

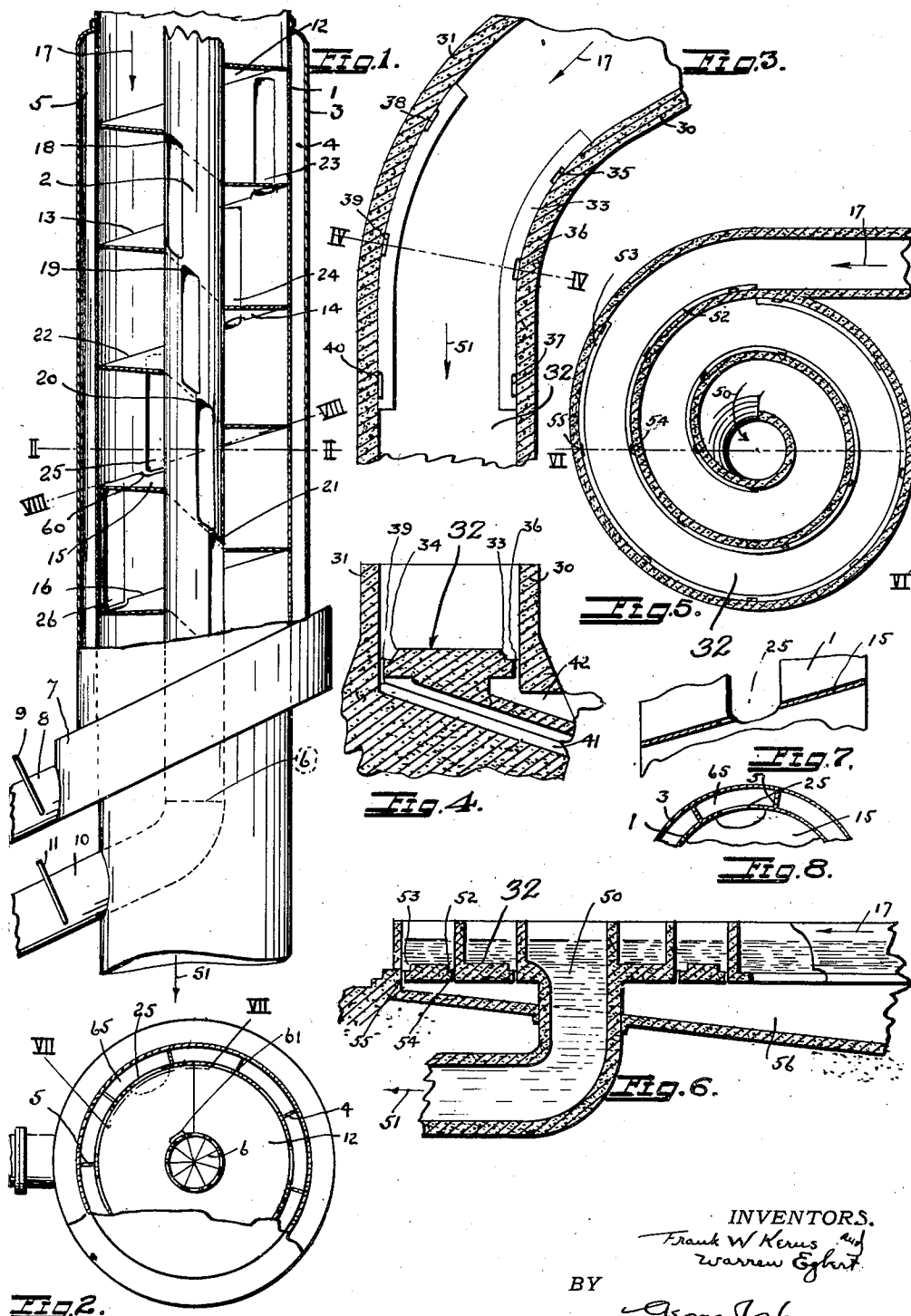
Sept. 27, 1932.

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1,880,185

METHOD AND MEANS FOR REMOVING SAND AND THE LIKE FROM FLUIDS

Original Filed July 25, 1927



UNITED STATES PATENT OFFICE

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METHOD AND MEANS FOR REMOVING SAND AND THE LIKE FROM FLUIDS

Application filed July 25, 1927, Serial No. 208,101. Renewed December 8, 1930.

Our invention has for its object the removal of solid matter from fluids and is particularly adapted to the removal of sand, gravel and other solid matter from streams.

5 A further object is the selected removal of material from fluids in motion, whereby relatively heavier or coarser particles are separated from relatively lighter or finer particles.

10 Other objects will appear from the specifications and drawing which follow:

These objects we accomplish by rotating the fluid, or giving it an angular velocity, during which the particles completely suspended in the moving fluid will travel with a radial component outwardly, and any particles encountering an added resistance to their movement, as friction against a radial surface, will travel inwardly towards the center.

We are of course aware that in a body of fluid moving in a straight line, the heavier particles will settle faster than the lighter particles, but in our invention the imparting of the curvilinear movement, or angular velocity being a departure from a straight line velocity, there is introduced the element of centrifugal force whereby the heavier particles attain an outward radial component in excess of that of the lighter particles, and there will therefore be a separation wherein the heavier particles which are still suspended in the moving fluid will move outward or away from the center of rotation and the lighter particles, in acquiring or being acted upon by a centrifugal force of insufficient magnitude will, through the action of gravity, settle to the bottom of the moving stream and at such time will encounter friction on the bottom surface of the flume or duct.

This friction decreases the rate of their movement relative to the stream direction, and introduces a component of angular velocity towards the center of rotation similar to that to be observed in the action of the grounds in a tea cup when the liquid in the cup is given a rotary movement.

It will thus be seen that the heavier particles will move outwardly and the lighter particles will move inwardly and a separation

between these two classes of particles will have been effected.

We provide suitable trapping means to collect these two classes of particles, to-wit: those which, being suspended, will move outwardly and those which having encountered an added resistance will move inwardly.

Throughout the following description we refer to the first class of particles as suspended particles being descriptive of their condition immediately before they are trapped.

Suitable ducts or ports are provided for collecting the several solid constituents during the progressive movement of the fluid and particles.

By referring to the accompanying drawing our invention will be made clear.

In the drawing, Fig. 1 is a view partly in elevation and partly in vertical section showing a pipe or conduit to which our invention has been applied with certain of the parts shown diagrammatically.

Fig. 2 is a plan of Fig. 1 on the line II—II thereof.

Fig. 3 is a plan view of a flume section to which our invention has been applied.

Fig. 4 is a cross section of Fig. 3 on the line IV—IV.

Fig. 5 is a plan view of a further development of our invention.

Fig. 6 is a cross section of Fig. 5 on the line VI—VI.

Figs. 7 and 8 respectively are fragmentary details of portions of Fig. 2, especially showing the ports in elevation and plan respectively.

Throughout the figures similar numerals refer to identical parts.

A conduit adapted to the passage of fluids is indicated by the numeral 1 having therein an axially positioned duct 2. Concentrically about the periphery of conduit 1, is a cylindrical member 3 spaced from conduit 1, while a plurality of partitions as 4, 5 divide the space between 1 and 3 into a plurality of passageways substantially parallel with the axial direction of the conduit 1.

Within the tube 2, are a further plurality of passageways formed by the radial wing members as 6, See also Fig. 2.

At 7 is a compartment into which the passageways between 1 and 3 discharge and which compartment is in effect a sand box from which an outlet 8 is provided under the control of the conventional gate shown diagrammatically at 9.

The partition or wing members as 6 and therefore the passageways in the tube 2 terminate in the lower portion thereof, the tube 2 then discharging through the pipe 10, which is likewise under the control of a conventional gate shown diagrammatically at 11.

Between the conduit 1 and tube 2 we interpose a spiral or helix, portions of which are shown at 12, 13, 14, 15, 16 respectively and which helix forces the fluid entering the conduit 1 in the direction of the arrow 17 to attain a rotary or spiral motion during its progress through the conduit.

The surface of this helix also furnishes a surface against which particles being conveyed in the fluid may impact and the particles are thereafter caused to slide inwardly upon the surface of the helix by the velocity pressure of the said fluid. The resistance offered to the movement of said particles by the friction on the helix surface causes the velocity pressure to move them inward towards the axis of rotation until they are caught in the ports positioned in the tube 2, such as those shown at 18, 19, 20, 21 respectively.

The wings or partition members as 6 provide a separate passageway within the tube 2 from each of these ports, causing them to discharge into the common outlet pipe 10.

The suspended particles being conveyed in the fluid flowing in the direction of 17, are by the spiral movement of the fluid caused to travel outward until they are trapped in one or the other ports 23, 24, 25 or 26.

Each of the ports as 23 to 26 discharges into one of the passageways within the space between the cylinder 3 and conduit 1, formed by the partition members as 4, 5. A special passageway for each of said ports into the sand box or compartment 7 is thus provided.

The suspended particles will therefore be trapped by one or the other of the ports 23, 24, 25, 26 and discharged through the sand box 7 and thence through the pipe 8 and valve 9 whereas the particles that have encountered added resistance as against the helical surface will be trapped in one or the other of the ports 18 to 21 and discharge through the pipe 10 and valve 11.

We have found that where particles are travelling with a moving body of fluid that if they are caused to impact upon the surface of the helix, they will, through the friction set up with the said surface, acquire a component of radial velocity inward towards the axis of fluid curvilinear movement, whereas the suspended particles being carried in said moving fluid body will acquire a com-

ponent of radial velocity away from said axis: and that segregation of the particles may therefore be secured due to the tendency of the finer and lighter particles to move toward the center of rotation, and the tendency of the heavier and coarser particles to move toward the outer boundary of the rotating fluid, and that we are therefore able to remove silt and gravel in the same apparatus from a moving body of water.

Referring particularly to Figs. 3 and 4, the direction of fluid movement is indicated by the arrows 17 and 51 and the side walls of a conventional flume are shown at 30, 31 respectively and the bottom thereof at 32.

The fluid entering at 17 is therefore given a curved or angular velocity as it progresses through the flume. Between the bottom 32 and the walls 30 and 31 respectively, we provide the depressed channel ways 33, 34 respectively and from the channel 33 are outlet ports 35, 36, 37 while from the channel 34 other outlet ports 38, 39, 40 are provided respectively.

The several ports discharge into the shoots or hoppers 41, 42 respectively.

As the fluid moves over the curved path in said flume the suspended particles will collect in the channel 34 and be discharged through the ports 38, 39 and 40 and the particles that have encountered added resistance will collect in the channel 33 and be discharged through the ports 35, 36, 37 respectively and due to the tendency of the lighter and finer particles to move toward the center of rotation and the tendency of the heavier and coarser particles to move toward the outer boundary they may be selectively discharged through the shoots 42 and 41 respectively.

In Figs. 5 and 6 is illustrated a modified form of apparatus for employing our invention particularly adapted to the removal of sand and gravel from flowing streams where the velocity is relatively high and carries an excess of smaller particles as sand, silt or the like.

The water enters in the direction 17 and passes around the spiral passage discharging through the central outlet 50 and thence continues on its way as shown by the arrow 51 having been clarified from the heavier as well as the lighter particles.

Channel ways along the inner and outer curvature of the flume or spiral passage are shown respectively at 52, 53 from which ports 54, 55 discharge into the common hopper or shoot 56 together with a sufficient quantity of water to flush the separated solid matter through the said shoot.

The lighter particles will continue to be removed through more than a full turn of the spiral as here shown, whereas the heavier particles which are removed more readily

will be separated in a shorter distance of the spiral travel.

The operation is continuous, the water emerging in the direction of the arrow 51 having been clarified of both the lighter particles discharging through the ports on the inner curvature, and of the heavier particles discharging through the ports along the outer curvature, the said particles having collected respectively in the channels 52, 53 and then flushed through the shoot 56 by a small water flow along with the separated particles through the respective ports.

We claim:

1. Apparatus for separating particles of solid matter from a flowing fluid containing the same, which consists of a duct having a helical surface over which said fluid is caused to travel, a plurality of ports spaced apart about the outer periphery of said surface, a tube substantially centrally positioned with respect to said helix and a plurality of other ports in said tube spaced about the inner periphery of said helix.

2. Apparatus for separating particles of solid matter from a flowing fluid containing the same, which consists of a duct having a helical surface over which said fluid is caused to travel, a plurality of ports spaced apart about the outer periphery of said surface, a tube substantially centrally positioned with respect to said helix and a plurality of other ports in said tube spaced about the inner periphery of said helix, a sand box and passages from each of said ports separately discharging into said sand box.

3. Apparatus for separating particles of solid matter from a flowing fluid containing the same, which consists of a duct having a helical surface over which said fluid is caused to travel, a plurality of ports spaced apart about the outer periphery of said surface, a tube substantially centrally positioned with respect to said helix and a plurality of other ports in said tube spaced about the inner periphery of said helix, a sand box and separate passages from each of said first named ports by which the said larger particles are discharged into said sand box and a receptacle and other separate passages by which said lighter particles are discharged into said receptacle, a discharge outlet from said sand box and a valve regulating the discharge from said box and another discharge outlet and other valve means regulating the discharge from the said receptacle.

4. The method of separating solid particles suspended in a fluid continuously flowing with a curved movement which consists in trapping the lighter particles substantially at the axis of said curve and trapping the heavier particles at the periphery of said curve, and thereafter withdrawing the clarified fluid.

5. A method of clarifying water carrying silt in suspension in a flowing stream which

consists in directing said stream to be treated into a circularly curved path of flow, controlling the velocity of flow and frictionally opposing the flow to cause centripetal diversion of the silt and finally discharging the diverted silt beyond the inner side of the said circularly curved path of the stream.

6. An apparatus for separating silt from a continuously flowing stream of water comprising a circularly curved conduit adapted for continuous gravital flow of water, said conduit having a flat bottom and inner and outer spaced walls forming a curved passage for the continuously flowing water and constituting frictionally retarding surfaces, and a central chamber containing a body of substantially nonflowing water, and passages formed in the inner wall, whereby silt separated from the continuously flowing water by centripetal action will enter into the central body of substantially non-flowing water and settle therein.

7. An apparatus for separating silt from a continuously flowing stream of water comprising a circularly curved conduit adapted for continuous gravital flow of water to be treated, said conduit having a bottom and inner and outer spaced walls forming a curved passage for the continuously flowing water and constituting frictionally retarding surfaces, a central chamber containing a body of substantially non-flowing water, vertically disposed baffle plates in the central chamber to prevent swirling of the water therein, and passages formed in the inner wall of the conduit whereby silt separated from the continuously flowing water by centripetal action will enter the central body of substantially non-flowing water and settle therein.

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