July 2, 1957 R. A. RUSCA ET AL 2,797,574

FABRIC ABRADER

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FIG. 1.

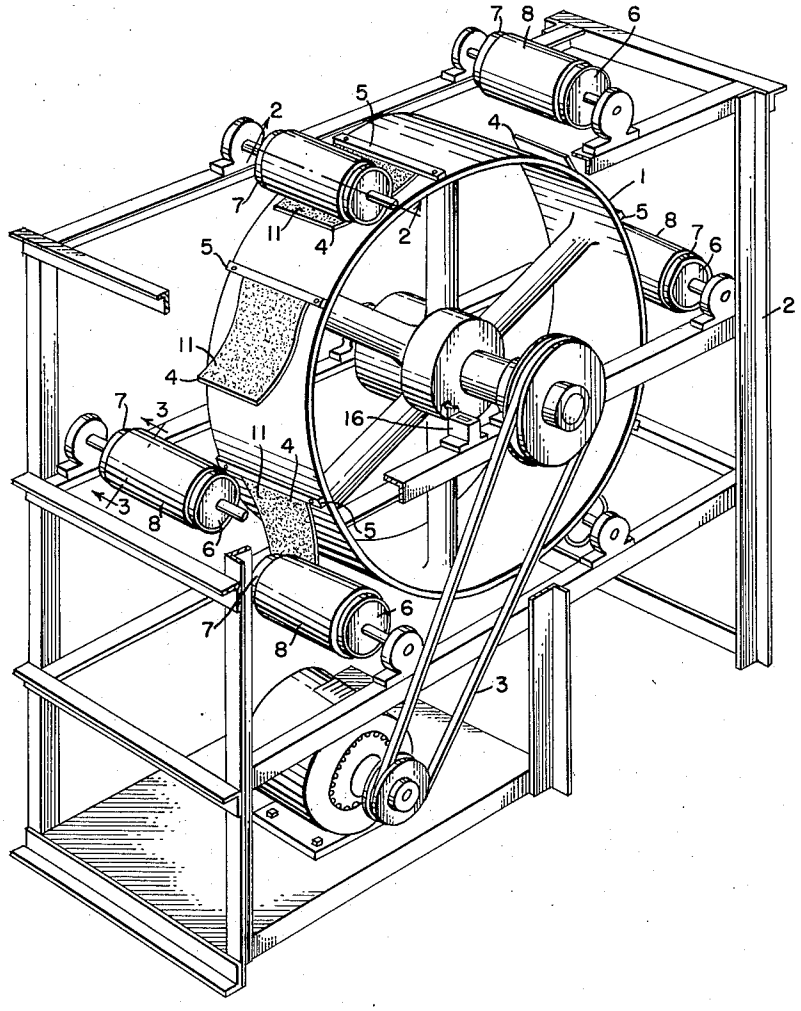
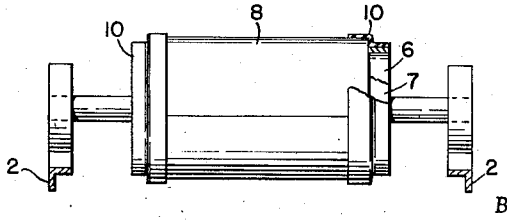


FIG. 4.



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FIG. 2.

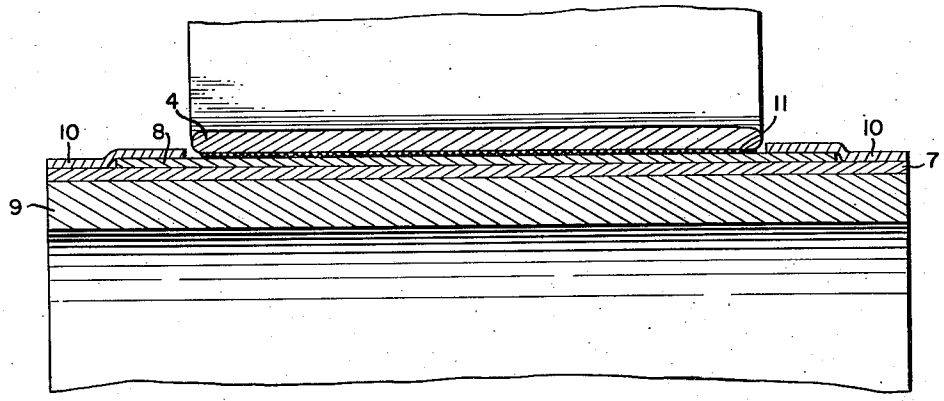
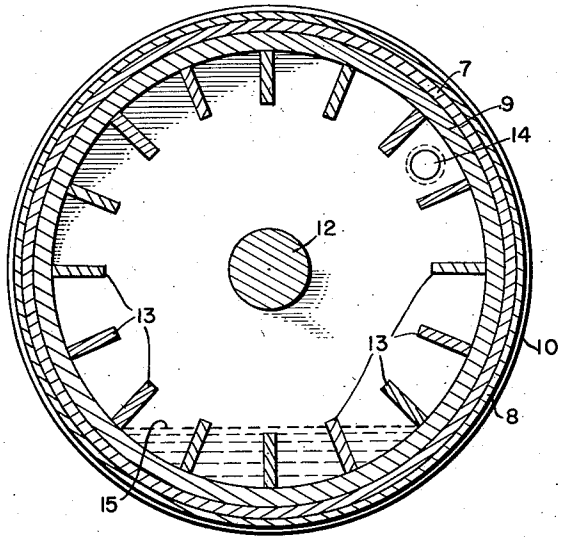


FIG. 3.



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FABRIC ABRADER

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Application February 14, 1955, Serial No. 488,168

1 Claim. (Cl. 73—7)

(Granted under Title 35, U. S. Code (1952), sec. 266)

A non-exclusive, irrevocable, royalty-free license in the invention herein described, for all governmental purposes, throughout the world, with the power to grant sublicenses for such purposes, is hereby granted to the Government of the United States of America.

This invention relates to an apparatus for determining the abrasion resisting qualities of textile fabrics.

In the art of determining the wearing qualities of textile fabrics, a number of standard methods of testing the fabrics are utilized. The methods used include tests for tensile strength, elongation, porosity and abrasion resistance.

The abrasion resistance is very important since it is related to fabric durability. In general, the present methods of evaluating abrasion resistance involve mounting a fabric sample on a non-yielding flat or spherical surface and subjecting the sample to abrasion. The abrasion is usually provided by the action of a rigid abrasive, such as emery cloth or sandpaper fastened to a non-yielding surface, that is rubbed against the fabric. Since the abrading action is usually simply that of one non-yielding surface against another, the abrasion tests do not duplicate actual in-service conditions.

A primary object of this invention is to provide an apparatus for determining the abrasion resistance of textile fabrics by abrading them in a manner that resembles the in-service wear of the fabrics in that the fabrics are free to undergo restricted motion away from and along with the abrasive material, and after being contacted with the abrasive material, the fabrics are allowed to momentarily "rest" and recover from the effects of the contact.

In general, the fabric abrader provided by this invention comprises: a rotatable abrading cylinder provided with a plurality of strips of resilient abrasive material that have one end attached to the periphery of the abrading cylinder, so that, as the cylinder rotates, the strips of abrasive material tend to extend radially from the cylinder; at least one fabric holding cylinder which is wider than the width of the strips of abrasive material and is rotatably mounted parallel to the abrading cylinder in a position in which a central portion of the fabric holding cylinder is contacted by the strips of abrasive material; a strip of resilient material encircling at least most of the portion of the fabric holding cylinder that is contacted by the strips of abrasive material; a means for attaching the edges of a strip of fabric to the fabric holding cylinder, so that the fabric extends around the cylinder and across said strip of resilient material; means for rotating the abrading cylinder; and means for rotating the fabric holding cylinder so that the surface speed of the fabric holding cylinder is different from the effective surface speed of the strips of abrasive material as they contact the surface of the fabric holding cylinder. In a preferred embodiment of the fabric abrader, the fabric holding cylinder is a closed-end type of cylinder which is mounted for free rotation and is provided with an internal fluid brake consisting of a liquid material the flow of which is restricted by baffles. In this manner the fabric holding

cylinder is caused to rotate by the frictional forces of the contact with the strips of abrasive material, but is restricted from rapid rotation by its internal brake, so that its surface speed is different from the effective surface speed of the strips of abrasive material as they contact the surface of the fabric holding cylinder.

Figure 1 is a pictorial illustration of a fabric abrader embodying the invention.

Figure 2 is an enlarged cross-section of a portion of a fabric holding cylinder wall illustrating the working relationship of the cylinder wall, the backing strip resilient material, the fabric being abraded, the fabric attaching means, and the fabric abrading means.

Figure 3 is a section on line 3—3 of Figure 1 showing the structure of a fabric holding cylinder provided with an internal fluid brake.

Figure 4 is an enlarged view of one of the fabric holding cylinders showing the method of mounting the test fabric and the method of securing it to the cylinder.

In the embodiment illustrated in the drawings, abrading cylinder **1** is rotatably mounted on frame **2** by conventional anti-friction bearings. The cylinder is rotated by means of conventional motor and pulley arrangement **3**.

The rotatable abrading cylinder is provided with a plurality of strips of resilient abrasive material **4**. One end of each of these abrasive strips is attached to the periphery of abrading cylinder **1** by attaching straps **5** that are bolted to the cylinder periphery so that the strips are free to swing out and extend substantially radially from the cylinder as the cylinder rotates. The strips of abrasive material **4** can consist of substantially any abrasive attached to a resilient material, e. g. particles of aluminum oxide or Carborundum attached to a cloth or other resilient material backing, emery cloth or sandpaper attached to a cloth or other resilient material backing, or the like. Strips of cloth backing coated with 1/0 aluminum oxide grit comprise particularly suitable strips of abrasive material. The ends of the strips of abrasive material can be attached to the cylinder by any conventional means for detachably mounting the end of a resilient strip.

A plurality of fabric holding cylinders **6** are rotatably mounted on frame **2** by means of conventional anti-friction bearings. The fabric holding cylinder **6**, which are wider than abrasive strips **4**, are mounted parallel to abrading cylinder **1** in positions in which their central portion is contacted by abrasive strips **4** when the strips extend substantially radially from the abrading cylinder as the abrading cylinder rotates. Cylinders **6** can be mounted by means of conventional detachable bearing mountings so that they can readily be removed for adjustment and/or to facilitate the attachments of fabrics to be abraded.

The central portions of each of the fabric holding cylinders **6** is encircled by a strip of resilient material **7**. These backing strip resilient materials can be attached to the surface of the fabric holding cylinder, e. g. by gluing, taping or the like conventional means for attaching a strip of resilient material to a cylinder, or they can simply be laid on the cylinder surface. The width of resilient material backing strip in relation to the width of the abrasive strips **4** can be varied widely, but the backing strip is preferably one which extends across at least most of the portion of the fabric holding cylinders **6** that is contacted by the abrasive strip. The resilient material strips **7** can be strips of wool, felt, leather, rubber, plastic or the like resilient materials. In general, the use of brightly colored wool or felt strips which are wider than the abrasive strips **4** and which are glued to the fabric holding cylinders is preferred. However, where special effects such as comparisons of the wearing

over different backing materials, over the edges of resilient backing materials, or the like, are desired, the width and composition of the backing strips can be varied to obtain the desired comparison.

A convenient means of attaching a strip of fabric to a fabric holding cylinder **6** is illustrated in Figure 2. A strip of fabric to be abraded, fabric **8**, is laid around the central portion of fabric holding cylinder **6** and is attached to a backing strip resilient material that is glued to wall **9** of the fabric holding cylinder, by adhesive fabric attaching tapes **10**. The fabric is attached along its edges, so that its central portion extends across, but is not attached to, the backing strip resilient material **7**. The fabric can be attached by means such as locking rings incorporated in the construction of fabric holding cylinder **6**, rubber bands, etc. It is necessary that the fabric be rigidly held only along its edges, so that the portion contacted by abrasive strip **4** is free to yield under the impact of initial contact and is free to undergo a restricted movement in the direction it is urged as the abrasive coating **11** is wiped along its surface. The strips of fabric **8** are preferably cut to a length equal to or slightly greater than the circumference of the fabric holding cylinder **6** with the backing strip resilient material **7** in place. The ends of the strips of fabric are preferably butted together or overlapped so that the end facing the direction in which the abrasive strip **4** is wiped along the fabric is covered.

In the illustrated embodiment of the fabric abrader, the fabric holding cylinders **6** are closed-end type cylinders which are mounted for free rotation and which are provided with the internal fluid brake illustrated in Figure 3. In such cylinders the wall **9** of the cylinder is continuous, or is joined by fluid tight unions, into a closed can, the ends of which are joined by fluid tight unions to the cylinder to shaft **12**. The interior of the sides of the cylinder walls are provided with baffles **13**. One end of the cylinder wall is provided with a removable filling plug **14**. The cylinder is partially filled with a fluid **15**, so that as the cylinder rotates, the force of gravity, pulling on the body of fluid is pushed off center by the paddle-like action of the baffles **13**, opposes the rotation of the cylinder. Substantially any non-volatile liquid material which is non-corrosive to the structural elements of the cylinder or solid particles which exhibit fluid flow, can be used. Mercury is particularly suitable. As will be apparent to those skilled in the art, the internal fluid brake can comprise a wide variety of arrangements of fluid and baffles, e. g. by using a relatively viscous fluid, or the above-mentioned solid particles, the number of baffles can be materially reduced or even eliminated.

A revolution counter **16** is preferably mounted on frame **2** at any convenient location. Substantially any of the conventional revolution counters can be used to respond to and indicate the number of times abrading cylinder **1** rotates.

The sizes, speeds and materials used can be varied widely, but for the testing of various types of fabrics, certain combinations are more advantageous than others in that they appreciably wear the fabrics within a reasonable time and yet do not wear them so rapidly that it becomes difficult to observe small differences in the wear resistance of the fabrics. In the testing of 8 ounce denim fabrics it was found convenient to employ: as abrading cylinder **1**, a wheel having a diameter of 30 inches; as abrasive material strips **4**, a fabric coated on one side with 1/0 aluminum oxide grit, in the form of 8 by 4 inch strips; as the fabric holding cylinders **6**, six closed-end type cylinders that were 6 inches wide and 3.5 inches in diameter, which were provided with an internal mercury fluid brake, and which were mounted at equidistant points with their shafts on a circle 2 inches from the periphery of abrading cylinder **1**; and, as the backing strip resilient material **7** surrounding the central portion of the fabric holding cylinders, six inch strips of red colored wool cloth glued to the surface of the cylinders. The fabrics to be abraded were cut into 11 by 5 inch strips and were laid around the central portion of fabric holding rolls **6** over the backing strip resilient material **7** with their ends butted together, and were attached along their edges by means of 1 inch strips of a cellulose adhesive tape. The fabrics were abraded by rotating abrading cylinder **1** at a rate of about 200 R. P. M. for from 1000 to 5000 revolutions. The so abraded fabrics were found to be uniformly abraded and the least resistant fabrics showed randomly distributed holes.

We claim:

A fabric abrader comprising: a rotatable abrading cylinder provided with a plurality of strips of resilient abrasive material that have one end attached to the periphery of the abrading cylinder, so that as the cylinder rotates the strips of abrasive material tend to extend radially from the cylinder; at least one fabric holding cylinder which is wider than the width of the strips of abrasive material and is rotatably mounted parallel to the abrading cylinder in a position in which a central portion of the fabric holding cylinder is contacted by the strips of abrasive material; a strip of resilient material encircling at least most of the portion of the fabric holding cylinder that is contacted by the strips of abrasive material; a means for attaching the edges of a strip of fabric around the fabric holding cylinder, so that the fabric extends around the cylinder and across said strip of resilient material; means for rotating the abrading cylinder; and means for controlling the free rotation of the fabric holding cylinder so that the surface speed of the fabric holding cylinder is different from the effective surface speed of the strips of abrasive material as they contact the surface of the fabric holding cylinder.

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