Oct. 6, 1942. H. W. THOMAS 2,297,729

SCREEN FRAME

Filed March 16, 1940

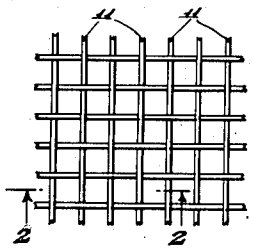

FIG. 1

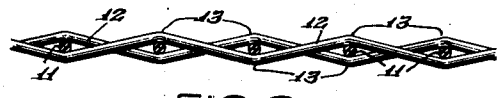

FIG. 2

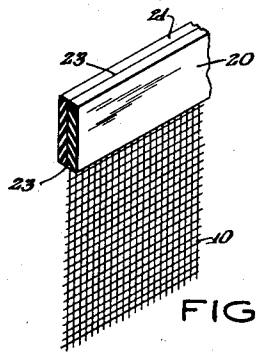

FIG. 4

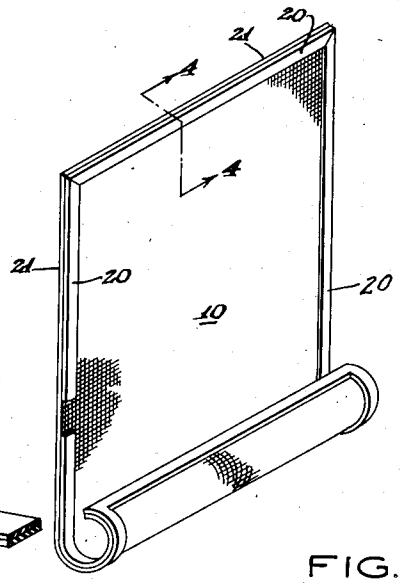

FIG. 3

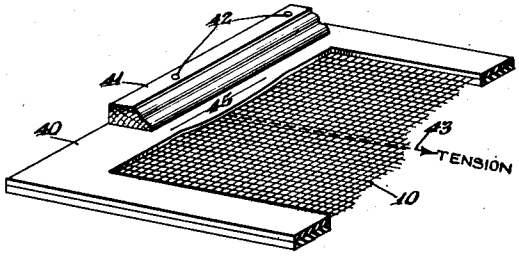

FIG. 6

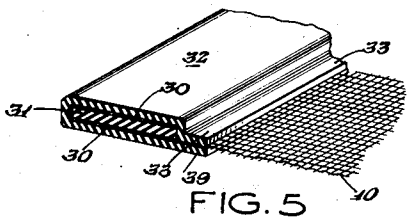

FIG. 5

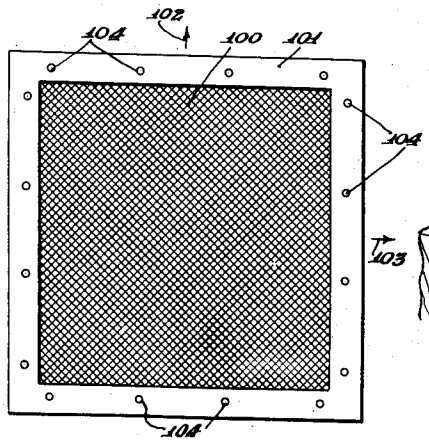

FIG. 7

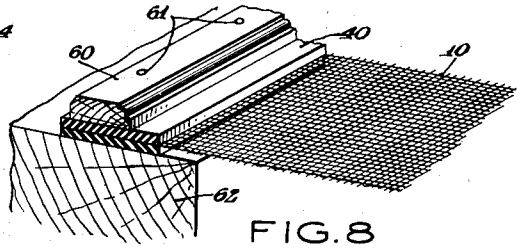

FIG. 8

INVENTOR.

Harry W. Thomas

BY

Samuel Astrotink

ATTORNEYS

Patented Oct. 6, 1942

2,297,729

UNITED STATES PATENT OFFICE

2,297,729

SCREEN FRAME

Harry W. Thomas, Miami Beach, Fla.

Application March 16, 1940, Serial No. 324,394

9 Claims. (Cl. 156—14)

This invention relates to reticular material composed primarily of single filament strands of thermo-setting or thermo-plastic synthetic resins and more specifically the invention relates to open mesh flexible and elastic screen cloth composed of permanently crimped nylon warp and weft strands, the perimeter of which screen cloth is bound and fixed in desired permanent position by novel binding means associated with and peculiarly adapted to the novel screen structure. The actual screen structure itself is more particularly described in my co-pending application Serial No. 265,114 filed March 31, 1939, and also my co-pending application for Screen material and method of making same, Serial No. 324,393 filed simultaneously herewith.

The novel screen material which is to be bound and arranged in accordance with the present invention is formed in accordance with both of the applications above-mentioned and comprises essentially an open mesh reticular screen structure made from a thermo-setting or thermo-plastic, non-metallic, non-vegetable, and non-animal fibres or strands, preferably single filament strands for reasons set forth in the aforementioned application. The material of which these strands are made is moisture resistant, not affected by common acids or alkalis, non-oxidizable, weather resistant and may be opaque, translucent, transparent or may be colored in any desired manner. The strands thereof may be composed wholly of synthetic polymerization products including vinyl resins, nylon, vynon, aldehyde condensation products, cellulose derivatives, alsifilm and other similar thermo-plastic or thermo-setting synthetic materials.

In the manufacture of the screens, the said materials, preferably in the form of single filament strands, are either first woven into the form of a screen and then thermally crimped so that complementary crimps in intersecting strands engage each other to resiliently maintain the strands in predetermined meshing relation; or they are first crimped and then woven into flexible, rollable screen cloth with complementary crimps in intersecting strands registering with each other and then given a thermal set so that complementary crimps are also in tight frictional, although resilient, engagement with each other. The material is flexible and elastic so that upon the application of tension the crimps may straighten out permitting a deformation of the screen in accordance with the pressure or tension created and upon relaxation of said deforming action, the crimps will be restored to their original position and the strands returned to their predetermined meshing relation.

For special sizes or for special uses, as for instance for insect screening or dust excluding screening and netting for backs and seats of chairs, binders for cushions or materials, strainers, sieves, tennis racquets, or other members where predetermined sizes are required, it is important that a means be utilized for preventing the unravelling of the screen material, while at the same time preserving the resilient construction thereof.

An important object of this invention, therefore, is to provide particularly in connection with screens of the type above described, resilient flexible binding for the perimeter thereof to protect the ends from unravelling while at the same time maintaining the flexibility and rollability of the screen.

Still another further important object of the present invention is the application of an elastic resilient binding to the edges of a screen of the type above set forth which will divide a concentrated tension at any one point and spread this tension over a greater area and particularly will linearly spread the tension at right angles to the line of tension so that the actual tension on any one point at or near the edge of the screen will be borne by a plurality of adjacent points.

Still another important object of the present invention is to provide a frame for screening of the type above described formed of the same material as the screening itself and secured thereto either by the cementing of said material to the screen or by the molding of such material by heat, or in any other suitable manner, or the fixing or heating of said frames upon the edges of said screens in the presence of catalysts or in any other applicable manner.

The binding of the screen, therefore, may consist preferably of an elastic rollable, flexible material. It may consist of a plastic or synthetic material, or a readily moldable thermally adherable material or any combination of each of the above.

Where a frame of the type of the present invention is utilized it may be applied at the same time that the screen itself is formed and may be applied to the edges of the screen by the very same process in which the screen is formed. Thus, since the screen itself should be thermally treated in order to provide the predetermined crimps which render it resilient and self-restorable, the heating process utilized for forming the crimps in the screen may also be utilized for

affixing the frame to the screen, particularly where the frame is to be affixed by any thermal process.

Many other objects and uses of the present invention will in part be apparent and in part be pointed out in the following description and drawing, in which,

Figure 1 is a plan view of a nylon screen of the type preferred for use in connection with the present invention.

Figure 2 is a cross-sectional view on line 2—2 of Figure 1.

Figure 3 is a view in perspective showing a frame bound upon the edges of the screen in the manner of my invention.

Figure 4 is a cross-sectional view in perspective on line 4—4 of Figure 3.

Figure 5 is a cross-sectional perspective showing a modification of the form set forth in Figure 4.

Figure 6 is a view in perspective partially broken away showing an application of my invention.

Figure 7 is a plan view of a bias cut screen bound with an elastic frame in accordance with my invention, and

Figure 8 is a view in perspective partially broken away showing still another application of my invention.

Referring now to Figures 1 and 2 I have here shown a nylon screen 10 having warp strands 11 and weft strands 12 which are interwoven with each other in the manner shown. Preferably, and in accordance with my patent applications above mentioned the nylon strands may be interwoven in any suitable manner and then thermally treated at a temperature in excess of 120° F. so that under the influence of the heat, the warp and weft strands will adopt a permanent set with relation to each other producing a series of crimps 13—13, each at an obtuse angle.

The material is resilient at the crimps so that even though the strands may under tension be straightened out so that the crimps disappear, nevertheless upon relaxation of the tension the crimps will be restored to their original position and since complementary crimps and intersecting strands register with each other at their respective troughs, the crimp when restored upon relaxation of any pressure or tension will tend to ride down the troughs of the complementary crimps and thus return to their original position.

This action and the construction of the screen itself is more fully described in my said copending application Serial No. 265,114 filed March 31, 1939, and my said co-pending application for Screen material and method of making same, Serial No. 324,393, filed simultaneously herewith.

In Figure 3 I have shown flexible rubber strips 20, and 21 applied to the edges of the screen 10 for the purpose of preventing unravelling of the said screen. The rubber strips 20 and 21 may be mounted on either side of the screen 10 at the edges thereof in any suitable manner for the purpose of binding the perimeter of the same without destroying in any way the flexibility or rollability of the screen. For this purpose cementitious material may be introduced at the inner surface 23 (Fig. 4) of the rubber, the said cementitious material adhering to juxtaposed faces of the rubber and binding the faces of the rubber together through the nylon or binding the rubber directly to the nylon. In such a case the cementitious material used should itself be flexible when dry so that it willl not interfere with the operation of the screen and so that it will not destroy the flexibility and rollability thereof.

Since the screen is given its final crimped form such as that shown in Figure 2 by a heat process of from 120° F. up to as high as 500° F. and even higher, the flexible rubber strip may even be virtually integrally associated with the screen 10 by utilizing the same heating process to obtain adherence of the rubber. The screen 10 after it has been woven and before it has been given the heat treatment which produces the crimped result shown in Figure 2 may be mounted at its edges between partially vulcanized rubber tapes or frames which are cemented together with flexible cement or other material. When the screening, the edges of which have thus been mounted between such partially vulcanized tapes or frames, is then subjected to heat treatment of the order of 300° F. then the strands are crimped to produce the result shown in Figure 2, while at the same time the rubber is vulcanized directly on to the edges of the nylon screen and becomes virtually an integral part thereof. The rubber edge being thus integrally associated with every portion of the edge of the nylon screen can transmit stresses upon one portion of the screen or at one point along one edge to other points along the same edge or to other portions of the perimeter without any danger of disengaging any portion of the rubber tape or frame from the particular portion of the edge of the nylon screen with which it has thus become integrally associated. In a similar manner other plastic materials which may flow, vulcanize, be molded, or otherwise become set or formed in the presence of heat may be utilized as an end mounting for the nylon screen, the only important aspect being that where the nylon screen is to be used as a flexible screen or rolling screen, the edge or tape must necessarily be flexible and elastic as well.

Even where stiffer frames are required plastic or synthetic material may be integrally associated in the manner above noted with the edges of the screen material.

Any peculiar or unusual form or shape of screen may thus be treated. For instance, where a nylon screen is to be used as a tennis racquet or a sieve or for any purpose where a tough, resistant, yet resilient and yielding surface is required, such an elastic flexible frame may be molded or placed upon the edge of the screen before the screen is mounted upon or in the ultimate structure of which it is to form a part. Thus, for instance, in a tennis racquet nylon screens may be made in the manner above noted from single filament nylon strands permanently crimped in the manner shown in Figure 2 and permanently mounted in frames which may be removably secured to the frame of the tennis racquet for ready replacement, should that be necessary. Since, however, the tensile strength of nylon is as high as 51,000 pounds per square inch, a nylon screen will be at least as good as any metal screen in place of which it might be used, while not being subject to the difficulties above described and described in my copending application abovementioned, which may be present in metal screens.

The edges may have any suitable formation consistent with the structural strength and the physical condition of the material which is to be applied to the nylon screen. Thus, for instance, in order to ensure that the edges of the screen could under no circumstances escape from their

binding a form such as that shown in Figure 5 may be used, wherein the edge 30 of the screen 10 is bent about the member 31 and then an outer tape or binding 32 is applied.

The inner filler or anchor 31 may be made of any suitable material. It may be a piece of nylon itself or a strip of rubber or a strip of any other suitable flexible and/or elastic material. The outer tape or binding 32 is then wrapped around the anchor 31 and the turned over edge 30 of the screen and brought together at the lips 33 and 39 in order to secure the binding. The material of the outer binding 32 may also be flexible and resilient for the purposes above noted.

Both the anchcor 31 and the outer binding 32 may be made of the same material as has been above described in connection with Figure 4 and may be secured in the same manner. Thus the anchor strip 31 may be a flexible plastic or any suitable material and the binding tape 32 may be a strip of unvulcanized rubber which is caused to adhere to the anchor strip 31 and the screen 10.

Upon the heat treatment of the screen 10 which produces the crimping shown in Figure 2 the rubber binding tape 32 may become vulcanized in the manner above-described.

Similarly, the anchor strip 31 as well as the binding tape 32 may be made of the same material and secured in the same manner.

The purpose of the flexible elastic strip is thus not merely to bind off the edges against unravelling but to distribute the tension. Thus, for instance, as is seen in Figure 6, the screen 10 carried in its elastic frame 40 is rigidly mounted in a frame structure in such a manner that the edges thereof are fixedly held, as for instance, by a molding 41 secured to the screen and the wall or window structure by nails 42 driven through the molding and the screen frame into the subjacent wall. Any tension applied to any particular point, as for instance in the manner indicated by the arrow 43 will result not in a pulling out of that strand even though such tension might possibly be of sufficient force by itself to pull the strand out of the frame, but will result in an extension or elongation of the elastic frame 40 at the area 45 which permits the force exerted upon the particular strand to reach equilibrium and at the same time distributes the forces on the elastic frame on either side of the axis of tension.

This result obtains whether or not the framed screen is fixedly mounted in fixed stationary, immovable position in a wall or structure or whether it is to be a rolling screen which is movably held in trackways or guides and this also applies whether or not the screen is mounted beneath a molding such as that shown in Figure 6 or is secured to a frame structure by means of hooks, screws, grommets, pins, snaps or any other suitable means associated with or cooperating with the frame of the screen itself.

The advantages of such a flexible elastic frame will now be obvious in that it presents a finished article which can readily be handled and may be fastened by nailing or screwing right through the frame or by means of eyelets or holes placed in the frame at various intervals in its perimeter.

As seen more clearly in Figure 8, the screen 10 in its frame 40 may not merely be temporarily secured at openings in building walls or other structures but may be permanently fastened to a wall at any suitable point and the frame of the screen at such fastening provides a weather proofing strip which is at least as efficient, if not more efficient, than any other type of weather stripping or flashing that may be used, thus preventing any seepage of any kind at the point of attachment of the screen to the structure.

Thus as seen in Figure 8, the molding 60 is pressed against the elastic frame 40 and the nails, screws or other suitable fastening means 61 are driven through the molding 60 through the frame 40 of the screen and into the subjacent stud or jamb 62 or any other portion of the underlying wall.

Since the elastic flexible frame 40 tends to flow about the seam or joint created by the pressure of the molding 60 against it and since it thus tends to fill up every portion of the interstices caused by irregularities in the molding 60 and in the underlying stud or wall 62, complete weather protection is provided along the line of the joint.

Where an adjustable screen of extreme elasticity is desired then the screen may be cut on the bias and the edges bound with elastic material which is longitudinally as well as transversely elastic as shown in Figure 7. The screen 100 is in Figure 7 shown cut on the bias with longitudinally and transversely elastic frame 101 bound along the edges to prevent unravelling thereof. The binding may here take the form shown either in Figure 4 or Figure 5 or it may be a binding of any other suitable form.

Since the structure of Figure 7 is cut on the bias it may readily be stretched in either of the directions shown by the arrows 102 and 103 being concomitantly shortened in the opposite direction. This stretchability is predicated not merely upon the longitudinal as well as the transverse elasticity of the frame 101, but upon the fact that when the screen material 100 is thus cut on the bias, the stretching in either of the directions shown by the arrows 102 and 103 will cause the strands to move from right angled intersecting relation with each other to acute and obtuse intersecting relation with each other thus permitting the material to be elongated in one direction or restricted in the other.

In this way the sheet framed in the manner shown in Figure 7, which would otherwise immediately unravel is prevented from unravelling by the binding herein shown while at the same time it may readily be stretched to accommodate different types of openings. For the purposes of securing said framed screens to openings, nails or other fastening means may be driven through the frame 101 or the eyelets or openings 104 in the frame 101 may be suitably grommeted to cooperate with any desired fastening means that may be used.

In the foregoing description I have referred to a type of screening and a method of manufacture thereof which is more completely described in my copending applications above noted. This type of screening preferably is made of synthetic thermally workable resins and may include polyamides which are derived from polymerizable monoaminomonocarboxylic acids and their amide forming derivatives as well as from any of the other materials and processes described in my said copending applications. The primary example of this type of material is nylon, the benefits and value of which for screening and netting purposes is more fully described in my said copending applications.

The main purpose of the present invention is the provision of the binding means at the edges of the nylon screen and the provision of a suitable frame of the type herein described which is

preferably both longitudinally and transversely elastic and resilient and which may be utilized to facilitate the securing of screens of predetermined length to openings of desired size.

While I have in the foregoing description described my invention in connection with nylon screens or netting of various kinds, many other uses of the invention will now be obvious to those skilled in the art. I would prefer, therefore, to be limited not by the specific disclosure herein but only by the appended claims.

I claim:

1. A flexible, rollable screen having resilient spaced, single filament strands of a synthetic non-metallic resinous material, said strands being thermally set in resilient interengagement with each other, and an edge binding therefor; said edge binding being thermally formed upon the edge of said screen and comprising a non-metallic tape, flexible, rollable and resilient with said screen.

2. A flexible, rollable screen having resilient spaced, single filament strands and an edge binding therefor, said edge binding comprising an anchor strip, the edge of said screen being rolled over said anchor strip and a binding strip secured over and concealing said rolled portion of said edge, said anchor strip and binding strip being formed of rubber vulcanized in place and flexible, rollable and resilient with said screen.

3. A method for forming a flexible, rollable resilient screen of plastic material meshes having a frame, said method comprising the weaving of a screen with single filament strands of plastic material, placing vulcanizable rubber strips upon an edge of said screen, heat treating the composite edge bound screen at vulcanizing temperature to impart a predetermined set to the strands and to finish the frame.

4. A method for forming a flexible, rollable resilient screen of plastic material meshes having a frame, said method comprising the weaving of a screen with single filament strands of plastic material, placing thermally formable binding strips upon an edge of said screen, heat treating the composite edge bound screen at a temperature above 120° F. and above the forming temperature of said thermally formable binding strip to impart a predetermined set to the strands and to finish the frame.

5. An edge bound adaptable screen, the binding of said screen being longitudinally and transversely extensible and retractable, said screen comprising interwoven and intersecting resilient strands resiliently interconnected to each other at substantially right angles, said strands entering said edge binding at an angle of the order of forty-five degrees, said screen being selectively extensible in either of two directions, the crossing strands being non-perpendicular to each other when said screen is extended.

6. A screen having resilient spaced, single filament strands and an edge binding therefor, said edge binding comprising an anchor strip, the edge of said screen being rolled over said anchor strip and a binding strip secured over and concealing said rolled portion of said edge.

7. A screen having resilient spaced, single filament strands of a synthetic non-metallic resinous material, said strands being thermally set in resilient interengagement with each other, and an edge binding therefor; said edge binding being thermally formed upon the edge of said screen and comprising a non-metallic tape resilient with said screen.

8. A flexible, rollable screen having resilient spaced, single filament strands of a synthetic non-metallic resinous material, said strands being thermally set in resilient interengagement with each other, and an edge binding therefor comprising a non-metallic tape, flexible, rollable and resilient with said screen, said edge binding being transversely elastic and yielding transversely and elastically to tension on any resilient strand.

9. A flexible, rollable screen having resilient spaced, single filament strands of a synthetic non-metallic resinous material, said strands being thermally set in resilient interengagement with each other, and an edge binding therefor comprising a non-metallic tape, flexible, rollable and resilient with said screen, said edge binding being transversely elastic and yielding transversely and elastically to tension on any resilient strand at the point of securement thereof to said binding, and at adjacent points on either side.

HARRY W. THOMAS.