June 17, 1930. J. P. VAN GELDER 1,764,861

APPARATUS FOR SEPARATING DUST OR FUME FROM AIR

Filed Nov. 15, 1926

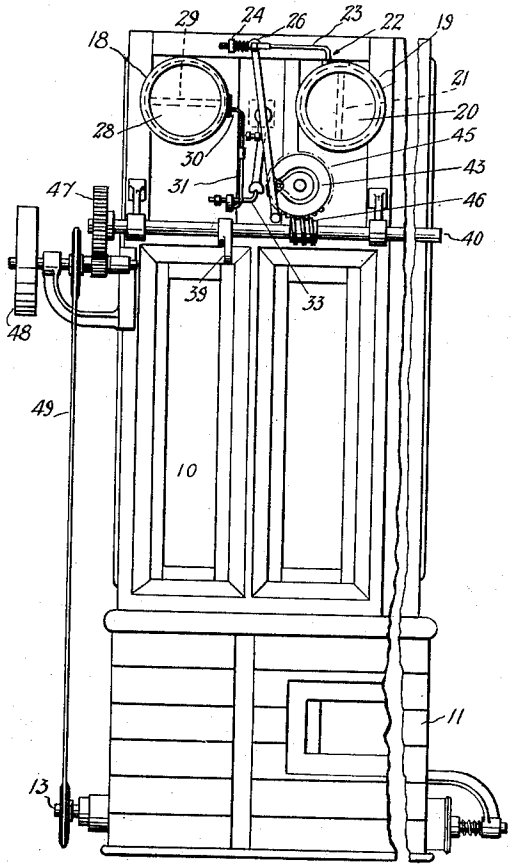


Fig. 1

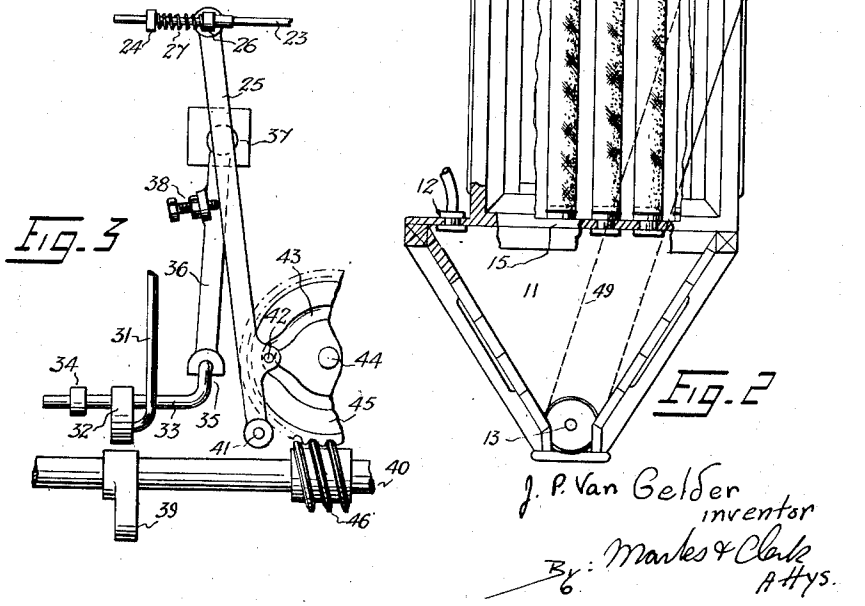


Fig. 2

Fig. 3

J. P. Van Gelder
inventor

By: Marks & Clark
Attys.

Patented June 17, 1930 1,764,861

UNITED STATES PATENT OFFICE

JOHANNES PIETER VAN GELDER, OF GRANVILLE, NEW SOUTH WALES, AUSTRALIA

APPARATUS FOR SEPARATING DUST OR FUME FROM AIR

Application filed November 15, 1926, Serial No. 148,566, and in Australia June 28, 1926.

It is common practice to effect the removal of accumulated dust or fume from fabric tube filters by mechanically shaking or rapping the suspension frames by which they are supported, and in certain cases provision is made for stopping the air flow during the shaking or rapping operation in order to allow settling of the dust which is thereby liberated in the casings. The tubes are subjected to considerable mechanical stress, particularly near their top ends, when they are thus forcibly shaken or vibrated, and their useful life is consequently abridged, and delays and inconveniences result from the closing down of sections of the apparatus to effect replacements.

The present invention consists in means whereby the tubes are discharged of accumulated dust by collapsing them automatically at intervals without shocking them or vibrating them. By these means the life of the tubes is conserved and stoppages to effect replacements become necessary only when the tubes have been used out, and have become too frail to maintain their integrity in service.

The collapsing of the tubes to liberate accumulated dust is effected by closing the suction orifice of the casing chamber for a few moments at intervals of anything from say one minute to thirty minutes and simultaneously opening and closing another orifice in it to atmosphere several times at short intervals. These actions are performed at prearranged times by constantly running mechanism. The tube clearing is therefore effected automatically, and when (as would almost invariably be the case in practice) two or more tube chambers are operated in parallel, without interrupting the continuity of the dust collecting operation. Dislodgement of the accumulation of dust hanging to the tube walls is effected in the relatively gentle shaking which is caused in the successive equalization and breaking of the vacuum condition in the casing which results from the repeated opening and closing of the atmospheric valve at short intervals whilst suction is not operating through the main air eduction pipe.

The effectiveness of this arrangement is so high as compared with the known arrangements which involve mechanical shaking or mechanical rapping, that fabric tube dust collectors are made practically usable for many purposes for which heretofore they were not usable. The capacity, rated in cubic feet of dusty air passed through in unit time, is increased very substantially, so that the cubic dimensions of the casings, and the number or size of the fabric tubes may be correspondingly reduced for a given demand.

In the accompanying drawing:—

Fig. 1 is a frontal elevation of portion of an apparatus for extracting dust from air;

Fig. 2 is a broken transverse sectional elevation through the machine; and

Fig. 3 is an enlarged fragmentary view of the valve operating mechanism.

The machine is constituted of a plurality of casings 10 usually constructed of wood and all built on a tunnel box 11 and all connected to a suction pipe through which air is educted. One or more entry vents 12 are provided in the upper part of the tunnel box 11, and a worm conveyor 13 is fitted in the bottom portion of it to move the dust which is deposited in it towards one end of it where provision is made for a cleaning door through which the accumulated dust may be removed. The inlets 12 are piped up to apartments or machines having a dusty atmosphere with the object of drawing the dusty air through the machine and extracting the dust from it. The floor 15 of the chambers 10 which separates these chambers from the tunnel box 11 below them is apertured and the apertures fitted with tube neck pieces to carry the bottom ends of the fabric bags 16. Usually, a

considerable number of these bags are hung in each chamber; they are tubular bags suspended at their upper ends by binding them around flanged discs 16× hung by tight springs 50 fixed on the underside of the top plate 17 of the chambers 10.

The upper part of each chamber 10 is fitted with two neck pieces 18 and 19. One of these neck pieces 19 is connected up to a main suction pipe (not shown). A condition of subatmospheric pressure is maintained in that pipe by means of an exhaust fan. In the neck piece 19 a butterfly valve 20 is fitted, carried on a spindle 21, and the spindle 21 is armed with a crank lever 22 by which the valve may be moved to open and close it. The operating movements are effected by a link 23, one end of which is pivotally connected to the lever 22; the other end of it slides in a bearing 24. The link 23 is moved by means of an arm 25 to which reciprocating motion is applied by the means hereinafter described. The top end of this arm is slotted, and a cross head 26 pinned on the link 23 carries an offset pin which engages the slotted end of the arm 25. Consequently, when the arm 25 is reciprocated, the link 23 is reciprocated, and the valve 20 is opened or closed accordingly. 27 is a helical spring sleeved over the link 23 between the cross head 26 and the stop 24.

The other neck piece 18 is also fitted with a butterfly valve 28 on a spindle 29, and this spindle is fitted with a crank arm 30 to which the top end of a link 31 is pivotally connected. The bottom end of this link is attached to a tappet 32 and the tappet is rotatably fixed on a slide bar 33. At one end of it this slide bar works freely through a fixed slide bearing 34. The other end of it is pivotally connected at 35 to the bottom end of a lever 36 which works on a fixed fulcrum 37. An adjustable screw 38 is carried in a lug on the lever 36 in the path of movement of the arm 25. When the arm 25 is moved to its extreme position it engages the screw end 38 and moves the lever 36, thereby moving the slide member 33 and bringing the tappet 32 into operative relation to the striker finger 39 on the shaft 40.

The rod 31 is thus reciprocated and the valve 28 is opened and closed repeatedly before the valve 20 is again opened by the cam 43.

The bottom end of the arm 25 is carried on a fixed fulcrum pivot 41, and above the pivot it is fitted with an offset roller pin 42 which works in a groove cam 43 which is cut in the side of a worm wheel 45. The worm wheel 45 meshes with a worm 46 which is keyed on the shaft 40; the shaft 40 extends the full length of the assembly of casings 10 and is driven at one end of it through gearing 47 from a belt pulley 48. The drive to the conveyor 13 is conveniently taken from the jack shaft which carries the pulley 48, by means of the belt or chain 49. The outer end of the neck 18 opens to atmosphere.

It is important to note that the fabric tubes 16 are held fixed at their ends and that their supports are not subjected to rapping or other vibration. Consequently there is no mechanical force applied to the tubes 16 which would operate to do them mechanical injury, as happens in dust extractor apparatus which includes shakers or strikers which are arranged to apply bodily movement or vibratory movement to the fabric tubes.

In operation, the valve 20 is normally open and the valve 28 closed and the shaft 40 is in continuous rotation. Once in each rotation of the wheel 45, the arm 25 is reciprocated by the groove cam 43 and the roller pin 42 on the arm 25, this movement being a gradual one. It is communicated through the link 23 and crank 22 to the valve 20 and that valve is brought slowly to the closed position. When the valve is thus closed, the casing 10 is no longer subjected to vacuum through the suction pipe line. As the tunnel 11 underlies two or more of the casings 10, each of which is separately fitted with valve mechanism as shown in Fig. 1, a condition of partial vacuum is maintained in the tunnel box 11 through one or more of the casings which for the time being are connected to the exhaust, notwithstanding that the exhaust valve 20 on one of the casings 10 is closed. The gearing is set so that the exhaust valves 20 on the several casings 10 which are associated with the one tunnel box 11 are not opened simultaneosly. Consequent upon the condition of partial vacuum existing in the tunnel box 11 and the breaking of the vacuum in the casing surrounding the tubes 16 on one of the casings by the closing of the exhaust valve 20 of that casing the tubes 16 in that casing slowly collapse and in this collapsing movement they suffer a very gentle agitation throughout their entire length; this agitation is not sufficient to dislodge all the accumulated dust within the tubes. During the time that the exhaust valve 20 is closed, that is for the short period whilst the cam 43 holds the offset pin 42 in the out position and so forces the arm 25 over, the lever 36 is moved through the contact of the arm 25 with the screw 38 and is held over so that it pushes the slider 33 and brings the tappet 32 into operative relation to the striker 39 on the shaft 40. In the rotation of the shaft 40 the tappet 32 is struck once in each rotation, and its movement is communicated through the link 31 to the air valve 28. The air valve 28 is thus fluttered, that is opened and closed rapidly. When it is open the indraft which breaks the suction within the casing 10 procures a full collapse of the tubes 16 therein. When it is closed, a sub-atmospheric condi-

tion is re-established in the casing 10 surrounding the tubes 16. As the pressure becomes equalized within the tubes and outside of them owing to the porosity of the tubes, the tubes are unconstrained and fall back into their normal tubular shape. The result is that whilst suction is cut off by the valve 20 the tubes 16 are several times gently "flapped" by collapsing them by means only of variation in atmospheric pressure and allowing them to distend again; these repeated movements of the tubes result in dislodgment of nearly the whole of the accumulated dust, which when liberated falls down through them into the tunnel box 11.

The clearing of the accumulated dust is effected periodically and automatically and in a manner which ensures maximum life to the tubes, inasmuch as they are not subjected to destructive mechanical stresses or rough treatment during the clearing operations.

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

1. In filter apparatus for extracting dust or fume from air, enclosed filter tubes, means for interrupting the air suction periodically and for repeatedly closing and breaking the atmospheric depression in the space surrounding the filter tubes while the suction is interrupted, said means comprising a valve for controlling the air suction connection, a valve for controlling a vent to atmosphere, a shaft, a striker on said shaft, a cam, a slow gear between said shaft and said cam, an arm link-connected to the valve in the outgoing air suction pipe and adapted to be reciprocated by said cam to operate said valve, a tappet link-connected to the atmospheric valve and adapted to be reciprocated by said striker to operate said atmospheric valve, and means operable by said arm for moving said tappet into register with said striker to repeatedly operate said atmospheric valve while the valve in the air suction pipe is held closed, and for moving said tappet out of register with said striker when the valve in the air suction pipe is held open.

2. In a tubular filter for extracting dust from air, a casing, fabric tubes arranged in spaced relation within the casing, the casing having a dusty air inlet below the tubes, a filtered air suction connection from the space in said casing which surrounds the tubes, a valve for controlling the air suction connection, means for closing said valve periodically, a vent to atmosphere from said casing space, a valve controlling said atmosphere vent, means for repeatedly opening and closing said vent valve at short intervals while the suction valve remains closed including a shaft, a striker on said shaft, a cam, a slow gear between said shaft and said cam, an arm connected to the valve controlling the suction connection and reciprocated by said cam to operate said valve, a tappet connected to the atmospheric valve and reciprocated by said striker to operate said atmospheric valve, and means operable by said arm for moving said tappet into register with said striker to repeatedly operate said atmospheric valve while the valve in the air suction connection is held closed and for moving said tappet out of register with said striker when the valve in said air suction connection is held open.

In testimony whereof I affix my signature.

JOHANNES PIETER VAN GELDER.