Feb. 21, 1956 J. D. ROBINSON 2,735,718

SOLUTION FORMING AND DISPENSING DEVICE

Filed July 14, 1953

3 Sheets-Sheet 1

Fig. 1.

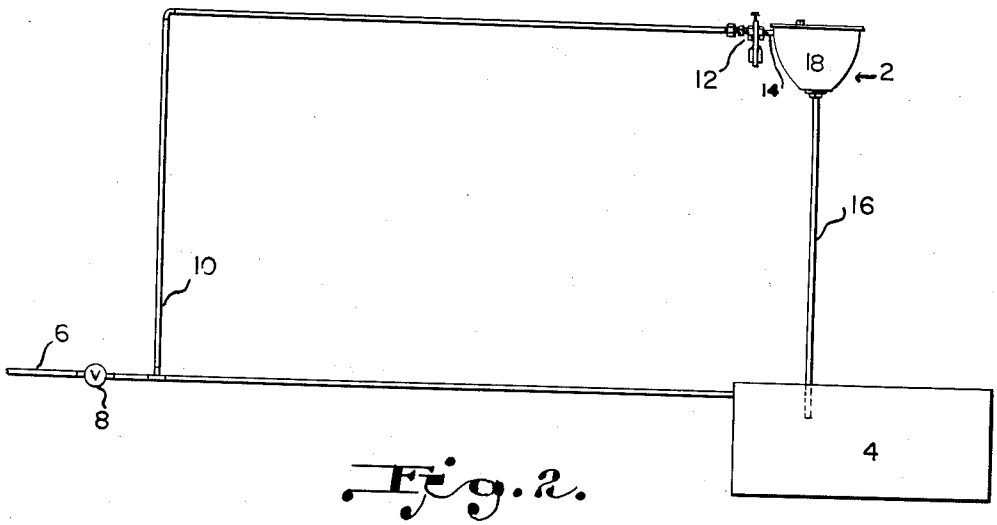

Fig. 2.

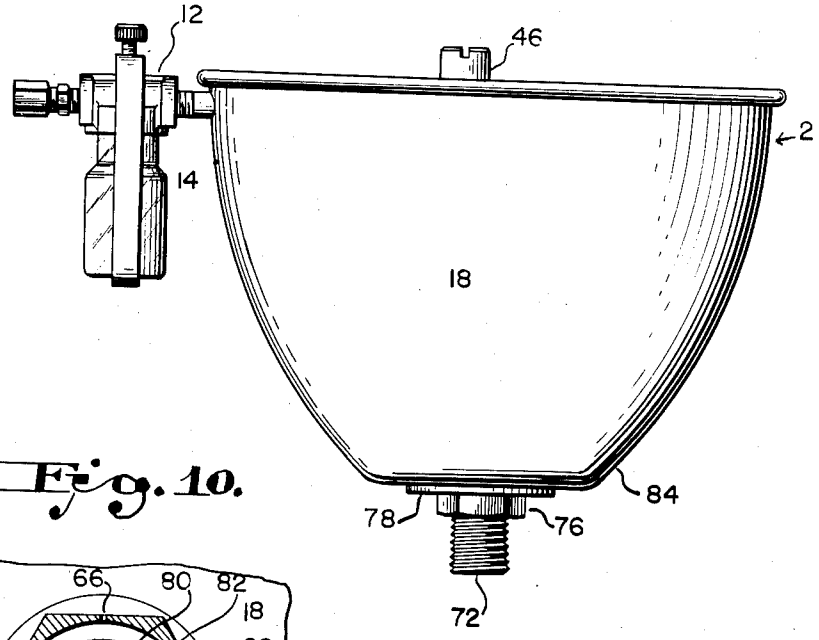

Fig. 10.

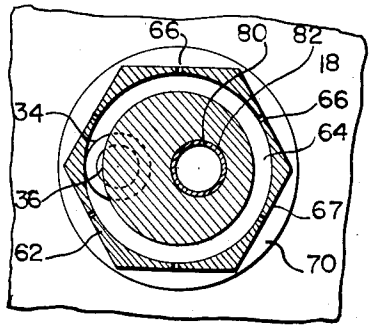

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Fig. 3.

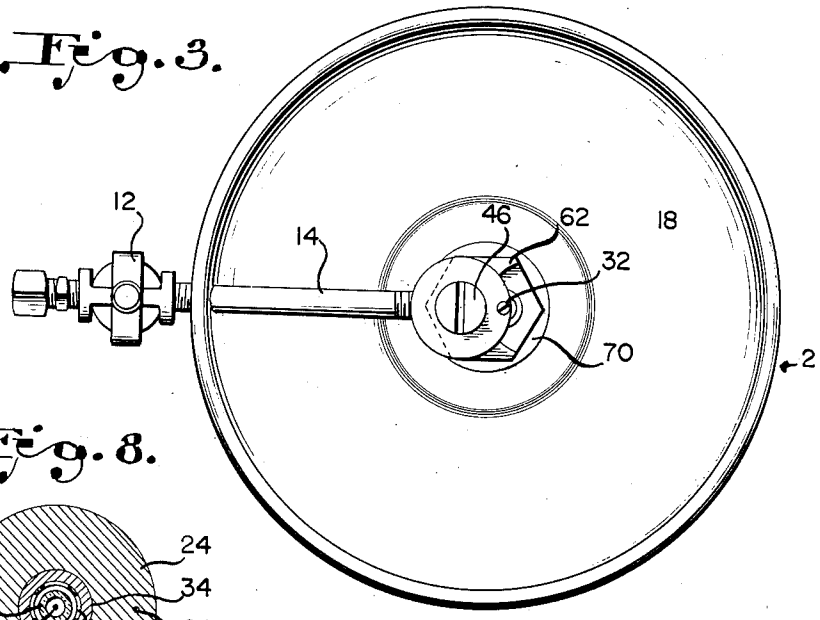

Fig. 8.

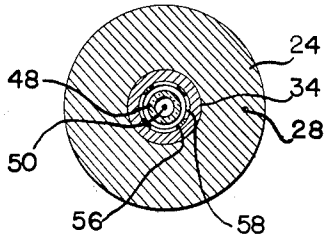

Fig. 4.

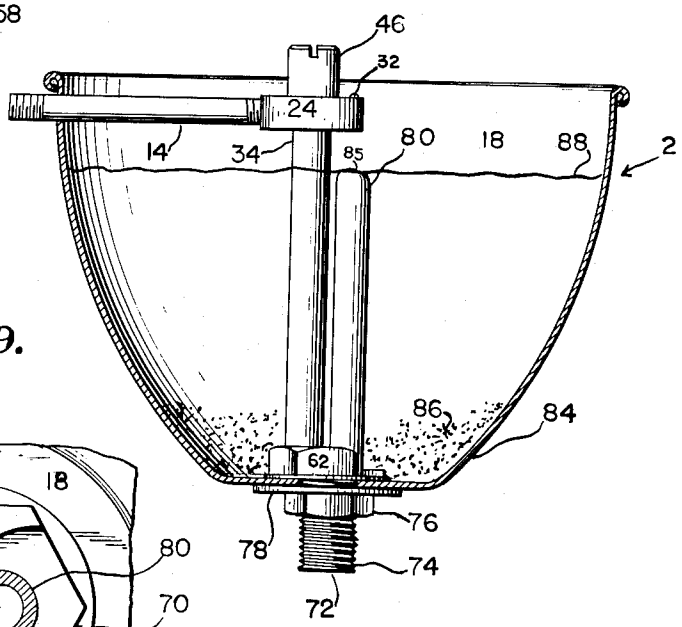

Fig. 9.

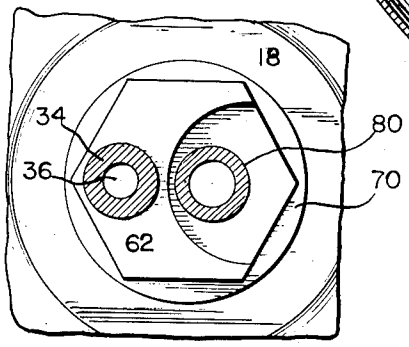

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Fig. 5.

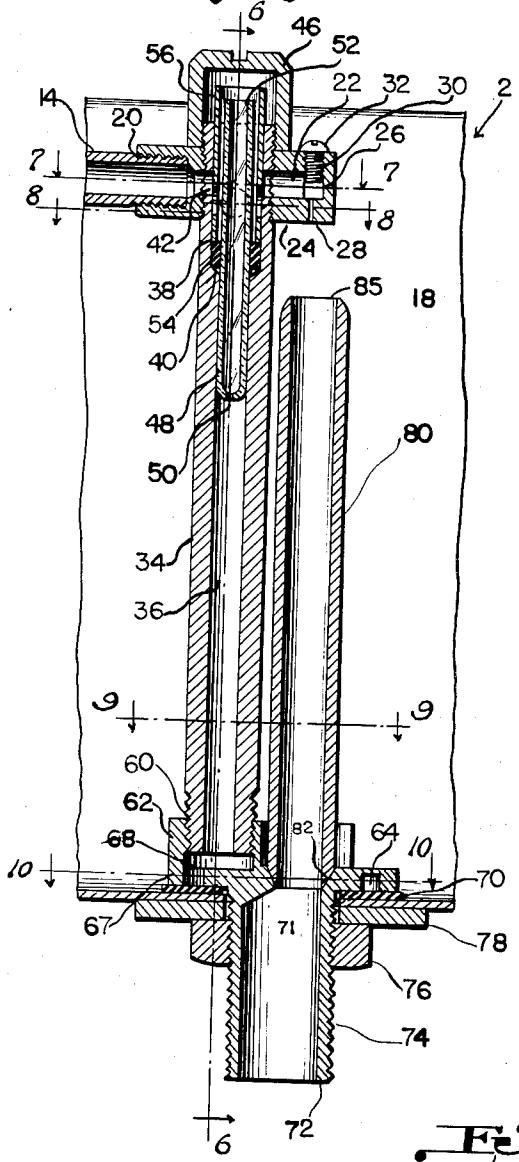


Fig. 6.

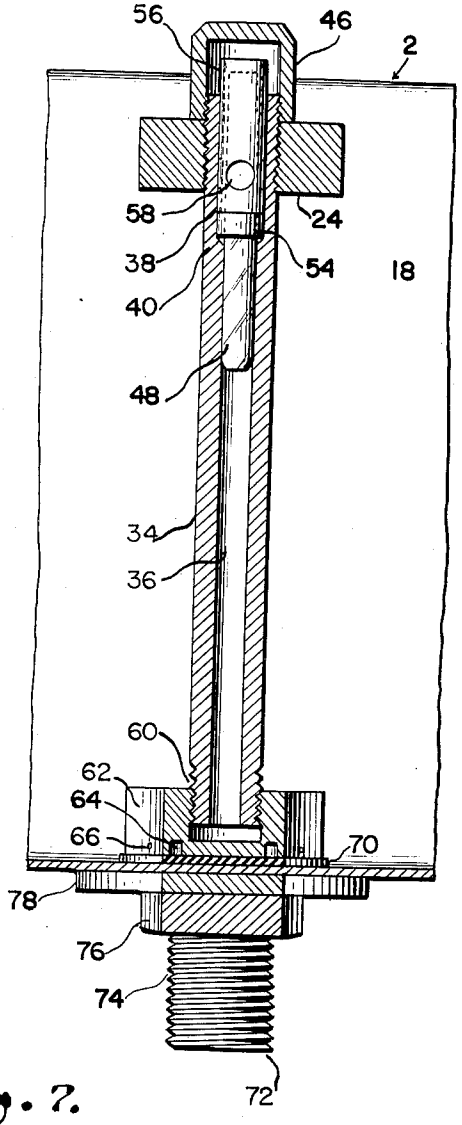
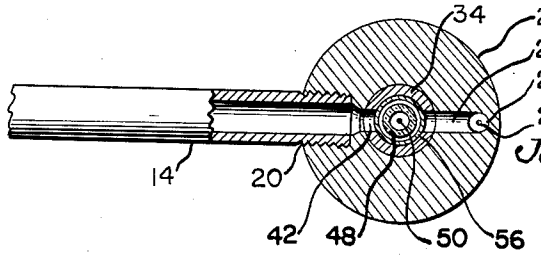


Fig. 7.



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United States Patent Office 2,735,718 Patented Feb. 21, 1956

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SOLUTION FORMING AND DISPENSING DEVICE

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Application July 14, 1953, Serial No. 367,956

8 Claims. (Cl. 299—83)

This invention relates to devices for dissolving and feeding detergent and particularly, to a solution forming and dispensing device adapted for use in connection with dish washing and the like apparatus.

Heretofore, detergent feeders for dish washing apparatus have been characterized by certain fundamental drawbacks. The foaming characteristics of liquid detergent eliminate it from many applications and powdered detergent is the more practical. In a typical prior installation a receptacle for powdered detergent was fed with water tapped off from the downstream side of the control valve in the water supply line leading to the washing machine sump. In passing over the bed of detergent in the container it was found necessary to tap off a considerable volume of water in order that the water intermingle sufficiently with the detergent to produce the solution for the sump. Since the pressure of the water supply line was subject to considerable variation, and since the volume of the water tapped off from the supply line was generally proportional to the supply line pressure, the resultant variations in volume of water passed over the detergent bed created great variations in the concentration of the solution bed by overflow to the sump. Furthermore, the volume of water passing over the detergent bed was necessarily great enough to over-fill the sump, and, thus, great variations in the resultant concentration of detergent in the sump were experienced. The object now is to provide a solution forming device inherently utilizing a very small volume of water, as compared with the volume passing through the sump water supply line, and, under all operating conditions, substantially independent of the variations in pressure. It is thus possible to maintain a completly saturate solution and, therefore, only small quantities of the solution need be added to the sump water. The resultant concentration of the sump water, when the sump is filled, is predictable and constant.

Another object of the invention is to insure that the water will always flow through the bed of detergent in the solution forming device. Heretofore, when water passed over or through the detergent, considerable variations in the characteristics of the detergent were encountered between the time when the detergent was first placed in the container and subsequently when the detergent became packed or caked. More specifically, the object now is to feed minute jets of water outwardly and upwardly through the bottom of the bed of detergent material in the solution forming device, thereby melting constantly shifting channels through the bed of material so that the water standing in the solution forming device above the bed of material is always at the maximum concentration, about 12%. Still another object is so to form the material container of the solution forming device that the detergent, as the lower part of it is carried off in solution, will feed by gravity downwardly and inwardly towards the jet openings through which water is supplied. By gravity feeding the detergent downwardly and inwardly

to a zone surrounding a plurality of radiating jets, uniform solution forming occurs irrespective of whether the container is full or nearly empty of detergent powder, and any tendency to cake or pack is forestalled by dissolving the detergent at the bottom of the mass, and by melting channels through it.

In furtherance of the above objectives certain physical limitations, particularly as to size, are inherent. The water fed into the solution forming device must be accurately metered and the metering opening must be quite small. Since a very small volume is utilized to squirt minute jets into the body of detergent, the jet openings must be extremely small. One object of the invention is that the metering orifice and the jet openings shall always be submerged and wet in the solution to avoid drying out; otherwise, the material deposited by evaporation in the metering orifice and in the jet openings would block flow therethrough. In carrying out this objective it is intended to provide, in the solution forming device, a container for the detergent powder, the container having a stand pipe through which the saturate solution overflows, and it is further proposed that the jet openings through which water is projected into the bottom of the material in the container shall be at the bottom of the container, and that the orifice of the metering device through which water flows to the jet openings shall be below the top of the stand pipe and, therefore, always submerged.

Still another object in the invention is to provide for the use of the solution forming device with various types and sizes of associated apparatus. Thus, it is intended that the subject solution forming and dispensing device shall be applicable to dishwashing machines, for instance, having large or small sumps or characterized by large or small volumes of water flowing to the sump. It is intended, therefore, to provide for the selection of any one of a number of metering devices respectively having different size metering orifices so that the proper metering element can be installed in the solution forming device after the associated apparatus has been measured and monitored for sump volume and sump water flow. A further object in this category is to insure that once the proper metering device has been determined and installed, it shall not be subject to adjustment or tampering by the customer. While the customer may inspect the selected metering elements or take them apart for cleaning, these activities do not affect metering characteristics of the elements when they are replaced and subsequently operated. Yet again it is intended to provide a telltale discharge associated with the metering elements for easy and sure determination that water is flowing into the device. This is particularly important where, as in the subject device, such small volume of water flows that it would otherwise be difficult to tell without close inspection, that it is functioning as required.

In addition to the above objectives it is intended to provide an assembly of parts which can be easily disassembled and reassembled for cleaning and having convenient access to all small openings or passages so that the latter may be readily inspected and cleaned, if necessary. These and other objects will be apparent from the following specifications and drawings in which:

Fig. 1 is a diagram of a typical installation of the invention;

Fig. 2 is a side elevation of the solution forming and dispensing device;

Fig. 3 is a plan view of the device as shown in Fig. 2;

Fig. 4 is a vertical cross section through the device showing the inner parts in side elevation, and with the filter removed;

Figs. 5 and 6 are enlarged vertical sections through the inner parts of the device;

Fig. 7 is a horizontal cross section along the line 7—7 of Fig. 5, looking in the direction of the arrows;

Fig. 8 is a horizontal cross section along the line 8—8 of Fig. 5, looking in the direction of the arrows;

Fig. 9 is a horizontal cross section along the line 9—9 of Fig. 5, looking in the direction of the arrows; and

Fig. 10 is a horizontal cross section along the line 10—10 of Fig. 5, looking in the direction of the arrows.

Referring now to the drawings in which like reference numerals denote similar elements, the detergent dispenser 2 is shown in Fig. 1 in a typical installation wherein it feeds a detergent solution to the sump diagrammatically indicated at 4 of a dish washer. The main supply of water to sump 4 is through water supply line 6 under the control of valve 8. On the downstream side of valve 8 a branch line 10 leads through filter 12 and thence through water input pipe 14 to dispenser 2, from which the water and detergent in solution overflow through solution supply line 16 to sump 4. It will be apparent that whenever valve 8 opens to supply water to sump 4, a certain amount of detergent solution will be introduced into the sump through solution supply line 16.

Referring now to Figs. 2 to 10 inclusive, the dispenser with which the invention is concerned includes an open top container 18 through an opening in the upper wall portion of which water input pipe 14 passes. Input pipe 14 is threaded at 20 to the horizontal bore 22 of a hollow fitting 24. Horizontal bore 22 passes nearly through hollow fitting 24 and the blind end 26 connects with a small telltale hole 28 from which water dribbles downwardly whenever there is input flow through pipe 14. Above telltale hole 28 is an inspection and clean-out hole 30 normally closed by screw 32.

Hollow fitting 24 is threaded around the upper portion of a down pipe 34 having a central bore 36, the latter having an enlargement 38 with an upwardly facing seat 40 at its lower end. Down pipe 34 has a transverse bore 42 communicating with the horizontal bore 22 of hollow fitting 24 and the top end of down pipe 34 is externally threaded as at 44 for receiving a removable threaded cap 46.

Fitting within enlargement 38 is a glass tube 48 having a small metering orifice 50 in its lower end and open top 52. Engaging around glass tube 48 is a resilient washer 54, preferably of synthetic material suitable to withstand the chemical action of detergent. A brass sleeve 56 fits loosely around the upper portion of glass tube 48 and rests on resilient washer 54, and a transverse bore 58 in brass sleeve 56 permits water to flow along the inside of the sleeve so that the water input through pipe 14 will pass not only to the blind end 26 of horizontal bore 22 of hollow fitting 24, but will also pass upwardly to the interior of cap 46 and then downwardly into glass tube 48. Small closely controlled amounts of water will, of course, descend through metering orifice 50 and through bore 36 of down pipe 34.

The lower end of down pipe 34 is threaded into an opening 60 in a base fitting 62, the latter having an annular channel 64 around its underside and a series of minute jet openings 66 extending outwardly through the lower skirt of base fitting 62 which surrounds annular channel 64. A passage 68 cut between the lower end of opening 60 in base fitting 62 and annular channel 64 permits the water descending through bore 36 of down pipe 34 to flow into annular channel 64 from which the water discharges in extremely small streams through jet openings 66. Beneath base fitting 62 is a large resilient washer 70 fitting snugly against lower inner side of container 18 and surrounding a bottom opening 71. It will be apparent that resilient washer 70 forms a bottom closure for annular channel 64. An outlet tube 72 having its upper end integral with the lower side of base fitting 62 extends downwardly through bottom opening 71 of container 18 and is provided on its exterior with threads 74 for receiving a nut 76, the latter clamping a large

washer 78 against the bottom of container 17 so as to hold the entire assembly rigid and provide water-tight connection. Outlet tube 72 connects with solution supply line 16 leading to the sump or corresponding element in the apparatus with which the dispenser is used.

The structure is completed by a stand pipe 80 having its lower end affixed at 82 to base fitting 62 and communicating with outlet tube 72. The upper end 85 of stand pipe 80 lies below telltale hole 24 so that water dribbling through the latter will pass directly downwardly through outlet tube 72. It should be noted, further, that the upper end of stand pipe 85 terminates well above the level of metering orifice 50 in glass tube 48 and, further, that the lower portion of container 18 converges downwardly and inwardly so that the detergent, indicated at 86 in Fig. 4 will feed by gravity to the region surrounding jet openings 66. The detergent solution will, of course, stand at the level of the upper end 85 of stand pipe 80 as indicated at 88 in Fig. 4.

Before operating the solution forming and dispensing device, the requirements for the particular apparatus with which the device is associated are carefully computed. After determining the amount of water to which the solution is to be added as, for instance, the amount of water in the sump of a dish washing machine, and after determining the rate of water flow to the sump, a glass tube 48 having the proper metering orifice 50 is carefully selected to provide the required amount of solution overflow through stand pipe 80. In actual practice it has been found best to have available a set of glass tubes having metering orifices 50 of graduated size so that the proper one may be selected after tests have been run and computations made on the sump flow and volume. The selected glass tube 48 is, of course, installed in the upper portion of down pipe 34 by removing cap 46 and brass sleeve 56. Resilient washer 54 is fitted around the selected tube 48 and arranged so that washer 54 seats tightly on seat 40 at the lower end of enlargement 38, washer 54 fits closely around glass tube 48 so as to form a good seal between the glass tube and the lower end of the second enlargement. Sleeve 56 is dropped into place, and after cap 46 is replaced the device is ready for operation, assuming detergent 86 has been placed in container 18. When water flows through input pipe 14 from filter 12 a dribble is detectable from telltale hole 28, this dribble of water falling as an inconsequential quantity into the sump through stand pipe 80, outlet tube 72 and pipe 16 leading to sump 4. Water from input pipe 14 flows upwardly around both sides of sleeve 56, over the open top 52 of glass tube 48 and thence downwardly through the glass tube and through metering orifice 50, it being noteworthy that the water flow through orifice 50 is the main determining factor in the amount of solution which eventually will overflow stand pipe 80. From metering orifice 50 water flows downwardly through central bore 36 of down pipe 34, through cut-out 68, into annular channel 64 in base fitting 62, and thence is discharged in extremely fine jet streams through jet openings 66 into the mass of detergent 86 which falls by gravity downwardly and inwardly in container 18. The downwardly and inwardly converging sides 84 of container 18 insure that the detergent will always feed towards the outlet ends of jet openings 66. The jets of water squirting out through jet openings 66 tend to melt channels through the detergent material and thus the detergent saturates the water to form a solution of substantially the maximum 12%, in the case of present commercially available detergent powders. The solution fills the upper portion of container 17 until it overflows the top 85 of stand pipe 80 and thence feeds downwardly by gravity to the sump. It will be apparent that only a saturate solution will overflow stand pipe 80, and, because of the small volume of flow, none of the undissolved detergent can be entrained in the overflow.

Since metering orifice 50 of glass tube 48 and jet

openings **66** of base fitting **62** are already immersed respectively in water and solution, they never dry out during operation and thus formation of blocking encrustation is precluded. When it is desired to inspect or clean the apparatus, inlet pipe **14** is first removed, and the entire assembly can then be taken apart and re-assembled, with full access to all passages.

The invention detailed above is not limited to the specific apparatus but is intended to cover all substitutions, modifications and equivalents within the scope of the following claims.

I claim:

1. A solution forming and dispensing device comprising, in combination, a receptacle having lower and upper portions, said receptacle being adapted to hold a bed of loose material to be dissolved in the lower portion and having an over-flow outlet in the upper portion, jet forming means in the bottom of said lower portion, said jet forming means comprising a fitting having a generally flat underside disposed towards the bottom of said receptacle, and having a substantially annular channel in said underside, and a peripheral side wall surrounding said channel, a flat sealing member underlying said channel and tightly engaging between said fitting and the bottom of said receptacle, said side wall having a plurality of minute openings therethrough extending respectively in various directions for directing minute streams of liquid outwardly from the fitting whereby to melt into the bed of the material in said lower portion, and means for feeding liquid under pressure to said jet forming means.

2. A solution forming and dispensing device comprising, in combination, a receptacle adapted to contain material to be dissolved in a lower portion thereof and having an overflow outlet in an upper portion thereof, jet-forming means in said lower portion, a conduit extending downwardly in said receptacle and connecting at its lower end with said jet-forming means for feeding liquid thereto whereby liquid in minute stream form intermingles with and melts the material in said lower portion, said conduit having an upper portion with a part thereof lying above said overflow outlet and a part thereof lying below said overflow outlet, a liquid supply pipe, a detachable connection between said pipe and the upper portion of said conduit above said overflow outlet, and liquid metering means removably disposed in the upper portion of said conduit below said overflow outlet.

3. A solution forming and dispensing device comprising, in combination, a receptacle having a lower portion adapted to contain material to be dissolved and having an overflow outlet in the upper portion thereof, a jet-forming element affixed in said lower portion, said element having a hollow interior separate from the interior of said container and having a plurality of jet openings connecting said interiors, a hollow pipe having lower and upper ends, said hollow pipe extending upwarly from said element and forming an input conduit for said hollow interior, a removable cap closing the upper end of said pipe, a liquid metering tube having a metering outlet orifice and an inlet opening, said metering tube being removably disposed in the upper end of said pipe, and liquid supply means connected to the upper end of said pipe for feeding liquid to the inlet opening of said metering tube.

4. A solution forming and dispensing device comprising, in combination, an open-top receptacle having side walls converging inwardly towards the bottom thereof and having a centrally disposed opening through said bottom, an externally threaded outlet pipe extending upwardly through said opening, an enlarged element affixed to the upper end of said outlet pipe and lying within said receptacle, said enlarged element having a generally flat bottom with a channel therein surrounded by a side wall and substantially circumscribing the upper end of said outlet pipe, a resilient washer underlying the bottom of said element, a clamp nut threadedly engaging said threaded pipe and clamping said washer between said element and the bottom of said receptacle, a plurality of minute openings extending through the side wall of said element and connecting said channel with the lower part of the receptacle interior, a supply pipe affixed to and extending upwardly from said element and having an axial bore communicating at its lower end with said channel, removable means closing the upper end of said supply pipe, liquid metering means in said supply pipe, means for supplying liquid to said supply pipe above said metering means, said element having an outlet passage extending vertically therethrough and communicating with the interior of said outlet pipe, and a stand pipe having an open upper end and a lower end connecting with the outlet passage in said element, whereby said element and said pipes may be disassembled from said receptacle upon removal of said nut.

5. The combination claimed in claim 4, said liquid metering means comprising a tube telescopically engaged in the upper end of said supply pipe and having a metering orifice in the lower end thereof.

6. The combination claimed in claim 4, and telltale outlet means adjacent the upper end of said supply pipe, said telltale outlet means draining into the upper end of said stand pipe.

7. The combination claimed in claim 4, the bore of said supply pipe having an enlargement at the upper end thereof, said liquid metering means comprising a tube of non-corrosive material telescopically and removably engaged in said enlargement, said tube having a metering orifice in the lower end thereof.

8. The combination claimed in claim 7, said metering orifice lying below the upper end of said stand pipe.

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