July 29, 1969 D. J. COHEN ET AL 3,457,647

SHOE-SIZE INDICATING APPARATUS

Filed Oct. 5, 1966 3 Sheets-Sheet 1

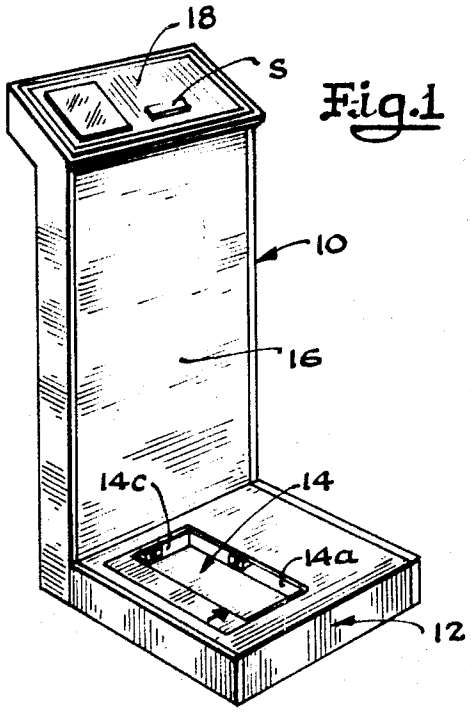

Fig.1

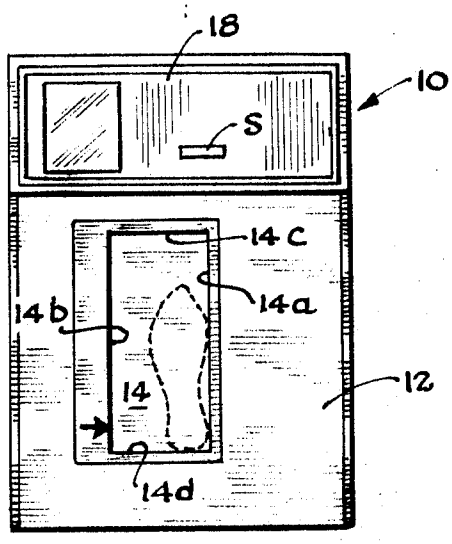

Fig.2

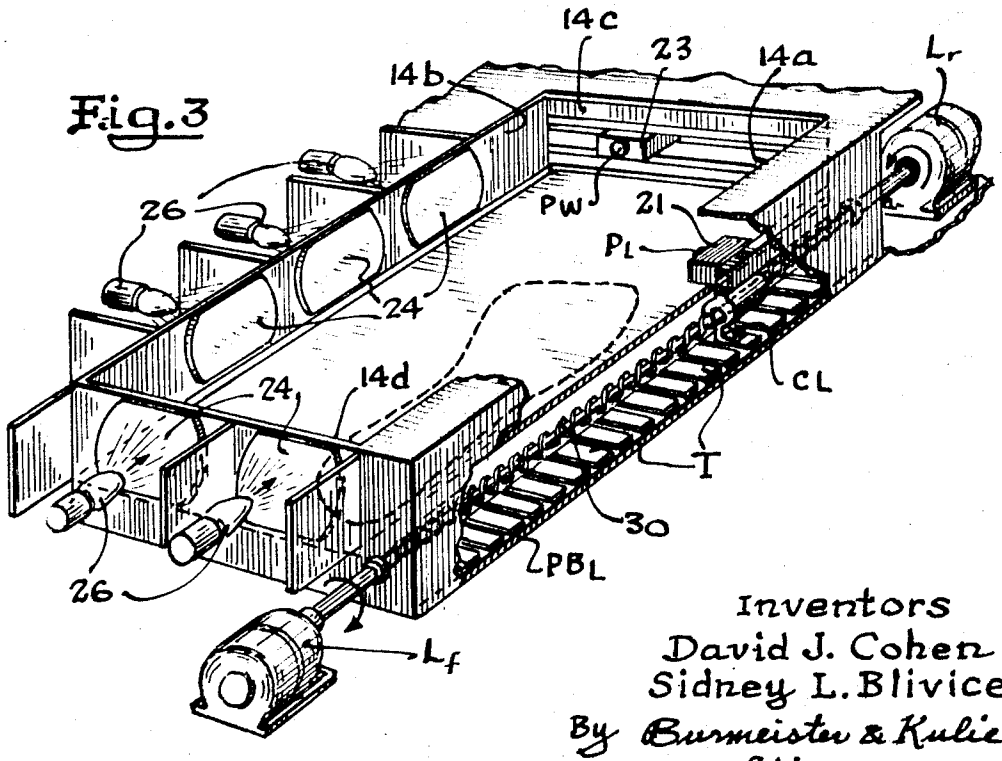

Fig.3

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SHOE-SIZE INDICATING APPARATUS

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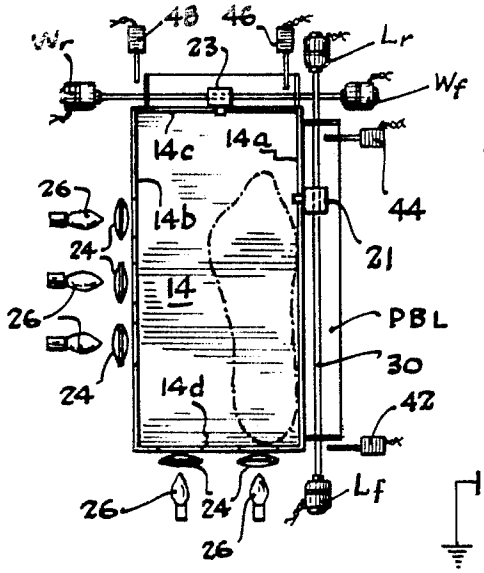

Fig.4

Fig.5

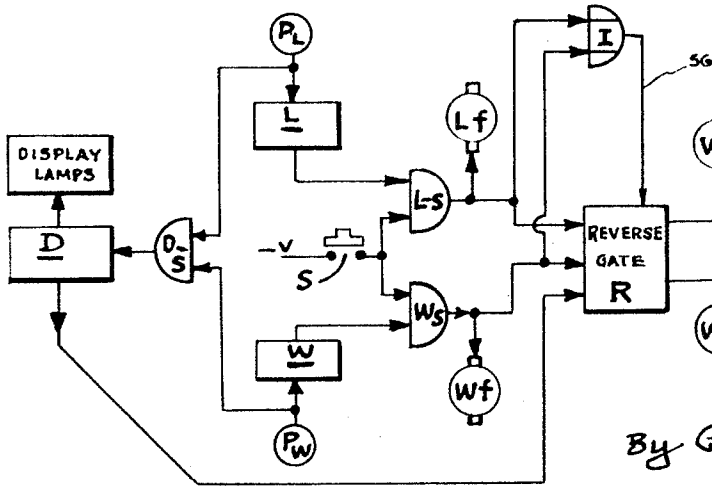

Fig.6

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SHOE-SIZE INDICATING APPARATUS

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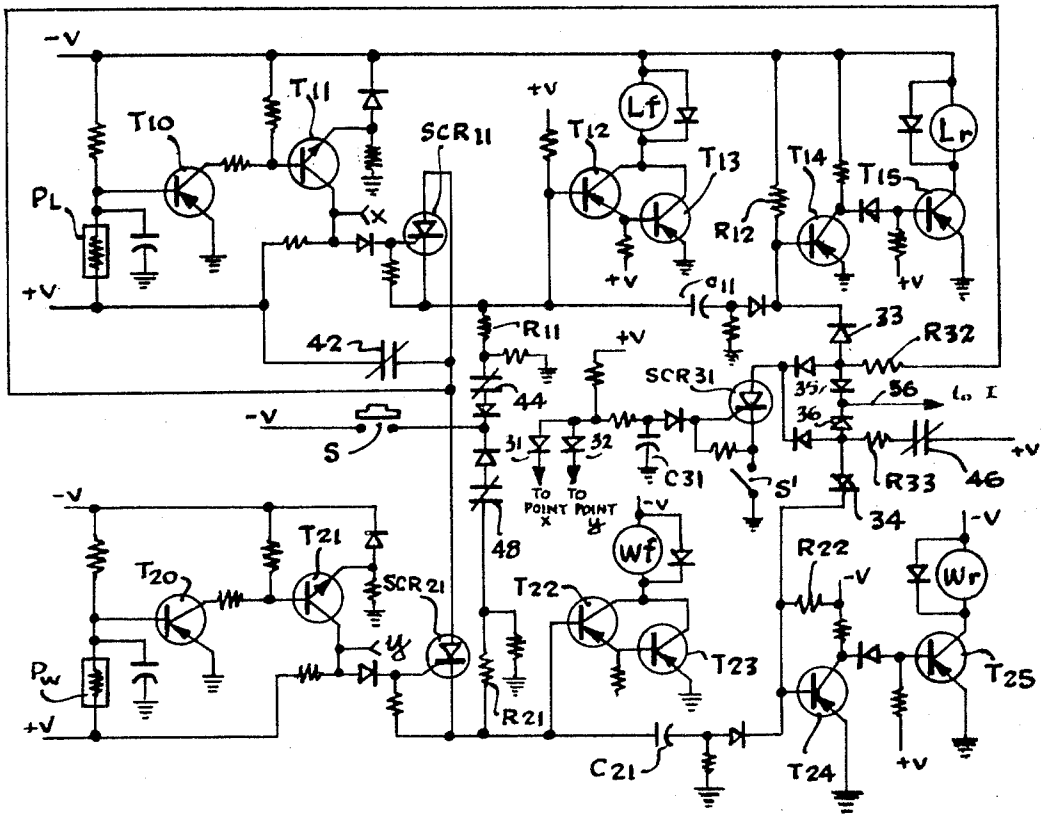
Fig.7



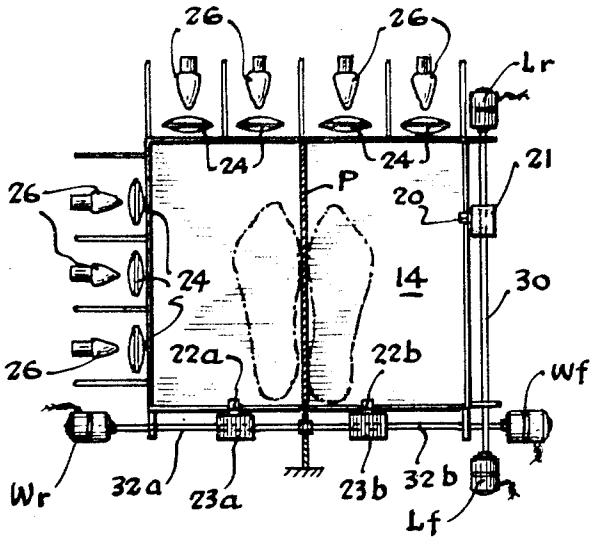


Fig.8

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SHOE-SIZE INDICATING APPARATUS

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U.S. Cl. 33—3 17 Claims

ABSTRACT OF THE DISCLOSURE

Shoe-size indicating apparatus including a foot receiving area, a first carrier driven along a predetermined path adjacent to said foot receiving area and substantially parallel to the longitudinal axis thereof, a second carrier driven along a predetermined path adjacent to said foot receiving area and substantially parallel to the lateral axis thereof, light source means for directing light toward said foot receiving area, first light sensitive means affixed to said first driven carrier and positioned to intercept light from said light source, second light sensitive means affixed to said second driven carrier and positioned to intercept light from said light source, and means for providing an indication of shoe size when the light sensitive means have been moved to a position tangential to the extremities of the foot being measured so as to experience an appreciable change in the intensity of light as received from said light source.

This invention relates in general to measuring apparatus and in particular to an improvement in an automatic shoe-size indicating apparatus as disclosed in a co-pending application, Ser. No. 346,601.

Automatic shoe-size indicating apparatus of one type or another is of course known in the art. Such prior art devices, however, have usually been characterized by relatively complex mechanical arrangements employing stepping motors, banks of electromechanical relays, numerous gear trains, and the like, and wherein physical contact must be made between exposed sensing components in the apparatus and the extremities of the feet being measured. The latter is undesirable because it gives rise to the introduction of certain inaccuracies in the measurements obtained. Further, such prior art devices usually require attendants to operate and attend it. Consequently, there is a need for shoe-size indicating apparatus of the type which is completely automatic wherein the user need only place his feet on the device and proper shoe length and width classification is determined and displayed on a visual read-out panel without the need of human attendants.

Prior art devices of the type having moving elements for contacting the foot being measured suffer from serious deficiencies in reliability for a number of reasons. Many of them are unreliable because they are not designed to accurately measure irregularly shaped objects or because the foot measuring elements require contact with the compressible portions of the foot for the basic length and width measurements. Those that use moving elements and mechanisms associated therewith are readily subjected to jamming, caused by faulty handling thereof and the introduction of foreign particles thereto. Where the foot measuring elements require contact with the foot, the mechanisms and mechanical components involved are subjected to much greater stresses and retarding forces than is necessary in apparatus wherein the foot being measured is not contacted by the measuring elements. Consequently, the need for the latter type of device which possesses inherently greater reliability is apparent.

One automatic shoe-size indicating apparatus which overcomes some and preferably all of the disadvantages referred to above is described and claimed in the aforementioned co-pending application, Ser. No. 346,601, to Sidney Blivice. Apparatus is disclosed therein which most advantageously directs radiant energy, such as light, parallel to a foot-receiving platform where the vertical length and width profiles of the foot are illuminated. Radiant energy sensing means, which are photocell means in the case where light is used, detect the point where the end margins of the foot are located. The preferred form of the apparatus uses a bank of photocells along one longitudinal side of a foot receiving platform with the source of light positioned along the opposing longitudinal side. Similarly, a bank of photocells is positioned along a lateral side of the foot platform and a light source positioned along the opposing lateral side of the foot well. Length and width measurements are correlated so the shoe width classification (A, B, C, etc.) automatically is dependent upon the length measurement. If the foot being measured requires a special shoe size which the machine cannot indicate, the machine automatically informs the user of this fact.

Such shoe-size indicating apparatus as above described has found immediate acceptance in the industry and has filled the need for a device which is capable of providing an accurate indication of length and width of a foot without further interpretation or extrapolation being necessary and wherein nothing other than light beams "touch" the foot itself. It should be noted, however, that the embodiment disclosed in application Ser. No. 346,601 uses a relatively large number of photocells as well as rather complex electrical circuitry to convert the width of the foot measured to a classification which is a function of the measured length. A general object of the present invention, therefore, is to provide an automatic shoe-size indicating apparatus wherein large numbers of photocells may be avoided and wherein a simple, yet highly reliable arrangement may be employed to provide read-out of shoe width classification as a function of the length of the foot being measured.

Accordingly, it is an object of the present invention to provide an improved automatic shoe-size indicating apparatus of a simplified construction wherein an accurate indication of length and width dimensions of a human foot may be effected without the need of physical contact between the foot and the sensing components of the apparatus.

A more particular object of the present invention is to provide an improved shoe-size indicating apparatus of the foregoing type wherein the number of radiant energy sensors or radiant energy sources are greatly reduced over the number used in the shoe-size measuring apparatus disclosed in said application Ser. No. 346,601. Another object of the invention is to provide an apparatus as just described where the circuitry used is greatly simplified to decrease the cost and increase the reliability of the apparatus.

In accordance with one aspect of the present invention, an improved shoe-size indicating apparatus is provided wherein a radiant energy sensor, such as a photocell, preferably is mounted on a carrier movable along a path parallel to the longitudinal axis of a foot receiving well or platform, and a similar radiant energy sensor is preferably mounted on an associated carrier movable along a path parallel to the lateral axis of the foot well. The first sensor is made responsive to the length dimension of the foot being measured and the second sensor is made responsive to the width dimension. Radiant energy sources are aligned along the length and width dimensions of the foot well. (If the sensors are less costly than

the energy sources, which is not now the case, the positions of the energy sensors and sources would be reversed.) The carriers move wipers along contacts which are positioned in relatively simple indicator circuits which indicate the correct shoe width and length classification for the foot involved. The carriers are driven by drive motor means to scan the length and width dimensions of the foot being measured and they operate the associated circuitry to indicate the proper shoe width and length classification. Each carrier is preferably stopped when the associated margin of the foot is reached.

The carriers are most advantageously mounted to move in planes above the bottom of the foot well, but outside the margins of the foot well, so that the foot being measured cannot be contacted by the carriers. Also, with this arrangement, the radiant energy is directed above and parallel to the foot well so the vertical length and width profiles of the foot are illuminated.

Another feature of the present invention is the provision of braking means responsive to each energy sensor means for braking the associated motor means where the associated movable carrier reaches the margin or extremity of the foot being measured.

The above and other objects, advantages and features of the invention will be best understood from the following description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a view in perspective of a shoe-size indicating apparatus which has been constructed in accordance with the present invention;

FIGURE 2 is an enlarged plan view of the apparatus as shown in FIGURE 1;

FIGURE 3 is an enlarged fragmentary view in perspective of the foot receiving well and the light producing and sensing means;

FIGURE 4 is a diagrammatic representation of the structure shown in FIGURE 3;

FIGURE 5 is a partial schematic representation of the electrical interconnections between the respective length and width printed circuit boards;

FIGURE 6 is a system diagram of the apparatus as shown in FIGURE 1;

FIGURE 7 is a partial schematic diagram of the electrical circuitry of the apparatus of FIGURE 1 and useful in the operational description thereof; and

FIGURE 8 is a diagrammatic representation of another embodiment of the present invention.

Referring now to the drawings a shoe-size indicating apparatus is shown at **10** which has been constructed in accordance with the present invention. The apparatus as illustrated includes a base **12** which rests on the floor and forms, inter alia, the housing for the various electrical components and wiring which respond to the placement of the foot to be measured on a foot receiving platform or well **14**. A pedestal **16** extends upwardly to the rear of the base **12** and supports a display panel **18** at the top upon which the measured shoe width and length classifications are displayed. As shown, the bottom of the foot receiving well **14** is located a short distance below the upper surface of the base **13** and is of a generally rectangular shape. Four walls, **14***a*–**14***d*, inclusive, extend upwardly from the periphery of the bottom of the foot receiving well **14**. As seen more clearly in FIGURE 2, a foot to be measured (shown in phantom line) is placed in the foot receiving well **14** with the heel abutting the bottom wall **14***d* and the side of the foot abutting the longitudinal side wall **14***a*. The manual push button switch S is depressed to activate the apparatus **10** and effect the respective length and width measurements of the foot and provide a visual indication of the same on the read-out panel **18**.

The scanning and sensing apparatus for obtaining the width and length measurements of a foot are illustrated generally in FIGURES 3 and 4. A light sensitive element P_L is mounted on a support carrier **21** and a similar light sensitive element P_W is mounted on a support carrier identified at **23**. The carriers **21** and **23** are intended for lineal movement along predetermined paths parallel to the longitudinal and lateral axes, respectively, of the foot receiving well **14**. The light sensors P_L and P_W may be any suitable component which exhibits a positive reaction to the presence or absence of light, such as a photocell or photo-sensitive resistor. In the preferred form, a photo-sensitive resistor is used of the type which exhibits a substantial reduction in overall resistance when exposed to a strong light.

The light sensors P_L and P_W are activated by a cross-lighting arrangement comprising a plurality of focusing lenses **24** positioned along the walls **14***b* and **14***c* as shown, and thus opposite the sensors P_L and P_W, with a plurality of incandescent lamps **26** being positioned behind the lenses **24**. Upon energization of the lamps **26**, light therefrom is focused in parallel ray beams traversing the surface of the foot receiving well **14**—that is, from wall **14***b* to **14***a* and also from wall **14***d* to **14***c*.

The movable carriers **21** and **23** are shown to be supported on associated driving mechanisms indicated at **30** and **32**, such as a threaded rod or worm drive. The drive rods when suitable rotated are effective to impart lineal movement to the carriers **21** and **23** along their lengths adjacent but parallel to the longitudinal and lateral axes of the foot receiving well **14**. Rotational drive is imparted to the drive rods **30** and **32** by drive motors L_f–L_r and W_f–W_r. The motor L_f is coupled to one end of the drive rod **30** which, upon energization, rotates the rod **30** in one rotational direction, e.g. clock-wise as shown in FIGURE 3, and the motor L_r is connected to the other end of the drive rod **30** to impart a rotational direction thereto in the opposite direction such as counter-clockwise. Similarly, the motor W_f is connected to one end of the drive rod **32** to impart a rotational direction thereto in one direction and the motor W_r is connected to the other end of the drive rod to impart a rotational direction in the opposite sense.

As further shown in FIGURE 4, a limit switch is placed at a location adjacent each end of the drive rods **30** and **32** and which limit switches are operated by physical contact with the movable carriers **21** and **23** thereby defining forward and reverse limits of lineal movement for the carriers **21** and **23**. Switch **42** is located at the end adjacent the motor L_f and switch **44** is located at the end adjacent motor L_r. Similarly, switch **46** is located at the end adjacent motor W_f and switch **48** is located at the end adjacent motor W_r.

As shown in FIG. 3, contact wipers extend downwardly from each of the movable carriers **21** and **23** and these wipers are intended to make electrical contact with the various terminal segments T formed on associated printed circuit boards. As seen, the carrier **21** has a single contact wiper C_L while the carrier **23** includes a plurality of such contact wipers, identified at C_W. A printed circuit board PBL is positioned underneath the drive rod **30** but parallel thereto, and a printed circuit board PBW is positioned underneath but parallel to the drive rod **32**. Each of the printed circuit boards include a plurality of terminal segments T of a suitable conductive material placed transverse the longitudinal axis of the boards.

As the carriers **21** and **23** are transported along their predetermined paths of travel, the contact wipers C_L and C_W make selective contact with the terminal segments T on the boards PBL and PBW and serve as an indication of length and width dimensions of a foot being measured in a manner to be described subsequently. The contact wiper C_L co-operates with the terminals T on the board PBL to indicate measured length while the contact wipers C_W co-operate with terminals T on the board PB_W to indicate measured width. In practice, it has been found that thirty-one terminal segments T are required on the length board PB_L and at least nine such terminals are required on the width board PB_W. Thirty of the length ter-

minals T correspond to adult shoe sizes one through 15, inclusive, including the intermediate half-sizes thereof. The thirty-first length terminal T is utilized to indicate a special length size beyond size 15. Nine width contact wipers C_W, corresponding to shoe widths AAA, AA, A, B, C, D, E, EE, and EEE, are also required.

As is well known when measuring a human foot for proper length and width size, a direct read-out of the measured width will not necessarily correspond to the correct shoe width classification. For a particular measured foot width, the correct shoe width classification varies as a function of the measured length. For example, a measured foot width may call for a size B width in conjunction with a size 8 length, but the same absolute foot width may correspond to a size A shoe width in conjunction with a size 9 or 10 shoe length. Similarly, the same absolute foot width may correspond to a size C width in conjunction with a size 6 or 7 shoe length.

The required correlation between measured width and length in the present invention is effected without complex mechanical intercouplings and arrangements such as found in the prior art. One form of the present invention contemplates width classifications suitably correlated to measured lengths by an arrangement which includes purely electrical interconnections between terminal segments of the length and width printed circuit boards PB_L and PB_W. As shown in the diagrammatic representation of FIGURE 5, terminal segments T on the length board PB_L are selectively interconnected to the terminal segments T on the width board PB_W through an associated diode rectifier **45** and conductor **43**. As shown, each width terminal is connected to a corresponding length terminal. Also connected to each length terminal of the circuit board PB_L is a length display light **40** through an associated one of the diodes **45**. Each of the length display lights **40** is terminated as a common reference point (ground) through the controlled rectifier SCR**31** and switch S'. A similar width display light **40** is connected between each contact wiper C_W and the ground reference point through the controlled rectifier SCR**31** and switch S'. A source of electrical power, identified at **41**, is connected between the contact wiper C_L and ground to complete the electrical circuit so formed.

In operation, the forward drive motors L_f and W_f are energized so as to cause the movable carriers **21** and **23** to move toward the limit switches **44** and **48**, respectively. As the light sensors P_L and P_w reach a position tangential to the extremities of the foot being measured, they are exposed to the light emanating from the lamps **26**. The reaction of the sensors P_L and P_w to the light is monitored and is used as a control signal to de-energize the motors L_f and W_f. In this immobilized condition, the length contact wiper C_L is in contact with a particular one of the terminal segments T on the length printed circuit board PB_L, corresponding to the measured length. At the same time, the several contact wipers C_W are in selective contact with terminal segments T on the width printed circuit board PB_W. Upon conduction of SCR**31**, electrical power is applied through the contact wiper C_L to the particular terminal T in contact therewith, through the associated diode **45** and display light **40** to ground, as well as through the associated terminal T on the printed circuit board PB_W, and from there to the particular contact wiper C_W in contact therewith and its associated display light **40** to ground through controlled rectifier SCR**31** and switch S'. Thus a direct read-out of the length as measured is indicated together with a width classification which is a function of the particular length measured. The diode rectifiers **45** are included in series with each of the conductors **43** to prevent an energized width terminal T from feeding back through its energizing wiper C_W connected in parallel with the other width terminals T.

Provision is also made for determining and indicating that a special shoe-size is required beyond the conventional size 15 shoe length and/or a size EEE shoe width. This is accomplished by the logic "OR" gate **50** shown in FIGURE 5 which includes a pair of inputs **50***a* and **50***b* and an output **50***c* connected to a display light **52**, which when illuminated, indicates that a special shoe size is required. Input **50***a* of the OR gate **50** is connected to the thirty-first terminal segment T on the length board PB_L, which is in proximity to the stop limit switch **44**. Whenever the length contact wiper C_L is stopped in a position where it is in electrical contact with this terminal segment, the special size display light **52** will be energized by the action of the "OR" module **50**.

An indication of a special width classification may be provided by applying a suitable input signal to the other input **50***b* of the OR gate **50** when the movable width carrier **23** has reached some predetermined position along its path of travel (right to left as viewed in FIGURE 5) corresponding to a width size exceeding EEE. The application of the input signal to input **50**B may be effected in several satisfactory ways. For example, a multi-contact limit switch **48** may be employed having one set of contacts interposed between the input **50***b* and a source of power. When the carrier **23** reaches the limit of its travel and operates the switch **48** to de-energize, the drive motor W_f, it also activates the special size display light **52**. Alternatively, an additional contact wiper C_W may be provided on the carrier **23** and utilized, in conjunction with an associated terminal segment on the width board PB_W to accomplish the same result. It is of course to be understood that the present invention is not to be limited to any specific mode.

With the foregoing arrangement as described, only minimal electrical circuitry is required and complex mechanical interconnection and couplings are thereby avoided. Accurate measurements of the length and width dimensions of a foot are effected simply and automatically by sensing means that are not exposed and do not contact the foot or feet being measured.

In addition to the features as above described, it will be appreciated that, for effective operation, the shoe-size indicating apparatus must also exhibit capabilities of a fast scan, good resolution, and be able to stop the drive motors, and in turn the scanning mechanism, rapidly and consistently so as to insure an accurate measurement and read-out. To this end, the necessary control circuitry has been provided to effect proper operation of the indicating apparatus. A system flow chart is depicted in FIGURE 6 to indicate overall functional operation with a partial schematic diagram shown in FIGURE 7 of the electrical circuitry for effecting the more significant control functions for the shoe-size indicating apparatus **10**.

Referring to FIGURES 6 and 7, the light sensors P_L and P_w are shown as photo-sensitive resistances which are responsive to the change between the shadow cast by the foot being measured and the exposure to light emanating from the lamps **26**. The length and width gates, identified as L and W in FIGURE 6, correspond to the silicon controlled rectifiers SCR**11** and SCR**21** as shown in FIGURE 7, which, when rendered conducting, indicate that light has been sensed by the sensors P_L and P_W. Upon exposure to light, sensors P_L and P_W exhibit a substantial reduction in resistance to render transistors T**10** and T**20** non-conductive. This in turn renders transistors T**11** and T**21** non-conductive thereby causing SCR**11** and SCR**21** to conduct. The length stop gate L–S shown in FIGURE 6, is comprised of resistor R**11** and transistor T**12**. Similarly, the width stop gate W–S is comprised of resistor R**21** and transistor T**22**. Stop gates L–S and W–S are "AND" gates responsive to the switching elements L and W in FIGURE 6 in conjunction with the manual control switch S to control the operation of the forward drive motors L_f and W_f. When the manual control switch S is depressed and the control rectifier SCR**11** is non-conductive, it will be seen that the length forward drive motor L_f will be energized to drive the movable carrier **21** toward its upper range limit. Similarly, the

width forward drive motor W_f is energized by the push button switch S being depressed and the silicon control rectifier SCR21 being in the non-conductive state. Upon exposure of the sensors P_L and P_W to light, the control rectifiers SCR11 and SCR21 are rendered conductive to inhibit one of the inputs to each of the L–S and W–S stop gates thereby de-energizing the forward drive motors L_f and W_f.

At the same time the rectifiers SCR11 and SCR21 are rendered conductive capacitors C11 and C21 will begin to charge thereby allowing the application of a momentary positive-going pulse to each of the base electrodes of transistors T14 and T24. These pulses are effective to cause momentary conduction of transistors T15 and T25, and thereby a momentary energization of the reverse drive motors L_r and W_r. Energization of the reverse motors L_r and W_r rapidly retards the motion of the forward drive motors L_f and W_f and provides an effective dynamic braking action thereon. It should be noted that the length of duration of the positive pulses, provided by the charging of capacitors C11 and C21, is determined by the R-C time constant of C11–R12 and C21–R22. The respective time constants can be adjusted to provide the optimum braking action. With this arrangement, the scanning mechanism is stopped rapidly on reaching the extremities of the foot being measured and accurate readout of the measurements is enhanced. The block D in FIGURE 6 corresponds to a bistable memory element such as the silicon controlled rectifier SCR31 in FIGURE 7. The display stop gate D–S is an "AND" gate comprised of diodes 31 and 32 and resistor R31. In the non-conductive state SCR21 is operative to de-energize the respective length and width display bulbs 40 and, in the conductive state, is effective to energize the display bulbs 40 and prevent reversing motors L_r and W_r from being energized. SCR31 is conductive only when sensors P_L and P_W are both simultaneously exposed to light. Thus it is seen that until the sensors P_L and P_W have reached a position tangential to the extremities of the foot being measured and exposed to light, electrical power is precluded from being applied to the terminal segments T and energize the particular display lights 40. Electrical power is withheld from the terminal segments until after the drive motors L_f and W_f are de-energized and the contact wipers C_L and C_W immobilized. In this condition, arcing between the wipers C_L and C_W and the terminal segments T is precluded. To further insure against such arcing, capacitor C31 is included to delay the conduction of SCR31 for a predetermined time after the length and width wipers C_L and C_W have stopped movement.

The illumination gate I, an "OR" gate, is effective to energize the illumination lamps 26 when either forward drive motor L_f or W_f is energized (either sensor P_L or P_W is moving forward). The output of the illumination gate I, not detailed in FIG. 7, connects to line 56 and can provide an input signal therein to the reverse gate R to inhibit the sensors P_L and P_W from traveling in reverse direction by insuring that the reverse drive motors W_r and L_r remain deenergized whenever forward drive motors L_f or W_f are energized. This inhibit is effective when the line 56 is clamped to ground potential by the illumination gate I, thereby grounding the anodes of diodes 33 and 34. Only when the anodes of diodes 33 and 34 rise to a positive potential can transistors T14 and T24 be rendered non-conductive and, in turn, cause transistors T15 and T25 to conduct so as to permit energization of reverse drive motors L_r and W_r. The reverse gate R has the function of determining when the light sensors P_L and P_W should reverse by controlling the operation of the reverse drive motors L_r and W_r. The reverse gate R consists essentially of normally-closed switches 42 and 46 (FIGURE 4), diodes 33, 34, 35 and 36, and resistors R32 and R33. It will be seen that reverse drive motor L_r can be energized only when SCR31 is rendered non-conductive, switch 42 is closed, and the output of the illumination gate I is above ground potential, in which case a positive potential will be applied to the anode of diode 33 through resistor R32. When the movable carriers 21 or 23 contact the associated limit switch 42 or 46, the involved reversing motor will then be deenergized. It should be noted that the forward driving motors L_f and W_f cannot be energized until SCR11 and SCR21 are rendered non-conductive. This can only occur when the normally-closed limit switch 42 is contacted by carrier 21 and opened.

The foregoing is not intended to be exhaustive of the complete electrical control circuitry and wiring for the shoe-size indicating apparatus but merely to provide a general understanding of system operation as a whole with particular emphasis on certain important features, such as: (1) the dynamic braking action by one drive motor upon the other associated drive motor and, (2) the energization of terminal segments T, and in turn the size display lights, only after the motors have been deenergized and the contact wipers C_L and C_W have been immobilized and come to rest. The remaining electrical circuitry and wiring to form the shoe-size indicating apparatus as a functional unit will readily be understood by those skilled in the art, particularly upon reference to the aforementioned co-pending application, Ser. No. 346,601.

It will be recognized that the apparatus as above described contemplates the measurement of one foot at a time. It may, in some instances, be desirable to measure both feet simultaneously on the possibility that one foot has a length or width dimension greater than the other. FIGURE 8 shows another embodiment of the present invention, wherein both feet may be measured simultaneously. The same reference numerals have been used to identify components which are identical with those described in the embodiment shown in FIGURES 1 to 7. As illustrated, both feet are placed within the foot receiving well 14 in a side-by-side relation abutting the center partition P constructed of a transparent material such as glass or plastic. The length measurement is effective in the same manner as described for FIGURES 1 to 7, comprising the movable carrier 21 on drive rod having a forward drive motor L_f and a reverse drive motor L_r connected at opposite ends thereof. The light source for effecting the length measurement includes the ilumination lamps 26 and the focusing lenses 24. The light sensor 20 is thus stopped when it reaches the longest extremity of both feet in combination.

For width measurement, however, two movable carriers must be provided, such as indicated at *23a* and *23b*, each of which include a light sensitive device *22a* or *22b* mounted thereon. A two piece drive rod is provided having one section *32a* with, for example, a right-hand thread and the other section *32b* threaded in the opposite direction, or with a left-hand thread. Forward and reverse direction motors W_f and W_r are connected at the outer ends of the drive rod 32. The sections *32a* and *32b* are suitably coupled at their inner ends such that upon energization of either the motor W_f or W_r the movable carriers *23a* and *23b* are moved in unison but in opposite directions. The illumination lamps 26 and focusing lenses 24 are provided in the manner shown. Each of the light sensing devices *22a* and *22b* can be connected in such combination to an output therefrom only when both of said devices are exposed to light, from the width associated illuminated lamps 26. In such case it is seen that the largest width dimension of the two feet in combination will be indicated.

While only two embodiments of the present invention are shown and described herein, it will be understood that certain modifications may be effected without materially departing from the true scope of the present invention. As an example, the present apparatus can readily be modified to include light source means affixed to the movable carrier for transmitting light upon a series of light

sensitive devices placed along a periphery of the foot receiving area. Another form of the present invention could include radiant energy of one form or another, such as heat, utilized in conjunction with an infra-red detector which could be mounted on a movable carrier of the type herein described.

What is claimed is:

1. Shoe-size indicating apparatus for indicating the length and width dimensions of a foot, comprising in combination:

a housing for the shoe-size indicating apparatus;

a foot receiving area defined upon said housing wherein the foot to be measured is placed, said area having a longitudinal axis and a lateral axis in relationship to which the foot is to be placed with its length along said longitudinal axis and its width along said lateral axis;

a first carrier movable along a predetermined path adjacent to said foot receiving area and substantially parallel to the longitudinal axis thereof;

a second carrier movable along a predetermined path adjacent to said foot receiving area and substantially parallel to the longitudinal axis thereof;

light source means for directing light toward said foot receiving area;

first light sensitive means associated with foot length affixed to said first movable carrier and positioned to intercept light from said light source;

second light sensitive means associated with foot width affixed to said second movable carrier and positioned to intercept light from said light source, each of said light sensitive means being positioned to allow the foot being measured to be interposed respectively between said first and second light sensitive means and said light source means, and each of said light sensitive means being responsive to changes in the intensity of light impinging thereon;

drive means for impelling said first and second movable carrier along their predetermined paths of travel;

means for providing an indication of shoe size when the light sensitive means have been moved to a position tangential to the extremities of the foot being measured so as to experience an appreciable change in the intensity of light as received from said light source;

and circuit means for modifying the actual value of width obtained for the foot being measured to a shoe width classification which is a function of its measured length.

2. Shoe-size indicating apparatus in accordance with claim 1 wherein the last mentioned circuit means for modifying width measurements as a function of length includes first electrical switch means responsive to the position of said first movable carrier, second electrical switch means responsive to the position of said second movable carrier, a series of electrical circuit paths which are respectively completed through said switch means in response to each different respective pair of positions of said first and second light sensitive means, and display means responsive to the electrical output of any of said circuit paths which are completed so as to provide an indication of shoe width as a function of measured length.

3. Shoe-size indicating apparatus in accordance with claim 1 wherein the last mentioned circuit means for modifying width measurements as a function of measured length includes a first set of electrical terminal elements corresponding to foot length positioned along a path parallel to the path of travel of the first movable carrier, a contact wiper extending from the first movable carrier to a position for making sliding contact with said first set of terminal elements, a second set of electrical terminal elements corresponding to foot width positioned along a path parallel to the path of travel of said second movable carrier, a plurality of contact wipers extending from said second movable carrier for making sliding contact with said second set of terminal elements, a source of power, means for selectively applying said power source to a circuit which includes said one contact wiper and said plurality of contact wipers, said first and second set of terminal elements being selectively interconnected as a function of the position of said movable carriers such that, upon application of power to said one contact wiper, a length measurement is indicated as a function of the measured length, and a width measurement is indicated as a function of the measured length and width.

4. Shoe-size indicating apparatus in accordance with claim 3 wherein the means for applying the electrical power to said circuit which includes said one contact wiper and said plurality of contact wipers includes switching means operative only upon the interruption of said drive means and at a time when said contact wipers have ceased movement and come to a stationary position, thereby preventing the occurrence of arcing between the contact wipers and the electrical terminal elements.

5. Shoe-size indicating apparatus for indicating the dimensions of a foot, comprising in combination:

a housing for the shoe-size indicating apparatus;

a foot receiving area defined upon said housing wherein the foot to be measured is placed, said area having an axis parallel to the foot dimension to be measured;

a carrier movable along a predetermined path in the vicinity of said foot receiving area and substantially parallel to said axis;

transmitting means for transmitting energy of a type which cannot penetrate the foot;

energy receiving means for receiving said transmitted energy, one of said means being affixed to said carrier, the other of said means being located in the vicinity of said foot receiving area and both of said means being positioned to allow the foot being measured to be interposed between them;

drive means for impelling said movable carrier along its predetermined path of travel; and

means responsive to a change in the amount of energy received by said energy receiving means occuring when the carrier has been moved to a position tangential to the extremity of the foot being measured, thereby providing an indication of said foot dimension.

6. Shoe-size indicating apparatus in accordance with claim 5 wherein said transmitting means includes light source means for directing light beams across and parallel to the surface of the foot receiving area and wherein said energy receiving means includes light sensitive means responsive to significant changes in the intensity of light impinging thereon.

7. Shoe-size indicating apparatus in accordance with claim 5 wherein the means for providing shoe size indication includes a plurality of electrical terminal elements positioned along a path parallel to the path of travel of said movable carrier, each of said terminal elements corresponding to a given shoe size, a contact wiper extending from said movable carrier for selectively making sliding contact with said terminal elements, display means interconnected to each of said terminal elements, a source of electrical power, and means for selectively applying said power source to said contact wiper, thereby activating a selected one of said display means as an indication of shoe size.

8. Shoe-size indicating apparatus in accordance with claim 7 wherein means are provided to indicate the requirement of a special shoe size beyond a selected range of shoe sizes, said means including switch means and special size display means, said switch means being connected between said special size display means and a selected one of said terminal elements and operative upon activation thereof to energize the special size display means.

9. Shoe-size indicating apparatus in accordance with claim 5 wherein said drive means for said movable car-

rier includes a drive rod having a forward and a reverse drive motor connected to the respective ends thereof, pulse circuit means, switch means for deenergizing said forward drive motor causing said pulse circuit means to apply a pulse of given duration to the reverse drive motor, thereby momentarily energizing the same and rapidly retarding the motion of the forward drive motor by dynamic braking action.

10. Shoe-size indicating apparatus for indicating the greater dimension as between two feet when measured simultaneously, comprising in combination: a foot receiving area defined upon said housing wherein both feet may be placed in a side-by-side relation, said area having an axis parallel to the dimension of the feet being measured; means for ensuring the feet to be measured are properly positioned within the foot receiving area with respect to a reference line and to each other in a side-by-side relation; sensing means operative along a predetermined path substantially parallel to the axis of the foot receiving area to determine the greater dimension as between the two feet positioned within the foot receiving area; said sensing means including a first sensor element movable along a path substantially parallel to an axis through the length dimension of the feet being measured, and second and third sensor elements movable along a path substantially parallel to an axis through the width dimensions of the feet, each of said second and third sensor elements being associated with a different foot and movable along their predetermined paths of travel, each of said sensor elements providing an indication upon reaching a contiguous, non-foot contacting position in relation to the extremities of the feet, and circuit means including memory means capable of selecting the larger of the lengths and widths as measured by said first, second and third sensor elements.

11. Shoe-size indicating apparatus of claim **1** wherein said drive means includes first drive means for impelling said first movable carrier, second drive means for impelling said second movable carrier; and there is further provided means responsive to the first light sensitive means for interrupting said first drive means when the first light sensitive means has been moved to a position tangential to the lateral extremity of the foot being measured, and means responsive to the second light sensitive means for interrupting said second drive means when the second light sensitive means has been moved to a position tangential to the longitudinal extremity of the foot being measured.

12. Shoe-size indicating apparatus of claim **5** wherein another foot dimension is also to be measured, said apparatus further comprising another carrier movable along a predetermined path in the vicinity of said foot receiving area and substantially parallel to said other dimension to be measured; means affixed to said other carrier responsive to said other foot dimension; a series of electrical terminal elements positioned in a direction parallel to said other dimension; means affixed to said other carrier for contacting terminal elements of said series in order to provide electrical outputs corresponding to the position of said other carrier; means responsive to the position of the first mentioned movable carrier that govern said electrical outputs; means responsive to any of said electrical outputs for providing an indication of shoe size corresponding to both of said dimensions of the foot being measured.

13. Apparatus in accordance with claim **5** wherein said carrier and means affixed thereto are located outside of said foot-receiving area where they cannot be contacted by the foot being measured.

14. Shoe size indicating apparatus of claim **5** wherein there is provided means responsive to the energy receiving means for interrupting said drive means when the means affixed to said carrier has been moved to a position tangential to the extremity of the foot being measured.

15. Apparatus in accordance with claim **6** wherein said foot-receiving area includes a platform whereupon the bottom of the foot to be measured is placed, and there is provided a solid transparent wall along the periphery of said foot-receiving area adjacent to the carrier and extending upwardly from said platform to provide a light transparent abutment for properly positioning said foot during the measurement thereof, and said wall serving to physically isolate the carrier and the means carried thereby from said foot without preventing light from passing through the wall.

16. Shoe size indicating apparatus of claim **5** wherein said drive means includes motor means, means coupling said motor means to said movable carrier, braking means responsive to said energy receiving means for effectively abruptly stopping said motor means in order to provide an accurate indication of said foot dimension when a significant change in the amount of said energy received by the energy receiving means occurs.

17. Apparatus in accordance with claim **1** wherein said first and second carriers and light sensitive means affixed thereto are located outside of said foot-receiving area and cannot be contacted by the foot being measured.

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