Sept. 16, 1941. C. H. PLUMLEE 2,255,807

DESILTING MACHINE

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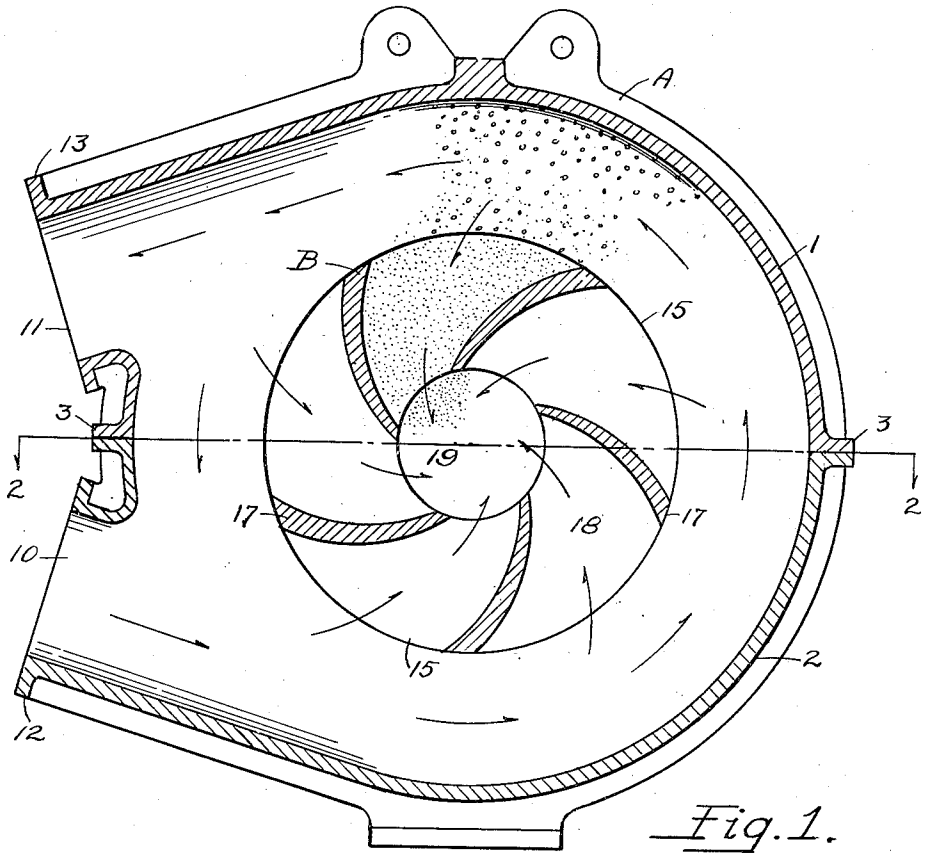


Fig. 1.

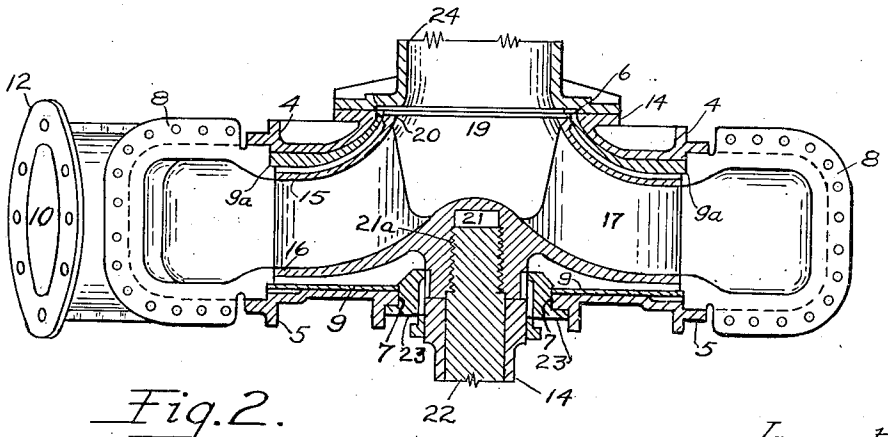


Fig. 2.

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DESILTING MACHINE

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5 Claims. (Cl. 209—211)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention generically relates to a mechanism for hydraulically separating material, more specifically it is directed to an improved desilting apparatus adapted to be used in connection with hydraulic dredging operations for the purpose of separating the finer from the courser particles of the dredged material as it is drawn through the dredge line, the separation being accomplished without interrupting or otherwise affecting the continuity of the dredging operation.

One object of this invention is to provide a desilting apparatus of the character designated which is adapted to be inserted and operated in the pipe line of a hydraulic or suction dredge installation and which embodies means for separating the finer from the courser particles of the material in the mixture of water and solids drawn through the pipe line and additional means for directing the respective particles along separate paths within the apparatus to suitably arranged discharge outlets.

Another object of this invention is to afford a desilting apparatus which although embodying the fundamentals of a centrifugal pump assembly differs from the latter in that its casing includes intake and discharge paths tangent to the periphery of the runner and a supplemental path to the exterior of the casing through the runner whereby the courser particles will pass around the interior of the casing and discharge through the tangential discharge path while the finer particles will travel through the runner to the exterior of the casing.

Another object of this invention is to provide a desilting apparatus of the type indicated having intake and discharge ports opening into paths tangent to the periphery of a runner, the latter having therein a central opening in communication with the exterior of the apparatus, whereby the amount of material separated from the mixture of water and solids entering the apparatus will be determined by the velocity of flow through the runner to the exterior of the apparatus.

Another object of this invention is to provide a desilting apparatus having a runner or impeller provided with a plurality of curved vanes defining a series of passages converging to a common outlet central of the runner and concentric with a similarly dimensioned outlet formed in the casing, whereby the mixture of water and solids entering the casing may pass through either the converging passages of the runner and discharge through its central opening or may travel around the runner within the casing from the intake to the discharge opening of the apparatus.

With these and other objects in view this invention consists in certain novel details of construction, combination and arrangement of parts to be more fully hereinafter described and claimed.

Briefly stated, this invention comprises an annular casing having tangential intake and discharge openings, a runner rotatably mounted within and centrally of the casing, the runner providing a plurality of passages extending from its periphery toward its hub and terminating in a common outlet concentrically disposed with respect to a central discharge opening formed in the casing. With this arrangement the finer particles of the material in the mixture of water and solids entering the casing after separation from the courser particles pass through the runner and exit through the central discharge opening while the courser particles of the material passing around the impeller will discharge through the tangential discharge opening in the direction of impeller rotation.

Referring more particularly to the accompanying drawing in which corresponding parts are indicated by similar reference characters:

Fig. 1 is a longitudinal section of the desilting apparatus constituting the subject matter of the instant application and

Fig. 2 is a fragmentary transverse vertical section taken on the line 2—2 of Fig. 1.

The solid material in the mixture of water and solids entering the casing is divided into course and fine particles by virtue of the fact that the courser particles have a greater fall velocity through water than the finer particles of the material, hence the amount of solid material carried by the water flowing through the runner will be determined by the velocity of the flow. In other words, particles having fall velocities through water less than the velocity of the water discharging through the runner will be carried along with the flow to the central discharge opening, whereas particles having greater fall velocities instead of passing through the runner, travel around the interior of the casing and exit through the tangential discharge opening.

With the preceding principle of operation in mind and referring to the illustrated embodi-

ment of this invention A indicates a casing and B a runner centrally mounted within the casing. Casing A which is substantially circular in formation consists of upper and lower sections 1 and 2, which are flanged connected as at 3; front and rear plates 4 and 5 having therein centrally arranged discharge and bearing openings 6 and 7 respectively; transversely arcuate peripheral section 8 and suitably disposed liners 9 and 9a, as clearly shown in Figs. 1 and 2 of the drawing.

In addition to the preceding elements casing A also includes tangential intake and discharge openings 10 and 11, the walls of which as in the case of the central discharge opening 6, are formed with perforated flanges 12, 13 and 14 for a purpose hereinafter to appear. The intake and discharge openings 10 and 11 are arranged one above the other and open into passages tangent to the periphery of runner B, as clearly shown in Fig. 1 of the drawing.

Runner B is rotatably mounted centrally of casing A and includes front and rear shrouds 15 and 16 between which are positioned runner vanes 17. These vanes are curved in a counterclockwise direction and coact to provide a series of passages 18 which converge inwardly from the periphery of the runner to a common outlet 19 opening into discharge orifice 20 formed in the hub of front shroud 15 and located concentric with the central discharge opening 6 in casing A, as clearly shown in Fig. 2 of the drawing.

Runner B is affixed on the inner end of a drive shaft 22 which is adapted to be driven by any suitable prime-mover. To effect this mounting rear shroud 16 of runner B has its hub formed with an internally threaded recess 21 to receive the externally threaded and reduced end 21a of drive shaft 22. Shaft 22 is suitably mounted in a bearing assembly 23 positioned in the bearing opening 7 formed in the rear plate 5 of the casing, as shown in Fig. 2 of the drawing.

In order to insert the instant apparatus in the pipe line of a hydraulic dredge installation, the free ends of the two pipe line sections (not shown) extend from the draghead to the intake opening 10 of casing A and from the dredge pumps to the discharge opening 11 of said casing and are adapted to be attached to the flanges 12 and 13 surrounding said openings, as will be understood without further discussion. To convey the fine particles of material passing through the runner to a suitable point of deposit, flange 14 surrounding opening 6 in the front plate of casing A is connected to the flanged end of supplemental discharge pipe 24, as shown in Fig. 2 of the drawing. In this connection it is to be noted that the diameters of the intake and discharge openings 10 and 11 respectively, are the same as that of the central discharge opening 6 in casing A.

Having described the structural details of this invention, its operation is as follows:

Assuming the apparatus to be connected as hereinbefore stated to the intake and discharge sections of a hydraulic pipe line and that runner B is being driven in an anticlockwise direction, as shown in Fig. 1, then the mixture of water and solids entering casing A through intake opening 10 and travelling in the direction in which the runner B is rotating, will have two possible paths of exit from the casing, that is to say, it may pass around the periphery of casing A and discharge through opening 11 or pass through the runner and discharge through opening 6 into supplemental discharge pipe 24.

As previously stated the separation of the fine and coarse particles of the mixture entering the casing and the direction of the separated particles along two paths of flow is based on the fall velocity of the particles through water. Particles having fall velocities through water less than the velocity of the water discharging through runner B are carried along with the flow through the converging runner paths 18 into supplemental discharge pipe 24, while those having greater fall velocities instead of passing through the runner, continue around the casing and exit in the director of runner rotation through discharge opening 11. Thus the proportion of material taking the runner path into discharge pipe 24 depends upon the velocity of flow through the runner which in turn is a function of runner speed.

This apparatus has been found to be very effective in hydraulic fill operations in which a mixture of water and solids is pumped from a borrow pit through a pipe line to a fill area. In this type of dredging the desilting apparatus is adapted to be installed in the pipe line near or on the dredge and the finer particles of the material removed from the mixture are wasted into the excavated portion of the borrow pit. In dredging operations wherein booster pumps are used the instant apparatus may be installed at any point in the pipe line provided that the fluid pressure within the dredge pipe at the selected location exceeds the pressure within the waste line by not less than the pressure generated by the runner when operating at its maximum speed.

When the finer particles of the dredged material are to be wasted, the desilting machine is installed on the dredge plant or on a separate floating plant near the dredge. When the fines are to be piped to a remote point the apparatus is located at the most economical point in the dredge pipe. The pipe between the dredge and the desilting apparatus is larger than that between the desilting apparatus and fill area. The optimum ratio of the two pipe sizes depends upon the percentage of fluid removed by the desilting apparatus. Pipe sizes are selected so that the fluid velocity is normally the same in all pipes under average operating conditions.

In conclusion it will be apparent this invention provides an apparatus embodying but few parts; furnishes an economical means for removing the fine material from the mixture of water and solids flowing through the pipe line; is especially applicable to hydraulic dredge fill operations, such as the construction of earth dams, wherein close control of the fines is necessary; is equally useful in dredging for sand to be used in concrete construction work, and finally it affords an apparatus which will effect a continuous separation of the finer and coarser particles of the material entering the casing without in any way interfering with the continuity of the dredging operations.

Having described my invention what I claim as new and wish to secure by Letters Patent is:

1. A desilting apparatus adapted to be inserted in the pipe line of a hydraulic dredge installation and comprising a casing including front and rear plates, and a peripheral section, the latter being formed with tangential intake and discharge openings, said front plate of the casing having a supplemental discharge opening central thereof, a runner rotatably mounted within the casing and having a central opening communicating with said supplemental discharge opening, said

runner including a plurality of curved vanes, whereby the finer particles of the material in the mixture of water and solids entering the tangential intake opening will be directed along a path of flow through the runner to the supplemental discharge opening in the casing, while the coarser particles will be caused to travel around the interior of the casing to the tangential discharge opening therein.

2. A desilting apparatus of the character described adapted to be inserted in the pipe line of a hydraulic dredge installation and comprising a casing including front and rear plates and a peripheral portion, the latter having therein tangential intake and discharge openings, said front plate being centrally formed with a supplemental discharge opening, a runner rotatably mounted in the casing, said runner embodying front and rear shrouds, a series of vanes between the shrouds, said vanes being curved in an anticlockwise direction, and coacting to provide a plurality of passages through the runner terminating in an opening formed centrally of the runner and disposed in alignment with said supplemental discharge opening, whereby the finer particles of the material in the mixture of water and solids adapted to enter the tangential intake opening in said casing, will be separated from the coarser particles, the finer particles flowing through the runner to the supplemental discharge opening and the coarser particles traveling around the casing to the tangential discharge opening.

3. A desilting apparatus adapted to be inserted in the pipe line of a hydraulic dredge installation, comprising a casing including front and rear plates and a peripheral section, said peripheral section having therein tangential intake and discharge openings, a runner rotatably mounted within the casing, said runner including front and rear shrouds, a plurality of vanes between the shrouds, said vanes being curved in an anticlockwise direction, and having a series of passages through the runner, said passages converging from the periphery of the runner to a common discharge outlet formed in its front shroud, and in alignment with a supplemental discharge opening formed in the front plate of said casing, whereby the finer particles of the material in the mixture of water and solids adapted to enter the tangential intake opening in said casing, will be separated from the coarser particles, the finer particles flowing through the runner to the supplemental discharge opening and the coarser particles traveling around the interior of the casing to the tangential discharge opening.

4. A desilting apparatus adapted to be inserted in the pipe line of a hydraulic dredge installation, comprising a casing including front and rear plates, and a peripheral section having therein tangential intake and discharge openings, a drive shaft journalled in the rear plate and having its inner end extending into the casing, a runner affixed to the inner end of said drive shaft, said runner embodying front and rear shrouds, and a plurality of vanes between the shrouds, the vanes being curved in an anticlockwise direction and coacting to form a series of passages through the runner, said passages converging from the periphery of the runner to a central orifice formed in the front shroud and disposed concentric with a supplemental discharge opening formed in the front plate of said casing, whereby the finer particles will be separated from the coarser of the material in the mixture of water and solids adapted to enter the casing in the direction of rotation of the runner, the finer particles flowing through the runner to the supplemental discharge opening and the larger particles passing around the interior of the casing and discharging in the direction of rotation through the discharge opening in said casing.

5. In a desilting apparatus, the combination with a casing including laterally spaced plates and peripheral section having therein tangential intake and discharge openings, one of said plates having therein a supplemental discharge opening; of means in connection with the casing for separating the finer from the coarser particles of material in the mixture of water and solids adapted to be delivered to the casing through its intake opening, said means including a rotary runner having a central outlet communicating with said supplemental discharge opening, whereby the separated particles may be caused to travel along independent paths of flow, one path extending through the runner and terminating in the supplemental discharge opening, the other path extending around the interior of the casing and terminating in the tangential discharge opening.

CARL H. PLUMLEE.