May 19, 1953 A. A. AINES 2,638,776

MECHANICAL FOOTWEAR TESTING MACHINE

Filed Aug. 1, 1947 2 Sheets-Sheet 1

Fig. 1

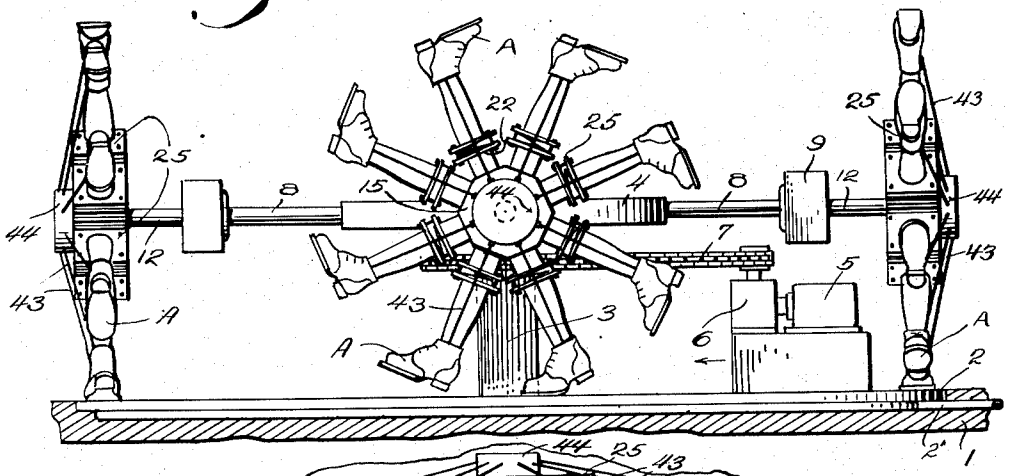
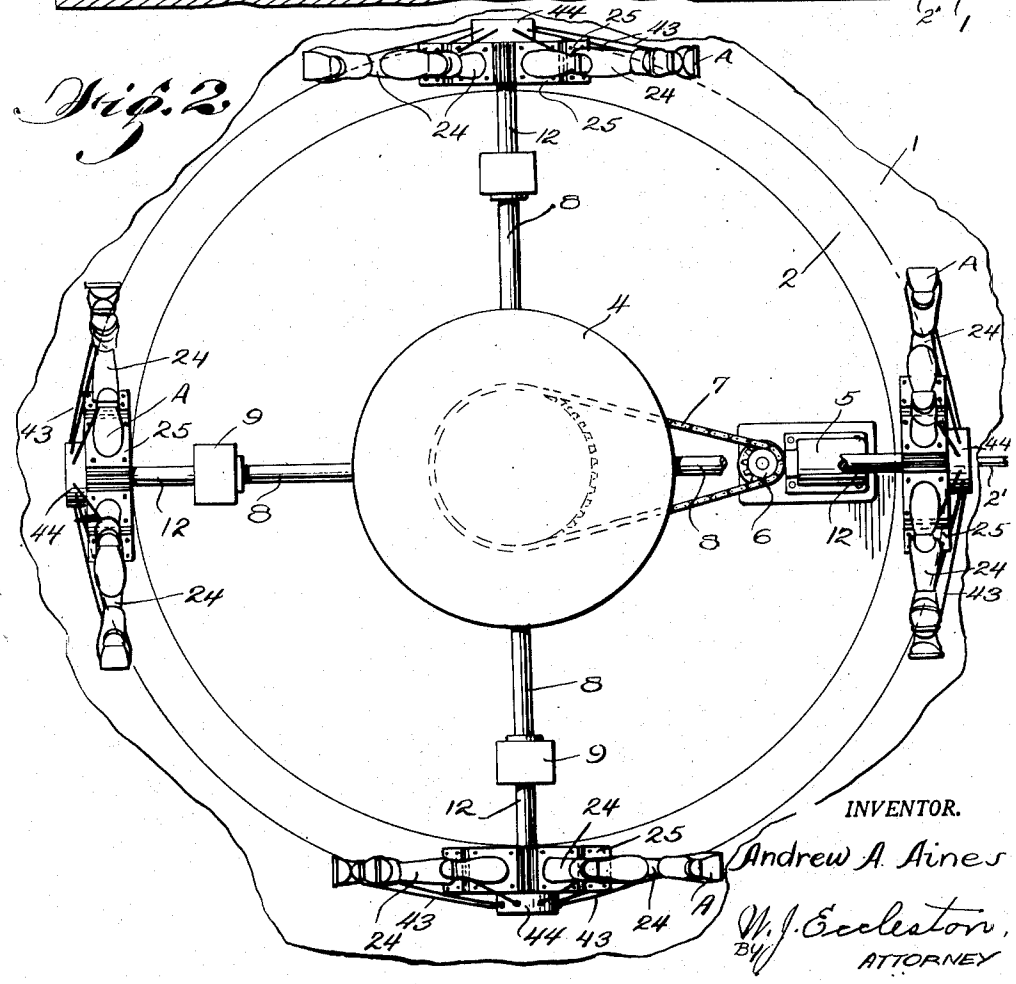


Fig. 2



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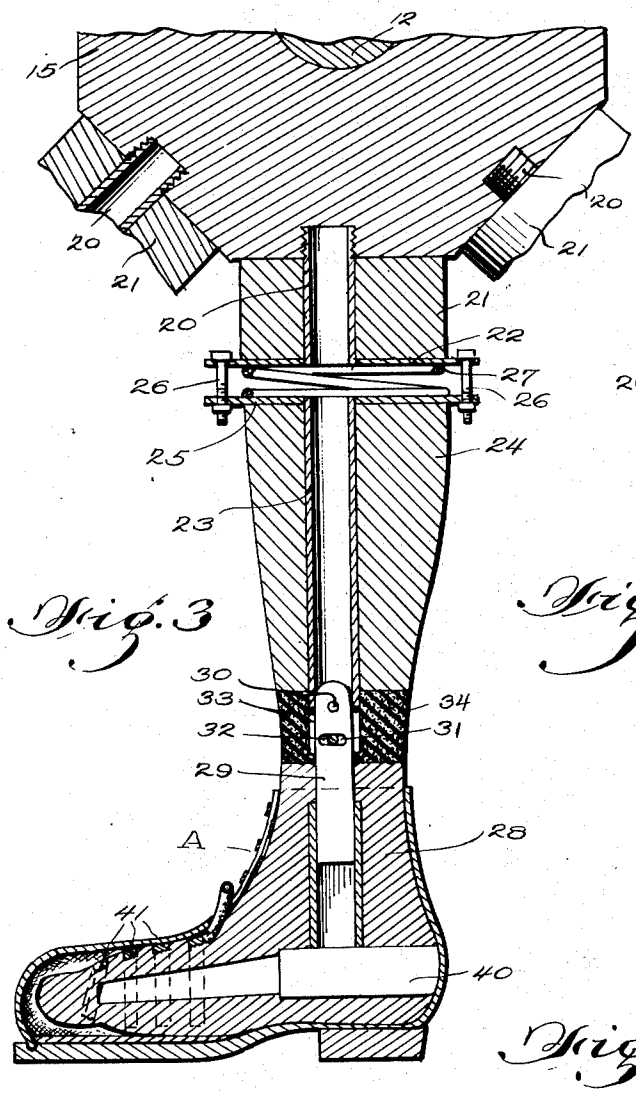


Fig. 3

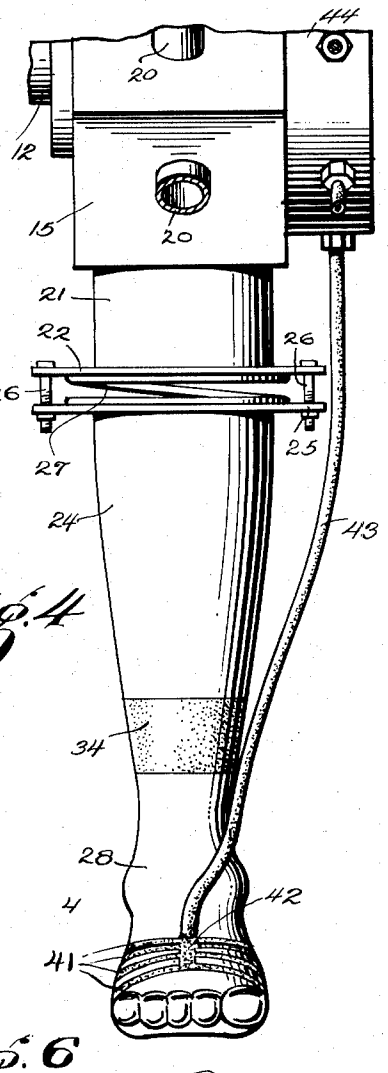


Fig. 4

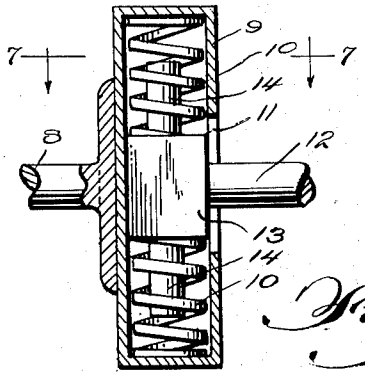


Fig. 5

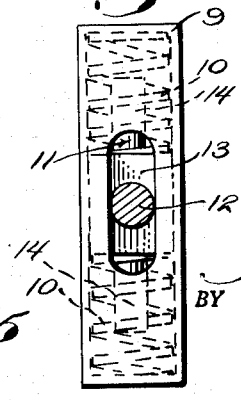


Fig. 6

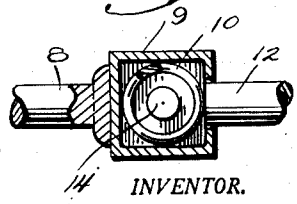


Fig. 7

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Patented May 19, 1953 2,638,776

UNITED STATES PATENT OFFICE

2,638,776

MECHANICAL FOOTWEAR TESTING MACHINE

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Application August 1, 1947, Serial No. 765,619

6 Claims. (Cl. 73—7)

(Granted under Title 35, U. S. Code (1952), sec. 266)

1

The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates to testing apparatus and especially to a machine for testing the wearability and durability of shoes.

A primary object of the invention consists in the provision of a testing machine provided with feet on which shoes may be placed and the machine operated so as to simulate actual conditions of use, as when walking.

A further object of the invention resides in the incorporation in the machine of heating means and perspiration simulating means so that actual service conditions may be reproduced and varied as desired.

A still further object of the invention consists in providing a machine which is capable of subjecting shoes to actual wearing conditions at a high rate of speed so as to indicate, in a matter of hours, the amount of wear which would be produced in shoes over a period of weeks or months of actual use.

Another object of the invention resides in the provision of means for heating or cooling the track with which the shoes cooperate.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings, in which,

Figure 1 is a front elevational view of the apparatus with the rear hub and related parts removed.

Figure 2 is a plan view of the apparatus with one of the shafts broken away.

Figure 3 is an enlarged sectional view through one of the artificial legs and related parts.

Figure 4 is a front elevational view of one of the artificial legs, and

Figures 5, 6 and 7 are detail views of one of the shock-absorbing elements.

In the testing of shoes it is essential that the shoes being tested be subjected to the same wear and tear to which shoes are subjected in actual use, and to this end it is necessary that the shoes being tested be applied to a surface with pressure corresponding to that which would be applied by the wearer and that the shoes be moved relatively to the surface in a manner corresponding to the movement of the feet of a person when walking or running. But it is immaterial whether the surface be moved relatively to the shoe supporting wheel or vice versa. In the present illustration, the mechanism is intended for outdoor operation

2

and the surface is fixed while the testing apparatus is considered to be moved bodily about the surface which is in the form of an annular track of approximately 50 feet in diameter.

The numeral 1 indicates a base preferably formed of concrete and to which is applied the annular track or surface 2. This tread-surface or trackway may be suitably roughened in simulation of conventional pavements or the like and to this end may be coated with abrasive garnet or carborundum imbedded in the concrete surface to provide an optimum index of resistance to the shoes as they are applied to and removed from the tread-surface. Also, one or more pipes 2' may be embedded in the concrete, slightly below the surface thereof, through which heating or cooling mediums may pass so as to approximate varying weather conditions. Disposed centrally of the trackway 2 is a pedestal or the like 3 on the upper end of which is rotatably mounted a disc 4. This disc may be rotated at the desired speed by any preferred means, but in the present instance an electric motor 5 operating through a gear reduction box 6 and sprocket chain 7 provides the necessary motive power. Extending radially from the disc 4 are a plurality of equally spaced horizontal rods 8, of which four are employed in the present embodiment of the invention. Each of these rods 8 is provided intermediate its end with a shock-absorbing element which is shown in detail in Figures 5, 6 and 7 and comprises a casing 9 fixed to the outer end of the rod and forming a housing for a pair of compression springs 10. The outer side of the housing is provided with a vertically extending slot 11 through which extends a rod 12. This rod is provided on its inner end with a piston 13 having pins 14 on its upper and lower ends which are received within the coils of the compression springs 10. Rotatably mounted on the outer ends of the rods 12 are the hubs 15 on which the artificial leg-foot members are mounted. It will thus be apparent that the shock-absorbing element, through the medium of the springs 10 and slot 11 serves to avoid damage to the apparatus in the event that any obstruction should be encountered by the shoes being tested.

In the present illustration, eight of the artificial leg-foot members are attached to each of the hubs 15 and consequently these hubs are of octagonal form so that the artificial legs may be suitably mounted on and radiate from the hubs. The legs are preferably formed of live resilient rubber surrounding a centrally arranged metal tubular

member. As clearly indicated in Figure 3 a metal tubular section 20 is threaded or otherwise fixedly secured to each of the eight flattened surfaces of the hub 15 and surrounding and fixed to each tubular section 20 is a section 21 of live resilient rubber which is representative of the upper portion of each leg. Fixed to the lower end of the tube 20 is a rectangular plate 22. The lower portion of the leg is also formed of a central tubular section 23 of metal surrounded by a live resilient rubber section 24 and to the upper end of the tube 23 is fixed a rectangular metal plate 25. The plates 22 and 25 are loosely connected against separation by means of bolts 26 which are threaded into the plate 25. By suitably adjusting these bolts the alignment of the elements 21 and 24 may be varied so as to alter the angle of gait. Interposed between these plates is a compression spring 27 which acts to provide the necessary pressure of the shoe on the track 2, and normally maintains the leg sections 21 and 24 in their adjusted relationship.

The artificial foot is indicated by numeral 28 and is also preferably formed of live resilient rubber. This foot member is fixed to a vertical plate 29 pivotally connected at its upper end within the lower end of the tubular section 23 as indicated by numeral 30, and the tube is slotted as indicated by numeral 33 to permit the plate to move about its pivot. Slightly below the pivot point 30 the plate 29 is provided with a horizontal slot 31 through which extends a pin 32 fixed adjacent the lower end of the tubular member 23 to provide the necessary articulation between the foot and leg, in other words, simulating the function of the human ankle. The space between the top of the foot member 28 and the bottom of the leg member 24 may be filled by a sponge rubber section 33 which serves to mask the joint between the foot and leg. The shoes to be tested are indicated by the letter A and it will be understood that the feet 28 are alternately shaped for right and left shoes.

To provide an adequate test of the shoes it is essential that actual conditions be reproduced as accurately as possible and to this end means are provided for heating the feet which are to be incased by the shoes, and preferably socks, and also means for simulating natural perspiration. For this purpose any type of electric heater 40 may be suitably mounted within the interior of the foot 28 so as to extend over and parallel the plantar area. To provide the simulated perspiration each foot has imbedded in its outer surface a plurality of wicks 41 extending laterally from a main wick portion 42. Terminating at or adjacent to wick portion 42 is a flexible tube 43 which has its upper end in communication with the interior of a tank 44 fixed to the outer surface of each of the hubs 15. These tanks, of course, are supplied with liquid preferably having a chemical formula approximating that of natural perspiration and this liquid will be fed through the tubes 43 to the wicks 41 by centrifugal force during the rotation of the hubs 15 as the latter are rotated in their travel along the track 2.

In the operation of the device, the shoes to be tested, right and left, are applied to the feet 28, preferably after socks have been applied thereto. The tanks 44 are provided with the proper liquid, the bolts 26 adjusted to provide the desired angular relationship between the leg members 21 and 24, and the current turned on the heaters 40. The motor 5 is then set in operation to cause the disc 4 to rotate and thereby bodily move the hubs 15 about the trackway 2. In this movement of the hubs 15 about the track the various shoes A mounted on the legs of each hub are caused to be successively brought into contact with the track; the heels of the shoe first engaging the track as in normal walking and then the sole, after which the shoe leaves the track as the heel of the succeeding shoe is brought into contact with the track. The desired pressure of the shoe against the track, corresponding to the weight of a person, is imparted by the springs 27. During these operations the interior of the shoe is heated, as in natural walking or running, by means of the heater 40 and the moisture or "perspiration" is supplied from the tank 44 by means of the tubes 43 discharging the liquid on to the wicks 41 and 42.

From the foregoing description and the attached drawings it will be apparent to those skilled in the art that I have devised an apparatus for testing shoes which is of rather simple construction; that it is capable of subjecting shoes to wear and tear in a manner closely resembling the conditions to which shoes are subjected in ordinary use; and that the apparatus may operate at high speed so as to apply to the shoes, in a matter of hours, stresses and strains corresponding in amount to those normally met with over a period of several months or more.

In accordance with the patent statutes I have described what I now consider to be the preferred embodiment of the invention but various changes may obviously be made in the details of construction without in any way departing from the spirit of the invention, and it is intended that all such changes be included within the scope of the intended claims.

I claim:

1. Footwear testing apparatus comprising an artificial foot adapted to receive a shoe, a circular track, pipes disposed beneath the track for conveying a heating or cooling medium therebeneath, and means to operate the foot to bring the shoe into contact with the track in a simulated walking movement.

2. Footwear testing apparatus comprising a circular track, a rotatably mounted horizontally disposed disc spaced above the track, a hub rotatably connected to the disc radially thereof, a plurality of artificial feet radiating from the hub and adapted to extend to or adjacent the track, a shock-absorbing element mounted between the hub and disc permitting up and down movement of the hub, and means for rotating the disc.

3. In a footwear testing apparatus, an artificial foot, a plurality of wick-like members extending about the foot, a source of artificial perspiration, and means for conveying the artificial perspiration to said wicks.

4. In a footwear testing apparatus, an artificial leg and foot, said leg composed of upper and lower spaced-apart sections, bolt-receiving means secured to the adjacent ends of said sections, a compression spring interposed between the adjacent ends of said sections, and bolts positioned in the bolt-receiving means for adjusting the angular relation between said sections.

5. In a footwear testing apparatus, an artificial leg and foot, said leg composed of upper and lower spaced-apart sections, plates secured to the adjacent ends of said sections, a compression spring interposed between the plates, and means interconnecting said plates for adjusting the angular relation of said plates.

6. Footwear testing apparatus comprising a circular track, a rotatably mounted hub spaced above the track on a horizontal axis, artificial legs and feet radiating from said hub, each leg composed of upper and lower spaced-apart sections, bolt-receiving means secured to the adjacent ends of said sections, a compression spring interposed between the adjacent ends of said sections, and bolts positioned in the bolt-receiving means for adjusting the angular relation between the sections.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,326,112	Stubbs	Dec. 23, 1919
1,400,042	Erb	Dec. 13, 1921
1,638,111	Coffin	Aug. 9, 1927
2,357,893	Harrington	Sept. 12, 1944
2,416,817	Carter	Mar. 4, 1947

OTHER REFERENCES

An article entitled, "Mechanical walker test shoe soles," found on page 29 of Popular Science Monthly, Jan. 1936.