Jan. 8, 1929. 1,698,101

M. G. MARTLING

TANGENTIAL SEPARATOR

Filed Oct. 18, 1927

Fig. 1.

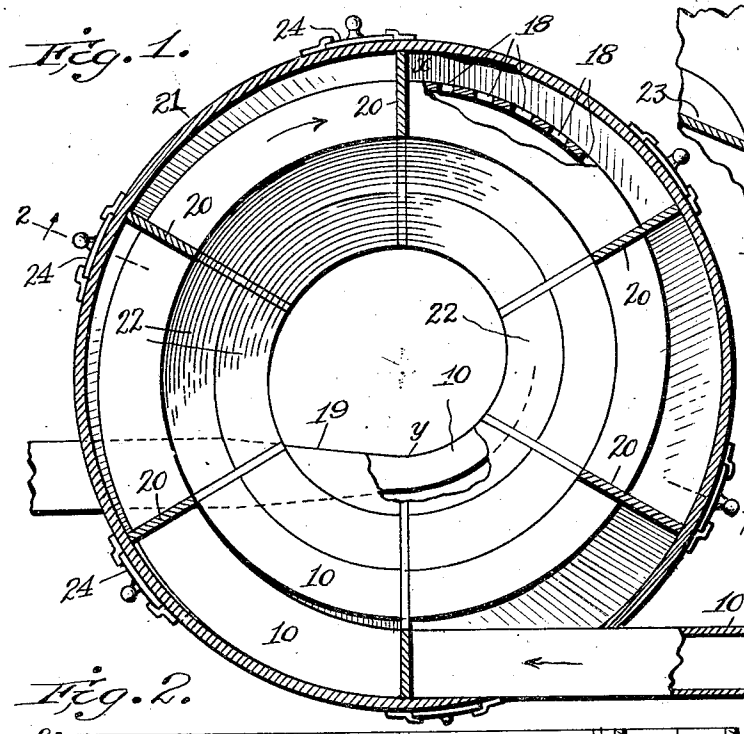


Fig. 4.

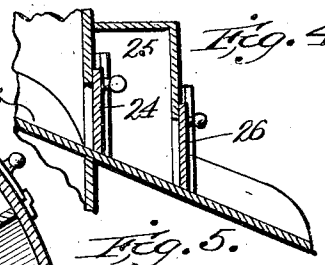


Fig. 5.

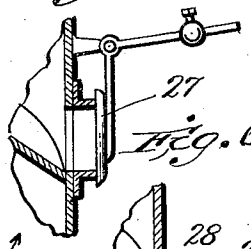


Fig. 6.

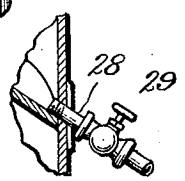


Fig. 2.

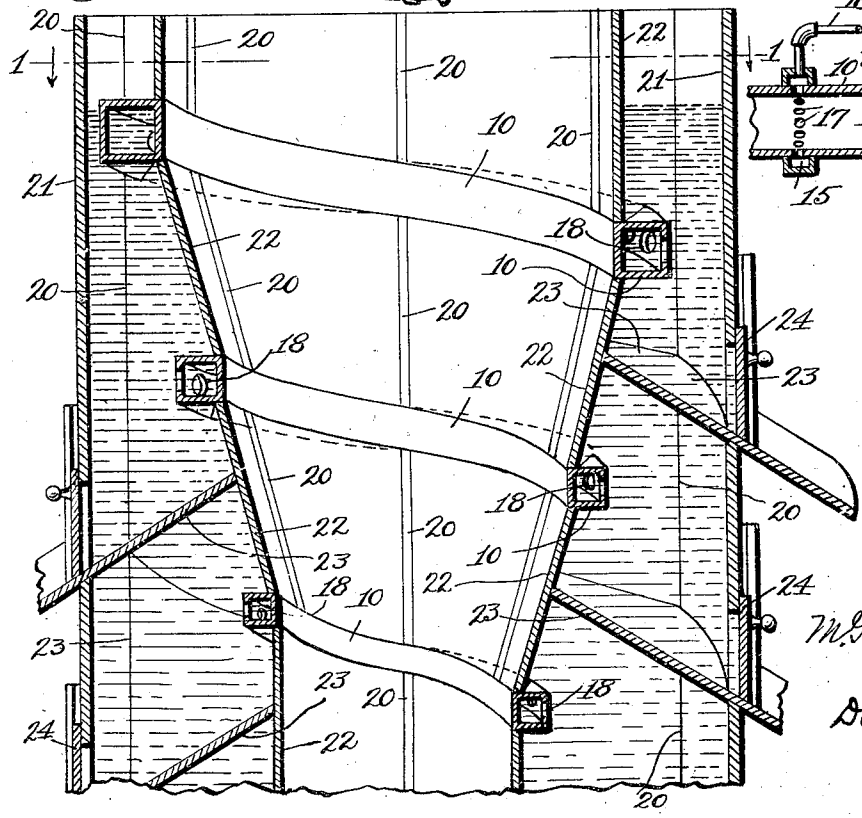
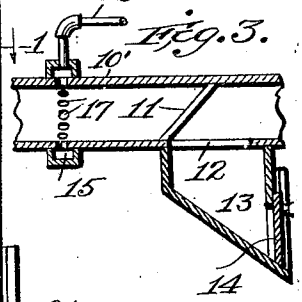


Fig. 3.



Inventor

M. G. Martling

By

Davis & Davis

Attorneys.

Patented Jan. 8, 1929. 1,698,101

UNITED STATES PATENT OFFICE.

MERRIFIELD GRAHAM MARTLING, OF THE UNITED STATES ARMY.

TANGENTIAL SEPARATOR.

Application filed October 18, 1927. Serial No. 226,950.

The object of this invention is to provide a simple apparatus for separating solids, such as sand, gravel, particles of water, etc., from a fluid, the construction being such that the separating of the particles is done continuously and thoroughly while the carrying-liquid is in motion, as more fully hereinafter set forth.

In the drawing—

Fig. 1 is a horizontal sectional view of an apparatus embodying a preferred form of my invention;

Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view of the preliminary separator;

Figs. 4, 5 and 6 are detail vertical sectional views of three modified forms of the discharging-valves.

Referring to the drawing by reference-numerals, 10 designates a tubular conduit which tapers in internal dimensions from approximately its upper, inlet end, to its lower, outlet end, and which is in the form of a conical spiral, the coils gradually decreasing in diameter toward the lower, outlet end of the tube.

The water or other fluid bearing the particles to be separated is conducted under pressure into the upper end of the conduit, said upper end of the conduit being extended laterally a suitable distance to form a convenient inlet portion at 10′. To separate out particles that are too large for separation by the separating-tube 10, I provide an inclined screen 11 in the inlet part 10′, this screen consisting desirably of parallel bars, inclining downwardly toward the apparatus, the lower conduit wall being provided with an opening 12 which leads to a trap-chamber 13 closed by a valve 14 of the gate type or any other suitable type. From time to time, the valve 14 may be opened to permit the discharge of accumulated rocks or other foreign substances. At the entrance-end 10′, I provide also a means for injecting air or other gas or fluid lighter than the carrying-fluid for the purpose of increasing the difference between the specific gravities of the flowing stream and the particles to be separated. A simple way of doing this is to provide the conduit 10′ with a hollow ring 15 into which is conducted, by a pipe 16, compressed air or other fluid, jet openings 17 being provided in the conduit 10′ to permit the air to jet into the inflowing stream in the form of numerous jets, to thereby intimately mix the air or other fluid with the carrying-fluid. In this way, the specific gravity of the particles carried by the fluid relative to the flowing stream as a whole is increased, with the result that the subsequent centrifugal-tangential separating process is rendered more efficient.

The outer wall of the tubular conduit 10 is provided with numerous perforations 18, this line of perforations extending from a point near the inlet-end of the conduit to a point near the outlet-end thereof. I prefer starting this series of holes at some point such as x shown in Fig. 1, so as to thereby leave a part of the outer wall of the first coil imperforate. I prefer also stopping this row of perforations at about point y shown in Fig. 1, as beyond this point y the conduit is enlarged gradually in conical form, as shown at 19, for a purpose hereinafter set forth.

As will be obvious, the swirling action given to the fluid as it passes down and around the conduit sets up centrifugal and tangential forces which tend to throw the solid particles carried by the fluid out against the outer wall of the conduit. As the particles pass the openings 18, they will be thrown out through said openings by centrifugal and tangential forces. Since the heavier particles are more subject to these forces than the lighter particles, the heavier particles will be discharged through the openings first, and then, as the stream progresses, the lighter particles will finally reach the outer wall and be likewise discharged. The holes are not graduated in size, as the separation which takes place is not dependent entirely upon size, but more particularly upon specific gravity. The question of size of the perforations relative to the size of the separated material is not a material one, so far as my invention is concerned. All that is necessary is to provide the outer wall with perforations sufficiently large to permit the largest particles that get by the screen 11 to be discharged through these perforations. By reason of the gradual reduction in cross-sectional area of the conduit and also the gradual reduction in the diameter of the coils of the spiral, the speed of the fluid is increased and also its tangential velocity is increased, with the result that the centrifugal and tangential forces are gradually increased toward the discharge-end of the conduit, whereby the separating

action toward the discharge-end is so greatly augmented, as compared with the upper end of the conduit, that the lighter or smaller particles flowing in the fluid are discharged through the openings 18. In this way, I am enabled to extract from the moving stream all the foreign, solid substances suspended therein.

For the purpose of facilitating the discharge of the foreign particles at numerous points throughout the length of the conduit, I provide still-fluid chambers throughout the length of the conduit. These chambers may be formed by a series of radial partitions 20, an outer shell 21, an inner shell 22 and bottom partitions 23, these latter partitions being desirably arranged spirally to correspond in a general way with the spiral arrangement of the conduit. These walls 20, 21, 22 and 23 provide a plurality of closed chambers into each of which a number of the holes 18 open. In operation, of course these pockets all become filled with fluid through the openings 18, and by reason of the fact that they are closed in all other respects the fluid in these pockets remains practically still, i. e., without eddies of any consequence. These still-fluid pockets, therefore, materially assist in the discharge from the conduit of the solid particles as they are carried along against the outer wall of the conduit. These pockets may be emptied from time to time in any suitable manner. I show a simple form of sliding gate 24 in Figs. 1 and 2, but I may employ instead such devices as are shown in Figs. 4, 5 and 6. In Fig. 4, I provide a trap-chamber 25 outside of the gate 24 and provide this trap-chamber with a gate-valve 26; this structure is advantageous because the contents of the chamber may be discharged without stopping the operation of the machine or interfering with its operation. In Fig. 5, I show a weighted valve 27 for closing the outlet of the chamber; by properly adjusting the weight, this valve may be adapted to dump the collected material automatically. In Fig. 6, I show a discharge-pipe 28 provided with an ordinary discharge-valve 29.

As stated above, I leave more or less of the outer wall of the uppermost coil of the conduit imperforate; I do this in order that before the stream reaches any of the discharge-openings 18, the solid particles carried by the stream will have an opportunity of being subjected to the centrifugal and tangential forces sufficiently to have reached the outer wall of the conduit. The heavier particles will reach this outer wall very quickly, while the lighter particles carried by the stream will take more time for yielding to the centrifugal and tangential forces. The separated material will naturally be graded as to size, since the larger particles are in practically all instances the heavier ones and they therefore will be deposited in the upper chambers of the apparatus. My prime purpose, however, is to provide in a simple apparatus a method and machine that will not only separate the easily-separated particles, namely, the heavier particles, but also the very light particles which are more or less impalpable and therefore require to be subjected to greater tangential and centrifugal forces for their separation. As heretofore stated, the delivery-end 19 of the conduit is shaped to provide an expansion tube in the form of a truncated pyramid or cone with the larger cross-sectional area at the discharge end; this is highly desirable for the reason that it reduces the back pressure which a restricted discharge-end would otherwise cause.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiments thereof, but I desire to have it understood that the apparatus disclosed is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combinations and relations described, some of these may be altered and others omitted and some of the features of each modification may be embodied in the others without interfering with the more general results outlined, and the invention extends to such use.

What I claim as new is:

1. In a separating apparatus, a conduit in the form of a conical spiral, the outer wall of said conduit being perforated at intervals along its length and the interior of said conduit tapering toward its exit-end, a plurality of still-fluid pockets being arranged along the length of the conduit, each in communication with the conduit through said perforations.

2. In a fluid separating apparatus, a conduit tapering interiorly toward its exit-end, this conduit being in the form of a helix whose coils gradually decrease in size toward the exit-end, the outer wall of said conduit being perforated at intervals along its length, and a series of closed chambers arranged along the length of the conduit in communication with the perforations in the conduit, each chamber being provided with a separate discharging means.

3. In a fluid separating apparatus, an outer casing, an inner casing, a spiral conduit associated with the inner casing and having a plurality of openings in its outer wall at intervals along the same, a plurality of vertical partitions extending from the inner casing to the outer casing, thereby forming a plurality of closed still-fluid chambers along the length of the conduit, and a separate discharging means for each one of said chambers.

4. In a fluid separating apparatus, a con-

duit in the form of a conical spiral, the coils decreasing in size toward the exit-end of the conduit, the outer wall of said conduit being provided with openings at intervals along its length and the interior diameter of said conduit tapering toward its exit-end, and means communicating with said openings to receive the separated particles ejected through said openings by the tangential and centrifugal forces.

In testimony whereof I hereunto affix my signature.

MERRIFIELD GRAHAM MARTLING.