

March 3, 1942.

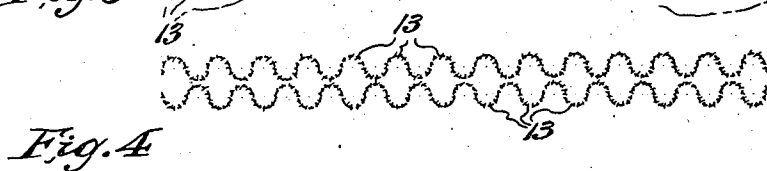
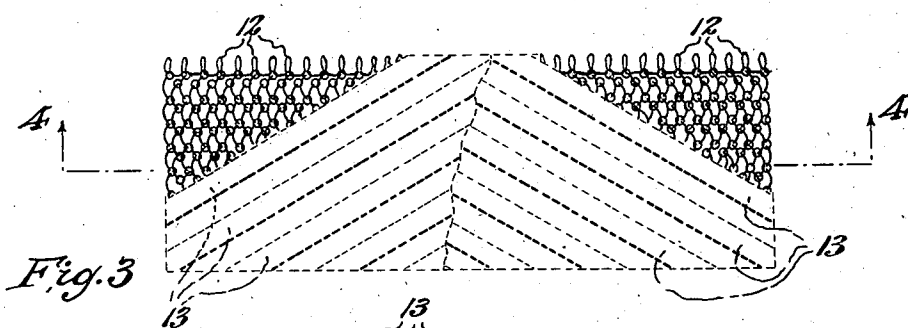
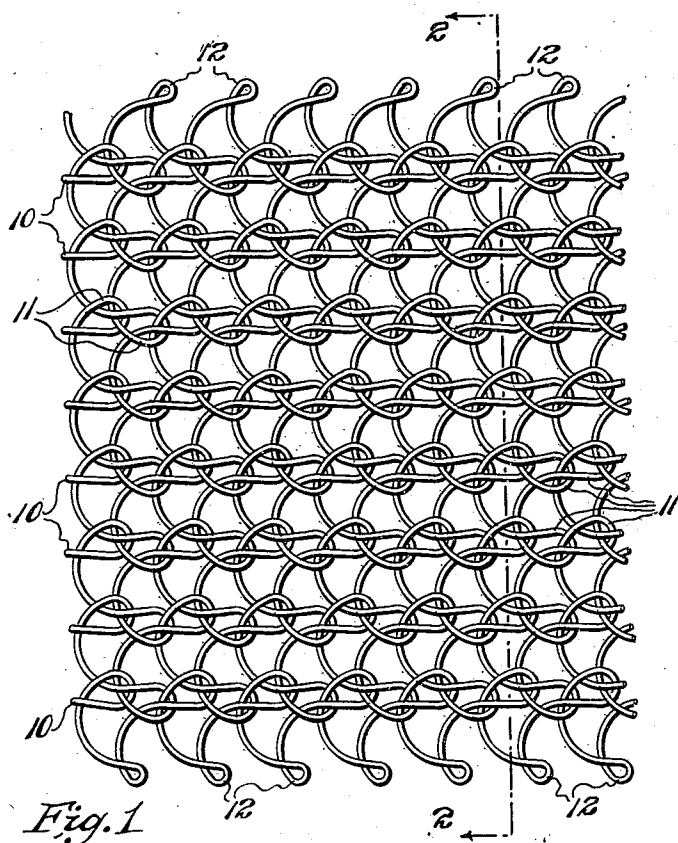
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2,274,684

FILTER MEDIUM AND FILTER BODY MADE THEREFROM

Filed Nov. 16, 1940

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

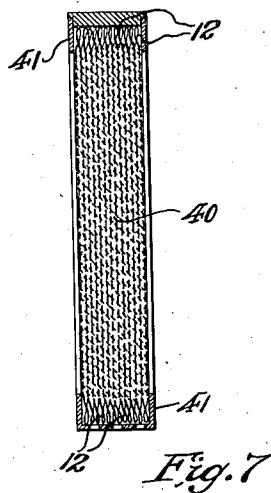
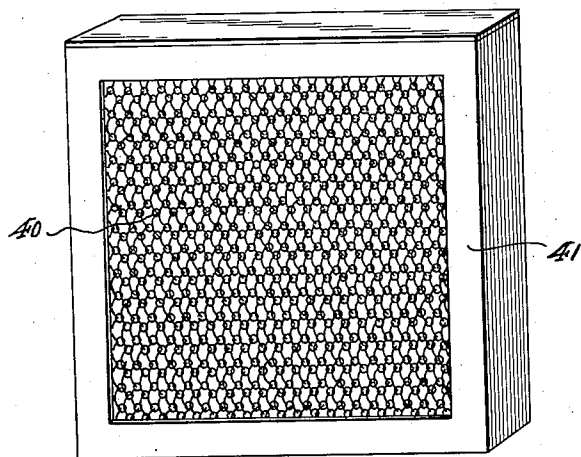
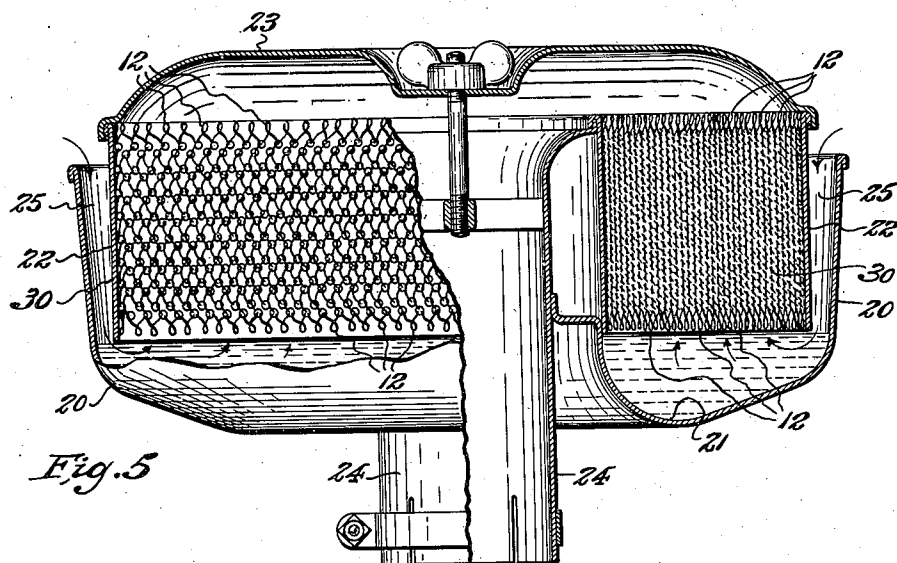


Fig. 6

Fig. 7

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UNITED STATES PATENT OFFICE

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FILTER MEDIUM AND FILTER BODY MADE THEREFROM

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Application November 16, 1940, Serial No. 365,928

4 Claims. (Cl. 183-69)

This invention relates, generally, to an improved filter material for use in wet, viscous or semi-dry types of air and gas filters; and the invention has reference more particularly to an improved filter material in the form of a single ply warp knit metallic mesh fabric.

Wet, viscous or semi-dry air and gas filters have heretofore been used in which the porous filter medium employed has comprised a tubular knit metallic fabric flattened to the form of a two-ply sheet; the sheet or sheets thus formed being superposed or rolled upon themselves to produce the desired mass of filter body. Such two-ply metallic fabric when formed into the desired filter mass or body has certain disadvantages due to its two-ply form. For example, when the tubular knit fabric is flattened into sheet form, the knitted loop strands and loop openings of the opposed plies are disposed in asymmetrical relation with the strands brought into abutting or close contact one with another, with the result that distribution of the metallic material and of the loop openings of the contiguous plies lacks uniformity, and consequently baffling effect of the metallic material as well as the porosity of the mass is likewise lacking in uniformity. Such lack of uniformity in these particulars makes for uneven resistance to flow of air or gas moving through the filter body, and also increases the likelihood of choking at points of excess resistance, especially where loop strands are closely aggregated in the contiguous plies. Furthermore, such lack of uniformity renders difficult the process of washing out the filter body when cleansing thereof is necessary.

Having in mind the disadvantages of a tubular knit two-ply metallic fabric in the make up of a wet, viscous or semi-dry filter body, an object of this invention is to provide a single ply metallic fabric for use in making up a filter body of such type which avoids said disadvantages. To this end I provide a single ply warp knit metallic fabric made of comparatively stiff wire, whereby the interengaged loops forming the fabric tend to resist relative displacement and consequently tend to retain and maintain the initial shapes and uniform distribution of the loop defined openings throughout the area of the fabric, as well as a considerable degree of self-supporting stability due to inherently greater resistance to both contraction and elongative stretch of the fabric; with the result that such single ply warp knit fabric may be readily built up into a filter body of desired mass by superposing sheets thereof or by rolling strips thereof

upon themselves, in such manner as to obtain a uniform relative spacing of the layers, and consequent substantially uniform porosity of the body mass, thereby to assure, without loss of dust capturing capacity, a filter mass of substantially uniform resistance to air or gas movement therethrough, less tendency to clog or choke, and one more easily and efficiently penetrative by a cleansing agent.

Another object of this invention is to provide a single ply knit metallic fabric having novel selvage edge formations especially advantageous in the make up of filter bodies of the oil bath type, wherein said selvage edges function to prevent oil pullover, facilitate oil run back, and prevent clogging, by coarse foreign substances, of the air or gas entrance area of such filter body.

Other objects of this invention, not at this time more particularly enumerated, will be understood from the following detailed description of the same.

Illustrative embodiments of this invention are shown in the accompanying drawings, in which:

Fig. 1 is a face view of an illustrative form of single ply warp knit metallic fabric for making up filter bodies according to this invention; and Fig. 2 is a sectional view thereof taken on line 2-2 in Fig. 1; Fig. 3 is a schematic face view of superposed corrugate sheets of such single ply warp knit metallic fabric adapted for building up the mass of a desired filter body, in such manner that the superposed sheets are uniformly spaced by said corrugations; and Fig. 4 is a sectional view, taken on line 4-4 in Fig. 3.

Fig. 5 is a cross-sectional view, with parts in elevation, of an oil bath type air filter equipped with a filter body made of the single ply warp knit metallic fabric having novel selvaged edges according to this invention, said filter body being shown in part side elevation and in part transverse vertical section.

Fig. 6 is a perspective view of a flat type air filter or screen device equipped with a filter body made of the single ply warp knit metallic fabric according to this invention; and Fig. 7 is a vertical cross sectional view thereof.

An illustrative form of single ply knit metallic fabric comprises a plurality of warp strands of wire 10 which are interlinked together by knitted loops 11, thus providing a single open mesh sheet or strip like body. The number and spacing of the warp strands 10 are so predetermined as to provide a width of fabric according to that required in the make up of a filter body or mass

of desired dimensions. The warp strands 10 comprise wires of comparatively stiff character, and this fact, together with the form and interlocking relation of the interlinked knit loops 11, produces a mesh fabric which is quite resistant to contraction and stretch so that the apertures formed by and between the loops tend to maintain their initial shapes and uniform distribution; and in addition to this the layers or sheets of the fabric, thus being of comparatively stable character, do not tend to sag but easily support themselves in extended and suitably spaced relation when superposed to form a filter body or mass of desired dimensions. The mesh fabric, due to its warp knit character, is provided along its opposite margins with selvage edges formed by outstanding free loops 12 spaced therealong. These loops may be wrought into desired shapes other than the S-shape shown, as, for example, into inverted U-shape. In certain types of filter bodies, the selvage edges thus provided have de- 5 vided advantages, as will be hereinafter subsequently explained.

Filter bodies, made up of superposed sheets or layers of single ply mesh fabric of the general character above set forth, may be utilized with the plane of the mesh opposed to the direction of air or gas flow therethrough, or with the plane of the mesh parallel to the direction of air or gas flow therethrough, accordingly as is most desirable under various conditions of use. 10

In filter bodies comprising superposed layers or sheets of the described single ply knitted metallic mesh, the stability of the mesh readily lends itself to uniform spacing of its contiguous layers, and since the apertures provided by and between the knitted loops of the mesh tend to maintain their initial shapes and uniform distribution, the porosity of the filter body and density of its mass is substantially uniform in all parts thereof, thus not only uniformly distributing the impingement areas formed by the metallic strands so as to assure uniform dust arresting or capturing effect at all points, but also obviating undue restriction of air flow at any point. Due to these factors a maximum air baffling effect is attained with a minimum resistance to air flow, whereby the efficiency of the filter body rates higher than is possible to attain with a filter body of equivalent mass and surface made of two-ply tubular knit mesh. The lower resistance attained in the filter body according to this invention permits the movement of a given volume of air through the body with less expenditure of power, or the movement of a greater volume of air with a given expenditure of power. 15

In use, the filter body is wet with a suitable fluid so that the metallic strands of the mesh are enabled to capture dust particles carried by the air when impinged thereupon. Wetting fluids such as oil or other more or less viscous fluids are ordinarily employed, in which the filter body is immersed to coat the strands therewith, or which is caused to flow into the filter body with the air or other gas. In a filter body according to this invention draining of oil from an immersed body is more quickly and efficiently attained; while in the oil bath type of filter run back of the oil is likewise more rapid and efficient, since the oil flow is subject to less obstruction by the single ply mesh than is the case with a two-ply mesh of the flattened tubular knit type, wherein intersections of loop strands of the contiguous plies form obstructing dams and hold- 20

ing pockets tending to greatly retard and sometimes even prevent oil run back. On the other hand, due to the more uniform resistance to air flow attained in the body composed of single ply mesh layers, i. e. air flow without varying restriction and impedance at different points within the body mass, there is less chance of uneven oil accumulation within said body mass, and no high air flow velocity points in some places, or unduly low resistance points in other places, whereby the air can rush through and either blow or suck the oil out at the discharge side of said filter body. Also due to the fact that in the single ply mesh the formation of comparatively minute pockets by intersecting loop strands of contiguous plies, as occurs in a two-ply mesh of the flattened tubular knit type, is substantially avoided, there is less tendency of the dust to accumulate and build up in spots with choking or clogging effect, and consequent reduced efficiency of the filter body as a whole. The filter body being of substantially uniform porosity, the ingoing dust is more evenly distributed to the filter body mass and may penetrate more deeply thereinto with less chance of filming or layering over the entrance air area of the filter body. This is particularly true where the air flow is parallel to the plane of the mesh layers, since the selvage loops 12 provide a more open entrance area, while at the same time serving to fend off relatively large foreign particles, such as flakes of leaves, paper or the like, in such manner as to prevent blanketing or choking thereby of the air entrance area of the filter body. Again due to the substantially uniform porosity of the filter body mass and elimination therefrom of small obstructing pockets, dust masses accumulated therein in use may be more quickly and efficiently washed out and away therefrom by a penetrating cleansing agent or fluid. 25

In Fig. 5 is shown a filter body according to this invention for use in an oil bath type of air filter, such e. g. as employed in connection with the air intake of an internal combustion engine carburetor. An illustrative conventional form of oil bath type air filter as shown, comprises a casing 20 formed to provide in its lower portion an oil reservoir or basin 21, and an annular filter body housing 22 above said reservoir or basin which opens into a domed top 23 leading to a central clean air discharge conduit 24 around which said housing 22 is disposed. The casing 20 provides external side walls extending upwardly from said reservoir or basin 21, said side walls being spaced outwardly from the filter body housing 22, thereby to provide an annular air intake passage 25 leading into said reservoir or basin, and thence communicating with the lower or air receiving end of said filter body housing. A filter body 30 according to this invention is positioned within the housing 22, so as to fill the interior thereof. This filter body 30 is formed by winding upon itself a strip of the single ply metallic mesh; said strip being of a width corresponding to the required height of the filter body mass. The strip of single ply metallic mesh is thus wound upon itself to form an annular body sized for insertion within the housing 22 so as to fill the interior thereof. When the strip of single ply metallic mesh is wound into such body form, the freely projecting selvage edge loops 12 will project from both the air ingress and air egress ends of the formed body to provide air intake and air outlet areas of considerably less density than that of the main body of the re- 30

sultant filter mass, thereby to provide a novel construction with the attendant advantages hereinafter subsequently mentioned.

In the operation of the oil bath type filter equipped with the novel filter body according to this invention as described, under the suction to which its air discharge passage is subjected in use, air is in-drawn through the intake passage 25 and caused to take up from the reservoir or basin 21 and carry on therewith some of the oil with which the latter is supplied; such oil charged air thereupon enters through the bottom intake area of the filter body 30, for upward movement through the mass of the latter, so that the carried oil is deposited upon and so as to wet the strand surfaces of the mesh of which the filter body is formed. The wetted strand surfaces are thus rendered capable of capturing and holding dust particles moving in and with the air stream into impingement upon such wet surfaces, whereby the dust is separated from the air. The air thus purified discharges from the top outlet area of the filter body for delivery through the discharge conduit 24 to the engine carburetor served by the filter.

In air filters used in connection with internal combustion engine carburetors, especially in the automotive field, there is frequently sucked into the filter coarse foreign material such as small pieces of paper, feathers, leaves and leaf flakes, and other flaky bits and the like. Among the advantages of the less dense bottom intake area of the filter body, which is provided by the freely projecting loops 12 of the lower selvage edges of the described single ply mesh strips are the following. Such selvage edge loops 12 provide spaced apart downwardly projecting fingers which serve to arrest and fend off any bits or flakes of foreign material so that the ingoing air may pass around such material into and through the main filter mass without obstructing ingoing movement of the air or causing undue rise of resistance to air flow through the filter mass. Should an accumulation of such bits or flakes of foreign material occur, or the same entangle with the spaced selvage loops 12, they cannot work deeply into the main filter mass, and will be so loosely held by the selvage loops 12 or fingers formed thereby as to be subject to quick and easy removal by the down wash of oil when the latter runs back to the reservoir after the engine is shut down and the inrush of air thereby stopped. Another advantage of the spaced downwardly projecting free loops 12 of the lower selvage edges of the filter body mesh, is that the same tend to separate the emerging oil streams during oil run back so as to break down any tendency of the run back oil to accumulate in the lower portions of the filter, and by adhesion or capillary effect of the mesh be so held as to obstruct its quick discharge.

In oil bath type air filters used in connection with internal combustion engine carburetors, the oil taken into the filter, when the air reaches a certain velocity, tends to accumulate in pools or masses in the upper sections of the filter body, thus offering such resistance to air outflow as tends to cause the air pressure to blow or pull off drops of oil which are carried away with the outgoing otherwise clean air. Such oil carry over is objectionable chiefly, however, for the reason that it quickly diminishes the quantity of oil in the reservoir to the point where the automatic bathing circulation of the oil back and forth between the reservoir and filter mass is interrupted,

thereby not only defeating efficient air cleaning functioning of the filter, but also wasting oil. Due to the presence of the spaced upwardly projecting fingers formed by the selvage edge loops 12 upstanding from the top outlet areas of the filter body, and by reason of the less dense character of said top outlet areas formed thereby, the oil under the pressure of air flow tends to creep up on the loop formed fingers, thus preventing the oil from accumulating in more or less consolidated masses. The oil thus deposited on the loop formed fingers tends to cling thereto with less back pressure effect upon the air flow, and consequently is less likely to be blown off and thereby pulled over into the outgoing air stream. As a consequence of such effect of the loop formed fingers, the air stream may be caused to move at somewhat higher velocity with less risk of oil pull over.

In Figs. 6 and 7 is shown a filter structure of the air screen type such, for example, as used in air-conditioning installations and the like. For such types of filters, the novel filter body comprises a filter mass 40 formed by superposed layers of the single ply knit metallic mesh, and such filter mass is supported in a suitable frame 41 in such manner that the plane of the mesh layers is perpendicular to the direction of air flow. The filter mass 40 also includes the less dense areas at the top and bottom ends which are provided by the loops 12 of the selvage edges of the mesh. Such less dense areas are also somewhat more resilient, and consequently permit of easy fitting of the mass into the frame without necessity for too precise dimensioning of the filter mass. When used in filter frames or screens of this type the novel filter mass provides the general advantages and efficiency characteristics already above noted.

As shown in Figs. 3 and 4, in making up filter bodies from single ply knit mesh by superposing sheets or layers thereof, the mesh sheets or strips may be optionally first corrugated so that corrugations 13 are formed to extend obliquely across the width of the sheets or strips from one selvage edge to the other. When assembling the sheets or strips in superposed filter body forming relation, by either piling or winding the corrugations of alternate sheets are disposed to cross each other, whereby the sheets or layers are spaced by said intersecting corrugations. This modified arrangement is found to be especially advantageous for filter bodies desired to be somewhat less dense or of more open character.

Having now described my invention, I claim:

1. A filter body comprising a plurality of layers of warp knit single ply metallic mesh made of comparatively stiff wire, each layer having along opposite margins thereof selvage forming substantially rigid loops, the aggregation of said selvage loops spaced apart in separated relation one to another and disposed to freely project from said margins in the plane of the layer providing filter body portions of less density than that of the main portions of the filter body.

2. A filter body comprising warp knit single ply metallic knit mesh fabric, said fabric having along longitudinal margins thereof freely projecting spaced selvage forming loops, said fabric being rolled longitudinally upon itself to provide a filter body wherein said selvage loops are disposed at ingress and egress ends thereof, the aggregation of said selvage loops providing filter body end portions of less density than that of the main portions of the filter body.

3. A filter body comprising warp knit single ply metallic mesh fabric made of comparatively stiff wire whereby the interknit loops thereof tend to resist relative displacement so as to substantially maintain the initial shapes and spaced distribution of the openings defined thereby throughout the area of said fabric, said fabric having along longitudinal margins thereof freely projecting spaced selvage forming loops, said fabric being rolled longitudinally upon itself to provide a filter body wherein said selvage loops are disposed at ingress and egress ends thereof, the aggregation of said selvage loops providing filter body end portions of less density than that of the main portions of the filter body.

4. A filter body comprising warp knit single ply

metallic mesh strips, said strips having along longitudinal margins thereof freely projecting spaced selvage forming loops, said strips having corrugations extending diagonally between their longitudinal selvage margins, at least two of said strips being superposed so that the corrugations of one cross those of the other, and said superposed strips being rolled longitudinally upon themselves to provide a filter body wherein said selvage loops are disposed at ingress and egress ends thereof, the aggregation of said selvage loops providing filter body end portions of less density than that of the main portions of the filter body.

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