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AIR FILTER

Filed Nov. 4, 1935

Fig. 1.

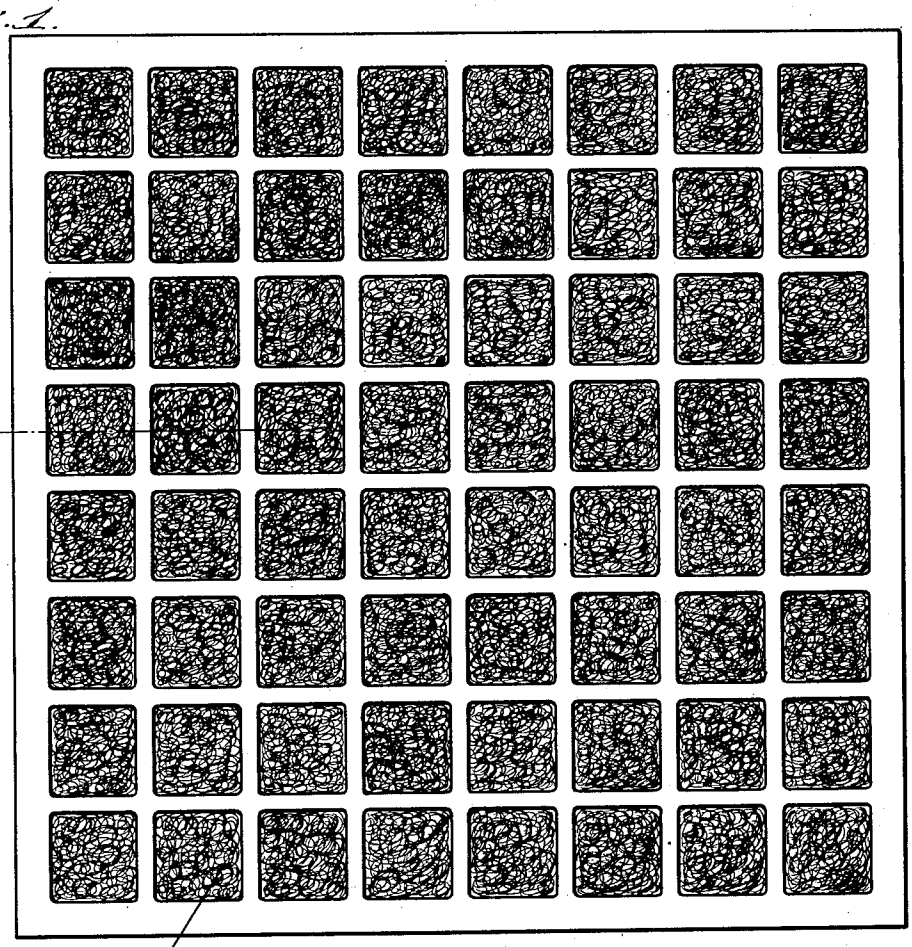
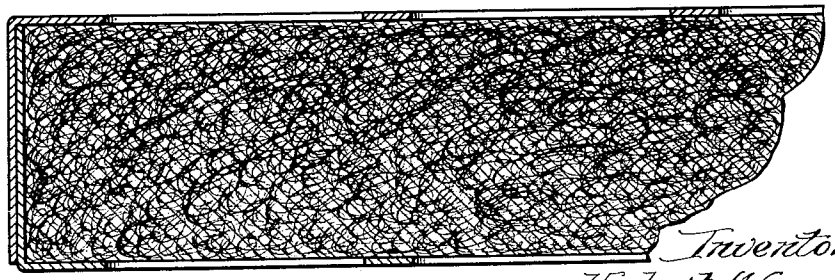


Fig. 2.



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AIR FILTER

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6 Claims. (Cl. 183—45)

This invention relates to an air-filter, and particularly to an air-filter pad of the impingement type having as its base curled animal fibres.

Air filters are generally divided into three classes, the strainer type, impingement type and inertia type. The first two types require the use of a filtering medium. In the strainer type the interstices of the filter are smaller than the particles to be filtered, whereas in the impingement type the interstices in the filter are much larger than the particles to be removed, and filtering depends upon impingement. Air filters of this type have been heretofore produced, the most common material for them being steel wool, although spun glass has also been used. Both of these materials are subject to breakage and the steel is subject to rust, whereas in accordance with the present invention a relatively light, inexpensive filter is produced which is not subject to rusting or breaking.

The invention is illustrated in the drawing, in which Fig. 1 illustrates a plan view of a hog hair filter, and Fig. 2 is a broken vertical section through the filter.

The filter pad may be produced from any animal fibre long enough to permit curling, and stiff cnough under the conditions and surroundings in the pad to be self-sustaining. Suitable hairs are horse mane or tail hair, cattle tail hair, hog hair and the like. Hog hair is preferred on account of its inexpensiveness.

In producing the filter, the hair is curled in the customary fashion. In the case of hog hair this is normally done by incorporating a small amount, say 10%, of longer hair, such as cattle tail hair, horse tail hair, or horse's mane hair, in order to assist in curling the hog hair properly. The curling may be accomplished, however, by curling the hog hair in the absence of long hair.

Minor proportions of uncurled hair may likewise be incorporated, the amount preferably being kept below 25% by weight of the hair. This uncurled hair may be either intermixed with the curled hair or may be evenly distributed on one face of the filter, for example the air exit face. In some instances it may be preferable to provide a slight layer of a strainer filter on the air exit face to cooperate with the impingement type pad.

The curled hair is then formed into a pad of the desired dimensions, care being taken to fluff the hair in packing to provide a pad of low density. For example a pad of the ordinary throw-away size, that is to fit a frame 20 x 20 x 2", will normally have only 7–8 oz. of hair in the case of hog hair. These density limits vary in accordance with the length of the hair and with the thickness of the pad. For example, a filter pad 1" thick will preferably be made with a higher density than a 2" thick pad. For hair of the thickness of hog hair, however, the mean density should be within the range of ½ oz. to about 1½ oz. of hair per 100 cubic inches of pad, and preferably from ¾ to 1¼ oz. A filter pad 1" thick is preferably from 1⅛ oz. to 1¼ oz. of hair per 100 cubic inches. With unusually short hog hair the higher ranges of densities may be necessary, preferably being above 1 oz. per 100 cubic inches.

The loosely formed pad is then treated with an adhesive to bind the outer hairs permanently together. This operation is preferably carried out by spraying the formed pad with an adhesive such as casein glue, or other substantially oil-proof adhesive. Animal glue, treated with potassium bichromate and formaldehyde, may be substituted for the casein glue. In some instances it may be desirable to spray the glued surface with ammonia-preserved latex to give it more flexibility and greater strength.

When thus surface-sprayed, the hairs on the outside of the pad to a depth in the order of an eighth of an inch within the pad are coated with the adhesive by which they are quite firmly united at their mutual intersections. The adhesive coated hairs thus joined together form, as it were, a highly reticulated shell which holds the interlocked but uncoated interior hairs in proper position.

The hairs are then coated with a tacky material or dust collector. One type of tacky material is made up of approximately four parts paraffin oil, one part of low melting point water-emulsified asphalt containing approximately 65% asphalt and ½ part vaseline. A typical melt point for the asphalt is of the order of 105° F. Dry asphalt may be used if desired but must generally be dissolved in the oil with heat. Oil soluble vegetable and animal pitches, and industrial pitches resulting from distillation processes, such as tars, may replace the asphalt. The vaseline gives the coating a body so that more coating material will adhere to the hairs. The asphalt supplies a greater degree of tackiness, and the oil assists in spreading the tacky material through any adsorbed dust. In many instances it is preferred to omit the asphalt.

This dust-collecting material may be sprayed on with a spray held against the pad, or the pad may be dipped in a solution of the mixture and a volatile solvent such as gasoline or carbon tetra-

chloride, the pad drained and the solvent evaporated.

It is preferred to apply the dust-catching medium from the air exit side of the filter with the result that there is considerable oil at the air exit side and less or none at the air intake side. This prevents the filter from clogging as soon as would otherwise be the case and provides a more even distribution of dust over the filter. Likewise, it permits shaking out dust from the air intake side where the oil is in small amount or lacking. In some instances the dust-catching medium is applied only ⅔ or ¾ of the way through the pad.

The weight of the adhesive applied is usually about 1½ oz. for a 20 x 20 x 2" pad and the oily material would generally be about 4 oz.

The present filter has been found to be extremely efficacious in the removal of dust, to the extent that window filters may be provided for home use to operate under home drafts without the use of a fan, and still be efficient enough to provide hay fever protection. For this purpose pads 1" thick are generally preferred.

In some instances it is preferred to make the air exit face relatively dense, and the air entry face relatively open. For example, in a 20 x 20 x 2" filter pad having an average density of one ounce per hundred cubic inches, the hair may be distributed so that five ounces of it is placed in about ¾ of an inch of the pad in depth and the remaining three ounces is spread out more thinly to make up one and one-quarter inch. The relatively open portion of the pad would then be used as the air intake face.

The amount of hair desirable for the filter is such that good efficiency will be obtained. For example, it is usually desirable to filter 95 to 98% of the dust from the air, and at the same time excessive resistance must be avoided. Normally, a filter pad 20" x 20" should have a resistance not substantially exceeding .08" water gauge when handling 300 cu. ft. of air per minute per square foot of filter area. With hair of the size and weight of hog hair, an average density for the pad of less than one-half ounce would generally cut down the efficiency below the desirable point, in pads thin enough for the ordinary type filter. On the other hand, pads having an average density in excess of about one and one-half ounces per hundred cubic inches may have too high a resistance for pads as thick as two inches. With hairs that are finer or less dense than hog hair, the preferred densities are likewise lowered, although precisely not in proportion. The term "cross-sectionally uniform" as used in the claims refers to a longitudinal section. As already explained, a transverse section from front to back of the pad need not be uniform.

Pads made from curled hair in accordance with this invention are self-sustaining in that they have sufficient resilience to support their own weight, and do not sag so as to leave openings between the edges of the pad and the frame in which they are normally confined. Furthermore, pads may be produced in accordance with this invention which will maintain themselves without the aid of a frame or box, such as are required for other filters of the impingement type. The pads may be made in any shape, whether straight or curved, and of any reasonable size, for example, 6' x 10'.

This invention is a continuation-in-part of our co-pending application, Serial No. 750,580, filed October 29, 1934.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible, in view of the prior art.

What we regard as new and desire to secure by Letters Patent is:

1. A substantially self-sustaining, cross-sectionally uniform air filter pad of the impingement type, having interstices of much greater size than dust particles, predominantly comprising curled animal hair of substantial length, the hairs being so loosely arranged as to have a mean density of the order of one-half to one and one-half ounces per hundred cubic inches of air filter pad for hair of the thickness and density of hog hair, and a tacky dust collecting medium upon hairs therein.

2. A pad as set forth in claim 1, in which the mean density of the hair in the pad is approximately one ounce per hundred cubic inches.

3. A substantially self-sustaining cross-sectionally uniform air filter pad of the impingement type having interstices of much greater size than dust particles, predominantly comprising curled animal hair of substantial length, the hairs being loosely arranged, and the depth of the pad and looseness of the hairs being correlated to remove at least 95% of the dust from air at a velocity of 300 feet per minute, while affording a resistance of not substantially more than .08" of water, and a tacky dust collecting medium upon hairs therein.

4. A pad as set forth in claim 3, in which the hairs at the air intake face of the pad are materially less densely arranged than hairs at the air exit face of the pad.

5. A filter pad as set forth in claim 1 in which the hairs at the surface of the pad are coated with an adhesive binder which secures the hairs together at their mutual intersections to form a reticulated surface shell, and in which the inner hairs are substantially free from such adhesive.

6. A filter pad as set forth in claim 1 in which the hairs are predominantly hog hair, combined with a small amount of longer hair of a quantity sufficient to curl the hog hair.

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