This invention relates to control devices and more particularly to a solenoid operated device for initiating and controlling a flow of fluid. It is an object of this invention to produce a simple and inexpensive fluid dispenser. It is another object of this invention to initiate and control a flow of fluid. It is another object of this invention to simplify the reloading operation for a fluid dispenser. It is a further object of this invention to prevent clogging of a fluid dispenser. It is a still further object of this invention to provide a fluid dispenser which is adapted to receive fluid from disposable containers. In the preferred embodiment of this invention, a device is provided to initiate and control the flow of detergent from a disposable container to a washing appliance. The disposable container is provided with a sealed spout to hold the detergent therein. The sealed spout is threadedly connected to the control device. The control device comprises an armature which is actuated by a solenoid disposed therearound. The armature is provided with a conical shape at either end. In normal position, one end of the armature closes an orifice in a valve seat. The armature moves upward in response to the initial inrush of current to the solenoid and the conical point on the other end of the armature punctures the spout seal. Thereafter, the armature settles to an intermediate position between the spout seal and the valve seat where a coil spring biasing the armature downward is neutralized by the magnetic force on the armature. After the desired amount of detergent is dispensed, the solenoid is de-energized and the coil spring biases the armature to close the orifice in the valve seat. Other objects and advantages of this invention will become apparent from the following detailed description taken in connection with the accompanying drawing wherein:

Fig. 1 is an elevation view of the subject device with portions thereof broken away and sectioned; Fig. 2 is an enlarged view of a portion of the structure shown in Fig. 1 with parts broken away and sectioned; and Fig. 3 is a top view of the structure shown in Fig. 1 with the fluid container removed. Referring more particularly to the drawing, a control device 19 is interposed between a liquid detergent supply 12 and an outlet fitting 14. The outlet fitting 14 is mounted in an appropriate location in a dishwasher, laundry machine, or similar appliance (not shown) and receives washing fluid through nozzle 16 from an external source (not shown). The washing fluid mixes with a liquid detergent 18 from supply 12 and passes through an outlet nozzle 20 to the washing appliance. The detergent supply 12 comprises a pressurized fluid container 22 having a liquid detergent 18 therein and also a gas or vapor 24 which is adapted to force the detergent 18 from the container 22. The container 22 is provided with an externally threaded spout 26 which is adapted to mate with an internally threaded hexagonal head portion 28 of a solenoid tube 30. A tight seal 32 is provided on spout 26 to prevent the escape of fluid and it overlies a bore 34 in head portion 28 when the container 22 is screwed into place. A polygonal, preferably hexagonal-shaped armature 36 is disposed in the solenoid tube 30 and is movable to a plurality of positions therein in response to current flow in a solenoid 38 which surrounds the tube. A suitable mounting means 40 is provided on the bottom of solenoid 38 and a pair of terminals 42 extend outwardly from an intermediate portion of the solenoid. These terminals 42 are adapted to be connected to an external circuit (not shown) which is operable to control the position of the armature 36.

The opening within tube 30 extends into the head portion 28 thereof and communicates with the bore 34 which is slightly smaller in diameter than the tube opening to form an annular shoulder 44. A coil spring 46 has one end seated on shoulder 44 and the other end bears against armature 36 to bias it in a downward direction. The bottom of tube 30 is flared to form an annular flange 48 which forms a union fitting with a hex nut 50 provided at the bottom of the solenoid 38. The hex nut 50 is internally threaded and receives an externally threaded portion 56 of the outlet fitting 14. A synthetic rubber valve seat 58 having a centrally disposed orifice 60 therein is provided at the bottom of the tube 30. The threaded portion 56 of outlet fitting 14 compresses a flared portion 62 on the valve seat 58 against the flange 48 on tube 30 to form a tight seal therewith. This seal prevents leakage from the tube 30.

Means is provided on the armature 36 for initiating fluid flow from the sealed detergent container 22. This means comprises a projection 64 which is formed on the upper end of armature 36 and has a conical-shaped point 66 thereon. On upward movement of the armature 36 against the action of coil spring 46, the point 66 is adapted to puncture the seal 32 on the spout 26 of the detergent container 22.

Means is also provided on the armature 36 for controlling the flow of detergent 18. More particularly, the lower portion 68 of the armature 36 is formed in the shape of a cone. This conical portion 68 cooperates with the orifice 60 formed in valve seat 58 to control the fluid flow. In operation, the armature 36 normally is biased to the position shown in Fig. 2 with the conical-shaped portion 68 closing orifice 60. An external circuit (not shown) is then closed, either automatically or manually, sending current through the solenoid 38. Since the initial inrush of current to the solenoid is high, the armature 36 travels to the end of tube 30 with considerable high force sufficient to cause the point 66 on the armature 36 to puncture the seal 32 of container 22.

The coil spring 46 is so selected that after the initial inrush of current to the solenoid, the armature 36 settles to a position intermediate the container seal 32 and the valve seat 58 where the upward magnetic force on the armature 36 equals the downward force of coil spring 46. The gas or vapor 24 then forces the liquid detergent 18 from the container 22. The liquid then flows around the hexagonal-shaped armature, through the orifice 60 in the valve seat 58 to the outlet fitting 14 where it mixes with fluid entering nozzle 16, and continues through outlet nozzle 20 to a washing appliance (not shown).

When the desired amount of detergent 18 is dispensed, the solenoid 38 is de-energized by opening of the external circuit and the conical-shaped portion 68 on armature 36 is biased by spring 46 to close orifice 60. On subse-
quent operations, the point 66 on the armature will serve to clear the punctured hole to prevent clogging.

When the container 22 is empty, it is merely discarded and a new one is installed, so it is apparent that reloading is thereby simplified.

While only a single embodiment of this invention has been shown and described, it is apparent that many variations in structure and operation may be made without departing from the scope of this invention as defined by the appended claims.

I claim:

1. A fluid dispensing device comprising a casing, means on said casing for securing a fluid container thereto, a solenoid disposed around said casing, an armature moveable between a plurality of positions in said casing, puncturing means on said armature, a valve seat in said casing, means positioned at the lower end of said armature forming a valve member, said armature moving to one of said plurality of positions in response to initial inrush of current in said solenoid to puncture the container and then receding to another of said plurality of positions to permit fluid flow through said casing, and said armature being moveable to still another of said plurality of positions in response to cessation of current flow in said solenoid to restrain fluid flow.

2. A fluid dispensing device comprising a casing having a passage for conducting fluid therethrough, means on said casing for securing a fluid container in dispensing relationship with said passage, a solenoid disposed around said casing, an armature operably associated with said solenoid for movement to a plurality of positions in said casing, puncturing means on one end of said armature and a conical valve member formed on the other end, a valve seat for said valve member associated with said casing, said armature moving to one of said plurality of positions in response to the initial inrush of current in said solenoid to puncture the container, and means engaging said armature and withdrawing the same to another of said positions after the initial inrush of current to said solenoid whereby fluid flows through said casing, said armature being moveable to another of said plurality of positions in response to cessation of current flow in said solenoid whereby said valve member engages said seat to restrain fluid flow.

3. The fluid dispensing device of claim 2 wherein said means engaging the armature comprises a coil spring adapted to counteract the magnetic force on said armature.

4. A fluid dispensing device comprising a cylindrical casing having an enlarged portion extending from an end thereof adapted to receive the sealed spout of a disposable fluid container, a valve seat partially closing the other end of the cylindrical casing, a solenoid encircling said cylindrical casing, a polygonal shaped armature positioned in said cylindrical casing and having a valve member formed on an end thereof and cooperating with said valve seat to completely close said other end of the casing when said solenoid is de-energized, puncturing means disposed on the other end of said armature and piercing said sealed spout in response to the initial inrush of current in said solenoid, and a coil spring engaging said armature and moving the same to a position intermediate the ends of said cylindrical casing after the initial inrush of current in said solenoid whereby fluid from said container flows around said armature and out of said casing.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>2,710,115</td>
<td>Chandler</td>
<td>June 7, 1955</td>
</tr>
<tr>
<td>2,773,681</td>
<td>Robbins</td>
<td>Dec. 11, 1956</td>
</tr>
<tr>
<td>2,779,504</td>
<td>Hayes</td>
<td>Jan. 29, 1957</td>
</tr>
<tr>
<td>2,830,743</td>
<td>Rimsha et al.</td>
<td>Apr. 15, 1958</td>
</tr>
</tbody>
</table>