May 30, 1939. E. MATTHIAS 2,160,027

FOOT-SOLE-CONTOUR DETERMINING APPARATUS

Filed Oct. 12, 1937

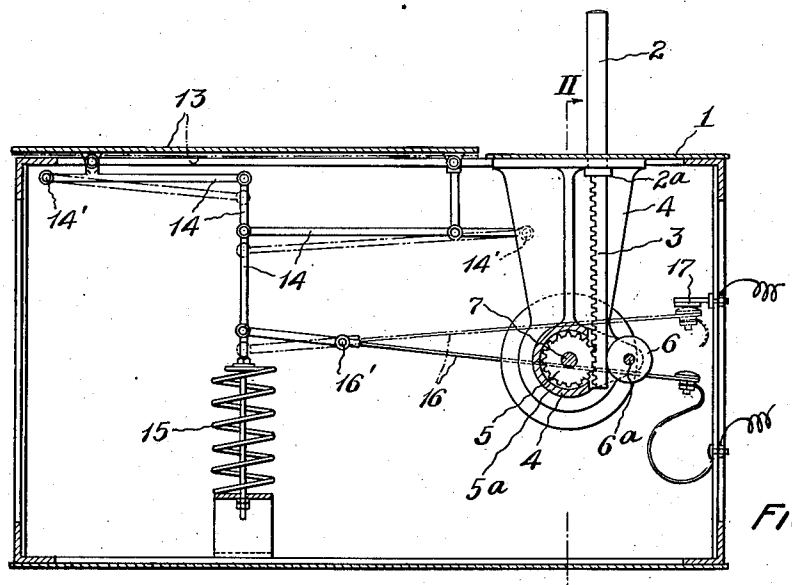


FIG. 1.

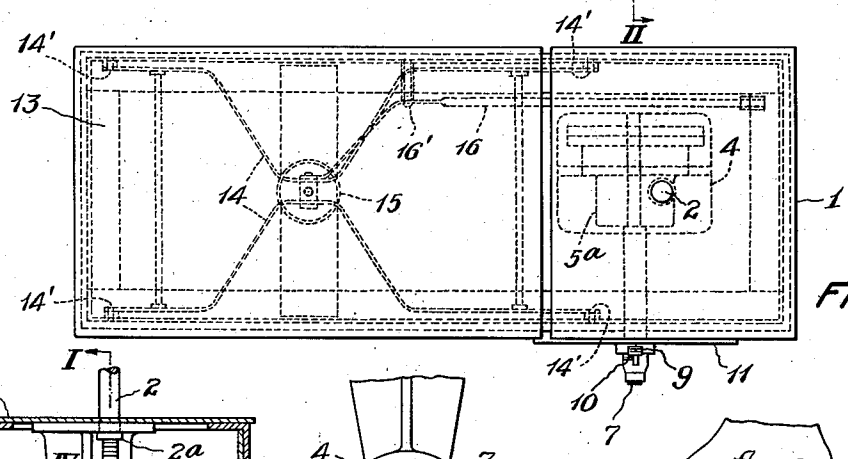


FIG. 3.

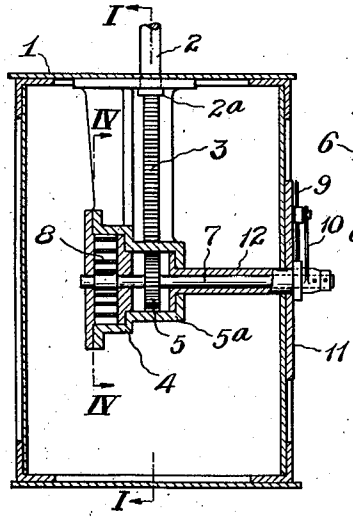


FIG. 2.

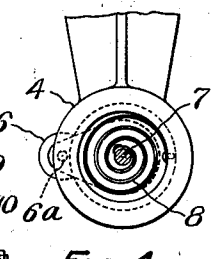


FIG. 4.

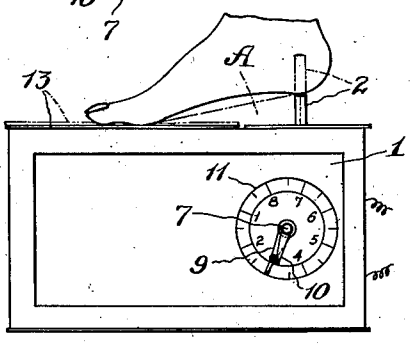


FIG. 5.

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FOOT-SOLE-CONTOUR DETERMINING APPARATUS

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5 Claims. (Cl. 33—3)

It is established knowledge that the elevation of the heel of the human foot with respect to the toes of the foot, which is to say, that the vertical distance of the lowermost point of the heel above the horizontal plane of the lowermost point in the ball of the foot varies greatly. This requires correspondingly higher or lower arch construction of the shoe, if the foot is to be maintained in its natural condition, instead of becoming overstrained and distorted from its natural form in consequence of unnatural confinement in a shoe.

This invention pertains to a method for determining the natural heel disposition of every foot, whereby to be able to establish the necessary height of the proper arch for each shoe. The method consists in measuring the maximum vertical dimension of a path travelled by the heel with the commencing point in the bottom of the heel as the upper end of the path while the foot is maintained hanging from the leg in a position of rest, the distance to be measured, as the freely hanging foot is caused to descend, being determined by the time required until the sole of the front of the foot or the ball of the foot contacts a level surface which the foot has been caused to approach.

The method may be performed in a simple manner by causing the bottom of the heel first to engage the top of a plunger movable through a tread surface which the foot is approaching and which plunger normally projects a distance equal to or somewhat greater than the maximum difference in elevation between the heel and ball of a foot when the leg hangs freely, and then continuing depression of the foot until the ball of the foot just encounters the tread surface whereby the measure of downward travel of the heel will determine the actual difference in elevation between the bottom of the heel and the ball of the foot when the leg hangs freely. Comparatively simple mechanism is required for thus rapidly determining the vertically offset relationship between the heel and the ball of the foot or greater elevation of the heel bottom than the ball of the foot when the leg hangs freely. The mechanism may additionally comprise a reactive mounting for the plunger, an indicating device operated by the plunger, and other dispensable details of construction to be later described.

It is to be understood that the drawing merely exemplifies one feasible mechanical embodiment subject to modification of equivalent parts or of their interacting relationship and function.

Adverting to the drawing:

Fig. 1 is a vertical longitudinal section of the apparatus.

Fig. 2 is a cross section taken on line II—II of Fig. 1.

Fig. 3 is a horizontal sectional view with the cover removed.

Fig. 4 is a vertical section on line IV—IV of Fig. 2.

Fig. 5 is a side elevation on a smaller scale showing a human foot resting thereon to indicate the intended application.

A box 1 has projecting up through its cover near one end a plunger 2 which interiorly of the box is designed as a rack 3, and the latter is mounted for vertically slidable movement in a bracket 4. The rack 3 meshes with a gear 5 and their engagement is maintained by the pressure of a roller 6 mounted in any suitable manner on a pin 6a. The gear 5 is operatively mounted in a housing 5a which may be integral with the bracket 4. The gear 5 is fixedly carried on a shaft 7 in which the inner end of a spiral spring 8 is situated whereas the outer end of the spring 8 is suitably secured to the housing 5a. A pointer 9 is frictionally engaged by an actuating arm 10 both of which travel around a dial 11 and a sleeve 12, likewise carried by the bracket 4, is provided as a bearing for the shaft 7. The pointer 9 is loosely mounted on the sleeve 12 outwardly of that side of the box where the dial 11 is, whereas the actuating arm 10 is fixed to the outer extremity of the shaft 7. Under the influence of the spiral spring 8 the plunger 2 is normally held in its protracted position as illustrated in Fig. 1 and in which position it projects a distance equal to or greater than the maximum measurable distance, or in other words, the maximum expectable measure of offset relationship, between the bottom of a human heel and the ball of the same foot. The top of the box at its other end carries a tread plate 13 articulated interiorly of the box with a lever mechanism 14 having two fixed pivots 14' and which is constructed according to the well-known system of decimal weighing scales, to permit a depression of the tread plate 13 parallelly to itself. A helical spring 15 serves to establish equilibrium and its tension is subject to adjustment. Extended from the lever mechanism 14 is a contact lever 16 which is designed to swing about the fixed point 16' and adapted to cooperate with a contact point 17 carried by the wall of the box. Fig. 1 illustrates in dot and dash lines an altered (slightly depressed) position of the tread plate 13 and of the lever mechanism 14 and of the consequential rocked

position of the contact lever 16 in which its terminus is in engagement with the contact point 17, whereupon an electrical circuit (see wire leads in Fig. 1) becomes closed to energize either an optical or an acoustical signal.

In operation, the person whose foot sole contour is being determined seats himself adjacent to the apparatus and while his foot is in a completely relaxed position with respect to his leg he brings the bottom of his heel into contact with the top of the protruding plunger 2. Meanwhile the front of the foot is still suspended freely in the air a distance above the plate 13 according to the construction of the particular foot. The plunger 2 becomes depressed upon a gentle descent of the foot thereagainst, without any muscular play, until the ball of the foot or the under surface of the front of the foot just touches the plate 13. As may be observed in Fig. 5 the direct line from the heel bottom to the ball of the foot will then determine the hypotenuse of the right angle triangle A, shown hatched, to supply the needed factors for the desired measurement. The light pressure which the foot exerts on the plate 13 sufficiently displaces the lever mechanism 14 in order to cause the swinging lever 16 to make the contact for furnishing the signal. Thereafter the foot may be removed. As the plunger 2 is caused to descend the rack 3 will turn the gear 5 against the action of the spiral spring 8 and consequently the shaft 7 is also turned in unison causing the actuating arm 10 to swing through an arc and to carry the pointer 9 along with it. After removal of the foot from the plunger 2 the spiral spring 8 will restore it to its projecting position of rest as limited by the collar shown between it and the rack 3 in Fig. 1. As the shaft 7 thereby becomes rotated in the opposite direction, it will turn the actuating arm 10 back to its original position, but the pointer 9 remains in its desired pointing position which may be read and interpreted from the dial 11, after which the pointer 9 may be manually returned to its commencing position. As soon as the plate 13 becomes released from foot pressure the lever mechanism 14 is restored to its initial position of rest subject to the action of the spring 15, whereupon the apparatus is readjusted for subsequent measurement.

The yielding plate 13 may be mounted in other ways than as exemplified so as to be adapted for slightly downward movement, indeed, the movability of the plate 13 is not necessary, instead only facilitates knowledge that correct measurement has been completed. If the plate 13 is fixed it may satisfactorily be determined by close observation at what time the contact of the front of the foot with the plate 13 establishes the end of the measuring procedure.

I claim:

1. In a device for determining the vertical distance between the heel bottom of a foot and a horizontal plane which the ball of the foot contacts when the leg is held in natural hanging position, a casing having a horizontal top wall, a vertically movable plunger slidably mounted within said casing and projecting normally with its upper end a predetermined distance above said top wall, means operatively connected with the inner portion of said plunger for indicating the distance the said plunger is depressed by the heel of a foot engaging the upper end of the plunger, means for returning said plunger automatically to its normal position when the heel disengages said plunger, a horizontal plate mounted for limited vertical movement and located normally above said top wall and above the said horizontal plane in a position to be engaged by the ball of the foot whose heel engages said plunger, and means responsive to a downward pressure upon said horizontal plate for closing an electric contact within said casing when said plate is depressed into said horizontal plane.

2. In a device for determining the vertical distance between the heel bottom of a foot and a horizontal plane which the ball of the foot contacts when the leg is held in natural hanging position, a casing having a horizontal top wall, a vertically movable plunger slidably mounted within said casing and projecting normally with its upper end a predetermined distance above said top wall, means operatively connected with the inner portion of said plunger for indicating the distance the said plunger is depressed by the heel of a foot engaging the upper end of the plunger, means for returning said plunger automatically to its normal position when the heel disengages said plunger, a horizontal plate mounted for limited vertical movement and located normally above said top wall and above the said horizontal plane in a position to be engaged by the ball of the foot whose heel engages said plunger, linkage means pivotally mounted within said casing about two spaced horizontal axes and connected with said horizontal plate for supporting the same in a horizontal position, spring means for maintaining said horizontal plate and linkage means in equilibrium, and means responsive to a downward pressure upon said horizontal plate for closing an electric contact within said casing when said plate is depressed into said horizontal plane.

3. In a device for determining the vertical distance between the heel bottom of a foot and a horizontal plane which the ball of the foot contacts when the leg is held in natural hanging position, a casing having a horizontal top wall, a vertically movable plunger slidably mounted within said casing and projecting normally with its upper end a predetermined distance above said top wall, means operatively connected with the inner portion of said plunger for indicating the distance the said plunger is depressed by the heel of a foot engaging the upper end of the plunger, means for returning said plunger automatically to its normal position when the heel disengages said plunger, said indicating means including a positively driven pointer movable over a scale on the outside of said casing, and a second pointer which is engaged by said first mentioned pointer and is moved together with the same in one direction, but remains stationary when the said first pointer during the return movement of said plunger moves in the opposite direction, a horizontal plate mounted for limited vertical movement and located normally above said top wall and above the said horizontal plane in a position to be engaged by the ball of the foot whose heel engages said plunger, and means responsive to a downward pressure upon said horizontal plate for closing an electric contact within said casing when said plate is depressed into said horizontal plane.

4. In a device for determining the vertical distance between the heel bottom of a foot and a horizontal plane which the ball of the foot contacts when the leg is held in natural hanging position, a casing having a horizontal top wall, a vertically movable plunger slidably mounted within said casing and projecting normally with its upper end a predetermined distance above said top wall, means operatively connected with

the inner portion of said plunger for indicating the distance the said plunger is depressed by the heel of a foot engaging the upper end of the plunger, means for returning said plunger automatically to its normal position when the heel disengages said plunger, said indicating means including a positively driven pointer movable over a scale on the outside of said casing, and a second pointer which is engaged by said first mentioned pointer and is moved together with the same in one direction, but remains stationary when the said first pointer during the return movement of said plunger moves in the opposite direction, a horizontal plate mounted for limited vertical movement and located normally above said top wall and above the said horizontal plane in a position to be engaged by the ball of the foot whose heel engages said plunger, linkage means pivotally mounted within said casing about two spaced horizontal axis and connected with said horizontal plate for supporting the same in a horizontal position, spring means for maintaining said horizontal plate and linkage means in equilibrium, and means responsive to a downward pressure upon said horizontal plate for closing an electric contact within said casing when said plate is depressed into said horizontal plane.

5. In a device for determining the vertical distance between the heel bottom of a foot and a horizontal plane which the ball of the foot contacts when the leg is held in natural hanging position, a casing having a horizontal top wall and a vertical side wall, a vertically movable plunger slidably mounted within said casing and projecting normally with its upper end a predetermined distance above said top wall, means operatively connected with the inner portion of said plunger for indicating the distance the said plunger is depressed by the heel of a foot engaging the upper end of the plunger, means for returning said plunger automatically to its normal position when the heel disengages said plunger, said indicating means including a positively driven pointer rotatable over a scale on the other face of the said vertical side wall of said casing, and a loosely rotatable second pointer coaxially which is engaged with said first mentioned pointer and adapted to be engaged by the latter to be moved together with the same in one direction, said second pointer remaining stationary when the said first pointer during the return movement of said plunger moves in the opposite direction, a horizontal plate mounted for limited vertical movement and located normally above said top wall and above the said horizontal plane in a position to be engaged by said plunger, and means responsive to a downward pressure upon said horizontal plate for closing an electric contact within said casing when said plate is depressed into said horizontal plane.

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