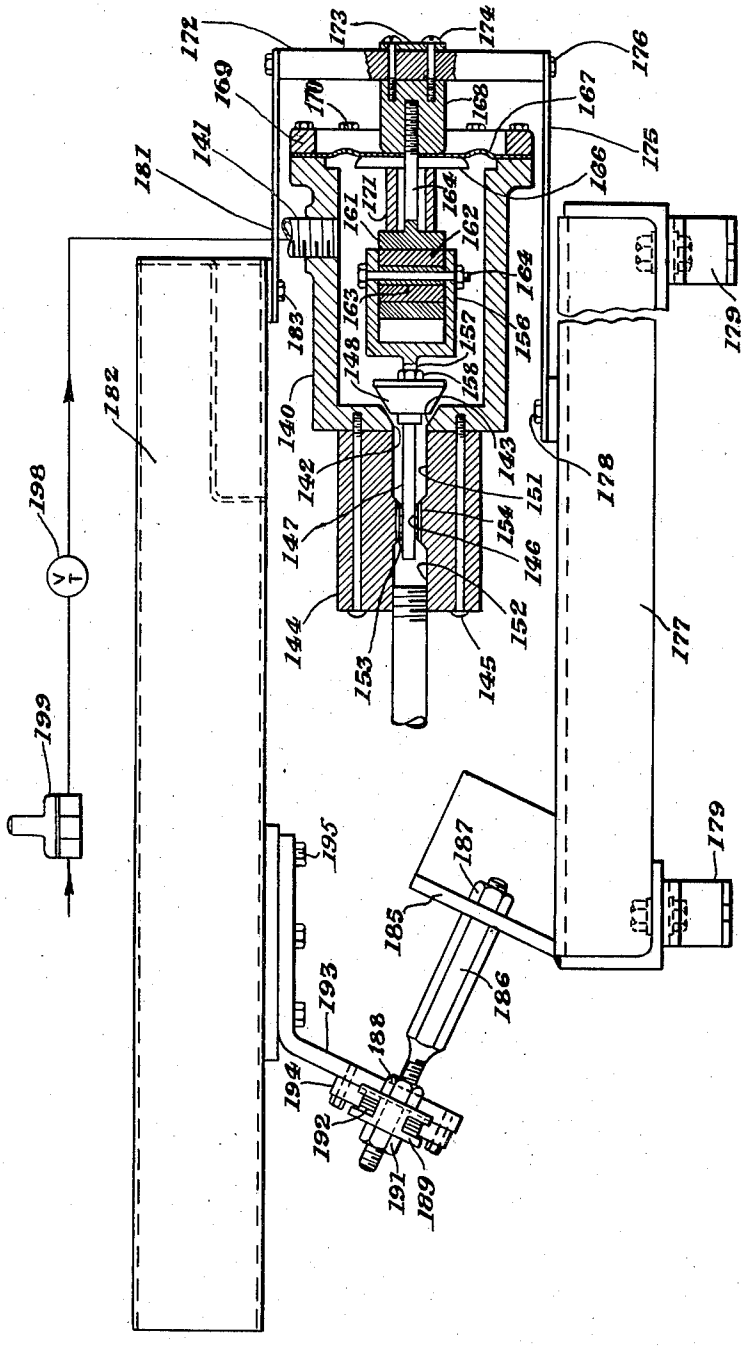
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FLUID OPERATED VIBRATING OR PULSATING MACHINE

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FLUID OPERATED VIBRATING OR PULSATING MACHINE

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The present invention relates to fluid operated vibratory trough conveyors, vibratory screens, and the like.

It heretofore has been proposed to operate conveyors, screens, etc. by unbalanced rotating weights, or electromagnetic vibratory motors. However, such devices have the disadvantage that the period or frequency of vibration is fixed and when the point of synchronism of the electromechanical forces is reached the apparatus becomes exceedingly sensitive and erratic in operation. Furthermore, there are installations where the use of electricity is not permitted because of fire or explosion hazard, and accordingly only the mechanically operated devices with the attendant wear of bearings, long power transmission shafts, belts, etc. can be employed. Such devices have not in general proved very satisfactory as they require considerable maintenance expense and frequent repair.

Accordingly, it is an object of the present invention to provide a fluid operated vibratory conveyor apparatus that may be directly operated by fluid under pressure.

Another object is the provision of a fluid operated vibratory conveyor apparatus having an adjustable stroke and period of vibration.

A further object is the provision of a fluid operated vibratory conveyor apparatus which is relatively simple in construction and can be employed for heavy duty.

Still another object is the provision of a fluid operated vibratory conveyor apparatus which is positive in operation and is rugged enough to be employed for a large variety of applications.

In accordance with the present invention, I provide a vibratory conveyor apparatus having a chamber in which a pressure responsive element is located, such as, for example, a bellows, or flexible diaphragm, and is connected to a control valve through a yieldable or resilient linkage composed of an inherently resilient solid member of rubber or the like, whereby the control valve may move with a lagging or snap action to control the period and stroke of the pressure responsive element. The vibration of the pressure responsive element may be employed for useful work by connecting a table, trough or screen thereto, or the casing providing the pressure chamber may be connected thereto to produce vibratory motion by the reaction forces. For example, when connected to a trough supported by inclined supports, a vibratory conveyor is produced having many advantages over the electrically operated or mechanically operated vibratory conveyors heretofore used. When electric motor or magnetic devices of this type are to be used in explosive atmospheres such as encountered in gun powder manufacturing, oil refineries, aluminum manufacture, powdered coal atmosphere, etc., they must be made explosion proof, which is relatively expensive construction, whereas, with my device no electricity is used and water which may be used to operate my device is not explosive.

For a more detailed explanation of the invention, reference is had to the following specification taken in connection with the annexed drawing, wherein I have shown a preferred embodiment, of the invention by way of example, and wherein the figure shows a side elevation partly in section of a preferred embodiment.

Referring to the drawing, the motor comprises a cylindrical housing 140 having an inlet 141 and an outlet bore 142 surrounded by a valve seat surface 143. A cylindrical guide member 144 is secured to the housing 140 by screws 145 and has a central bore 146 which receives the guide stem 147 of a tapered valve member 148. The guide member is counterbored at its ends, as indicated at 151 and 152 to provide a web 153 and a plurality of bores 154 pass through the web 153 to connect bores 151 and 152 and thus allow flow of fluid from chamber 140 when the valve is open. Any suitable form of valve may be employed.

A clevis 156 has its end 157 threaded into the valve 148 and locked in position by a lock nut 158. A sleeve 161 contains a grommet or bushing 162 of rubber or other suitable inherently resilient material which in turn has a sleeve 163 therein, and a bolt 164 passes through the clevis 156 and sleeve 163 to secure sleeve 161 thereto. A screwed rod 164 is suitably secured to sleeve 161, as by welding, and passes through a plate 166 and diaphragm 167 and is threaded into block 168, and a spacer tube 171 is interposed between block 161 and plate 166. Diaphragm 167, which may be made of any suitable flexible material, such as corrugated metal, sheet rubber, fabric reenforced rubber, synthetic rubber substitute, or the like, is clamped to the periphery of casing 140 by a ring 169 and bolts 170 to provide a working chamber on one side thereof.

A bar 172 is clamped to block 168 by a plate 173 and screws 174 and at its lower end carries a flexible spring strap 175 suitably secured thereto at one end 176 and bolted to the base 177 at its other end 178. The base 177 rests on vibratory members 179 of suitable construction, as for example, rubber. The bar 172 at its upper end

carries one end of a flexible spring strap 181, the other end of which is fastened to the bottom of a conveyor trough 182, as indicated at 183. The housing 140 is secured to the base 177 in any suitable manner. The front end of the conveyor trough or table 182 is supported for vibration, preferably by inclined bar or leaf springs in such manner as to provide vertical and horizontal components of movement of the trough. As shown, the base 177 has two inclined flanges 185 to which are secured two hexagonal bars 186 by nuts 187. The opposite ends of bars 186 are reduced and threaded to receive spacer nuts 188 upon which rest spring clips 189 held thereon by lock nuts 191. Horizontal bar or leaf springs 192 rest in the spring clips and are bifurcated at their ends. An extension plate 193 is suitably secured to the trough 182 and is clamped to the springs 192 at their middle by a bar 194 and bolts 195. Thus, the springs 192 support and guide the front end of the trough 182. The inlet line 141 may have a throttle valve 198 and a water pressure regulator 199 therein.

The period of vibration of the trough 182 at a given water pressure is determined partly by its mass and partly by the bias of springs 192. The period of vibration thus may be varied by adjusting nuts 188 and 191.

In operation, water enters the working chamber through inlet 141 and exerts a pressure on the diaphragm 167. The outward movement of diaphragm 167 tends to move valve 148 off of its seat, but the rubber grommet 162 yields and allows a certain movement of the diaphragm before this occurs. The area of diaphragm 167 is greater than the area of the valve 148. At the same time that fluid pressure is moving the diaphragm it is also acting to hold valve 148 on its seat until finally the movement of the diaphragm has deformed the rubber grommet 162 sufficient to cause the valve to lift off its seat, thus opening outlet 142 to relieve the pressure in the working chamber and allow the grommet to assume its normal shape. The flow of fluid through the valve opening reduces the pressure in the working chamber and by its dynamic action as it flows past the valve, tends to force the valve back to its seat and closes the valve. The closing of the valve allows the pressure in the working chamber to build up and again move the diaphragm, thus repeating the cycle of operation and causing the diaphragm to vibrate. The vibration of bar 172 secured to the diaphragm is transmitted through flexible strap 181 to the conveyor trough to cause it to vibrate. The other end of bar 172 is secured to the base 177 through flexible strap 175 so as to set up a certain vibration of the base which assists the conveying action. The flexible straps 175 and 181 guide the diaphragm for rectilinear movement and at the same time allow the trough to partake of the vertical and horizontal movements required for conveying action. The period of vibration is determined in part by the weight of the trough and the strength of the spring support therefor, and can be varied by varying these factors or the pressure or flow of the fluid supplied to the motor. Preferably I employ a water pressure regulator 199 of known construction to maintain a constant inlet supply pressure, and I control the operation of the motor by a throttle valve 198 on the inlet side.

What I claim as my invention and desire to secure by United States Letters Patent is:

1. In a vibrating apparatus, the combination of a base, a material-handling member to be vibrated, resilient means carried by the base to support said member for vibration, a spring strap connected at one end to the base, a second spring strap connected at one end to said member, a bar secured to both spring straps adjacent their free ends, and motor means to vibrate the bar and cause the member to vibrate through the second spring strap.

2. The structure of claim 1 characterized in that the bar and spring straps are secured to the base and the member to be vibrated in such manner as to place an initial load on the resilient means supporting said member.

3. The structure of claim 1 characterized in that the longitudinal axis of the bar is disposed substantially normal to the longitudinal axes of the spring straps and the latter are secured to the ends of the bar.

4. In a vibrating apparatus, the combination of a base, a conveyor, means to resiliently support the conveyor including a leaf-spring mounted with its longitudinal axis in a horizontal plane and disposed at right angles to the travel of the material on the conveyor and its transverse axis at an angle inclined to the conveyor, a pair of spring straps one connected to the base and the other connected to the conveyor with their free ends projecting outwardly in the same direction, a bar secured to both spring straps adjacent the free ends of the latter, and motor means to vibrate the bar and cause the conveyor to vibrate horizontally with a vertical component of motion.

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