Aug. 19, 1930. D. J. MORTON 1,773,113

KINETOGRAPH

Filed April 9, 1927

Fig. 1

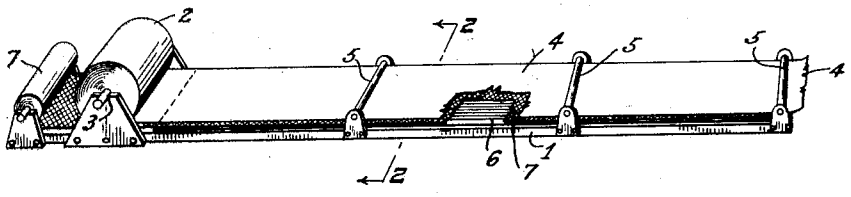


Fig. 2

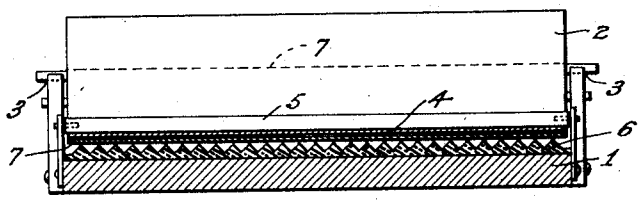


Fig. 4

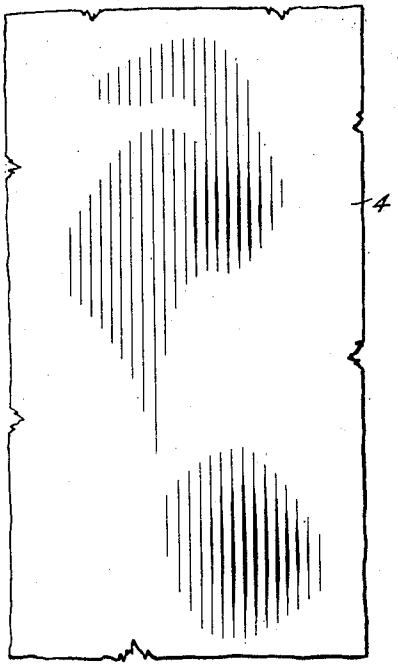
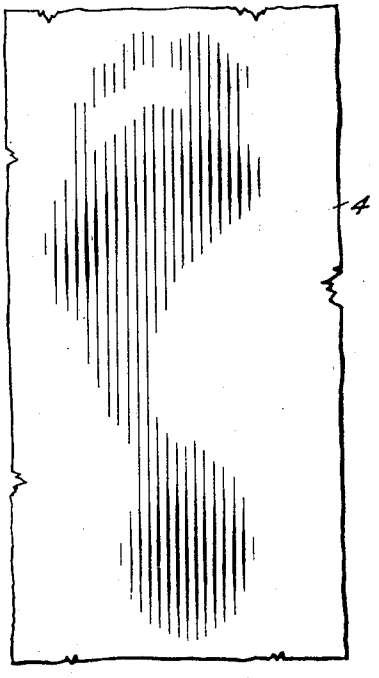


Fig. 3



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UNITED STATES PATENT OFFICE

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KINETOGRAPH

Application filed April 9, 1927. Serial No. 182,214.

This invention relates to process and apparatus for orthopedic measurement. Great inconvenience and distress is caused by troubles with the feet, which are commonly generically designated as "flat foot." Heretofore, however, the various conditions thus loosely classified have not been customarily differentiated from each other or accurately designated by reason of the inability of the diagnostician to determine the exact conditions existant.

It is impossible to form any accurate conception of the foot conditions by mere impression of the foot upon a surface or by the discoloration of the under surface of the foot by the floor, since divergent conditions and different natural characteristics respond similarly to such crude methods. Heretofore no satisfactory quantitative methods of measurement have been available.

As is well known, the bones of the foot constitute two arches at right angles to each other; one of these extends from the ball of the big toe to the ball of the little toe, and is called the metatarsal arch. The principal arch is supported by the metatarsal arch and tht heel. The normal condition of the foot, therefore, distributes the weight of the body between the three points of suspension, comprising the two ends of the metatarsal arch and the heel.

The present invention is concerned more particularly with determining improper conditions of the feet while the patient is walking.

Difficulty with the foot generally results from the fact that there is less lateral stability in the metatarsal arch because of its relatively narrow width. There is a tendency of the ankle, therefore, to bend either outwardly or inwardly. The latter element is the more common and is called pronation. In this condition the main arch of the foot no longer lies in a vertical plane as it should, and if this condition continues and becomes aggravated, it results in such a weakening of the main arch as to cause it to break down, resulting in the condition of "flat foot."

The incipience of difficulty with the arches of the foot is generally indicated, therefore, by an improper distribution of weight between the three points of support.

In accordance with this invention, therefore, means are provided for indicating the relative distribution of weight between the three points of support. Since, however, this invention relates more particularly to the measurement of the foot while walking and while thus the weight distribution varies from instant to instant, the invention contemplates means for recording the maximum value of pressure to which each point is subjected during the step cycle.

In the embodiment of the invention herein shown there is provided a plane surface over which the person may be caused to move and means are associated with that surface or with those portions of it which are to contact with the foot, for recording the maximum value obtained by the pressure thereon. In general proper diagnosis does not necessitate, at least for many purposes, quantitative values, it being sufficient to be able to compare relative weight distribution. It is therefore possible to employ, and the invention is herein embodied in an apparatus which does employ, a simple form of recording apparatus.

Referring now more particularly to the drawings, which illustrate the apparatus of the invention and with which the process may be carried out, Figure 1 is a perspective view of the apparatus. Figure 2 is a section on the line 2—2 of Figure 1, on an enlarged scale. Figure 3 represents an actual impression made by a normal foot upon the apparatus and Figure 4 represents an impression made by a foot which is pronated. The particular construction of the apparatus will be best seen from Figure 2, in which the numeral 1 indicates a base of any convenient material, preferably of a sufficient length to enable the subject to take several steps over a surface, in order that a normal stride may be attained. The numeral 2 designates a roll of impression material, which may be conveniently a roll of paper, so mounted as shown at 3, that the strip wound thereon may be caused to overlie the support 1, as shown at 4. Guides 5 may be arranged to overlie

the paper if desired to retain the same in place. Associated with the strip 4 are means capable of making an impression upon the paper substantially proportionate to the weight superposed upon it. In the form illustrated this comprises a rubber mat 6, having projections, here in the form of pointed or inverted V-shaped ridges, in its upper surface, while a carbon strip 7, as for example, ink fabric, is interposed between the ridges and the paper 4. With this construction, when the patient is caused to walk across the paper sheet the points of the V-shaped rubber ridges are depressed, as a function of the weight imposed upon each unit of area and this not only increases the amount of carbon transferred to the underside of the sheet, because of greater pressure, but also increases the width of each impression because of the flattening of the apices of the ridges. Furthermore, by reason of a yielding of the foot and mat, the total area of contact between the points of suspension and the paper increases with the pressure.

In operation the patient is caused to walk over the surface of the apparatus after the sheets have been superposed as described, and each foot-print is recorded on the under surface of the paper strip in a series of spaced impressions corresponding to the projections of the rubber mat. Thus, where longitudinal ridges are used the impression will be in the form of a plurality of parallel lines. These lines will, however, vary both in intensity and width, and the relative blackness of the three points of suspension is substantially proportional to the relative weight distribution thereon. Obviously, within the broad scope of this invention any suitable means may be employed to make a record of the momentary maximum pressure to which each unit of area is subjected, but the one herein illustrated is simple and efficient, and generally possessed of ample accuracy for diagnostic purposes.

Since certain changes in carrying out the above process and in the constructions set forth, which embody the invention, may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a device of the character described having a surface adapted to receive an impression, a plurality of printing elements by which said surface is supported, each of said printing elements being depressible by pressure to increase the printing area in response to increased pressure, said surface and said printing element together constituting a support on which a person may be caused to walk.

2. A device of the character described comprising, in combination, a strip of rubber having inverted V-shaped corrugations, said corrugations being yieldable responsive to pressure, a strip of paper thereon and supported by said corrugations and transfer material in contact with said paper.

3. An orthopedic measurement device including, in combination, transfer material and a support therefore having spaced yielding transfer material supporting parts.

4. An orthopedic measurement device including, in combination, a transfer sheet and a support therefor having on its sheet-supporting area a multiplicity of spaced resilient supporting parts.

5. A device of the character described comprising, in combination, a strip of material serving as a carbon transfer sheet, a strip of paper superposed thereon, said material resting on a plurality of resilient corrugations, said paper being adapted to transfer an impression thereon at the points that the corrugations contact with the transfer sheet, proportionate to the area of said points.

In testimony whereof I affix my signature.

DUDLEY J. MORTON.