May 30, 1961 F. E. GUPTILL, JR 2,986,099

CONTROLLING PUMPING OF SLURRIES

Filed June 18, 1958

Fig. 2.

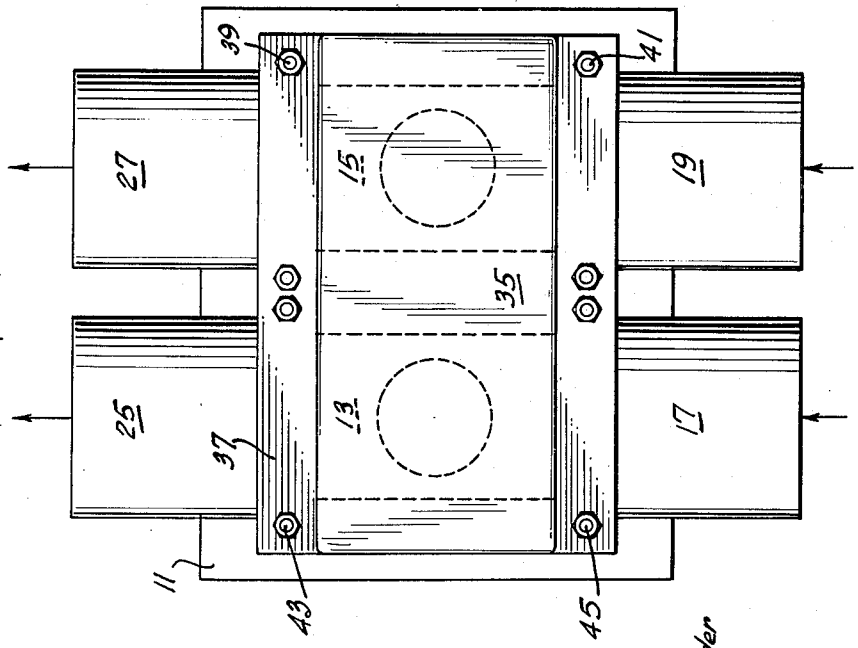
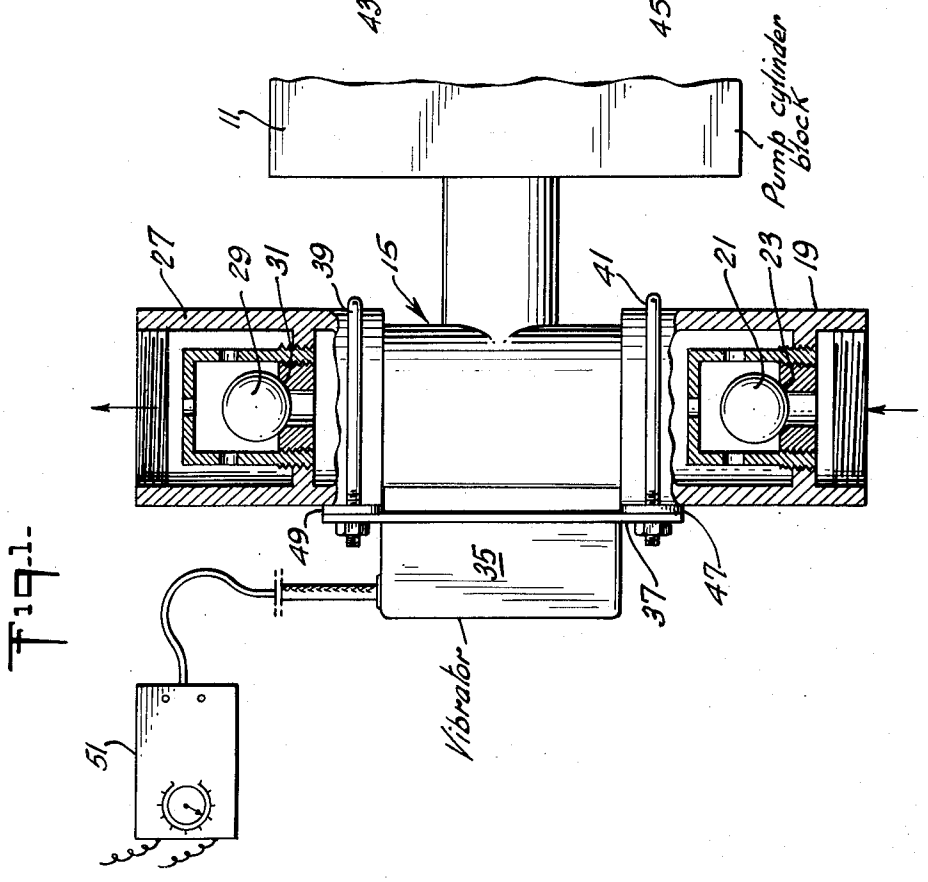


Fig. 1.



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CONTROLLING PUMPING OF SLURRIES

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6 Claims. (Cl. 103—153)

The present invention relates to a method of and apparatus for pumping a flowable mixture of solid particles in a liquid. It is particularly concerned with improving the operation of check valves to assure positive seating at all times.

When pumping a slurry of such solids as coal or talc particles suspended in a liquid such as water it has been found that solid particles tend to accumulate between the valve and seat of the intake and output check valves, thus causing imperfect seating and resultant leakage and pressure loss past these valves.

In accordance with the present invention the pumping of a flowable mixture of solid particles in a liquid by forcing the mixture through a conduit having a check valve therein is improved by continuously vibrating the check valve to stop solid particles from accumulating therein and preventing seating thereof. An advantageous procedure is to vibrate the conduit externally and transmit the resulting vibrations to the internally located check valve to assure seating thereof.

In the drawings:

Fig. 1 is a side elevational view, parts being broken away and shown in section, of a part of a pump and associated valve mechanisms embodying the invention; and

Fig. 2 is a side elevational view of the apparatus as viewed from the left in Fig. 1.

Referring to Fig. 1, there is shown a two cylinder pump **11** having a pair of pipe T's or valve manifolds **13** and **15** protruding laterally from one end thereof for the intake and output of a slurry being pumped.

The lower branches of both pipe T's are connected to vertical intake valve bodies **17** and **19**, which may be supplied with slurry by a single conduit leading from a storage tank. Each intake valve body contains a check valve comprising a ball **21** which moves upwardly away from a seat **23** during the suction stroke of the pump piston, and then falls downwardly and seats against the seat **23** on the pressure stroke.

The upper branches of both pipe T's are connected to vertical output valve bodies **25** and **27**, through which the slurry passes out under pressure to a single discharge conduit on the pump strokes of the pistons. Each output valve body contains a check valve comprising a ball **29** which moves upwardly away from a seat **31** during the pressure stroke of the piston, and then falls downwardly and seats on the seat **31** on the suction stroke.

Pump **11** can be any of several types which are designed for pumping mud or slurries. One I have used successfully is an American Marsh 12 x 1—⅜ x 12 steam-driven-Simplex plunger pump with special forged steel block fitted for use with externally mounted valves having two slurry pumping pistons operating at 30–60 strokes per minute and delivering 800–1600 pounds per hour of coal-water slurry at pressures up to 5000 pounds per square inch.

Proper seating of the intake and output check valves at all times is assured by mounting a vibrator **35** on a flat supporting plate **37** which extends across both of the pipe

T's **13** and **15** and is clamped tightly in position by two pairs of U-shaped pipe clamps **39**, **41**, **43**, and **45** passing around the intake and output valve bodies. Shims **47** and **49** near the top and bottom of mounting plate **37** provide an air gap beneath the major part of the plate while still permitting transmission of vibrations from vibrator **35** to the valve bodies.

Vibrator **35** may be operated in any suitable way, such as electrically, pneumatically, hydraulically, or by an unbalanced rotating armature. I have used successfully an alternating current electrical vibrator the magnitude of whose vibrations are controlled by a rheostate controller **51**, such as the model V–15 electric vibrator manufactured by the Syntron Company of Homer City, Pa. A suitable vibrator is shown in U.S. Patent 2,187,717, granted January 23, 1940 to C. S. Weyandt.

While I have shown the vibrator as applied to a plurality of valve manifolds having several intake and output check valves, it is evident that it can be used in connection with a single valve, and that it can be mounted in any other suitable way.

Obviously, many modification and variations of the invention, as hereinbefore set forth, may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

I claim:

1. In apparatus for pumping a flowable mixture of solid particles in a liquid comprising conduit means, a pump connected to said conduit means, and check valve means in said conduit means comprising at least one check valve having a valve seat and a movable seating member, said seating member operating to move away from said valve seat upon a stroke of said pump in one direction and to move toward and seat upon said valve seat upon a stroke of said pump in the opposite direction, the improvement comprising vibrating mechanism operatively connected to said check valve means and so constructed and arranged as to vibrate said check valve means to prevent solid particles from accumulating thereon thereby assuring seating thereof.

2. In the apparatus of claim 1, said vibrating mechanism being mounted externally on said conduit means adjacent said check valve means.

3. In the apparatus of claim 2, said vibrating mechanism being an electrical vibrator.

4. In the apparatus of claim 1, said conduit means being a valve manifold, said check valve means comprising both intake and output check valves in said manifold, said vibrating mechanism being mounted externally on said valve manifold and transmitting vibrations to both said check valves.

5. In the apparatus of claim 1, said conduit means being a plurality of valve manifolds, said check valve means comprising both intake and output check valves in each of said manifolds, a mounting secured externally to all of said manifolds, and a single vibrating mechanism carried by said mounting for vibrating all of said manifolds and all of said check valves.

6. In apparatus for pumping a flowable mixture of solid particles in a liquid comprising a reciprocating pump, a valve manifold connected to said pump and having an intake side and an output side, a check valve controlling said input side having a seat carried by said valve manifold and a movable seating member, said seating member operating to move away from said valve seat upon a suction stroke of said pump and to move toward and seat upon said valve seat upon a pumping stroke of said pump, a second check valve in said output side of said manifold having a second seat carried by said valve manifold and a movable seating member, said seating member operating to move away from said second valve

seat upon the pumping stroke of said pump and to move toward and seat against said second valve seat during the suction stroke of said pump, the improvement comprising vibrating mechanism mounted on said manifold and coacting therewith to vibrate said manifold and said valve seats therein to dislodge solid particles from said valve seats when said seating members seat against said valve seats.

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