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APPARATUS FOR DESHALING GRAVEL

Filed May 25, 1931

2 Sheets-Sheet 1

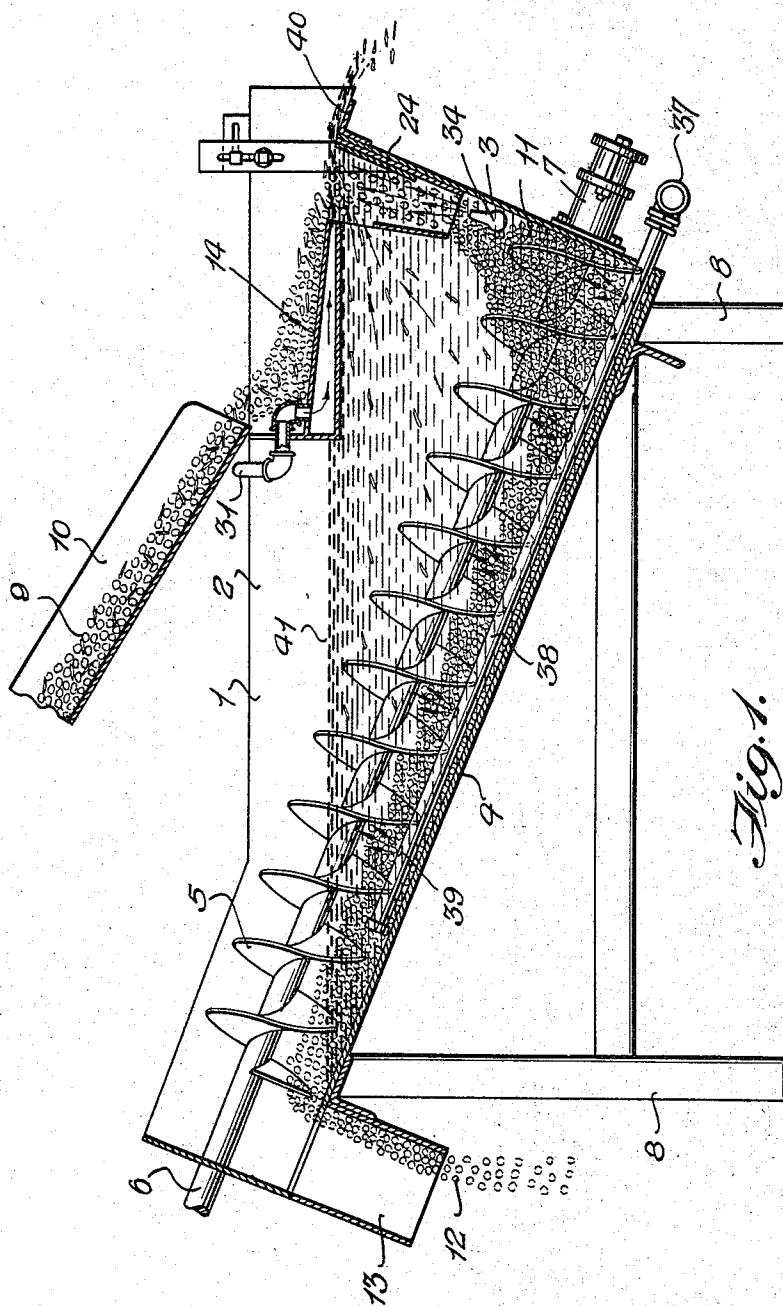


Fig. 1.

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Fig. 2

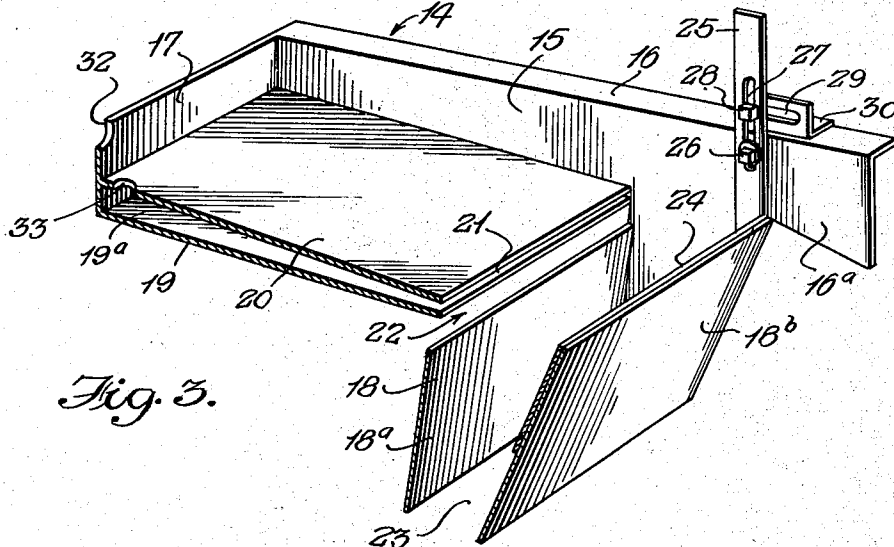
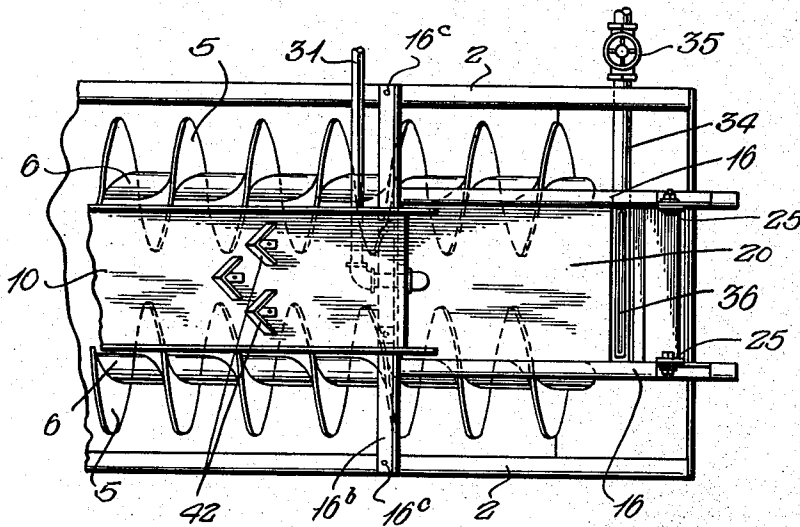


Fig. 3.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR DESHALING GRAVEL

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5 Claims. (Cl. 209—156)

The invention relates to the washing of gravel or other substances in which various impurities and foreign substances, such as shale, lignite, bark, water-logged wood, and coal, are removed from the gravel by properly directed fluid currents, and has for its objects to provide new and useful improvements in apparatus of this character.

An important object of the invention is to provide a shale removing device which may be removably secured to gravel washing apparatus of known and generally used types, for the efficient and complete removal of the described impurities or deleterious foreign substances. These impurities are usually of less specific gravity than the gravel to be washed and therefore react favorably to suitably disposed water or fluid currents during the cleansing of the gravel.

A further object of the invention is to provide a device of the character described in which a plurality of separate fluid currents are utilized and so disposed and combined as to cooperate with one another for the removal of practically all of the lighter impurities.

A still further object is the provision of means for a more thorough and desirable general washing of the gravel or other material to be treated.

A still further object is the provision of adjustable means for controlling the rate of flow of the gravel or other material through the shale removing device, thereby adapting the apparatus for the thorough cleansing of gravel in which foreign materials are present in varying proportions.

With such objects in view, as well as other advantages which may be incident to the use of the improvements, the invention consists in the parts and combinations thereof hereinafter set forth and claimed, with the understanding that the several necessary elements constituting the same may be varied in proportions and arrangement without departing from the nature and scope of the invention.

In order to make the invention more clearly understood there are shown in the accompanying drawings means for carrying the same into practical effect, without limiting the improvements, in their useful applications, to the particular constructions which, for the purpose of explanation, have been made the subject of illustration.

In the said drawings:

Fig. 1 is a view in longitudinal section of a gravel washing apparatus constructed and designed in accordance with the present invention.

Fig. 2 is a plan view of the front portion of the same.

Fig. 3 is a view in perspective, partly in vertical section of the improved shale removing device

contemplated by and forming a part of the invention.

Referring to the drawings, 1 indicates the gravel washer or tank of any preferred type having side walls 2, a forward or end wall 3 and an upwardly and rearwardly inclined bottom wall 4. The washed gravel is conveyed rearwardly and upwardly by means of a pair of screw conveyers 5 or other suitable power driven conveying devices. The forward ends of the conveyor shafts 6 project through the front wall 3 of the washer and are journaled in bearings or stuffing boxes 7 secured to the wall 3 of the washer. Suitable gearing (not shown) is connected to the opposite ends of the shafts 6 for driving the conveyers. The washer 1 is or may be supported in the position illustrated by standards or frame supports 8.

The gravel to be washed and which contains various deleterious substances or foreign materials of lighter weight than the gravel is indicated at 9 and initially enters the washing apparatus through an inclined delivery chute 10, and the construction of the washer causes the gravel to accumulate at the forward or deeper end thereof as shown at 11. The washed gravel 12 which has been freed of the deleterious foreign material is discharged by the conveyers 5 through a discharge opening 13 at the rear end of the washer. The impure materials are discharged from the washer at the forward and upper end thereof at the point indicated at 14, and which as illustrated comprises a flanged lip extending across the forward wall of the washer at its upper end.

The shale removing device which constitutes an important feature of the present improvements, is indicated generally at 14, and is designed to be removably positioned at the forward end of the tank 1. The shale removing device includes a relatively shallow pan or receptacle having side walls 15 provided with outwardly projecting flanges 16, a rear wall 17 and a downwardly projecting discharge hopper 18 at its forward end. The forward end of the shale remover is supported on the lip 14 of the tank by means of the shoulders or wings 16a, one at each side of the device, and the rear portion of the flanges 16 of the shale remover is secured to a transverse member or support 16b which is in turn secured as at 16c to the side walls 2 of the washer tank 1. The receptacle 14 further comprises a bottom wall 19 and a second gravel supporting wall or surface 20 spaced therefrom and constituting in effect a false bottom converging or inclining downwardly toward its forward end and toward the bottom wall or plate 19, and forming a closed conduit 19a the forward extremities of said plates forming a relatively restricted and elongated aperture or orifice 21. The rear wall 18a of the hopper 18 terminates at its upper end below the forward extremity of the lower plate 19, as best seen, in 61

Fig. 3, thereby providing a second elongated aperture 22 immediately below the more restricted orifice 21. The forward wall 18b of the hopper 18 is inclined downwardly and rearwardly towards the rear wall 18a to provide a relatively narrow gravel discharge opening 23.

A movable baffle plate 24 having upwardly projecting side supports 25 is or may be normally disposed adjacent the forward wall 18b of the hopper 18, and is supported by suitable bolts or fastening means 26 projecting through the side walls 15 of the receptacle and through elongated apertures 27 one formed in each support 25. The baffle 24 may be adjustably positioned in the hopper relative to the walls 18a and 18b thereof by means of a bolt or fastening device 28 engaging the recess or slot 27 in each side supporting member 25 and also projecting through an elongated recess or slot 29 in a bracket member 30, one secured in position on each flange 16 of the side walls 15 of the receptacle. In this manner the baffle 24 may be swung about its pivots 26 towards or away from the wall 18b of the hopper, or raised and lowered with respect thereto by reason of the cooperating slots 27 and 29.

Water or other fluid under any desired pressure is admitted into the closed conduit or chamber 19a between the bottom plates 19 and 20 by means of a supply pipe 31 projecting through a recess 32 in the rear wall 17 and thence communicating with an inlet 33 in the upper plate 20 adjacent the rear end thereof. The water or fluid so admitted is discharged with regulated pressure in a substantially thin and horizontal sheet through the restricted horizontal aperture 21 adjacent the hopper 18 and immediately below the gravel supporting plate or surface 20.

A second source of water or other fluid supply under regulated pressure is provided in the form of a substantially horizontally disposed pipe 34 immediately below the outlet 23 of the hopper 18. The supply of fluid to the pipe 34 may be controlled by means of a valve 35 and an elongated restricted aperture 36 in said pipe is positioned adjacent the discharge outlet 23 and extends a distance substantially equal to the longitudinal extent of said discharge outlet. In this manner it will be noted that the fluid supply to the pipe 34 is directed upwardly under regulated pressure in a relatively thin sheet or stream in a direction counter to that of material descending by gravity through the hopper 18.

A third source of water or other fluid supply enters the bottom of the washer 1 through a supply pipe 37 extending transversely across the front of the washer and communicating with one or more pipes or conduits 38 disposed near and substantially parallel to the bottom surface 4 of the washer and adjacent or between the screw conveyers 5. The pipe or conduit 38 is provided along its upper surface with a plurality of spaced apertures 39 through which the fluid is directed upwardly under regulated pressure through the body of material being carried rearwardly by the conveyers 5. All of the described sources of fluid may have their individual valve devices and may be connected if desired to a common supply pipe in the operation of the apparatus which will now be described.

The washer or tank 1 is filled with water or other fluid, the liquid level being indicated at 41 in Fig. 1. Suitable supply pipes, not shown, are preferably utilized for this purpose. The gravel 9 containing impurities and relatively light foreign substances to be removed descends

by gravity through the chute 10. Adjustably mounted diverting plates or devices 42 serve to level and distribute the gravel in a relatively thin sheet as it descends to the forward end of the delivery chute 10. Thence the gravel enters the shale remover proper over the rear wall 17 thereof and descends down the inclined supporting surface 20 and is discharged by gravity over the forward end of said plate into the hopper 18. At this point of entrance into the hopper 18 the descending stream of gravel encounters a relatively thin sheet of water under considerable pressure which is projected across the entrance into the hopper through the restricted aperture 21 of the shale remover. This sheet of water encounters the shale, lignite, bark and other impurities and projects a considerable portion of the same across the entrance of the hopper and over the discharge lip 40 and thence out of the washer. Coincidentally an upwardly directed stream of water or other fluid from the elongated orifice 36 in supply pipe 34 encounters the descending gravel and forcibly ejects certain of the lighter materials and impurities which have passed below the horizontally directed stream of water from pipe 31. Such lighter materials as are encountered by the upwardly projected stream are conveyed out of the washer over the discharge lip 40 together with the first mentioned impurities, the horizontally directed stream from pipe 31 assisting in said ejection. The washed gravel which is now substantially free of impurities accumulates as at 11 in the forward portion of the washer and is continuously removed upwardly and rearwardly thereof by the conveyers 5. During its travel toward the discharge opening 13 of the washer the gravel encounters the upwardly directed and spaced jets or streams of water from the apertured pipe or pipes 38. These latter mentioned streams carry upwardly any remaining impurities and convey the same through the elongated aperture 22 adjacent the entrance to the hopper 18 and such remaining impurities are discharged out of the washer by the described counter-streams of water from the pipes 31 and 34. The gravel 12 which is discharged from the washer has been thoroughly cleansed of and freed from all objectionable matter in the manner described. The combination of the three separately directed currents in direction counter or transverse to that of the passage of the gravel are so associated and combined as to obtain highly successful results in the removal of all impurities. It will be further noted that the horizontally and vertically directed streams of water from pipes 31 and 34 respectively converge at the point where the impure gravel is first admitted to the washer to afford a maximum pressure, at this point, immediately adjacent the discharge outlet 40, and where the maximum amount of impurities are present. The separation at this point is facilitated by the intermediate current flow from the washer proper through the aperture 22 of the shale removing device. The direction of such flow is toward the overflow 40 and transversely to that of the gravel entering the chute or hopper 18. The area of the hopper 18 may be varied by adjusting the baffle 24 to increase or diminish the width of the hopper dependent upon existing conditions and the proportion of impurities present in the gravel. By adjusting inwardly the baffle 24 to decrease the area of the hopper the upwardly directed current flow through pipe 34 is rendered more effective in removing the impure materials since

the descent of gravel is retarded by the baffle plate.

A further advantage resulting from the described arrangement is that the outward flow of water and impurities through the intermediate aperture 22 is augmented or induced by the adjacent and angularly disposed converging fluid currents from pipes 31 and 34. A suction is thereby induced at the point 22 by these latter currents, which serve to promote the flow of water through the aperture 22 in the manner of a venturi or on the atomizing principle. Said intermediate upward current flow from the washer through the port 22 is initially induced by the upwardly projected jets of water through the spaced apertures 39 in the supply pipe 38. The residual impurities in the gravel and which are of less specific gravity are carried by said jets to and through the port 22 and into contact with the upwardly and outwardly directed streams from pipes 34 and 31, and are removed from the washer by said latter streams.

The washing device or shale remover constituting the present improvements is equally efficient in the reclaiming of low grade iron ore.

Instead of utilizing the screw conveyers 5 in the apparatus, flight conveyers or bucket elevators may be substituted with equal advantageous results. The device obviates the necessity of using jigs or shaking screens heretofore commonly used for the removal of these lighter impurities from the gravel.

What I claim is:

1. In an apparatus for separating impurities from gravel: The combination of a gravel washing tank, a deshaling device removably positioned on said tank, said deshaling device having a gravel receiving surface terminating in a hopper communicating with said tank, means for feeding gravel mixed with impurities to said surface to be received by said hopper, means for directing a jet of washing fluid through said deshaling device in a horizontal direction beneath said receiving surface and out of contact with said material, means for directing a jet of washing fluid in a vertical direction through said hopper in contact with the oppositely moving flow of said material, and means in said tank for directing an intermediate current of washing fluid from said tank toward said deshaling device intermediate said horizontal and vertical jets, said jets and current of washing material converging and impinging upon said material at the entrance to said hopper, whereby the lighter materials are diverted laterally from said hopper and discharged from said tank.

2. In an apparatus for separating impurities from gravel: the combination of a gravel washing tank, a deshaling device removably positioned on said tank, said deshaling device having a fluid conduit and a gravel receiving surface terminating in a hopper communicating with said tank, means for feeding gravel mixed with impurities to said surface to be received by said hopper, a pipe for directing a jet of washing fluid through said deshaling device in a horizontal direction beneath said receiving surface toward said hopper and out of contact with said material, a pipe in said tank for directing a jet of washing fluid in an upward direction through said hopper in contact with a downwardly moving flow of material, and a pipe in said tank having a plurality of spray orifices for directing an intermediate current of washing fluid upwardly through said tank toward

said deshaling device intermediate said horizontal and vertical jets, said jets and currents of washing fluid converging and impinging upon said material at the entrance to said hopper, whereby the lighter materials are diverted laterally from said hopper and discharged from said tank.

3. In a gravel washing apparatus including a washer tank: a deshaling device removably positioned on said tank for receiving the gravel to be washed, said device consisting of a gravel receiving surface terminating at its forward end in an angularly disposed and downwardly projecting hopper and a closed fluid conduit beneath said gravel receiving surface, said hopper being open at its lower end to discharge washed gravel by gravity into said tank, means disposed below said hopper for directing a jet of washing fluid in a vertical direction through the open lower end of said hopper in contact with said gravel to elevate lighter impurities therefrom before the gravel passes from the device to said washer tank, and means for directing a washing fluid in a horizontal direction through said fluid conduit for diverting said lighter impurities elevated by said vertical jet, and an adjustable baffle plate pivotally mounted on said device and depending into said hopper for regulating the flow of gravel through said deshaling device in contact with said separate streams of washing fluid.

4. In a gravel washing apparatus including a washer tank: a deshaling device removably positioned on said tank for receiving the gravel to be washed, said device consisting of a gravel receiving surface terminating at its discharge end in an angularly disposed and downwardly projecting open ended hopper, a closed fluid conduit beneath said gravel receiving surface, said hopper being open at its lower end to discharge washed gravel by gravity into said tank, means for directing a washing fluid in a horizontal direction through said fluid conduit into contact with the gravel at the discharge end of said gravel receiving surface to separate from the gravel the material of less specific gravity, and an adjustable baffle plate pivotally mounted on said device and depending into said hopper for regulating the flow of gravel through said hopper in contact with said washing fluid.

5. A deshaling device for removable attachment to gravel washing tanks, designed to be removably positioned on said tanks, comprising in combination: a frame member open at its top and having side walls and a rear wall and a gravel receiving surface inclined forwardly and downwardly from said rear wall, a downwardly projecting open ended discharge hopper at the forward end of said device for receiving material from said surface, a fluid projecting chamber beneath and secured to said receiving surface communicating at its discharge end with the upper end of said hopper, means for conducting a washing fluid under pressure into said chamber, and an adjustable baffle member pivotally mounted on the side walls of said frame and depending in said hopper for controlling the amount of material received therein, whereby said fluid is directed only against material after passing from said receiving surface into said hopper to direct lighter impurities in the material away from said hopper, and the washed heavier material is discharged by gravity through the open lower end of said hopper.

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