

Oct. 21, 1958

R. W. PRICE
CONDUCTIVE SHOE

2,857,556

Filed April 11, 1955

2 Sheets-Sheet 1

Fig. 1

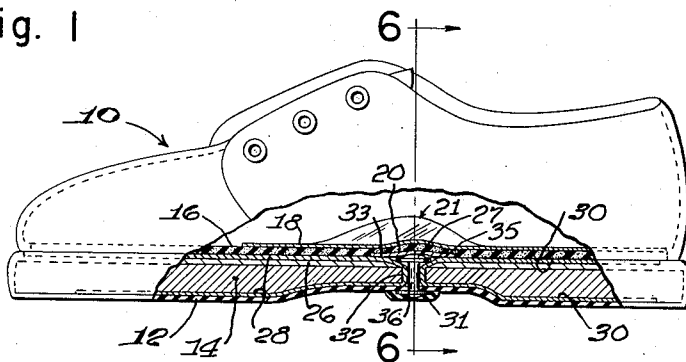


Fig. 2

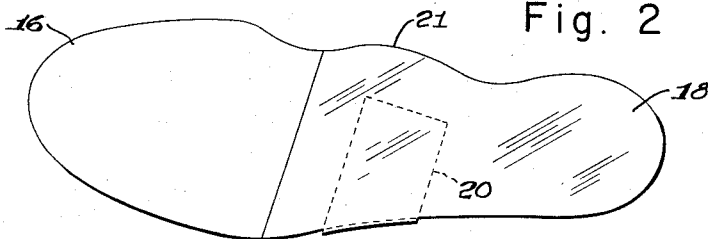


Fig. 3

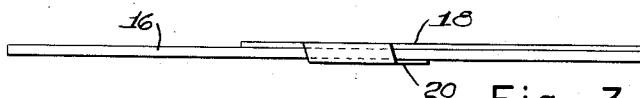


Fig. 4

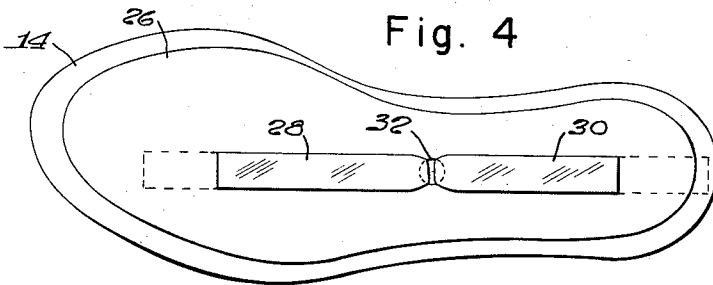


Fig. 5

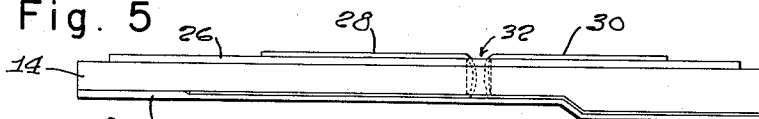
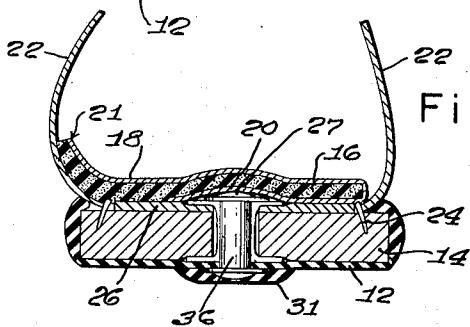


Fig. 6



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Fig. 7

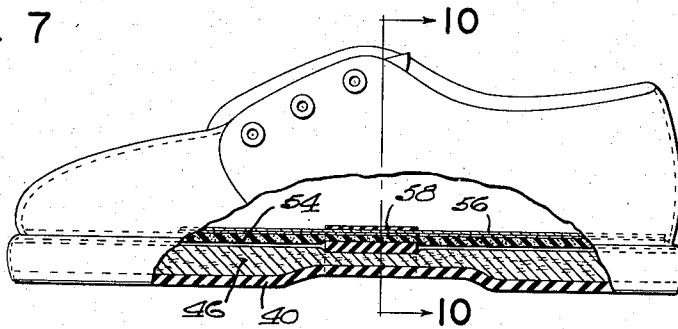


Fig. 8

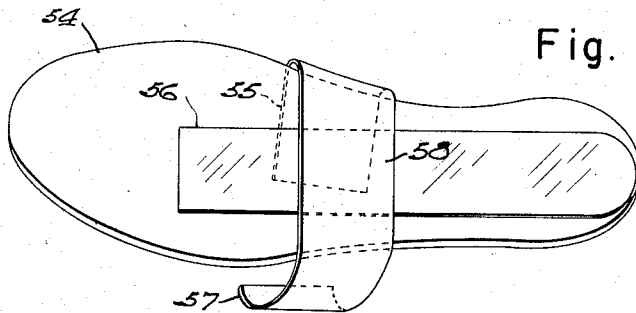


Fig. 9

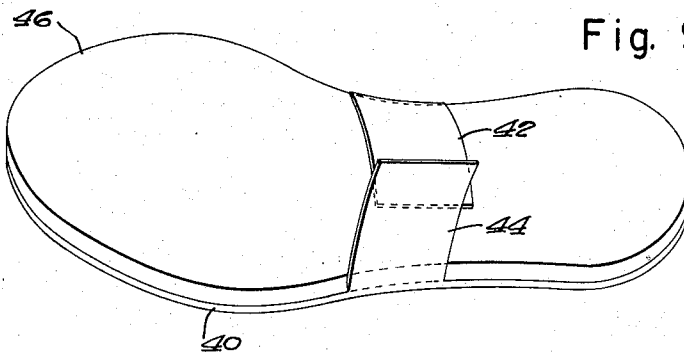
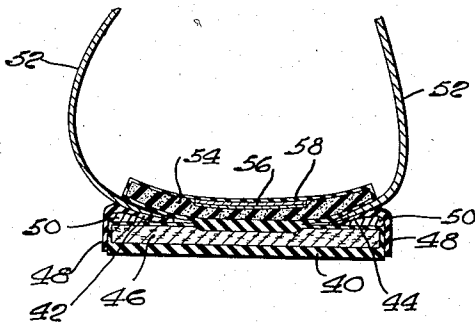


Fig. 10



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2,857,556

CONDUCTIVE SHOE

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7 Claims. (Cl. 317-2)

This invention relates to a conductive shoe.

The invention has for an object to provide a novel and improved conductive shoe arranged to establish a grounded connection between the body of the wearer and a grounded floor or surface to the end that static electric charges may be discharged harmlessly through the conductive shoe and into the grounded floor or other surface whereby the risk of explosion as the result of static spark from the wearer may be reduced to a minimum.

With this general object in view and such others as may hereinafter appear the invention consists in the conductive shoe hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention:

Fig. 1 is a side elevation, partly in cross section, of a conductive shoe embodying the present invention;

Fig. 2 is a plan view of the insole shown in Fig. 1;

Fig. 3 is a side elevation of the insole;

Fig. 4 is a plan view of the outer sole portion of the shoe shown in Fig. 1;

Fig. 5 is a side elevation of the same;

Fig. 6 is a cross sectional view taken on the line 6-6 of Fig. 1;

Fig. 7 is a side elevation, partly in cross section, of a modified form of conductive shoe embodying the present invention;

Fig. 8 is a perspective view of the insole shown in Fig. 7;

Fig. 9 is a perspective view of the outer sole portion of the shoe shown in Fig. 7; and

Fig. 10 is a cross sectional view taken on the line 10-10 of Fig. 7.

In general the present invention contemplates an electrically conductive shoe adapted to be worn by persons in places where explosives or volatile liquids are present, and which are particularly adapted to be worn by surgeons and other hospital personnel in an operating room where explosive vapors and gases from volatile inflammable liquid anesthetics, such as ether, may be ignited by sparks produced by the discharge of static electric charges built up in the body of the person. The illustrated conductive shoe may and preferably will include a conductive outer sole of relatively soft, flexible material, such as a conductive rubber outer sole and a relatively thin and flexible conductive metallic foil strip secured to the upper surface of the insole for contact with the foot of the wearer, and means for electrically connecting the metallic foil with the conductive rubber outer sole of the shoe. Thus, in accordance with the present invention static electric charges may be slowly dissipated and harmlessly discharged from the body of the person through the conductive shoe and into the grounded conductive floor of the hospital operating room. An important advantage of the present construction of conductive shoe resides in the provision of the relatively thin conductive metallic foil strip which may and preferably will comprise a laminated or

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reinforced aluminum foil strip secured to the insole for contact with the foot of the wearer, such metallic strip being relatively smooth and non-absorbent so as to retain its conductivity over long periods of time. The conductive metallic foil may and preferably will be laminated with a relatively thin strip of plastic sheet material characterized by being difficult to tear, thus forming a tough reinforcing base for the metal foil preventing rupture under severe conditions of use. Prior conductive shoes of which I am aware are usually provided with conductive rubber insoles for contact with the foot of the wearer, and after a period of time such conductive rubber insoles lose their conductivity on the upper surface thereof upon becoming soiled, which in effect provides a non-conductive film on the upper surfaces of such prior insoles, thereby greatly reducing their conductive characteristics.

Referring now to the drawings, 10 indicates generally the conductive shoe embodying the present invention and which includes a conductive rubber outsole 12 secured to a mid-sole or filler portion 14, and the numeral 16 represents the insole or sock lining which may comprise sponge rubber or other non-conductive material. The conductive rubber outsole 12 extends over the entire area of the bottom of the shoe including the heel portion. The upper surface of the insole 16 is provided with a flexible conductive metallic foil portion 18 secured thereto, the foil portion extending from a point immediately in front of the arch portion of the instep rearwardly to the end of the heel portion of the insole. As illustrated in Fig. 2, the metallic foil portion 18 is provided with a lateral extension 20 which may be folded downwardly and inwardly around one edge of the insole to provide an integral conductive surface on the underside of the insole immediately above the center of the arch portion. It will also be observed that the insole 16, including the conductive foil member 18 attached thereto, is provided with a rounded lateral extension 21 adjacent the arch portion which in the assembled form, as shown in Figs. 1 and 6, is arranged to extend upwardly a short distance whereby to assure firm engagement with the wearer's foot adjacent the arch portion at all times.

As illustrated in Fig. 6, the upper or body portion of the shoe indicated at 22 may be stitched or otherwise secured to the mid-sole 14 as indicated at 24, and a non-conductive filler member 26 may be provided between the mid-sole 14 and the insole 16. In order to provide an electrical connection between the conductive metal foil 18 of the insole and the conductive rubber outsole 12, a metal rivet 36, which may comprise copper or other conductive metal, is extended through an opening 32 formed at the center of the arch portion, the lower end of the rivet embracing and having electrical contact with the conductive rubber outer sole 12. The upper end of the rivet extends through the mid-sole 14 and the filler member 26 and embraces the upper surface of the filler member. Thus, the head 27 at the upper end of the rivet is arranged to frictionally engage the lateral extension 20 on the underside of the insole 16 to make electrical contact therewith as shown. In practice the exposed head of the lower end of the rivet may and preferably will be covered by a plug of conductive rubber 31 vulcanized thereto and to the adjacent surfaces of the outer sole as shown.

In order to further assure firm electrical contact between the metallic conductive foil strip 18 of the insole and the conductive rubber outsole 12 over a relatively large area, a pair of elongated conductive foil strips 28, 30 are provided, one strip 28 extending from an intermediate portion corresponding to the ball of the foot between the insole 16 and the filler member 26, then passing under one edge of the head 27 of the rivet and down-

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wardly through the opening 32 along the length of the rivet, the other end of the strip 28 being folded back and extended toward the toe portion between the underside of the midsole and the inner surface of the conductive rubber outsole as shown. The other elongated conductive metal strip 30 may be similarly extended between the insole 16 and the filler member 26 from the heel portion, through the opening 32 in conducting engagement with the rivet 36 and rearwardly between the mid-sole and the conductive rubber outsole toward the heel portion. With this construction it will be seen that the foil strips 28, 30 are in electrical contact with the rivet 36 and the outsole 14 and that the lateral extension 20 on the underside of the insole is also in electrical contact with portions of the strips 28, 30 on both sides of the upper head portion 27 of the rivet as indicated at 33, 35 in Fig. 1.

Referring now to Fig. 7, in a modified form of the present invention the conductive shoe is provided with an outer sole of relatively soft, flexible material, such as a conductive rubber outer sole 40 provided with integral lateral extensions or straps 42, 44 adjacent the arch portion of the instep of the shoe, such conductive straps being folded upwardly and inwardly in overlapping relation about a non-conductive mid-sole portion 46. The outer edges of the shoe may be provided with a non-conductive rubber trim portion 48 which may extend inwardly for a short distance over the edges of the upper surface of the mid-sole and over filler pieces 50 provided along the edges of the mid-sole. The upper portions 52 of the shoe may be stitched or adhesively secured to the mid-sole to provide the structure shown in Fig. 10. The insole 54, which may comprise a non-conductive material, such as sponge rubber, is provided with a relatively thin, flexible metallic conductive strip 56, preferably a laminated aluminum foil strip, extended longitudinally of the insole, and a conductive rubber strap 58 is wrapped about the arch portion of the insole in electrically conductive engagement with the upper surface of the strip 56, the ends of the strap 58 being arranged in overlapping relation on the underside of the insole whereby the overlapping portions 55, 57 of the strap 58 engage with the overlapping portions of the lateral extensions 42, 44 of the outsole 40. In practice the conductive rubber portions of the shoe are assembled in an uncured form, and upon assembly the conductive rubber portions of the shoe, including the area adjacent the arch portion of the instep of the shoe, are vulcanized together so as to form a permanent integral conductive bond from the upper surface of the conductive metal strip through the insole conductive rubber strap 58, and the overlapping lateral extensions 42, 44 to the outsole 40. The conductive metal strip 56 may and preferably will comprise a laminated strip adhesively secured to the upper surface of the insole 54, and the conductive rubber insole strap 58 may be adhesively secured to the upper surface of the metallic strip 56 with a conductive rubber cement.

In practice the conductive metallic strip embodied in the present invention may comprise a relatively thin aluminum foil in the order of .001" to .002" in thickness which may and preferably will be laminated to a sheet of polyester plastic film, such as that sold under the trade name of "Mylar," characterized by its non-tearing qualities whereby to reinforce the relatively thin foil strip and render it less subject to being torn or ruptured in use. In practice the laminated foil strip may be secured to the upper surface of the insole with any suitable adhesive, such as a pressure sensitive adhesive.

From the above description it will be seen that the present conductive shoe may be used with advantage by surgeons, nurses and other attendants in operating rooms where the fumes of ether or other combustible vapors or gases are apt to be present, such shoes permitting a slow dissipation and continuous discharge of static electricity from the wearer's body through the shoe and into a grounded conductive floor of the operating room. The

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rubber trim portion 48 extending around the edge of the shoe may and preferably will be of non-conductive rubber and serves as a scuff guard to prevent scuffing of the floors by the conductive rubber portion 40 of the shoe. It will also be observed that the conductive aluminum foil forming the conductive surface between the foot of the wearer and the shoe is relatively thin so as not to interfere with the comfort of the wearer and has the further advantage of retaining its electrical conducting qualities over a considerable period of time.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:

1. A conductive shoe comprising an outer sole of conductive rubber, a non-conductive insole having a metal foil conductive strip secured to the upper surface thereof for contact with the wearer's foot, and means for electrically connecting said conductive foil strip to the conductive rubber outer sole, said metal foil conductive strip being of a thickness of the order of a few thousandths of an inch and having a thin, tough plastic reinforcing strip laminated to its underside to prevent tearing and the development of wrinkles in the foil when the shoe is worn.

2. A conductive shoe comprising a non-conductive mid-sole extending the full length of the shoe and having a sole portion, a heel portion and a raised instep portion, said mid-sole being provided with an outer sole of conductive rubber secured thereto and entirely covering the bottom and marginal edges of said mid-sole, an insole having a flexible metal foil conductive strip secured to the upper surface thereof for contact with the wearer's foot, said metal foil strip of a thickness of the order of a few thousandths of an inch and having a lateral extension folded around one edge and secured to the underside of said insole adjacent the arch portion of the instep, and a metal conducting member disposed beneath the insole and extended through an opening in said arch portion and in conducting engagement with said outsole and with said lateral extension on the underside of the insole, said metal conducting member and the adjacent portion of the conductive outer sole disposed in said raised instep portion being free of contact with the ground when worn.

3. A conductive shoe as defined in claim 2 wherein a pair of additional and similar elongated flexible metal foil conducting strips are extended longitudinally of the shoe between the insole and the mid-sole, through said opening, and between the mid-sole and the outer sole, said additional metal strips being in conducting engagement with said lateral extension, metal conducting member and outer sole, the lower end of said metal conducting member having a conductive rubber covering vulcanized to the adjacent portion of the conductive rubber outer sole.

4. A conductive shoe comprising an outer sole of conductive rubber, a non-conductive insole having a flexible metal conductive foil strip secured to the upper surface thereof for contact with the wearer's foot, said foil being of a thickness of the order of a few thousandths of an inch, and conductive rubber connections between said conductive metal strip and said outer sole, said conductive rubber connections including conductive rubber extensions from said insole in contact with said metal foil strip, and conductive rubber extensions from said outer sole and in contacting relation to said first named extensions, said extensions being vulcanized together in the assembled shoe to form an integral conductive rubber bond between the outer sole and the upper surface of said conductive metal foil strip.

5. A conductive shoe comprising an outer sole of conductive rubber, a non-conductive insole having a flexible metal conductive foil strip secured to the upper surface thereof for contact with the wearer's foot, said conductive

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foil strip being of a thickness of the order of a few thousandths of an inch, and conductive rubber connections between said conductive metal strip and said outer sole, a non-conductive mid-sole disposed between said outer sole and said inner sole, said conductive rubber connections including a conductive rubber strap secured to the upper surface of said metal strip and wrapped about the underside of the insole adjacent the arch portion, said outer sole having laterally extended conductive rubber straps wrapped about the upper surface of said mid-sole adjacent the arch portion and in contacting engagement with the strap wrapped about the underside of the insole, the contacting portions of the insole strap and the outer sole straps being vulcanized together in the assembled shoe to form an integral electrically conductive rubber bond between the outer sole and the upper surface of the conductive metal foil strip.

6. A conductive shoe comprising an outer sole of conductive rubber extending the full length of the shoe and having a sole portion, a heel portion and a raised instep portion, a non-conductive insole, a conductive metal foil having a thin, tough plastic reinforcing strip lami-

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nated to its underside and secured to and conforming to the upper surface of the non-conductive insole and of a thickness of the order of a few thousandths of an inch, and means for establishing electrical connection between the metal foil and the conductive outsole.

7. A conductive shoe as defined in claim 6 wherein said foil covers a portion only of the upper surface of the insole and wherein the electrical connection between the foil and the outsole is disposed at the instep portion of the shoe out of contact with the ground when the shoe is worn.

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