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APPARATUS AND METHOD FOR OBTAINING TEST CORES

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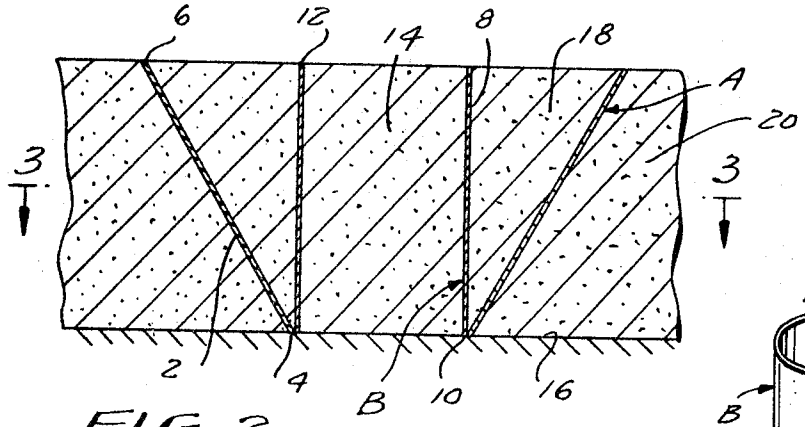


FIG. 2

FIG. 1

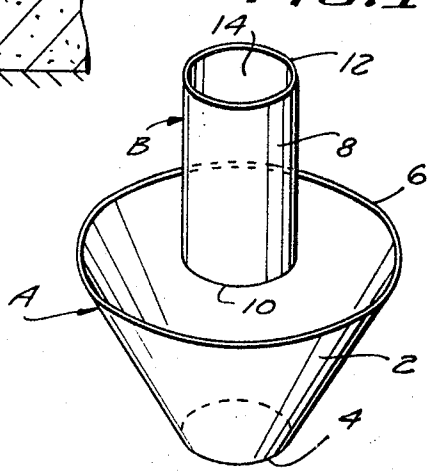
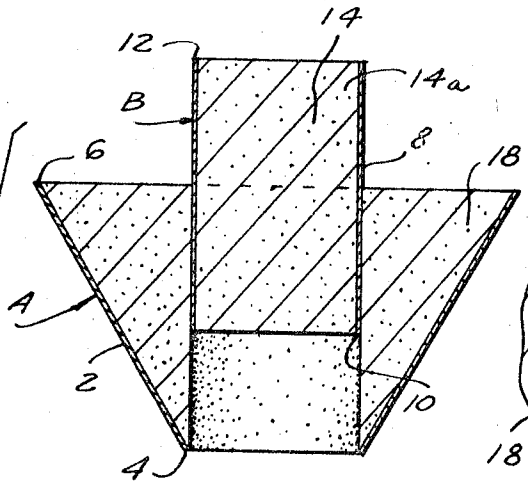


FIG. 4



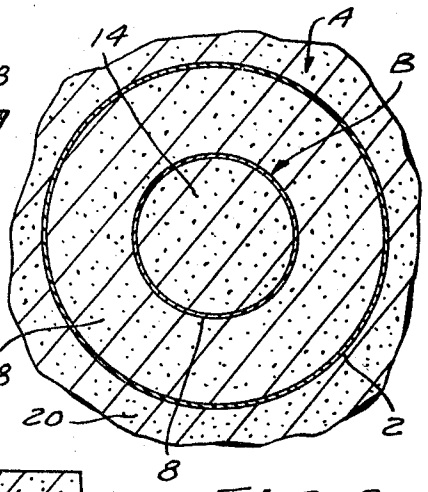
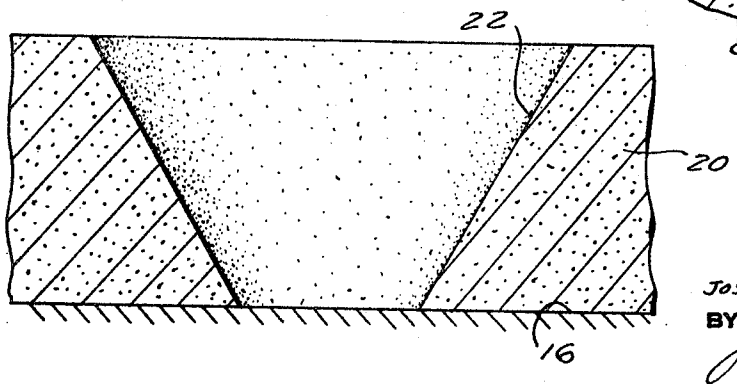


FIG. 3



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APPARATUS AND METHOD FOR OBTAINING TEST CORES

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ABSTRACT OF THE DISCLOSURE

Obtaining test cores set in situ from concrete floors or the like by using inner and outer members of different shapes, the inner member being essentially cylindrical and producing the test core and the outer member having outwardly and upwardly flaring sides and facilitating the removal of the test core from the floor.

The present invention relates to apparatus and method for the obtaining of test cores from bodies of set plastic material and the like, e.g., concrete floors in buildings or concrete or macadam roadways.

Many structural elements are formed of plastic materials which are permitted to set in place. Typical are roadways and floors and walls of buildings, and particularly multiple dwellings, office buildings and public buildings such as schools. The strength of the thus-formed structural elements depends upon many factors, including the particular climatic conditions to which the structural members are subjected while the concrete or other plastic structural material is setting and after setting has taken place. Accordingly, the only positive way of determining the nature, and particularly the strength, of the set material is to take a sample from the floor or wall after the material in question has set and subject that sample to appropriate laboratory tests. The desirability of doing this is obvious, particularly because of the overriding importance, from a public safety point of view, that the strength of such structural members be up to specification. However, because of the difficulty involved in removing a sample from a hard concrete mass or the like, the conventional procedure is to pour a test cylinder separate from the floor, and to take actual samples from the floor only in cases where the test cylinders indicate the possible existence of understrength concrete.

The removal of a test core from the hardened floor is accomplished by drilling into the floor after the poured concrete has been permitted to set for a length of time such as to permit it to assume its initial and partly final physical characteristics. These operations are a source of considerable trouble, time, and expense, not only because of the cost of the equipment needed to cut a core from a concrete floor or the like and the cost of replacement of the cutting elements themselves as they become worn out in use, but also because of the length of time required to cut the cores from the floor, the latter representing a major factor of expense because of the high cost of labor. Moreover, since the concrete covers and hides the supporting surface and embedded reinforcing members from view, the use of a diamond cutting tool frequently results in cutting the top and bottom reinforcements, an extremely undesirable situation because of the reduction in the overall structural strength which results from interrupting the continuity of the slab.

Attempts have been made to provide in the floor a core-defining form. Test cores have vertical parallel sides, and usually are cylindrical. When forms of appropriate

test core shape are placed in the floor the pressure of the concrete on the outer surfaces of the walls of the form effectively prevent removal of the form and its contained core from the floor, even when the outer surface of the form is greased or similarly treated before the concrete is poured. It is believed that the weight of the concrete in a thick floor, before the concrete has set, and its shrinkage characteristics as it sets, so forces the concrete at the bottom of the floor against the bottom of the test core form as to produce an adhesion therebetween sufficient in magnitude to effectively prevent the removal of the form from the floor after the concrete has set.

It is the prime object of the present invention to devise a method and apparatus for obtaining test cores from concrete floors or the like which eliminate the above disadvantages, and in particular permit the obtaining of appropriately shaped and dimensioned cores through the use of cylindrical forms made of paper or other disposable material, but without in any way adversely affecting the status of the cores as accurate and reliable representations of the condition and properties of the remainder of the concrete comprising the floor.

To these ends I provide a two-piece core-forming structure comprising an outer open-topped tubular member and an inner open-topped tubular member, preferably but not necessarily as two separate units. The outer member is mounted on the area where the concrete wall or floor is to be formed, and it has sides which slope upwardly and outwardly to an appreciable degree; preferably it is in the shape of a truncated cone. The inner member is preferably formed of paper, wax-impregnated cardboard, plastic, or other disposable material, and has a shape such as to produce the desired test core, that is to say, it is essentially cylindrical. It is appropriately supported within the outer member. When it is of the same height as the outer member the lateral cross-sectional dimension of its lower end is at least substantially the same as the lateral cross-sectional dimension of the lower narrow end of the outer tubular member, its lower end registering with and being substantially received within the narrow end of the outer member, the inner member extending from the narrow end of the outer member toward the wide end thereof and in a preferred form being substantially unconnected to the outer member. After the outer and inner members have been appropriately positioned, the concrete or other plastic settable structural material is poured, that plastic material forming the wall or floor around the outer member and entering the space inside the inner member and the space between the inner and outer members, both of these spaces being open-topped so that the concrete can readily flow thereinto. The concrete is then allowed to set, and the concrete which defines the wall or floor and the concrete inside the inner member are both subjected to the same pouring and setting conditions as well as "strength gain" conditions of curing, workmanship, time, temperature, humidity, protection and the like.

When the condition of the concrete is to be tested, all of the concrete inside the outer member (this including the inner member and the concrete inside it) is removed from the floor. This may readily be accomplished because of the upwardly and outwardly flaring orientation of the walls of the outer member. Ordinarily the outer member is removed at the same time, but this is not essential. Thereafter the test core defined by the concrete inside the inner member is readily separated from the remainder of the assembly removed from the floor. In many instances the inner member, relieved from the lateral pressure of the concrete of the floor, can readily be pushed

out from the concrete which surrounds it, to wit, the concrete which entered the space between the inner and outer members, but even if the inner member cannot be thus readily disengaged from the relatively small mass of concrete which now surrounds it, that surrounding mass of concrete may readily be broken away to free the inner member, after which the test core may be removed from the inner member in any suitable fashion, as by stripping or breaking the inner member away from the test core. Alternatively, the core may be driven out from the inner member. The space left in the floor when the concrete inside the outer member is removed therefrom can either be filled with concrete, or that space can be used to house pipes or other elements designed to pass through the floor or wall in question.

To the accomplishment of the above, and to such other objects as may hereinafter appear, the present invention relates to the apparatus and method for the forming and obtaining of test cores, as defined in the appended claims, and as described in this specification, taken together with the accompanying drawings, in which:

FIG. 1 is a three-quarter perspective exploded view of the inner and outer members of the device of the instant invention;

FIG. 2 is a cross sectional view taken through a portion of a concrete floor and showing the manner in which the device is adapted to be used;

FIG. 3 is a cross sectional view taken along the line 3—3 of FIG. 2; and

FIG. 4 is a cross sectional exploded view similar to FIG. 2 and showing one manner in which the test core may be removed from the inner member.

While in this specification mention is made specifically of the formation of a floor structure from concrete, this is by way of exemplification only, and it will be understood that the invention is applicable to the obtaining of test cores from widely varying types of structural elements formed of widely varying types of plastic settable materials, the invention being applicable to all situations in which the test core is to be accurately representative of the remainder of the structural element.

The core forming apparatus comprises an outer member generally designated A and an inner member generally designated B which is adapted to be located inside the outer member A and which is preferably removable therefrom. The outer member A comprises a wall **2** which slopes upwardly and outwardly from a comparatively narrow lower end **4** to a comparatively wide upper end **6** which is open. It may be formed of any suitable structural material such as metal, plastic or paperboard, and preferably takes the shape of a truncated cone. The inner member B comprises a wall **8** extending between a lower end **10** and an upper end **12**, the upper end **12** being open and the space **14** inside the wall **8** being shaped to produce a test core of desired configuration, e.g. cylindrical. The lateral cross sectional dimension of the inner member B at its lower end **10** is preferably at least substantially as great as the corresponding dimension of the lower end **4** of the outer member A. The heights of the outer and inner members A and B as specifically disclosed in the drawings are substantially the same. The inner member A may also be formed of any suitable structural material, but a disposable material, such as plastic or paper, is preferred, for reasons which will become apparent below.

In use the outer member A is adapted to be mounted in any appropriate location in a formed structural element from which a test core is to be taken. Thus, as shown in the drawings, it may be placed, with its narrow end **4** down, on the upper surface **16** of the supporting structure on which a concrete floor is to be poured. Any suitable means may be provided for retaining it in that position. The inner member B is located inside the outer member A with the lower end **10** of the inner member B registering with and substantially received within the narrow end **4** of the outer member A. As may be seen from FIGS. 2 and 4, the lower end **10** of the outer member B fits snugly within the open lower end **4** of the outer member A in the form here specifically disclosed. In its preferred form the inner member B is essentially unconnected to the outer member A except to the extent that there may be a frictional engagement therebetween them adjacent to their lower ends **10** and **4** respectively.

By locating the inner member B within the outer member A a space **18** is defined between the inner and outer members B and A, a space **14** is defined inside the inner member B and a space **20** is defined outside the outer meber A, all of those spaces being open-topped and all of those spaces being closed at their bottoms at least by the surface **16** of the supporting structure. The height of the member B is at least as great as, and is preferably substantially the same as, the desired thickness of the floor to be formed. The height of the inner member B in the form specifically disclosed is the same as that of the outer member A.

In use, after the outer member A has been positioned on the supporting surface **16** and the inner member B has been positioned therein, the concrete or other plastic material is poured, the mass of concrete in the space **20** which surrounds the outer member A defining the floor which is being formed. Concrete also enters and fills or substantially fills the spaces **14** and **18** (see FIG. 2).

After the concrete or other plastic material has been permitted to set to desired degree the concrete inside the outer member A is removed from the floor. This removal is readily accomplished because of the upwardly and outwardly flaring outer surfaces of that concrete mass, which comprises the concrete in the space **14** as well as the concrete in the space **18**. It is believed that this is most readily accomplished by lifting the outer member A in any appropriate manner, the outer member A as it is removed from the concrete in the space **20** carrying along therewith the concrete masses in the spaces **14** and **18**. Ready separation of the outer member A and its contents from the remainder of the floor may be facilitated by appropriately coating the outer surface of the member A with some appropriate release material before the concrete is poured. Even though the pressure of the concrete is exerted laterally on the outer member A, the fact that the outer surfaces thereof flare upwardly and outwardly ensures that the pressure of the concrete thereon will not prevent the removal thereof from the floor.

Thereafter, and as indicated schematically in FIG. 4, the test core defined by the concrete in the space **14** inside the inner member B is removed in any appropriate fashion. One such fashion involves the driving of the core, designated **14A** in FIG. 4, together with its surrounding inner member B out from the outer member A via the open bottom of the latter. If this is not feasible or desired, the concrete in the space **18** surrounding the inner member A may be broken or chipped away, leaving the inner member B with the test core **14A** therein. Thereafter the inner member B is separated from the test core **14A** in any appropriate manner, as by driving the core **14A** axially out from the inner member A, or by unwrapping the inner member B if it is in the form of paper or by breaking it away if it is in the form of plastic or other disposable material.

After the concrete inside the outer member A, either with or without the outer member A itself, has been removed from the floor, the continuity of the floor may be recreated by filling the space **22** left by the removal thereof (see FIG. 4) with concrete or other plastic material. Alternatively, the space **22** may be left empty, thereby to provide a space (which may, if desired, be lined by the outer member A) through which pipes, wires, conduits or the like may be passed. It is worthy of note that such reinforcements as exist in the floor remain uncut and intact.

In the preferred form here specifically disclosed the inner and outer members A and B are separate structures which are substantially unconnected to one another. This type of construction is preferred because it facilitates the removal of the test core **14A** together with its surrounding inner member B from the concrete in the space **18** within the outer member A, as shown in FIG. 4. However, it would be feasible to form the inner and outer members A and B as a single interconnected unit with the two members secured to one another, in which event the test core **14A** would be driven out from its surrounding inner member B while the latter remains in position relative to the outer member A.

The length of the test core need not be the same as the depth of the floor. For example, a test core having a length of 6 or 8 inches is satisfactory, but some floor sections may have a much greater depth, such as 20 inches. In such situations the outer member A has a height equal to the depth of the floor but the inner member B may have a lesser height. In such an event any suitable means may be provided for supporting the inner member B of lesser height within the outer member A. Such means may comprise a block resting on the surface **16** and received within the lower end **4** of the outer member A, on which block the inner member B of lesser height is adapted to rest. Instead of a block the outer member A may be provided with a re-entrant wall extending vertically up from its lower end **4**, that wall substituting for the lower portion of the inner member B shown in the drawings; the inner member B of lesser height rests on the upper end of that re-entrant wall, a partition member extending across the bottom of the inner member B so as to define the lower end of the test core **14A**. The partition member could be formed integral with the re-entrant wall of the outer member A or could be separate therefrom. Other variations will suggest themselves.

The structural members involved are simple and inexpensive, and the members A and B, when not disposable, may be used a plurality of times. The saving in time and equipment, when compared with prior art methods where the test cores are physically cut from the floor, is far greater than the cost of the parts involved in accordance with the teachings of the present invention, so that truly significant manufacturing economies are realized. Through the use of the present invention truly representative test cores may be produced with substantially the same facility and nominal expense as characterizes the conventional formation of test cylinders separate from the floor. Moreover, since the test cores **14A** set under precisely the same conditions as the concrete in the space **20** which makes up the body of the floor, the test cores **14A** will be accurately representative of the condition and physical properties of the actual floor material, thus favorably differentiating over the prior test cylinders.

While but a single embodiment of the present invention has been here specifically disclosed, it will be apparent that many variations may be made therein, all within the scope of the present invention.

I claim:

1. A form for making a test core of a body of set concrete or the like comprising an inner tubular member having substantially vertical side walls extending between an open upper end and a lower end, said lower end adapted to be closed, the walls forming a boundary within which the concrete is poured, and means for facilitating the removal of the test core from the body of set concrete surrounding it comprising an outer tubular member having upwardly and outwardly sloping side walls extending from an open wide upper end to a lower narrow end, said inner member being received within said outer member so as to extend from the direction of said narrow end of said outer member toward the wide end thereof with its lower end substantially registering with the narrow end of said outer member.

2. The form of claim **1**, in which said inner and outer members are of substantially the same height, the lower end of said inner member being substantially received within the narrow end and substantially filling said narrow end of said outer member.

3. The form of claim **2**, in which said inner member is formed of a thin disposable material.

4. The form of claim **2**, in which said inner member is formed of paper.

5. The form of claim **1**, in which said inner member is formed of a thin disposable material.

6. The form of claim **1**, in which said inner member is formed of paper.

7. The form of claim **1**, in which said outer member is in the shape of a truncated cone and said inner member is in the shape of a cylinder, said inner member being substantially unconnected to said outer member.

8. The form of claim **7**, in which said inner and outer members are of substantially the same height, the lower end of said inner member being substantially received within the narrow end and substantially filling said narrow end of said outer member.

9. The form of claim **7**, in which said inner and outer members are of substantially the same height, the lower end of said inner member being substantially received within the narrow end and substantially filling said narrow end of said outer member, and in which said inner member is formed of a thin disposable material.

10. The form of claim **7**, in which said inner and outer members are of substantially the same height, the lower end of said inner member being substantially received within the narrow end and substantially filling said narrow end of said outer member, and in which said inner member is formed of paper.

11. The form of claim **7**, in which said inner member is formed of a thin disposable material.

12. The form of claim **7**, in which said inner member is formed of paper.

13. The method of forming a concrete test core from a concrete floor or the like which comprises: positioning in the area where said floor is to be formed an outer tubular member having upwardly and outwardly sloping side walls extending between an open wide upper end and a lower narrow end, within which is an inner tubular member having substantially vertical side walls extending between an open upper end and a lower end, said lower end of said inner member substantially registering with the narrow end of said outer member, said inner member extending from the direction of said narrow end of said outer member toward said wide end thereof; pouring concrete over said area around said outer member, between said inner and outer member, and inside said inner member; permitting said concrete to set; removing from the floor the set concrete within said outer member, this including the set concrete within said inner member; removing said inner member, together with the concrete core formed therewithin, from the concrete between said outer and inner members; and removing said core from said inner member.

14. The method of claim **13**, in which, when said set concrete within said outer member is removed from said floor, said outer member is removed therewith.

15. The method of forming a concrete test core from a concrete floor or the like which comprises: positioning in the area where said floor is to be formed an outer tubular member having upwardly and outwardly sloping side walls extending between an open wide upper end and a lower narrow end, within which is an inner tubular member of substantially the same height as said outer member having substantially vertical side walls extending between an open upper end and a lower end, said lower end of said inner member registering with and being substantially received within the narrow end of said outer member, said inner member extending from said narrow

end of said outer member toward said wide end thereof; pouring concrete over said area around said outer member and inside said outer and inner members; permitting said concrete to set; removing from the floor the set concrete within said outer member, this including the set concrete within said inner member; and removing said core defined by the concrete within said inner member from the concrete between said inner and outer members.

16. The method of claim **15**, in which, when said set concrete within said outer member is removed from said floor, said outer member is removed therewith.

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73—421; 249—61, 134, 142, 188