

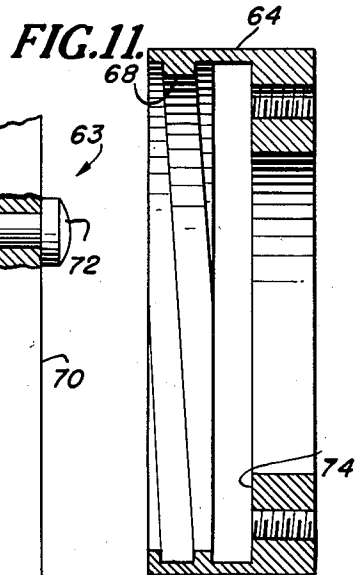
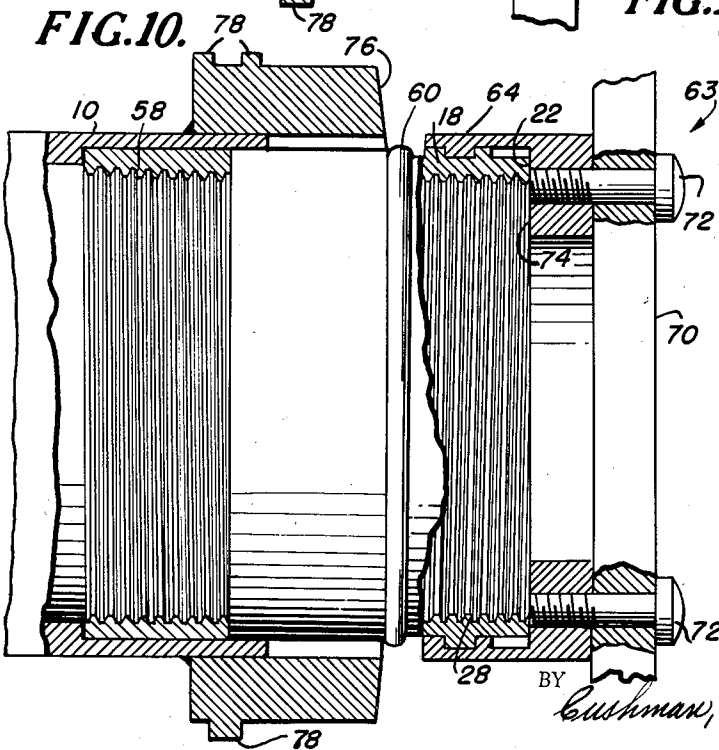
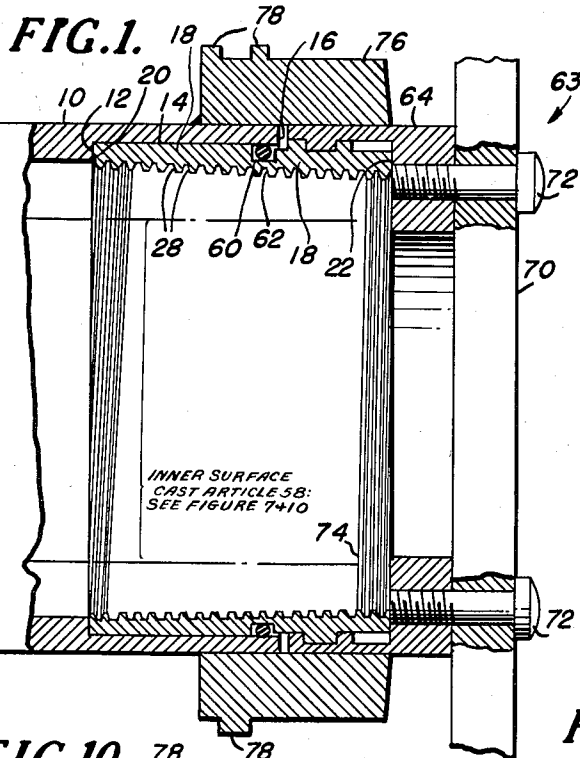
March 15, 1960

F. L. MAGOON
THREAD CASTING METHOD

2,928,764

Filed Jan. 15, 1954

3 Sheets-Sheet 1



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FIG. 3.

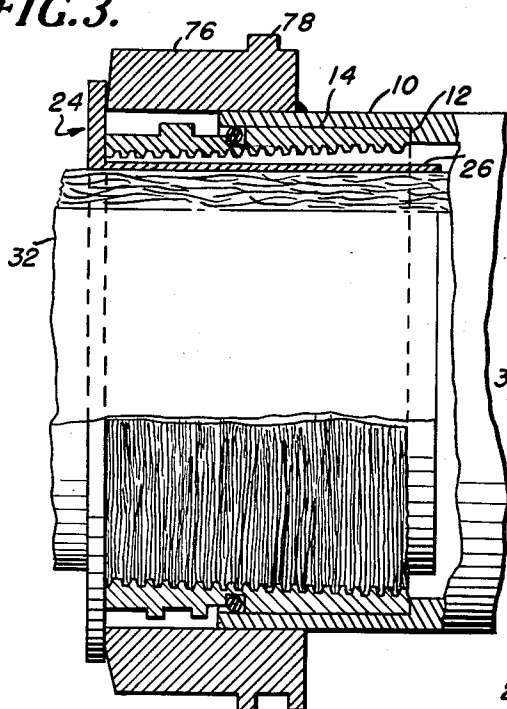


FIG. 4.

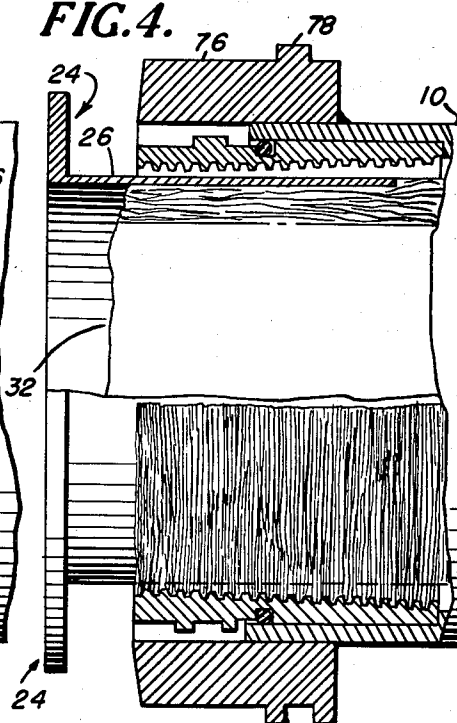


FIG. 2.

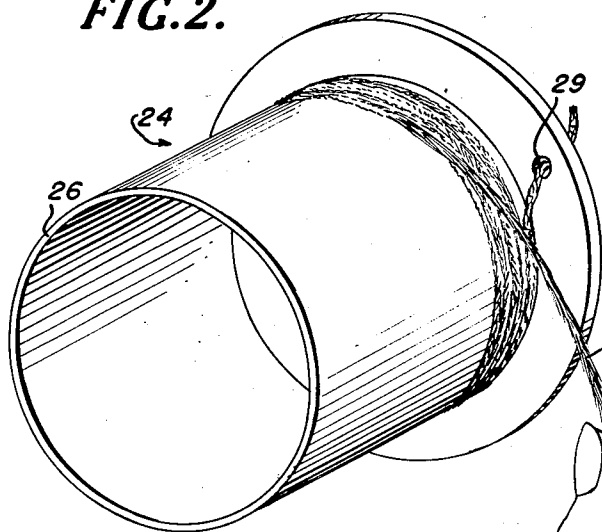
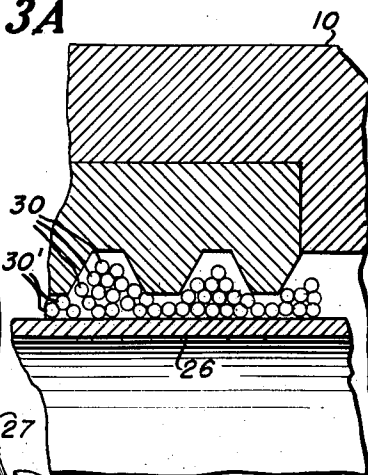


FIG. 3A



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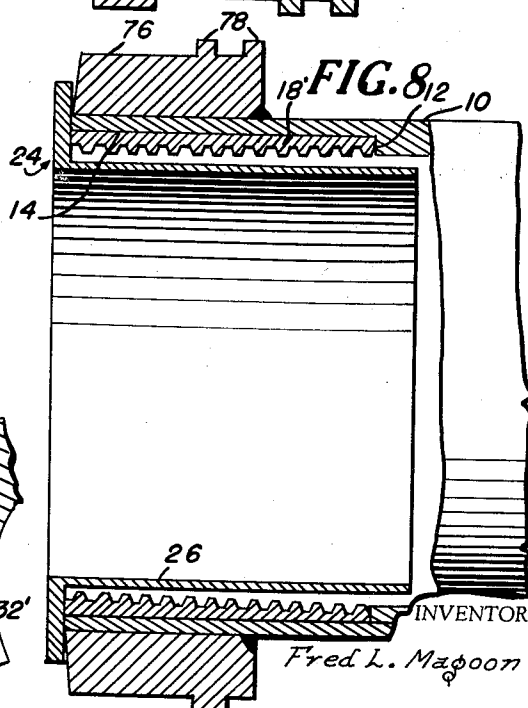
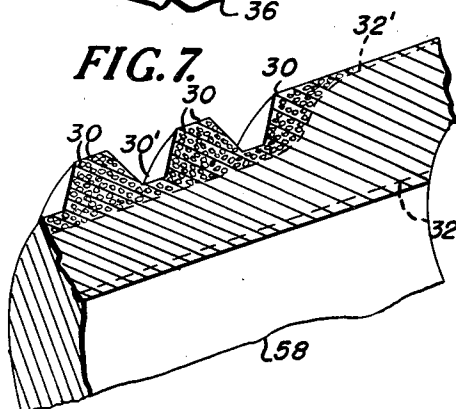
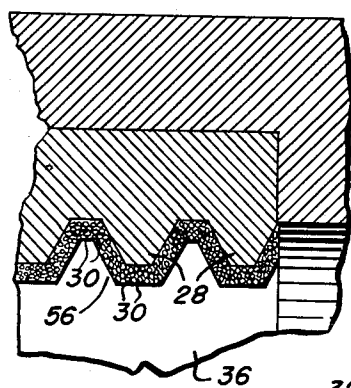
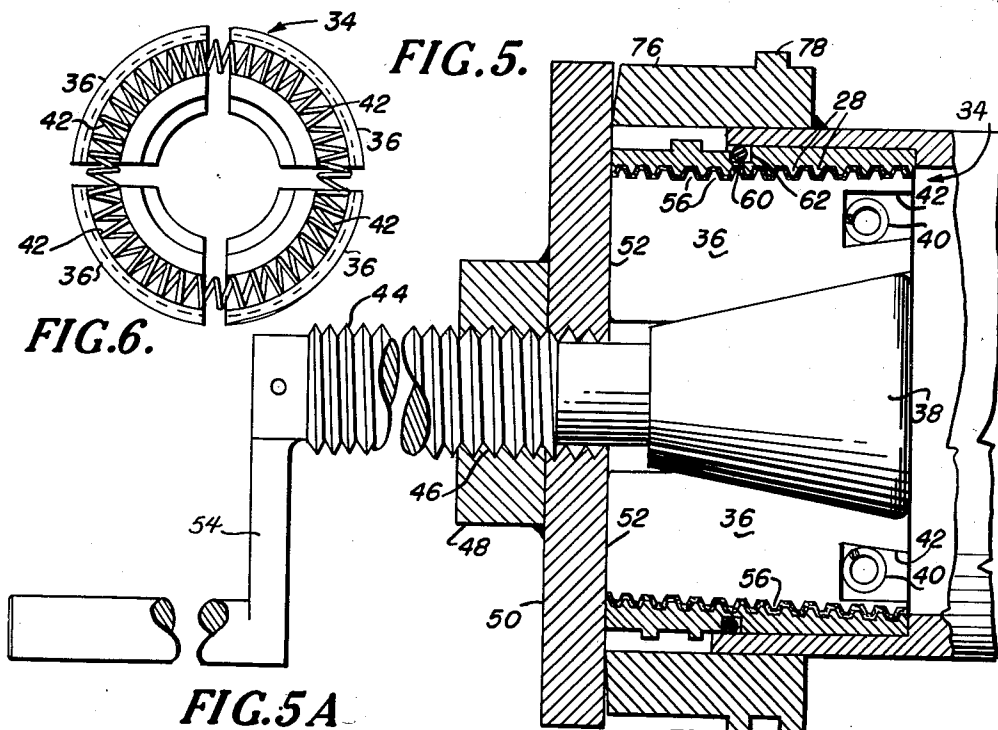
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3 Sheets-Sheet 3



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2,928,764

THREAD CASTING METHOD

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Application January 15, 1954, Serial No. 404,328

6 Claims. (154—83)

This invention pertains to the casting of articles from liquid settable materials such as thermosetting resins and particularly pertains to the integral casting of screw threads on such cast cylindrical articles wherein the threads are filled with reinforcing fibers running substantially in the direction of the threads. The invention is most directly concerned with methods and apparatus for positioning the thread reinforcement fibers preparatory to a casting operation.

As fully set forth in United States Patent No. 2,629,894 to Herbert D. Boggs and assigned to the assignee of the present application, it adds greatly to the strength of screw threads on so-called plastic articles to have reinforcing fibers running longitudinally or in the direction of the thread. In the just mentioned patent, methods and apparatus for so affixing threads to a previously existing pipe or other article is described and claimed. The purpose of the present invention is to provide methods and apparatus for positioning reinforcing fibers into mold threads for casting threads having reinforcement running longitudinally therethrough, the threads being cast integral with the body of the article.

It is, therefore, a primary object of this invention to provide improved methods and apparatus for positioning reinforcing material for and casting reinforced threads integrally with cast articles.

A further object of the invention is to provide methods and apparatus for positioning an elongated bundle of reinforcing fibers into a thread or threads cut into a mold in which a threaded article is to be cast.

A further object of the invention is to provide apparatus for compacting bundles of reinforcing fibers into a threaded mold.

A further object of the invention is to provide apparatus for removing a threaded mold portion from a cylindrical mold.

Still further objects and the entire scope of the invention will become more fully apparent and will be in part expressed or otherwise obvious from the following detailed description and the appended claims.

The invention may be best understood with reference to the accompanying drawings, in which:

Figure 1 shows a side elevational view in cross-section of one end of a casting mold having a threading sleeve inserted therein and a sleeve removing wrench positioned thereon in accordance with features of the present invention.

Figure 2 shows a threading mandrel according to a feature of the invention.

Figure 3 shows a cross-sectional view of a mold with a threading mandrel shown in Figure 2 inserted therein and with certain reinforcement fibers arranged therein.

Figure 3A shows an enlarged view of a portion of the structure shown in Figure 3.

Figure 4 shows structure as in Figure 3 with a threading mandrel partially removed.

Figure 5 shows a fiber thread compactor device in

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place in one end of a mold and threading sleeve according to a feature of the invention.

Figure 5A shows an enlarged section of the structure of Figure 5.

Figure 6 shows an end view of compactor segments otherwise shown in Figure 5.

Figure 7 shows a partial view in section of a length of threaded cast pipe or tubing according to the invention.

Figure 8 shows a mold end having therein a threading sleeve for producing "upset" threads according to the invention.

Figure 9 shows a side elevational view of a threading sleeve as otherwise shown in Figure 1.

Figure 10 shows the threading sleeve of Figure 1 partially removed by use of a wrench according to the invention, and

Figure 11 shows in cross-section a wrench sleeve otherwise shown in Figures 1 and 10.

In the drawings, wherein like reference characters designate like parts throughout, an exemplary form of apparatus according to the invention is shown, wherein reference character 10 designates one end of a cylindrical pipe or tube casting mold which may be, for example, twenty feet long and three and one-half inches in internal diameter. Representative art for casting pipe or tubing from thermosetting resins with glass fiber reinforcement therein is fully explained in the copending applications of Herbert D. Boggs, Serial No. 200,193, now U.S. Patent No. 2,776,450, filed December 11, 1950, for Pipe Forming Machine and Method, and Serial No. 264,976, now U.S. Patent No. 2,785,442, filed January 4, 1952, for Plastic Tubular Members and Manufacture Thereof, and in the copending application of Lewis Perrault, Serial No. 391,821, filed November 13, 1953, for Casting, all assigned to the assignee of the present application. However, it is to be understood that the present invention is not limited to such art, but is applicable to casting of any articles, hollow or solid, from any settable material, and whether or not the body of the article may have reinforcement fibers therein.

Referring now primarily to Figures 1 and 3 the mold 10 may be cut away to form shoulder 12 and length 14 of increased internal diameter, the mold terminating at end 16. Into the enlarged section between shoulder 12 and end 16 of mold 10, there may be placed a threading mold or sleeve 18. Sleeve 18 is characterized by having a fairly close sliding fit between its outer surface and the inner surface of the mold 10 along the length of increased diameter 14 as previously mentioned. Sleeve 18 extends from an inner end 20 abutting the shoulder 12 to an outer end 22 which, in the particular example of Figures 1 and 3, extends a considerable distance beyond the end 16 of the mold 10.

For the practice of the invention a threading mandrel designated generally as 24 is provided (see primarily Figures 2, 3 and 4, this having a thin cylindrical sleeve section 26 of sheet metal or the like about which a layer of strands or bundles of fiber reinforcement material 27, for example, a bundle or roving of glass fibers, may be wrapped more or less uniformly as shown in Figure 2. Preferably the material 27 is wound or wrapped to conform approximately to the pitch of thread or threads 28 which is preformed in the inner surface of the threading sleeve 18. The thread 28 defines the thread eventually to be cast in the tubular article. The ends of material 27 can be tacked lightly to the sleeve 26 in any convenient manner, as by overlapping, use of an aperture 29, use of cement at the ends, etc. The outer diameter of mandrel sleeve 26 preferably is to be just slightly less than the smallest diameter to be encountered at the thread 28 when the mandrel sleeve 26 is inserted within

the threading sleeve 18 and therefore within the thread 28 cut therein. This is shown in Figure 3.

In accordance with the present invention, when reinforcing material 27 is wound on the mandrel sleeve 26 as heretofore explained and the mandrel 24 then inserted into the threading sleeve 18 while turning in a direction conformable with the direction and pitch of the threads 28, the fiber 30 will readily lay up in the thread 28. This situation is illustrated in Figure 3 and in the enlarged section thereof shown in Figure 3A, the latter showing end views of individual fibers 30 of material 27 (greatly exaggerated in size for descriptive purposes) laid up in the valleys of the thread 28, it being granted that there may be some of the fibers, designated 30', shown in Figure 3A, remaining between the ridges of threads 28 and the outer surface of the mandrel sleeve 26.

After the mandrel 24 has been inserted and the threads laid up as shown in Figures 3 and 3A, the main fiber reinforcement (if there is to be any) for the pipe, tubing or other article may be inserted into the mold 10 while the mandrel 24 remains in place. As is fully developed in the copending applications of Herbert D. Boggs, Serial Nos. 200,193, now U.S. Patent No. 2,776,450, and 264,976, now U.S. Patent No. 2,785,442, and Lewis Perrault, Serial No. 391,821, for making reinforced pipe or tubing a preformed tubular reinforcing liner 32 may be slidably inserted into the mold so that it occupies the position shown in Figure 3. The existence of mandrel sleeve 26 in the threading sleeve 18 while the liner 32 is inserted prevents disarrangement of the thread reinforcing material 27.

After the liner 32 is in place, the mandrel 24 may be withdrawn, as by pulling directly out without turning. The original tacking of the material 27 at its ends to mandrel 24 is thereby easily broken. The mandrel when partially withdrawn is shown in Figure 4. Since the mandrel sleeve is quite thin, there will be little displacement of the liner 32 (if any) with respect to the thread reinforcement material 27 and the result will be that the liner 32 now lies in contact with the thread reinforcing fibers 30. When no liner is present, the fibers 30 and 30' will nevertheless remain in the thread 28.

The next step, which is optional, may be the insertion into the threading sleeve 18 (and liner 32 if any) of a thread reinforcement compactor assembly designated generally as 34 and shown in Figures 5 and 6. Four segmental jaws 36 are provided arranged about a central conical wedge member 38. The segments 36 are collected against the wedge 38 by means of a spring 40 seated in arcuate grooves 42 in each segment. The wedge member 38 has extending from its smaller end a threaded extension 44 which engages complementary threads 46 in a nut 48 fixed as by welding to a plate 50. The ends 52 of segments 36 abut the plate 50 and therefore as the wedge member 38 and threaded extension 44 are rotated by handle 54, the wedge 38 is moved toward the plate 50, whereby the segments 36 are forced outwardly. The outer surfaces of segments 36 may be provided with aligned threads 56 which are formed to match the threads 28 in the thread sleeve 18. It will thus be observed that with fibers 30 already in the threads 28 the expansion of the segments 36 outwardly so that the threads 56 seat therein, causes a compacting of the reinforcing fibers into the threads 28. This arrangement insures that the reinforcement material is firmly seated in the thread 28 all the way to the root thereof. An enlarged view of the compacted fibers is shown in Figure 5A.

The compactor 34 may be used before any liner 32 is in place, or after. If afterward, the forces will be applied to fibers 30 and 30' of material 27 through the liner.

During the casting operation, which may be a completely centrifugal operation as in accordance with the copending applications of Boggs, Serial No. 200,193, now

U.S. Patent No. 2,776,450, and 264,976, now U.S. Patent No. 2,785,442, or may be partially or completely by virtue of an expandable mandrel as in the copending application of Lewis Perrault, Serial No. 391,821, or any other casting operation, a suitable end cap (not shown) may be placed on the mold 10 to prevent the flow of liquid settable material therefrom during the casting operation. This end capping would cover the mold either partially or completely at the outer end 22 of thread sleeve 18. Thereafter, the settable material is flowed into the mold and fills the voids around and about the thread reinforcement material 27, as well as liner 32 if one is present. The completed cast article, if a hollow pipe or tube, may be shown as in Figure 7, where it is designated by reference character 58, the ends of fibers 30 and 30' there being designated. If a reinforcing liner 32 is present, the extent thereof would fall generally between dash lines 32' shown in Figure 7.

In the casting of pipe, tubing or other cylindrical articles, it is thought to be apparent at this point that the thread 28 which is cast in the article may have its greatest diameter equal to or less than the internal diameter of mold 10, or may be of the "upset" type so as to have its greater diameter larger than the inner diameter of the mold. In either case, if it may be assumed that the opposite end of the cast article is not involved and the article may therefore be slidably removed from the mold 10 outwardly of the threaded end, it is obvious that any extraction means will suffice, such as a pipe pull-out device as shown in the copending application of Lewis Perrault, Serial No. 391,821, filed November 13, 1953, and assigned to the assignee of the present application. The threading sleeve 18 will slide out of the mold and may be subsequently removed from the article as by simply unscrewing the sleeve 18. However, assuming it is necessary to withdraw the article in the other direction, that is, for example, to the left in Figure 1, it is first necessary to remove the threading sleeve 18. Of course, it must be further observed that an article with an upset thread cannot be removed slidably from the mold in a direction which would require the upset thread to pass the length of the mold.

Where upset threads are involved, which in no event can be pulled through the mold, there is no need of a threading sleeve as shown in Figure 1. Therefore, a simplified sleeve 18' may be used, as shown in Figure 8.

For an operation requiring the removal of the cast article to the left as shown in Figure 1, a tool according to a feature of the present invention may be provided for unscrewing the threading sleeve 18 from the pipe prior to removal of the pipe from the mold 10. Referring now to Figures 1 and 9-11, a mold wrench 63 comprising an internally threaded sleeve 64 may be provided. The outer surface of the threaded sleeve 18 is provided with a thread 66 in the region which will lie between the end 16 of mold 10 and the outer end 22 of threading sleeve 18. This thread is arranged to seat in a thread 68 on the wrench sleeve 64. A suitable cross-bar handle 70 may be affixed to the wrench sleeve 64 by stud bolts 72 whereby the sleeve 64 may be readily rotated. The wrench 64 is further provided with a shoulder portion 74 for abutting the outer end 22 of the threading sleeve 18. If the direction of threads 66 and 68 is opposite to the direction of threads 28, it will be apparent that the wrench sleeve 64 may be screwed onto the threading sleeve 18 until the end 22 of sleeve 18 is engaged by the shoulder 74, whereupon the entire threading sleeve 18 may be unscrewed from the threads now cast on the article within the mold 10.

For completing the mold 10 to provide means for engaging the usual end cap (not shown) which is used during the casting operation, a ring 76 may be provided, having a thread 78 thereon for receiving the end cap.

A sealing ring 60 may be provided in a groove 62 in the thread ring for making a tight fit between the thread-

ed sleeve 18 and the enlarged section 14 of the mold 10 for preventing flow of liquid settable material out of the assembly between the threading sleeve 18 and the mold.

From the foregoing it is apparent that threads may be cast integral with the body of an article and yet longitudinal fiber reinforcement is placed in the threads throughout the entire body thereof, notwithstanding the configuration of other reinforcement material in the body of the cast article.

The foregoing detailed description of methods and apparatus is given only for purposes of example, and the scope of the invention is to be determined from the appended claims.

What is claimed is:

1. In the art of producing a cast cylindrical article having an exteriorly threaded end portion and having the threads reinforced by lengths of fibrous material extending circumferentially of the article with a longitudinal pitch similar to that of the threads, the method of forming and orienting the fibrous thread reinforcement comprising the steps of: winding lengths of reinforcing fibers about a thin-walled tubular mandrel; positioning the mandrel coaxially with an end of a cylindrical mold, the mold being interiorly threaded at that end and having a smallest diameter only slightly greater than the exterior diameter of the mandrel; rotatably inserting the mandrel into the mouth of the mold with an advance per revolution approximating the pitch of the mold threads, whereby the lengths of fibrous reinforcement material will travel into the mold along the valleys of the mold threads; and withdrawing said mandrel while preventing a counter-rotation thereof to leave the lengths of fibrous reinforcement laid up in the valleys of the mold threads; and introducing a settable material into the mold to cast the tubular article.

2. In the art of producing a cast tubular article having an exteriorly threaded end portion and having the threads reinforced by lengths of fibrous material extending circumferentially of the article with a longitudinal pitch similar to that of the threads, the method of forming and orienting the fibrous reinforcement comprising the steps of: winding lengths of reinforcing fibers about a thin-walled tubular mandrel; positioning the mandrel coaxially with an end of a cylindrical mold, the mold being interiorly threaded at that end and having a smallest diameter only slightly greater than the exterior diameter of the mandrel; rotatably inserting the mandrel into the mouth of the mold with an advance per revolution approximating the pitch of the mold threads, whereby the lengths of fibrous reinforcement material will travel into the mold along the valleys of the mold threads; placing a tubular formation of fibrous material to extend within the interior of the mandrel and along the interior of the unthreaded portion of the mold; and withdrawing said mandrel while preventing a counter-rotation thereof to leave the lengths of fibrous reinforcement laid up in the valleys of the mold threads; and introducing a settable material into the mold to cast the tubular article.

3. The method of producing a fibrously reinforced cast cylindrical article having an exteriorly threaded end portion and having the threads reinforced by fibrous material extending circumferentially of the article with a longitudinal pitch similar to that of the threads, comprising the steps of: winding lengths of reinforcing fibers about a thin-walled tubular mandrel; positioning the mandrel coaxially with an end of a cylindrical mold, the

mold being interiorly threaded at that end and having a smallest diameter only slightly greater than the exterior diameter of the mandrel; rotatably inserting the mandrel into the mouth of the mold with an advance per revolution approximating the pitch of the mold threads, whereby the lengths of fibrous reinforcement material will travel into the mold along the valleys of the mold threads; withdrawing said mandrel while preventing a counter-rotation thereof to leave the lengths of fibrous reinforcement laid up in the valleys of the mold threads; and introducing a heat-settable material into the mold and then curing the contents of the mold.

4. The method of producing a fibrously reinforced cast tubular article having an exteriorly threaded end portion and having the threads reinforced by lengths of fibrous material extending circumferentially of the article and with a longitudinal pitch similar to the threads, comprising the steps of: winding lengths of reinforcing fibers about a thin-walled tubular mandrel; positioning the mandrel coaxially with an end of a cylindrical mold, the mold being interiorly threaded at that end and having a smallest diameter only slightly greater than the exterior diameter of the mandrel; rotatably inserting the mandrel into the mouth of the mold with an advance per revolution approximating the pitch of the mold threads, whereby the lengths of fibrous reinforcement material will travel into the mold along the valleys of the mold threads; placing a tubular formation of fibrous material to extend within the interior of the mandrel and along the interior of the unthreaded portion of the mold; withdrawing said mandrel while preventing a counter-rotation thereof to leave the lengths of fibrous reinforcement laid up in the valleys of the mold threads; and introducing a heat-settable material into the mold and then curing the contents of the mold.

5. The method defined in claim 1 and further including the step of compacting the thread reinforcement into the mold threads after the withdrawal of the mandrel.

6. The method defined in claim 3 and further including the step of compacting the thread reinforcement into the mold threads after the withdrawal of the mandrel.

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