May 9, 1933. F. D. CHAPMAN 1,908,220

HYDRAULIC CONVEYER

Filed Dec. 7, 1931

Fig. 1.

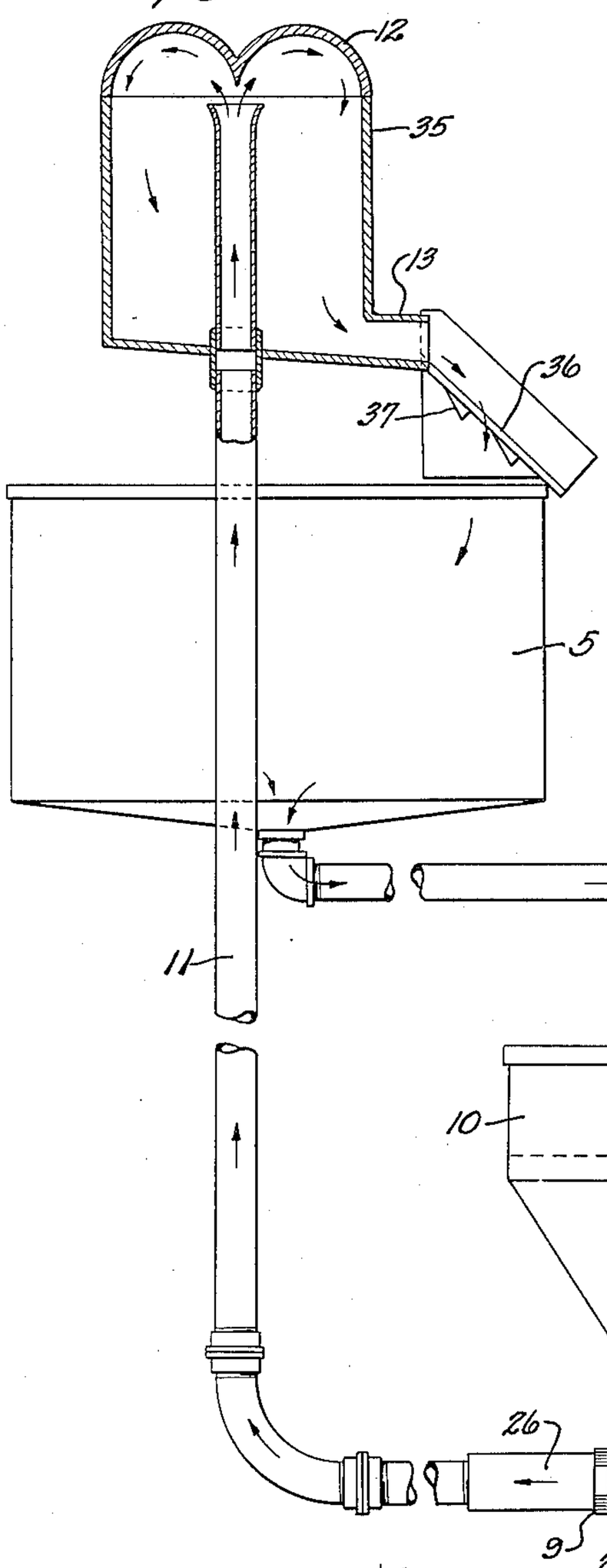


Fig. 3.

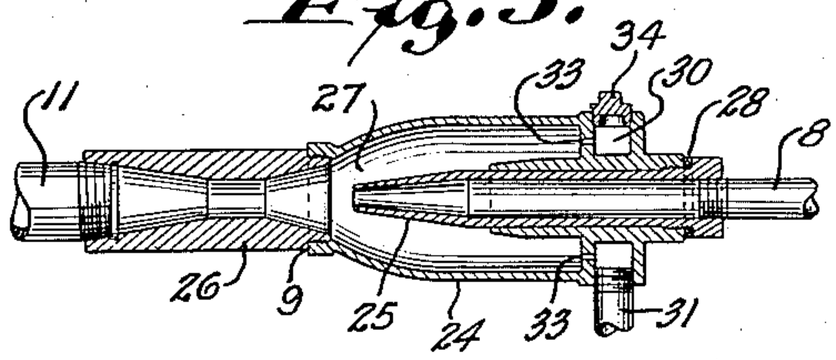


Fig. 4.

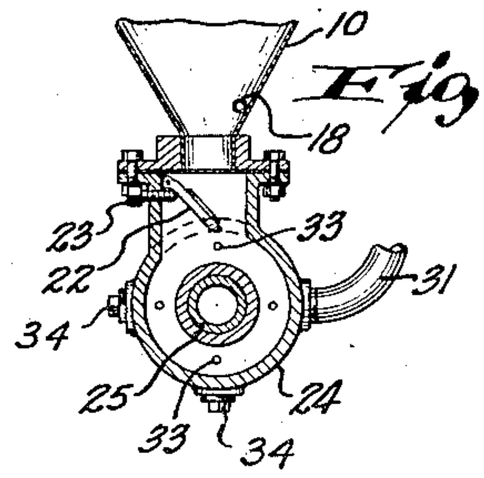
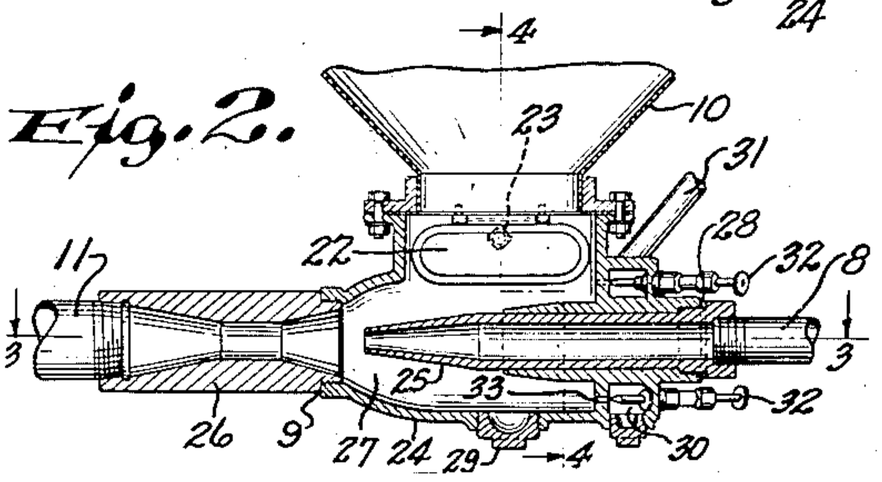


Fig. 2.



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HYDRAULIC CONVEYER

Application filed December 7, 1931. Serial No. 579,406.

The present invention relates in general to improvements in the art of transporting materials in bulk, and relates more specifically to improvements in the construction and operation of hydraulic conveyers which are especially adapted for the transportation of granular materials such as peas, beans, berries or the like.

Generally stated, the object of this invention is to provide an improved hydraulic conveyer for granular material, which is simple in construction, readily manipulable, and efficient in operation.

It is frequently desirable in the art of handling bulk material, to resort to hydraulic means for conveying the substance from one place to another. This is especially true in canning factories where commodities such as peas must be continuously transported, and simultaneously elevated, washed, and otherwise treated, during normal operation of the factory. The conveyers besides transporting and simultaneously cleansing or otherwise treating the peas or other commodity, must avoid mutilation thereof and must also have relatively large capacity and be operable without interruption.

It is a more specific object of the present invention to provide an improved hydraulic conveyer especially adapted for the transportation of green peas or the like.

Another specific object of the invention is to provide various improvements in the details of construction and operation of hydraulic conveyers, whereby the operation of such devices is facilitated and the efficiency thereof is enhanced to a maximum.

A further specific object of the invention is to provide apparatus which besides performing a transporting function, may also be utilized for the purpose of elevating, washing, heating, cooling, or otherwise treating the commodity being transported.

Still another specific object of the invention is to provide a hydraulic transporting system all parts of which are readily accessible for inspection and cleaning, and wherein mutilation of the commodity is positively avoided.

Another specific object of the invention is to provide a liquid actuated transporting device which is entirely automatic in operation, and which may be readily adjusted to produce various conditions of operation.

These and other objects and advantages will be apparent from the following detailed description.

A clear conception of an embodiment of the several features of the invention, and of the mode of constructing and of operating hydraulic elevators built in accordance with the improvement, may be had by referring to the drawing accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views:

Fig. 1 is a somewhat diagrammatic part sectional elevation of a hydraulic elevator or lift especially adapted for the transportation of green peas or the like;

Fig. 2 is an enlarged longitudinal vertical section through the improved hydraulic ejector or flow inducing mechanism;

Fig. 3 is a similarly enlarged longitudinal horizontal section through the ejector mechanism, taken along the line 3—3 of Fig. 2; and

Fig. 4 is a likewise enlarged transverse section through the ejector, taken along the line 4—4 of Fig. 2.

Referring to the drawing, the improved transporting system shown therein by way of illustration, comprises in general a liquid supply tank 5; a conduit or return pipe 6 communicating at its upper end with the lower portion of the tank 5; a pump 7 communicating at its suction side with the lower end of the pipe 6 and adapted to deliver liquid into a discharge conduit or pipe 8; an ejector 9 communicating with the pipe 8 and with a supply hopper 10; a conveyer pipe 11 formed to receive a mixture of granular material and liquid from the ejector 9 and to deliver the same at its upper end against a spreader or dome 12; and a separator 13 for removing the granular material from the liquid and for returning the latter to the supply tank 5.

The supply tank 5 contains sufficient liquid such as water to keep the system abun-

dantly supplied with transporting fluid, and is preferably located at a considerable distance above the hopper 10. A branch pipe 14 which connects with the return pipe 6 laterally adjacent to the hopper 10, has one branch 15 communicating with the upper portion of the hopper past a valve 16 controlled by a float 17, and has another branch 18 which communicates tangentially with the lower circular portion of the hopper 10 past a shut-off valve 19. The top of the hopper 10 is open for the reception of granular material such as green peas, in bulk, and the float 17 riding upon the liquid in the lower portion of the hopper 10, controls the opening and closing of the valve 16 and thereby establishes a definite level of liquid in the hopper. The branch 18 delivers liquid under pressure into the lower portion of the mass of liquid and granular material within the hopper 10, thus whirling the mixture and insuring intimate mixing of the materials. The valve 19 serves to control the quantity and pressure of the liquid delivered into the hopper 10 through the branch 18, and also permits stoppage of the flow of liquid from the tank 5 through the branch 18 whenever desirable.

The pump 7 may be of the centrifugal or any other type, driven from any suitable source of power. A shut-off valve 20 may be disposed in the pump discharge pipe 8 near the pump 7, and an automatic check valve 21 may also be provided in the pipe 8 between the valve 20 and the ejector 9. This check valve 21 prevents liquid from the conveyer pipe 11 from backing up through the pipe 8 to pump 7 and pipe 6, when the pump is shut-down and the valve 20 is left open. The lowermost portion of the granular material supply hopper 10 is also provided with a flap check valve 22 which automatically closes when the pump 7 is stopped and prevents liquid from the conveyer pipe 11 from backing up into the hopper 10, and the extent of opening of the flap valve 22 may be varied by means of a set screw 23 which serves to adjustably limit the opening movement of the valve 22.

The improved ejector 9 for delivering the mixture of granular material and liquid at high velocity into the lower end of the conveyer pipe 11, comprises a main casing 24 having an upper opening communicating directly with the lower delivery opening of the hopper 10; a nozzle 25 disposed centrally within the casing 24 and communicating with the pump discharge pipe 8; a Venturi tube 26 having a locally restricted passage connecting the interior of the casing 24 with the lower end of the conveyer pipe 11 beyond the discharge end of the nozzle 25; and means located at the end of the casing 24 remote from the tube 26 for producing whirling motion of the mixture of granular material and liquid surrounding the nozzle 25. The ejector assembly is such that an annular suction passage 27 is formed around the discharge orifice of the nozzle 25 and directly in advance of the Venturi tube 26, so that the jet delivered from the nozzle into the constriction of the tube 26 will draw the mixture of granular material and liquid from within the casing 24 and will deliver the same at high velocity into and through the conveyer conduit 11.

The nozzle 25 may be adjusted along the axis of the casing 24 in order to vary the cross-section of the passage 27, by means of shims 28 and the adjacent screw threads, and a removable plug 29 permits drainage of liquid from the casing 24. The whirl producing means at the end of the casing 24, consists of an annular chamber 30 to which liquid from the pump discharge pipe 8 is admitted through a branch pipe 31 and valve 31′, a series of adjustable needles 32 extending angularly through the chamber 30, and an annular series of orifices 33 controlled by the needles 32 and disposed helically relative to the axis of the nozzle 25. Pipe plugs 34 facilitate construction of the chamber 30 within the casing 24, and also permit access to the chamber 30 for cleaning, and the needles 32 are provided with hand wheels for permitting convenient adjustment thereof.

The separating device 13 associated with the upper extremity of the conveyer pipe 11, comprises the spreader plate 12; a collecting tank 35 disposed beneath the plate 12; and a separating grid 36 associated with the inclined bottom of the tank 35. The upper extremity of the pipe 11 may be flared as shown in order to improve the spreading action, and the grid 36 is preferably provided with depending fins 37 for insuring rapid and complete separation of the liquid from the granular material. The fins 37 return the drainage liquid directly to the supply tank 5, and the separated granules are discharged from the lower end of the grid 36.

During normal operation of the improved hydraulic conveyer, the pump 7 is operating to withdraw liquid from the supply tank 5 through the suction pipe 6 and to deliver the liquid through the discharge pipe 8 and nozzle 25 to the conveyer pipe 11 past the Venturi tube 26. Granular material such as peas, is delivered in bulk into the supply hopper 10 wherein a definite level of liquid is maintained by the float 17. Liquid under pressure is also entering the hopper 10 tangentially through the branch 18, and causes the mixture of peas and liquid within the hopper 10 to whirl and to thoroughly mix. The whirling mixture is withdrawn from the lower end of the hopper 10 past the flap valve 22 by the suction created in the passage 27, and first enters the space within the casing 24, surrounding the nozzle 25. Fluid under pressure delivered from the pump discharge

pipe 8 through the branch pipe 31 and chamber 30 is injected through the orifices 33 and produces whirling motion of the mixture delivered from the hopper 10 and causes the swirling mass to advance along the nozzle 25 toward the annular suction passage 27. The mixture of peas and liquid is thus delivered in the form of an annular swirling layer, into the constricted passage of the tubing 26 by the jet delivered at high velocity from the nozzle 25, and the entire mixture is eventually discharged from the Venturi tube 26 into the lower end of the conveyer pipe 11 at high velocity. The mixture of liquid and peas is thus carried upwardly through the pipe 11 and is eventually delivered against the spreader plate 12 which reverses the direction of flow and deposits the peas and liquid into the tank 35 of the separating device 13. The mixture then flows toward the separating grid 36 where the liquid is drained from the peas and is returned to the supply tank 5, the fins 37 insuring complete drainage of the liquid. The peas are eventually delivered from the lower end of the grid 36 in thoroughly washed condition.

It will be apparent that the operation of the hydraulic conveyer is entirely automatic, and the conveying liquid may be used over and over. The float 17 serves to establish a definite level of liquid in the supply hopper 10 and the degree of agitation of the material in the lower end of the hopper 10 may be varied by adjusting the valve 19. The check valve 21 serves to prevent liquid from the conveyer pipe 11 from entering the pump 7 in case the pump is stopped, and the stop valve 20 and valves 19, 31′ may be closed when the system is not in operation. The valve 31′ also serves to control the quantity of liquid delivered to the chamber 30, and the needles 32 may be readily adjusted to vary the degree of whirling of the mixture of peas and liquid within the casing 24. By whirling the mass within the chamber 24, accumulation of peas within the bottom of this casing, is positively avoided and uniform distribution of the peas within the conveyer pipe 11 is insured. Due to the fact that the liquid flowing at high velocity through the pipe 11 is retarded at its periphery by the friction introduced by the confining surfaces of the conveyer pipe, the peas will seek the center of the stream which is traveling at maximum velocity, and will not be mutilated by rubbing against the pipe surfaces. The separating device 13 serves to quickly segregate the peas from the liquid and to return the liquid to the tank 5, and the various control valves permit convenient adjustment to meet any desired conditions of operation.

It should be understood that it is not desired to limit the invention to the exact details of construction and to the precise mode of operation herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. In combination, a conveyer conduit having a constricted inlet end and an upwardly directed discharge portion, a nozzle for directing a jet of liquid into said constricted end, a casing forming a chamber surrounding said nozzle and communicating through an annular opening with said constricted end, a hopper for delivering granular material and liquid into said chamber, and fluid pressure actuated means operable only when said jet is interrupted to intercept communication between said hopper and said chamber.

2. In combination, an elevating conduit having a constricted lower inlet end, a nozzle for directing a jet of liquid directly into said constricted end, a casing forming an annular chamber surrounding said nozzle and communicating through an annular opening surrounding said jet directly with said constricted end, a hopper for delivering granular material and liquid into said chamber, and a check valve actuated by the pressure in said chamber and operable only when said jet is interrupted to intercept communication between said hopper and said chamber.

3. In combination, an elevating conduit having a constricted lower inlet end, a nozzle for directing a jet of liquid directly into said constricted end, a casing forming an annular chamber surrounding said nozzle and communicating through an annular opening surrounding said jet directly with said constricted end, a hopper for delivering granular material and liquid into said chamber, means for causing the admitted mixture of granular material and liquid to whirl about said nozzle prior to delivery thereof from said chamber through said opening to said constricted end, and a check valve actuated by the pressure in said chamber and operable only when said jet is interrupted to intercept communication between said hopper and said chamber.

4. In combination, an elevating conduit having a constricted lower inlet end, a nozzle for directing a jet of liquid directly into said constricted end, a casing forming an annular chamber surrounding said nozzle and communicating through an annular opening surrounding said jet directly with said constricted end, a hopper for delivering granular material and liquid into said chamber, common means for injecting liquid under pressure into said nozzle and said chamber, and a check valve actuated by the pressure in said chamber and operable only when said

jet is interrupted to intercept communication between said hopper and said chamber.

5. In combination, an elevating conduit having a constricted lower inlet end, a nozzle for directing a jet of liquid directly into said constricted end, a casing forming an annular chamber surrounding said nozzle and communicating through an annular opening surrounding said jet directly with said constricted end, a hopper for delivering granular material and liquid into said chamber, common means for simultaneously injecting liquid under pressure axially through said nozzle and tangentially into said chamber, and a check valve actuated by the pressure in said chamber and operable only when said jet is interrupted to intercept communication between said hopper and said chamber.

6. In combination, an elevating conduit having a lower inlet and an upwardly open outlet end, a nozzle for directing a jet of liquid into said conduit inlet, a casing forming an annular chamber surrounding said nozzle and communicating with said conduit inlet, a hopper for delivering granular material and liquid into said chamber, means for laterally spreading the mixture of granular material and liquid delivered from said outlet end, and means for separating the liquid from the elevated granular material and for returning portions of the former to said hopper, chamber and nozzle.

7. In combination, a conveyer conduit having a constricted inlet end and a discharge portion at a higher level than said constricted end, means for directing a jet of liquid into said conduit through said constricted end, a casing forming a chamber communicating with said constricted end through an orifice surrounding the jet, means for delivering granular material into said chamber through an opening disposed below said conduit discharge portion, and fluid pressure actuated means operable only when said jet is interrupted to intercept communication between said hopper and said chamber through said opening.

In testimony whereof, I affix my signature.

FRANK D. CHAPMAN.