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WATER SOFTENING DEVICE

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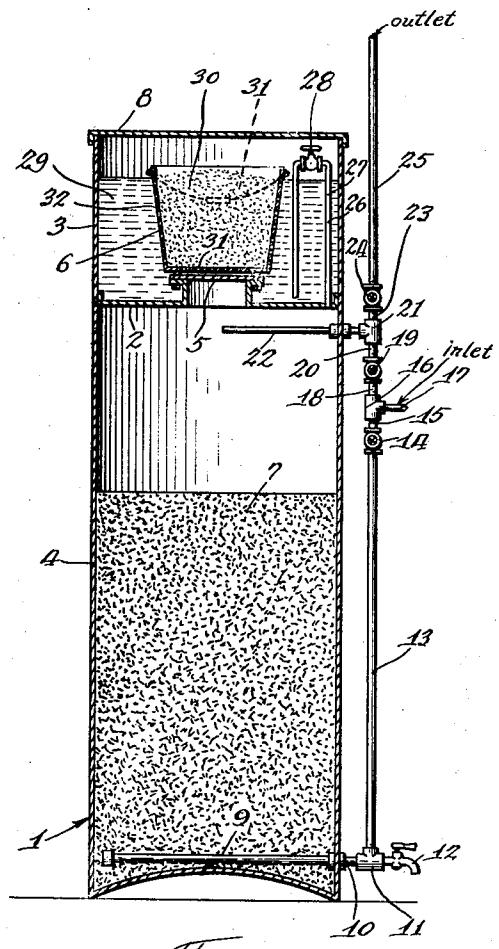


Fig. 1.

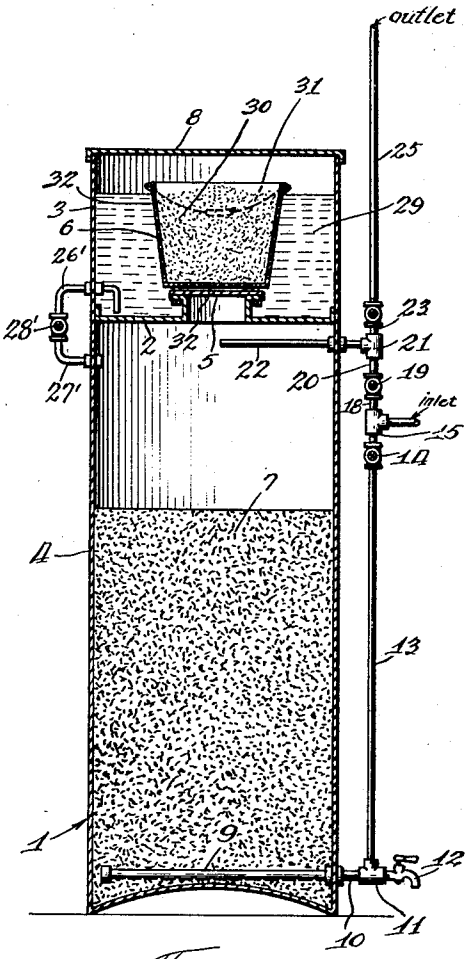


Fig. 2.

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WATER SOFTENING DEVICE

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3 Claims. (Cl. 210—24)

The present invention relates to a simple and efficient device employing base-exchanging material such as zeolite granules together with relatively simple but highly efficient means for regenerating the water softening power of these granules when desired.

Among the primary objects of the invention, and aside from the softening of the water itself, the present inventor has provided simple and efficient means for producing, without loss of time and during the normal operation of the bed of zeolite granules, a solution of a suitable salt such as sodium chloride, which will serve to regenerate the granules when necessary. For this purpose the inventor provides an upper compartment in the water softener in which, upon a suitably raised portion, there is placed a foraminous container such as a bucket or the like, into which salt is placed, the bucket then being set into the compartment, the latter containing water sufficient to equal substantially the depth of the container, whereby the salt will slowly and automatically dissolve, forming a strong or saturated salt solution which will thus immediately be available whenever necessary for regenerating the granules in the compartment immediately below.

In the ordinary water softeners as hitherto used, it was necessary to shut off the operation of the softener and then to prepare the salt solution, or else to place the salt directly into contact with the granules, all of which consumed a considerable amount of time, so that the water softener would be out of operation for a considerable period. By the present invention, however, the time for regeneration is cut down very materially, and the operation is made so simple that the softener may be serviced by entirely inexperienced persons, with the minimum amount of labor, turning of valves, and the like.

In the hereunto appended drawing, two different means are shown for carrying out the present invention, both of the figures being vertical cross sections of suitable apparatus. It is to be understood at this point that these illustrations are purely diagrammatic and that the exact proportions thereon shown and the exact methods of making the connections are of course purely a matter of choice, and that the illustrations are to serve merely as exemplifications of the fundamental principles underlying the invention and are not to be taken literally as working drawings or as limitations of the invention.

As will be seen from the two figures, the difference between which is very slight and relates only to the means for transferring liquid from one compartment to the other, the water softener consists of a housing 1 which is divided by a horizontal partition 2 into an upper and a lower compartment 3 and 4, respectively. This partition 2 is preferably provided with an upstanding flange or other raised portion 5 which serves to support a foraminous container or bucket 6. In the lower compartment 4 there is a bed of zeolite granules or like base-exchanging material 7. A suitable cover 8 is provided for the upper compartment so as to close off the water softener against the ingress of dirt and dust. Near the bottom of the lower compartment and embedded in the zeolite granules 7 there is a perforated pipe 9. This pipe is connected by means of a nipple 10 and a T 11 with a drain cock 12. Into the same T 11 there is also screwed a water-conducting pipe 13 which is provided with a valve 14, at the other side of which there is a short nipple 15 which is screwed into the T 16, which bears a branch line 17, marked on the drawing "Inlet", which serves for the introduction of the water that is to be softened. On the other side of the T 16 and connected by another nipple 18 there is a valve 19 which, by means of a second nipple 20, is connected to a further T 21, the branch of which is connected through a suitable nipple with a pipe 22 that extends into the empty upper section of the lower compartment 4. On the upper side of the T 21, connected by a nipple 23, there is a valve 24 which in turn is connected with a pipe 25 marked "Outlet", which serves to conduct the softened water to whatever point it is intended to use it.

In order to enable the establishment of a connection between the upper compartment 3 and lower compartment 4, two different means are shown. In Fig. 1 this is accomplished by means of a siphon which has two branches 26 and 27 and a valve 28, which latter is in the extreme upper portion of the upper compartment 3, just below the cover 8, so as to be above the level of any liquid which may be in this compartment. The compartment is shown in the drawing as containing water 29, and in the foraminous bucket 6 there is shown a mass of salt 30. A suitable bail 31 for the convenient handling of the bucket is illustrated in dotted lines because, as shown in the drawing, this bail is assumed to be on the far side of the bucket. It will be noted that the bucket is provided on the sides as well as on the bottom with holes or openings 32. In Fig. 2 the connection between the upper compartment 3 and the lower compartment 4 is secured by means of pipes 26' and 27', which are connected with

each other through the intermediation of the valve 28'. The function of the siphons 26, 27, 26' and 27' is identical, the essential difference being that in the modification shown in Fig. 2 the valve 28' is on the outside of the apparatus instead of on the inside, as it is in Fig. 1.

The operation of the apparatus as above described, and referring particularly to Fig. 1 for the present, is as follows:

When the zeolite granules are new and hence still have their base-exchanging properties, water which is to be softened is fed into the apparatus through the inlet 17. At that time, valves 19 and 24 will be tightly closed and valve 14 will be wide open. Valve 28 in the upper compartment will also be open. The drain cock 12 will be closed. Water will therefore flow downwardly from the T 16 through the valve 14 and the pipe 13 into the T 11 and thence to the left and into the perforated pipe 9, being discharged through the perforations into the bed of zeolite granules 7. The water will rise through these granules and will gradually fill the compartment 4 at that part which is above the level of the zeolite granules. After the water has completely filled the lower compartment 4, both between the interstices of the granules 7 and the empty space thereabove, it will be forced through the pipe 27 and the open valve 28 into the pipe 26 and will hence be discharged into the upper compartment until a point is reached where the upper compartment is about seven-eighths full. At that time valve 28 is immediately closed, so that the water can no longer flow into the upper compartment. Thereafter, valve 24 is opened, thus allowing the water to discharge through the pipe 25 and be directed to wherever the water is intended to be used. As in ordinary use the pipe 25 will lead to the household supply which is provided with the usual faucets, a flow of water through the apparatus will thus be effected only when the faucets are open for the withdrawal of water for use. This water, by virtue of having passed through the zeolite granules, will be suitably deprived of the hardening constituents, such as the calcium and magnesium salts therein contained.

This normal operation is continued as long as desired and need be interrupted only when the zeolite granules have lost their base exchanging properties. During this normal operation, however, the user of this device will place a suitable quantity of salt in the portable foraminous container or bucket 6 and, after lifting the lid 8, will place this container upon the raised portion 5, then replacing the lid. The bucket 6 is suitably made of such a size that it will contain just the right amount of salt to regenerate the amount of zeolite granules in the lower compartment. The salt will thus automatically and gradually dissolve until it forms a strong salt solution in the upper compartment. Inasmuch as the time required for the solution of the salt is only a very small fraction of the length of time that is required for the exhaustion of the zeolite granules, it will be seen that there will thus be produced in compartment 3 a solution of regenerating salt, ready for use when required.

When it is found that the water issuing from the faucets is no longer of sufficient softness, which indicates that the granules 7 require regeneration, this is accomplished as follows: Valves 24 and 14 are closed and drain cock 12 is opened. Under the influence of gravity, water will then run out through the pipe 9 and the drain cock 12. Inasmuch as the apparatus is otherwise hermetically closed, this will tend to produce a lower pressure or partial vacuum in the lower compartment 4, which will soon diminish the amount of water which flows through the drain cock 12 and thus cause a suction on the line 27. By then opening the valve 28, it will be evident that this suction will draw water up through the pipe 26, through the valve 28 and the line 27, so that a siphoning action will take place, which will siphon the salt solution from the upper compartment 3 into the lower compartment 4, whereby the salt solution will flow into the interstices of the zeolite granules, thus surrounding them with salt, which, as is well known, drives the magnesium and calcium salts out of the granules, replacing these elements by the element sodium, thereby regenerating the granules. The operator will keep the valve 12 open until he, or she, hears a hissing noise, which indicates that all of the salt solution has been drawn onto the granules and that compartment 3 is then empty. Thereupon the valve 12 is closed immediately. The valve 28 is then also closed and the salt solution is allowed to remain on the granules as long as desired, which usually is only from twenty minutes to a half hour. Thereupon the valve 12 is opened to allow the salt solution to run out of the lower compartment, and the valve 19 is also opened, whereby water from the source of supply and through the pipe 17, T 16 and nipple 18 will flow through the valve 19, nipple 20 and T 21 into the pipe 22, thus getting into the upper part of the compartment. The water will thus pass downwardly through the granules 7 and out through the pipe 9 and drain cock 12, washing the salt solution out of the granules. After a few minutes washing, the drain cock 12 is closed, the valve 19 is closed, and the valve 14 is opened. This therefore re-establishes the normal flow into the lower compartment through the pipe 13 and perforated pipe 9, so that the water rises upwardly, as it did originally, through the granules and again completely fills compartment 4. As the valve 24 is still closed, this water finds no means of escape until the operator opens valve 28, which again allows fresh water to enter the upper compartment 3 to fill the same to the desired level, whereupon the valve 28 is closed and the valve 24 is opened, thus establishing the initial operating conditions. Thereupon another bucket of salt is placed into the upper compartment and the lid 8 replaced, so that the device is again in the condition it was when the present description of the operation was begun.

Referring for the moment to Fig. 2, the operation of this is self-evident, as it is actually the same except that the valve 28' is on the outside of the apparatus instead of on the inside. Also, it will not be necessary to depend upon the partial vacuum in the lower chamber, as the mere opening of the valve 28' will immediately start the salt solution running into the lower compartment. It is however preferable to depend somewhat upon the suction, as the noise made by the suction through the pipe 27' when the upper compartment 3 is empty gives the operator immediate indication as to when to close the drain cock 12.

It will be seen from the above description of the apparatus and its operation that there is here provided an extremely efficient and simple means for regenerating zeolite granules. There are no complicated valve systems to be operated,

and there is no danger of running salt water into the pipe line leading to the household faucets, as is sometimes the case with the more complicated and involved regenerating systems used in this art. Furthermore, the entire device, particularly as shown in Fig. 1, can be made of a small and neat appearance, which greatly enhances its desirability when located in the basements of homes that are provided with gas or oil burners and are used as playrooms, billiard rooms and the like, in which an unsightly water regenerating device would be objectionable from an esthetic point of view. It may be mentioned that the upper compartment, at least, of this type of water softener is preferably made of enameled or glass lined steel material, as this will effectively resist the corrosive action of the salt; in fact, the entire apparatus can be made of enameled ware, thus presenting a neat and clean appearance and being resistant to corrosion and rust. The perforated bucket 6 is also preferably made of enameled ware. The exact shape of this bucket is, of course, a matter of indifference and it may not be necessary in all cases to supply the raised portion 5 in the partition 2, as obviously this partition could be flat, and lugs could be provided upon the container or bucket 6 so as to keep the bottom thereof free of the partition.

Reserving for himself such modifications as lie within the skill of the art, what the inventor claims is:

1. A water-softening apparatus comprising the combination of a vertical cylindrical housing, a horizontal partition therein dividing the same into an upper and a lower compartment, a bed of base-exchange granules in the lower compartment, a separate and freely removable foraminous pail supported by said partition, and means for establishing communication between the upper and lower compartment to permit of liquid flow therebetween.

2. A water-softening apparatus comprising the combination of a vertical cylindrical housing, a horizontal partition therein dividing the same into an upper and lower compartment, means on said partition extending into the upper compartment for supporting a pail thereon, a separate and freely removable foraminous pail supported on said means, a bed of base-exchange granules in the lower compartment and a valved siphon pipe communicating between the upper and lower compartments whereby salt water formed in the upper compartment may be siphoned onto the granules in the lower compartment.

3. A water-softening apparatus comprising the combination of a substantially cylindrical elongated vertical housing, a horizontal partition therein near the upper part thereof dividing the housing into an upper and lower compartment, a bed of zeolite granules partly filling the lower compartment, a perforated pipe extending into the zeolite bed through the wall of the housing near the lower part of the lower compartment, an upwardly extending flange forming a part of the horizontal partition and extending a short distance into the upper compartment to form means for supporting a pail thereon, a freely removable perforated pail normally supported on said flange and intended for containing a regenerating salt, whereby when water is placed into the upper compartment and said pail is set therein a salt solution will automatically be formed, and a valved siphon pipe having one leg extending downwardly into the upper compartment almost to the bottom thereof and a second leg extending through the horizontal partition, a valve above the water level in the upper partition, and means for causing water to flow in and out of the upper and lower compartments.

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