

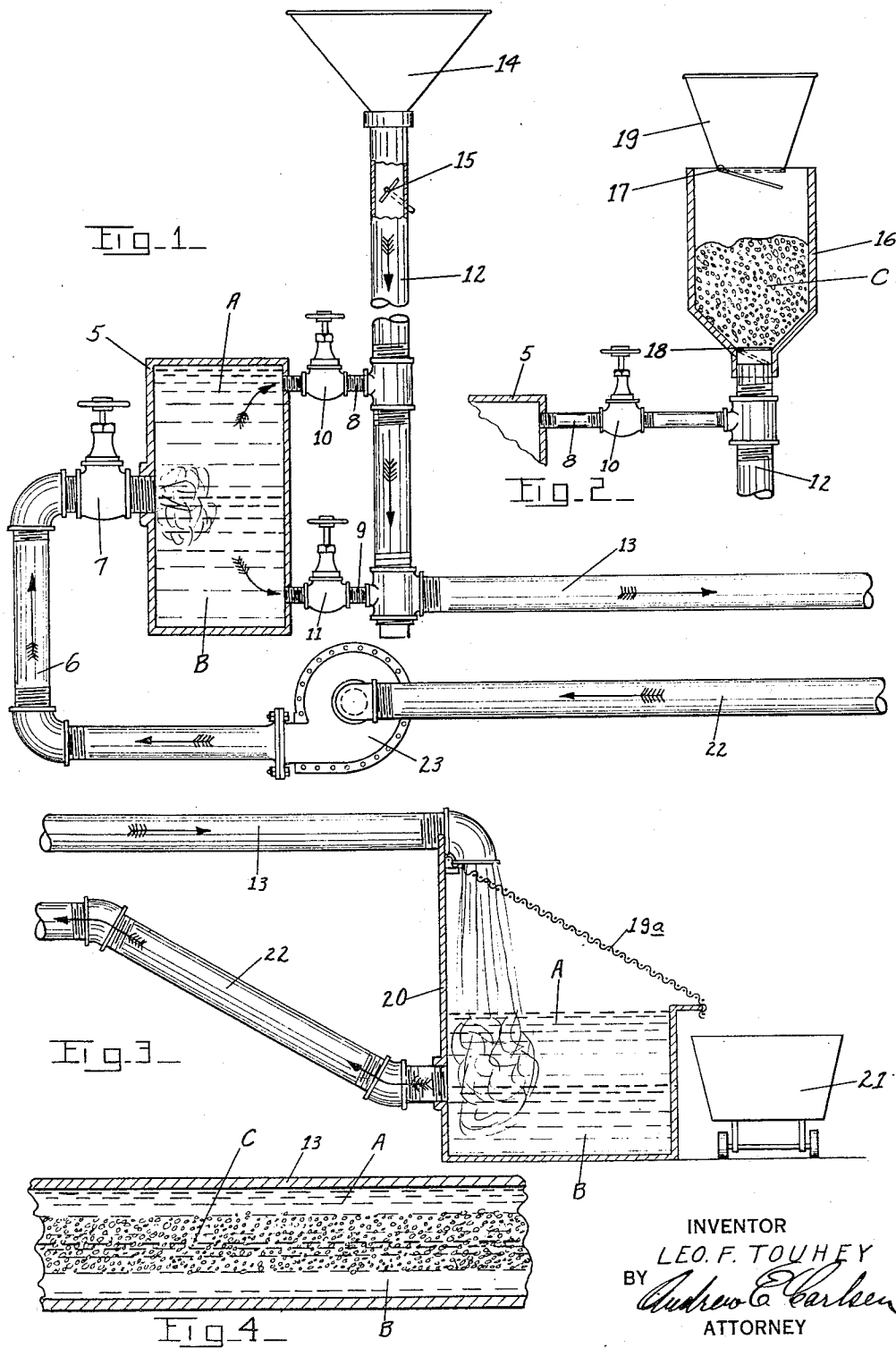
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MEANS AND METHOD FOR TRANSPORTING MATERIAL

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MEANS AND METHOD FOR TRANSPORTING MATERIAL

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This invention relates to apparatus and methods of transporting materials, particularly grain and other substances which are in or may be reduced to comparatively small particles, and the primary object is to provide a novel, efficient, and practical apparatus and process or method by means of which such materials may be conducted from one point or location to another through pipes or tubes by means of a fluid circulated medium and in such a manner as to substantially eliminate friction and/or clogging of such materials within the pipe line during the conveying or transporting operation. More particularly the object is to provide a circulation transport system employing two immiscible transporting fluids forced through the same conduit but having relatively greater and lesser specific gravities than the material to be conveyed, and which material is fed into the transporting line so that such material will remain in suspension between the upper and lower conduit surfaces during travel movement therein.

In the accompanying drawing, which illustrates one embodiment of the invention—

Fig. 1 is an elevation, partly in section, of the material receiving and fluid pumping end of the transporting system.

Fig. 2 is a detail sectional elevation of a modified form of material feeding device.

Fig. 3 is an elevation, partly in section, of the structure employed at the material delivering end of the transporting system.

Fig. 4 is an enlarged detail vertical section taken longitudinally through the material transporting conduit.

Referring to the drawing more particularly and by reference characters, 5 designates a separation chamber, having an inlet pipe 6 provided with a valve 7, and outlet pipes 8 and 9 provided with valves 10 and 11, respectively. The pipes 8 and 9 supply the vertical extension 12 of the transport conduit or pipe 13. The grain or other material to be transported is fed into the pipe 12 from a hopper 14 at the upper end thereof, and under control of a valve 15. The extension 12 also serves as a standpipe to maintain liquid column pressure control in the circulating system. Where a relatively high degree of circulation pressure is to be used, however, or when the liquids and materials are to be forced to high elevations, then I employ a return pressure control such as indicated in Fig. 2, wherein a receptacle 16 is substituted for the upper end of pipe 12, and hopper 14, and has upper and lower control valves 17 and 18, the

valve 17 controlling the discharge from supply hopper 19. When employing this arrangement the valve 18 is closed while receptacle 16 is being filled, but when the material in 16 is to be discharged into the fluid stream valve 17 is closed and valve 18 is opened to permit and control the material feed into the fluid stream passing through conduit 13.

The conveyor conduit discharges its contents at the delivery end of the apparatus (Fig. 3) down onto an inclined screen 19a over a receiving receptacle 20, the fluid contents passing through the screen, while the material conveyed thereby passes down over the screen into a suitable receptacle 21. A fluid return pipe 22 connects the receptacle 20 with the intake of a power operated centrifugal pump 23 to the outlet of which is connected pipe 6.

The apparatus thus shown and described is, except in certain particulars, purely illustrative of preferred mechanical equipment that may be used in carrying out the process of my invention, and being more or less conventional in character is subject to variations in design, arrangement, etc. The crux or critical differentiation over the prior art of which I have knowledge resides in the fact that I employ, as the transporting medium, two liquids, A and B, which are immiscible and have specific gravities that are different from each other and also different from that of the material C to be conveyed. By thus proportioning the relative weights or specific gravities the two liquids will produce a suspension of the material to be conveyed between the upper and lower walls of the enclosing conduit, and consequently the transporting movement will be effected without substantial or damaging friction or resistance as between the material and conduit, and the particles will be conveyed through the tube with practically the same freedom as if they themselves had a liquid or fluid consistency.

Because of the forced circulation and return movement of the liquids the agitation in receptacles 5 and 20 and in the pump 23 will tend to co-mingle and unite them. This tendency is offset by placing the outlet pipes 8 and 9 at relatively high and low points in the chamber 5 and the inlet pipe 6 at an intermediate point. As a result of this arrangement the relatively slow movement or current through chamber 5 will permit gravitational separation of the fluids before they are respectively discharged into the conveyor conduit. The arrangement also contemplates the injection of the material C into

the lighter fluid A before the latter reaches the fluid stream B, from pipe 9, so that the material C will drop down through the lighter liquid to its intermediate, suspended, transporting position at the receiving end of conduit 13.

It will also be noted that pipe 22 is connected with the receptacle 20 at a level between the top and bottom thereof so that even though agitation may have partially intermixed the liquids they will be drawn in substantially equal proportions into and through the pump 23.

The valves 10 and 11 are employed to regulate and control in some measure the respective fluid flows, although the volume ratio will be substantially determined by the amounts of the liquids originally placed in the system. Likewise the velocity of the fluid stream will be determined by the capacity and speed of the pump 23, but the valve 7 is useful to make current flow adjustments as material is fed into the conveyor stream.

The fluid agents employed must of course be immiscible but may be of any suitable character depending upon numerous factors such as the nature, weight, consistency, etc., of the material to be transported. As an example of liquids which might be used to convey particles of the weight and consistency of wheat seed, brine may serve as the lighter fluid, having a specific gravity less than that of the wheat, while carbon-tetrachloride might be employed as the relatively heavier liquid. When seed, grain, or similar products are to be transported, liquids cannot be used that would have a deteriorating or harmful effect. In some instances after the material has been transported and separated from the conducting stream it will become necessary to dry, and possibly wash and dry it before it can be further used or disposed of, but such treatments form no part of the instant invention and are therefore not here considered in detail.

It is understood that various modifications in the herein disclosed apparatus and method may be made without departing from the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. The method of transporting material from one place to another which comprises establishing a stream between the two places of immiscible liquids having different specific gravities, and feeding the material into the stream for conveyance thereby.

2. The method of transporting material which comprises feeding the material into a stream having liquids immiscible with respect to each other and of different specific gravities.

3. The method of transporting material which comprises feeding the material into a stream having two immiscible liquids with specific gravities which differ from each other and from that of the material.

4. The method of transporting material which comprises feeding the material into a stream having immiscible liquids of different specific gravities, and separating the material from the stream at point of delivery.

5. The method of transporting material which comprises feeding the material into a stream having two immiscible liquids with specific gravities which differ from each other and from that of the material, and separating the material from the liquids at point of delivery.

6. The method of transporting material which comprises circulating a stream of two immiscible liquids differing as to their specific gravities to and from the point of delivery, feeding material into the stream moving toward the point of delivery, and removing the material from the stream upon reaching the point of delivery.

7. The method of transporting material which comprises circulating a stream of two immiscible liquids differing as to their specific gravities to and from the point of delivery, feeding material into the stream moving toward the point of delivery, passing the returned stream into a separation chamber to vertically separate the two liquids, and reuniting the two liquids to form the stream flowing to the point of delivery.

8. The method of transporting material which comprises circulating a stream of two immiscible liquids differing as to their specific gravities to and from the point of delivery, passing the returned stream through a separation chamber to separate the two liquids, separately conducting the separated liquids in the chamber back to the common stream formed thereby, and feeding the material to be transported into the lighter of the two liquids before both liquids are reunited.

9. An apparatus of the character described comprising a main transport conduit adapted to convey liquids and material to a place of deposit, a liquid separation chamber having upper and lower outlets communicating with the receiving end of the transport conduit, means for feeding material into the conduit, a return conduit, and means for circulating the liquids through said separation chamber and said transport and return conduits.

10. An apparatus of the character described comprising a main transport conduit adapted to convey liquids and material to a place of deposit, a liquid separation chamber having upper and lower outlets communicating with the receiving end of the transport conduit, means for feeding material into the conduit, a return conduit, and means for circulating the liquids through said separation chamber and said transport and return conduits, one of said chamber outlets having a valve to control the passage of liquid therethrough.

11. An apparatus of the character described comprising a main transport conduit adapted to convey liquids and material to a place of deposit, a liquid separation chamber having upper and lower outlets communicating with the receiving end of the transport conduit, means for feeding material into the conduit, a return conduit, and means for circulating the liquids through said separation chamber and said transport and return conduits, said chamber outlets having valves to control the passage of the liquids therethrough.

12. An apparatus of the character described comprising a main transport conduit adapted to convey liquids and material to a place of deposit, a liquid and material separation device at said place of deposit, a chamber at the receiving end of the conduit and having relatively high and low outlets communicating with the conduit, means for feeding material into the receiving end of the conduit, a return conduit connecting the material separation device and said chamber, and means for circulating the liquids through said conduits.