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2,907,404

ADJUSTABLE SIEVES

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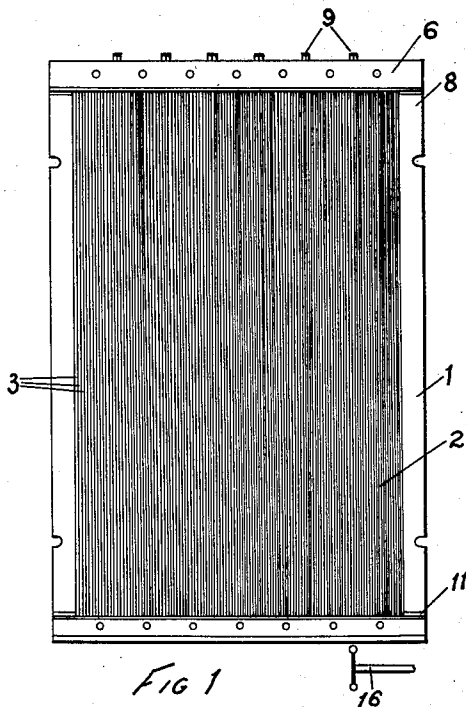


FIG 1

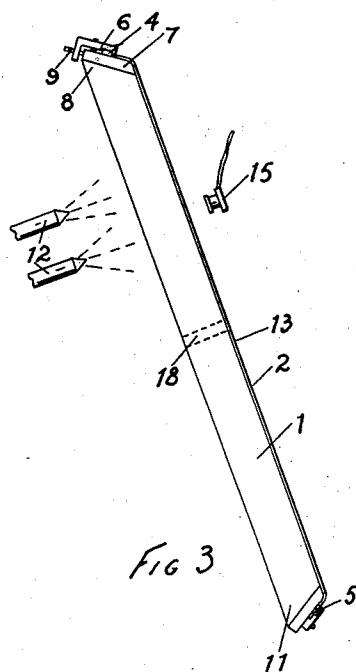


FIG 3

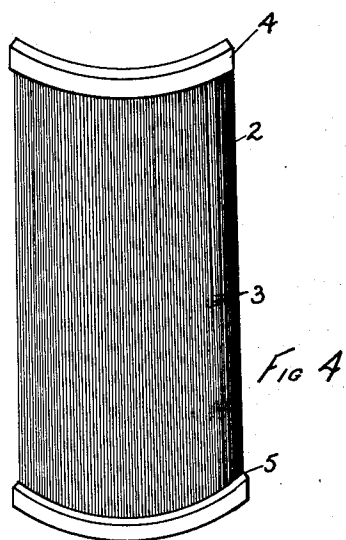


FIG 4

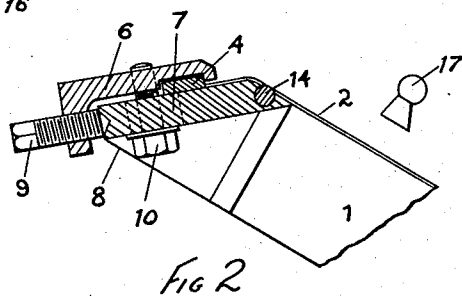


FIG 2

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ADJUSTABLE SIEVES

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6 Claims. (Cl. 183—9)

This invention relates to screens for size separation of solid particles or the removal of discrete particles of small size carried in a gaseous current. It is particularly applicable to the screening of particles from air and is a continuation in part of my co-pending patent application 517,202, now abandoned.

It is the object of this invention to provide an efficient vibrating screen consisting of straight flexible filaments assembled in a frame side by side and parallel to one another under uniform tension and uniform distances apart with the spacing between the wires being a maximum of 50 microns.

In order to achieve these objects it is essential that the screen filaments be smooth and of uniform cross section, that they be unsupported along their lengths for a distance at least nine inches and that they be assembled under a high tension for example, between six and fifty tons per square inch in the case of metal wires.

In practice to achieve maximum uniformity of spacing the screens are made of straight high tensile metal wires assembled side by side and in substantial contact throughout their length, by which term is meant that the wires are assembled as closely in contact throughout their full lengths as is practicable within the limitations imposed by minute variations in diameter of even the highest grade wires and also variations of the wire diameters due to temperature changes.

A screen assembled in this manner will be substantially impervious to liquids and offer excessive resistance to the passage of gases unless the wires are individually vibrating so that the effectiveness of screening or in other words the effective widths of the spaces between the wires is for practical purposes determined solely by the amplitude of vibration. For any set of operating conditions, including velocity of the fluid stream, this is determined by the tension on the wires which is preferably made adjustable.

The invention is illustrated diagrammatically in the accompanying drawings in which:

Fig. 1 is a front elevation of the screen,

Fig. 2 is a sectional side elevation of one end of the screen showing the method of tensioning the same.

Fig. 3 is a side elevation of the screen, and

Fig. 4 illustrates a modification.

As shown in Figures 1, 2 and 3 the screen consists of a strong and rigid frame 1 in which the parallel filaments 2 are mounted. The filaments may for example consist of heat and chemical resistant nickelchrome alloy wires 3 of about 24 gauge, spaced in substantial contact with each other and with each wire 3 under a tension of about 13 pounds. Generally the thinner the wires 3 the greater will be the efficiency of the screen, but the thinness of the wires 3 is limited by practical manufacturing considerations, particularly as it is desirable that the ends of the wires 3 be connected together by brazing them to the bars 4, 5, to ensure that in use there is no relative lateral displacement of the wires 3 and that the tension in all the

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wires is substantially the same. Tension is applied to the wires 3 in any suitable manner such as by a fixed tensioning means or the adjustable tensioning device illustrated and comprising the tensioning bar 6 which is slotted to engage bar 4 and is pulled along the inclined surface 7 at one end 8 of frame 1 by means of the jack screws 9. When the wires 3 are at the required tension the tensioning bar 6 is clamped in position by the bolts 10. A similar arrangement may be used at the end 11 of frame 1 but generally the bar 5 is merely clamped in a fixed position at this end.

In the modification shown in Fig. 4 the bars 4, 5, are curved so that the wires 3 lie on a cylindrical surface and are parallel to the axis of said surface. This construction may be used for building up a cylindrical screen but with such a structure the vibration of the wires towards the axis of the cylindrical structure will be very limited.

It will be seen from the drawings, especially Figs. 1 and 4, that the plurality of parallel filaments constituting the screen define a substantially continuous surface from one end to the other and from one side to the other.

In use the filaments 2 in the screens are vibrated normally by the flow of fluid onto them assisted where necessary by electrical, or mechanical or sonic means, the screen becoming effectively coarser the greater the amplitude of vibration. In any case under normal screening or classifying conditions the screen due to its vibration will allow the passage of particles of greater diameter than the normal width of the spaces between the filaments 2 when the screen is not vibrating.

Other factors being equal the amplitude of vibration will decrease with increase in the tension of the filaments 2, but in practice the tension on the filaments 2 must be adjusted to suit requirements when the screen has been installed, since the efficiency of screening will depend on other factors such as temperature, humidity and the effectiveness of the means causing vibration of the screen.

Under wet screening of particles in a gaseous stream the tension applied to the filaments is not so critical. For example, in screening dust laden air, water sprays 12 may be directed onto the upstream side of the screen as shown in Figure 3. Due to the small width of the spaces between the filaments 2 and the surface tension of the water the latter appears largely to fill the spaces between the filaments, and entrap the dust particles. The water then flows in a turbulent manner down the downstream side 13 of the screen with the entrapped dust particles and into a reservoir forming part of an air duct in which the screen is installed leaving the air substantially free of both dust and water particles.

Material which does not pass the screen falls on the upstream side thereof but it is a peculiar and improperly understood feature of the screens in accordance with this invention and clearly a contributory factor to the efficiency of the screens that under both dry and wet screening condition that a very substantial collection of particles occurs on both the upstream and downstream side of the screen. For example under wet screening conditions generally about two thirds and in any case the major proportion of particles collected are discharged on the downstream side of the screen. Under dry screening conditions generally about one third and in any case a minor proportion of the particles collected are discharged on the downstream side of the screen. A further unusual feature of the screen is that under dry screening conditions it effects an aggregation of the particles passing through it the aggregates so formed being many times larger than the maximum size of particle in the gaseous stream being filtered.

For example efficient screening of particles, under both wet and dry conditions, of less than one micron can be

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effected even though the width of the spaces between the filaments is about ten microns such spacing often occurring due to imperfections in the wires even though they are intended to be placed in substantial contact.

Said screens are also found to be extremely effective under wet screening conditions in effecting wetting of small particles carried in a gas stream.

These phenomena are directly related to the effective spacing between the wires and are found to occur when the spacing between the unvibrated wires is less than 50 microns. Uniformity of spacing is essential otherwise there will be lack of uniformity of screening over the whole area of the screen and to achieve such uniformity in practice in the most convenient manner the wires are placed in substantial contact throughout their full length. For the same reasons uniformity of tensioning is essential and in the case of steel wires should be between 6 and 50 tons per square inch of cross section of the wires.

A spacer such as the threaded rod 14 illustrated in Fig. 2 may be satisfactorily used as a spacer the threads being positioned between adjacent filaments 2.

It has been found that screens having an area of six square feet may be efficiently operated with gaseous streams at rates varying between 750 and 2,500 cubic feet per minute under wet conditions and 300 to 1,250 cubic feet per minute under dry conditions. Normal rates are 1,000 and 500 cubic feet per minute under wet and dry conditions respectively.

Where necessary the filaments 2 may be made of ferromagnetic material and vibrated by an electro-magnet 15 as shown in Figure 3, or by a mechanical vibrator 16 as illustrated in Figure 1. The screen and frame may of course be vibrated as a whole by an electro-magnetically operated vibrator of any normal type. Alternatively the filaments 2 may be made through resonance, to vibrate in sympathy with sound waves produced by a sonic generator 17 as illustrated in Figure 2.

With any form of vibrating mechanism the amplitude of vibration of the filaments may further be controlled by attaching one or more light bridges 18 across and in contact with them as indicated in Fig. 3.

To enable effective vibration to occur however, the wires must be longitudinally unsupported by bridges or other means over a distance of at least nine inches since supporting the wires at any lesser distance apart will result in excessive pressure drop through the screen.

It will be seen, with a screen according to this invention, that it is possible basically by variation of tension to obtain the minute variations in the effective widths of the spaces between the filaments which are necessary when dealing with particles of very small size. It will also be seen that the screen is self cleaning or may be easily cleaned by brushing, or by a flow of a gas or liquid therethrough.

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While the invention has been described as applied to the screening of particles from a gaseous stream using metal wire screens such wires may under certain conditions be replaced by filaments made of materials other than metal, and the screens used for removal of solid particles from a liquid stream.

What I claim as new and desire to secure by Letters Patent is:

1. A filtering screen comprising a pair of supports maintained in spaced apart relationship, a plurality of filaments assembled under tension between said supports, said filaments being positioned parallel to one another in a single layer and extending in the same direction, said filaments being uniformly very closely spaced together not more than about 50 microns apart and defining a substantially continuous surface, said screen being effective to remove very small particles of less than about 50 micron size from a fluid current, and means for adjusting the tension in said filaments.

2. A filtering screen as in claim 1 including means for flowing a liquid onto said filaments.

3. A screen as in claim 1 wherein said substantially continuous surface defined by said filaments is flat.

4. A screen as claimed in claim 1 wherein all of the filaments are connected to said supports only adjacent the filament ends.

5. A screen as in claim 1 including means associated therewith for vibrating the filaments.

6. A screen as in claim 1 wherein the means for adjusting tension comprises a movable member connected to one end of said filaments and at least two threaded members in threadwise engagement with said movable member at spaced apart points and bearing against one of said supports, rotation of said threaded members being adapted to vary the position of said movable member relative to said support to change the tension in said filaments.

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