April 7, 1936. M. A. DONAHOE ET AL 2,036,262

LIQUID AGITATOR

Filed May 18, 1934 2 Sheets-Sheet 1

Fig. 1.

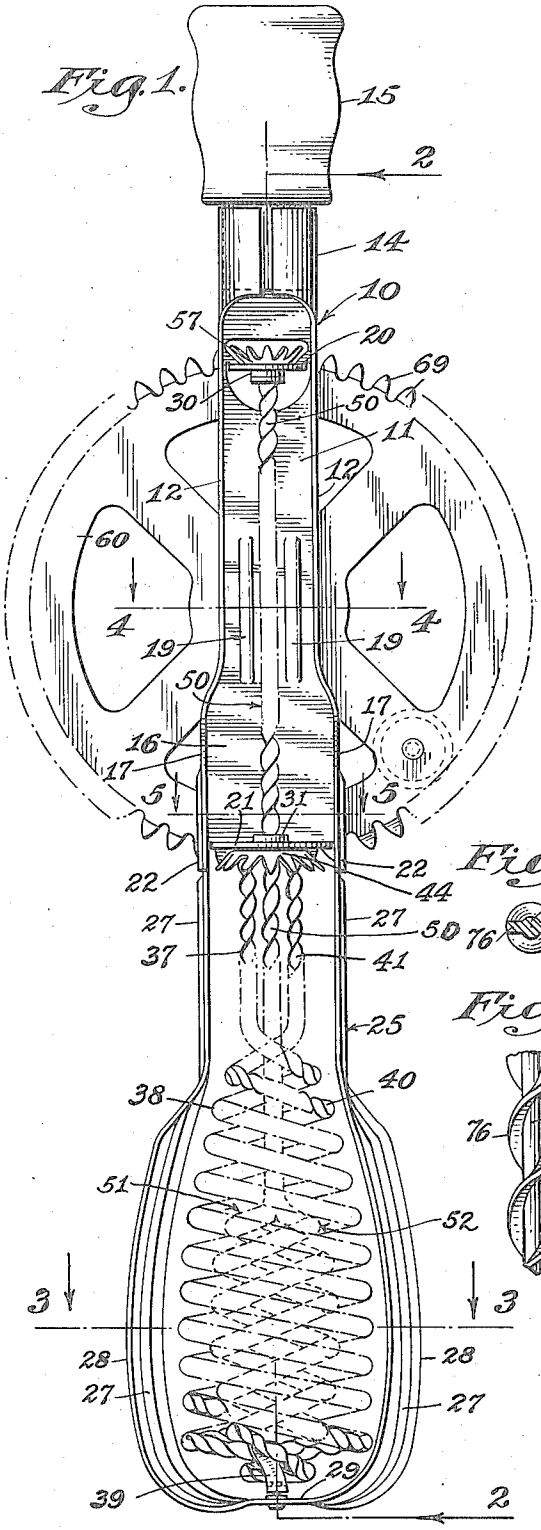


Fig. 2.

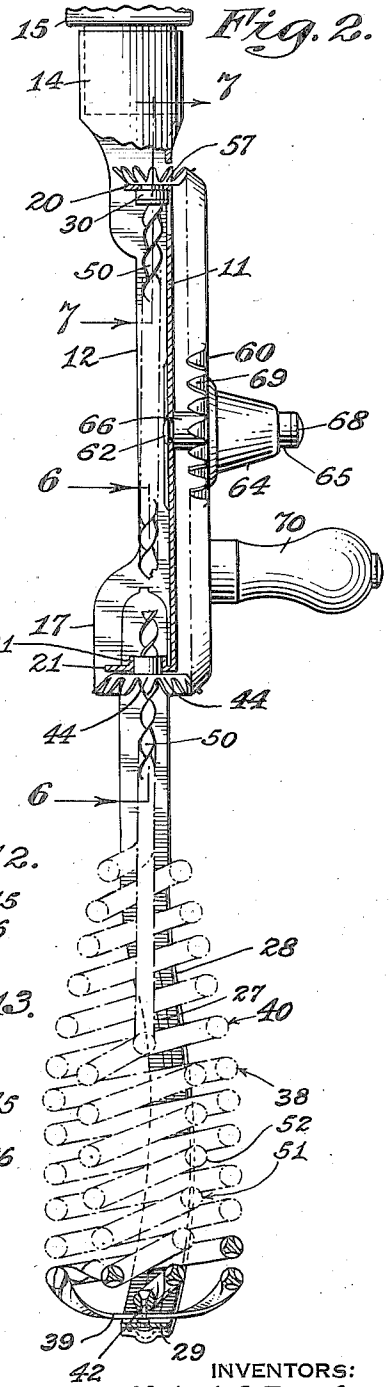


Fig. 12.



Fig. 13.

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Fig. 3.

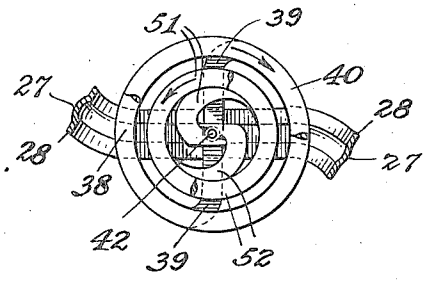


Fig. 4.

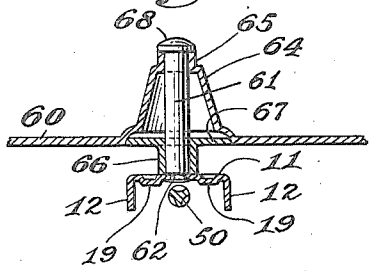


Fig. 6.

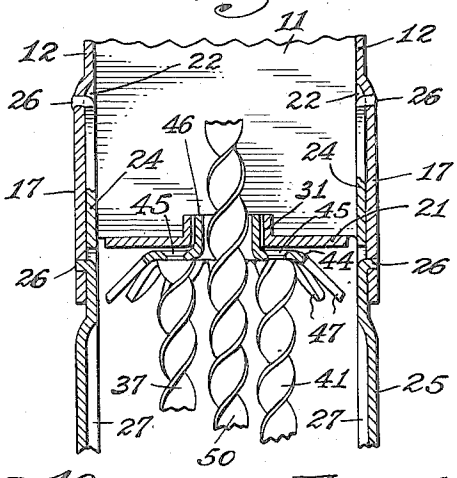


Fig. 5.

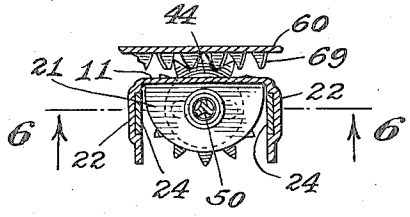


Fig. 7.

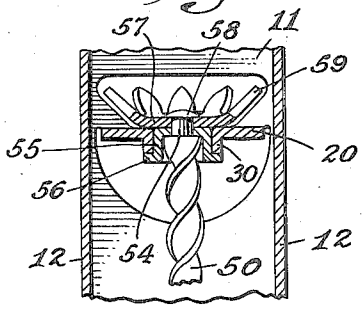


Fig. 10.

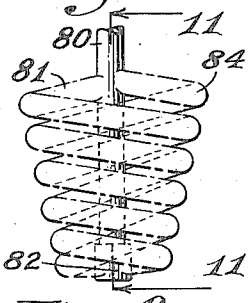


Fig. 11

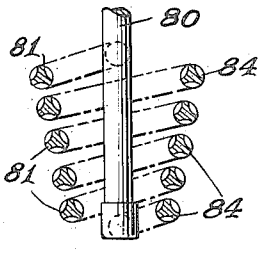


Fig. 8.

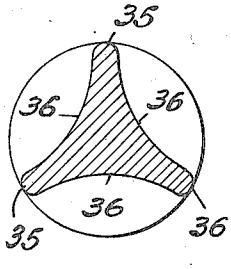
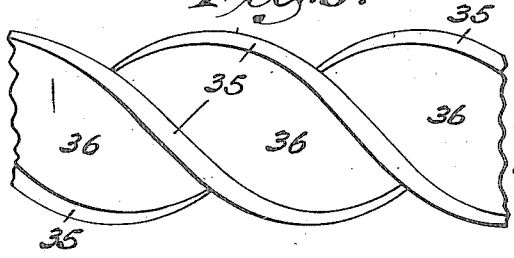


Fig. 9.



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UNITED STATES PATENT OFFICE

2,036,262

LIQUID AGITATOR

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Application May 18, 1934, Serial No. 726,254

17 Claims. (Cl. 259—131)

This invention relates to improvements in agitators and more particularly to improvements in agitators designed primarily for use in connection with liquids.

An object of the invention is to provide a new, simple and efficient agitator for liquids so constructed that in operation liquids will not be splashed to any considerable extent.

Another object of the invention is to provide an agitator which will operate efficiently in liquids of various viscosities.

Another object of the invention is to provide an agitator for liquids of such construction as to present a multiplicity of gripping surfaces to the liquid being agitated.

A further object of the invention is to provide an agitator which serves to aerate the liquid during agitation by driving air downwardly into the liquid.

A further object of the invention is to provide an agitator of such construction that it is capable of being operated in a vessel of relatively small diameter, such as an ordinary water glass.

A still further object of the invention is to provide an agitator of such construction that a part thereof serves to prevent contact between the moving parts of the device and the vessel containing the liquid which guard serves at the same time to redirect agitated liquid into the zone of agitation.

In the preferred form of the invention, the agitating elements are made in the nature of double spiral coils of wire, one series of coils being located within the other and substantially concentrically relative to the other. The wire used is so shaped as to provide a plurality of edges, and in constructing the coils the wire is twisted so that these surfaces between the edges provide a multiplicity of gripping surfaces for contact with the liquid to be agitated. The two series of coils are mounted for concentric rotation and actuating means is provided for rotating the series in opposite directions. Thus if the outer wires of coils is rotated in a direction which forces liquid downwardly at any one time, the inner series of coils is rotated in a direction to cause the liquid to travel upwardly at the same time.

One form of wire used in producing coils in accordance with the invention is so shaped as to be substantially triangular in cross-section and with the sides thereof forming substantially concave surfaces. Another form of wire used is of such shape as to have a substantially cylindrically mid portion from which a pair of flat portions extend diametrically oppositely. Either form of wire is twisted to have a desired number of turns per inch so that the area of contact of the coils formed of the twisted wire with the liquid being agitated is substantially increased.

While the preferred form of the invention contemplates the use of concentric series of coils, it will be evident that the invention is not to be thus limited since a single series may be used with high efficiency. In fact, if the agitator is to be power driven, it may be desirable to make use of a sturdy shaft to which the wires of a coil are secured. If the agitator is to be manually operated, use may be made of a large gear pivoted to the frame of the agitator and meshing with upper and lower gears to which the series of coils are respectively connected. Thus reverse rotation of the series will be accomplished.

Other features, objects and advantages of the invention will become apparent by reference to the following detail description read in the light of the accompanying drawings, wherein

Fig. 1 is a vertical elevation of an agitator embodying the invention.

Fig. 2 is a section taken substantially on the line 2—2 of Fig. 1.

Fig. 3 is a section taken substantially on the line 3—3 of Fig. 1.

Fig. 4 is a section taken substantially on the line 4—4 of Fig. 1.

Fig. 5 is a section taken substantially on the line 5—5 of Fig. 1.

Fig. 6 is a section taken substantially on the line 6—6, either of Fig. 2 or Fig. 5.

Fig. 7 is a section taken substantially on the line 7—7 of Fig. 2.

Fig. 8 is a cross-section of a wire used in the manufacture of the agitator element.

Fig. 9 is a fragmentary view of the agitator element in twisted position.

Fig. 10 is a vertical elevation of a section of agitator element designed particularly for power operation.

Fig. 11 is a section taken substantially on the line 11—11 of Fig. 10; and

Figs. 12 and 13 are representations of a modified form of agitator element corresponding to the showing of Figs. 8 and 9 respectively.

Referring now to the drawings and particularly to Figs. 1 to 7 inclusive, 10 indicates generally a frame member for an agitator comprising a substantially flat portion 11 and side flanges 12. The frame member is preferably stamped from sheet metal of suitable thickness. The upper part of the frame is fashioned into

substantially split cylindrical form as at 14 to provide a socket in which a handle member 15 of suitable size and configuration may be secured in any suitable manner. The lower end of the flat portion of the frame is widened as at 16 and the flanges extending upwardly therefrom are of increased width as at 17. The mid portion of the flat part 11 is provided with ribs 19 (Fig. 4) to serve as reenforcements. Below the socket 14 a tab 20 of semi-circular form is punched from the flat part 11 of the frame and bent to extend substantially perpendicularly thereto. The lower end of the enlargement 16 has a semi-circular tab 21 extending perpendicularly thereto.

The flanges 17 are provided with longitudinal depressions 22 for the reception of the ends 24 of a guard member indicated generally at 25. These ends 24 are flattened as shown in Fig. 6 and are provided with fingers 26 fitting in openings in the walls of the depressions 22 and fastened in such openings in any suitable manner, such as by flattening the ends of the fingers over the outer surfaces of the depressions. The vertical portions of the guard 25 below the end parts 24 are provided with grooves 27 midway between the edges, such grooves serving as reenforcements and also aids in the circulation of liquid being agitated in a manner to be explained hereinafter. The vertical portions of the guard member are spread apart to provide curved upright parts 28 which are twisted at an angle to the normal and arranged substantially in parallelism as shown in Fig. 3. The base of the guard is flattened as at 29 to serve as a retainer for a bearing member.

The upper tab 20 has a central orifice formed by pressing a depending annular flange 30 from substantially the center thereof. The lower tab 21 is formed with a similar flange 31 which is upstanding instead of depending.

The agitator elements used in the invention may be formed in a number of ways. In one form as shown in Figs. 8 and 9, a substantially triangular wire is utilized, such wire having corners 35 and sides 36 which present substantially concave surfaces. A wire of this character is then twisted, being given any suitable number of turns per unit length. The twisted wire as shown in Fig. 9 is then formed into an agitator coil as shown in Figs. 1 and 2. By inspection of these figures it will be seen that the coil is made up of a straight portion 37 leading into a coil 38 spirally wound and partially of helical form. The wire at the lower end of the coil 38 is flattened out as at 39 and then a coil 40 is formed similar in configuration to the coil 38 and positioned with the turns thereof between the turns of the coil 38. This coil 40 terminates in an upright straight portion 41 similar to portion 37. The flattened out part 39 is provided with a small hole fitting over a stub shaft 42 rigidly secured to the flattened part 29 of the guard.

The ends of the straight portions 37 and 41 are secured in diametrically opposite relation to the web of a gear 44 by riveting as at 45 or in any other suitable manner. The gear 44 has a bearing sleeve 46 formed integrally therewith for rotation within the upstanding flange 31 in the tab 21. The teeth 47 of the gear 44 are bent downwardly as shown in the drawings.

The inner agitator element is formed from wire of similar character to that previously described and is composed of an extended straight portion 50 leading into a spirally wound coil 51. This coil 51 is given a somewhat rounded form so that the lowermost part thereof can be provided with a hole through which the stub shaft 42 passes. This shaft may have its end enlarged to lock the coil against displacement. The wire of the coil 51 then continues in another coil 52 of similar configuration to the coil 51 and with the turns thereof positioned between the turns of the coil 51. The end of the coil 52 is secured to the straight portion 50 at the beginning of the coil 51 by welding or by any other suitable arrangement.

As will be seen from the drawings, the straight portion 50 passes through the collar 46 formed integrally with the gear 44 and continues upwardly with the upper end thereof rounded as at 54. Fitting on this upper end of the wire is a collar member 55 having an opening fitting over the rounded portion 54 and having a downwardly extending part fitting within the depending flange 30 and having an annular flange 56 bent under the lower edge of the flange 30. The rounded end 54 of the wire passes through a gear 57 and the end thereof is riveted as at 58 to hold the gear and the collar 55 on the end of the wire. By this arrangement part of the web of the gear 57 rests on top of the tab 20. The teeth 59 of the gear are bent upwardly in an angular direction.

In order that the two gears 44 and 57 may be rotated simultaneously, use is made of a single large gear 60. To support the gear 60 use is made of a shaft 61 rigidly secured to the flat portion 11 of the frame as at 62 and extending perpendicularly therefrom. The point at which the shaft is secured to the frame is preferably between the two reenforcing ribs 19. The gear 60 is provided with substantially conical hub part 64 terminating in a cylindrical portion 65 fitting closely around the shaft 61. In addition, use is made of a collar 66 also fitting around the shaft 61 and having a flange 67 secured to the gear 60 by welding or by having a part of the hub of the gear shrunk onto the edge of the flange. The outer end of the shaft 61 is formed with a head 68 for locking the gear onto the shaft. Gear 60 is provided with teeth 69 bent inwardly at such an angle as to mesh with the teeth of the gears 44 and 57. A handle 70 is secured to the gear for manually rotating the same.

If desired, the coils may be made from members similar to those illustrated in Figs. 12 and 13. The wire in this case consists of a substantially cylindrical mid portion 75 from which extend diametrically opposite flat wings 76. A wire of this character can be twisted into the desired number of turns per unit length and then formed into agitator coils in the same fashion.

While the preferred form of the invention has been shown particularly as embodying an agitator to be manually operated, it will be apparent that the agitator can be constructed for power operation. Moreover, it has been found in practice that one of the concentric coiled agitator elements can be dispensed with particularly when the device is power operated. For this purpose the arrangement shown in Figs. 10 and 11 may be used efficiently. In this modification of the invention use is made of a shaft 80 which can be connected directly to the source of power, such as an electric motor or to any other convenient source of power. Secured to the shaft 80 above the lower end thereof is one end of a coil 81 wrapped to present substantially inverted conical form. The upper end of the coil 81 may be secured to the shaft by welding, soldering, or by any other suitable arrangement. The lower

end of the coil 81 is secured to an enlargement 82 at the lower extremity of the shaft 80 by welding, soldering etc. Also secured to the shaft 80 in the same manner as the coil 81 is a coil 84 wound in the same fashion as coil 81 and positioned to have the turns thereof interposed between the turns of the coil 81.

The operation and use of the invention in either form shown is substantially as follows. When the preferred form of the invention is used, that is, the form in which concentric coiled agitators are employed, power is applied either manually or mechanically to rotate the tube coiled agitator elements. For best results, the direction of rotation of the outer element is clockwise when viewed from above as in Fig. 3 and the direction of rotation of the inner element naturally will be counterclockwise, since the two gears 44 and 57 are rotated in opposite directions. When the outer coil is rotated in this fashion it tends to force liquid downwardly and outwardly. At the same time the inner coil tends to lift the liquid and force it outwardly. Thus definite agitation of the liquid is accomplished. As the outer coil forces liquid outwardly, the movement of the liquid away from the coil is interrupted by contact with the curved portions 26 of the guard. As will be seen from the drawings, these portions of the guard are so positioned that the wide surfaces thereof lie in the path of liquid moving outwardly so that the outward movement is interrupted and the liquid is in effect redirected against the agitator elements. The indentations 27 in the guard members serve to present a curved surface for aiding in this direction of liquid. Another beneficial result from the use of guard members of this type is that a whirling motion of the liquid at the edge of the vessel containing the same is reduced to such an extent that the liquid does not tend to creep up the vessel sufficiently to be discharged therefrom even though the liquid level is close to the top of the vessel. In fact, in practice it has been found that liquid will not be discharged from a vessel when the agitator elements are rotated properly even though the normal level of the liquid is close to the top of the vessel. However, if the elements are rotated in such direction that the outer element normally tends to lift the liquid, then noticeable splashing may result.

The agitator of the present invention possesses the feature of improved agitation in either form shown due to the fact that the coiled elements present a multiplicity of gripping surfaces to the liquid, such surfaces resulting from the twisting of the wire used in making the elements. In other words, a greater surface contact between the liquid and the agitator elements is obtained.

Due to the spiral movement of the agitator elements in the liquid, very little greater power is required for agitating liquids of high viscosity than is required for agitating light viscosity liquids. The agitator elements are in effect screwed into the liquid so that it may be said that they slip through the liquid rather than striking the same a direct blow as is customary in agitators of usual types.

Another feature inherent in the invention results from the construction thereof whereby the movement of the agitator elements and particularly the element tending to force liquid downwardly simultaneously drives air into the liquid to thoroughly aerate the same while agitation is being accomplished. The aeration is so pronounced that air is driven into the liquid to the bottom of the agitator element in distinction to surface aeration as is common with conventional types of agitators.

Due to the spiral arrangement of the wire and the twisted formation thereof, the elements can be cleaned readily, since as before stated, their action in travelling through the liquid is in the nature of a screw action causing a greater contact between surfaces and the liquid. Thus even with very viscous liquid adhering to the agitator, it may be cleaned readily by rapid rotation in hot water or in hot soapy water.

The provision of the particular guard members permits the agitator to be inserted into a small vessel, such as an ordinary water glass in which vessel it can be operated efficiently, and due to the fact that splashing is substantially entirely eliminated when the elements are properly rotated, no cover is necessary. The guard serves to prevent contacting between the rotating element and the wall of a vessel.

From the foregoing it will be seen that the present invention in either form illustrated possesses advantages not present in prior structures, and since it is capable of considerable modification, no limitation is to be imposed thereupon in view of the illustrated embodiments, but such limitations as are imposed are to be only those set forth in the following claims.

We claim:

1. A liquid agitator comprising a spirally coiled member made up of turns of twisted multi-edged wire and means for rotating said member.

2. A liquid agitator comprising a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil being interposed between the turns of another coil, and means for rotating said coils.

3. A liquid agitator comprising a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil being interposed between the turns of another coil, said coils being secured together for simultaneous rotation, and means for rotating the coils.

4. A liquid agitator comprising a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil being interposed between the turns of another coil, and means for rotating said coils, said coils being wound into helical shape for part of the length thereof.

5. A liquid agitator comprising a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil being interposed between the turns of another coil, said coils being secured together for simultaneous rotation, and means for rotating the coils, said coils being wound into helical shape for part of the length thereof.

6. A liquid agitator comprising a spirally coiled member made up of turns of twisted multi-edged wire, a second spirally coiled member made up of turns of twisted multi-edged wire arranged concentrically to said first member, and means for rotating said members simultaneously and in opposite directions.

7. A liquid agitator comprising a pair of members, each made up of twisted spirally arranged coils of multi-edged wire, the turns of one coil being interposed between the turns of another coil, said member being mounted concentrically, and means for rotating said members simultaneously and in opposite directions.

8. A liquid agitator comprising a spirally coiled member made up of twisted turns of substantially triangular shaped wire, the sides of which

form substantially concave surfaces and means for rotating said member.

9. A liquid agitator comprising a spirally coiled member made up of twisted turns of wire, said wire having a substantially cylindrical mid-portion and flat diametrically opposite wings, and means for rotating said member.

10. A liquid agitator comprising a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil being interposed between the turns of another coil, and means for rotating said coils, said wire being of substantially triangular shape with the sides thereof forming substantially concave surfaces.

11. A liquid agitator comprising a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil being interposed between the turns of another coil, and means for rotating said coils, said wire having a substantially cylindrical mid-portion and flat diametrically opposite wings.

12. A liquid agitator comprising a frame, a member made up of spirally arranged coils of twisted multi-edged wire, a guard depending from said frame, said member being mounted for rotation relative to said guard, a gear secured to said member and mounted for rotation relative to said frame, and a manually operable gear secured to said frame for driving said first gear.

13. A liquid agitator comprising a frame, a member made up of spirally arranged coils of twisted multi-edged wire, a guard depending from said frame, said member being mounted for rotation relative to said guard, a gear secured to said member and mounted for rotation relative to said frame, and a manually operable gear secured to said frame for driving said first gear, said guard having upright flat expanses, twisted to present flat surfaces in the path of liquid driven outwardly by said member.

14. A liquid agitator comprising a frame, a guard depending from said frame and made up of separated expanses of strip metal, a pair of members each made up of a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil of a member being interposed between the turns of another coil of said member, said members being mounted for coaxial rotation one within the other and means for rotating said members simultaneously and in opposite directions.

15. A liquid agitator comprising a frame, a guard depending from said frame and made up of separated expanses of strip metal, a pair of members each made up of a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil of a member being interposed between the turns of another coil of said member, said members being mounted for coaxial rotation one within the other and means for rotating said members simultaneously and in opposite directions, said guard having portions of the expanses thereof positioned to present wide surfaces in the path of liquid forced outwardly by the outer of said members to redirect liquid toward said members.

16. A liquid agitator comprising a frame, an upper and a lower gear secured to said frame for rotation relative thereto, a guard member depending from said frame, a pair of agitator elements each made up of a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil of a member being interposed between the turns of another coil of said member, said members being pivotally secured to the base of said guard, one of said members having the ends of the wire thereof secured to the lower gear the other of said members being positioned within the first and having a driving member secured thereto, said driving member passing through said lower gear and being secured to said upper gear for rotation therewith, and means for rotating said gears simultaneously and in opposite directions to cause simultaneous coaxial rotation of said members in opposite directions.

17. A liquid agitator comprising a frame, an upper and a lower gear secured to said frame for rotation relative thereto, a guard member depending from said frame, a pair of agitator elements each made up of a plurality of spirally arranged coils of twisted multi-edged wire, the turns of one coil of a member being interposed between the turns of another coil of said member, said members being pivotally secured to the base of said guard, one of said members having the ends of the wire thereof secured to the lower gear the other of said members being positioned within the first and having a driving member secured thereto, said driving member passing through said lower gear and being secured to said upper gear for rotation therewith, and means for rotating said gears simultaneously and in opposite directions to cause simultaneous coaxial rotation of said members in opposite directions, rotation of said outer member in one direction causing liquid to be forced downwardly, rotation of the other member at the same time causing liquid to be forced upwardly toward the outer member, said guard member being twisted to present wide surfaces in the path of liquid directed outwardly by the outer member to redirect said liquid toward said member.

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