

[54] **PARTIAL WEIGHT BEAR WARNING DEVICE**

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[22] Filed: **Feb. 22, 1971**

[21] Appl. No.: **117,509**

[52] U.S. Cl. **340/272**, 36/8.5

[51] Int. Cl. **G08b 13/10**

[58] Field of Search 340/272; 200/85; 36/2.5 Y, 36/2.5 AC, 8.5, 1; 33/3 R, 3 A; 73/172

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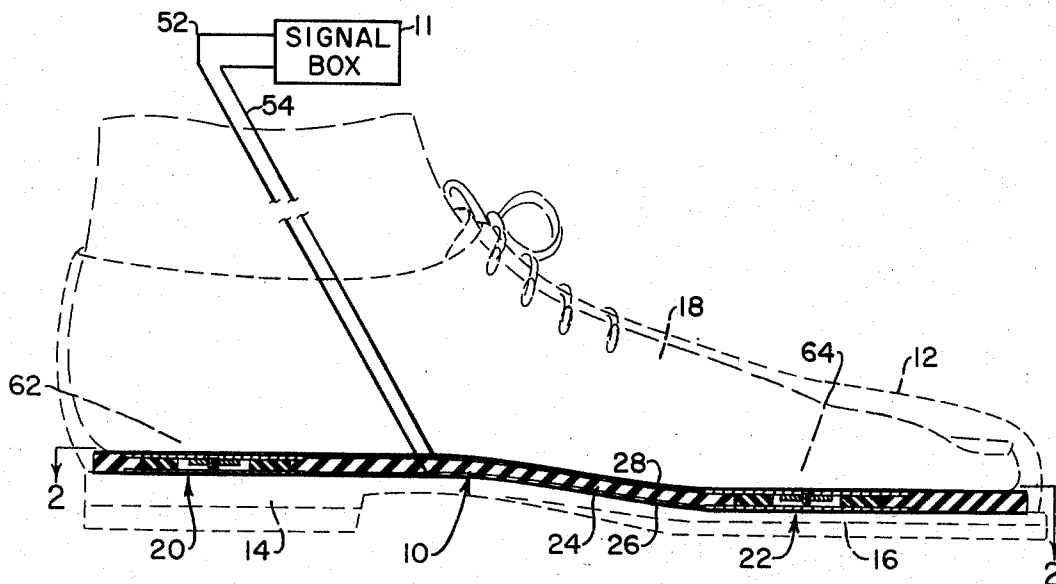
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[57] **ABSTRACT**

A device for warning a patient when he exceeds a predetermined amount of weight on his foot during locomotion comprising two force-sensitive electrical contactors disposed one each in predetermined positions beneath the heel and ball of the foot. The contactors are secured in a thin pad shaped to conform to the bottom of the shoe or footwear of the patient. Each electrical contactor includes a pair of flat circular metal plates separated by a resilient member and connected to a battery-powered alarm.

21 Claims, 3 Drawing Figures



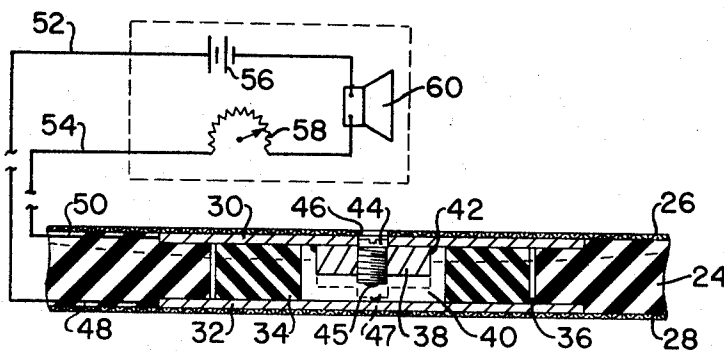
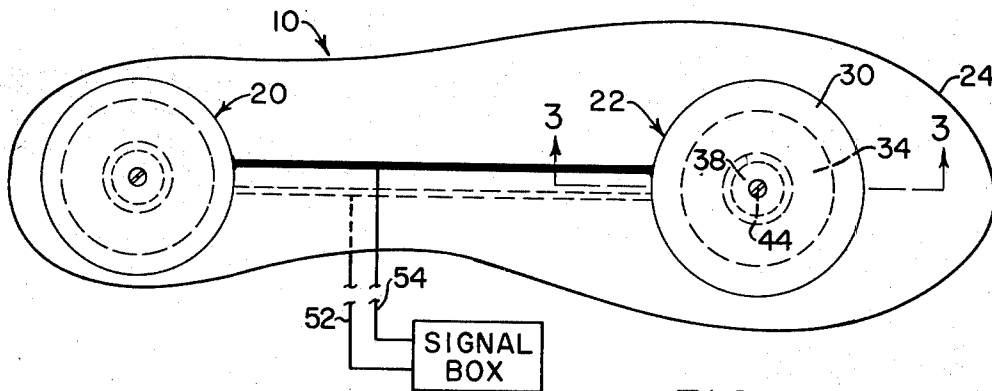
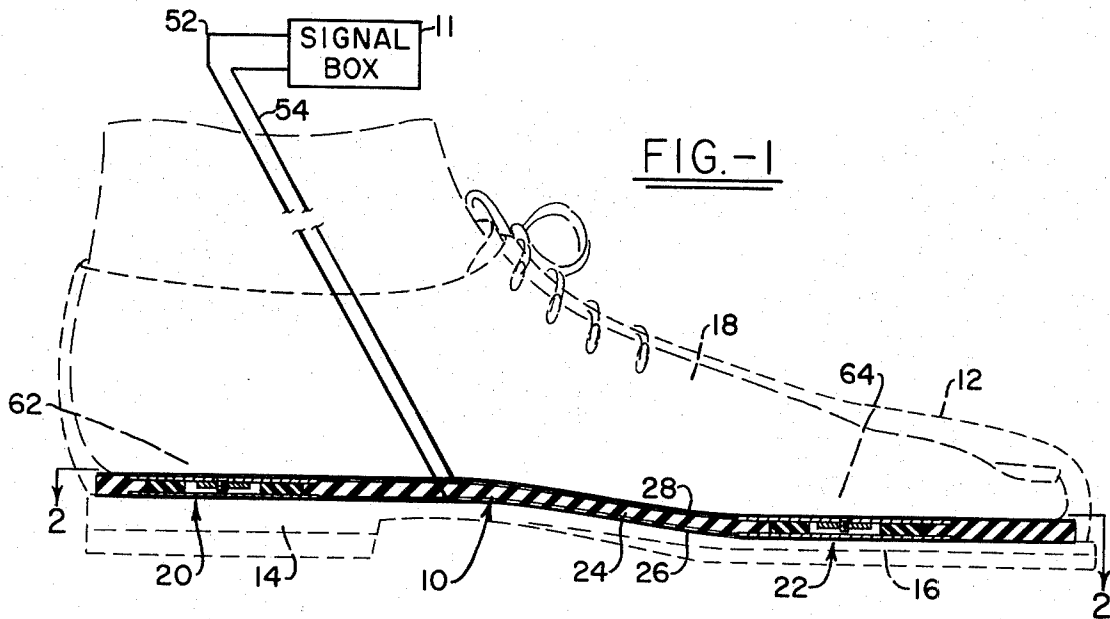


FIG.-3

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PARTIAL WEIGHT BEAR WARNING DEVICE

This invention relates to devices for aiding patients during convalescence and in particular to a device for permitting a patient to bear partial weight on his leg.

There are many situations in which a patient should continuously and repeatedly place a certain amount of weight on his leg or foot in order to speed up the healing process. It is usually important, however, that he does not exceed another certain amount of weight on the leg since this might damage the repair or injury.

One example of such a situation is a period of convalescence following a mold arthroplasty repair of the femoral head and vitalium cup or ball and socket joint in the hip. This operation involves separating the ball and socket and removing damaged or deteriorated material. An artificial cup is placed over the ball and it is placed back in the socket. Exercise and use of the hip joint helps the bones to develop a new layer of cartilage. Too much force or weight on the hip in the early stages of convalescence, however, can damage the ball or socket. The patient is, therefore, placed on crutches and told to put a certain amount of weight on his leg, say about twenty pounds. In order that the patient know how much twenty pounds is, it has been the practice to have the patient step on a scale or walk over a force-sensing device in the laboratory. This has a decided disadvantage since once the patient leaves the scale or laboratory he no longer can check his weight and soon forgets or loses his appreciation of how much weight he is actually placing on his leg and hip as he walks around on crutches.

It is, therefore, desirable to have a device or means which would permit the patient to place a certain amount of weight on his leg or foot while he is walking but at the same time signal or warn him when he exceeds a predetermined amount of weight. The device should be lightweight, reliable, and not uncomfortable to the patient since he will be continuously carrying or wearing it during locomotion or walking.

It is, therefore, an object of this invention to provide a device for permitting a patient to bear up to a certain amount of weight on his leg or foot but warn him when he exceeds the certain amount.

It is also an object of this invention to provide such a device which is lightweight and comfortable to the user.

It is a further object to provide such a device which can be used in conjunction with normal footwear.

Other objects will be in part apparent and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the appended claims.

IN THE DRAWING

FIG. 1 is a sectional elevational view of a device constructed in accordance with this invention, illustrated in use in conjunction with the shoe of the patient;

FIG. 2 is a view of the device of FIG. 1, taken substantially along line 2—2 of FIG. 1; and

FIG. 3 is an enlarged sectional view of a portion of the device of FIG. 2 taken substantially along line 3—3 of FIG. 2.

With reference to the drawing and in particular to FIG. 1, a device according to the present invention comprises a foot pad assembly 10 and a signal box or alarm 11. The foot pad assembly 10 and signal box 11 are operably connected by a pair of flexible insulated electrical wires 52, 54. The foot pad assembly 10 is thin and shaped to fit or conform to the bottom of the shoe 12 of the patient.

Referring now to FIGS. 1 and 2, the foot pad assembly 10 comprises a thin pad 24 of soft resilient material, such as sponge rubber, and a pair of pressure or force-sensing means 20 and 22 located respectively in the heel 14 and toe 16 of the shoe 12 when the foot pad assembly 10 is located in the shoe 10 beneath the foot 18 of the patient. Each force-sensing means 20, 22 is secured in the pad 24 in a predetermined position such that one force-sensing means 20 is centered beneath the heel or os calcis 62 of the patient and the other force-sensing means 22 is centered beneath the ball or metatarsal heads 64 of the foot 18 of the patient.

More particularly, and with reference to FIG. 3, there is an enlarged view of the force-sensing means 22. Both force-sensing means 20 and 22 are the same with the exception that the force-sensing means 22 is larger in diameter than the force-sensing means 20. An illustration and description of one, therefore, will suffice for both.

In the particular embodiment illustrated, the force-sensing means 22 comprises a contactor assembly having a lower flat circular metal contact plate 32 and an upper flat circular plate 30. The plates 30 and 32 are thin and held apart in vertical spaced apart relationship by a resilient dielectric member 34. In the particular embodiment illustrated, the dielectric member 34 is a rubber O-ring which is generally rectangular in cross-section. The two plates 30, 32 and the O-ring member 34 are centered with respect to each other and have a common vertical axis.

The upper plate 30 has a circular hole 46 therein and a threaded nut 38 secured thereto by any suitable means, such as a weld 42 or soldering. The nut 38 is positioned on the side of the upper plate 30 that is closest to the lower plate 32, and located coaxially with respect to the two plates 30, 32 and the O-ring 34. The nut 38, therefore, extends downwardly from the upper plate 30 into the hole 40 of the O-ring 34 and toward the lower contactor plate 32. The hole 46 is also positioned coaxially with respect to the plates 30, 32, the O-ring 34 and nut 38, and thus permits the passage of a set screw 44 through the upper plate 30. The set screw 44 is threadably engaged with the nut 38 and thus can be moved toward and away from the lower contactor plate 32 by screwing it in and out of the nut 38. A rounded lower end or contactor 45 is provided on the set screw 38 to engage with the lower plate 32 at its center 47 when the upper plate 30 and nut 38 are forced downwardly as illustrated in dotted lines in FIG. 3. The set screw 38 is short such that when it is retracted into the nut 38 to a point at which only the contactor 45 protrudes out of the bottom of the nut 38, the screw 38 will not protrude out of the top of the foot pad assembly 10.

Each pressure-sensing means or contactor assembly 22 or 20 is received in the resilient pad 24 to secure the contactor assembly in a predetermined position beneath the foot. The O-ring 34 is disposed in a hole 36

in the pad 24 while the upper and lower plates 30 and 32 located on opposite sides of the O-ring somewhat compress the pad 24 in the area radially outwardly of the O-ring 34. The pad 24 is substantially softer than the O-ring 34 and offers little resistance to the force of the foot as compared to O-ring 34.

With reference to FIGS. 2 and 3, a flat braided, flexible wire 50 extends along the top side of the pad 24 and is connected to both top plates 30 in the two contactor assemblies 20 and 22. A second flat, flexible braided wire 48 extends along the bottom side of the pad 24 and is connected to both bottom plates 32 in the two contactor assemblies. The pad 24 which separates the wires 48 and 50 is a dielectric and, therefore, insulates the wires 48 and 50. A pair of wires 52 and 54 are connected to the wires 48 and 50, respectively, and extend to the signal box 11.

The complete pad 24 and contactor assemblies 20 and 22 are covered on top by a suitable thin sheet of material 26. A hole is provided in the material 26 above the set screw 44 in each contactor assembly 20, 22 to permit adjustment of the set screw 38. A similar thin sheet of material 28 is provided on the bottom of the pad 24 and contactor assemblies 20, 22. The sheets of material 26 and 28 are adhered to the pad 24 and respective plates 30 and 32 to maintain the foot pad assembly 10 as a unit.

With reference to FIG. 3, in the particular embodiment illustrated the signal box 11 or means to warn the patient includes an audible alarm 60. Also included in the signal box 11 is a battery 56 and rheostat 58. The battery 56, rheostat 58, and alarm 68 are connected in series with the ends of the wires 52 and 54 opposite the flexible wires 48 and 50. The battery 56, rheostat 58, and alarm 60 should be small and neatly fitted into a small container which can be conveniently carried by the patient, say for example in a pocket. While the alarm 60 in the particular embodiment illustrated is an audible alarm, it could be any other means for alerting the patient, such as a light. The rheostat 58 is provided to permit adjustment of the volume of the alarm 60.

When the upper plate 30 is forced toward the lower plate 32 until the contactor 45 engages the lower plate 32 as illustrated in dotted lines in FIG. 3, the circuit is completed through the contactor assembly 20 or 22 through the wire 50, wire 54, rheostat 58, alarm 60, battery 56, wire 52, and wire 48, and cause the alarm 60 to sound.

The amount of force required to cause the contact tip 45 to touch the lower contact plate 32 can be adjusted by turning the set screw 44 in and out of the nut 38 and change the spacing between the contactor tip 45 and the plate 32. If the spacing is large, it will take a large force to compress the O-ring 34 enough to cause the contactor tip 45 to touch the plate 32. Likewise, if the spacing is small, the force required for contact will be small.

In the use of the device, the foot pad assembly is removed from the shoe or footwear 12 and placed on a table or flat surface. The set screw 38 in one contactor assembly 20 or 22 is adjusted away from the lower plate 32 until the head of the set screw is flush with the outer surface of the plate 30. The set screw 38 is then adjusted toward the lower plate 32 just until the alarm rings, when a weight equal to the maximum permitted

on the leg or foot is placed on the contactor assembly. The process is then repeated with the other contactor assembly.

The foot pad assembly 10 is then reinserted into the shoe 12. The patient places his foot in the shoe and places the signal box in his pocket with the wires 52 and 54 extending down to the shoe. As he walks, maximum weight is placed successively on his heel and ball of his foot and if he exceeds the predetermined limit in either position, the alarm will momentarily sound.

It should be noted that while the specific embodiment illustrated is shown in conjunction with a "left" shoe, the same device can be used with a "right" shoe by turning the foot pad assembly 10 over. When the pad assembly 10 is turned over, it will fit neatly into a "right" shoe. Also, it will be appreciated that while it is preferred that the plates 30, 32 be circular, they could be any generally flat configuration which is expedient.

While a certain representative embodiment and details have been shown for the purpose of illustrating the invention, it will be apparent to those skilled in this art that various changes and modifications may be made therein without departing from the spirit or scope of the invention.

What is claimed is:

1. A device for permitting a patient to bear part of his weight on his foot but warning him when he places at least a predetermined weight on said foot comprising, sensing means for detecting a weight on said foot including means for adjusting the minimum weight which is detected by said sensing means to said predetermined weight, means for maintaining said sensing means in a predetermined position adjacent the bottom of said foot so that said sensing means will detect said predetermined weight when said patient bears said predetermined weight on said foot; and, means operably connected to said sensing means to signal said patient when said predetermined weight is placed on said foot.

2. A device as claimed in claim 1, wherein said means for detecting a weight includes a pair of electrical contacts held apart by a resilient member.

3. A device as claimed in claim 2, wherein said electrical contacts include a pair of coaxially spaced apart, generally flat circular plates and said resilient member is an elastomeric ring disposed centrally between said plates.

4. A device as claimed in claim 3, wherein said contacts further include a contactor adjustably mounted on one of said plates and located centrally with respect to the hole in said ring so that the distance between said contactor and the other said plate can be adjusted.

5. A device as claimed in claim 4, wherein said contactor is a screw threadably mounted on said one of said plates so that turning said screw in said one of said plates moves said screw toward and away from said other plate.

6. A device as claimed in claim 1, wherein said sensing means includes two force detectors disposed one each generally beneath the heel and ball of said foot.

7. A device as claimed in claim 2, wherein there are two pairs of said electrical contactors disposed one each generally beneath the heel and ball of said foot.

8. A device as claimed in claim 3, wherein there are two pairs of said electrical contactors disposed one each generally beneath the heel and ball of said foot.

9. A device as claimed in claim 4, wherein there are two pairs of said electrical contactors disposed one each generally beneath the heel and ball of said foot.

10. A device as claimed in claim 5, wherein there are two pairs of said electrical contactors disposed one each generally beneath the heel and ball of said foot.

11. A device as claimed in claim 1, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

12. A device as claimed in claim 2, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

13. A device as claimed in claim 3, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

14. A device as claimed in claim 4, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

15. A device as claimed in claim 5, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted

to hold said sensing means and to fit into the footwear of said patient.

16. A device as claimed in claim 6, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

17. A device as claimed in claim 7, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

18. A device as claimed in claim 8, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

19. A device as claimed in claim 9, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

20. A device as claimed in claim 10, wherein said means for maintaining said sensing means in a predetermined position includes a resilient pad adapted to hold said sensing means and to fit into the footwear of said patient.

21. A device as claimed in claim 20, wherein said means operably connected to said sensing means includes an electrically operated audible alarm connected to said contact.

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