Oct. 24, 1950 K. S. HALLGREN 2,527,414

RUBBER SOLE FOR FOOTWEAR

Filed Dec. 12, 1949

Fig. 1.

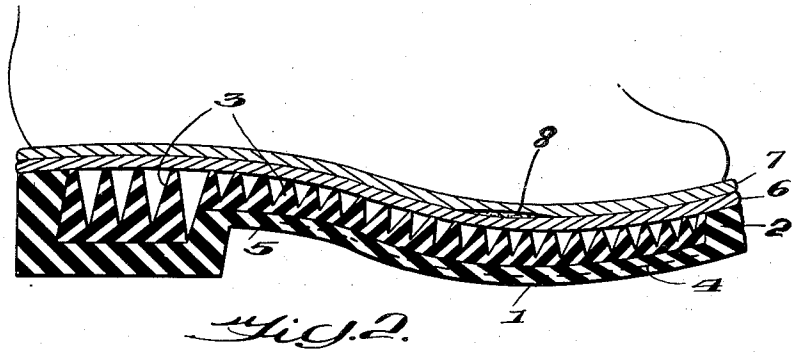


Fig. 2.

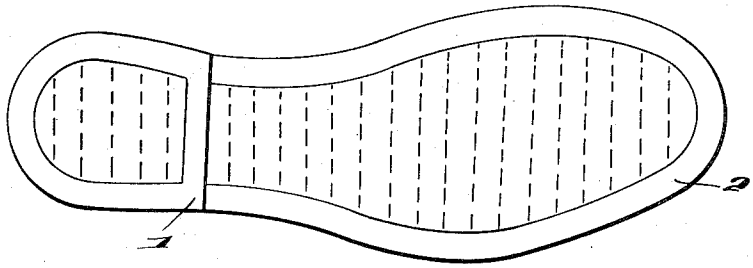


Fig. 3.

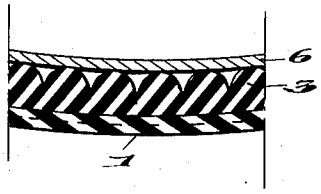


Fig. 4.

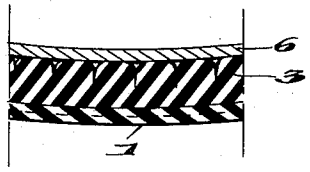


Fig. 5.

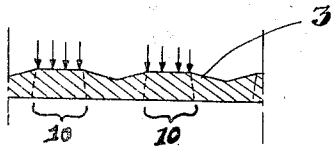
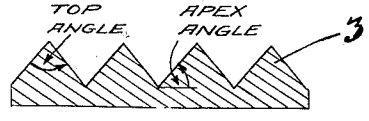


Fig. 6.



INVENTOR.
KARL SIMON HALLGREN
BY
Robert B Pearson
ATTORNEYS

Patented Oct. 24, 1950

2,527,414

UNITED STATES PATENT OFFICE

2,527,414

RUBBER SOLE FOR FOOTWEAR

Karl Simon Hallgren, Valby, Copenhagen, Denmark

Application December 12, 1949, Serial No. 132,529
In Denmark August 22, 1944

Section 1, Public Law 690, August 8, 1946
Patent expires August 22, 1964

4 Claims. (Cl. 36—32)

1

This application is a continuation-in-part of my co-pending application Serial No. 641,249, filed January 15, 1946, now abandoned, and entitled Caoutchouc Sole for Footwear.

The invention relates to an improved rubber sole construction having a number of highly desirable advantages over the soles previously known to the art. Of particular importance is the novel manner in which the new sole construction provides a desirable degree of resilience and softness during walking, and yet is sufficiently resistant to large loads as to prevent overloading and the resultant direct transmission of sharp blows or other forces to the feet. This feature of the new sole might be likened to the provision of springs on an automobile in such a manner that the springs are sufficiently resilient to give a soft ride under normal conditions where a slightly bumpy road is being travelled, and which nevertheless will not "hit bottom" readily and transmit sharp jolts to the riders when the automobile travels over a road having deep depressions therein.

The rubber sole of the invention provides relatively large deformation at the loads ordinarily imposed during normal walking. Such loads would probably run between one and three kilograms per square centimeter. Relatively smaller deformations occur during overloading, such as when a person jumps onto the step of a bus or streetcar, or in the case where a person runs up a flight of stairs, particularly if the steps are taken two or three at a time. In the latter case, the overloading would be likely to run to the order of eight to forty kilograms per square centimeter, or greater.

Overloading is also likely to occur with previous soles in the case of a person climbing over rocks, or walking on pebbles or stones as large as plums. This local overloading which would occur as a result of the placing of the entire weight of a person, increased in some cases by the additional force of the movement of the person, upon a rather small area could bruise the foot and cause considerable discomfort, as could the overloading which might occur when the weight is placed on the edge of a step or the like.

Another important advantage of soles constructed in accordance with the invention is a high degree of thermal insulating power which, together with the advantage previously discussed, is accomplished with a most efficient use of the minimum amount of material in the sole. Thermal insulating of the foot from hot or cold surfaces being walked upon is highly desirable, particularly where this can be accomplished without rendering the sole excessively heavy. Obviously, almost any sole could be given good insulating properties if weight is not to be considered as a factor, or if other desirable features can be disregarded, such as the resistance to overloading previously discussed. However, applicant has provided a high degree of thermal insulating power in a shoe sole while maintaining the weight low and at the same time providing the other desirable features referred to herein.

2

A further advantage of soles constructed according to the inventon is the evenness of wear of such soles compared with prior art soles. Since weight is a factor to be considered in rubber shoe soles, the most efficient use possible should be made of the quantity of material decided upon as desirable in each sole. Efficiency of use of the given quantity of material also includes evenness of wear, since a sole which wears out in particular areas before other areas are worn out, must be thrown away while there still remains a considerable quantity of sole material which should have been used, but which must be wasted. Uneven wear also results in uneven transmission of forces to the foot, and may, for this reason, require discarding of a shoe long before the sole material has all been utilized. The applicant has personal knowledge of a pair of shoes made in accordance with Frisch British Patent No. 510,426, the soles of which, after some months of wear, showed deep depressions on their bottom sides. These depressions, caused by uneven wear, extend transversely of the sole below the "ball" of the foot below the ribs on the upper side of the sole. Obviously, there was uneven transmission of forces to the feet, and the local wear at particular places was wearing out the sole material in such manner that the shoe would have to be discarded or resoled long before all of the material of the sole had been used.

It is an important object of the invention to provide a sole having the advantages discussed above, and it is also an object of the invention to provide a sole in which not one, but all of the desired advantages are incorporated.

Another very important object of the invention is the provision of a rubber shoe sole having a plurality of transversely extending ribs on the upper surface of the sole, these ribs being substantially triangular in cross section with a vertex of the triangle pointing upwardly, and, even more important, spaced apart by similarly extending triangularly cross sectioned air spaces pointing downwardly so that the adjacent walls of adja-

cent ribs diverge from each other as they extend upwardly. This provision of the triangularly cross sectioned, downwardly pointing air spaces causes the ribs to become what might be termed mutually supporting as increased loads are placed on the sole. This causes the sole to provide the above-explained feature of resisting overloading, while providing softness during normal walking. What occurs is that adjacent walls of adjacent triangular ribs are brought increasingly together, beginning where they come together at the downwardly extending vertex of the intervening air space, their area of contact increasing in an upwardly extending direction and in a progressive manner as greater loads are applied. The elastic resistance of the sole to the applied pressure will increase progressively with increasing compression of the sole and the increase in the rib wall areas which are in contact. It can be seen that the extreme condition would be when the entire wall areas of the ribs in the region of the pressure are in contact with the adjacent rib walls, the result being a change of the triangular ribs to more nearly square ribs, with each rib being supported against further sideward expansion by one or more adjacent ribs. Between the extreme condition just described and the other extreme of zero pressure, the sole provides a variable resistance to pressure, the resistance increasing progressively as the pressure and compression increase.

Another object of the invention is to provide a sole as described herein, in which the angles defining the transverse ribs are so chosen as to enable the ribs to function in accordance with the invention.

A further object of the invention is to provide a novel method of making a rubber sole.

These and other objects of the invention will be apparent from the following specification taken in conjunction with the accompanying drawings, in which

Fig. 1 is a longitudinal cross sectional view taken through a sole made in accordance with the invention;

Fig. 2 is a bottom face view of the sole shown in Fig. 1;

Fig. 3 is a fragmentary longitudinal sectional view of a portion of the sole shown in Fig. 1, and showing the sole under an intermediate degree of compression;

Fig. 4 is a view similar to Fig. 3, but showing the effect of an extreme degree of compression;

Fig. 5 is a diagrammatic view showing the result when the "top angle" is too large and the "apex angle" too small; and

Fig. 6 is a diagrammatic view serving as a definition of the terms "top angle" and "apex angle."

Referring now to Fig. 1 and Fig. 2, there is shown a sole made of rubber and having a lower wearing portion 1 and a raised edge portion 2 to provide a central cavity in which are located a plurality of substantially triangularly shaped rubber ribs 3. The ribs in the heel portion of the shoe are taller than the others so that an upper sole 6 will rest on the upwardly pointed vertices of the ribs and on the upper edge of the solid edge or rim portion 2. The ribs 3 may be made integral with the sole 1, which may have reinforcing cord fabric therein at 4 extending from the shank 5 to the front edge of the sole, or the ribs 3 may be separate from the sole 1 and attached thereto as by cement, stitching, or vulcanizing. The sole 1 can be made from a single rubber sheet to which a thin leather rim 7 would be attached and to which, in turn, the vamp of the shoe would be attached. A thin layer of cork dust 8 may be placed under the ball of the foot in accordance with known practice.

In making the sole described above, it may be desirable to make both the sole 1 and the ribs 3 of the same type of rubber, or it may be desirable to make the two parts of different types of rubber, selecting a particular rubber according to the properties desired in the particular part of the construction. It might also be desirable to make the ribs in various parts of the sole of different types of rubber in accordance with the different types of pressures to be customarily received by each portion.

In one construction, the sole portion 1 could be made of a tough, wear resisting type of rubber or composition with good resistance to tearing. The ribs 3 could be made of a softer and more resilient type of rubber. The upper edges of the ribs are generally attached by cement or vulcanizing both to the bottom sole and to the upper sole.

A simple, yet effective method of making a sole would be to place the lower part of the sole 1 in one form and to place the ribs portion of the sole in another form, the two forms then being brought face to face and heated for vulcanizing the two parts together.

While I have referred to the ribs 3 as being substantially triangular in cross section, they may be slightly flattened at their upper edges. However, the triangularity of the air spaces is very important and is essential in achieving the mutually supporting feature discussed above.

In use, soles according to my invention absorb the pressures of normal walking by compression of the ribs, 3, and as the pressure increases, the ribs become increasingly more mutually supporting up to what might be considered a moderately heavy pressure, at which point the ribs would assume the type of configuration shown in Fig. 3. The ribs would continue to move together with increase in pressure until the extreme shown in Fig. 4 were reached. The advantages of the type of operation just referred to, and which are achieved only by the type of sole described herein, are well explained in the opening paragraphs of this specification.

It is essential to the successful operation of a sole constructed in accordance with the invention, that the "top angle" and the "apex angle" as defined by Fig. 6, be within certain critical ranges. While the angles could vary somewhat with the type of rubber used, the types of rubber which would generally be used would require that the "apex angle" should be no smaller than 30°–40°, in which case the "top angle" would be 120°–100°. If the "apex angle" is smaller, the ribs will not have the property of becoming "mutually supporting," but will behave like a plate with an uneven surface, with resulting uneven compression when loaded. This would also cause the pressure on the top of the sole to be concentrated in limited areas 10, as shown in Fig. 5, causing uneven wear of the tread surface. If the ribs have the type of configuration preferred by applicant, the pressure on the tops of the ribs will be scattered over the entire bottom or tread surface of the sole in an even manner, resulting in even wear and the cushioned walk peculiar to soles so constructed.

The ribs 3 should not be too slender, for the result will be insufficient transverse support, and the ribs may bend transversely. The "apex

angle" should therefore not exceed 70°–75°, corresponding to a "top angle" of 40°–30°.

Thus the range of angles for the "apex angle" is 30°–75° and for the "top angle" is 120°–30°.

I claim:

1. A rubber shoe sole comprising a bottom sole having upstanding edge portions forming a cavity therein, and an interior sole portion in the form of transversely extending ribs of substantially triangular cross section positioned within said cavity with the bases of the ribs on the upper surface of the sole and with the lower end portions of the upwardly extending side walls of the ribs meeting the side walls of adjacent ribs to form downwardly pointed air spaces of triangular cross section between the ribs, the size of said ribs being such that the adjacent walls of said ribs are brought increasingly together as the load increases, correspondingly decreasing the size of said air spaces whereby the ribs become mutually supporting to an increasing degree under increasing pressures.

2. A rubber shoe sole as set forth in claim 1, in which the bottom sole and the ribs are of different types of rubber.

3. A rubber shoe sole as set forth in claim 1, in which the ribs in portions of the shoe differ in the material used from ribs in other portions of the shoe.

4. A sole as set forth in claim 1, in which the "apex angle" of the ribs lies in the range 30°–75° and the "top angle" lies in the range 120°–30°.

KARL SIMON HALLGREN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,037,105	West	Apr. 14, 1936
2,038,972	Watanabe	Apr. 28, 1936
2,104,583	Daly	Jan. 4, 1938
2,251,468	Smith	Aug. 5, 1941
2,287,282	Tousley	June 23, 1942
2,295,763	Sperry	Sept. 15, 1942

FOREIGN PATENTS

Number	Country	Date
72,155	Norway	Oct. 19, 1945