steel wires in at least the bottom wall and spaced upwardly from its bottom surface, a void drain for said beam comprising

an elongated tube extending transversely through said bottom wall,

a base integral with the lower end of said tube and projecting laterally therefrom,

shoulder-forming means integral with said base and projecting above said base, said shoulder-forming means engaged by and underlying at least one of said steel wires.

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