Fig. 1.

Fig. 2.

Fig. 3.
This invention relates in general to liquid flow control devices, and in particular to a new and useful liquid flow diverter for faucet, drinking fountain and similar applications.

The present invention is particularly applicable for controlling the discharge of a liquid such as water in an apparatus such as a faucet. At the present time, there are devices such as diverter valves which may be associated with liquid lines for effecting, for example, the discharge of the liquid in a steady stream, a spray, or even upwardly for drinking fountain purposes. Prior to the present invention, it has been known, for example, to provide a faucet with means which permit the liquid to be discharged in a spray or a steady stream under the control of a hand-operated valve, for example. With devices of this sort it is sometimes difficult to exclude a spray discharge when it is desired to have only a stream discharge and vice versa, and in some instances the steady stream flow discharge can only be effected when a hand valve control is grasped and in all other instances a spray discharge will be effected. A further disadvantage in such devices is that the liquid is discharged through discharge openings which are oriented on a fixed location in the spout or faucet and it is not possible to direct or angle this spray.

In accordance with the present invention there is provided a simple and inexpensive device which permits not only the changeover from one type of stream flow or discharge to another or one location of discharge to another location, but also a shifting in the direction or angling at which the discharge will take place. Also each time the flow of fluid is admitted to the device such as by turning on a faucet handle, provision is made to insure that a particular desired stream, for example, a steady stream, is emitted from the device so that undesirable splashing and wetting from a spray will be avoided as would be the case if no faucet handle was turned on and the user inadvertently expected a steady stream instead of a spray.

In its broadest form the invention includes a main flow conduit having a throat section. Flow of liquid through the main conduit into the throat section produces a reduced pressure area at a location at which a secondary stream or diverging stream flow is tapped. This diverging stream may be angled off in any given direction, such as upwardly for direction to a drinking fountain, or downwardly for effecting a spray. There will be no tendency for liquid to flow through this diverging stream conduit when normal flow is being directed through the main stream conduit which has the throat section. The device further includes a valve means for closing off the main discharge flow passage whenever it is desired to effect a diverting stream flow.

In a preferred arrangement, the apparatus advantageously includes a housing for a ball or pivotal member having a passage defined therethrough for the main stream flow. The exit portion of the passage may advantageously be made with a narrowed throat section which widens outwardly into a divergent flow section. In one embodiment, the throat section or a section adjacent the throat section is provided with a plurality of ports or openings which lead through respective passages downwardly for forming small diameter spray passages for the discharge of liquid. The ball member advantageously includes one or more small passages which intersect the main flow passage for the purposes of communicating the main flow passage with a connecting conduit for the housing of the device.

A further feature of the invention is the provision of a flow diverter element or a hand valve which is adapted to seat on a valve seat formed in the divergent stream portion of the main flow conduit directly before the steady stream discharge of the device. The diverter element is normally biased upwardly off its associated valve seat to permit flow through the device through the main flow stream through the divergent passage and then through the discharge in the usual manner. When such a flow is being effected, there is no flow through the secondary passages because of the low pressure produced in the secondary passage due to the venturi effect of the flow through the throat section. The diverter, however, includes a projection which extends upwardly through the projecting portion of the socket member and which may be manipulated to cause the diverter to move downwardly against its valve seat and close off the main fluid flow. It is only at such time that a secondary flow will be effected through the plurality of ports and passages which are provided to effect a downward spray.

The inventive principles may also be embodied in any fluid system where diverse fluid flows are desired. For example, the device may be particularly advantageous for use in a combination drinking fountain and faucet. In such an instance the secondary flow which will be turned on only when the diverter is actuated, will extend upwardly from the area around the throat section of the main fluid passage for permitting an upward flow stream at the top of the device when it is desired to use it as a drinking fountain.

Accordingly, it is an object of the invention to provide a device for selectively diverting a fluid stream.

A further object of the invention is to provide a device which includes a main fluid flow conduit formed with a throat section and a divergent passage section leading to a discharge with at least one secondary flow stream being tapped at the area of the throat section and wherein the main flow will be through the main conduit discharge except when the diverter is closed off at which time a secondary flow will be effected.

A further object of the invention is to provide a device for selectively effecting a steady stream or a spray discharge from a faucet or other conduit with a diverter or adjusting element therein being movable for changing from a normal steady stream flow to a spray stream flow.

A further object of the invention is to provide a device for attachment to a faucet or similar conduit which includes a rotatable member having a main passage for the discharge of liquid in a stream and one or more secondary passages for the discharge of liquid in a spray
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with means therein for selectively making the change from the steady stream discharge to the spray discharge and wherein the pivotal member may be oriented for varying the angle and direction of the discharge.

A further object of the invention is to provide a device, particularly for use on a faucet control, which includes a rotatable member carried in a housing which communicates with the main liquid flow conduit and wherein the ball member has an upward projection which may be grasped by the hand for orienting the discharge and projecting means which may be shifted by the fingers of one's hand for varying from a steady stream to a spray discharge.

A further object of the invention is to provide a liquid flow control device where liquid is directed through a passage having a throat section which produces negative pressure conditions when liquid is flowing therethrough terminating in a first stream discharge with a secondary stream conduit connected from the throat section outwardly to a separate second stream discharge, and with diverter means movable in the passage for closing off the discharge when it is desired to effect a secondary stream flow.

A further object of the invention is to provide a device for controlling the flow of liquid and its discharge in one or more types of discharge patterns and stream directions which is simple in design, rugged in construction and economical to manufacture.

For a better understanding of the present invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts throughout the several views shown in this respect.

FIG. 1 is a perspective view of a flow-diverter for sink faucet constructed in accordance with the invention; and FIG. 2 is an enlarged transverse sectional view of the spray-rinse flow diverter of FIG. 1.

FIG. 3 is a partial transverse sectional view of an alternate embodiment.

Referring to the drawings in particular, the invention embodied therein includes control valve generally designated 10 out of which a central liquid flow conduit or spout 12 extends. In the embodiment illustrated, the valve 10 is of a type which permits the regulation of the temperature and flow rate of the liquid through the conduit 12 under control of a single-handle control 14.

In accordance with the invention there is provided a liquid flow control attachment generally designated 16 for the end of the conduit 12. The attachment 16 includes a generally cylindrical housing portion 18 with a male extending portion 20 which is adapted to be fitted into a female socket portion 22 of the conduit 12. In a preferred arrangement, the portion 20 is made of a plastic material such as a phenolic which is secured to the conduit 12 by means of epoxy resin or similar bonding agent.

The cylindrical portion 18 is formed with an upper spherical seat for rotatably holding the upper portion of a ball member or pivotal element generally designated 24. A lower cylindrical seat 18b is formed by a nut member 26 which is threaded into the housing 18 after the ball member 24 is positioned therein. The housing 18 includes a top opening 18c and a bottom opening 18d through which the ball member 24 extends. The ball member 24 includes an upper portion 24a made of a handle-shaped configuration which may be manipulated by the hand to rotate the central ball portion 24b within the housing 18 for the purposes of orienting a flared discharge end 24c.

The ball portion 24b is seated within the housing 18 by packing 25 adjacent openings 18c and 18d and is provided with a plurality of bores or passages 28 which communicate with a main fluid flow passage 30 defined in the spout 12 and the attachment 16. The passages 28 extend inwardly from the exterior of the ball portion 24 into communication with a central or first fluid flow passage 32 for downward flow of the liquid through a steady-stream discharge opening 34 defined in the divergent portion 24c. The discharge opening 34 is defined on an interior bridge portion 36 which forms a valve seat for a diverter element or control member generally designated 38. The diverter element 38 carries a washer 40 which is secured to the upper portion thereof, and a compression spring 42, which is mounted on a ledge formed by the lower portion 24c, is biased against the washer 40 and urges the divergent element 38 into an upward position as indicated in FIG. 2. A plunger sealing element or packing 44 is disposed around the diverter element shaft portion 38a to tightly seal an opening 46 through which the upper end of the shaft portion 38a extends. On top of the diverter element 38 there is positioned a button or finger-engaging element 48 but it is sufficient if the top of the diverter be merely rounded off. The element 48 may, for example, be pressed downwardly by a person's hand to move the diverter element from the position indicated in FIG. 2 to a position at which a bottom edge 38b will be seated on the ledge portion 36 to close the discharge 34.

The diverter element 38 is guided at its upper end in the bore 46 during its vertical movement and at its lower end a plurality of radially projecting fingers 50 insure that the element is centered within a cylindrical bore 52 of the lower portion 24c of the pivotal member 24.

In accordance with the invention, the lower portion 24c may be formed integrally with the lower end of the ball portion 24b or as a separate nozzle element, as in the illustrated embodiment, which is threaded into an internally threaded portion of the bore 32. The interior bore of the lower portion 24c is of particular configuration and includes the throat portion 52 which leads downwardly into a widened section 54 which, in the embodiment indicated, is of substantially uniform diameter but of larger diameter than the throat portion 52. The first fluid flow passage also includes a divergent section 56 in which the flow area increases downwardly to a first or steady stream discharge opening 34. The throat 52 which may have converging walls as shown in FIG. 2 is a section of reduced diameter so that it acts as a venturi to produce a high velocity and low pressure therein. This high velocity and low pressure is also carried over to the widened area 54 located at the throat exit so that fluid flowing through the throat 52 will tend to create a reduced pressure area in the widened section 54.

When the diverter element 38 is in the position shown, water from the bore 30 of the spout 12 flows through one or more of the bores 28 which extend from the bore 30 to the interior of the pivotal member 24 and extends through the diverter element 38 to discharge upwardly to the position indicated, the flow will be downwardly through a narrow opening 38c and out through the discharge 34 in a steady stream. The widened area 54 is connected through a plurality of circumferentially spaced individual ports 58 into separate passages 60 which are provided for effecting a spray discharge of the liquid. In the embodiment illustrated, the passages 60 extend downwardly obliquely from the ports 58 and there are advantageously from 8 to 12 passages. It should be appreciated that other passages may be formed in a spiralling manner or other configuration and may be any desired number in order to effect the desirable spray conditions.

A feature of the construction is that there will be no tendency for some of the liquid to be diverted through the widened area 54 into the passage 58 and the passages 60 when the diverter element 38 is in the normal position indicated in FIG. 2. This is so because the throat 52 is connected through the widened area 54 to the divergent bore portion 56 so that negative pressure conditions are encountered due to the venturi effect thereby causing the throat 52, in the vicinity of the widened section 54 during normal fluid flow downwardly out through discharge 34. This negative pressure would extend through the passages 60 and prevent any likelihood of spray during this condition of operation.
As shown in the alternate arrangement of FIG. 3, the ports 58a of passages 60a may open into the throat 52a and the widened area 54 of FIG. 2 may be eliminated.

The angle or direction at which the stream exits through the discharge 34 may be controlled by pivoting the upper handle portion 24a to cause the ball portion 24b to rotate within the housing 18 and thus change the axis at which the discharge is effected. In addition, it is a simple matter to change from a steady stream through the discharge 34 to a spray through the passages 69 by depressing the button 48 and to cause the diverter 38 to move downwardly and bring the lower surface of the ledge 36 to close the discharge opening 34. When this is done there is positive pressure at throat section 52 and the widened area 54 so that the liquid will flow outwardly through the ports 58 and the passages 60 in the form of a spray.

It should be appreciated that many variations in the general configuration of the pivotal element 24 may be effected in order to vary, for example, the location of the steady stream discharge or the spray discharge or the type of such spray or steady stream discharge. In the embodiment illustrated, the nozzle lower portion 24c is threaded internally so as to receive a fitting, such as a stream straightener or end trim. After the liquid is delivered through the conduit 12 by moving the handle 14, it is a simple matter with the inventive device to change from a normal steady stream discharge which will normally be downwardly to a spray discharge, or to direct a discharge in the form of a spray or stream in any desired direction by manipulating the pivotal member 24 and the diverter 38 which is associated therewith. Normally the discharge will be in a steady stream whenever the handle 14 is actuated, and this is an advantage since in most cases a spray discharge is only desirable in special instances. To effect a spray discharge, the button 48 must be depressed, otherwise the discharge will be in a steady stream. The hydraulic pressure of the water acts against the conical lower surface of the stem 38a to hold the diverter 38 in the depressed position.

From the above description it will be observed that whenever the control valve 10 shuts off the water to spout 12, the spring 42 will automatically place the stem 38 in a position shown in FIG. 2, that is the position in which the control member 38 does not cover the discharge 34. This is shut off, the control member 38 will assume this position so that upon a subsequent opening of the control valve 10, a stream instead of a spray will be emitted from the device. Accordingly, the spray is not put into operation until it is positively operated, hence depressing the button 48. Each time the handle 14 is operated to turn on the faucet 10, it is assumed that a steady stream will be emitted and undesirable splashing and wetting from a spray will be avoided as would be the case when the control valve 10 is opened and the user inadvertently expected a steady stream instead of a spray.

The invention hereinabove described may be varied in construction within the scope of the claims, for the particular device selected to illustrate the invention is but one of many possible embodiments of the same. The invention, therefore, is not to be restricted to the precise details of the structure shown and described.

What is claimed is:

1. A fluid flow control system including a flow conduit having an interior bore formed with a throat of reduced diameter and terminating in a first liquid discharge opening, at least one passage connected to the bore of said flow conduit at a location adjacent said throat where negative pressures will occur during flow through said first discharge opening, a diverter element positioned in said bore being of a dimension to permit fluid flow therearound and out said first discharge, means biasing said diverter element in a direction away from said first discharge opening, said diverter element being movable against the force of said biasing means to close said first discharge opening to divert the fluid flow outwardly through said passage, and means cooperative with the hydraulic pressure of the fluid to maintain said diverter member in said position in which it closes said first discharge opening, whereby upon shutting off of the fluid flow the diverter member automatically returns to the position in which it permits fluid flow and said first discharge opening.

2. A liquid flow control device comprising means defining a liquid flow conduit terminating in a discharge opening for a steady stream liquid discharge, said conduit being formed with a throat section and another downstream section of increased flow area whereby to produce negative pressure in said throat section when liquid flows through said throat section and said other section through said discharge, at least one passage for the liquid extending from within said fluid conduit in the vicinity of said throat section to an exterior spray discharge opening, and diverter means for closing steady stream discharge to divert said liquid flow to said passage for discharge through said spray discharge opening, including a plunger element slideable in the bore of said liquid flow conduit, said plunger element having an end face which is biased against said liquid discharge, means biasing said plunger element in a direction away from said steady stream liquid discharge to normally permit flow through said liquid discharge, said plunger element being movable to cause the end face thereof to cover said steady stream liquid discharge, and means cooperative with the hydraulic pressure of the liquid to maintain said diverter member in said position in which it closes said first discharge opening, whereby upon shutting off of the liquid flow, the diverter member automatically returns to the position in which it permits liquid flow out said stream discharge opening.

3. A faucet attachment comprising a housing having a top and a bottom opening and forming an interior ball socket, a pivotal ball socket member pivotally mounted within the socket of said housing and projecting through the top and bottom openings, said housing having a bore for the flow of liquid, said ball member having a main fluid flow conduit defined therethrough, and conduit means communicating said main fluid flow conduit with the bore of said housing, main fluid flow conduit including a throat section and a lower divergent wall section having increased area flow terminating in a first discharge passage means defined in said ball member extending from said main fluid flow bore in the vicinity of said throat section outwardly to a separate second liquid discharge, diverter means for closing said first stream discharge to permit discharge through said passage means and said second discharge, said ball member having an upper portion which projects outwardly through the top of said housing forming a handle for manipulation and pivoting movement of said ball member for changing the angle of discharge and direction of discharge of the steady stream liquid discharge.

4. The device of claim 3, further comprising means "biasing" said diverter means in a direction away from the position in which it closes said first discharge opening and means cooperative with the hydraulic pressure of the liquid to maintain said diverter member in said position in which it closes said first discharge opening, whereby upon shutting off of the liquid flow, the diverter member automatically returns to the position in which it permits liquid flow out said first discharge opening.

5. A faucet attachment comprising a housing having a top and a bottom opening and forming an interior ball socket, a pivotal ball socket member pivotally mounted within the socket of said housing, said housing having a bore for the flow of liquid, said ball member having a main fluid flow conduit defined therethrough, and conduit means communicating said main fluid flow conduit with the bore of said housing, said main fluid flow conduit
including a throat section and a lower wall section having increased area flow terminating in a steady stream discharge, passage means defined in said ball member extending from said main fluid flow bore in the vicinity of said throat section outwardly to a separate liquid spray discharge, and diverter means for closing said steady stream discharge to permit discharge through said passage means and said spray discharge, said ball member having an upper portion extending outwardly through said housing forming a handle for manipulation and pivoting movement of said ball member for changing the angle of discharge and direction of discharge of the steady stream liquid, including a plunger member slideable in the bore of said ball member and projecting upwardly through the top thereof to said housing to form a control projection, means biasing said plunger member in a direction away from said steady stream liquid discharge, said plunger member being movable by depressing the projection to cause it to move to close said steady stream discharge opening and to divert liquid to said passage.

5. The device of claim 4, further comprising means biasing said diverter means in a direction away from the position in which it closes said first discharge opening and means cooperative with the hydraulic pressure of the liquid to maintain said diverter member in said position in which it closes said first discharge opening, whereby upon shutting off of the liquid flow, the diverter member automatically returns to the position in which it permits liquid flow out said first discharge opening.

6. A spray rinse control for a faucet through which water is to be discharged comprising a housing having an interior bore adapted to communicate with the bore of the faucet, a member pivotal in said housing and having a flow passage defined therein communicating with the interior bore of said housing, said flow passage including a throat section and a section of increased flow area formed to produce negative pressures at said throat section when flow is through said throat section and said flow area, said flow passage terminating in a first stream discharge opening, said pivotal member projecting outwardly from said housing adjacent the lower end thereof and said first discharge opening being directed downwardly from the bottom of said housing, said diverter means in the fluid flow conduit of said pivotal member slideable therein to position an end to cover said first stream discharge opening to cause the liquid to flow through said passages and being displaceable away from said discharge opening to permit fluid to flow through said first discharge opening whereby the negative pressures at said throat section will prevent fluid flow through said said passage, said pivotal member including a ball having a portion rotatable in said housing having a handle projection projecting upwardly from the top of said housing, and a discharge portion projecting downwardly from the bottom of said housing, said ball portion being in sealing engagement with said housing.

10. A spray rinse control for a faucet through which water is to be discharged, comprising a housing having an interior bore adapted to communicate with the bore of the faucet, a member pivotal in said housing and having a flow passage defined therein communicating with the interior bore of said housing, said flow passage including a throat section and a section of increased flow area formed to produce negative pressures at said throat section when flow is through said throat section and said flow area, said flow passage terminating in a first stream discharge opening, said pivotal member projecting outwardly from said housing adjacent the lower end thereof and said first discharge opening being directed downwardly from the bottom of said housing, said diverter means in the fluid flow conduit of said pivotal member slideable therein to position an end to cover said first stream discharge opening to cause the liquid to flow through said passage and being displaceable away from said discharge opening to permit fluid to flow through said first discharge opening whereby the negative pressures at said throat section will prevent fluid flow through said said passage, said pivotal member including a ball having a portion rotatable in said housing having a handle projection projecting upwardly from the top of said housing, and a discharge portion projecting downwardly from the bottom of said housing, said ball portion being in sealing engagement with said housing.

11. A device for providing flow controlled spray and liquid discharge from a conduit such as a faucet comprising a housing having an interior bore adapted to communicate with the bore of the faucet for the flow of the liquid therethrough, said housing having a top and a bottom opening, a pivotal member including a central ball-shaped portion which is rotatable in said housing, an upper hand-gripping portion which extends through the top opening of said housing and a downwardly extending stream and spray discharge fitting extending downwardly from said central ball-shaped portion to the bottom opening of said housing, said ball member portion and said spray discharge portion defining a bore in communication with the bore of said housing and having a throat section, and a wall section of increased flow area terminating in a stream discharge opening, said discharge fitting having a passage defined therein extending from the throat section downwardly and terminating in a spray discharge opening, a diverter member slideable in the bore of said ball-shaped portion and said liquid discharge fitting, means to bias said diverter member upwardly to a position at which liquid flow may proceed from said throat section, said divergent wall section and through said discharge in a steady stream, said plunger member being movable against said biasing means to close said steady stream discharge.
discharge opening whereby the liquid flow is diverted through said passage and out said spray discharge.

12. The device of claim 11, further comprising means cooperative with the hydraulic pressure of the liquid to maintain said diverter member in said position in which it closes said first discharge opening, whereby upon shutting off of the liquid flow, the diverter member automatically reverts to the position in which it permits liquid flow out said stream opening.

13. A device for providing for controlled spray and liquid discharge from a conduit such as a faucet, comprising a housing having an interior bore adapted to communicate with the bore of the faucet for the flow of the liquid therethrough, said housing having a top and a bottom opening, a pivot member including a ball-shaped portion which is rotatable in said housing, an upper hand-gripping portion which extends through the top opening of said housing and downwardly extending stream and spray discharge fitting extending downwardly from said central ball-shaped portion whereby the liquid flow is diverted through said passage and out said spray discharge, said diverter element comprising a bore in communication with the bore of said housing and having a throat section and a divergent wall section of increased flow area terminating in a steady stream discharge opening, said diverter member being movable against said biasing means to close said steady stream discharge opening whereby the liquid flow is diverted through said passage and out said spray discharge, said diverter element comprising a bore in communication with the bore of said housing and having a throat section and a divergent wall section of increased flow area terminating in a steady stream discharge opening, said diverter member being movable against said biasing means to close said steady stream discharge opening whereby the liquid flow is diverted through said passage and out said spray discharge.

16. A device for providing for controlled spray and liquid discharge from a conduit such as a faucet comprising a housing having an interior bore adapted to communicate with the bore of the faucet for the flow of the liquid therethrough, said housing having a top and a bottom opening, a pivot member including a central ball-shaped portion which is rotatable in said housing, an upper hand-gripping portion which extends through the top opening of said housing and downwardly extending stream and spray discharge fitting extending downwardly from said central ball-shaped portion whereby the liquid flow is diverted through said passage and out said spray discharge, said diverter member being movable against said biasing means to close said steady stream discharge opening whereby the liquid flow is diverted through said passage and out said spray discharge.
having one end connected into the bore of said flow conduit and terminating in a second discharge opening at its opposite end, a diverter element in said bore of said flow conduit having a portion adapted to close said first discharge opening, means biasing said diverter element in a direction away from a location at which it closes off said first discharge opening whereby flow will normally be through said first discharge opening, said diverter member being displaceable against the force of said biasing means to position it to close said first discharge opening whereby flow will be all through said passage and means cooperative with the hydraulic pressure of the liquid to maintain said diverter member in said position in which it closes said first discharge opening, whereby upon shutting off of the liquid flow, the diverter member automatically returns to the position in which it permits liquid flow out said first discharge opening.

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