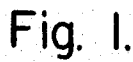
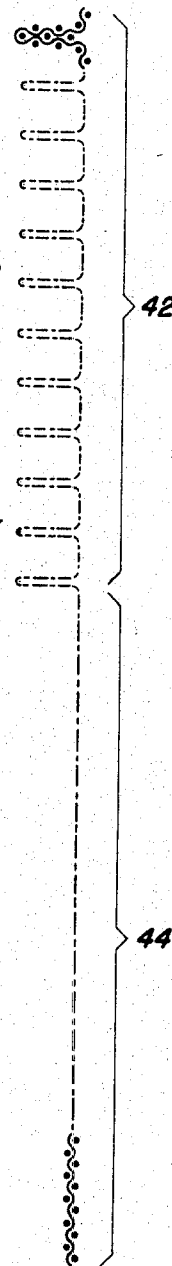
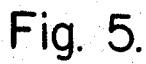
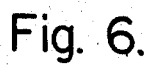
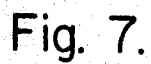
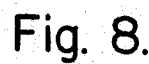


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FLOW STRAIGHTENER
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FLUID FLOW DEVICE INCLUDING A PARALLEL PASSAGEWAY FLOW STRAIGHTENER

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This invention relates in general to a fluid flow device for use in a spout and more specifically to a device for use in a spout for a bathtub or the like for filling the latter in a silent manner for varying flow rates.

It has been observed that many objections have been voiced as to the noise associated in filling a tub with water. Such noise for the most part has been attributed to the distortion of the water stream pattern as it escapes from the spout or faucet causing the water stream to splash in the collecting pool of water in the bottom of the tub. This distortion is often attributed to turbulence created in the water as it flows through the spout and/or to the entrapment of air in the water stream as it discharges from the faucet. Distortion of the water stream is also affected by the velocity at which the water is discharged from the spout.

It is therefore an object of this invention to provide for an improved spout construction that results in the forming of a smooth, clear, symmetrical, uninterrupted water stream which enters into a collecting pool of water in a very silent manner at varying flow rates ranging between a very low rate and a full flow rate.

Another object is to provide an improved filler spout in which the water stream stops at the spout end when the flow of water to the spout has ceased.

Another object is to provide a silent flow filler spout that is relatively simple in construction, positive in operation, and relatively inexpensive to produce.

A feature of this invention resides in the provision of a means located in the spout end of a faucet which is constructed and arranged so as to insure the initiation of the water stream at the center portion thereof.

Another feature of this invention resides in the provision of a perforated element in the spout end of a filler which is constructed and arranged to minimize the entrapment of air in the water stream as it discharges from the spout end, and which also stops the water at the spout end when the flow of water to the filler has ceased.

Another feature of the invention resides in the provision of a concavo-convex perforated element in the spout end of a faucet for creating a clear, smooth, symmetrical and uninterrupted stream discharging therefrom under conditions of low flow.

Other features and advantages will become more readily apparent when considered in view of the drawings and specifications in which:

FIG. 1 is a cross sectional view of the improved fluid flow device of this invention.

FIG. 2 is a detailed plan view of an element used in the spout end of FIG. 1.

FIG. 2A is an expanded end view of the element of FIG. 2.

FIG. 3 is a detailed plan view of another element used in spout end of FIG. 1.

FIG. 4 is a sectional view taken along line 4—4 of FIG. 3.

FIG. 5 is a detailed plan view of another element used in the spout end of FIG. 1.

FIG. 6 is a sectional view taken along line 6—6 of FIG. 5.

FIG. 7 is a perspective view of the water stream resulting from the spout end of FIG. 1 during a low flow rate.

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FIG. 8 is a perspective view of the water stream resulting from the spout of FIG. 1 during higher flow rate.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed is for the purpose of description and not of limitation.

Referring to the drawings, there is shown in FIG. 1 a faucet 10 which includes a spout arm 12 adapted for use in conjunction with a receptacle for filling the same, as for example, a bathtub or the like. As shown, the spout arm 12 comprises a hollow casting or structure to define a fluid flow path 16. One end of the spout arm 12 is provided with internal threads 18 by which it is suitably connected to a conduit (not shown) which supplies the water thereto. A threaded opening 20 is formed adjacent the other end of the spout arm 12 for accommodating a spout end or nozzle 22. In the illustrated embodiment the spout end or nozzle 22 comprises a tubular member having a bore 24 extending therethrough. The bore 24 is of a relatively large diameter to define a relatively low velocity orifice for the flow of water therethrough. As shown, the upper end portion 26 of the spout end 22 may be externally threaded whereby it may be readily screwed into the threaded opening 20 of the spout arm 12. A suitable gasket or washer 28 may be interposed between the spout arm 12 and the shoulder 30 of the spout end 22 to form a fluid tight fitting therebetween. The discharge end of the spout end 22 is provided with an intumed annular flange 32 to provide a retaining means for a silent flow means 34 disposed within the spout end 22 in accordance with this invention.

The silent flow means 34 includes a plurality of structures which are constructed and arranged to result in a smooth, clear, symmetrical and uninterrupted stream for filling a tub or other receptacle in a very silent manner at any of the various flow rates ranging between very low, e.g. 0.1 g.p.m. and full flow, e.g. 10 g.p.m.

One of the structures comprises a strip of material 36 which is perforated throughout. In the illustrated embodiment the strip 36 may comprise a screen which may be formed of either a wire or plastic mesh.

Accordingly, the screen strip 36 illustrated comprises a continuous length of screen material having a width which is substantially equal to the length of the bore 24 in the spout, and the strip of screen material is sufficiently long so that it may be formed to define a plurality of radially disposed passageways 38 and a wall area 40 circumscribing the passageways 38. As best seen in FIGS. 2 and 2A, the screen strip 36 is folded or bent in a substantially sinuous manner over a portion 42 of its length to define a rosette pattern of parallel passageways in the assembled form thereof which extend longitudinally of the bore in the spout end. The unfolded or extended portion 44 of the screen mesh material 36 is utilized to encircle the rosette of passageways 38 defined by the folds thereof to form a wall circumscribing the rosette of passageways.

The screen strip thus folded, as in FIG. 2, is inserted into the bore 24 of the spout end and is retained thereby by any suitable means, as for example, the intumed flange 32 and the inherent frictional resistance of the screen 36 against the wall of the bore due to the tendency of the screen strip to unfold or uncoil, or by any other suitable positive fastening means. Accordingly the screen strip 36 so folded defines numerous parallel passageways 38 which together with the portion 44 of screen area circumscribing the same tends to absorb the turbulence of the

water flowing therethrough. Also the many passageways 38 thus defined further function as straightening means for the fluid flow therethrough, and directs the water flowing therethrough into one smooth and uninterrupted stream under full flow conditions.

In accordance with this invention a second structure 46 is employed to enhance a smooth, uninterrupted stream at conditions of extremely low fluid flow rates. This is attained by a screen or perforated construction 48 having a concavo-convex or bowl shape as evidenced in FIGS. 5 and 6. As illustrated, the structure of FIGS. 5 and 6 comprises the screen 48 that is extended across the orifice defined at the discharge end of the spout end, downstream of the passageways 38 defined by the rosette screen. The screen 48 is disposed in the spout end so that it is concave in the direction of fluid flow therethrough. As shown, the peripheral portion of the concave screen 48 may be circumscribed by suitable mounting ring 50 which is retained in position on inturned flange 32 formed on the spout end. Due to the concavo-convex shape of the screen 48 it functions to initiate the water stream at the center or lowestmost point thereof when the flow of water is turned on. As the flow of water through the spout end 22 is increased, the stream merely becomes larger in diameter to extend outwardly toward the periphery of the concave screen without any other otherwise material alteration in its smooth, symmetrical and uninterrupted shape. Also the screen 48 functions to immediately stop the water at the spout end when the water is turned off. This is because the water, due to the cohesive force thereof, is retained by the screen 48 at the spout end. In the absence of the concavo-convex screen it has been noted that air becomes entrapped in the stream as it discharges from the spout end thereby causing distortion in the stream pattern as flow is increased. When this happens, noise is created as the stream of water splashes in the collecting pool.

To further enhance the silent flow of water from the spout end 22, an intermediate flat screen of wire or mesh 54 is interposed between the straightening screen 36 and the convex screen 48. As best seen in FIGS. 3 and 4, the intermediate screen 54 comprises simply of a flat disc shaped screen which is interposed between the convex screen and the bottom of the straightening screen. A mounting ring 56 may be provided for screen 54.

In operation, actual experience has shown that the filler spout 10 constructed in accordance with this invention results in a smooth, clear, symmetrical and uninterrupted stream that enters into the tub in a very silent manner between conditions of very low flow rate, as for example 0.1 g.p.m. to a full flow rate, as for example 10 g.p.m. See FIGS. 7 and 8 for a pictorial illustration of the respective streams at the low and full flow rates respectively.

With the construction described, the smooth, clear, symmetrical and uninterrupted stream as depicted results because the main forces acting on the stream are the cohesive forces of the water itself and gravity. Consequently, the stream results in a smooth column of water extending between the end of the spout and the surface of the collecting pool of the water in the tub in which the water merely flows into the collecting pool in an uninterrupted and silent manner.

From the foregoing, it will be readily apparent that the silent flow structure of the spout end 22 is relatively simple in structure and can be fabricated at relatively low cost. It is preferred that the screens be made of an 18-8 stainless steel. Also, the spout end may be made of plastic. By forming the same of plastic, production costs can be substantially minimized. Plastic further provides for wider design flexibility. A plastic spout end further eliminates any danger of chipping a tub in the event the spout end is inadvertently dropped during installation.

While the instant invention has been described with reference to a particular embodiment thereof, it will be readily appreciated that variations and modifications may

be made without departing from the spirit or scope of the invention.

What is claimed is:

1. A filling spout for silently discharging liquid into a receptacle to fill the same comprising:
 - (a) means defining a relatively low velocity discharge nozzle discharging to a receptacle,
 - (b) means disposed in said nozzle to absorb the turbulence in a flow of liquid therethrough and to straighten and direct said liquid flow therethrough into one smooth stream at full flow motion,
 - (c) said latter means including a plurality of parallel passageways extending longitudinally of said nozzle,
 - (d) said passageways being radially disposed within the circumference of said nozzle,
 - (e) and a concavo-convex pervious means extending across the discharge end of said nozzle downstream of said passageways to insure a smooth, uninterrupted stream during low flow rates,
 - (f) said pervious means being concaved in the direction of liquid flow therethrough whereby the stream originates at the lowermost point of said pervious means upon the initiation of the liquid flow, and which stream merely becomes larger as flow is increased, said stream forming a clear symmetrical column extending between the spout end and the pool collecting in the receptacle so that the liquid falling in said column silently flows into said pool.
2. A filling spout for silently discharging liquid into a filling receptacle comprising:
 - (a) a spout end having a bore sized to define a relatively low velocity discharge orifice discharging to said receptacle,
 - (b) means disposed in said bore to absorb the turbulence of the flow of liquid therethrough and to straighten and direct said flow into one smooth stream at substantially full flow rate,
 - (c) said latter means including screen means defining a plurality of parallel passageways extending longitudinally of said bore,
 - (d) said passageways being radially disposed within the circumference of said bore,
 - (e) and a concavo-convex perforated means extending across the discharge end of said bore downstream of said passageways to insure a smooth, uninterrupted stream under conditions of low flow rates,
 - (f) said perforated means being concaved in the direction of liquid flow therethrough whereby the stream originates at the center lowermost point of said perforated means upon the initiation of said stream, said stream merely becoming larger as flow is increased, whereby said stream results in a smooth, clear, symmetrical column of liquid extending between the spout end and the pool collecting in the receptacle so that the liquid falling in said column silently flows into said pool.
3. A means for discharging water into a tub in filling the same in a silent manner throughout an entire range of operating flow rates comprising:
 - (a) a spout adapted to extend into a tub and in spaced relationship above the bottom of said tub,
 - (b) said spout having an opening formed in the end thereof,
 - (c) a spout end connected to said opening in communication with the flow path of said spout,
 - (d) said spout end having a bore sized to define a relatively low velocity nozzle discharging into said tub,
 - (e) means in said bore end to establish a smooth, clear, symmetrical stream of water discharging therefrom,
 - (f) said latter means including a continuous screen folded to define a rosette of longitudinally extending passageways, radially disposed within the circumference of said bore wherein said passageways are circumscribed by an extended portion of said screen,

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- (g) said screen absorbing the turbulence of the water flowing through said nozzle and said passageways defining the direction of the flow of water there-through into one smooth stream,
- (h) means for retaining said screen in position within said bore, 5
- (i) and a second screen means disposed in said bore to provide for a smooth uninterrupted stream at extremely low flow conditions,
- (j) said second screen means including a concavo-convex screen disposed across the outlet of said nozzle downstream of said first mentioned screen, 10
- (k) said second screen being concave in the direction of the flow therethrough whereby the shape of said second screen establishes the stream at the lower most point thereof when the said stream is initiated and enlarging said stream radially as flow is increased, said second screen minimizing the entrapment of air to prevent distortion of the stream pattern as it escapes as flow is increased, 15
- (l) and means for retaining said second screen in position within said spout end. 20

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4. The invention as defined in claim 3 and including:
 (a) a flat screen disposed between said first and second mentioned screens.

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