July 29, 1952 M. E. NELSON 2,604,696

INTEGRATING LEG GAUGE

Filed Sept. 22, 1947 2 SHEETS—SHEET 1

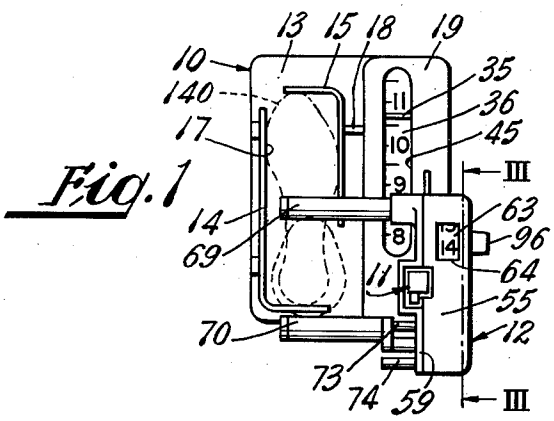


Fig. 1

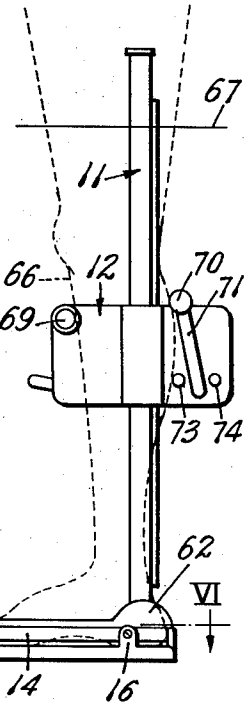


Fig. 2

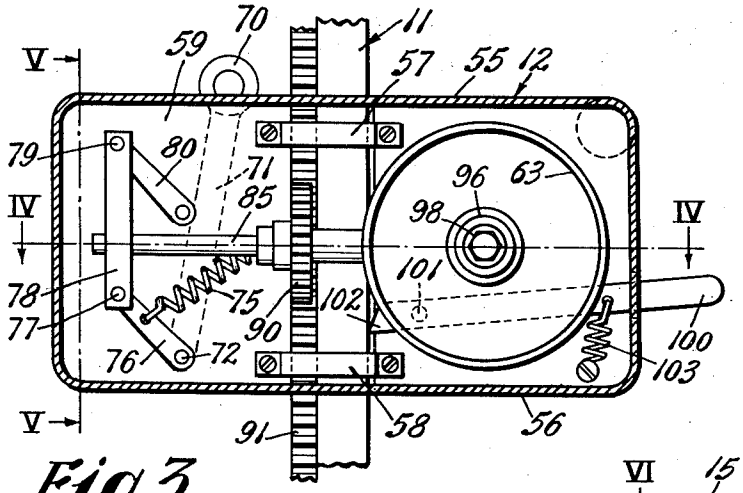


Fig. 3

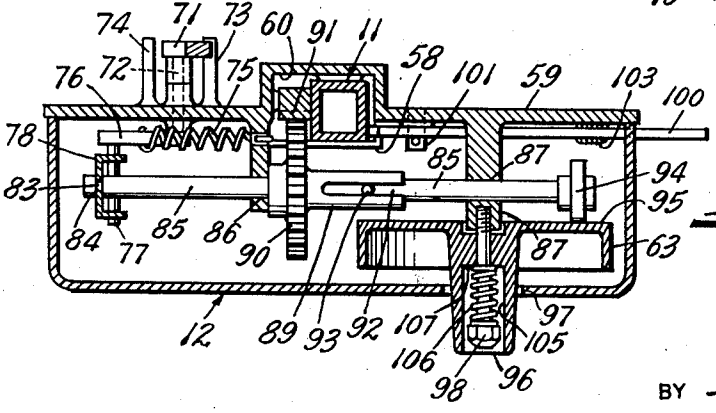


Fig. 4

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Fig. 5

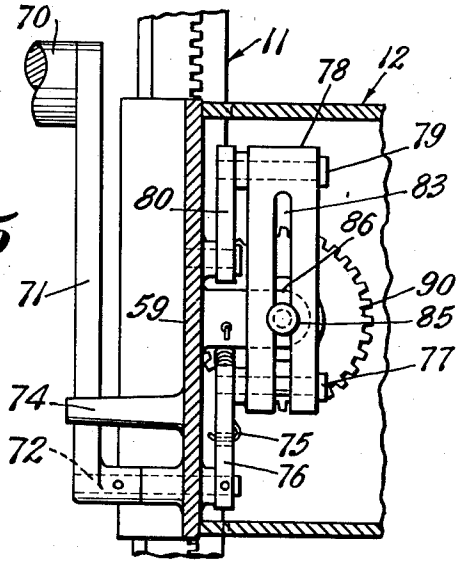


Fig. 6

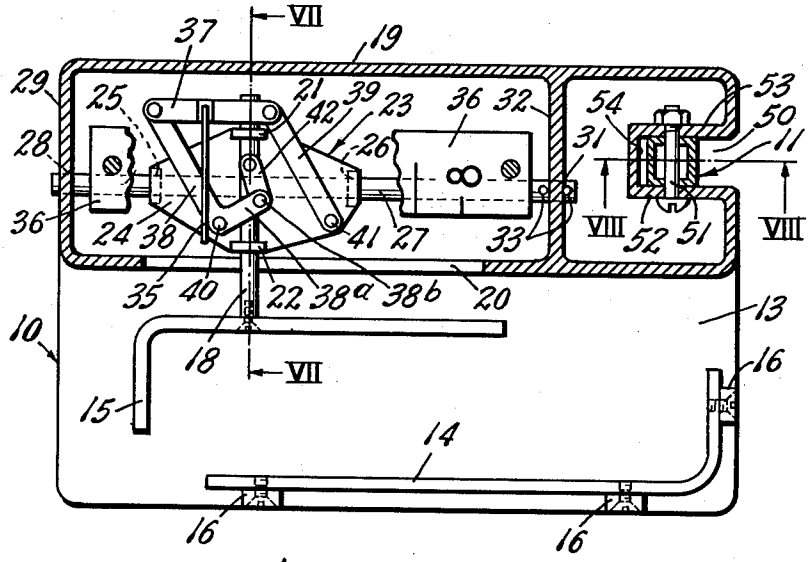
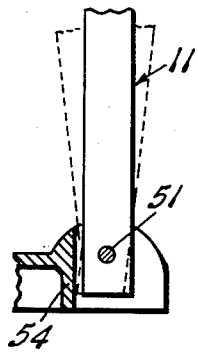


Fig. 8



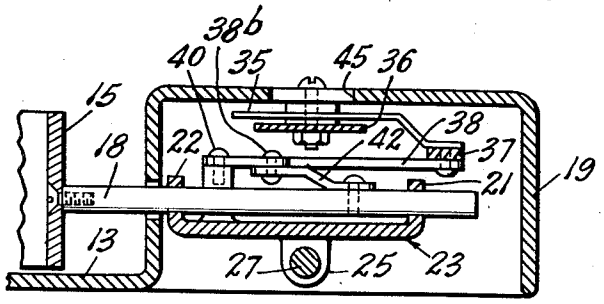


Fig. 7

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INTEGRATING LEG GAUGE

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3 Claims. (Cl. 33—2)

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This invention relates to devices for measuring the human foot and leg to determine the size of stocking that will provide the best fit.

A broad object of the invention is to provide a leg or foot gage that will in a single operation determine stocking size therefor.

A more specific object is to provide a gage that will integrate the length of the foot or leg with the mean width or thickness thereof, to determine the proper size stocking therefor.

Another object is to provide a device of the general type described which is simple and easy to use and is reliable in operation.

Other more specific objects and features of the invention will appear from the description to follow of a specific embodiment thereof.

Modern stockings are obtainable in various foot length sizes and also various leg length sizes. However, the proper stocking size for a good foot fit and for a good leg fit is not determined only by the length of the foot or the leg. The fabrics from which stockings are constructed are yieldable in either direction but are only slightly yieldable in both directions simultaneously. In other words, the threads from which the stockings are woven have very little stretch, but the fabric can stretch in one direction by contracting in the other direction. As a result, a stocking size that will fit a thin leg of given length will not fit a fat leg of the same length. Instead, the same stocking will appear much shorter on the fat leg than on the thin leg. The same holds true for wide and narrow feet of the same length.

Some people have ascertained their proper size stocking, both as to foot size and as to leg size, by trial and error. Others have not been able to do this. Furthermore, until relatively recently, many stocking manufacturers made only a very limited number of different leg sizes, and stocking purchasers have not had opportunity to determine their proper size.

Attempts have been made to ascertain the proper stocking size by measuring the length of that portion of the leg that is desired to be covered by the stocking and then making one or several random measurements of the thickness of the leg at typical points, such as the ankle, the calf, and/or just above the knee. However, this has proven unsatisfactory in many instances because no two legs are proportioned the same and while a calf measurement may be typical as to the average leg thickness for many persons, it will not be typical of all.

The machine of the present invention is essentially an integrating machine that automatically gives a reading that is proportional both to the length and thickness of the leg. The machine also gives the foot size by integrating the length of the foot with the width of the foot at its widest point. A full understanding of the invention may be had from the following description which refers to the drawing.

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In the drawing:

Fig. 1 is a plan view of a machine in accordance with the invention with a foot and leg shown in dotted lines in position to be measured;

Fig. 2 is a side elevation of the machine in operative relation to a leg and foot which are shown in dotted lines;

Fig. 3 is a detail vertical section taken in the plane III—III of Fig. 1;

Fig. 4 is a horizontal section in the plane IV—IV of Fig. 3;

Fig. 5 is a detail vertical section in the plane V—V of Fig. 3;

Fig. 6 is a horizontal section in the plane VI—VI of Fig. 2;

Fig. 7 is a detail vertical section in the plane VII—VII of Fig. 6; and

Fig. 8 is a detail vertical section in the plane VIII—VIII of Fig. 6.

Referring to Figs. 1 and 2, the machine includes a base 10 and an upright or standard 11 extending upwardly from the base. A casing 12 is slidable vertically on the standard 11 and contains a mechanism for gaging the leg. The base 10 includes the mechanism for gaging the foot, and it will be described first.

Referring to Fig. 1, the base 10 comprises a lower flat platform 13 upon which the foot 140 is placed. For gaging the foot two L-shaped members 14 and 15 are provided. The member 14 is rigidly connected to the platform 13 as by a pair of upstanding lugs 16 on the platform (Fig. 2). The short arm of the member 14 is adapted to rest against the heel of the foot, and the long arm is adapted to rest against the inside surface of the foot as indicated at 17 in Fig. 1.

The other L shaped member 15 is movable, and can be adjusted so that its long arm contacts the outer surface of the foot at its widest part and the short arm contacts the end of the toe. This member 15 is supported for movement in a horizontal plane by a supporting rod 18 which extends through a slot provided therefor in the wall of a casing 19 which is positioned on one side of the platform 13.

Within the casing 19, the rod 18 is slidably mounted in holes provided therefor in a pair of

upstanding lugs 21 and 22 on a carriage 23. Carriage 23 consists of a flat plate 24, edge portions of which are turned up to form the lugs 21 and 22, and other edge portions of which are turned down to form a pair of lugs 25 and 26, which have apertures receiving a stationary supporting rod 27. The rod 27 may be extended through an aperture 28 in one end wall 29 of the casing 19 and through another aperture 31 in a partition wall 32 of the casing 19. The rod 27 can be restrained against longitudinal movement by a pair of pins 33 which are extended through the rod on opposite sides of the partition wall 32.

The L shaped member 15 moves laterally according to the width of the foot, causing the rod 18 to slide through the lugs 21 and 22; and moves longitudinally according to the length of the foot, sliding longitudinally in the slot 20 to accommodate this movement. Both movements of the rod 18 are combined, by means of a mechanism to be described, to cause a movement of a pointer 35 over a scale 36 and thereby indicate the size of stocking foot that is required for the best fit. Thus the pointer 35 is secured to a bar 37 extending parallel to the scale 36 and pivotally secured at its opposite ends to a pair of parallel arms 38 and 39 respectively. The arms 38 and 39 are pivotally secured at points 40 and 41 respectively to the carriage 23, so that the bar 37 and the pointer 35 are permitted to move in a horizontal plane but are prevented from turning within that plane. This causes the pointer 35 to always remain normal to the scale 36. The scale 36 is viewed through a window 45 (Fig. 1) which may be narrower than the length of the pointer 35, so that the lateral movement of the pointer is not apparent, and it appears to move only longitudinally along the scale 36. The arms 38 and 39 are swung about their pivot points 40 and 41 in response to sliding movement of the rod 18 through the carriage lugs 21 and 22. To this end, the arm 38 has a short extension 38*a* extending perpendicularly from its pivotal end and pivotally secured as at 38*b* to one end of a link 42, the other end of which is pivotally secured to the rod 18.

It will be apparent that longitudinal movement of the L member 15 parallel to the foot moves the carriage 23 bodily, and that the pointer 35 is carried along with the carriage to produce an indication on the scale 36 that is proportional to the length of the foot. It will also be observed that outward movement of the L member 15 causes the rod 18 to slide through the lugs 21 and 22 and rotate the arm 38 in such direction as to cause the pointer 35 to move to a higher number on the scale 36 in response to a wide foot than a narrow foot. Therefore, the mechanism responds to both the length and the width of the foot to integrate the two measurements and produce an indication on the scale 36 of the proper foot size that is required. It has been determined by experiment that the length of the extension 38*a* should be 1" when the length of the arm 38 is 2⅛". With these proportions, a change in foot width of ½ inch changes the reading on the scale 36 about one inch.

Referring to Fig. 1, scale 36 shows conventional foot sizes from 8 to 11½. These are standard foot sizes which are supposed to indicate the length of the foot. However, a stocking that will fit perfectly a foot of one width will not fit another foot of the same length but different width. The present instrument, by integrating both the length and width of the foot, indicates the stocking size that will properly fit the foot being measured.

The leg-measuring mechanism, including the standard 11 and the casing 12 will next be described. Referring to Fig. 6 it will be observed that the casing 19 is formed with a pocket or recess 50 in which the lower end of the standard 11 is pivotally secured by a pivot bolt 51, which extends through apertures provided in the standard and in the wall sections 52 and 53 defining the sides of the pocket 50. As shown in Figs. 6 and 8, the inner portion 54 of the wall defining the inner end of the pocket 50 is spaced from the adjacent surface of the standard 11 when the latter is in vertical position, but is contacted by the standard in response to slight angular movement of the latter about the pivot bolt 51 in either direction. Therefore the wall 54 acts as a stop member to limit oscillation of the standard 11. Limited oscillatory movement is desirable, as will be explained later.

The standard 11 extends through apertures provided therefor in the top wall 55 and the bottom wall 56 of the casing 12. The casing 12 is guided for vertical sliding movement along the standard 11 by a pair of straps 57 and 58 which are secured to the main wall 59 of the casing 12 and hold the portion of the wall 59 that is juxtaposed to the standard 57 snugly thereagainst. As best shown in Fig. 4, the wall 59 is shaped to define a trough 60 which fits around the sides of the standard 11 and prevents the casing from rocking on the standard.

The procedure for determining the leg size with the present invention is to first place the casing 12 in its lowermost position, resting on the highest portion 62 (Fig. 2) of the base, set an indicator 63 (Fig. 1) displayed through a window 64 in the upper wall 55 of the casing 12 to zero, and then raise the casing 12 along the leg 66 to the level 67 thereon where it is desired that the hem of the stocking be. This hemline 67 will in many instances be determined by the normal position of the garter that is employed. Otherwise it is chosen according to the desire of the fittee. At the completion of the upper movement of the casing 12 to the hemline 67, the indicator 63 will indicate the leg length size of stocking that will produce the best fit for the particular leg that has been measured. The indicator 63 and the mechanism for actuating it will next be described.

Referring first to Fig. 2, it will be observed that there are two parallel, horizontal bars 69 and 70 which project from the side of the casing 12 and lie against the front and rear respectively of the leg 66 that is being gaged. The bar 69 is rigidly secured to the front wall 59 of the casing 12. The other bar 70 is secured to the upper end of an arm 71 that is secured at its lower end to a shaft 72 rotatable in a journal formed in the casing wall 59. The arm 71 can rock through quite a wide angle, the movement being limited by a pair of stops 73 and 74 extending from the casing wall 59. Secured to the inner end of the shaft 72 for rotation therewith is an arm 76. A helical tension spring 75 (Fig. 3) is connected to this arm 76 to maintain the member 70 in contact with the leg as the casing 12 is moved upwardly therealong.

The outer end of the arm 76 is pivotally connected, as by a pivot 77, to the lower end of a bar 78, the upper end of which is pivotally con-

nected, as by a pivot 79, to an arm 80, the other end of which is pivotally supported on the wall 59 of the casing. The bar 78 therefore can swing through an arc while maintaining itself in vertical position, in response to movement of the bar 70 in accordance with the contour of the leg being gaged. Referring to Fig. 4, it will be observed that the bar 78 is of channel form, the pivots 77 and 79 extending through the flanges of the section. The web of the channel section contains a longitudinal slot 83, and the edges of this slot ride in an annular groove 84 in a shaft 85 which shaft is supported for rotary and longitudinal movement in a pair of bearing members 86 and 87 formed integrally with the wall member 59. Mounted upon the shaft 85 intermediate the bearings 86 and 87 is a sleeve 89, carrying a pinion 90 that meshes with a rack 91 secured to the side of the standard 11. This pinion 90 and the sleeve 89 therefore rotate through an angle proportional to the vertical distance through which the casing 12 is moved.

The shaft 85 is coupled to the sleeve 89 for rotation therewith and for longitudinal sliding movement with respect thereto, by a pin 93 extending radially from the shaft 85, which pin engages a longitudinal slot 92 in the sleeve. The shaft 85 carries a driving roller 94 that frictionally engages a face 95 of the indicator drum 63. This drum 63 has a hub 96 formed integrally therewith which extends through an aperture 97 in the casing 12. The hub 96 is supported for rotation by a screw 98 that is threaded into the bearing member 87. The outer end of the hub 96 is counterbored as indicated at 105, for reception of a helical spring 106, which is compressed between the shoulder 107, at the inner end of the counterbore, and the head of the screw 98, to urge the drum 63 against the driving roller 94.

When the member 70 and the shaft 85 are retracted by the spring 75, the roller 94 is near the outer edge of the face 95, so that for a given angular movement of the roller 94, the corresponding angular movement of the indicator 63 is relatively small. On the other hand, the farther the element 70 is displaced by a thick leg, the nearer the roller 94 will be moved toward the center of rotation of the face 95, and the angular movement of the indicator 63 will be correspondingly greater. The overall result is that the reading produced on the indicator 63 in response to movement of the casing 12 from lowermost position to the desired hemline 67 is not only a function of the vertical distance that the casing 12 moves (which is a measure of the length of the stocking as it will be worn) but is also a function of the thickness of the leg. This thickness of the leg must be taken into account if the desired position of the stocking on the leg is to be had, because of the foreshortening of the stocking fabric resultant from an increased thickness.

It has been determined that the longitudinal movement of the shaft 85, the diameter of the face 95, and the diameter of the roller 94 should be such that the speed ratio of the roller 94 to the indicator drum 63 should vary from about 4.4 when the calibrating elements 69 and 70 are 3.75 inches apart to a ratio of about 1.9 when the elements 69 and 70 are 8.75 inches apart.

It has been previously mentioned that the standard 11 has a limited range of oscillatory movement. This is necessary because the leg contacting element 69 is rigidly connected to the casing 12 and therefore the casing must move back and forth to compensate for the irregularities in the surface of the leg contacted by the element 69.

The calibration of the indicator 63 is purely arbitrary, but in practice would be associated with the particular calibration adopted by a stocking manufacturer.

To prevent the casing 12 from dropping of its own weight along the standard 11 a brake is provided. This brake consists of a lever 100 which is pivotally connected as by a pivot 101 to the casing wall 59 and is so proportioned that as the outer end, which projects through an aperture provided therefor in casing 12, is moved downwardly almost into horizontal position, the inner end 102 contacts and binds against the standard 11 to prevent downward movement of the casing 12. The lever 100 is normally urged into the locking position by a helical tension spring 103. The lever does not prevent upward movement of the casing because upward movement tends to release the brake whereas downward movement tends to set it. After a measurement has been taken and it is desired to lower the casing 12 into bottom position preliminary to the making of another measurement, the outer end of the lever 100 is raised to release the brake and permit the casing 12 to be moved downwardly along the standard.

The indicator 63 can be reset by rotating the exposed end of the hub 96, the latter resembling a knob. Such resetting is easily done because of the limited frictional resistance between the face 95 and the roller 94.

Although for the purpose of explaining the invention a particular embodiment thereof has been shown and described, obvious modifications will occur to a person skilled in the art, and I do not desire to be limited to the exact details illustrated.

I claim:

1. A gage of the type described comprising: a casing adapted to be moved vertically alongside a leg to be gaged and having a pair of relatively movable members adapted to contact opposite sides of the leg and move toward and away from each other according to the varying thickness of the leg; an indicator movable in a single fixed path; a variable ratio transmission mechanism having rotary input and output elements; means for rotating said input element a distance proportional to the vertical movement of said casing comprising a rack supported against vertical movement along which said casing travels, and a pinion within said casing meshing with said rack and coupled to said input element; means coupling said output element to said indicator for moving said indicator a distance in said single fixed path proportional to the movement of said output element; and means for varying the ratio of said transmission in accordance with the spacing between said members, to increase the ratio of the movement of said output member relative to that of the said input member in response to an increase in the spacing between said members.

2. A gage of the type described comprising: a casing adapted to be moved vertically alongside a leg to be gaged and having a pair of relatively movable members adapted to contact opposite sides of the leg and move toward and away from each other according to the varying thickness of the leg; an indicator movable in a single fixed path; a variable ratio transmission mechanism

having movable input and output elements; means for moving said input element a distance proportional to the vertical movement of said casing; means coupling said output element to said indicator for moving said indicator a distance in said single fixed path proportional to the movement of said output element; and means for varying the ratio of said transmission in accordance with the spacing between said members, to increase the ratio of the movement of said output member relative to that of the said input member in response to an increase in the spacing between said members; a platform and a standard rising from said platform, said casing being slidable along said standard; overrunning brake means for preventing downward movement of said casing along said standard while permitting free upward movement therealong; and means for releasing said brake to permit downward movement of said casing.

3. A gage of the type described comprising: a casing adapted to be moved vertically alongside a leg to be gaged and having a pair of relatively movable members adapted to contact opposite sides of the leg and move toward and away from each other according to the varying thickness of the leg; an indicator movable in a single fixed path; a variable ratio transmission mechanism having movable input and output elements; means for moving said input element a distance proportional to the vertical movement of said casing; means coupling said output element to said indicator for moving said indicator a distance in said single fixed path proportional to the movement of said output element; and means

for varying the ratio of said transmission in accordance with the spacing between said members, to increase the ratio of the movement of said output member relative to that of the said input member in response to an increase in the spacing between said members; a platform and a standard rising from the platform, said casing being slidable along said platform; one of said two relatively movable members being fixed to said casing; and said standard being hingedly secured to said platform for limited oscillatory movement to permit said one member to follow the contour of the leg.

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