2,153,741 W. H. COBI PROCESS OF MAKING REINFORCED HOLLOW SLABS

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Fig. 1

Fig. 2

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This invention relates to hollow concrete blocks and slabs and has for its object to provide an improved process and apparatus for making such slabs, as well as to provide an improved slab of this type.

It is known that concrete in setting exerts a binding action upon a core or the like which may be placed therein. While hollow beams or slabs are desirable for numerous purposes there have been no commercial satisfactory ways of forming such hollow slabs where they are considerably longer than ordinary building blocks. This is believed to be due to the difficulty in extracting a core. In making short concrete blocks one expedient has been to use a relatively dry cementitious material which can hold its shape immediately after being compressed so that the core may be withdrawn without waiting for the material to set. A variety of collapsible cores have been suggested but a difficulty with many of these has been the sticking of the core to the cementitious material and the difficulty in loosening them.

According to this invention these difficulties have been eliminated by loosening the cores from the set concrete, by sequentially prying the cores loose and by prestressing the hollow slab when set.

Referring to the drawings—

Fig. 1 is a side elevation partly in section showing the apparatus for making hollow concrete slabs.

Fig. 2 is an exploded view of the end wall of the mold and the tensioning apparatus.

Fig. 3 is a longitudinal view partly in section through the collapsible core.

Fig. 4 is a section on the line 4—4 of Fig. 3.

Fig. 5 is a perspective illustrating the way in which the collapsible core is removed from the cast slab.

Fig. 6 is a perspective showing one type of concrete slab made by this invention.

In Fig. 1 the concrete block or slab 10 is formed in the mold illustrated which is comprised of a bottom portion 11, side walls not shown and an end wall 12. To the bottom of the mold may be attached some usual type of vibrating mechanism such as is customarily used with molds. The reinforcing means 13 extends through the upper and lower portions of the slab and as shown in Figs. 1 and 2 the longitudinal reinforcing members extend through the end wall 12 where they may be attached to clamps 14 for the purpose of applying stress to these tension means and holding them under stress while the cementitious material is setting. The gripping means 16 which hold the ends of the reinforcing wires may be tightened by means of rotation of the spindles shown so that stress is transmitted from the reinforcing wires 13 to the frame 18 and to the end wall 12 of the mold.

The inner face of the end wall 12 includes a rubber or other yieldable material 17 for the purpose of engaging the end of the core 19 and also for the purpose of forming a snug fit around the reinforcing wires where they pass through the end wall. As shown in Fig. 2 the end wall is made in at least three portions, a main or middle portion grooved to receive the reinforcing wires and end or cupping portions for closing the 15 grooves through which the reinforcing wires pass.

Secured to the end wall is a center clip 18 comprising spring fingers adapted to engage the inner end walls of the core to assist in centering or positioning the core within the mold. A similar end wall may be used at the other end of the mold, but instead of using clamps and other tensioning means for the reinforcement it will be understood that the reinforcing wires may be secured to a fixed support whereby the tensioning 25 means is necessary at only one end of the mold. The end walls of the mold may clamp the core between them and thus assist in supporting the core during the molding process. The engagement between the ends of the core and the rubber or other yieldable material 17 provides a substantially liquid-tight seal to keep the cementitious material from getting inside of the core during pouring or setting. As shown in Figs. 3, 4 and 5 the collapsible core 35 includes comparatively thick wall portions 28 connected by much thinner portions 21 which are soldered or otherwise secured to the thick walls. In practice it has been found desirable to make the thick walls of about ½ inch commercial sheet tin while the thin walls 21 may be of brass only about .005 inch thick. For expanding the collapsible core there is provided a fluid pressure holder 22 which is of pure gum rubber about ¼ inch thick and constructed to withstand an internal air pressure of forty to fifty pounds per square inch. The fluid pressure holder 22 contacts with a series of blocks 23 which press outwardly upon the thick walls of the core. Within the rubber container 22 is a tension rod 24 arranged to prevent the end plugs 25 from pulling out under the internal pressure. The plugs 25 may be vulcanized or securely cemented to the walls of the pressure holder and end rings 28.
serve to hold the gum rubber walls securely in contact with the end plugs 28. As shown in Fig. 3 the pressure holder when inflated has a tendency to expand slightly between the blocks but this is not objectionable. The left end of the core in Fig. 3 is shown as being provided with an ordinary valve stem such as is used in tires and through this rod 27 the inflating and deflating operations may take place. Eyes 28 or the equivalent are secured to the inside of the core adjacent one end so that the ends of a gripping handle 29 may be engaged and assist in withdrawing the core from the finished slab. Fig. 2 shows how the springs of the centering clip 16 are slotted at 30 to give clearance for the eyes 28.

In operation the bottom of the mold is generally made of ply wood and substantially wider than the mold so that the sides may, if desired, rest upon it. The desired tension, about 3000 to 5000 pounds per square inch is maintained on the reinforcing wires 18 while the concrete is setting. After it has set the external tension applying means is disconnected from the reinforcing wires with the result that the portions of the concrete around these wires are placed under an initial compression while the reinforcing still remains under tension. The compression initially placed on the slabs not only strengthens them and makes them better adapted for use as beams but the initial stressing of the concrete restraining the tension applying means from the re-inforcing wires in external tension assists in releasing the core from the gripping action in which it is held by the concrete in setting, due to a shortening of the slab. The core itself when expanded in position may have substantial compression placed upon it by the end walls, although if desired this is not necessary since the pressure on the end walls may be transmitted to the side walls of the mold without passing through the core to any substantial extent.

It is thought, however, that stressing the core in this manner may assist in releasing the core and allow a small displacement of the core to occur between the core and concrete when any longitudinal compression is removed from the core and placed upon the concrete. After removal of the end walls and deflating the fluid pressure holder, it may be necessary to drive a wedge between each thick side of the core and the contiguous concrete for the purpose of sequentially loosening the core from the concrete and allowing the core to be contracted radially inward.

In separating the sides from the concrete the thin sides 21 are also disconnected from the concrete. After collapsing the core may be again inflated and inserted in position for use over again.

Among the advantages of this invention may be mentioned the simplicity and ease with which the collapsible core may be removed. The pre-stressing of the concrete is believed to assist in removal of the core. Where the term "concrete" has been used a more precise term should be cement mortar or grout. In pouring the cementitious material is preferably one part of cement to two or three parts of sand. The hollow beams being under an initial compression are better adapted to withstand fixtures than would be the case if they did not have such initial compression. As used herein the term "slab" signifies an elongated block whether used as a beam or column.

I claim:
1. The process of making a reinforced hollow slab of moldable material which comprises longitudinally tensing the reinforcements of said slab while simultaneously longitudinally compressing a core within said slab during setting of the material and then prestressing the slab when set from the stress in said reinforcements to facilitate removal of said core.
2. The process of making a reinforced hollow slab of moldable material which comprises longitudinally tensing the reinforcements of said slab while simultaneously longitudinally compressing a collapsible core containing internal pressure within said slab during setting of the material and then prestressing the slab when set from the stress in said reinforcements and core and removing the internal pressure from said core to facilitate its removal.
3. The process of assisting in the removal of a core from a reinforced hollow slab of moldable material which comprises externally and longitudinally tensing the reinforcing means of said slab and simultaneously externally stressing said core longitudinally under compression while the moldable material is setting, and after the material has set removing the external stress from said core and the external tension from said reinforcements whereby said slab is placed under an initial compression and the core tends to become loosened from the set slab material.
4. The process of assisting in the removal of a core from a reinforced hollow slab of moldable material which comprises externally and longitudinally tensing the reinforcing means of said slab and simultaneously externally stressing said core longitudinally under compression and transversely under tension while the moldable material is setting, and after the material has set removing the external longitudinal and the internal transverse stress from said core and the external tension from said reinforcing means whereby said slab is placed under an initial compression and the core tends to become loosened from the set slab material.
5. A process of making a reinforced hollow slab from plastic cementitious material which comprises applying a longitudinal tensioning force to the reinforcement elements embedded within said material and simultaneously applying a longitudinally compressive force to a removable forming core disposed in a hollow of said slab while the material of the slab is in a plastic condition, said forces resulting from the reaction of each other, permitting the plastic material to set, and thereafter disconnecting the application of said forces, whereby the core is released and the set material is placed under compression by the tensioned reinforcing elements.

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