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Breunsbach

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[54] **LIQUID INJECTION ADAPTOR**

[75] Inventor: **Maurice C. Breunsbach, Hamburg, N.Y.**

[73] Assignee: **Spirolet Corporation, North Tonawanda, N.Y.**

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[21] Appl. No.: **352,193**

Related U.S. Application Data

[60] Continuation-in-part of Ser. Nos. 247,207, April 24, 1972, and Ser. No. 266,393, June 26, 1972, Pat. No. 3,743,187, said Ser. No. 247,207, is a division of Ser. No. 7,747, Feb. 2, 1970, Pat. No. 3,692,243, said Ser. No. 266,393, Continuation of Ser. No. 77,880.

[52] **U.S. Cl.** **239/401,** 239/416, 239/417, 239/489, 239/602, 137/604, 259/151

[51] **Int. Cl.** **B05b 7/10,** F16k 19/00

[58] **Field of Search** .... 239/398, DIG. 19, 399, 401, 239/403, 405, 407, 416, 416.5, 417, 417.3, 487, 489, 569, 576, 602; 259/151; 137/604, 605

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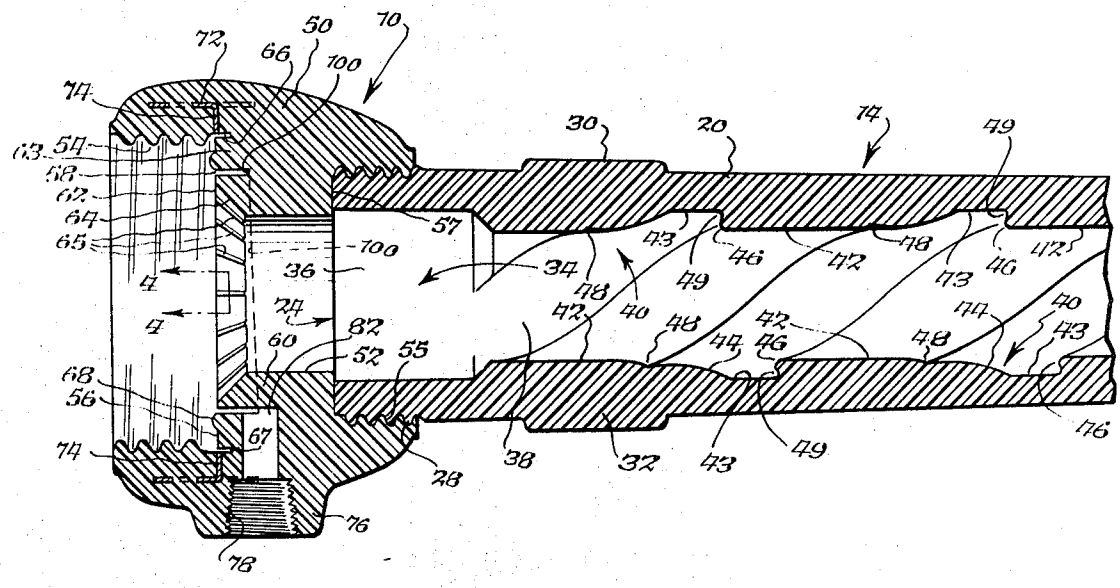
Primary Examiner—Robert S. Ward, Jr.

Attorney, Agent, or Firm—Conrad Christel et al.

[57] **ABSTRACT**

A resiliently yieldable adaptor having a bore therethrough is provided with a liquid manifold passage at the inlet end thereof having a progressively diminishing depth to effect uniform flow of liquid through radial passages leading into the bore. Means are provided at the inlet end of the adaptor to insure centering of the hose coupling attached thereto.

15 Claims, 5 Drawing Figures

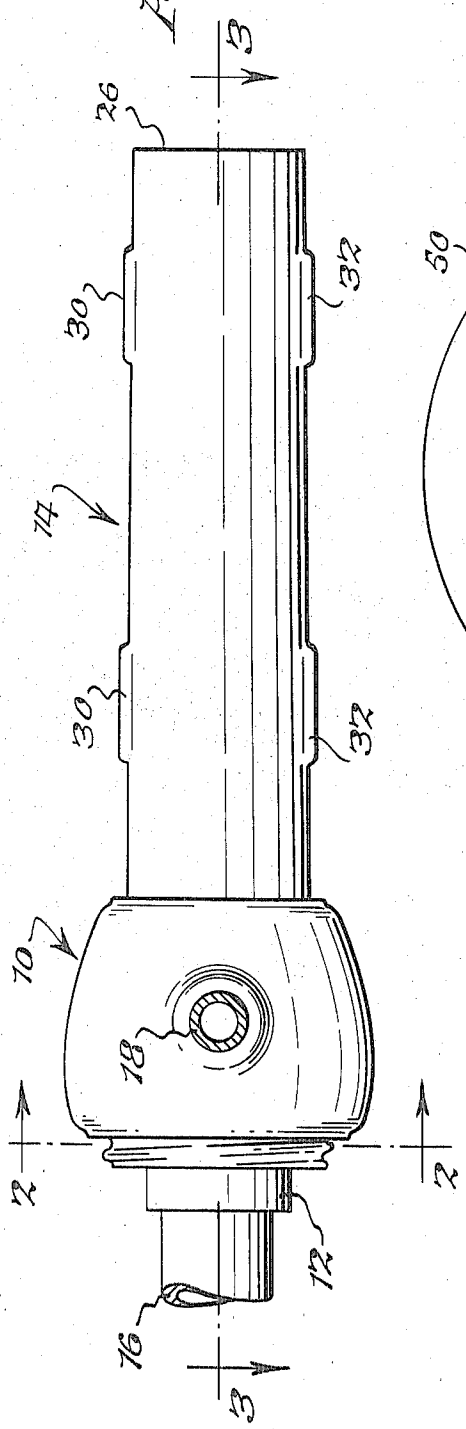


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SHEET 1 OF 2

Fig. 1.



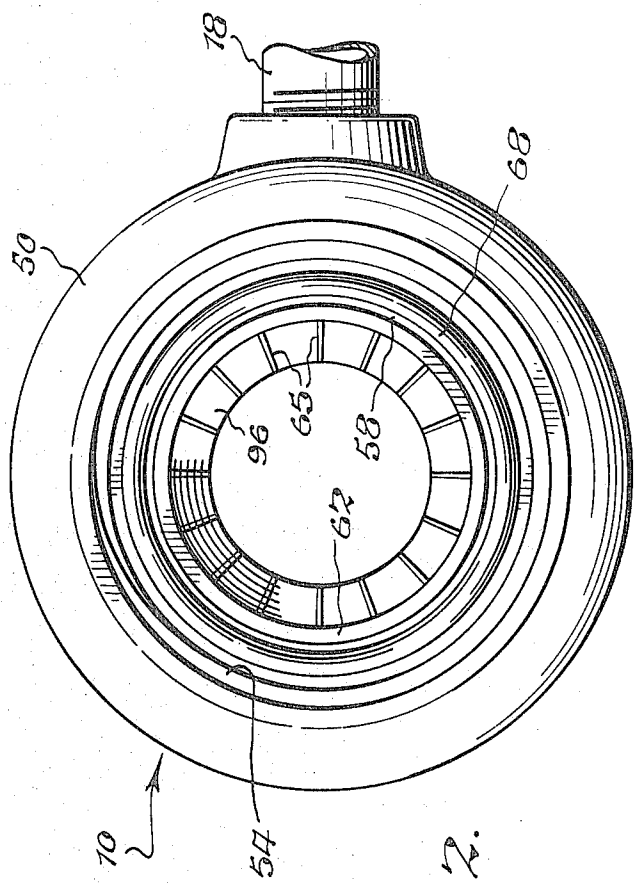


Fig. 2.

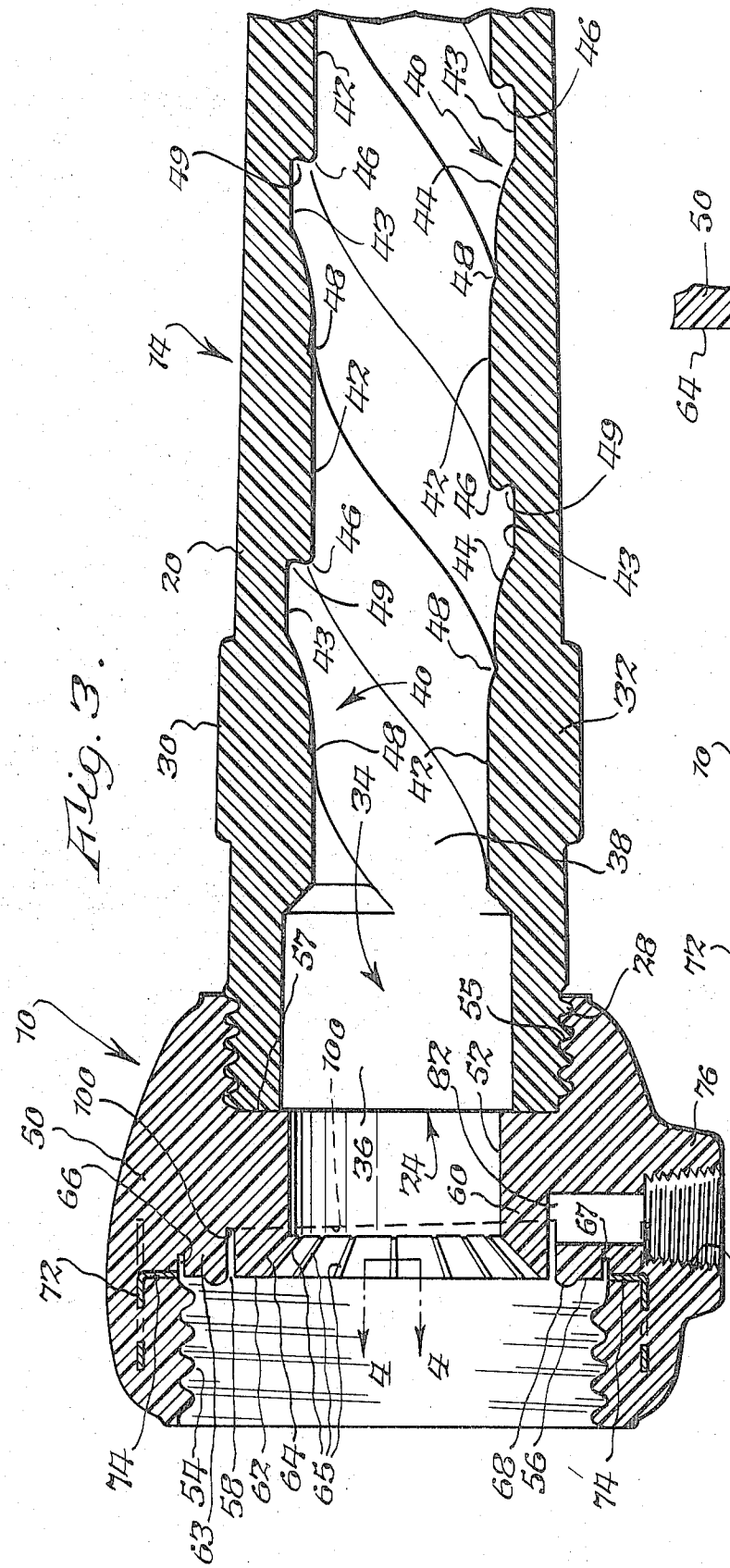


Fig. 3.

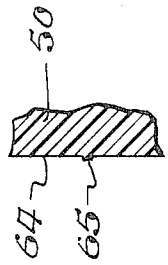


Fig. 4.

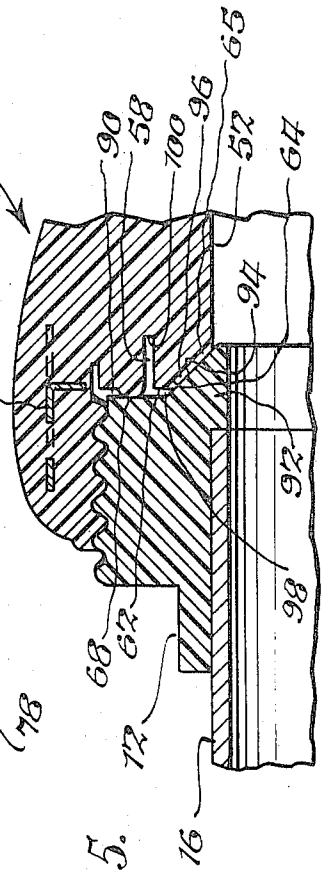


Fig. 5.

LIQUID INJECTION ADAPTOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of application Ser. No. 247,207, filed Apr. 24, 1972 and application Ser. No. 266,393 filed June 26, 1972, now U.S. Pat. No. 3,743,187. Application Ser. No. 247,207 is a division of application Ser. No. 7747, filed Feb. 2, 1970, now U.S. Pat. No. 3,692,243, and application Ser. No. 266,393 is a continuation of application Ser. No. 77,880, filed Oct. 5, 1970, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a liquid injection adaptor and, more particularly, to a liquid injection adaptor used in conjunction with nozzles for "cement guns" used in handling cementitious materials.

During the passage of dry cementitious materials pneumatically blown through a cement gun discharge nozzle, water is introduced transversely into the stream of dry material and mixed therewith to form a wet cementitious material which issues through the nozzle as a high velocity stream to be directed upon a background surface. Often, the means for introducing the liquid into the stream of dry material comprises an adaptor connected to the inlet end of the nozzle and interposed between the latter and a hose coupling connected to a conduit for conveying the dry material from a suitable source. Generally, the adaptor is provided with an annular manifold connected to a liquid inlet and communicating with radial passage means extending circumferentially about the adaptor bore for injecting the liquid radially under pressure into the stream of dry material. The dry material should be uniformly wetted throughout in order to obtain an optimum mix. However, a problem sometimes arises in uniformly wetting the dry material because of the varying flow of liquid through the radial passage means. Also, axial misalignment of the coupling relative to the adaptor can vary the flow of liquid injected into the stream of dry material.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide an improved liquid injection adaptor having novel liquid flow control means to insure uniform wetting of the dry materials passing through the adaptor.

It is another object of this invention to provide the foregoing liquid injection adaptor with means centering the associated coupling relative to the adaptor.

The liquid injection adaptor of the present invention is characterized by the provision of an annular manifold groove of progressively diminishing depth to insure a uniform flow of liquid therefrom through radial passages into a stream of dry material for uniformly wetting the latter. A series of equally and circumferentially spaced ribs formed on and integral with an annular shoulder on the adaptor are engagable with the outer beveled surface of a coupling member to positively center the coupling member relative to the adaptor further facilitating uniform liquid flow into the path of the dry material.

The foregoing and other objects, advantages and characterizing features of the present invention will become clearly apparent from the ensuing detailed description of an illustrative embodiment thereof, taken

together with the accompanying drawings wherein like reference characters denote like parts throughout the various views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a liquid injection adaptor of the present invention, shown mounted between a nozzle and a material conveying conduit;

FIG. 2 is an end view, on an enlarged scale thereof, looking in the direction of arrows 2—2 in FIG. 1;

FIG. 3 is a longitudinal sectional view, on an enlarged scale, taken about on line 3—3 of FIG. 1, an end portion of the nozzle being broken away for ease of illustration;

FIG. 4 is a fragmentary sectional view, on an enlarged scale, taken about on line 4—4 of FIG. 3; and

FIG. 5 is a fragmentary sectional view, on an enlarged scale, showing a hose coupling connected to the inlet end of the adaptor of FIG. 3.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

Referring now in detail to the illustrative embodiment depicted in the drawings, there is shown in FIG. 1 a liquid injection adaptor, generally designated **10**, constructed in accordance with this invention, and shown attached at one axial end thereof to a hose coupling **12** and attached at the other axial end thereof to a nozzle **14**. Hose coupling **12** is connected to a conduit **16** through which dry cement ingredients from a suitable source (not shown) are conveyed by a blower (also not shown) in a manner known in the art. Such material is forced under pressure through conduit **16**, hose coupling **12**, adaptor **10**, and into and through nozzle **14**. Liquid, usually water, is added to the dry material by means of a pipe **18** connected into adaptor **10**. The dry material and water are intermixed to produce a wet cementitious material which is directed through nozzle **14** and outwardly therefrom onto the desired surface.

As shown in FIG. 3, nozzle **14** comprises an elongated hollow body **20** formed of a suitable elastomeric material and having a generally cylindrical outline but slightly tapered toward the discharge end. Body **20** is provided with an inlet end **24** and an outlet end **26** (FIG. 1), the inlet end **24** being externally threaded as at **28** for threaded engagement with adaptor **10**. Two pairs of diametrically opposed lugs **30** and **32** are formed on the outer surface of nozzle **14**, integral therewith, for facilitating the grasping and handling of nozzle **14**.

Nozzle **14** is provided with an axial bore, generally designated **34**, having a first chamber **36** at the inlet end **24**, an elongated, intermediate mixing chamber **38**, and an outlet chamber (not shown). Bore **34** tapers uniformly from the inner end of chamber **36** to the outer end of the outlet chamber. This gradual taper tends to choke the cementitious mix as it is conveyed outwardly through nozzle **14** to minimize spreading of such mix and to constrain the projecting stream within the desired path.

A double helical thread formation, generally designated **40**, defines the inner wall surface of mixing chamber **38** to effect a thorough mixing of the mix passing through bore **34**. Each helix formation **40** comprises a projection **42** and a groove **43** separated by a curved, sloping shoulder **44**. Projection **42** is provided

with a leading face 46 and a trailing shoulder 48 interposed between projection 42 and shoulder 44. A sand hook or undercut 49 is formed at the juncture of groove 44 and leading face 46 of projection 42. Nozzle 14 is of the type disclosed and shown in application Ser. No. 266,393 filed June 26, 1972, supra, and assigned to the same assignee as the present invention, and reference may be had thereto for a more detailed description and operation of nozzle 14 and the significance of the specially configurated thread formation 40, including projection 42, shoulder 44, sand hook 49, etc. This specially configurated formation facilitates the thorough blending of the dry cementitious ingredients with the water while efficiently controlling the degree of turbulence generated in the nozzle to produce a consistent and thorough mix. It should be understood, however, that adaptor 10 of this invention is not restricted for use with the specific nozzle 14 illustrated in FIG. 3, but can be used in conjunction with any type of nozzle, including metal nozzles.

In accordance with this invention, adaptor 10 is composed of a resiliently yieldable elastomeric material, preferably urethane, which is wear and abrasion resistant and sufficiently rigid so as not to deform under the pressure employed to convey the dry ingredients therethrough. However, any suitable resiliently yieldable material of sufficient durometer and density, can be used in lieu of urethane, if desired. Adaptor 10 is of a unitary, one-piece construction and can be of any convenient size suitable for a particular application.

Adaptor 10 comprises a hollow body 50 of a generally curved or rounded outline having an axial bore 52 and an enlarged diameter internal threaded inlet opening 54 (FIG. 3) at one end for receiving a suitable hose coupling, such as shown at 12 in FIGS. 1 and 5. The other or outlet end of adaptor 10 is provided with a threaded opening 55 for receiving threaded portion 28 of nozzle 14. Inlet opening 54 terminates in an annular end wall 56 which serves as a seat for coupling 12 and outlet opening 55 terminates in an end wall 57 serving as a seat for the threaded end portion of nozzle 14.

An annular recess or groove 58 extends axially inwardly of end wall 56, providing a liquid manifold and defining an inner, collar-like wall portion 60 having an end face 62 lying in a generally common transaxial plane with end wall 56. End face 62 is beveled to form an inclined wall or shoulder 64 which also serves as a seat for a portion of hose coupling 12 and is provided with a plurality of generally radially extending teeth or ribs 65 thereon for a reason that will hereinafter become apparent. An annular recess 65 extends axially inwardly of end wall 56 in substantial parallelism with manifold groove 58 and provides a relief for accommodating radial expansion of the resiliently yieldable material in the area of end wall 56 upon compression of the same by hose coupling 12 threaded into opening 54. An annular bead 68 is formed on end wall 56 between annular recesses 58 and 66 to engage and provide a fluid tight seal against the abutting end of hose coupling 12, as shown in FIG. 5.

An annular metal reinforcing ring 72 is embedded in body 50 between threaded opening 54 and the outer surface of body 50 and serves to reinforce and rigidify the inlet end of adaptor 10. Reinforcing ring 72 is provided with an open mesh for receiving the plastic material therethrough to form a mechanical interlock therewith and has a plurality of circumferentially spaced lugs 74 struck out from the inner end of ring 72 and extending radially inwardly therefrom to properly position ring 72 within body 50 during the formation thereof by a suitable molding process.

A boss or projection 76 extends radially outwardly from body 50 and is provided with a tapped opening 78 for receiving pipe 18 (FIGS. 1 and 2) connected to a suitable source of liquid (not shown). Opening 78 communicates with a radially extending passage 82 leading to manifold groove 58.

In use, adaptor 10 is threaded on nozzle 14 until end wall seat 57 of adaptor 10 firmly engages the nozzle inlet end face. Hose coupling 12 is then connected into threaded opening 54 until the coupling end face 90 (FIG. 5) is seated against sealing bead 68 of adaptor 10 as shown in FIG. 5. An internal flange or boss 92 projects axially from end face 90 of coupling 12 and has an outer wall surface 94 overlying shoulder 64 and inclined inwardly at an angle corresponding to the angle of inclined shoulder 64. With end face 90 in initial abutting engagement with sealing bead 68, surface 94 rests against the outer surfaces or ribs 65 and is slightly spaced from shoulder 64 to form a series of annular passages 96 defined between ribs 65 and leading into bore 52. Also, the spacing between coupling end face 90 and the adaptor end face 62 forms an annular communicating passage 98 between manifold groove 58 and passages 96. Thus, water or other liquids can be directed radially inwardly into bore 52 via tapped opening 78, manifold groove 58, and passages 98 and 96.

During the blasting operation, a cement mixture in dry powder form is forced under pneumatic pressure through conduit 16, hose coupling 12, bore 52 of adaptor 10 and through the bore of nozzle 14. Simultaneously, a liquid, such as water, under pressure is introduced into bore 52 through pipe 80, opening 78, manifold 58 and passages 98 and 96. The water is mixed with the cement particles passing through bore 52 in adaptor 10 to form a wet cementitious admixture. Thread formation 40 of nozzle 14 imparts a spiral twisting or rifling motion to the admixture to thoroughly intermix the ingredients and obtain the proper consistency and density. The rifling motion becomes progressively shallower toward the outlet end 26 of nozzle 14 and provides a choking action, the result of which is an efficiently controlled stream of cement emulsion directed at a high velocity against a background surface with relatively little rebound and relatively no dust contamination of the ambient atmosphere.

A significant feature of the liquid injection adaptor of this invention is the liquid flow control means located at the inlet end thereof which is effective to vary the rate of liquid flow therethrough and also to insure flow under a uniform pressure at the selected rate to uniformly wet the dry ingredients passing through adaptor 10. To this end, manifold groove 58 varies in depth progressively from a maximum at liquid inlet passage 82 to a minimum at a point diametrically opposite inlet passage 82, as best seen in FIG. 3. Groove 58 is provided with an inclined bottom wall 100 which tapers progressively inwardly toward the inlet end of adaptor 10 from a maximum depth at inlet passage 82 to a minimum depth at a point 180° from passage inlet 82. It has been found that in adaptors having annular manifold grooves of constant depth, the portion of liquid flowing therefrom at a point remote from the region of liquid ingress

flows under a lesser pressure than that portion adjacent the region of liquid ingress. Accordingly, in such constant depth annular manifolds, the rate of flow of the liquid injected into the bore from the remotely located point is considerably less than the rate of flow adjacent the inlet, resulting in nonuniform wetting of the dry ingredients. It has been found that the tapering, progressively diminishing groove depth feature embodied in the present invention maintains manifold groove **58** completely filled with liquid throughout its circumferential extent, i.e. the liquid fills manifold groove **58** at the region thereof located remotely from the liquid inlet as readily as at the inlet region, to effect a constant flow of liquid at a uniform rate through passage **98** and through all of the passages **96** radially into the adaptor bore **52**, thereby insuring uniform wetting of the dry material passing axially through bore **52**. Also, the equally, circumferentially spaced ribs **65** on inclined shoulder **64** positively centers the coupling inclined surface **94** relative to inclined shoulder **64** to maintain the sizes of passages **96** equal in depth further insuring uniform radial flow of the liquid therethrough into adaptor bore **52**.

At the initial stage of the blasting operation, the nozzle operator can thread coupling **12** relative to adaptor **10** in such a manner as to obtain an optimum water flow pattern. If the material issuing from nozzle **14** is too wet, coupling **12** is threaded further into opening **54** to compress bead **68** and ribs **65** thereby decreasing the size of passage **98** and passages **96** to restrict the flow of water therethrough. Annular relief recess **66** will accommodate the expansion of material in the area of end wall **56**. If desired, the flow of liquid through passages **98** and **96** can be completely interrupted by still further threading coupling **12** into opening **54** to an extent closing passages **96**. If the issuing material is not sufficiently wetted, coupling **12** can be threaded outwardly of opening **54** to enlarge passages **96** and **98**, as required. These adjustments are made quickly and easily by the operator who need only rotate coupling **12** with one hand while holding nozzle **14** with the other. The flow of the liquid remains uniform at the selected rate throughout the circumferential extent of manifold groove **58** due to the progressively varying groove depth effected by the tapering bottom wall **100** of manifold groove **58** as hereinbefore described. Thus, a sensitive water control means is provided to produce a highly controlled cementitious material with very little rebound and dust.

While nozzle **14** and coupling **12** can be formed of the same material ad adaptor **10**, e.g. urethane or any other suitable resiliently yieldable material which is highly resistant to the abrasive action of the cementitious material passing therethrough and to the generation of static electricity normally accompanying such passage, it should be understood that adaptor **10** can be used with nozzles and couplings formed of any material, such as metal for example, which are widely used in industrial applications.

From the foregoing, it is apparent that the objects of the present invention have been fully accomplished. An improved liquid injection adaptor is provided for effectively controlling the flow of liquid at a uniform rate into a stream of dry material to uniformly wet the latter. A preferred embodiment of this invention having been described in detail, it is to be understood that this has been done by way of illustration only.

I claim:

1. An adaptor comprising: a body formed of a resiliently yieldable plastic material having a bore therethrough, an inlet end and an outlet end; a threaded opening communicating with said bore; an annular wall extending radially inwardly from the wall of said threaded opening toward said bore and having at least a portion thereof defining a seat; an inlet passage in said body; an annular manifold passage of a varying size for effecting a selected uniform rate of liquid flow therethrough; said manifold passage being spaced radially outwardly of said bore and communicating with said inlet passage; said annular wall and said seat defining flow control passage means adjacent said inlet end communicating between said manifold passage and said bore.

2. An adaptor according to claim **1** wherein said manifold passage progressively diminishes in size away from said inlet passage.

3. An adaptor according to claim **1** wherein said manifold passage has a tapering wall to effect a progressively diminishing cross sectional area thereof away from said inlet passage to effect a selected constant rate of flow of liquid therethrough.

4. An adaptor according to claim **1**, said seat including an inclined shoulder having means centering the conical surface of a hose coupling threadable in said opening.

5. An adaptor according to claim **4** wherein said centering means comprises a plurality of circumferentially spaced ribs formed on said shoulder and defining therebetween a series of passages communicating with said bore, said series of passages being variable in size upon compression of said ribs to vary the rate of delivery of liquid therethrough.

6. An adaptor according to claim **1** wherein said flow control passage means includes means provided on said seat defining a series of passages communicating with said bore, said series of passages being variable in size upon axial compression of said inlet end to vary the rate of delivery of liquid therethrough.

7. An adaptor according to claim **6** wherein said passages defining means comprise a plurality of ribs on said seat whereby compression of said ribs toward said seat varies the size of said passages.

8. An adaptor according to claim **7** wherein said series of passages are inclined inwardly from said annular wall to said bore in the direction of said outlet end.

9. An adaptor according to claim **7**, together with a hose coupling threaded in said opening and urged against said ribs to compress said ribs and thereby vary the size of said series of said passages.

10. An adaptor according to claim **6** wherein said flow control passage means included an annular passage communicating between said manifold passage and said series of passages, said annular passage being variable in size upon axial compression of said inlet end.

11. An adaptor according to claim **10** including an annular bead on said annular wall outwardly of said manifold passage, said bead forming an annular seat, said passages defining means comprising a plurality of ribs on said first mentioned seat, together with a hose coupling threaded in said opening and urged against said annular bead to form a fluid tight seal therebetween, said bead and said ribs yielding under compression upon further threading of said coupling into said

opening to vary the size of said annular passage and said series of passages.

12. An adaptor according to claim 11 wherein said seat is provided with an annular relief recess therearound.

13. An adaptor according to claim 1 wherein said resiliently yieldable material is urethane.

14. An adaptor according to claim 1 wherein said body is of a unitary, one-piece construction.

15. In combination with a nozzle for directing cementitious material therethrough, said nozzle having an inlet end and a bore, a liquid injector adaptor having an inlet end and an outlet end and a bore therethrough, said adaptor receiving said nozzle at said outlet end, a hose coupling for delivering cementitious material to said adaptor, said adaptor receiving said coupling at said inlet end, passage means adjacent said inlet end of said adaptor for connecting the bore thereof to a source of liquid, said passage means including at least one passage variable in size upon axial compression of said adaptor inlet end by said coupling.

* * * * *