July 4, 1950 W. W. McNAMARA 2,513,420

DRIVE MECHANISM FOR CLEANING-AIR TUBES IN SELF-CLEANING FILTERS

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Fig. 1.

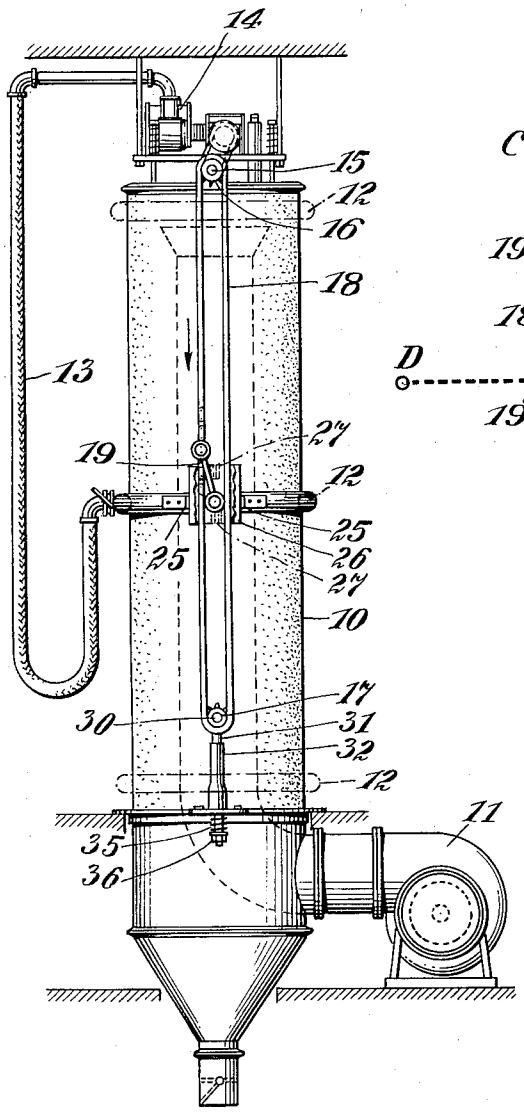


Fig. 2.

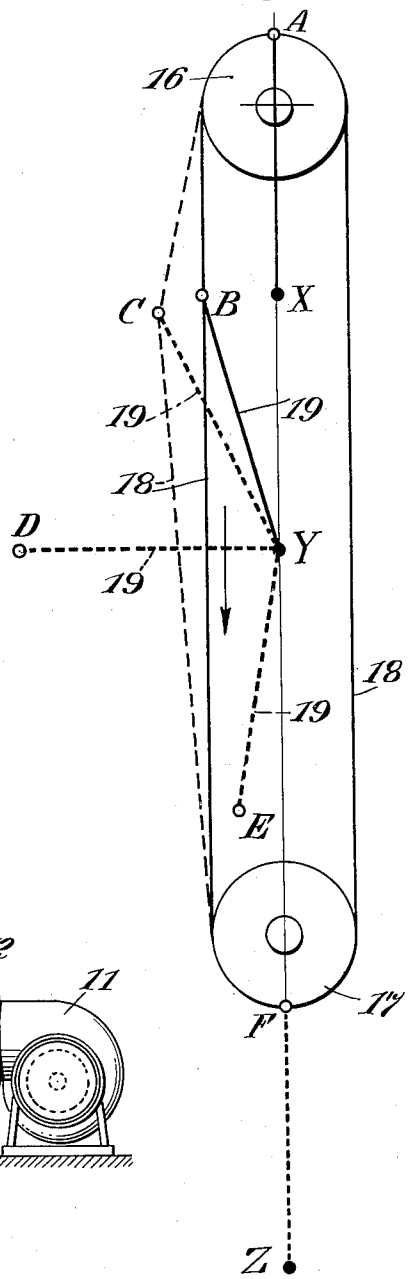
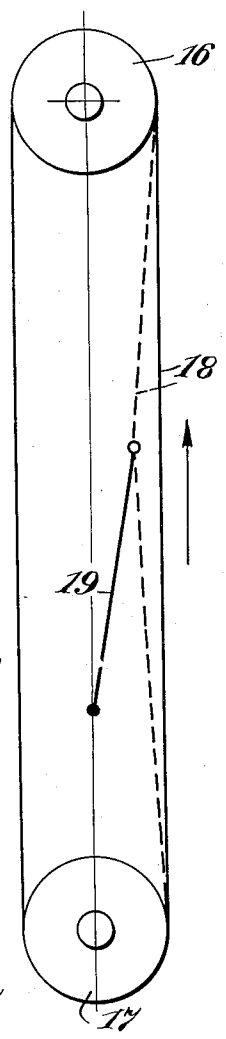


Fig. 3.



INVENTOR.
William W. McNamara
BY Ridsdale Ellis
his ATTORNEY

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Fig. 4.

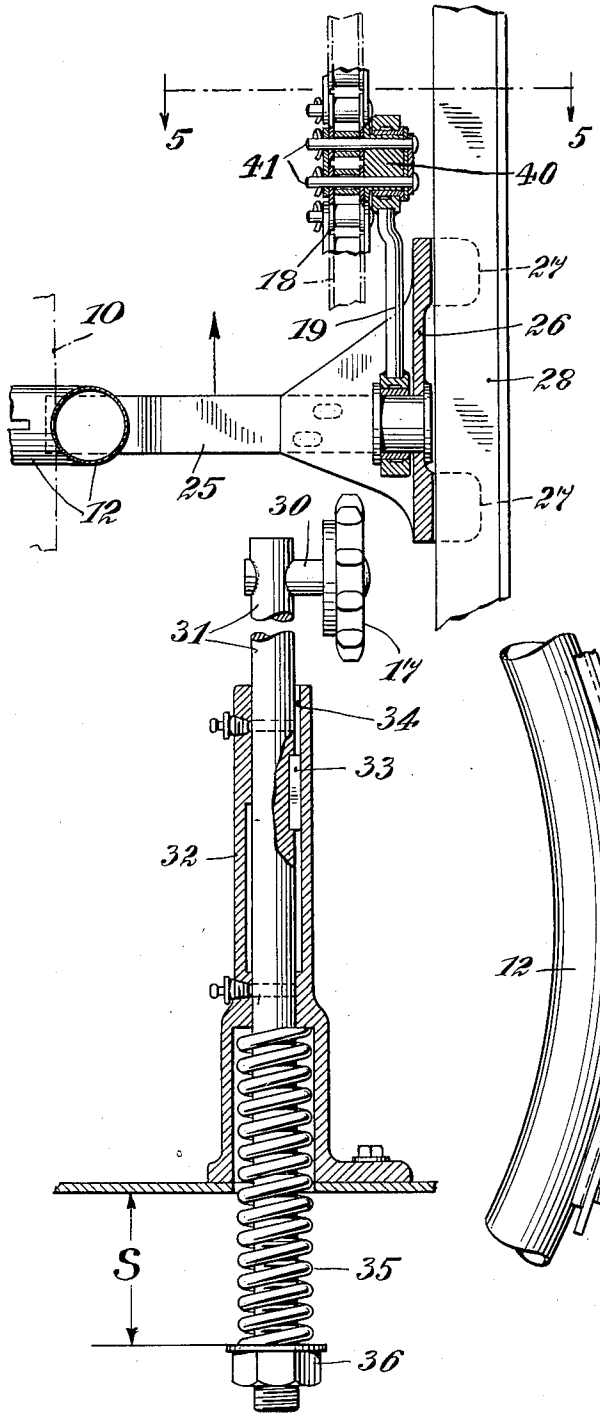
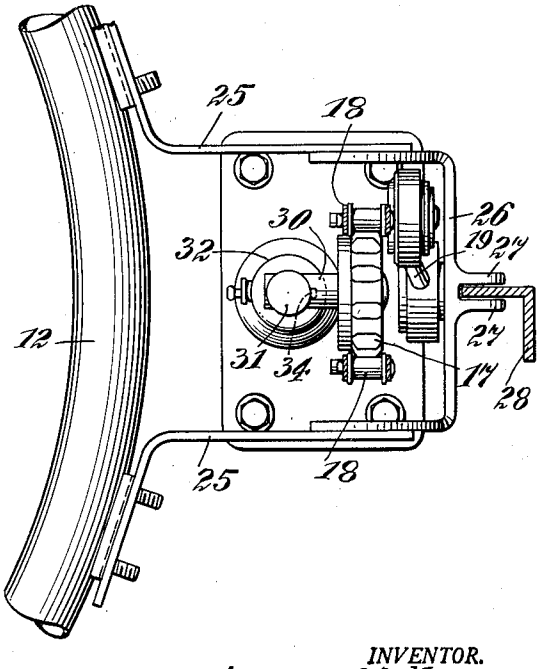


Fig. 5.



INVENTOR.
William W. McNamara
BY Ridsdale Ellis
his ATTORNEY

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DRIVE MECHANISM FOR CLEANING-AIR TUBES IN SELF-CLEANING FILTERS

William W. McNamara, Union, N. J., assignor to Pulverizing Machinery Company, Summit, N. J., a corporation of New Jersey

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6 Claims. (Cl. 183—61)

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This invention relates to drive mechanism for cleaning-air tubes in self-cleaning filters of the type in which the air to be filtered passes outwardly through a layer of suitable material, usually felt. Usually the filtering material is cylindrical in form, in which case the cleaning-air tube is ring-shaped. For convenience the invention will be described as applied to a cylindrical filter with a ring-shaped cleaning-air tube, usually termed a blow-ring. It is not intended thereby to restrict the scope of the invention to filters of that particular construction.

The blow-ring is slotted or perforated on its inner side where it contacts the tube so that by supplying compressed air to the ring such air can be forced inwardly through the felt from the outside to clean the felt. To prevent lateral escape of the cleaning air, the blow-ring is made of slightly smaller diameter than the filter cylinder so that, due to the internal air pressure in the cylinder, the filter material is pressed outwardly against the blow-ring.

The filter cylinder is vertically arranged with a hopper attached to its lower end for the collection of the separated dust. The blow-ring is reciprocated up and down the outside of the filter cylinder to keep the latter permeable to air. Chains have been used as a drive for reciprocating the ring. These chains are endless and pass over sprockets top and bottom. One link of the chain has a pin or bearing member extending laterally from it and to the free end of the pin is pivotally attached one end of a connecting member. The other end of this member is secured to the ring or a frame carrying the ring. One of the sprockets is driven continuously and consequently the pin connected to the chain moves up and down. The thrust of the chain on the blow-ring is not in line with the chain, either in the plane of the chain as a whole or at right angles thereto.

The connecting member is attached to the blow-ring at a point horizontally about midway between the two flights of the chain between the sprockets. Consequently, the member, except at its top and bottom positions, is at an acute angle to the chain. The result is that when the member is pushing the ring downwards, there is a tendency for the member to push the chain laterally outwards and the ring laterally in the other direction. By providing vertical guides for the ring, lateral movement of the latter can be avoided. The degree to which the chain moves laterally depends on its tension so that the greater its tension, the less it is deflected.

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The thrust of the chain on the blow-ring is not in line with the chain in a direction at right angles to the plane of the chain for the reason that the chain exerts pressure on the connecting member through a pin extending laterally from one of the links of the chain. There is, accordingly, an unbalanced force on the pin and the link to which it is attached tending to cant such link and those adjacent thereto. Such canting results in wearing the teeth on the sprockets so that they become sharp-pointed, a condition commonly referred to as "shark's teeth". The greater the tension on the driving chain, the less the tendency of the connecting member to cant the links of the driving chain sideways adjacent the point at which the connecting member is attached thereto.

Another method of correcting this tendency is based on the fact that, where the ring runs up and down between guides, the lower end of the connecting member, due to its connection to the ring, is restrained to travel in a substantially fixed vertical line spaced a fairly constant distance from the plane of the chain. If the upper end of the connecting member is pivotally connected to the pin attached to the chain so that such end cannot move axially with respect to such pin, the upper end of the connecting member is restrained by the chain to travel in a plane parallel to that of the chain. Where the ring is free to move laterally to a considerable degree, the connecting member can be held vertical by providing a broad bearing surface between the pin on the ring and the lower end of the connecting member.

With both the upper end of the connecting member and the chain moving in parallel planes, the only possible movement is a rocking one between the pin and the chain link to which it is attached with respect to the upper end of the member in a plane perpendicular to the plane of the chain. This rocking movement may be prevented by providing a wide bearing surface between the pin or a part carried thereby and the upper end of the connecting member. By such means the pin is held perpendicular to the plane of the chain so that there is no canting of the chain link to which the pin is attached. Under such conditions the wear on the sprockets and chain is evenly distributed.

Best practice is to use both methods, i. e., suitable tension in the chain and a broad bearing surface on the member which connects the connecting member to the chain.

I have found that the requisite tension can

best be obtained by a spring mounting for the idler sprockets. If the top sprocket is the driven one, then it will be the lower sprocket that is spring-mounted.

With a rigid connecting member the length of stroke of the ring must equal the distance from the top of the upper sprocket to the bottom of the lower sprocket. Consequently, if the ring at the top of its upstroke is below the upper sprocket, at the bottom of its downstroke the ring will be below the lower sprocket. This means that the connecting member must be connected to the ring in such a manner that the latter can move up and down past the lower sprocket. Conveniently this is accomplished by mounting the lower sprocket on a pedestal and attaching to the ring a U-shaped frame, the arms of which are attached to the ring and are spaced apart a greater distance than the diameter of the sprocket, so that the frame surrounds the chain as the ring moves up and down. The connecting member is secured to the middle of this U-shaped frame.

One form of construction is illustrated, by way of example, in the accompanying drawings, wherein:

Fig. 1 is a side elevation of a self-cleaning filter embodying the present improvements;

Figs. 2 and 3 are diagrammatic views showing the effect of slackness in the driving chain on the down and up strokes, respectively;

Fig. 4 is a side elevation on an enlarged scale of the blow-ring bracket, connecting member, lower sprocket, and adjacent parts; and

Fig. 5 is a section on the line 5—5 of Fig. 4.

The filter comprises a felt tube 10 into which dust-laden air is forced by a blower 11. Surrounding the tube is a cleaning-air ring 12 supplied with compressed air by a flexible pipe 13 and compressor 14. Across the top of the filter is a shaft 15 at each end of which is a sprocket 16. This shaft is driven by the same motor which drives the compressor 14. Below each sprocket 16 is an idler sprocket 17 and connecting the upper and lower sprockets are endless chains 18. Rigid connecting members 19 connect the chains 18 to the ring 12.

Fig. 2 shows the various positions of the connecting member under various conditions. AX represents the position of the member at the top of the stroke, A being the point of attachment of the member to the chain and X the point of attachment to the ring. If the chain were perfectly taut, then on the downstroke the member would assume the position BY. As, however, there is always some slack or give in the chain, the member will be in a position such as CY. If the chain is slack enough to allow the member to move into position DY, then the member will swing around to EY when it will pull instead of push. As the ring moves downward, it finally reaches the point Z or the length of the link FZ below the bottom of the lower sprocket.

It will be noted that X, Y and Z are all along the same straight line. That is due to the fact that the ring or the frame which carries it runs in vertical guides which prevent the ring being pushed laterally by the thrust of the member 19.

On the upstroke the connecting member is pulling, not pushing, so that the chain is pulled inwards to the dotted line position, instead of being pushed outwards, as on the downstroke.

As shown in Figs. 4 and 5, the blow-ring or cleaning-air ring has attached to each side a

U-shaped bracket comprising side members 25 and a central part 26 which serves as a guide shoe. Lugs 27 engage the two sides of a guide rail 28. The lower sprocket 17 is mounted on a pedestal and the side members 25 are spaced apart more widely than the diameter of the sprockets and the two parts of the chain 18 so that the ring can move from position X to position Z (Fig. 2).

The lower sprocket 17 is mounted on a stub shaft 30 extending laterally from the top of a support consisting of rod 31 slidably mounted in a vertical tubular pedestal 32. On this rod is a key 33 which engages a keyway 34 to prevent the rod turning. The bore of the lower part of the pedestal is enlarged to receive the upper end of a spring 35. The lower end of the spring bears against a nut 36. In assembling the drive mechanism, the chain is put around the sprockets and nut 36 is turned first until the slack is taken out of the chain 18 and then until the spring is under predetermined tension, as indicated by the distance S. It will be noted that so long as S is three inches or other predetermined value, the tension in the chain 18 will have the desired value independently of the absolute position of the sprocket 17.

In one installation the filter may be of one height and of a different height in another. This involves differences in chain lengths, etc. Deviations from standard are taken care of by the fact that turning the nut 36 takes up any slack in the chain due to constructional variations before any tension is placed on the chain by the compression of the spring 35. Comparison of Figs. 2 and 3 shows that, when pushing, the angle the connecting member makes with the vertical is increased, while, when pulling, that angle is decreased. It is advantageous, therefore, to push down and pull up instead of pull down and push up, since the weight of the ring aids downward, but hinders upward, movement.

To avoid too great an angle between the connecting member and the vertical, the length of the connecting member should not be much less than twice the diameter of the sprockets. Also the tension in the chain should be so proportioned to the frictional drag of the ring on the felt tube and the weight of the ring that the maximum lateral deflection of the driving chain from the vertical is not much more than one-quarter of the length of the connecting member on either the up or down stroke.

I have found that for a filter bag 7 feet long a satisfactory tension for the spring 35 is around 200 lbs. For longer bags a higher tension is desirable, unless the connecting member is increased in length proportionately. If that is not done, the connecting member may pass from position YC to YD and then to YE.

In the upper ends of the rigid connecting members 19 are journalled bearing members 40 each secured to the chain by two pins 41, as shown in Fig. 4. The mutual bearing surfaces of said bearing members and said connecting members are wide enough to prevent relative canting of the two members.

I claim:

1. A self-cleaning air filter, comprising a filter frame, a vertical filter layer carried by such frame, a cleaning-air tube pressed against said filter layer, a pair of sprockets on either side of said filter layer, one vertically over the other, an endless chain passing around each pair of sprockets, means for driving one of each pair of

sprockets continuously in the same direction, a slidable support for the idle sprocket of each pair, a spring acting on said support to place the chain under tension, and rigid connecting members between the chains and the tube, whereby as the chains move around said sprockets they reciprocate said tube up and down the filter layer.

2. A self-cleaning air filter as in claim 1, in which the connecting members have a length not less than twice the diameter of the sprockets and the tension in the chain is such that the maximum lateral deflection of the chains during operation of the filter is not more than one-quarter of the length of the connecting members.

3. A self-cleaning air filter, comprising a filter frame, a vertical filter layer carried by such frame, a cleaning-air tube pressed against said filter layer, a pair of sprockets on either side of said filter layer, one vertically over the other, one sprocket being driven continuously in the same direction and the other being idle, an endless chain passing around each pair of sprockets, vertical guides for the cleaning-air tube adapted to restrain lateral movement of the latter, a pair of rigid connecting members each pivotally connected at one end to the cleaning-air tube and at the other end to a link of one of said chains whereby as the chains move around said sprockets they reciprocate the said cleaning-air tube up and down the filter layer, a slidable support for the idle sprocket of each pair permitting the distance between the sprockets to be varied, and a spring between the filter frame and said slidable support to place the chain under tension.

4. A self-cleaning air filter, comprising a filter frame, a vertical filter layer carried by such frame, a cleaning-air tube pressed against said filter layer, a pair of sprockets on either side of said filter layer, one vertically over the other, an endless chain passing around each pair of sprockets, means for driving one of each pair of sprockets continuously in the same direction, and rigid connecting members each pivotally connected at one end to the tube, bearing members each secured to a link of one of said chains passing through the other end of said connecting member whereby as the chains move around said sprockets they reciprocate the said tube up and down the filter layer, the mutual bearing surfaces of said bearing members and said connecting members being wide to prevent relative canting of the two members.

5. A filter as in claim 4, in which the chain is of the roller type and the bearing member is secured thereto by two pins passing through both the bearing member and adjacent rollers of the chain.

6. A self-cleaning air filter, comprising a filter frame, a vertical filter layer carried by such frame, a cleaning-air tube pressed against said filter layer, a pair of sprockets on either side of said filter layer, one vertically over the other, an endless chain passing around each pair of sprockets, means for driving one of each pair of sprockets continuously in the same direction, a pair of hollow pedestals on said filter frame, each having a rod slidably mounted in its bore and projecting therefrom at both ends, each rod having one of the idle sprockets mounted on one end thereof, a spring surrounding each of said rods bearing at one end on the pedestal and at the other end on a nut on the end of said rod opposite the end carrying the idle sprocket, whereby turning said nut first takes up the slack in the chain and then compresses the spring and thereby places the chain under tension, and rigid connecting members between the chains and the tube whereby as the chains move around said sprockets they reciprocate said tube up and down the filter layer.

WILLIAM W. McNAMARA.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
488,698	Payne	Dec. 27, 1892
2,185,079	Hall	Dec. 26, 1939
2,476,942	Arnold	July 19, 1949

FOREIGN PATENTS

Number	Country	Date
255,876	Germany	Jan. 23, 1913