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APPARATUS FOR ASCERTAINING THE REQUIRED SHAPE FOR CORRECTIVE ARCH OR FOOT SUPPORTS

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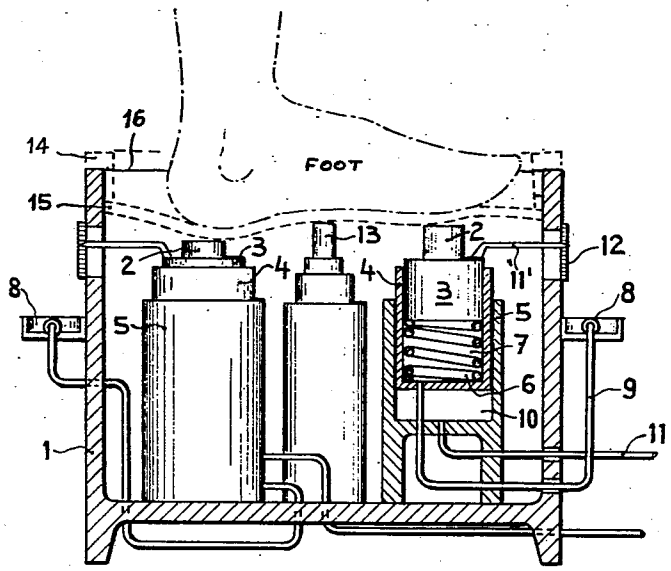


Fig. 1

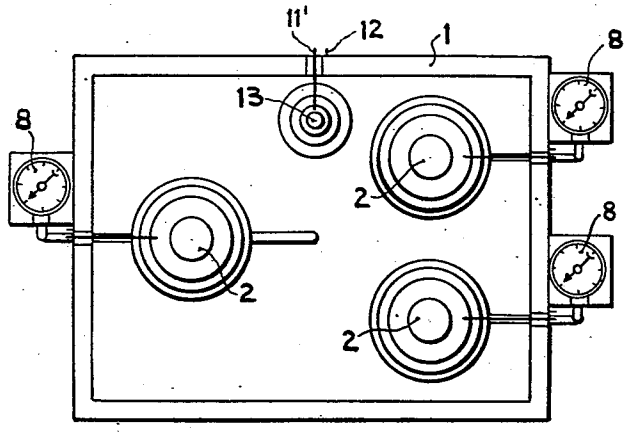


Fig. 2

INVENTOR.
GABRIEL MAKOWSKY

BY

ATTORNEY

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APPARATUS FOR ASCERTAINING THE REQUIRED SHAPE FOR CORRECTIVE ARCH OR FOOT SUPPORTS

Gabriel Makowsky, Zurich, Switzerland

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9 Claims. (Cl. 73—172)

The instant invention relates to foot or arch supports for deformed feet, and more particularly to an apparatus for measuring the extent of the deformity and the required degree of correction to be incorporated into the support corrective of the particular deformity.

Heretofore in determining the design of an arch or foot support for deformed feet, the procedure has been to make a plaster cast of the deformed feet and to make the support in accordance with the cast. Another prior known method is to measure the foot deformity with the aid of known devices, compare the measurements with those of the average, non-deformed normal foot, and to construct the supports in such a way that they should tend to correct the deformity. In both of these methods, the starting point is the foot, and with it the changed body position resulting from the deformed feet, so that actually the main purpose served by supports so made was to prevent the deformities from becoming worse and more marked. Because the weight distribution at the feet of the weight of the human body due to foot deformities is different from the normal distribution of such weight with normal feet, such improper weight distribution still is the fact when using the arch supports so produced.

The object of the instant invention is to provide an apparatus by which truly corrected and corrective foot or arch supports are produced in which the body weight is properly and normally distributed at the feet of the wearer notwithstanding the deformity.

A further object of the invention is to provide arch supports corrective of foot deformities in which the body weight is distributed substantially half to the fore portion of the foot and the other half to the heel thereof.

I accomplish the foregoing, and other, objects in my instant invention by measuring the weight distribution of the body of the person on the deformed feet at two transversely spaced points of the sole of the deformed foot and at one point central of the heel. Then the weight distribution is adjusted until half is carried by the heel point and half carried equally divided by the two points of the sole. The adjustment is made by elevating or lowering the individual support points, and when the desired half and half distribution is obtained, the point of maximum height of the arch above a fixed reference point is also measured. Preferably a container or pan is then disposed on the measuring points, such container consisting of yieldable material at least at and about the measuring points so that, after the adjustment has been made to the proper weight distribution, a cast can be made of the foot as properly loaded by the person's weight. The apparatus for performing the foregoing sequence of operations has at least three spring support points for supporting the foot, each support point being provided with an individual indicating mechanism, from which the weight supported on the point can be conveniently read, and with an individual indicator of the height of the support with reference to a fixed level. Preferably the apparatus is provided with a fourth spring measuring point, likewise adjustable in height, for measuring the height of the arch.

My invention will be more fully understood from the following description of an illustrative embodiment of the apparatus of my invention when read in conjunction with the appended drawing, in which:

Figure 1 is an elevational sectional view, in simplified form, of the embodiment; and

Figure 2 is a top view thereof.

The housing **1** is a rectangular container having an open top within which a plurality of supports **2** are vertically supported from the container bottom. Each of the supports **2**, of which three are shown in Figure 1 to support thereon, respectively, the sole of the foot at two laterally spaced regions and the heel at one region, includes a piston guided in a cylinder **4**. Cylinder **4**, having a closed bottom, is slidable in a fixed cylinder **5** resting on the bottom of the housing. A compression spring **6** is disposed within the slidable cylinder **4** and is braced between the bottom of the piston **3** and the bottom of cylinder **4**, the interior region **7** of the cylinder **4** below the piston being filled with a substantially incompressible liquid. A pressure indicator **8**, conveniently located at and sppported on the exterior wall of the housing, with its indicating dial facing upwardly for facility in reading, is connected by hydraulic line **9** to the interior region **7**, the scale of the indicator being calibrated to give a direct reading of the weight load applied to the support **2**. The interior region of the fixed cylinder **5** below the bottom of the slidable cylinder **4** and the bottom of the cylinder **5** is connected by a hydraulic line **11** to a source of incompressible liquid for admitting more or less liquid to the region **10**, thus varying the volume thereof for a given pressure prevailing therein and hence the vertical distance to which the slidable cylinder **4** extends into the cylinder **5**, that is, the position occupied by the top of the support **2**. Each of the pistons **3** carries, preferably affixed to the top or other portion of the piston where it will not impede the relative movement of the two cylinders, an individual pointer **11'** extending through a slit in the housing wall and adapted to travel over the vertical scale **12** on the exterior housing wall, permitting direct reading of the vertical position of the piston level. In the preferred form of my apparatus a fourth appropriately positioned measuring point **13** is provided for measuring the height of the arch, which support **13** is constructed the same as the supports **2** except for the omission of the pressure indicator **8** and the hydraulic line **9**, since the weight carried thereby is not measured.

While in the foregoing description of the illustrative embodiment I have stated the cylinder **5** of each support **2** (and **13**) is fixed, mainly to facilitate distinguishing it from the slidable cylinder **4**, each cylinder **5** may be adjustable in its horizontal position and is fixed only in its vertical direction and level. Such horizontal adjustment permits of ready adaptation of my apparatus to various foot sizes, rather than requiring perhaps a different specific unit for different ranges of foot sizes.

To measure the distribution of the weight of the person, the person steps onto the apparatus, preferably placed on the floor or other convenient low level, so that his heel and front portion of his foot are supported by the plurality of supports **2**, the foot being thus supported at three points, two spaced points at the sole and one at the heel. For a normal foot, the weight should be supported half at the heel and half at the fore portion of the foot. The actual distribution is read from the respective pressure indicators **8**. Thereupon the supports **2** which carry too great a portion of the person's weight are raised and those not carrying sufficient weight are lowered, by controlling the amount of liquid in the region **10** of the individual fixed cylinders **5**, forcing more liquid thereinto through the respective pipe **11** or permitting liquid

to drain therefrom through such pipes. The control means for such valving of the liquid may be of any known type and is not shown in the drawing. The readings of the scales 12 as indicated by the pointers 11' are then taken for the correct weight distribution so obtained, that is, when the heel support 2 carries half the weight and the two sole supports between them carry the other half thereof. Having ascertained the foot position for the proper, that is, half body weight each on the heel and forefoot, the height of the arch must be measured. This measurement is by means of the measuring point or support 13, but can also be by other and known means. .

Fabrication of the foot or arch support for the deformed foot is based on the readings so obtained. The relative vertical positions of the three supports 2 for the corrected weight distribution are noted as basic points for the arch support and to them is added as the fourth basic point the measured height of the arch. The surface of the arch support is thus constructed on the basis of these four fixed points by taking an impression of the foot in accordance with which the arch support, incorporating the necessary corrections to restore the deformity back to normal, is made.

A particular advantage results from combining the measurements for the corrected weight distribution with the taking of the cast of the foot. For this purpose, as shown by the dashed lines in Figure 1, a tray or pan 14 having a thin flexible bottom 15, for example of sponge or foam rubber or some other suitable material, fits into the open top of the housing and is placed on the adjusted supports 2 (and 13) the foot being replaced thereinto in the measuring position, and the tray filled with moist casting compound 16 and permitted to harden to form the cast. The bottom of tray 14 need, however, be made of yieldable or flexibly deformable material only in the regions thereof over the supports, and thus does not influence the measurements at the supports. In such regions of the bottom 15 over the supports, the bottom may have openings into which the supports 2 and 13 pass, which openings are covered by an elastic yieldable layer of material.

A further modification of the illustrative embodiment is in the use of a rest attached to the top of the support 2 for the heel. This rest is made adjustable in its transverse inclination and is for the purpose of restoring the heel to its normal position, particularly in deformities or weakness of the ankle, talipes, and clubfoot. Still other modifications will suggest themselves to those skilled in the art without departing from the spirit of my invention.

What I claim is:

1. Apparatus for measuring the distribution at the feet of the weight of a person comprising a plurality of supports adapted to support the foot, the supports being spaced from each other, and each support including a loading surface adapted to support one region of the foot, weighing means yieldingly supporting the loading surface, an indicator interconnected with the weighing means to indicate the load carried by the loading surface, and means for varying the vertical position of the weighing means.

2. Apparatus according to claim 1 in which each loading surface is interconnected with height indicating means adapted to indicate its height relative to a predetermined reference level.

3. Apparatus according to claim 1 in which the means for varying the vertical position of the weighing means is hydraulically operable.

4. Apparatus according to claim 1 in which the plurality of supports numerically is three, one support being positioned to receive the heel and the other two are positioned transversely spaced from each other to receive the sole.

5. Apparatus according to claim 1 in which a measuring support is positioned in vertical alignment with the region of maximum height of the arch of the foot, the measuring support including an upper surface, means yieldingly supporting the upper surface, means for varying the vertical position of the yielding means supporting the upper surface, and a height indicating means interconnected with the upper surface to indicate the relative height of the arch of the foot from a predetermined reference level.

6. Apparatus for measuring the distribution at the feet of the weight of a person comprising a plurality of supports spaced from each other and adapted collectively to carry the weight, each support comprising a piston, a hollow first, vertically positioned, cylinder having a closed bottom in which the piston is slidably guided, a coil spring supported on the bottom of the first cylinder and acting on the piston to oppose its motion into the first cylinder, a second cylinder having a closed bottom in which the first cylinder is a slide fit and of a height greater than the height of the first cylinder, means for filling the interior of the second cylinder below the bottom of the first cylinder with variable amounts of an incompressible liquid, an incompressible liquid of predetermined amount filling the interior region of the first cylinder between its bottom and the piston, and an indicating means connected to the latter interior region for direct reading of weight applied to the free end of the piston.

7. Apparatus according to claim 6 in which each support has its piston provided with a pointer and a scale supported independently of the piston to provide a reading of the vertical position of the piston relative to a reference point.

8. Apparatus according to claim 6 in which the plurality of supports numerically is three, one support being positioned to receive the heel and the other two are positioned transversely spaced from, and aligned with, each other to receive the sole, and a fourth support comprising a piston, a vertically positioned hollow slidable cylinder having a closed bottom, a coil spring braced between the piston and the bottom of the slidable cylinder, incompressible liquid filling the interior region of the slidable cylinder, a vertically fixed hollow cylinder in which the slidable cylinder is a slide fit and of a length exceeding that of the slidable cylinder and having a closed bottom, means for filling the interior region of the fixed cylinder below the slidable cylinder with variable amounts of incompressible liquid to vary the relative vertical positions of the two cylinders, a pointer extending from the piston, and a scale supported independently of the piston to which the pointer extends to indicate the vertical position of the piston, the fourth support being positioned in substantial vertical alignment with the highest point of the arch of a foot resting on the plurality of supports.

9. Apparatus according to claim 6 in which each piston has a loading platform extending from the upper portion thereof, the plurality of supports is numerically three, one support positioned to receive the heel and the other two transversely spaced from each other to receive the sole, and the loading platform of the heel support is adjustably inclinable transversely to the length of the foot.

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