June 29, 1937. J. E. LUDLAM 2,085,374

ARCH SUPPORT FOR SHOES

Filed Nov. 14, 1934 4 Sheets-Sheet 1

FIG. 1

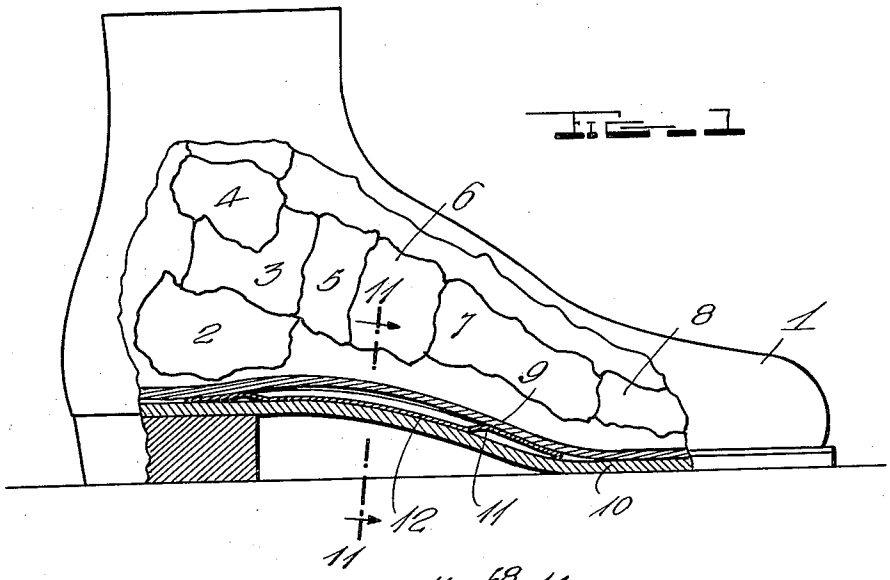


FIG. 2

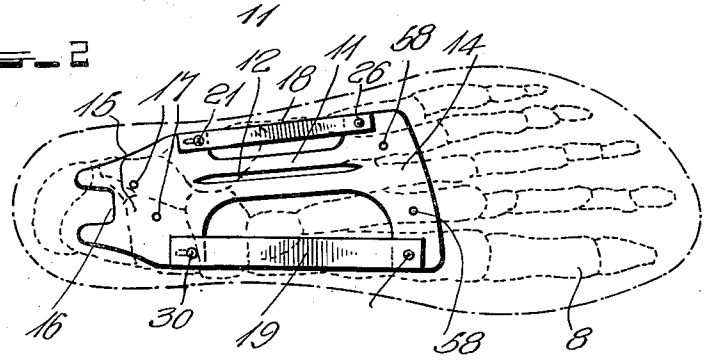
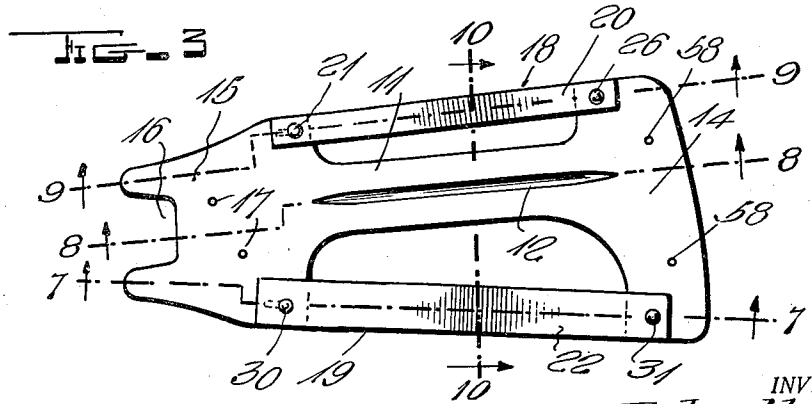


FIG. 3



INVENTOR.
James E. Ludlam,
BY John B Brady
ATTORNEY.

June 29, 1937. J. E. LUDLAM 2,085,374

ARCH SUPPORT FOR SHOES

Filed Nov. 14, 1934 4 Sheets-Sheet 2

Fig. 4

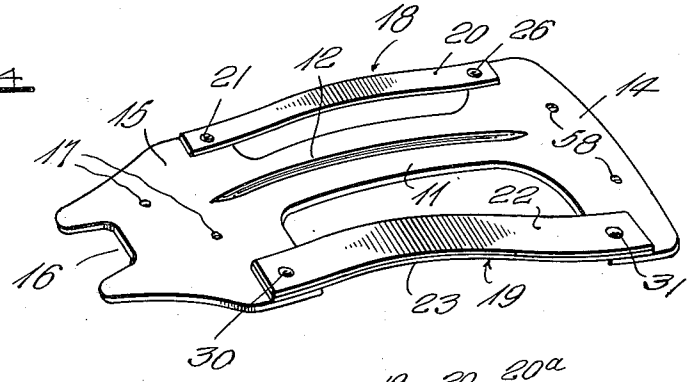


Fig. 5

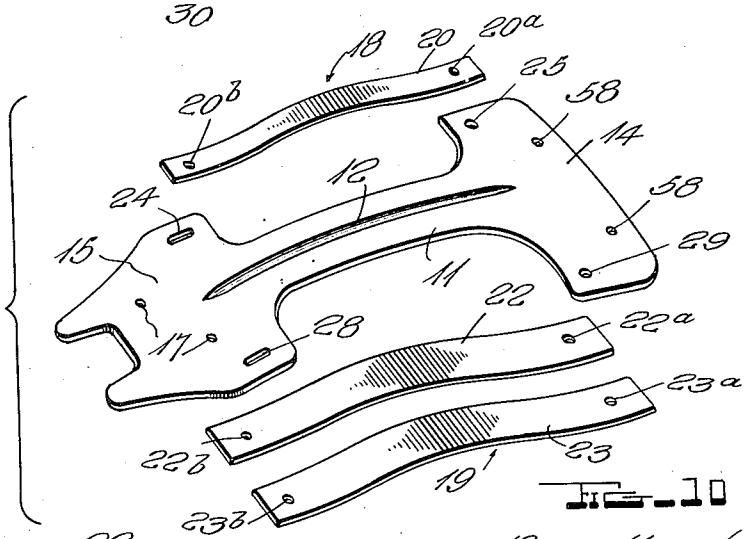


Fig. 6

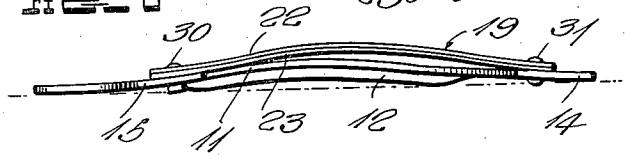


Fig. 10

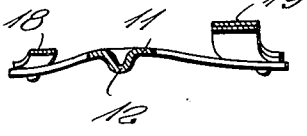


Fig. 7

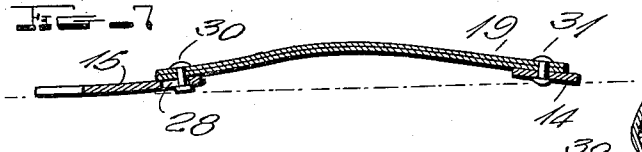


Fig. 11

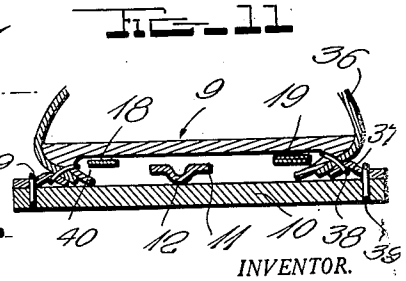
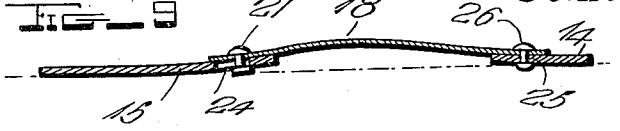


Fig. 8



Fig. 9



INVENTOR.

James E. Ludlam,

BY John B Brady

ATTORNEY.

June 29, 1937. J. E. LUDLAM 2,085,374

ARCH SUPPORT FOR SHOES

Filed Nov. 14, 1934 4 Sheets-Sheet 3

FIG. 12

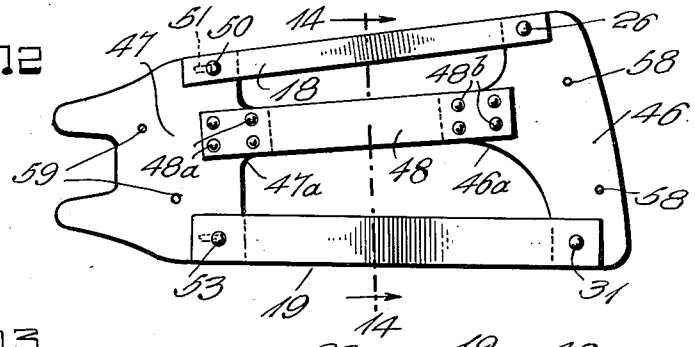


FIG. 13

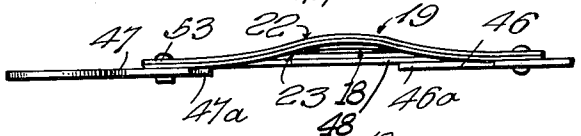


FIG. 14

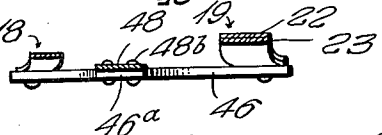


FIG. 15

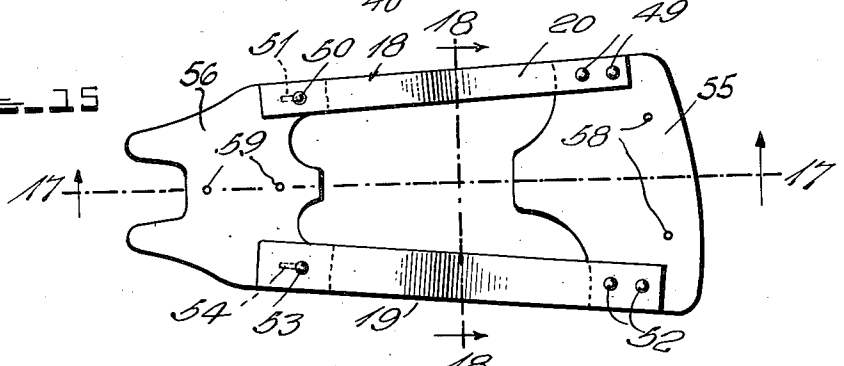


FIG. 16

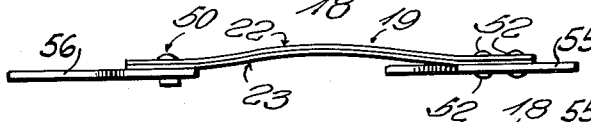


FIG. 18

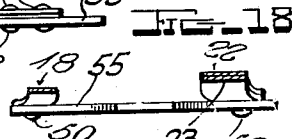


FIG. 17

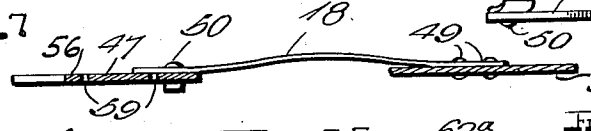


FIG. 24

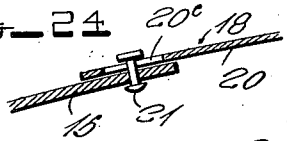


FIG. 26

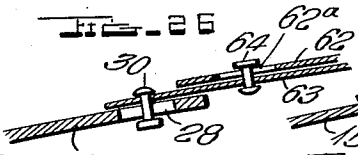


FIG. 27

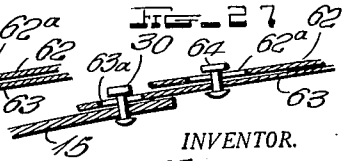
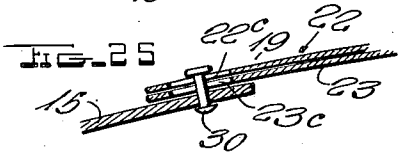


FIG. 25



INVENTOR.

James E. Ludlam,

BY John O. Brady

ATTORNEY.

June 29, 1937. J. E. LUDLAM 2,085,374

ARCH SUPPORT FOR SHOES

Filed Nov. 14, 1934 4 Sheets-Sheet 4

FIG. 19

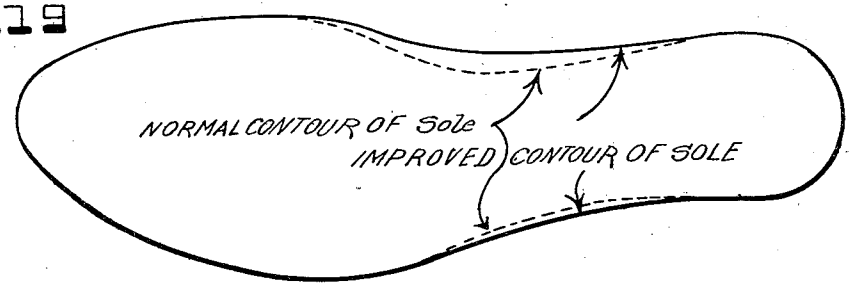


FIG. 20

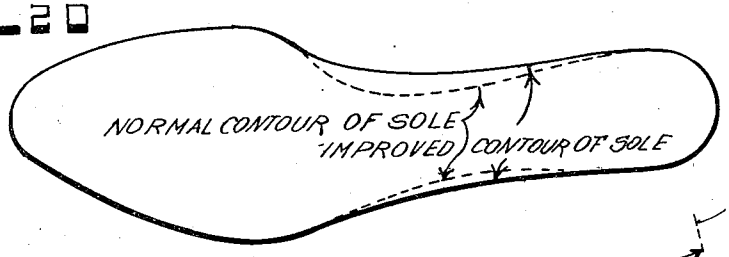


FIG. 21

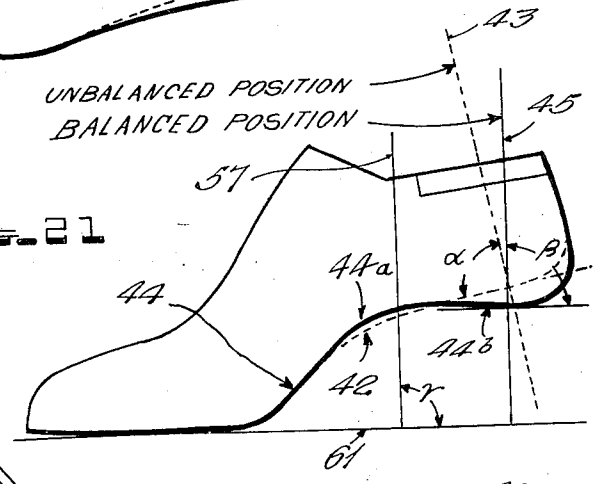


FIG. 22

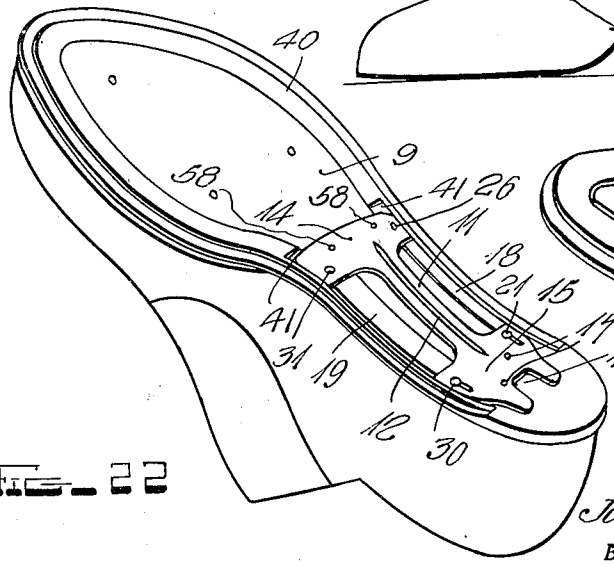
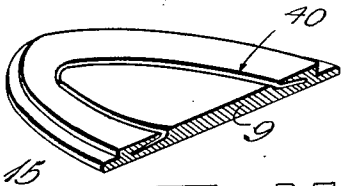


FIG. 23



INVENTOR.
James E. Ludlam,
BY John B. Brady
ATTORNEY.

Patented June 29, 1937

2,085,374

UNITED STATES PATENT OFFICE

2,085,374

ARCH SUPPORT FOR SHOES

James E. Ludlam, Belleville, N. J.

Application November 14, 1934, Serial No. 753,045

16 Claims. (Cl. 36—71)

My invention relates broadly to shoes and more particularly to a construction of arch support for shoes.

One of the objects of my invention is to provide a construction of arch support for shoes in which both the inner and outer longitudinal arches of the foot are flexibly supported.

Another object of my invention is to provide a simplified construction of arch support for shoes comprising a rigid member and flexible members for supporting both the inner and outer longitudinal arches of the foot.

Still another object of my invention is to provide a construction of arch support which may be either built into a shoe or inserted into the shoe as an additional member.

A further object of my invention is to provide a construction of arch support which includes a rigid member having a bridge portion off center with respect to the foot and a pair of spring portions operating to support both the inner and outer longitudinal arches wherein the spring portions have predetermined yieldable characteristics to insure adequate support for all portions of the foot from heel to ball.

A still further object of my invention is to provide a construction of arch support shaped to a modified form of last for providing a wider inner and outer sole in the shank portion of the shoe within which separate resilient portions of the arch support operate to provide a broad support for the bones of the inner and outer arches of the foot.

Another object of my invention is to provide a special arrangement of balanced last and arch support for shoes in which the contour of the last, modified to accommodate a relatively wide arch support by which the calcaneus, astragalus, scaphoid, internal, middle, and external cuneiform bones, the cuboid and all of the metatarsal bones, and also numerous tendons, ligaments and muscles, may be firmly supported.

Other and further objects of my invention reside in the construction of balanced arch support for shoes as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

Figure 1 is a side elevation partially in section of a shoe provided with my improved arch support; Fig. 2 is a top plan thereof, with the arch support shown in full lines and the bones of the foot shown in dotted lines whereas the shoe itself is indicated by a dash and dotted line; Fig. 3 is a top plan view of the arch support per se on an enlarged scale; Fig. 4 is a perspective view thereof; Fig. 5 is a similar view showing the component parts of the improved arch support; Fig. 6 is a side elevation thereof; Figs. 7, 8, and 9 are longitudinal sectional views taken on correspondingly numbered lines indicated on Fig. 3; Fig. 10 is a transverse, vertical section taken on line 10—10 of Fig. 3; Fig. 11 is a transverse vertical section taken on line 11—11 of Fig. 1; Fig. 12 is a top plan view of a modified form of my improved arch support; Fig. 13 is a side elevation thereof; Fig. 14 is a transverse vertical section taken on line 14—14 of Fig. 12; Fig. 15 is a plan view showing still another form of my improved arch support; Fig. 16 is a side elevation thereof; Fig. 17 is a central vertical longitudinal section taken on line 17—17 of Fig. 15; Fig. 18 is a transverse vertical section on line 18—18 of Fig. 15; Figs. 19 and 20 are plan views respectively showing the normal and improved outline of the sole used for a man's and woman's shoe respectively; Fig. 21 is a theoretical view of the balanced position of the foot attained by the use of my improved last and arch support; Fig. 22 is a perspective view of a last provided with the improved insole, parts of the chamfered rib on which are stitched the welt and upper, cut away to provide an appropriate space for the reception of my improved arch support; Fig. 23 is a sectional perspective view of a portion of the insole used in connection with my improved arch support; and Figs. 24, 25, 26, and 27 are cross-sectional views of fragmentary parts of the resilient spring member at the connection thereof with the calcaneus supporting portion.

The arch support of my invention comprises a relatively rigid span extending longitudinally at an off center position of the foot. The off center span has end portions formed either integrally therewith or joined to the end portions of the span, which end portions extend laterally of both sides of the off center span. The forward portion has one side extending farther than the other side beyond the off center span, said forward portion supporting the entire width of the foot for supporting the five metatarsal bones and being raised near the central part of said fore end portion to conform to the contour of the foot in the rear of the metatarsal phalangeal joints.

For purposes of explaining my invention, I have hereinafter called the forwardly positioned laterally extending portion of the arch support the metatarsal supporting portion. I have hereinafter called the rearwardly positioned laterally extending portion the calcaneus supporting portion. The laterally extending metatarsal and calcaneus supporting portions extend different distances from the off center span. I attach two separate springs to the metatarsal and calcaneus supporting portions, one for supporting the inner longitudinal arch of the foot and the other for supporting the outer longitudinal arch of the foot. The bones of the respective arches supported by the device of my invention are the calcaneus, astragalus, scaphoid, internal, middle, and external cuneiform, cuboid and metatarsals.

The springs are positioned on longitudinal axes which extend at an angle to each other, the spring for supporting the inner arch being spaced farther from the center span than the spring for supporting the outer arch. Both springs are riveted at their forward ends adjacent the opposite edges of the metatarsal supporting portion. I provide a single spring for supporting the outer longitudinal arch. I provide a double spring to support the inner longitudinal arch. Both springs are constituted by strips of tempered steel. The double spring comprises strips which are disposed one above the other. The springs are provided with rivet members adjacent their rear ends which extend through slots in the calcaneus supporting portion and allow the springs to yield under the load of the outer and inner longitudinal arches within limits determined by the length of the slots in the calcaneus portion. The slots permit limited yielding action of the springs. The arrangement of the double spring beneath the inner longitudinal arch produces a firm yet resilient support for exercising the muscles of the inner longitudinal arch of the foot. Similarly, the yieldable spring under the outer longitudinal arch serves to impart a massaging action to the muscles of the outer longitudinal arch. In one form of my invention, the center span is integral with the metatarsal and calcaneus supporting portions so that the arch is formed by providing a cutaway portion on each side of the off center span. The springs are mounted on either side of the off center span adjacent the opposite edges of the lateral end portions.

The arrangement of the double spring and single spring for supporting the inner and outer longitudinal arches is such that a firm support is imparted to all of the bones and members of the foot from heel to ball. When the bone structure of the foot weakens and lowers, the foot inverts and lowers at the inner side. If given the proper support, the bone structure can be realigned. It has been found that shoes containing my arch support have gradually raised the respective arches of the foot with extraordinary comfort to the wearer. I explain as follows, one of the methods employed.

The internal twin spring can be made to operate with respect to a predetermined slot length in the calcaneus supporting portion to allow for a certain degree of lowering under body weight. By making the internal spring higher than the last to which it is to be fitted and forcing the complete arch support to the insole, the internal spring yields to a lower degree absorbing the allowance made by the predetermined slot lengths. When the outer sole is sewed to the shoe, said spring is firmly held in operative position. As the shoe continues to be worn and the inner and outer soles loosen, the internal spring releases and gradually rises to its original height. The wearer, therefore, has been receiving a gentle, resilient support, the muscles have been strengthening and the bone structure continually rising. My arch support when arranged in this manner continues to rise, under the inner longitudinal arch of the foot until it has reached a higher normal position. The bones and muscles of the feet, from heel to ball, lower when the weight of the body is placed on them and rise again to their original position, with each step. This action proves that the proper arch support should yield under weight if the arches and muscles of the foot are to function cooperatively with the arch support to their best advantage for permanently maintaining foot health. The arch of my invention yields at either side of the foot independently or in unison, providing a spring action for each individual or both longitudinal arches, thereby cooperating in a scientific manner to fulfill the natural functioning of foot movement. The forward or metatarsal portion of my arch support starts to widen forward of the transverse arch continuing from the center span and extends laterally on both sides for supporting the five metatarsal bones of the foot, more extension being made at the inner side than the outer side of the span. While the extreme forepart of the arch support is curved to conform to the natural shape of the foot and last in rear of the metatarsal-phalangeal joints, the central portion of said forward portion is raised to more effectively support the portion of the foot between the transverse arch and the metatarsal-phalangeal joints.

I have found that greater foot comfort may be obtained by associating the arch support with relation to a special design of shoe and balanced last. By harmoniously and scientifically combining the design of the balanced last, the design of the arch support and the special design of shoe, I have found that the greatest comfort can be imparted to the foot. I have made many models of lasts in finally arriving at the balanced last which I employ in association with the arch support of my invention, and I have found as a result of experimental determination that the design of last of my invention employed in association with the arch support of my invention and design of shoe insures a high degree of comfort to the foot. I have found it necessary to so design the last that the weight of the body bearing at the heel portion of the foot may be lowered to a position of greater equilibrium. This modification of last structure provides a greater support to the foot, especially beneath the rear central portion and the internal arch. The last is widened at the outerside to provide extra space for the cuboid and fifth metatarsal bone.

In designing the higher heel lasts for women, the base of the heel is lowered in different amounts to correspond to the height of heel, bringing the heel nearer to a horizontal plane. This change of last structure produces a slightly higher arch and lowered heel, bringing more weight bearing at the arch of the foot and heel thereby reducing weight at the ball. It is here that the arch support of my invention with springs under the inner and outer sides of the foot is so important, due to the fact that not only one side of the arch support must yield, but both sides must yield to allow the central portion of the foot to lower when weight is placed on the foot. This change in last balance automatically changes the weight distribution by decreasing the pressure at the metatarsal-phalangeal portion of the foot and shifting more of the load to the central and rear portion of the foot and outer side of the foot. The new balance also allows the body to stand in a straighter and more upright position, and allows a minor lengthening of the muscles at the posterior portion of the leg. This new scientific balance and posture coupled with the new double spring arch support and wider shank shoe operates to provide extraordinary comfort through a more equalized distribution of body weight.

My invention contemplates an arch support including a metatarsal supporting portion and a

calcaneus supporting portion with members interconnecting the said supporting portions, each of which have inherent resiliency. The members are constituted by strips which are anchored at their forward ends adjacent the edges of the metatarsal supporting portion and which are slidably connected through a pin and slot connection adjacent opposite edges of the calcaneus supporting portion. My reason for allowing the members to slide at the rear thereof is that as the weight of the body is brought to bear on the feet with each step, greater stress is placed on the members near the heel or calcaneus supporting portion. My arch support provides an instantaneous shock absorber to the nerves and muscles and by providing a double set of spring strips constituting one of the members which bridge the cutaway portion of the arch support, I secure that degree of yieldability required for properly supporting the inner arch and I overcome in large measure, breakage due to rust and other conditions brought about by deterioration and the use of a single spring.

Referring to the drawings in more detail, reference character 1 designates a shoe which encloses the foot which I have represented by illustrating the disposition of the several bones of the foot. Reference character 2 designates the calcaneus, 3 the astragalus, 5 the scaphoid, 6 the internal cuneiform, 7 the metatarsal, and 8 one of the phalanx bones. There are also various tendons and muscles which must be supported by the arch support. The insole of the shoe 1 is shown at 9 in superimposed relation with respect to the outersole 10.

The arch support is illustrated at 11 and in the arrangement shown in Fig. 1, the arch support is built in as an integral part of the shoe. It is understood, however, that the arch support may be applied as an insert in the shoe. The arch support shown in Figs. 1–11 includes a central span 11 having therein a longitudinally extending strengthening rib 12. It will be seen that the central span 11 is off center with respect to the center line of the foot, that is, the span 11 is nearer the outer longitudinal arch of the foot. The arch support terminates at opposite ends in the metatarsal supporting portion 14 and in the calcaneus supporting portion, 15, respectively. The calcaneus supporting portion 15 is recessed, as indicated at 16 making it possible to employ the arch support of my invention in shoes which are built by connecting means such as screws extending through the heel of the shoe. Apertures 17 are provided in the calcaneus supporting portion 15 for securing the arch to the insole. Apertures 58 are provided in the metatarsal supporting portion 14 for securing the metatarsal supporting portion 14 in position.

The spring support for the inner longitudinal arch is represented generally at 19. The spring support for the outer longitudinal arch is shown generally at 18. The spring support 19 comprises two spring steel, tempered elements each supported mutually by the other and each supported by the metatarsal and calcaneus supporting portions. The tension of spring supports 18 and 19 is substantially different. That is, spring support 18 for the outer longitudinal arch is constituted by a single spring element and is normally lower than the spring support 19 for the inner longitudinal arch. Reference character 22 designates the upper spring element of spring support 19 which is adjacent to the lower spring element 23 of spring support 19. The calcaneus supporting portion 15 is provided with a slot at 24 and the metatarsal supporting portion 14 is apertured at 25 to receive rivet member 26 which passes through aperture 20a in strip 20 of outer longitudinal arch support 18. A rivet 21 extends through an aperture 20b in strip 20 and through slot 24 in the calcaneus supporting portion 15. The spring support 19 for the inner longitudinal arch has the elements 22 and 23 thereof connected with the calcaneus supporting portion 15 and the metatarsal supporting portion 14 by means of rivets 30 and 31, respectively. The rivet 31 passes through apertures 22a and 23a in elements 22 and 23 and through aperture 29 provided in the metatarsal supporting portion 14. The rivet 30 passes through apertures 22b and 23b in elements 22 and 23 and through slot 28 in the calcaneus supporting portion 15 respectively.

In order to provide for the coaction of the spring elements and the mounting thereof with respect to the calcaneus and metatarsal supporting portions, I construct the spring elements in a very special manner, as shown more particularly in Fig. 5. The spring support 18 which supports the outer longitudinal arch is narrower and shorter than the spring support 19 which supports the inner longitudinal arch. Preferably, the support for the outer longitudinal arch is stiffer than the support for the inner longitudinal arch and a different degree of action is thus obtained in the support for the inner longitudinal arch than in the support for the outer longitudinal arch. The support 19 is bowed upwardly a greater distance than is the support 18.

It will be observed that in each instance the spring elements actually bridge both the calcaneus supporting portion 15 and the metatarsal supporting portion 14. There is no free end or cantilever effect of the spring elements permitted. The overlapping of the spring elements upon both the calcaneus and metatarsal supporting portions is illustrated more particularly in the cross-sectional views of Figs. 7 and 9.

The manner of mounting the arch support with respect to parts of the shoe is shown more particularly in Figs. 11 and 22. The insole 9 is chamfered or cut away on an angle, as represented in Figs. 22 and 23 and in Fig. 11 at 40. A sufficient portion of the chamfered part of the insole is cut away at 41, as shown in Fig. 22, to allow the spring portions of the arch support to fit within the insole, as illustrated in Figs. 22 and 11. The span 11 fits within the space between insole 9 and outersole 10, as shown more particularly in Fig. 11. The upper 36 of the shoe 1 is stitched to the insole 9 and to the welt 37 by means of stitches 38 in the customary manner, as shown in Fig. 11. The welt 37 and outersole 10 are stitched in the usual manner by means of stitches 39, as shown in Fig. 11. The space between the insole 9 and outersole 10 may be filled in the usual manner with cork, felt, or other appropriate material. Layers of a selected material as felt, rubber, or a material otherwise selected, may be placed above, or below, or between or to encase the springs of my arch support. The springs of my arch support may also be lubricated to prevent squeak, rusting or other complications. When the spring arch is properly placed in position with the spring supports 18 and 19 aligned in the cut away portions 41 of the insole 9, a resilient support is

provided for both the inner and outer longitudinal arches.

In the manufacture of some shoes with which the spring arch of my invention is designed to cooperate, I provide a modified shape of last and insole as shown more particularly in Figs. 19, 20, and 21. Fig. 19 shows the contour of the insole in the improved shoe construction of my invention from which it will be seen that a considerably greater width is provided at that portion of the shoe which must support a greater width of the foot at the inner and outer longitudinal arches. This increased width enables the spring supports for both the inner and outer longitudinal arches to be rendered more effective in supporting the bones, muscles, and tendons of the foot. I have illustrated in dotted line the normal contour of the general type of insole heretofore available in the art. Fig. 19 shows more particularly the contour of the insole of my improved shoe as applied to a man's shoe.

The last of a woman's shoe and width of the insole and outsole at the shank, has, in the past, been even more detrimental for properly supporting the bones, muscles, and tendons of the foot than has the normal design of a man's shoe. Fig. 20 shows the correction which the shoe construction of my invention provides for a woman's shoe. The solid outline illustrates the contour of the insole of the shoe of my invention showing the added space provided for the bones, muscles, and tendons of the foot at the shank of the shoe, as compared to the narrow space provided by the normal insole, as illustrated in dotted lines in Fig. 20. The enlarged area provided in the shoe construction of my invention greatly increases the wearing comfort of the shoe, and yet, by reason of the coaction afforded by the introduction of the arch support of my invention, a firm, wide support is provided for all of the bones, muscles, and tendons of the foot from heel to ball. Figs. 19 and 20 merely illustrate the modification which is made in the lateral dimension of the last. Fig. 21 shows the manner in which an entirely novel balance is obtained in a last as applied, for example, in a woman's shoe. The contour of the last for a woman's shoe as heretofore known in the art, is illustrated by dotted line **42**. With this normal last contour, the direction of the body with respect to the arch and heel along which the weight of the body is applied to the shoe when standing is illustrated by dotted line **43** showing an unbalanced condition. As distinguished from the dotted line contour, the last of the shoe of my invention is shaped according to the solid line contour **44** from which it will be observed that the internal portion of the last immediately adjacent the metatarsal bones, and beneath and in rear of the transverse arch, is raised along line **44***a* whereas, the contour of the last immediately below the astragalus and the calcaneus is lowered and extended in a substantially horizontal plane, as illustrated at **44***b*. The result of the modification is that the body stands in a more upright balanced position as indicated by line **45** and is rendered effective along axis **57**. The angles α and β are all 90° and are formed by the axes shown drawn normal to tangents to the curves forming the contour of the last. The angle γ is 90° and is disposed between axis **57** and the base line **61**. The application of force along axis **57** operates to balance the shoe and greatly increase wearing comfort. The change in the design of last is brought about by reason of the increased support effected by the arrangement of the spring arch of my invention within the shoe. The spring arch must be so correlated to the design of last that there is a coaction which affords maximum wearing comfort. The spring arch construction is such that the external spring support is shorter than the internal spring support according to the natural shape of the foot.

I have heretofore described the arch support as comprising a central span having the metatarsal supporting portion and the calcaneus supporting portion integrally connected therewith. I may construct the arch of my invention in a number of modified forms, certain of which I have illustrated in Figs. 12–18.

Referring to Figs. 12–14, I have shown a separate plate **46** constituting the metatarsal supporting portion and another separate plate **47** constituting the calcaneus supporting portion. Plate **47** is provided with apertures **59** for securing the plate in position. Plate **46** is provided with apertures **58** for securing the plate in position. These plates each have inwardly directed connecting portions **46***a* and **47***a*. A strip of spring steel **48** interconnects the connecting portions **46***a* and **47***a*. A multiplicity of rivets indicated at **48***a* and **48***b* extend through opposite ends of strip **48** and securely connect the ends of strip **48** with the inwardly directed connecting portions **46***a* and **47***a*. The off center span is thereby rendered resilient by reason of the spring steel construction of the strip **48** but at the same time provides a support of the required firmness. The arrangement of the rivets **48***a* and **48***b* are such that relative movement between the plates **46** and **47** and strip **48** is prevented. The construction of the spring support **18** for the outer longitudinal arch and the spring support **19** for the inner longitudinal arch is identical with the construction described in Figs. 1–11 and which is more specifically described in connection with Figs. 15–18. As illustrated in Fig. 13, the spring support **19** is higher than the spring support **18**. Spring support **19** is also longer than spring support **18**.

Where extreme economy in manufacture must prevail, it is not necessary to employ the central span **48**, and I may omit this, as illustrated in the construction shown in Figs. 15–18. In this arrangement, the spring supports **18** and **19** serve not only as supports for the longitudinal arches but also as frame members for maintaining the spring arch in rigid assembly. For this reason, the single rivets heretofore provided are omitted and in lieu thereof, a multiplicity of rivets are employed for securing the spring supports **18** and **19** in position with respect to the metatarsal supporting plate **55** and the calcaneus supporting plate **56**, as shown. The spring element **20** is connected with the metatarsal supporting plate **55** by the assembly of rivets illustrated at **49** at one end. The other end of spring element **20** is connected with calcaneus supporting portion **56** by rivet **50** which passes through a slot **51** in calcaneus supporting plate **56**. The coacting spring assembly **19** is secured to the metatarsal supporting plate **55** by rivet assembly **52**, as shown. The opposite end of spring assembly **19** is connected through rivet **53** which extends through slot **54** in calcaneus supporting plate **56**, as shown. The same method of insuring the coaction of the spring elements constituting the spring supports

through the slot and rivet connections is provided as hereinbefore described in connection with Figs. 1–11 and 12–14.

The spring members constituting the supports for the inner and outer longitudinal arches may be connected with the calcaneus supporting portion in a variety of ways. I have illustrated examples of different methods of connection of the spring members at the rear of the arch support in Figs. 24, 25, 26 and 27.

In Fig. 24, the rivet 21 is secured through an aperture provided in the calcaneus supporting plate 15 and extends upwardly and through the slot 20c formed in the spring element 20. The spring element 20 is, therefore, adjustable at its rear end within certain limits defined by the slot 20c.

Fig. 25 illustrates a modified method of mounting the rear ends of the twin spring elements 22 and 23 with respect to the calcaneus supporting plate 15. In this arrangement, rivet 30 is mounted in calcaneus supporting plate 15 and extends upwardly and through slots 23c and 22c in spring elements 23 and 22 respectively. The rearward movement of the spring elements is limited by the abutment of the extremities of the slots 22c and 23c with the sides of the rivet 30.

I may also employ the arrangement shown in Fig. 26 wherein twin spring elements 62 and 63 are superimposed upon each other and are free to yield longitudinally. The spring element 63 has the end thereof overlapping the calcaneus supporting plate 15. Rivet 30 is carried in the end of strip 63 and extends through slot 28 in calcaneus supporting plate 15. Strip 63 carries rivet 64 therein. Rivet 64 projects through a slot 62a in resilient strip 62. Movement of strip 62 with respect to strip 63 is limited by abutment of the slotted portions 62a with rivet 64.

I may reverse the arrangement illustrated in Fig. 26 and employ the assembly shown in Fig. 27 wherein rivet 30 is secured in calcaneus supporting plate 15 and passes through slot 63a in spring element 63. Spring element 62 which is superimposed upon spring element 63 is slotted at 62a to allow passage of rivet 64. The slotted portion 62a of strip 62 allows limited yielding movement of strip 62 with respect to strip 63 within the limits of the abutment of the ends of the slotted portion of strip 62 with rivet 64. In all instances, I have shown the strip members separated and the head of the rivet exaggerated in size for the purpose of more clearly illustrating the invention, but it will be understood that in actual assembly the coacting parts are positioned in close coacting arrangements.

In the design of the spring arch of my invention, I have found that it is necessary to provide spring elements of various sizes, heights, weights, and resiliency for supporting people of different weights and also for supporting the various heights of arches and muscles of feet which require a more or less firm resilient support. With this in view, I wish it clearly understood that springs of different tensions and slot lengths may be employed in the arch construction of my invention and springs of modified shapes and sizes without departing from the spirit of my invention. The arch support of my invention is of extraordinary value to children, especially in shoes having the wider shank and welt process construction. During the growing years from early childhood and while the foot is developing through the ossification period, my arch support will provide a firm, yet resilient support to the complete foot, from heel to ball, particularly under the inner longitudinal arch, thereby not only preventing inward turning and lowering of the foot, but continuously exercising and massaging and preserving the complete foot structure in compliance with natural foot functioning. It is understood that my arch support may be made in shoes of any process, material or width of shank, or in shoes made over any type of last and may be used either covered or uncovered in part or in whole with any selected material, previous to being built into shoes, or the unit comprising my arch support may be made and inserted in shoes already manufactured. In other words, the support of my invention may be used in shoes of standard last or in shoes of the improved last of my design.

While I have described my invention in certain preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. An arch support for shoes comprising a rigid metallic stamping having a metatarsal supporting portion and a calcaneus supporting portion integrally connected by a span member, independent spring supports for the inner and outer longitudinal arches carried by said metatarsal and calcaneus supporting portions, and means whereby said spring supports are independently yieldable.

2. An arch support for shoes comprising a metallic stamping having a metatarsal supporting portion and a calcaneus supporting portion interconnected by a span member, and separate spring supports for the inner and outer longitudinal arches, each of said spring supports bridging the gap between said metatarsal supporting portion and said calcaneus supporting portion, and means whereby said spring supports are independently yieldable under pressures applied over the entire lengths thereof.

3. An arch support comprising a metatarsal supporting portion and a calcaneus supporting portion, separate spring members forming supports for the inner and outer longitudinal arches of the foot, said separate spring members interconnecting said metatarsal supporting portion and said calcaneus supporting portion, and means whereby said spring members are independently yieldable under pressures applied over the entire lengths thereof.

4. An arch support comprising a metatarsal supporting portion, a calcaneus supporting portion, and a pair of spring members, one of said spring members being constituted by a pair of coacting resilient strips interconnecting said metatarsal supporting portion and said calcaneus supporting portion and adapted to move in alignment with the inner longitudinal arch of the foot, the other of said spring members being constituted by a single resilient strip interconnecting said metatarsal supporting portion and said calcaneus supporting portion and adapted to move in alignment with the outer longitudinal arch of the foot, and means whereby said spring members are independently yieldable under pressures applied over the entire lengths thereof.

5. An arch support comprising a metatarsal supporting portion and a calcaneus supporting portion, a spring member interconnecting said supporting portions and constituting an outer

longitudinal arch support, a separate spring member interconnecting said supporting portions and constituting an inner longitudinal arch support, one of said spring members being spaced from the center line of said supporting portions a greater distance than the other of said spring members, and means whereby said spring members are independently yieldable under pressures applied over the entire lengths thereof.

6. An arch support comprising a metatarsal supporting portion, a calcaneus supporting portion, and separate spring members interconnecting said supporting portions, one of said spring members being disposed to move in alignment with the inner longitudinal arch of the foot and the other of said spring members being disposed to move in alignment with the outer longitudinal arch of the foot, said first mentioned spring member being spaced a greater distance from the center line of said supporting portions than is said last mentioned spring member.

7. An arch support comprising a metatarsal supporting portion and a calcaneus supporting portion, separate spring members interconnecting said supporting portions, one of said spring members having a greater degree of resiliency than the other of said spring members, and means whereby said spring members are independently yieldable under pressures applied over the entire lengths thereof.

8. An arch support comprising a metatarsal supporting portion and a calcaneus supporting portion, separate spring members interconnecting said supporting portions, one of said spring members being disposed to move in alignment with the outer longitudinal arch of the foot and the other of said spring members being disposed to move in alignment with the inner longitudinal arch of the foot, said last mentioned spring member being normally elevated in a plane higher than the plane of said first mentioned spring member, and means whereby said spring members are independently yieldable under pressures applied over the entire lengths thereof.

9. An arch support comprising a metatarsal supporting portion, a calcaneus supporting portion and supports for the inner and outer longitudinal arches of the foot extending between said supporting portions, said supports each including a resilient strip member rigidly secured to the metatarsal supporting portion, and means whereby said supports are independently slidable with respect to said calcaneus supporting portion in varying amounts for flexibly suspending the inner and outer longitudinal arches of the foot.

10. An arch support comprising a metatarsal supporting portion, a calcaneus supporting portion, and separate resilient members extending between said supporting portions on opposite sides of the center line thereof, at least one of said resilient members being constituted by a pair of flat resilient strips slidable in confined relation one upon the other, and means whereby each of said resilient members is independently yieldable under pressures applied over the entire lengths thereof.

11. An arch support comprising a metatarsal supporting portion, a calcaneus supporting portion, and separate resilient members interconnecting said supporting portions on opposite sides of the center thereof, at least one of said resilient members being constituted by coacting strips and having a rivet and slot connection with said calcaneus supporting portion, the other of said resilient members likewise having a rivet and slot connection with said calcaneus supporting portion, said rivet and slot connections allowing restricted sliding movement between said resilient members and said calcaneus supporting portion, said resilient members thereby being independently yieldable to support the inner and outer longitudinal arches of the foot.

12. In a shoe, an insole having an enlarged shank, an arch support extending longitudinally of said shank and having laterally extending projections at each end thereof, and separate spring members bridging the opposite extremities of the laterally extending projections of said arch support and disposed to move in alignment with the inner and outer longitudinal arches of the foot, said spring members being independently yieldable.

13. In a shoe, an insole having an enlarged shank, an arch support extending longitudinally of said shank and having laterally extending projections at each end thereof, longitudinal recesses in the under surface of said insole at the shank portion of the shoe, and spring members disposed in said recesses and interconnecting the extremities of the laterally extending projections on said arch support, said spring members adapted to be aligned with the inner and outer longitudinal arches of the foot and being independently yieldable under pressures applied over the entire lengths of the said spring members.

14. A balanced shoe in which the axis of support normal to the calcaneus supporting portion of the shoe is substantially vertical and in which the internal transverse arch portion of the shoe is substantially elevated, including an arch support having a spring member disposed to move in alignment with the inner longitudinal arch and a separate spring member disposed to move in alignment with the outer longitudinal arch, said first mentioned spring member being bowed in the direction of the foot a greater distance than is said second mentioned spring member, and means whereby said spring members are independently yieldable in operation under pressures applied over the entire lengths thereof.

15. An arch support comprising a substantially rigid metallic member having a longitudinally extending span with enlarged ends thereon, a strengthening rib disposed in said span, spring members interconnecting the enlarged ends of said metallic member disposed on either side of said span, at least one of said spring members including a pair of resilient strips secured at one end to said rigid member and slidably connected with said rigid member at the other end, the other of said spring members likewise secured to said rigid member at one end and slidably connected with said rigid member at the other end, said slidable connections permitting said spring members to yield independently under pressures applied over the entire lengths thereof, the limit of yieldability of said resilient strips being predetermined.

16. In combination with an arch support comprising a metatarsal supporting portion, a calcaneus supporting portion, and separate resilient members extending between said supporting portions on opposite sides of the center line thereof, independent means encasing said resilient members.

JAMES E. LUDLAM.