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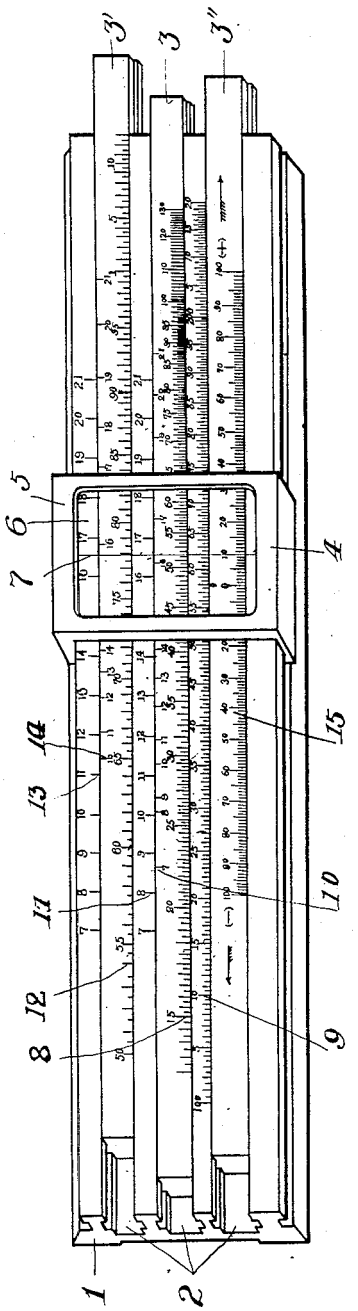
K. TSUDA

DEVICE FOR FINDING THE WEIGHT AND STATURE OF PERSONS

Filed Oct. 24, 1921



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DEVICE FOR FINDING THE WEIGHT AND STATURE OF PERSONS.

Application filed October 24, 1921. Serial No. 510,071.

To all whom it may concern:

Be it known that I, KANJI TSUDA, a subject of the Emperor of Japan, and a resident of No. 437, Kabe-Machi, Asa-Gori, Hiroshima-Ken, Empire of Japan, have invented new and useful Improvements in Devices for Finding the Weight and Stature of Persons, of which the following is a specification.

This invention relates to devices for finding the weight and stature of persons, and has for its object to provide a novel device by the use of which the strength of the human body can be readily ascertained.

A further object of the invention is to provide a device of this character, which is not only useful for physicians, but at the same time equally adoptable by and effective for officials engaged in the examination of conscripts, applicants for life insurance, and in the corporal examination of emigrants, factory laborers and the like.

A further object of the invention is to provide a device of the character, which will be effective and reliable in all such examinations.

The invention is more readily understood by referring to the accompanying drawing, shown in perspective view.

Referring to the drawings the instrument proper, or rather the stationary body portion of it, is represented by the reference numeral 1, upon which there are provided three longitudinal grooves 2, extending throughout its entire length and adapted to receive therein respectively slides 3, 3′ and 3″. The stationary body portion is also grooved along its outer sides and is adapted to engage corresponding edges of the cursor 4, of the construction similar to that of the ordinary slide rule, having frame 5, glass plate 6 and the usual hair line 7.

The slide 3 has graduation 8 which represents weight of body. Upon the upper side of the groove 2 is a graduation 11 which represents ages and is divided into 14 equal divisions, beginning with seven years of age and ending with 21 years. According to the statistical reports of the Government men cease to grow at the average age of 21, and this is why the graduation runs from 7 years of age to 21 years, the former being the school age.

Upon the one side of the groove within which slide 3″ moves is another graduation 9, which represents height of body or stature. We assume that all human bodies are of similar solids. Consequently we may assume that the weight of a human body varies directly as the cube of its stature, and also the girth of chest varies directly as the stature. Moreover we add an assumption that the constant of these variations or proportions are some functions of sexes and ages, and as this stature graduation is represented by a logarithm of a number corresponding to the height of body the distance from zero point to certain other point x will be $\log x - \log 100$, or $\log \frac{x}{100}$, where 100 denotes the number at zero point, as in an ordinary slide rule.

Now assuming L to denote stature and G to denote weight, then—

$$G = K(L)^3$$

where K is a constant to be determined in accordance with stature and weight corresponding to the sexes and ages of statistical value of the respective countries.

The value of K remains constant so long as the sexes and ages remain same, but varies as soon as the sexes and ages are changed.

Now assuming the stature graduation be marked a at a certain point and ma at another point, and assuming the distance between a ma be shifted from its original position to some other position the ratio of the number of the graduation on both extremities will be equal to the ratio of a and ma, i. e., $\frac{1}{m}$. This is true throughout the entire graduation for stature, no matter how often and wherever it is shifted. This fact is also applicable to and equally established with the graduation of weight, as will be readily understood.

Further, G varies in accordance with the

cube of L, and consequently by shifting the distance *a—ma* taken from stature graduation on to the graduation of weight the ratio of the number as represented at both extremities will be $\left(\frac{1}{m}\right)^3$, for instance, the distance between 100 centimeters to 150 centimeters on the stature graduation is equal to the distance 16 kilogrammes on the weight graduation; so the ratio 16/54 is equal to $(100/150)^3$.

The slide 3 has graduation 10 which serves to make adjustment of ages as will appear later.

The marking of this graduation 10 may be effected as follows:

Move the slide so as to cause the graduation of standard weight at certain age to come into same line with the graduation of standard height at same age. Move the slide to this position, then note on the slide the graduation 10 which will correspond with the graduation 11 of same age.

It will be seen that by causing a certain point of stature graduation to come into alignment with a certain point on the slide the ratio of the number of graduation lying within the same line will be constant, and therefore by causing the graduation of ages on the slide to deviate from the graduation of ages on the other side of the groove it is possible to adjust the standard point of the ages.

Upon the slide 3″ is marked a grading graduation 15. The zero point of this grading scale is, as shown, located in the middle of the scale.

In the slide 3″ the graduation running toward one direction is designated by a symbol plus (+) while the graduation running toward other direction is designated by a symbol minus (−), the number of degrees gradually increasing both ways from the zero point. The slide 3 has no such designations as plus or minus, but the graduation gradually increases its number towards the right and decreases towards the left. Conveniently, the rear surface of this part of the scale may be provided with certain graduations.

Now assuming two men A, and B, respectively, whose standard weights measure 25 k. g. and 50 k. g., respectively, while their actual weights measure 30 k. g. and 60 k. g. respectively, the ratio of excess of the actual weight over that of the standard weight for A and B will be

$$\frac{5}{25}=\frac{10}{50}, \text{ i. e. } \frac{1}{5}$$

It will be observed that in view of logarithmic graduation of the weight scale the space between 25 k. g. and 30 k. g. will be equal to the space between 50 k. g. and 60 k. g. By providing even graduation, therefore, the grading scale is enabled to give to A and B same degrees of grading. In short, by making the weight graduation logarithmic and also by having the grade scale evenly graduated, it is possible to make the grading of weight scale so that the same may be directly proportional to the ratio of excess or deficiency of the actual weight relatively of the standard weight.

Upon the slide 3′ is marked a graduation 12 which indicates girth of chest, having zero point fixed at one end of the scale. Upon the one side of the groove in which slide 3′ is arranged to move is marked a graduation 13 indicating the ages in the same manner as in the case of the graduation 11. The slide 3′ is also marked with graduation 14 serving to facilitate adjustment of ages.

The manner in which this graduation is marked is as same as previously described, i. e. move the slide so as to bring graduation of standard height at certain age into line with that of the standard girth of chest of same age. Cause the slide to stop at this point. The mark on the slide 3′ the graduation 14 of same age will then correspond with the graduation 13 of that age.

Assuming that L denotes stature, U the girth of chest, then:—

$$U=KL$$

where K is a constant to be determined according to the sexes and ages of the standard statistical value as previously described with regard to the weight.

From the above it will be seen that as the stature to graduation of is logarithmic the graduation of girth of chest U will become equally logarithmic. By shifting from one point to another the distance between *a—ma*, the ratio of the number graduation on both extremities will be equal to the ratio of the distance between *a* and *ma* i. e. $\frac{1}{m}$. This is true of and equally established upon the graduation of the girth of chest.

In view of the charactertistic of the logarithm, when a certain point of the graduation 12 is brought into alignment with a certain point of the graduation 9 the ratio of the number of graduation lying within same line is always constant on both scales. For instance, assuming that boys at 15 years of age have the average height 1.581 m. girth of chest 0.756 m. then by moving slide 3′ so as to cause the mark corresponding 0.756 m. to come into line with the mark corresponding 1.581 m. of the stature graduation 9, the ratio will be $\frac{756}{1581}$, which is the value of K for boys at 15 years of age.

Therefore, by making the graduation of ages on the groove side to deviate from the graduation of ages on the slide it is possible to effect the alteration of the standard point.

Now assuming the standard girth of chest measure 60 c. m. while the actual girth of chest exceed 3 c. m., then the ratio of such excess will be $\frac{1}{20}$. If the standard girth of chest of 90 c. m. is exceeded by 3 c. m., then the ratio of such excess will be $\frac{1}{30}$, the ratio of the two is such that the former is worth $\frac{3}{2}$ times as much as the latter and consequently the grading of the former must be worth $\frac{3}{2}$ times as much as the latter.

In view of the fact that the girth of chest is logarithmically graduated and in view of the fact that the gradings are evenly graduated it is possible to give to the former $\frac{3}{2}$ times of degrees as much as the latter. In short, by marking the chest graduation logarithmically represented beside the graduation evenly divided, it is possible to mark the grading of chest so that the same may be directly proportional to the ratio of excess or deficiencies of the actual girth of chest relatively of the standard girth of chest.

In the present invention the slides are conveniently graduated on both surfaces so that the same may be used for the examination of both sexes, and if desired the scale may take a form of circular or semicircular shape instead of rectangular. Where the circular scale is used the slide which is also circular in form must be placed in concentric order as will be readily understood.

I will now proceed to explain the manner in which this instrument is actually used. The weight scale slide is first arranged according to the sex of the person to be examined, move the age graduation of slide with the age graduation of the stationary body plate, then move the zero point of the third slide or grading slide to come into line with the stature graduation measured, move the cursor so as to cause its hair line to come to the weight graduation measured, and the resultant graduation indicated by the hair line will be the grade required.

As to the girth of chest the same operation may be followed, and in practice, the slide is first chosen to suit the sex of the person to be examined, and when the proper slide is placed in its position, the age graduation on the slide is caused to come in line with that of the stationary body plate, then bring the zero of the grading scale into coincidence with the stature graduation, move the cursor so as to cause its hair line to come upon the graduated mark of the girth of chest, and the resultant graduation indicated by the hair line will be the grading required.

What I claim is:—

1. In a device for finding the weight and stature of persons, a body having a fixed age scale, a fixed ages scale, and a fixed logarithmic stature scale, spaced apart, a slide having a logarithmic weight scale adjustable with respect to said fixed logarithmic stature scale, and also having an age adjustment scale, adjustable with reference to said fixed ages scale, a slide having a grading graduation scale, a cursor adjustable longitudinally on the body and arranged to be set to the said age adjustment scale to indicate the result on said scale and said fixed ages scale.

2. In a device for finding the weight and stature of persons, a body having a fixed age scale, a fixed ages scale, and a fixed logarithmic stature scale, spaced apart, a slide having a logarithmic weight scale adjustable with respect to said fixed logarithmic stature scale, and also having an age adjustment scale, adjustable with reference to said fixed ages scale, a slide having a grading graduation scale, a cursor adjustable longitudinally on the body and arranged to be set to the said age adjustment scale to indicate the result on said scale and said fixed ages scale, and a slide arranged between said fixed age scale and said fixed ages scale and having a logarithmic graduation girth scale and a scale for adjustment of ages, respectively adjustable with relation to said fixed age scale and said fixed ages scale.

In testimony whereof I affix my signature in presence of two witnesses.

KANJI TSUDA.

Witnesses:
RGUICHI TODA,
W. EHIHARAH.