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# UNITED STATES PATENT OFFICE.

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## MIXING DEVICE.

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Specification of Letters Patent.

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*To all whom it may concern:*

Be it known that I, FOSTER HAVEN HILLIARD, a citizen of the United States of America, residing at Memphis, county of Shelby, and State of Tennessee, United States of America, have invented certain new and useful Improvements in Mixing Devices; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to a mixing device for conveyer conduits and is particularly adapted for use in pipe line dredges to hold the solid material in suspension in the liquid. In excavating heavy material, such as sand and gravel, or a mixture of both, by means of a pipe line dredge the proportion of solid material to water that can be transported through the pipe line is limited by the settling of the solid material to the bottom of the pipe. When carrying small proportions of sand (up to 12 per cent.) the same is carried through the pipe in spite of settling. However, when the percentage is higher the settling results in an accumulation of sand in the pipe which eventually stops the flow entirely. In order to overcome this accumulation it is necessary, at stated intervals in the length of the pipe, to maintain the mixture as uniform as possible during the flow, and this I do by raising the sand from the bottom to the top of the pipe.

The object of my invention is to maintain a mixture of the solid material with the liquid so that it may be borne along with the current without undue friction against the bottom of the pipe.

The invention consists in providing a conduit or pipe with a fixed diaphragm or plate, having a warped surface, the front edge of which coincides with the horizontal diameter of the pipe while the surfaces of said diaphragm gradually deviate from the plane of the edge until the horizontal diameter is again reached and extended in the plane of the axis of the conduit for a distance sufficient to overcome the swirling action imparted to the material by the spiral formation of the diaphragm.

In the accompanying drawing: Figure 1 is a diagrammatic view of a pipe-line dredge having my improved mixer applied thereto. Fig. 2 is a partial longitudinal vertical section of one form of mixer. Fig. 3 is a similar view of a modified form. Fig. 4 is an end view of Fig. 2 looking in the direction of the arrows, and Fig. 5 is a transverse vertical section on the line 5-5 of Fig. 2.

Referring to said drawing, A designates the hull of the dredge which carries a centrifugal dredging pump B of well known construction for sucking the dirt and water through a suction pipe C and discharging it through the discharge pipe D which is made up of a plurality of detachable pipe sections and supported in the usual manner on a plurality of pontoons E.

The mixer preferably comprises two sections 1 and 2 of pipe shorter in length but of the same diameter as the sections of the suction and discharge pipes so that the mixer sections may be interposed between any two sections of said pipes. The section 1 contains a plate or diaphragm 3 the diameter of which coincides throughout its length with the diameter of said section, the front edge 4 of the plate coinciding with the horizontal diameter of the section to divide the latter into upper and lower halves. The surfaces of the plate gradually deviate from the horizontal plane of the edge 4 until they coincide with the vertical diameter of the section, (Fig. 5). The deviations continue until the surfaces again coincide with the horizontal diameter but in inverted positions as indicated at 5, (Fig. 2), thus forming surfaces warped through 180 degrees. Section 2 of the mixer contains a straight plate or diaphragm 6 mounted therein to coincide with the horizontal diameter of the section and is adapted to form a continuation of the rear horizontal portion of the warped diaphragm 3.

Experience has shown that good results are attained by making the diaphragm 3 about five times the length of the diameter of the section and the diaphragm 6, about three times the diameter of the section. It is preferable to form the diaphragms, in separate pipe section of the same length as the diaphragms as sometimes the standard section for the pipe line will be found irregular and a perfect fitting of the parts will insure better results. This is particularly

true of the warped diaphragm as the straight diaphragm may with impunity be inserted in a standard section, of the pipe line, which connects with the section containing the warped diaphragm.

Instead of making the mixer as above described both the warped and straight diaphragm may be formed of one piece as shown in Fig. 3 and this one piece may either be fitted in a single section of pipe of the same length, or the piece may be inserted in any standard section. The diaphragm divides the contents of the pipe into upper and lower portions. The lower portion of the contents is rich in solid material and the upper portion is principally water. After separating the solid matter from the water, the function of the warped diaphragm is to transfer the former which is indicated by the heavy arrows to the top of the pipe and the water, which is indicated by the light arrows, to the bottom. The swirling motion imparted to the water by the diaphragm 3 is a serious objection and would carry the solid matter quickly back to the bottom of the pipe if it was released directly from the diaphragm 3. To check this swirling motion and hold the solid material in the upper half of the pipe until motion parallel to the axis is recovered, the horizontal section or extension 6 of the mixer is added to the rear end of the diaphragm 3. On emerging from the rear end of the diaphragm 6 the solid material gradually gravitates to the bottom of the pipe again, advancing in the direction of the flow as it does so. At another point where the conditions, similar to those described above, result again, another mixer is necessary and the elevation of the solid material is repeated. The number of mixers required in any given pipe will depend on the length of the pipe line and the percentage of solid material carried. Experience has shown that with a 24 inch pipe carrying 30 per cent. sand, the mixers should be spaced about 150 feet apart. The percentage of sand, possible with a 24 inch dredge, will be increased from 12 to 30 per

cent. by the insertion of the mixer in the discharge pipe.

I claim—

1. A conduit having a stationary mixer mounted therein coinciding with the diameter of the conduit and comprising a forward warped portion, and a rear straight portion.

2. A conduit having a mixer fixed therein coinciding with the diameter of the conduit and comprising a forward portion warped through 180 degrees, and a rear straight portion extending in the plane of the longitudinal axis of the conduit.

3. A conduit having a diaphragm fixed therein coinciding with the diameter of the conduit, said diaphragm having horizontal front and rear ends and being warped between said ends through 180 degrees, and a straight portion forming an extension of said rear end to overcome the swirling motion imparted to the contents of the conduit by said warped portion.

4. A pipe, a plate fixed therein of a width substantially equal to the diameter of the pipe and of a length five times said diameter, said plate being warped 180 degrees between its front and rear ends and a straight plate coinciding with the rear end of the warped plate to overcome the swirling motion imparted to the contents of the pipe by the warped portion of the plate.

5. In a pipe line dredge, the combination with a suction or discharge pipe, of a mixer mounted therein comprising a plate having its front edge coinciding with the horizontal diameter of the pipe, and having a rear portion warped through 180 degrees, and a straight plate mounted in said pipe parallel to the longitudinal axis of the latter and forming a continuation of the warped portion.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

FOSTER H. HILLIARD.

Witnesses:

C. M. NORFLEET,

C. L. JONES.