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第一章 计算机组成原理概述

1.1 计算机的发展历程

1.1.1 电子计算机的诞生

1946年，世界上第一台电子计算机ENIAC在美国宾夕法尼亚大学诞生。

1.1.2 计算机的发展阶段

- 第一代：电子管计算机
- 第二代：晶体管计算机
- 第三代：集成电路计算机
- 第四代：大规模集成电路计算机

1.2 计算机的分类

1.2.1 按用途分类

1.2.2 按规模分类

1.3 计算机的应用

1.3.1 科学计算

1.3.2 数据处理

1.3.3 过程控制

1.3.4 人工智能

1.4 计算机的性能指标

1.4.1 字长

1.4.2 运算速度

1.4.3 存储容量

1.4.4 可靠性

1.5 本章小结

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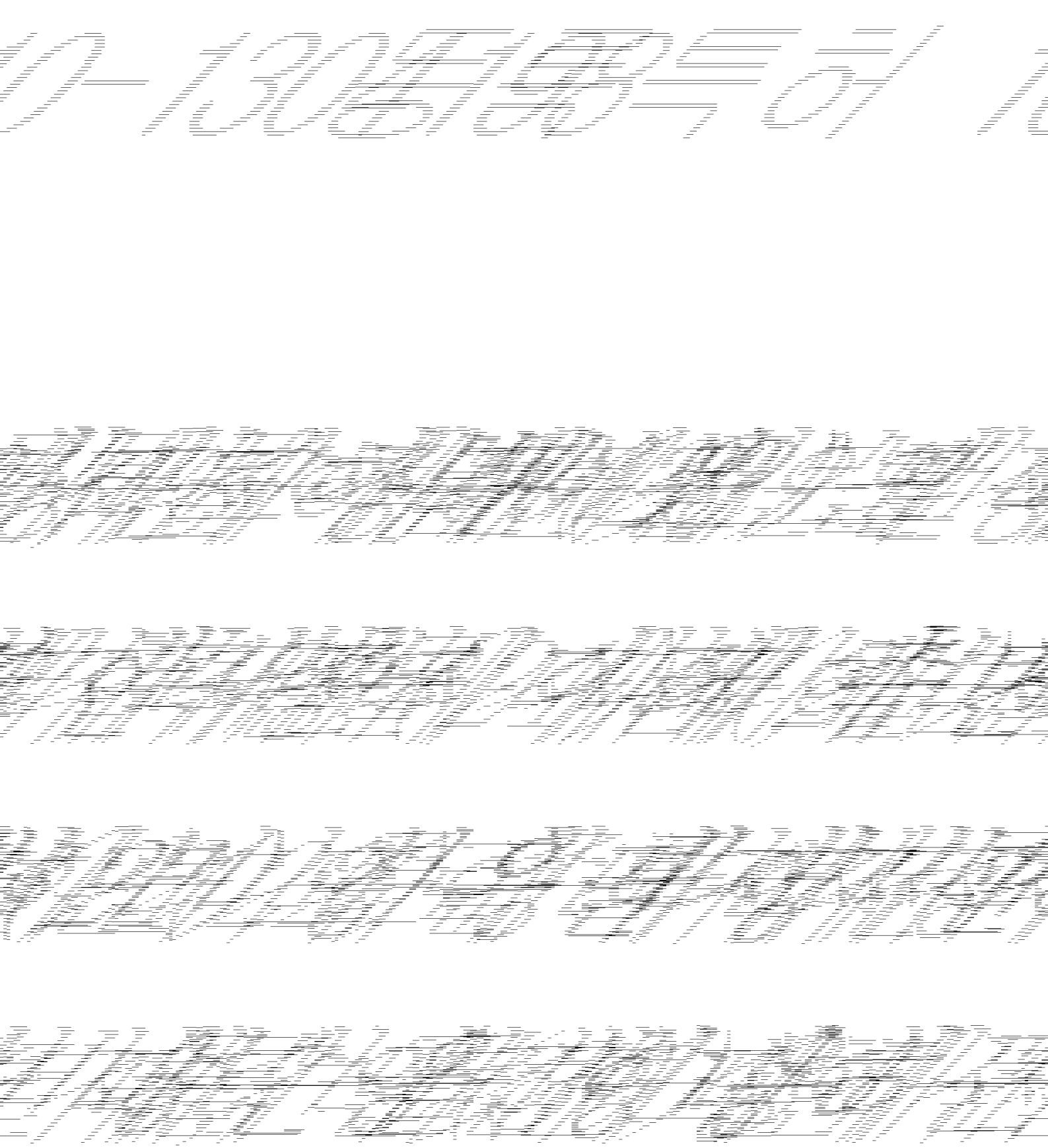

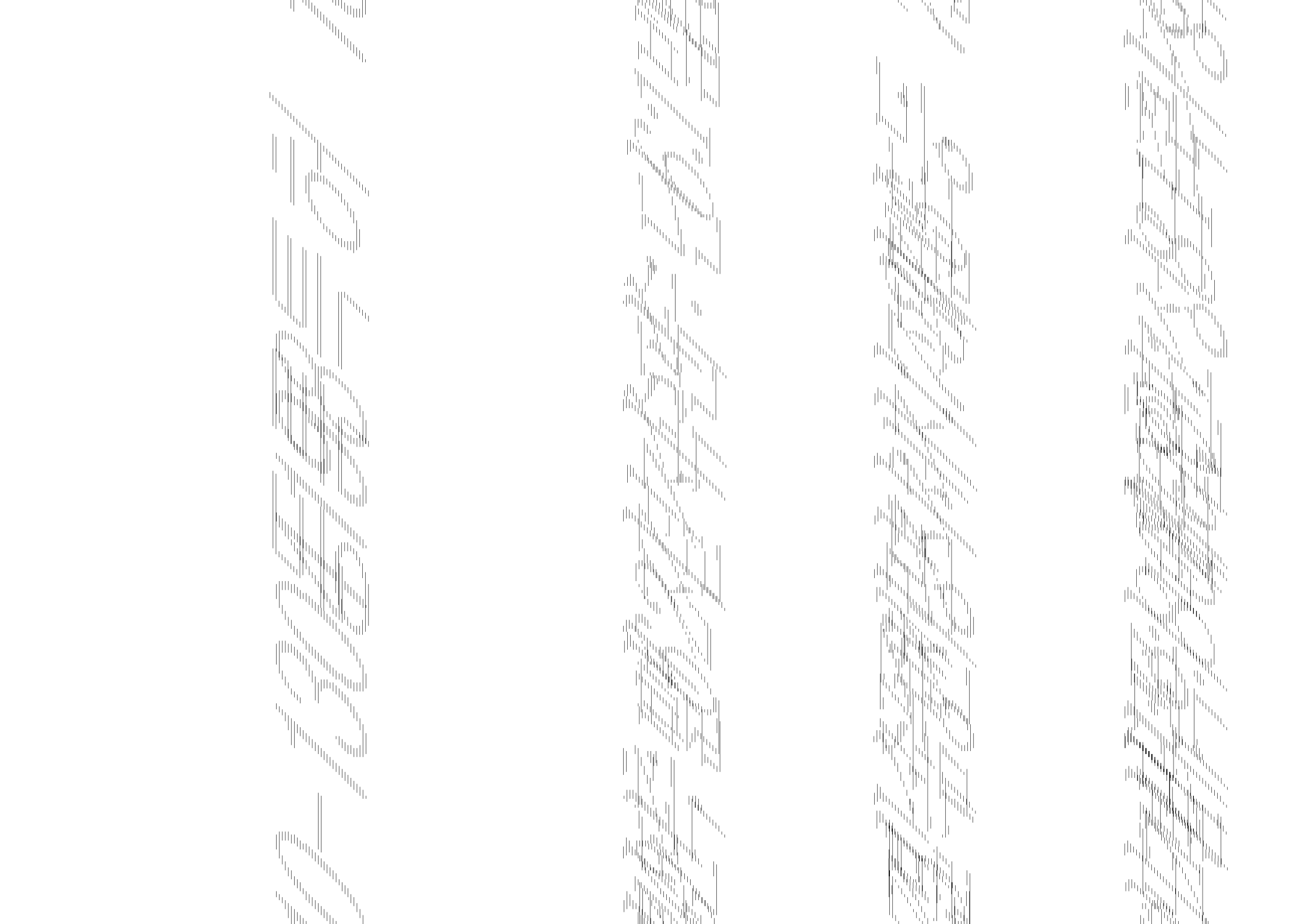

11-1 从信号到三分 A

第一章 绪论

第一节 研究背景与意义

一、研究背景

随着信息技术的飞速发展，数据已经成为现代社会的重要资源。

二、研究意义

本研究具有重要的理论和实践意义。

第二节 研究方法

一、文献研究法

通过查阅相关文献，了解研究现状。

二、实证分析法

收集数据，进行统计分析。

第三节 论文结构

本文共分为五章，结构如下：

第一章为绪论，介绍研究背景、意义和方法。

第二章为文献综述，对相关理论进行梳理。

第三章为研究设计，说明数据来源和分析方法。

第四章为实证分析，对数据进行统计分析。

第五章为结论与建议，总结研究发现并提出建议。

KR101304198B1 Measuring device for joint flexibility of the ankle

Measuring device for joint flexibility of the ankle

[0001] The present invention relates to a measuring instrument used for diagnosing damage and degree of damage to an ankle in an ankle injury, or for accurately measuring the degree of flexibility of an ordinary ankle. The ankle is provided with an ankle The present invention relates to an ankle flexibility measuring instrument capable of measuring the flexibility of the ankle.

[0002] Often, ankle ligaments are damaged during daily life or during exercise. For example, when ankle is twisted when jumping from a high place to landing, the ankle ligament is damaged by the load applied to the ankle. If injuries are severe, such as ligament rupture, it will cause severe pain. Therefore, X-RAY and MRI can accurately diagnose the degree of injury of the ankle ligament, and appropriate treatment is performed.

[0003] If the ankle ligament is slightly injured, it may be possible to move it other than swelling or bruising. In this case, it is necessary for the diagnosis person to directly rotate the ankle of the injured person to the left and right, And degree of damage.

[0004] However, objective and quantitative measurements were not possible with the facilitator. For example, not only was there a difference in the ankle rotation angle depending on the force applied by the diagnostic person (torque), but also quantitative data on how exactly the ankle rotation angle was obtained could not be obtained. However, the diagnosis was made only by the reaction of the ankle rotation according to the degree of the patient 's suffering. In addition, the degree of rotation of the ankle, that is, the flexibility of the ankle varies according to the age, gender, and development of the ankle ligaments. Therefore, in order to accurately diagnose ankle injuries, It is necessary to have a measuring instrument.

An object of the present invention is to provide an ankle flexibility measuring instrument capable of objectively measuring an ankle rolling range for an objective and accurate diagnosis of injury and an injury level when ankle ligament is injured, There is a purpose.

According to the present invention, the above and other objects can be accomplished by the provision of a device comprising: a base part constituting a lower part of a device; a leg fixing part inclined at an angle to an upper part of the base part to form a space for accommodating the leg; An angle display unit which displays an angle scale on the surface and is coupled to one side of the leg fixing unit close to the ground, and an angle display unit that is rotatably coupled to the angle display unit, And the ankle flexure measuring device is provided with an ankle rotation part in which a space for accommodating the ankle flexure is formed. According to a preferred aspect of the present invention, the leg fixing part is inclined at a predetermined angle to the upper surface of the base part, A pair of leg side support plates and an inner side of the pair of leg side support plates to support the calf region The leg binding means is provided with a calf support plate and a leg binding means provided in a space formed by the leg side support plate and the calf support plate. According to a preferred feature of the present invention, According to a preferred aspect of the present invention, the ankle rotation part includes a rotation coupling piece rotatably coupled to the angle display part, and a foot seating part for seating the foot to form a space for accommodating the foot. According to a preferred feature, the footrest portion includes a foot side support plate coupled to the rotary coupling piece and extending forward to support the foot side, and a foot plate formed to support the foot between the inside of the foot side support plate, According to a preferred aspect of the present invention, the foot binding means Preferably, the means is a toe coupling band in which a Velcro tape is formed on the surface, more preferably a heel supporting pad having a concave inner surface and installed at the rear of the foot plate. According to a preferred feature of the present invention, A driver groove is formed on one side so as to detachably engage with the torque driver, and furthermore, a weight is further provided on the rear side of the foot mount part closest to the ground.

According to the present invention, the rotation angle of the ankle can be measured in a state where the ankle is fixed from the knee to the ankle, which is the lower part of the leg, so that it is possible to accurately diagnose whether the ligament is injured or damaged in an ankle injury, And to evaluate the results of the reconstruction and operation caused by limitation of the postoperative joint motion at various points after the operation.

[0014] BACKGROUND OF THE INVENTION 1. Field of the Invention [0001] The present invention relates to an ankle flexibility measurement device, Figure 4 is a view for explaining measuring the torque applied to the ankle flexibility measuring instrument according to the present invention Figure 4 is a view for explaining the measurement of the torque applied to the ankle flexibility measuring instrument according to the present invention Figure 5 is a view for explaining that the ankle rotating part is restored to its original position when external force applied to the ankle flexibility measuring instrument according to the present invention disappears Fig.

[0015] Hereinafter, preferred embodiments of the present invention will be described in detail with reference to the accompanying drawings. Prior to this, terms and words used in the present specification and claims should not be construed as limited to ordinary or dictionary terms, and the inventor should appropriately interpret the concept of the term appropriately to describe its own invention in the best way. The present invention should be construed as meaning and concept consistent with the technical idea of the present invention based on the principle that it can be defined. Therefore, the embodiments described in this specification and the configurations shown in the drawings are only the most preferred embodiments of the present invention and do not represent all the technical ideas of the present invention. Therefore, It should be understood that equivalents and modifications are possible.

[0016] The ankle flexibility measuring device according to the present invention is an instrument for measuring an injury or an injury of an ankle when an ankle is injured or measuring an accurate data of an ankle which is usually flexible. It is a measuring instrument that measures how much the ankle is rotated.

[0017] 1 to 3, the apparatus for measuring ankle flexibility according to the present invention includes a base 10 constituting a lower portion of a device 100, An angular display unit 40 coupled to one side of the leg fixing unit 20 near the ground and having an angle scale displayed on the surface thereof, And an ankle rotation part 50 which is connected as far as possible.

[0018] The base portion 10 is a bottom base for firmly supporting the instrument 100 on the bottom surface and includes a horizontal plate 11 contacting the bottom surface and a bottom portion 11 extending upwardly from the rear of the horizontal plate 11, And a straight plate (12). The upper surface of the vertical plate 12 is formed as an inclined surface inclined downward. The horizontal board 11 and the vertical board 12 may be integrally formed and may be joined by separate fastening means such as bolts or pieces.

[0019] The leg fixing part 20 fixes and supports a part from the lower part of the knee to the ankle under the legs and includes a pair of leg side supporting plates 21 coupled to the upper surface of the vertical plate 12 to support the leg side parts, And a calf support plate (22) provided between the inside of the leg side support plate (21) and supporting a calf portion. The leg side support plate 21 and the calf support plate 22 form a space for accommodating the legs, and it is preferable that the leg binding means 30 is provided for firmly supporting the legs in the space. The leg binding means 30 may be a leg binding band 31 having a Velcro tape formed on its surface. The figure shows a leg binding band 31 fastened to a binding groove 34 formed so as to be spaced from a surface of a calf support plate 22 but may be fastened to a groove formed opposite to the leg side supporting plate 21.

[0020] The angle display unit 40 displays an angle of rotation of the ankle coupled to the lower surface of the leg-fixing unit 20. The angle display unit 40 is an annular ring having a hollow therein so that the foot can be inserted and removed therein. Is displayed. The angle scale 41 is displayed at a predetermined angle with respect to the reference point at which the ankle is not rotated to the right and left, and the angle of 0 ° and the left and right sides.

[0021] As shown in FIG. 3, the ankle rotating part 50 rotates the ankle by placing the foot in a space for accommodating the foot, and an indication mark 52 indicating an angle of rotation at the reference point is displayed on the surface. Can be measured. The ankle rotation part 50 includes a rotation coupling part 51 rotatably coupled to the angle display part 40 and a foot mounting part 60 that is coupled to one side of the

rotation coupling part 51 to seat the foot . The rotating engagement piece 51 is indicated on the surface with an indication (arrow 52 in the drawing) so as to indicate the angle scale 41. [

[0022] The footrest portion 60 includes a foot side support plate 61 coupled to the rotation coupling piece 51 and extending forward to support the foot side and a foot plate (not shown) formed to support the sole between the inside of the foot side support plate 61 62). The foot side supporting plate 61 and the foot plate 62 form a space for accommodating the feet, and it is preferable that the foot binding means 70 is provided for firmly supporting the feet in the space. The foot binding means 70 may be an instep binding band 73 having a Velcro tape formed on its surface. The figure shows a foot binding band 73 fastened to a binding groove 74 formed so as to be spaced from a surface of a foot plate 62 but may also be fastened through a groove formed in the foot side supporting plate 61. The foot binding means 70 further includes a heel support pad 75 having a concave inner surface and installed at the rear of the foot plate 62 so that the front portion of the foot is supported by the foot binding band 73, And the back portion of the foot can be comfortably and firmly supported by the heel supporting pads 75. [

[0023] The ankle flexibility measuring instrument according to the present invention as described above can measure the accurate torque value applied during the ankle rotation, which will be described with reference to FIGS. 4 and 5. FIG.

[0024] FIG. 4 is a view for explaining measurement of a torque applied to the ankle flexibility measuring instrument according to the present invention. FIG. 5 is a view for explaining a method of measuring the torque applied to the ankle flexibility measuring mechanism according to the present invention. Fig.

[0025] As shown in the drawing, the ankle flexibility measuring instrument 100 according to the present invention is configured such that a torque driver 80 is detachably coupled to one side of a foot rest 60 for measuring an accurate torque value applied during an ankle rotation, A driver groove 81 is formed. Therefore, it is possible to measure the accurate torque value applied by the torque driver 80 during the rotation, and thus the individual ankle rotation angle data can be obtained individually.

[0026] Further, a relatively heavy metal weight 76 is provided behind the foot rest 60 closest to the ground. Therefore, in the normal state without an external force, the footrest 60 is located at the reference point by the weight 76, and it becomes unnecessary to align the reference points. In order to measure the rotation angle, After the rotation angle is measured, the weight 76 is returned to its home position by gravity as shown in Fig. 5, and the foot rest 60 is automatically returned to the reference point.

[0027] According to the ankle flexibility measuring apparatus of the present invention configured as described above, the rotation angle of the ankle can be measured while fixing the knee to the ankle under the leg, so that it is possible to accurately diagnose whether the ligament is injured or damaged in an ankle injury As well as being able to measure the accuracy of how much ankle is usually flexible.

[0028] Base unit: 10 Horizontal plate: 11 Vertical plate: 12 Leg fixing unit: 20 Leg side support plate: 21 Calf support plate: 22 Leg binding unit: 30 Leg binding band: 31 Bonding groove: 34,74 Angle display unit: 40 Angle scale: 41 Ankle rotation part: 50 rotation coupling part: 51 indication part: 52 foot part: 60 part side part: 61 foot part: 62 foot part: Home: 81 Ankle flexibility measuring instrument: 100

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(54) **Title:** DEVICE FOR MEASURING RANGE OF MOTION OF ANKLE

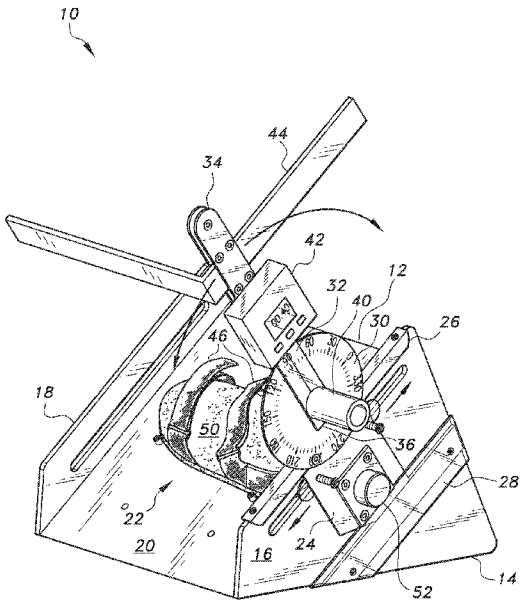

FIG. 1

(57) **Abstract:** The device for measuring range of motion of an ankle (10) provides for angular measurement of the range of motion of a patient's ankle, and includes a foot rest (12) having a base (14), a pair of sidewalls (16, 18) and an inclined upper surface (20). A foot retainer (22) releasably receives the patient's foot (F). A mounting plate (24) is slidably mounted to one of the pair of sidewalls (16, 18). The lower end (36) of an elongated rod (32) is rotatably mounted to the mounting plate (24). An inclinometer (42) is secured to the elongated rod (32). A retaining bar (44) is secured to the elongated rod (32), adjacent its upper end (34). The retaining bar (44) is adapted for positioning adjacent a calf muscle (C) of the patient when the patient's foot (F) is received in the foot retainer (22).

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DEVICE FOR MEASURING RANGE OF MOTION OF ANKLE

TECHNICAL FIELD

The present invention relates to measurement of range of motion of a patient's ankle, and particularly to a device for measuring range of motion of an ankle for both side-to-side movement (i.e., eversion and inversion) and vertical foot movement (i.e., dorsiflexion and plantar flexion).

BACKGROUND ART

The ankle includes three joints, namely the ankle joint proper or talocrural joint, the subtalar joint, and the inferior tibiofibular joint. The full range of motion (ROM) of a person's foot about the ankle is defined by the range of motion of each of these three joints, particularly side-to-side foot motion (i.e., eversion and inversion) and vertical foot motion (i.e., dorsiflexion and plantar flexion). In order to diagnose angle injury, most measurements of ankle range of motion are only taken in an up and down direction (i.e., vertical angular movement). Only measuring dorsiflexion and plantar flexion is equivalent to leaving at least half of potentially valuable data unmeasured. Thus, a device for measuring range of motion of an ankle solving the aforementioned problems is desired.

DISCLOSURE OF INVENTION

The device for measuring range of motion of an ankle provides for angular measurement of the range of motion of a patient's ankle. The device for measuring range of motion of an ankle includes a foot rest having a base, a pair of sidewalls and an inclined upper surface. A foot retainer is secured to the inclined upper surface of the foot rest for releasably receiving the patient's foot. The foot retainer is preferably rotatably secured to the inclined upper surface. A mounting plate is slidably mounted to one of the pair of sidewalls, such that the mounting plate is selectively slidable along a direction parallel to the inclined upper surface for proper positioning with respect to the patient's foot and ankle. It should be understood that the mounting plate may be slidably mounted to the foot rest in any suitable manner, such as, for example, by a pair of brackets secured to the foot rest for slidably receiving the mounting plate.

An elongated rod, having opposed upper and lower ends, is further provided, with the lower end thereof being rotatably mounted to the mounting plate. An inclinometer, such as a

digital inclinometer, angle sensor or the like, is secured to the elongated rod for measuring an angular displacement of the elongated rod with respect to the inclined upper surface of the foot rest. A measuring member may be further fixedly secured to the mounting plate. The measuring member has indicia formed thereon indicating an angular displacement of the elongated rod, such that the elongated rod and the measuring member form a conventional goniometer. It should be understood that the inclinometer performs the measurement of the patient's range of motion, and the goniometer may be used for calibrating the inclinometer.

A retaining bar is secured to the elongated rod, adjacent the upper end thereof, with the retaining bar extending substantially orthogonal to the elongated rod. The retaining bar is adapted for positioning adjacent a leg of the patient when the patient's foot is received in the foot retainer. Preferably, the retaining bar is slidably mounted on the elongated rod for selectively adjusting a height of the retaining bar with respect to the foot rest, allowing the device for measuring range of motion of an ankle to be used by patients having varying heights and body types.

These and other features of the present invention will become readily apparent upon further review of the following specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a device for measuring range of motion of an ankle according to the present invention.

Fig. 2 is a perspective view of the device for measuring range of motion of an ankle according to the present invention in a first configuration.

Fig. 3 is a perspective view of the device for measuring range of motion of an ankle shown in an alternative configuration.

Similar reference characters denote corresponding features consistently throughout the attached drawings.

BEST MODES FOR CARRYING OUT THE INVENTION

The device for measuring range of motion of an ankle 10 provides for angular measurement of the range of motion of a patient's ankle. As shown in Figs. 1 and 2, the device for measuring range of motion of an ankle 10 includes a foot rest 12 having a base 14, a pair of sidewalls 16, 18 and an inclined upper surface 20. In conventional devices for measuring range of motion (ROM) of a patient's ankle, only the angular movement in an up

and down direction is measured (i.e., vertical angular movement). The inclined upper surface 20 of the foot rest 12 allows the patient to position his or her foot F at a horizontal angle, allowing for measurement of side-to-side (i.e., eversion and inversion) and vertical range of motion (i.e., dorsiflexion and plantar flexion). In other words, the device for measuring range of motion of an ankle 10 allows for measurement of a full functional range of motion of the ankle, which includes contributions from both the subtalar joint, also known as the talocalcaneal joint, and the talocrural joint. It should be understood that the overall contouring and relative dimensions of foot rest 12 are shown for exemplary purposes only. The inclined upper surface 20 is inclined at approximately 40° with respect to base 14, which is adapted for sitting on a support surface, such as a horizontal floor surface.

A foot retainer 22 is secured to the inclined upper surface 20 of the foot rest 12 for releasably receiving the patient's foot F. The foot retainer 22 is preferably rotatably secured to the inclined upper surface 20 to allow the foot rest to be rotated 360°. However, the foot retainer 22 can be detachably secured to the foot rest 12 to permit repositioning of the foot retainer 22 in this manner. The foot retainer 22 can be positioned for measuring a side or horizontal bending movement of the ankle joint, as illustrated in Fig. 2 or for measuring a vertical bending movement of the ankle joint, as illustrated in Fig. 3. The foot retainer 22 includes a pad 50 or contoured mount for comfortably supporting the sole of the patient's foot F. At least one strap 46 may be provided for releasably securing the patient's foot F during measurement. It should be understood that any suitable type of pad or retainer may be used in the construction of foot retainer 22, and that straps 46 are shown for exemplary purposes only, and foot F may be secured to foot retainer 22 by any suitable releasable fixture or fastener.

A mounting plate 24 is slidably mounted to one of the pair of sidewalls. In the example of Figs. 1-3, the mounting plate 24 is shown slidably mounted to sidewall 16, although it should be understood that mounting plate 24 could be slidably mounted to sidewall 18 with the device for measuring range of motion of an ankle 10 operating in a substantially identical manner. As shown, the mounting plate 24 is selectively slidable along a direction parallel to the inclined upper surface 20 for proper positioning with respect to the patient's foot and ankle. Mounting plate 24 may be selectively held in a desired position by tightening knob 52, or through the usage of any suitable type of engaging member, locking device, frictional fit or the like. It should be understood that the mounting plate 24 may be slidably mounted to the foot rest 12 in any suitable manner, such as, for example, by a pair of brackets 26, 28 secured to foot rest 12 for slidably receiving the mounting plate 24.

An elongated rod 32, having opposed upper and lower ends, 34, 36, respectively, is further provided, with lower end 36 being rotatably mounted to the mounting plate 24 (at 40). An inclinometer 42, such as a digital inclinometer, angle sensor or the like, is secured to the elongated rod 32 for measuring an angular displacement of the elongated rod 32 with respect to the inclined upper surface 20 of the foot rest 12. A measuring member 30 may be further secured to the mounting plate 24. The measuring member 30 has indicia formed thereon indicating an angular displacement of the elongated rod 32, such that the elongated rod 32 and the measuring member 30 form a goniometer. It should be understood that the inclinometer 42 performs the measurement of the patient's range of motion, and the goniometer may be used for calibrating the inclinometer 42.

A retaining bar 44 is secured to the elongated rod 32, adjacent the upper end 34 thereof, with the retaining bar 44 extending substantially orthogonal to the elongated rod 32. It should be understood that the substantially L-shaped retaining bar 44 is shown for exemplary purposes only. The retaining bar 44 is adapted for positioning adjacent or proximate a calf muscle C of the patient when the patient's foot F is received in the foot retainer 22 (about 20 cm below the tuberosity of the tibia in an average adult). Preferably, the retaining bar 44 is slidably mounted on the elongated rod 32 for selectively adjusting a height of the retaining bar 44 with respect to the foot rest 12, allowing the device for measuring range of motion of an ankle 10 to be used by patients having varying heights and body types.

In use, the patient places his or her foot F on the foot retainer 22 and lowers his or her lower leg as much as possible; i.e., the patient stretches in the direction of motion being measured until he or she reaches the maximum tolerable angle. The retaining bar 44 is then lowered to the level of the leg while the patient's foot is held in the foot retainer 22. The inclinometer 42 measures the degree to which the patient can bend his or her ankle, as indicated by the level of the lowered leg. For plantar flexion movement, the foot is positioned on the foot retainer 22 such that the toes point toward the base of the foot rest 12, as shown in Fig. 3. Once in this position, the patient stretches forward to measure plantar flexion movement. To measure dorsiflexion movement, the foot retainer 22 is turned 180° from the position shown in Fig. 3 and the same foot is positioned heel first onto the foot retainer 22, i.e. with the patient facing away from the foot rest 12, such that the toes point toward the top edge of the foot rest 12. Once in this position, the patient stretches forward to measure dorsiflexion movement. For measuring side-to-side motion, the foot is positioned across the foot rest 12, as shown in Fig. 2, and the patient stretches to one side, away from the

foot rest 12. To measure the range of motion for the opposite side of the same ankle, the patient can rotate the foot retainer 180° and reposition his or her foot accordingly.

It should be understood that the device 10 may be used in combination with additional measurement devices or aids for precision measurement. For example, one or more foot plate sensors may be positioned under the foot of the patient to compensate for any unwanted motion of the patient, such as elevation of part of the foot during extreme bending of the ankle. As another example, an additional laser pointer or the like may be added, fixed to the elongated rod 32, to identify the internal axis of the measured ankle that joins the two malleoli with respect to one another. Such a laser pointer could be received within the housing of joint 40, for example.

The device for measuring range of motion of an ankle 10 allows for accurate measurement of the ankle joint in all cardinal planes, while simultaneously allowing for adjustment of the axis of rotation by variable placement of the center of rotation. The device 10 allows for controlled measurement of these ranges of motion while the patient's ankle is fully weight bearing (or simulative of full weight bearing position). This provides for an accurate assessment of any alteration in ankle flexibility. The device 10 allows for measurement of the ankle in a functional manner, enabling it to move along three-dimensional axes, e.g., in a forward direction and opposing side directions.

It is to be understood that the present invention is not limited to the embodiments described above, but encompasses any and all embodiments within the scope of the following claims.

CLAIMS

1. A device for measuring range of motion of an ankle, comprising:

a foot rest having a base, a pair of sidewalls and an inclined upper surface;

a foot retainer secured to the inclined upper surface of said foot rest, said foot retainer being adapted for releasably receiving a patient's foot;

a mounting plate slidably mounted to one of the pair of sidewalls, wherein said mounting plate is selectively slidable along a direction parallel to the inclined upper surface;

an elongated rod having opposed upper and lower ends, the lower end thereof being rotatably mounted to said mounting plate;

an inclinometer secured to said elongated rod for measuring an angular displacement of said elongated rod with respect to the inclined upper surface of said foot rest; and

a retaining bar secured to the elongated rod, adjacent the upper end thereof, said retaining bar extending substantially orthogonal to the elongated rod, said retaining bar being adapted for contacting a leg of the patient when the patient's foot is received in said foot retainer.

2. The device for measuring range of motion of an ankle as recited in claim 1, further comprising a pair of brackets secured to said foot rest for slidably receiving said mounting plate.

3. The device for measuring range of motion of an ankle as recited in claim 1, further comprising a measuring member secured to said mounting plate, the measuring member having indicia formed thereon indicating an angular displacement of the elongated rod, the elongated rod and the measuring member forming a goniometer.

4. The device for measuring range of motion of an ankle as recited in claim 1, wherein said retaining bar is slidably mounted on said elongated rod for selectively adjusting a height of said retaining bar with respect to said foot rest.

5. The device for measuring range of motion of an ankle as recited in claim 1, wherein said foot retainer is rotatable with respect to the inclined upper surface.

6. The device for measuring range of motion of an ankle as recited in claim 1, further comprising at least one strap secured to said foot retainer for releasably securing the patient's foot thereto.

7. The device for measuring range of motion of an ankle as recited in claim 1, wherein the inclined upper surface is inclined with respect to the base of the foot rest by an angle of approximately 40°.

8. A device for measuring range of motion of an ankle, comprising:

a foot rest having a base, a pair of sidewalls and an inclined upper surface;

a foot retainer pivotably secured to the inclined upper surface of said foot rest, said foot retainer being adapted for releasably receiving a patient's foot;

a mounting plate slidably mounted to one of the pair of sidewalls, wherein said mounting plate is selectively slidable along a direction parallel to the inclined upper surface;

a pair of brackets secured to said foot rest for slidably receiving said mounting plate;

an elongated rod having opposed upper and lower ends, the lower end thereof being rotatably mounted to said mounting plate;

an inclinometer secured to said elongated rod for measuring an angular displacement of said elongated rod with respect to the inclined upper surface of said foot rest; and

a retaining bar secured to the elongated rod, adjacent the upper end thereof, said retaining bar extending substantially orthogonal to the elongated rod.

9. The device for measuring range of motion of an ankle as recited in claim 8, further comprising a measuring member fixedly secured to said mounting plate, the measuring member having indicia formed thereon indicating an angular displacement of the elongated rod, the elongated rod and the measuring member forming a goniometer.

10. The device for measuring range of motion of an ankle as recited in claim 8, wherein said retaining bar is slidably mounted on said elongated rod for selectively adjusting a height of said retaining bar with respect to said foot rest.

11. The device for measuring range of motion of an ankle as recited in claim 8, wherein said foot retainer is rotatable with respect to the inclined upper surface.

12. The device for measuring range of motion of an ankle as recited in claim 8, further comprising at least one strap secured to said foot retainer for releasably securing the patient's foot thereto.

13. The device for measuring range of motion of an ankle as recited in claim 8, wherein the inclined upper surface is inclined with respect to the base of the foot rest by an angle of approximately 40°.

14. A device for measuring range of motion of an ankle, comprising:

a foot rest having a base, a pair of sidewalls and an inclined upper surface;

a foot retainer pivotably secured to the inclined upper surface of said foot rest, said foot retainer being adapted for releasably receiving a patient's foot;

a mounting plate slidably mounted to one of the pair of sidewalls, wherein said mounting plate is selectively slidable along a direction parallel to the inclined upper surface;

an elongated rod having opposed upper and lower ends, the lower end thereof being rotatably mounted to said mounting plate;

an inclinometer secured to said elongated rod for measuring an angular displacement of said elongated rod with respect to the inclined upper surface of said foot rest; and

a retaining bar slidably mounted on the elongated rod, adjacent the upper end thereof, said retaining bar extending substantially orthogonal to the elongated rod.

15. The device for measuring range of motion of an ankle as recited in claim 14, further comprising a pair of brackets secured to said foot rest for slidably receiving said mounting plate.

16. The device for measuring range of motion of an ankle as recited in claim 14, further comprising a measuring member fixedly secured to said mounting plate, the measuring member having indicia formed thereon indicating an angular displacement of the elongated rod, the elongated rod and the measuring member forming a goniometer.

17. The device for measuring range of motion of an ankle as recited in claim 14, wherein said foot retainer is rotatable with respect to the inclined upper surface.

18. The device for measuring range of motion of an ankle as recited in claim 14, further comprising at least one strap secured to said foot retainer for releasably securing the patient's foot thereto.

19. The device for measuring range of motion of an ankle as recited in claim 14, wherein the inclined upper surface is inclined with respect to the base of the foot rest by an angle of approximately 40°.

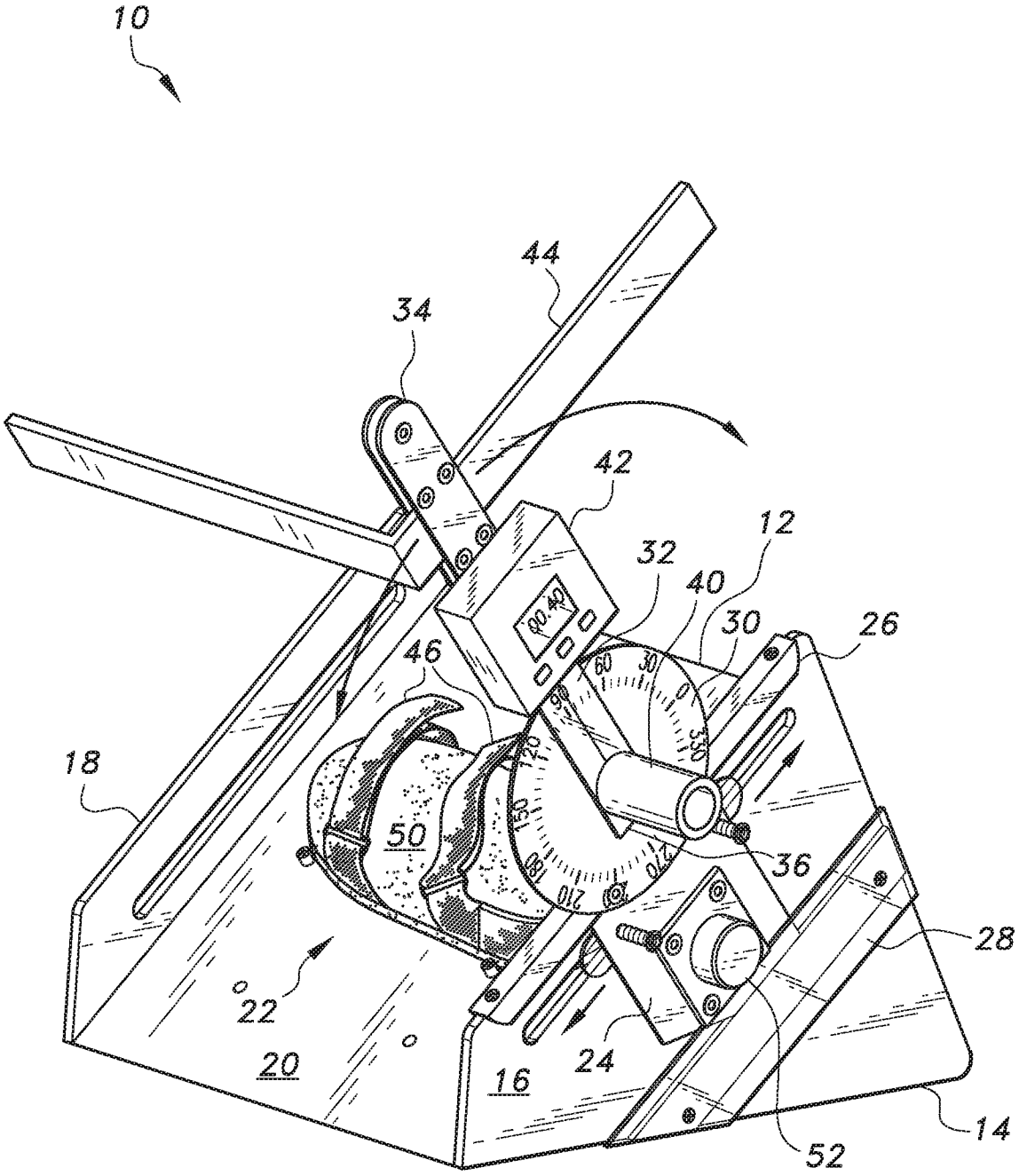

FIG. 1

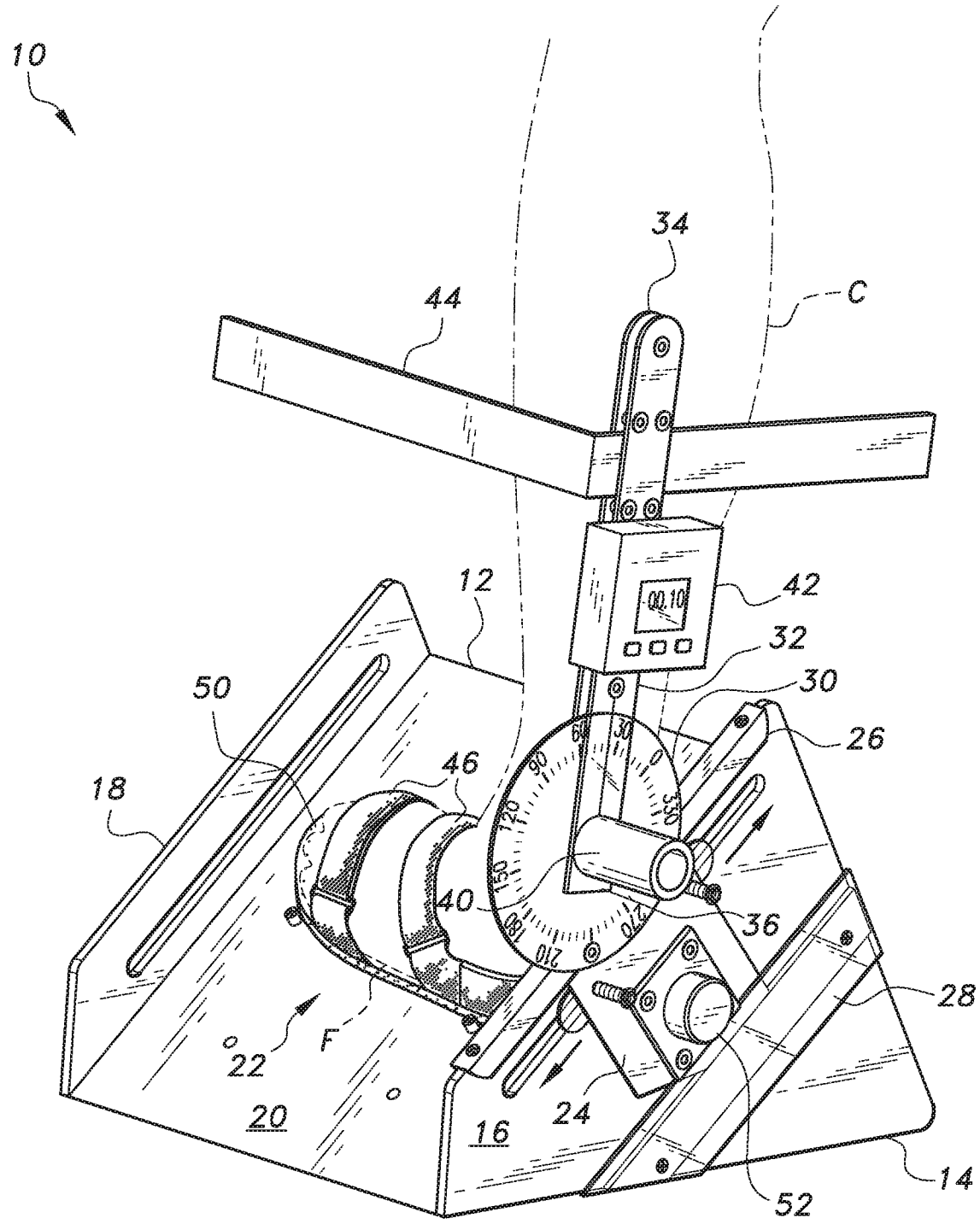

FIG. 2

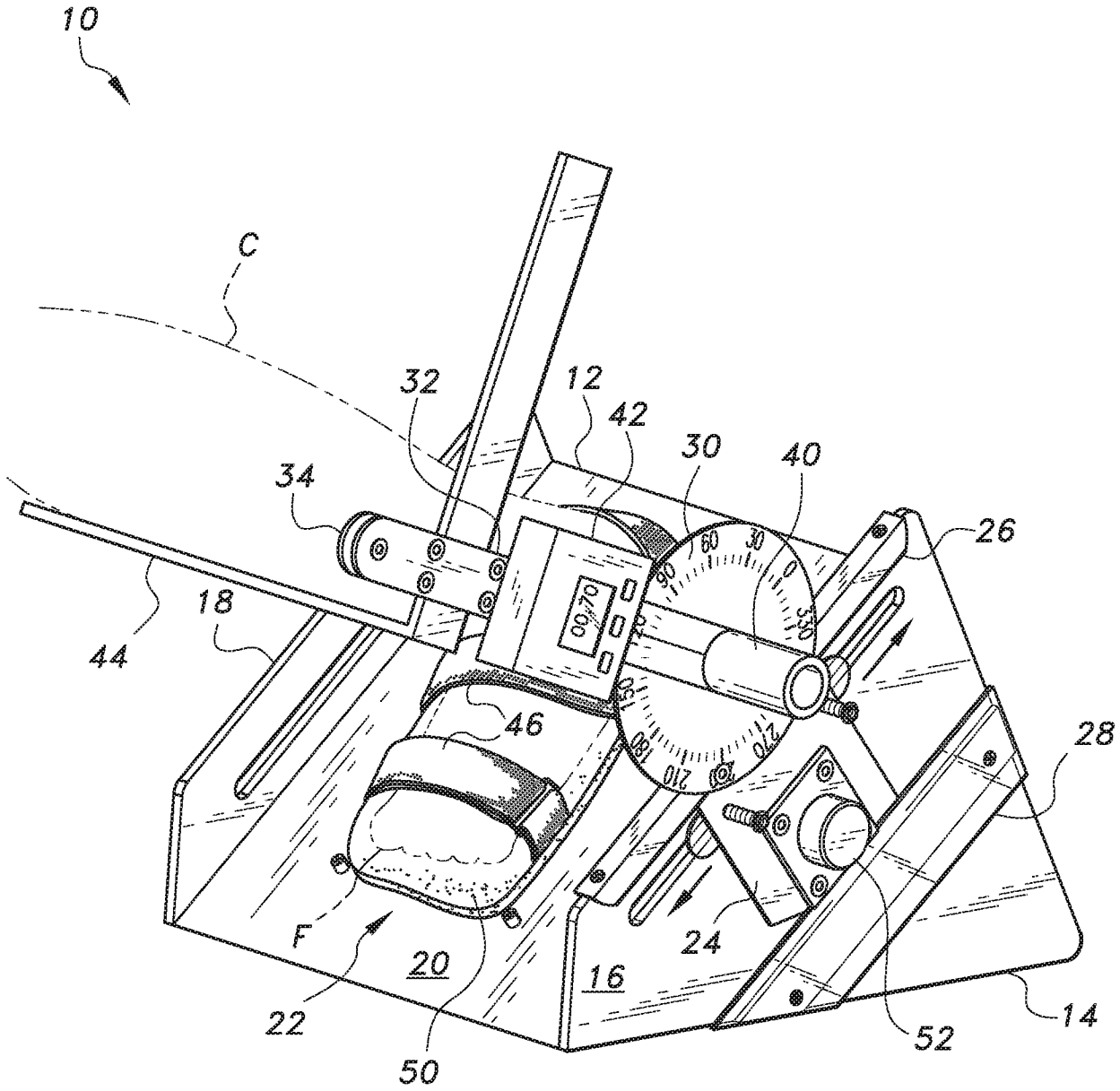

FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2017/034033

A. CLASSIFICATION OF SUBJECT MATTER

A61B 5/11(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B 5/11; A63B 23/08; A61F 005/00; A61H 1/02; A61B 5/103

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & Keywords: ankle, angle, measure, inclinometer, foot, bar, slide

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 2083477 U (NORTHWEST NORMAL UNIV.) 18 December 1991 See claim 1 and figures 1-4.	1-19
A	WO 2011-059936 A1 (STEADMAN PHILIPPON RESEARCH INSTITUTE et al.) 19 May 2011 See claim 1 and figures 1-4.	1-19
A	US 2004-0210168 A1 (TAKIZAWA et al.) 21 October 2004 See paragraphs [119]-[127] and figure 5.	1-19
A	US 5891002 A (MAKI) 06 April 1999 See claim 1 and figures 1-8.	1-19
A	US 2004-0030275 A1 (MORINAKA) 12 February 2004 See claims 1-8 and figures 1-7C.	1-19

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2017 (31.07.2017)	**01 August 2017 (01.08.2017)**

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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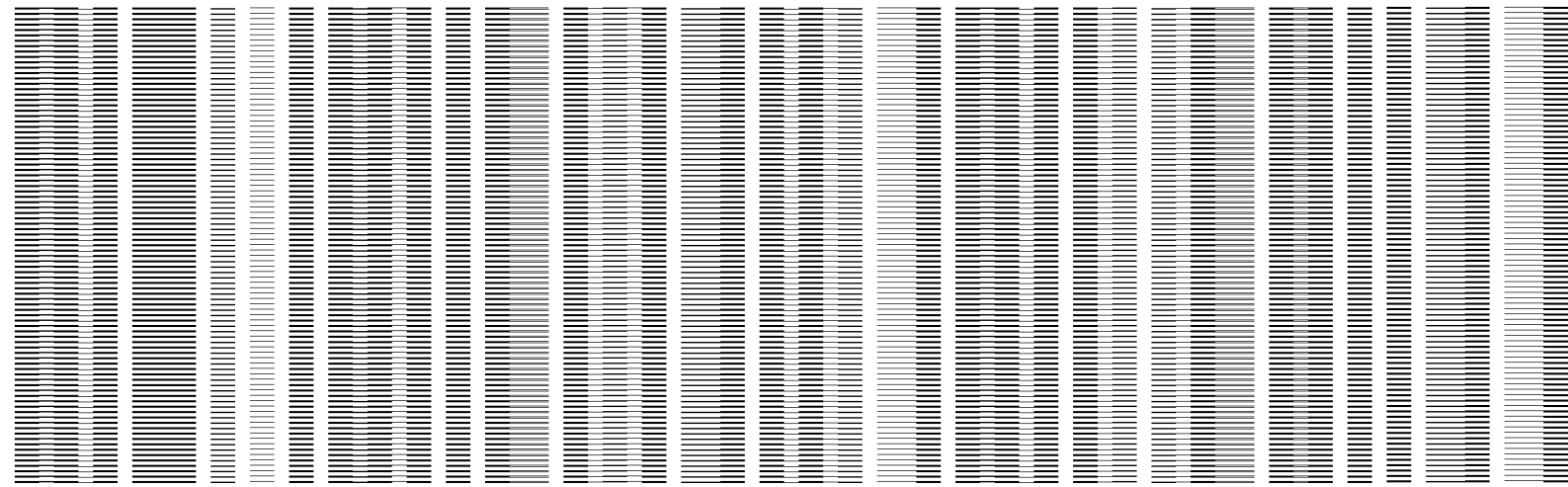

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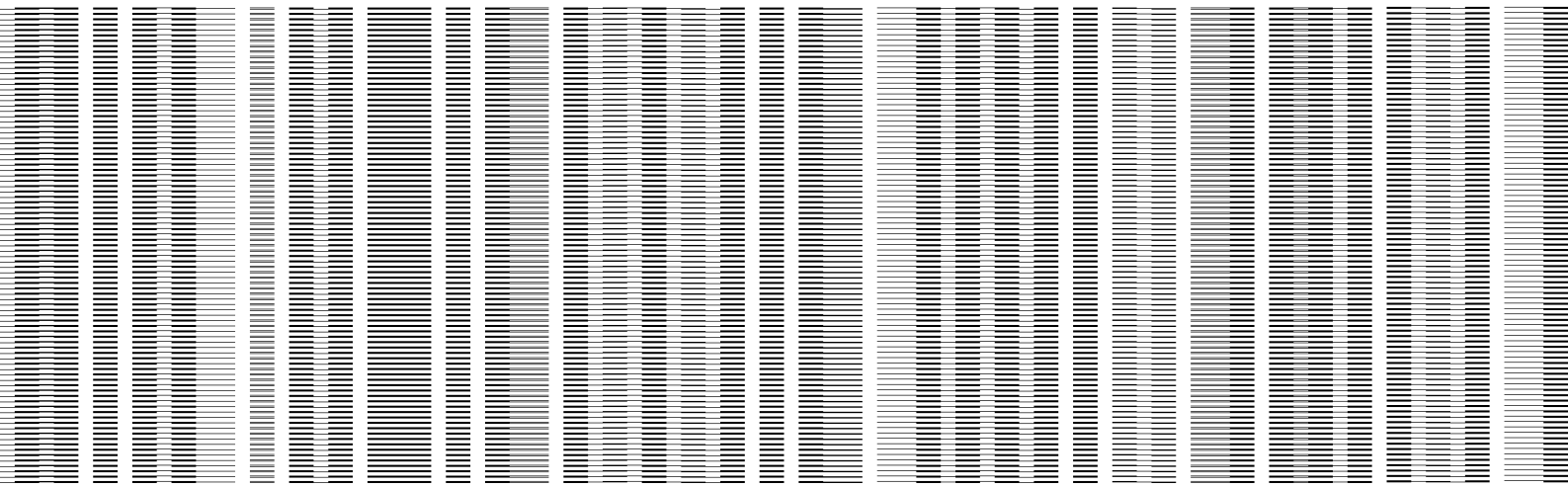

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