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R. W. BRADLEY

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DEVICES FOR FINDING PROTRUDING METAL OBJECTS IN SHOES

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2 Sheets-Sheet 1

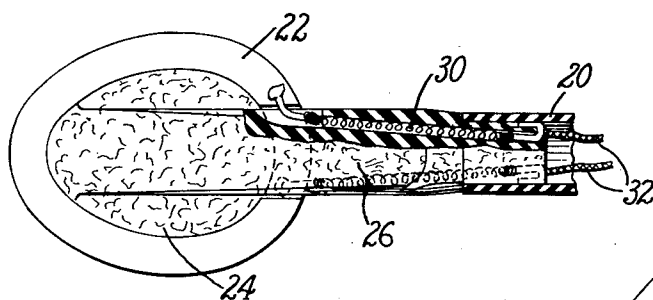


Fig. 3.

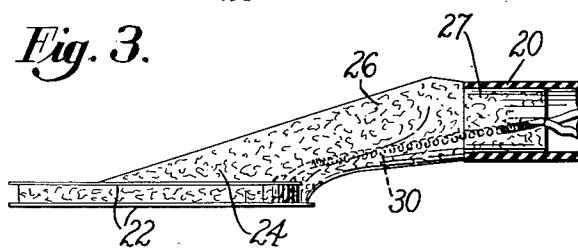
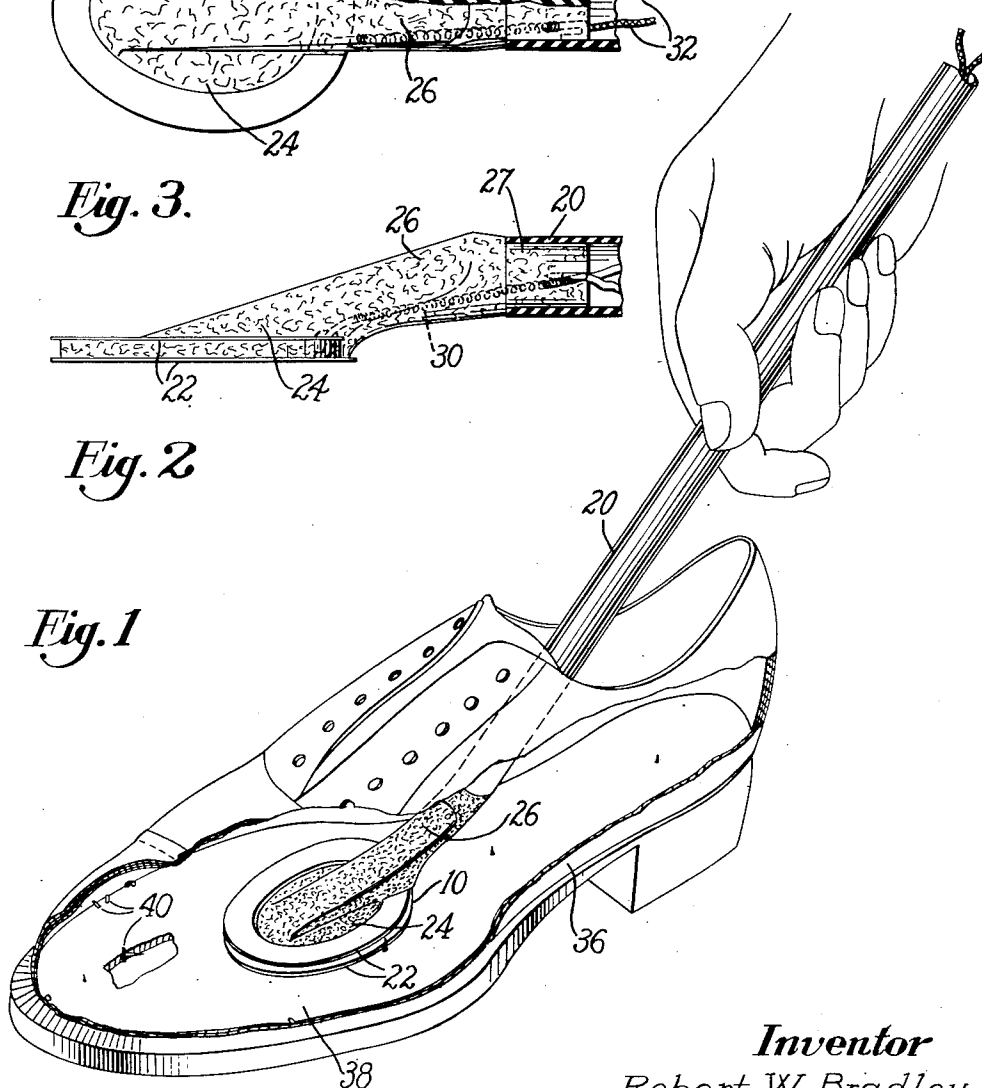


Fig. 2

Fig. 1



Inventor

Robert W. Bradley

By his Attorney

W. H. C. C. C.

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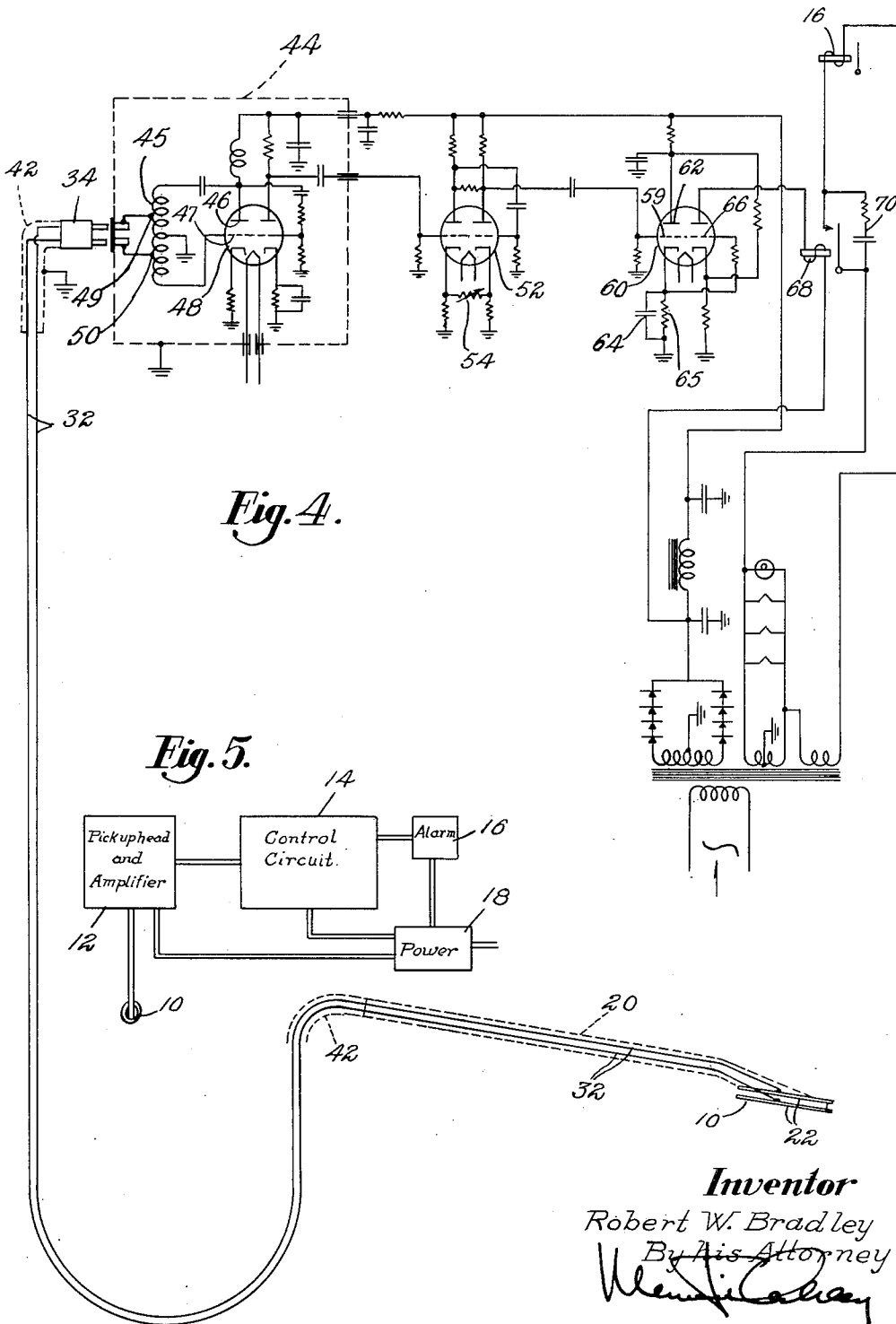
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DEVICES FOR FINDING PROTRUDING METAL OBJECTS IN SHOES

Robert W. Bradley, Marblehead, Mass., assignor to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

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10 Claims. (Cl. 324—61)

This invention relates to apparatus for use in examining the interiors of shoes to detect the presence of foreign metal objects such as tacks, staples and the like protruding into the foot cavity of the shoe.

In the manufacture of shoes of many types, tacks are commonly employed temporarily to secure the shoe materials prior to the operation of securing the upper to the sole of the shoe. Occasionally, in spite of the care taken in removing all of such tacks, one will either be overlooked or its head will be broken off. Such tacks and occasionally other foreign metal objects such as lasting staples may, in the finished shoe, protrude into the foot cavity, that is, the space to be occupied by the wearer's foot. The presence of such protruding metal objects is, of course, highly objectionable to a person who tries on or wears the shoe.

Accordingly, finished shoes are commonly subjected to an examination, sometimes referred to as "tack finding," usually performed by girls who run their fingers along the inner surfaces of the shoe in an endeavor to detect any protruding metal. This operation is hazardous, since frequently a tack will have become lodged in a shoe with its point projecting in such a manner as to cause injury during the examination. Further, the examination by the use of the fingers is not entirely efficient, inasmuch as tacks occasionally lodge in comparatively inaccessible positions, for example, at the tip of the forepart of the shoe.

In view of the foregoing, it is an object of the invention to provide improved apparatus for detecting metal objects protruding into the foot cavity of shoes, which apparatus eliminates any necessity for inserting the fingers into a shoe, and which at the same time makes possible a quick and thorough examination while giving adequate indication of the presence of such undesirable metal objects.

To this end, and in accordance with a feature of the invention, there is provided a probe having a handle and a contact member carried by one end of the handle which is readily moved by the operator over the inner bottom surface of the shoe. The probe is connected to a device responsive to engagement of the contact member with a tack or other protruding metal for operating a signal device, warning the operator of the presence of foreign metal. If desired, of course, the device may be employed to initiate the operation of other devices such as a device for rejecting the shoe.

Since all metal objects in the shoe are not objectionable, it being common to employ metallic shank pieces and lasting staples, an important requirement of such a device is its ability to distinguish between contact with a protruding metal object and the mere proximity of a metal object. Accordingly, in accordance with another feature of the invention, advantage is taken of the fact that the rate of change of electrical conditions produced in a circuit coupled to the probe is much greater upon actual engagement of the probe with a metal object than upon passage

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of the probe in mere proximity thereto, to provide voltage transients which are made effective to operate an alarm only upon such actual engagement.

A further feature of the invention comprises a probe having a handle, one end of which flexibly supports a curved contact member whereby coverage of all portions of the shoe bottom is facilitated.

In accordance with a still further feature of the invention, the probe comprises two similar, superposed contact members and electrically balanced leads for coupling the members to the indicating device in opposed relation to ground, whereby the effect of outside disturbances is minimized.

These and other features of the invention are disclosed in the following specification and the accompanying drawings and are pointed out in the claims.

In the drawings,

Fig. 1 is a perspective view illustrating a shoe partly in section with a tack detecting probe therein, said probe being constructed in accordance with a preferred embodiment of my invention;

Fig. 2 is a view in side elevation and partly in section of the probe shown in Fig. 1;

Fig. 3 is a plan view, partly in section, of the probe shown in Fig. 1;

Fig. 4 is a schematic diagram of the electric circuits of the apparatus; and

Fig. 5 is a block diagram showing the elements of the apparatus of the invention.

The apparatus comprises a probe 10 (Fig. 5) operatively associated with a detector set comprising a pick-up head and amplifier 12, and a control circuit 14 coupled to the amplifier and responsive to voltage transients to operate an indicating device 16 to warn the operator of the existence of foreign metal.

The probe 10 as shown in Figs. 1, 2 and 3 comprises a handle 20 one end of which supports a curved, flat-bottomed probe head including two similar superposed curved conductive contact members 22 secured to a soft rubber block 24 in spaced disposition, the block 24 having a gooseneck 26 the upper end 27 (Fig. 2) of which is attached to the handle 20. The handle is illustrated as being of electrical insulating material, although the use of such material is not essential for the purposes of the invention. The contact members 22 are connected, through flexible, extensible coils 30 of conductive wire such as bronze wire, to conductive leads 32 which extend through the handle to a plug 34 (Fig. 4) by which the probe can be connected to the detector set. The flexible construction of the neck of the probe just described is such that the contact members can be readily inserted in a shoe, such as the shoe 36 (Fig. 1), and can rapidly be moved over the bottom surface 38 of the foot cavity to cover, in successive portions, substantially the entire bottom whereby any metal object 40 protruding upwardly from the bottom will be engaged by the lower contact member 22. The curved shape of this contact member adapts it to engage, at the outer edge of the head, a substantial length of the margin of a shoe bottom within the toe and facilitates complete coverage of all areas, particularly at the margin of the bottom. A shield 42 grounded to the chassis of the detector set is provided around the leads 32 to reduce the effect of outside disturbances.

In the detector set there is provided a shielded pick-up head 44 comprising an oscillator and a preamplifier. The oscillator, while it may be of any suitable type, here is shown as a shunt-fed Hartley type having an oscillatory tank circuit comprising a tank coil 45 the ends of which are respectively capacitively coupled to the plate 46 and connected to the grid 47 of a triode section of a tube 48, thus effectively providing inductively coupled input and

output circuits. The coil 45 is tapped to ground between its ends, and on either side of the ground tap, lead taps 49 and 50 are provided to which the contact members are connected when the plug 34 is in its receptacle. Thus provision is made for coupling the leads to the oscillatory circuit (and thereby to the input circuit) in opposed relation with respect to ground.

When the head of the probe 10 is moved over a shoe bottom and one of the contact members engages a protruding metal object, a high rate-of-change effect is produced in the oscillatory circuit to produce voltage transients which appear at the plate 46.

While I do not wish to limit myself as to the exact way in which such rate-of-change effects produce such transients, I believe that there is either an electric charge pick-up communicated to the grid or input circuit, or a sudden change of loading imposed on the oscillatory circuit, or perhaps both.

By coupling the contact members to the oscillatory circuit in opposed relation, I have found that the effect of outside electric disturbances is greatly reduced over the effect when only one contact member and one lead are employed.

Voltage transients at the plate 46 are progressively amplified, first in a second triode section of tube 48, and then in two sections of a tube 52 wherein degenerative gain control is provided by a variable resistor 54 connecting the cathodes of the sections. The characteristics of the amplifier provide discrimination against low audio and sub-audio frequencies, and further protect the detector from false triggering by slow changes of electrical conditions such as those involved in moving the probe near a metal shank piece.

The output of the amplifier is coupled to the grid 59 of a triode section of another tube 60. In the cathode circuit of this section are a condenser 64 and a resistor 65 having jointly a large time-constant. This section thus operates as a "pulse stretcher" to prolong the conduction period of the control section of the tube 60 by supporting a conductive bias on its grid 66 for the time necessary to operate a relay 68 in the plate circuit of the control section. The relay 68 is connected to control the operation of the indicating device 16, which is herein shown as a buzzer, from an A. C. source to avoid sparking in the buzzer. A resistance-capacitance filter 70 is provided to reduce sparking of the contacts of relay 68. If desired, shielding may be provided for the relay in place of the filter to reduce feed-back disturbances to the input elements of the detector. The power supply is conventional and will not be further described herein.

In operation, the operator grasps the probe by its handle and moves the lower contact member 22 over the bottom surface of the foot cavity of a shoe. Should the contact member engage a metal object, the buzzer will sound, and the operator may then segregate the shoe for removal of the object. It will be understood that the invention is not limited to the use of a buzzer for indicating the presence of a metal object, but that any suitable signal, such as a light, may be employed for this purpose.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for detecting the presence in a shoe of metal objects protruding from the shoe materials into the foot cavity comprising a probe having a handle and two similar superposed conductive contact members supported by the handle by which said contact members may be moved over the bottom surface of the shoe cavity, an indicating device, and two electrically balanced leads coupling the contact members to said indicating device in opposed relation, said indicating device being constructed and arranged to indicate engagement between a contact member and a metal object in response to electrical contact between said object and one only of said contact members.

2. Apparatus for detecting the presence of a metal object protruding into the foot cavity of a shoe comprising a probe having a handle and including a conductive contact member supported by said handle for movement over the bottom surface of the said foot cavity, an electron tube having input and output circuits, means for coupling the contact member to the input circuit, an alarm, and a control circuit, including an amplifier discriminating against low audio and sub-audio frequencies, connected to operate said alarm in response to voltage transients in the output circuit, for warning the operator of engagement of the contact member with a metal object.

3. Apparatus for detecting the presence of a metal object protruding into the foot cavity of a shoe comprising a probe having a handle and a contact member supported by said handle for movement over the bottom surface of the foot cavity of a shoe, an oscillatory circuit, means for coupling said contact member to said oscillatory circuit, an amplifier having a response discriminating against low audio and sub-audio frequencies for amplifying voltage transients produced in said oscillatory circuit by engagement of the contact member with a metal object, and means coupled to said amplifier and responsive to such amplified voltage transients to indicate engagement of the contact member with a metal object.

4. Apparatus for detecting the presence of metal objects protruding into the foot cavity of a shoe comprising a probe having a handle, a pair of similar contact members carried by said handle for movement over the foot-contacting surface of a shoe, an electron tube having input and output circuits, means for coupling said contact members to said input circuit in opposed relation, and means responsive to voltage transients in the output circuit of said tube produced by engagement of a contact member with a metal object to indicate such engagement.

5. A probe for use with apparatus of the class described comprising an elongated handle, a curved, flat-bottomed probe head flexibly supported by said handle for engaging and moving over the bottom surface of the foot cavity of a shoe, said head including a conductive contact member shaped and arranged to engage, at the outer edge of said head, a substantial length of the margin of a shoe bottom, within the toe, and a conductive lead for said contact member extending through said handle.

6. A probe for use with apparatus of the class described comprising an elongated handle, a curved, flat-bottomed probe head flexibly supported by the handle for movement over the bottom surface of a shoe inside the foot cavity, said head including two similar spaced superposed conductive contact members, the lower member being shaped and arranged to engage, at the outer edge of said head, a substantial length of the margin of a shoe bottom within the toe, and a pair of electrically balanced conductive leads each connected to one contact member and extending through said handle for connecting the probe to an indicating device.

7. Apparatus for detecting the presence of metal objects protruding into the foot cavity of a shoe comprising a probe having a handle and a pair of similar conductive contact members flexibly supported by the handle for movement over the surface of a shoe bottom inside the foot cavity, an oscillatory circuit including a tube having a cathode, a grid and a plate, means for coupling said contact members with said oscillatory circuit in opposed relation, an alarm, and means operative in response to voltage transients at the plate of said tube to cause operation of the alarm.

8. A tack detecting device for shoes comprising an oscillator, an amplifier discriminating against low audio and sub-audio frequencies connected to the oscillator for amplifying transients in a circuit thereof, an alarm, an alarm control relay connected to the output of the amplifier for causing operation of the alarm upon receipt of amplified

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voltage transients, and a manipulatable contact member coupled to a tank circuit of the oscillator.

9. In a device for detecting metal objects in shoes, an oscillator having a tank circuit comprising an inductance coil, a probe comprising two spaced metallic contact members coupled in a balanced circuit across a portion of the coil, means for amplifying a voltage impulse set up in the tank circuit upon engagement of a contact member with a metal object, and an alarm device arranged to be operated in response to an amplified impulse.

10. In a device for detecting the presence of metal objects in shoes, a conductive contact member, a handle carrying said member and by which said member may be moved inside a shoe in contact with the shoe bottom, an electron tube having input and output circuits, means for coupling said member to at least one of said circuits whereby contact of said member with a metal object is effective to produce voltage transients in the output circuit, an amplifier coupled to said output circuit to amplify such

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transients, said amplifier having characteristics discriminating against low audio and sub-audio frequencies, and an indicating device connected to said amplifier for control by the output thereof to indicate the presence of amplified transients and hence engagement between said member and a metal object.

References Cited in the file of this patent

UNITED STATES PATENTS

10	902,753	Marshall	Nov. 3, 1908
	1,437,375	Young	Nov. 28, 1922
	2,355,105	Preston	Aug. 8, 1944
	2,419,266	Kliever et al.	Apr. 22, 1947
15	2,529,846	McBrayer et al.	Nov. 15, 1950
	2,559,627	Johnson	July 10, 1951
	2,636,917	Law	Apr. 28, 1953
	2,691,104	Corbitt	Oct. 5, 1954
	2,708,746	Shaw	May 17, 1955