The present invention has to do with a material washing and lifting apparatus. The principal object of the present invention is to cleanse and elevate material without the necessity for conveying such material through a pump or the like.

Another object of the invention is to provide a washing and elevating apparatus free from moving parts and wherein air under pressure is substituted for mechanical lifting or elevating means.

A further object of the present invention is the provision of a simplified, rapidly operating, and efficient washing and elevating mechanism suitable for use in vegetable canneries and the like. These and such other objects as may hereinafter appear, are obtained by the novel construction, unique combination, and improved arrangement of the several elements which constitute the invention, one form of which is illustrated in the accompanying drawing in which:

Figure 1 is a side elevation, partly in section, of apparatus embodying the invention;

Figure 2 is a plan view of the intermediate hopper shown in Figure 1;

Figure 3 is a vertical section through such hopper on the line 3—3 of Figure 2; and

Figure 4 is a transverse section of such hopper taken on the line 4—4 of Figure 2.

Like reference characters are used to designate similar parts in the drawing and in the following description.

The apparatus illustrated comprises two lifting stages. A single lift may be used or more than two stages of elevation as desired or required.

The apparatus illustrated is of a form suitable for installation in a canning factory, such as a pea canning establishment. A floor 10, generally the ground floor of the factory, supports a feed hopper 11. Any suitable means (not shown) may be employed for supporting hopper 11 of suitable size at a convenient height for manual loading.

A U-shaped conduit 12 has a short leg connected to the bottom of the hopper 11 for draining such hopper, and a long leg extending upwardly and terminating in a curved discharge end, the long leg of the U-shaped pipe 12 emptying into a hopper 13 herebefore referred to as an intermediate hopper.

The U-shaped pipe 12 at its closed end extends beneath the floor 10; a distance determined partly by the height of the long leg of the pipe 12, partly by air pressure which is injected into such long leg, and partly by the amount of material washing to be done therein. The closed end or bottom of the conduit 12 may be disposed in an excavation provided therefor if the floor 10 is not spaced sufficiently high to accommodate such closed end.

The intermediate hopper 13 encloses or surrounds a suitable screen. Such screen may be one or more stationary elements or it may comprise a moving screen such as illustrated in the several figures of the drawing. The moving screen illustrated is designated by reference character 1 and is of the endless belt type having apertures therethrough of suitable size. With the flights of the belt of screen 1 running horizontally, two screening effects are obtained therefrom in intermediate hopper 13. This belt sifts out all of the smaller foreign matter, such as sand, small pebbles, and the like.

Screen 1 is mounted upon pulleys, rollers, or other suitable bearing members 14. The roller member 14 at the left of Figure 1 is suitably attached by shaft or otherwise to a gear 5 which is driven by a gear 5 upon a shaft having at its other end a pulley 7. The shaft carrying gear 5 at one end and pulley 7 at the other end may be suitably journaled in brackets mounted upon the hopper 13 as shown in Figures 2 and 3. The pulley 7 is rotated by a belt driven by a motor 4.

Beneath the belt screen 1 in hopper 13 is a frame for a removable flat screen 3. An opening for the insertion and removal of screen 3 is provided in the side wall of hopper 13. A material guide 15 is disposed at the right hand end of Figure 1 to guide material ejected from U-shaped pipe 12 onto the screen 1, the direction of flight of the screen 1 being shown by the arrows in Figures 1 and 3.

There are two discharge openings in hopper 13. One, that at the left of Figure 1, is employed for material to be further washed and elevated.

A screen 18 is suitably disposed in hopper 17 for the separation of solid material of a certain size or larger from solid material of a smaller size and from the liquid used to elevate the material from hopper 13 to hopper 17. A discharge spout 19 may be disposed at the base of screen 18. The hopper 17 is suitably disposed upon a floor 24, which in the present illustration is the second floor of a canning building.

The second discharge aperture or opening in the hopper 13 has connected thereto a pipe 26.
The discharge pipe 20 is superposed with respect to the discharge end of the U-shaped pipe 12 and conveys the major portion of the liquid which is discharged from pipe 12 downwardly out of hopper 13 after it has passed through the screens 1 and 2 to hopper 11. The branch of the screen 3 arrests excessive flow of the liquid discharged from pipe 12 across the hopper 13 into the pipe 16.

Hopper 11 has a draining aperture to which is connected a pipe 21 extending downwardly therefrom, emptying into the upper leg of the U-shaped member 16 and conveying the material which had been left in hopper 13 generally directly over the short leg of pipe 16 which is employed to carry material and liquid from the hopper 13 to the hopper 17.

Material to be washed and elevated is carried from hopper 14 to hopper 15 and from hopper 13 by a suitable liquid. In canning operations such medium is water. The water supply is through conduit 22, which is branched, one branch 2 having a valve therein for the regulation of the flow of water thenceforth. Such branch empties into hopper 13 over the flights of screen 1. The position of branch 2 in Figure 1 has been found to be satisfactory, but its position may be varied according to circumstances.

The branch from conduit 22 also has a valve therein. It empties into the hopper 13. Water flows through branch 2 for the purpose of supplying water with which to start operations. When a sufficient supply of water has accumulated in the system the valve in conduit 8 is closed but is opened again for replacing water that is wasted or lost, provided the continuous flow of water from branch 2 is insufficient for this purpose. Water valve in branch 2 is set to take care of all waste or losses.

In addition to water circuits there are air circuits in the system. Air under pressure is supplied by a pump 23 driven by motor 4 or by any other motor which may be suitably mounted in a convenient position. In Figure 1, motor 4 is shown depending from joists in floor 24. The air compressed by air pump 23 leaves the pump by conduit 25 which has two branches. One branch 26 discharges into pipe 12 while the other branch 27 discharges into conduit 16. The branches 26 and 27 enter the conduits 12 and 16, respectively, in the long legs of such U-shaped member 16, and generally above the enclosed bottom of such U-shaped members.

The operation of the apparatus is substantially as follows:

Material to be washed, as for example, peas, is deposited in hopper 11. Water flows thereover and thenceforth into the hopper 11 through the branch 8. The flow of water is cut off by the valve in branch 8 at a later time, as previously indicated. The air pump 23 is set in operation by motor 4, which motor also drives the belt screen 1. As water and material flow down the short leg of conduit 12 and start up the long leg thereof, the air from pump 23 admitted to the long leg, conduit 15 and 22 mixes with the water. This lightens the water or increases its bulk. It may also have an injective or pushing effect, if desired, whereby to cause a definite lift. The water, air and material flow upwardly in the long leg of member 13 and the water and material empty into the hopper 13, the material and water falling upon the screen 1, and the water flowing through both flight of such screen to carry it material of smaller cross section than the openings in the screen 1. The separated material after passing through screen 1 is collected upon the screen 3, which screen 3 is removed from time to time.

Material which will not pass through the screen 1 is carried on the top flight thereof over the left hand pulley 14, Figure 1. Peas drop from the screen frame which supports the screen 3 arrests excessive flow of the liquid discharged from pipe 12 across the hopper 13 into the pipe 16.

Any material which may adhere to the screen 1, such as pea hulls, is washed from the lower flight thereof by the flow of water therethrough from the pipe 23. The water is then permitted to discharge its contents through the flights of the screen 1 at a point intermediate the pulleys 14. The pea hulls that collect upon the screen 3 are waste material and are collected on screen 3 for later removal.

The material that is emptied into the pipe 16 is carried downwardly therein and past the bottom and upwardly in the leg thereof by the water falling from hopper 17. In such long leg, air is forced from the pump 23 by conduits 25 and 27, such air lightening the water which is mixed with the material. Such air may be admitted with an injunctive force if desired. The material is carried upwardly in the long leg of pipe 16 and discharged into hopper 17 where the material above a selected diameter is rolled across the screen and leaves the apparatus by a discharge spout 15.

Water and solid material of a diameter less than the porosity of screen 18 flows back to hopper 13 by pipe 21 to be used over and over for elevating material through the U-shaped member 16. At the beginning of operations, a suitable amount of water is supplied for the operation of the second stage member 16. Conduit 22 may be extended over for this purpose. Ordinarily the volume of water in the second stage is maintained substantially constant by the flow of water from conduits 22 and 12 which flows across the hopper 13 over the frame supporting the screen 13 and upon the screen 1.

There is relatively little solid material which is to be separated by the screen 18. Such material which flows therethrough flows back to hopper 13 by U-shaped member 16. Air is sufficient to separate most of the foreign substances which are emptied into the system with the peas when loaded at hopper 11.

The pump 23 may be a high speed reciprocating pump or other suitable air pump. It may be of relatively small size for little air pressure is required for the lifts illustrated in Figure 1. The flow of air through the conduits 25, 26 and 27 is substantially constant. The pulsations of the air pump are so close together that they are not really discernible one from another. Nevertheless such pulsations provide some agitation for the material to be washed and the liquid used in washing such material in the long legs of U-shaped members 12 and 16.

In addition to the agitation produced by the pulsations of the air pump 23, there appears to be generated in each of the pipes 12 and 16 a periodic surge, which bears little or no relation whatever to the speed of operation of the pump 23. Such surge may manifest itself by a backing-up of water and material into hopper 11 followed by an abrupt discharge of such material and water therefrom through the member 12 into the hopper 13. This surge is repeated during all the time that the apparatus is functioning at brief intervals.

In the system illustrated, peas or other material...
emptied into the hopper 11 are completely enveloped in water. The water is agitated and aerated. Such agitation and aeration coupled with the contact of the material against the walls of the pipes, 12 and 15 produces a cleansing effect comparable to that which is found in washing machines of a modern type. The cleansing effect is many times that which may be obtained by causing the material to flow unagitated through a pipe of the same length as the members 12 or 15.

The pipe 16 is shown projecting downwardly below the level of floor 10. Such length adds to the washing effect. It is so illustrated to point out the physics of the apparatus. A lift of material like peas equal to the drop thereof in the conduits 13 and 16 may be obtained by freely aerating the water in the long leg of such members.

The long leg of conduit 12 is about three-sevenths below and four-sevenths above the bottom of hopper 11. To lift the water and material in conduit 12, there is generally required a force of air of small magnitude. In conduit 16, three-fifths of the long leg is below the level of hopper 13 and two-fifths above such level. Free aeration of the water in the long leg of conduit will cause the total weight of the material and water in the long leg to be less than the total weight of material and liquid in the short leg, hence a ready flow of liquid and material to hopper 17. The pulsations of the air pump keep the material and liquid agitated, preventing separating and settling in the cleansing effect. This increases cleansing and tends to blanch. If the water is to be maintained at a high temperature, steam may be used in place of air. Preferably it should be admitted in pulsations or surges. If hot water and steam are used, the device becomes a blancher.

The number of stages of lift is unlimited. It is governed by the height the material is to be carried and the specific cleansing effect desired. One or more stages may be lifting and cleansing with cold water, and one or more higher stages may be blanching. The hopper 13 may be so constructed with the parts shown with a splash shield added that it will effectively prevent water in one stage from mixing with water in a succeeding stage.

What is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. A device of the class described, comprising means forming a hopper adapted to receive a quantity of material in a relatively small form, means comprising an elevating conduit having a short leg with its upper end communicating with said hopper and having a long leg extending upwardly above said hopper, means providing a receiver adapted to receive the discharge of said long leg, a conduit connecting the bottom of said receiver with said hopper, means providing a movable foraminous member positioned below the discharge end of said long leg, said receiver having an additional conduit connected to the bottom thereof for forming the short leg of a second elevating conduit, the upper end of said second elevating conduit extending above said receiver and discharging into a second receiver, a separating screen in said second receiver adapted to receive the material discharged from the upper end of said second elevating conduit, a third conduit connecting the bottom of said second receiver with said first receiver, means for moving said foraminous member of said second receiver, charge the material deposited thereon into the receiving end of the shorter leg of said second elevating conduit, means in said first receiver for causing a restricted flow of liquid from said receiver back into said hopper, and means for discharging gaseous fluid under the bottom portions of the longer legs of said elevating conduits.

2. In a device of the class described, the combination of a hopper adapted to receive a quantity of peas or other relatively small objects, means providing an elevating conduit having a long leg and a relatively short leg, the short leg having its upper end connected to said hopper, means for discharging water into said hopper, a receiver positioned below the discharge end of said long leg above said hopper, a pipe connecting said receiver with said hopper, a second elevating conduit comprising a short leg and a longer leg, said short leg having its inlet end connected to said receiver, the longer leg extending upwardly above said receiver, a second receiver disposed below the discharge member of said second receiver, a pipe connecting the longer leg, means for connecting said second receiver with said first receiver, means for injecting steam into the bottom portions of each of said longer legs whereby to cause the elevation of the water and the peas from said hopper through the short leg and thence into the longer leg of said first elevating conduit into said first receiver, and means for causing the peas discharged into said first receiver to pass into the shorter leg of said second elevating conduit whereby the steam discharged into the bottom of the long leg of said second elevating conduit causes the peas and water therein to flow downwardly through the shorter leg, thence upwardly through the longer leg of said second elevating conduit and thence into said second receiver, the water from said second receiver being separated from said peas and returned to said first receiver, and the water from said first receiver being separated and returned to said hopper, all in a closed circuit.

3. The hereindescribed process of heat treating peas and the like which comprises the steps of conveying the peas from a given point in a confined stream of water along a predetermined course of travel which includes upwardly extending portions, injecting steam into the stream of water at a plurality of spaced apart zones along the upwardly extending portions of its travel, elevating by the injected steam the water and the peas therein above the given point and simultaneously blanching the peas by the injected steam and the water heated thereby as the peas are forced upwardly.

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