

IRREGULARITIES IN THE SHAPE OF THE HOOF CAPSULE OF THE FORE LIMB  
IN THE MATURE ANIMAL.

BY MARTIN JOHN DEACON A.F.C.I.

FEBRUARY 1989.

## Introduction.

The hoof capsule of the horse should ideally be of a flowing symmetrical shape with equal distances between the centre line through the frog and the hoof wall both on the medial and lateral aspects also measuring slightly longer than wide. These dimensions will allow the internal mechanics to function correctly.

Irregularities in the shape of the hoof capsule are in the first instance an indication of either an imperfection in the conformation which will need accomodating or that the horse is not shod level to its foot fall.

Both causes will then effect the action of the limb requiring the horse to use more energy to make a stride. When the horse tires the possibility of the limbs offending each other or of the horse stumbling are increased. Therefore a more flowing and direct stride is more desirable.

If however, the cause of these hoof capsule irregularities are not analysed and dealt with, the long term or irreparable damage will ensue.

The causes of these irregularities fall into four main catagories:-

- 1). Irregularities caused by adverse pressure.
- 2). Irregularities caused by leverage.
- 3). Irregularities caused by the lack of mechanical function.
- 4). Irregularities caused by an excess of mechanical function.

IRREGULARITIES CAUSED BY ADVERSE PRESSURE.

This condition is normally found in horses with either a severe unlevel foot fall or a medial lateral low limb misalignment. In such cases the hoof capsule will develop a pressure contraction.

In the case of severe unlevel foot fall the hoof capsule will develop a contraction around the initial point of impact with the ground, causing the horn to compact and apply undue pressure to the coronary band directly above, which in turn will compromise the blood supply and subsequently reduce the growth rate of the horn in that area, the horn also becomes keratonised and hard, therefore restricting the expansion mechanics in the foot. These contractions are normally found in the heel and or the heel quarter.

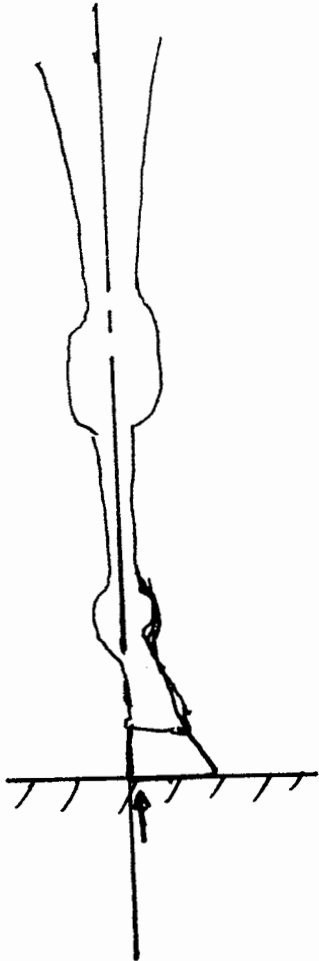
In the case of medial lateral low limb misalignment the pressure problem is two-fold and likewise the "toe in" and "toe out" will have different effects on the shape of the hoof capsule. With the "toe in" stance the inside heel will make contact with the ground and as the limb is constructed carries more weight on the medial aspect. The amount of contraction caused is normally slight but as the limb breaks over the pressure is more towards the outside toe. This combined with the limb misalignment will apply excessive pressure to the outside toe area. This situation often makes the hoof capsule become bold and sometimes bulbous around the outside toe area. With the "toe out" stance the foot makes contact with the ground with the outside heel first and because the limb is not built to bear the majority of its weight on the lateral aspect the heel will contract more and from a more forward position, however, as the limb breaks over there will be less distortion around the toe area. If this problem goes unchecked it is possible that the horse will contract unilateral sidebone. When the limb makes contact with the ground with only one heel the stresses on the laminae are diagonally across them creating a spiralling stress effect between the hoof capsule and the laminae, which will sometimes result in shearing of the laminae.

#### Foot Preparation.

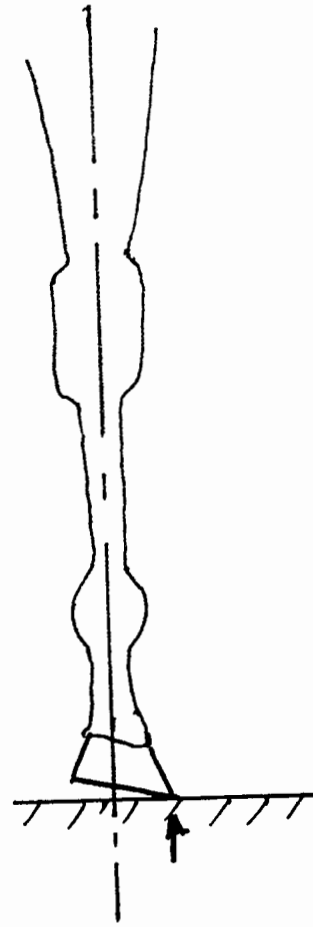
When dressing the foot one must firstly obtain an even foot fall. With medial lateral low limb imbalances it is necessary to allow the horse to stand as it is conformed, this will afford the animal maximum comfort and remove or reduce any increased concussion and stresses on the joints. Dressing for this type of limb misalignment will not always level the foot fall in such a case one must strike a compromise by distributing the concussion more efficiently and also reducing the distorting of the hoof capsule which is caused by the unlevel foot fall. This can only be achieved by shoeing.

## Shoeing

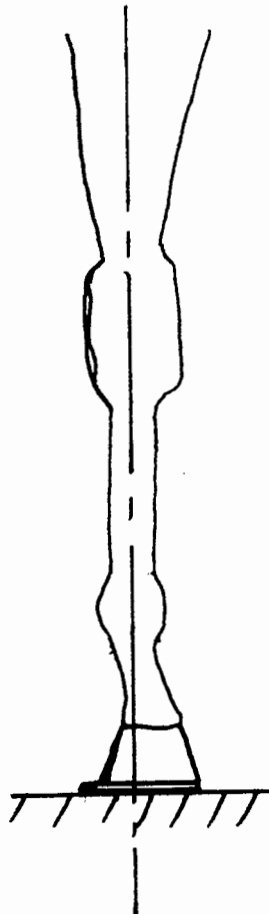
In the case of poor foot fall the majority of the correction is done with foot preparation, so provided the foot is shod with enough length and support the hoof capsule will return to a more balanced form. If good foot fall cannot be achieved by foot preparation then one should graduate the side of the shoe. In the case of limb misalignment one must shoe to give a better medial lateral weight bearing balance. This can be achieved by fitting a shoe with either a medial or lateral extension and a rolled toe. The roll must be where the animal breaks over, which on the "toe in " stance will be to the outside of the centre of the toe and the inside on the "toe out" stance. This will encourage the limb to move straighter. In more severe cases it is advisable to fit a medial or lateral extended "Bar" shoe. This will increase the amount of support given at the heel and reduce the amount of distortion to the hoof capsule, also distributing the concussion on the heel more efficiently. This type of shoe will not only give a better weight distribution but also improve the foot flight, thus reducing the likelihood of offending another limb, either at speed or when tired. It will also reduce the amount of energy required to complete a stride.



Increased Concussion Poor Conformation



Increased Concussion Poor Foot Fall



Improved Weight Distribution For Poor  
Conformation

IRREGULARITIES CAUSED BY LEVERAGE.

Leverage irregularities are found in horses with either a broken back hoof pastern axis, an anterior/posterior ground surface imbalance or with a medium or high limb misalignment. Leverage as opposed to concussion/contraction is caused after the foot has loaded onto the suspensory ligament and the weight is transferred from the back of the foot to the front, which is the first stage of flexion, this combined with the angle of the fetlock will apply leverage to the point of breakover.

In the case of both the broken back hoof pastern axis and the anterior/posterior ground surface imbalance the horse loads onto the suspensory and because of the lack of support at the heel it dips backwards, thus creating an extra movement. This extra movement will retard the fore limb action and will apply added leverage at the point of breakover, which due to the make up of the hoof will pull the heel together, distort the bars and rupture the laminae giving corns. If not corrected this could lead to distal sesamoid lameness through the increased concussion on the navicular bursa through the deep flexor tendon. The distortion of the hoof capsule will take the form of contracted or collapsed heels.

In a case where there is a medium or high limb imbalance the distortion of the hoof capsule will be governed by the point of breakover. This point will be in the centre of the limb above the deviation. These distortions can be recognised by a hollow or straight area in the hoof capsule with signs of stress in the white line which in some cases will result in tearing of the laminae. These problems are caused because the point of breakover is not in the centre of the hoof, therefore applying leverage at a weaker point of the hoof wall, this combined with the difference in the thickness of the wall either side of the point of breakover forces the hoof capsule to distort making the wall behind and on the same side to straighten with the heel quarter becoming pronounced. However, the toe on the opposite side will become bolder sometimes shearing the laminae.

### Foot Preparation

This problem is treated mainly by foot dressing. Firstly one must dress the ground surface according to the foot fall. Once this is achieved one must dress forward the hoof capsule remodelling in such a way to reduce or remove the irregularities. Although this may seem purely cosmetic it reduces or removes any adverse leverage allowing the hoof capsule to function more equally which will eventually result in the hoof capsule adopting a more symmetrical form.



## Shoeing

### Broken back axis:-

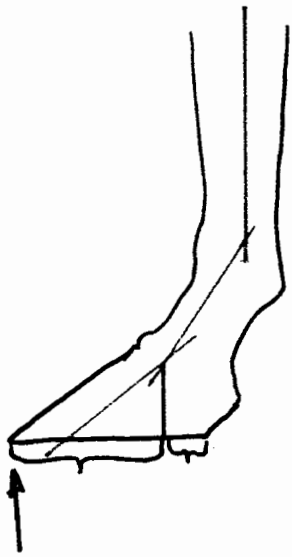
This is shod with an "Egg Bar" shoe with a rolled toe. This will give the limb the correct amount of support at the heel, whilst at the same time removing the point of impact from the heels, this will firstly allow the heels to return to the correct form and then grow enough to return to the correct hoof/pastern axis.

### Anterior/Posterior ground bearing imbalance:-

This type of hoof often goes unseen because the angles of the limb are in the correct alignment. Here the problem lies with the ground surface in relation to the centre point of the pedal joint and as this is not possible to correct this horse must be shod to work, therefore an artificial balance is achieved by shoeing. In these cases it is not practical to obtain enough support at the heel by shoeing with length because there would be too much shoe exposed behind the heel for the horse to work. In such cases a rolled toe is used, this allows one to reduce the heel length but still obtain the correct anterior/posterior ground bearing.

### Medium or high limb misalignment:-

This type of foot must be shod according to the severity of the deviation. In such lesser cases provided one remodels the foot capsule, the foot can be shod with just a rolled toe, providing the roll is in the correct position for the breakover, the roll must also be wide enough so as not to create any one point of pressure as the horse moves. Where the deviation creates an unacceptable medial/lateral weight distribution problem it will be necessary to fit a medial or lateral extension shoe, this will centralize the weight bearing support and also improve the foot flight, again reducing the chance of offending the opposite limb. If the hoof capsule is weak at the heels a medial or lateral "Bar" shoe may be fitted, this will give the foot more support and distribute the concussion again rolling the toe of the shoe at the point of the breakover.



Broken Back Hoof/Pastern Axis



Anterior Posterior Ground Surface Imbalance



Arrows Showing Leverage Effect On Heels



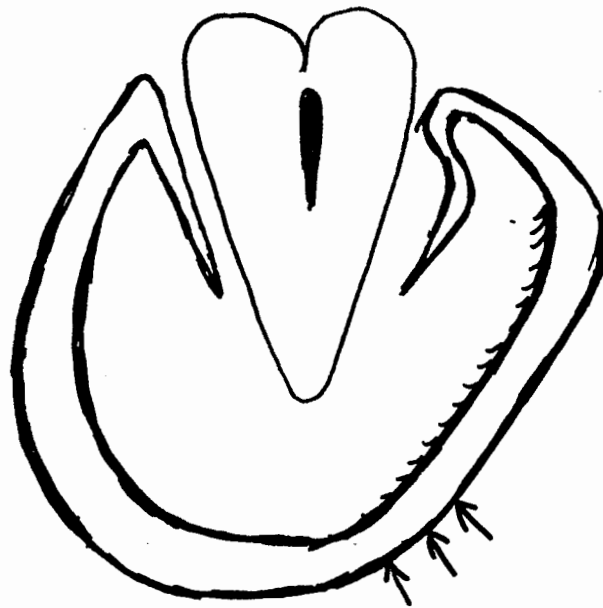
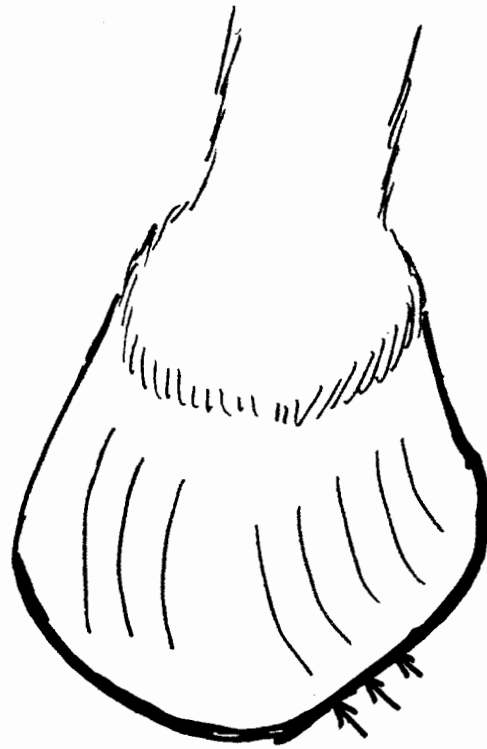
Area Of Breakover  
Correct Foot Fall Poor Weight Distribution



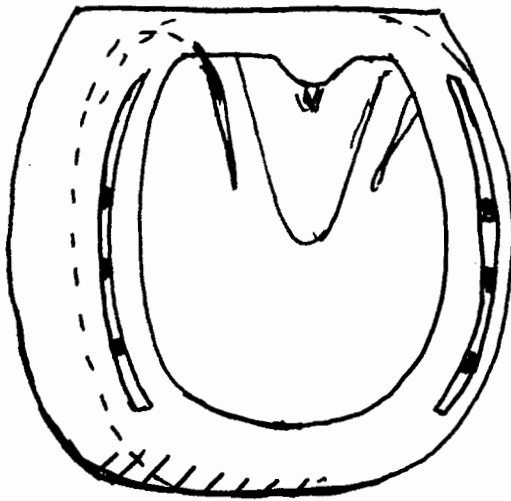
Incorrect Foot Fall



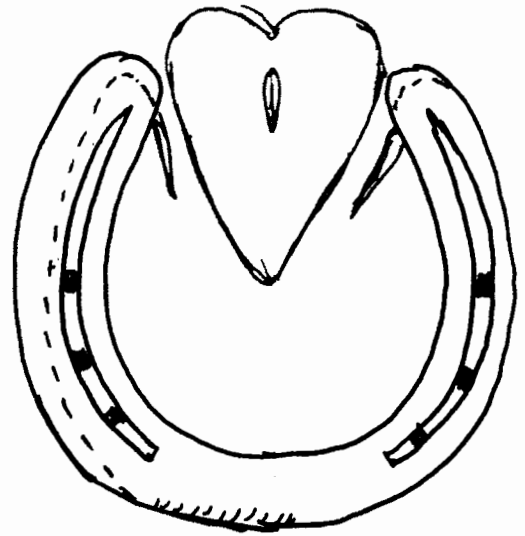
Extension For Improved Weight Distribution



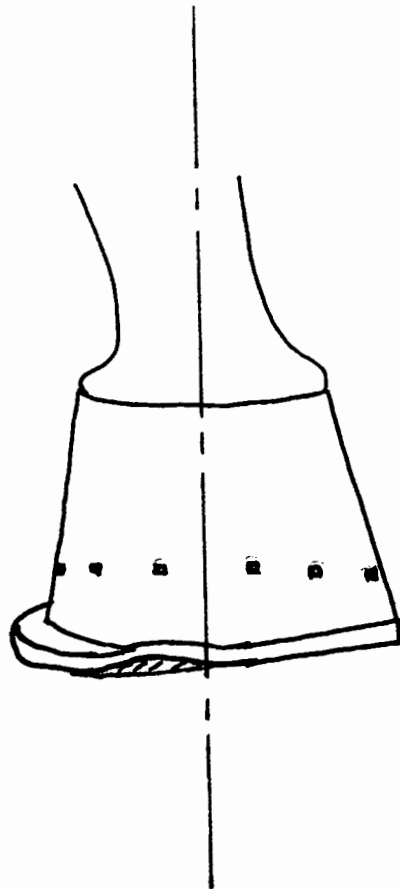
Distorted Hoof Capsule By Leverage Due To Medial/Lateral Imbalance At Breakover



Medial Or Lateral Extension Bar Shoe



Medial Or Lateral Extension Shoe



Medial Or Lateral Extension Fitting

IRREGULARITIES CAUSED BY THE LACK OF MECHANICAL FUNCTION.

These irregularities are normally found in cases where ossification has occurred, such as uni and bilateral sidebone. In situations such as these one must monitor and stabilize. The reason for this approach is that the damage to the lateral cartilage has already been done and is irreversible. However, careful and sympathetic treatment can often halt any progression in the problem, thus affording the animal maximum comfort given the reduced function.

Sidebone is caused by excessive concussion either unilaterally or bilaterally, in the case of unilateral sidebone this is often caused by an unlevel foot fall medial laterally. Bilateral sidebone can be caused by a very upright conformation, which gives poor suspension on the fetlock, thus increasing concussion. When the animal develops unilateral sidebone the hoof capsule on the effected side will contract. With bilateral sidebone both heels contract, in such cases the mechanical functions of the hoof are severely restricted.

One of the few cases where correction can be achieved is where the horse has had an injury that has prevented the animal from bearing part or all of its weight on the limb for a sustained period of time. In such cases the hoof capsule contracts, the sole becomes more concave and the frog will atrophy. In the instance where there has been partial weight bearing (normally the toe) the hoof capsule becomes stilted, breaking forward the pastern axis. In these cases the process must be achieved gradually because the site of the injury will contain a certain amount of damaged tissue which will have healed with the limb in the resting position. Once the limb has been returned to the normal position the hoof capsule will slowly revert to normal.

### Foot Preparation

Where ever possible one must dress the foot as to the foot fall. However, due to the lack of function combined with the amount of concussion incurred, the growth rate of the horn may be impaired. In such a case it is necessary to level the foot by means of shoeing.

### Shoeing

In cases where the mechanical problem cannot be reversed it is not always possible to remodel the hoof capsule or achieve any lasting success by doing so, in such a situation shoeing is often the only way. When shoeing one must seek to reduce or remove the pressure created by the mechanics leading up to the effected area, in effect apply a shoe that will either perform the function that the foot can no longer do, or at least remove or reduce the concussion around the effected area. To shoe the unilateral sidebone initially as diagram:-

This type of shoe reduces concussion by levelling the foot fall and with no nails around the contracted area thus removing any pressure caused by the restriction of the hoof capsule movement that nailing might cause.

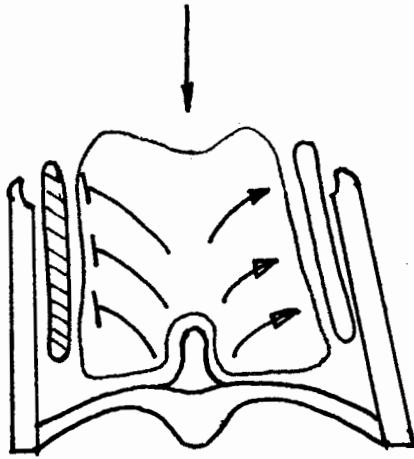
Often it is possible after a period of time to dress the foot to the foot fall and apply a parallel shoe, although it is adviseable to shoe with a reasonably broad webb as this distributes the weight better and therefore reduces concussion.

To shoe for bilateral sidebone:-

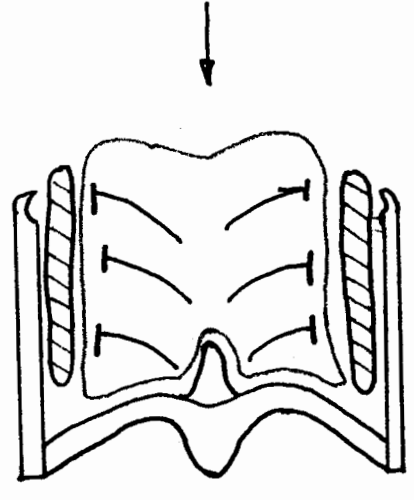
With bilateral sidebone the whole of the expansion mechanics are effected and as these are situated in the posterior section of the foot the horse is reluctant to move freely and to apply any amount of pressure to the foot. This problem is far more serious.

The most one can achieve is only limited success. This is done by shoeing with a broad webbed shoe, rolled toe and a rim pad will reduce the amount of concussion and the rolled toe will ease the breakover and reduce the leverage on the toe of the hoof capsule, which in turn will reduce the amount of pressure between the wall and the ossified cartilage when the horse breaks over which would otherwise crush the sensitive laminae.

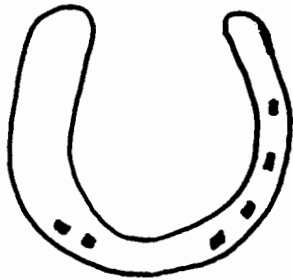
Unilateral Sidebone



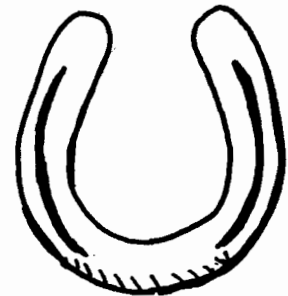
Bilateral Sidebone



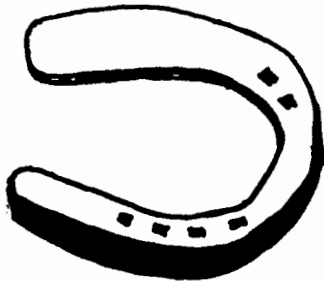
Arrows Indicate Mechanical Function  
Still In Operation



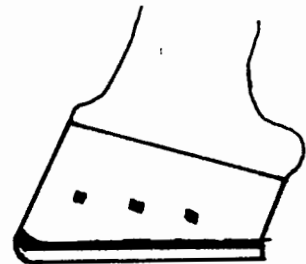
Unilateral Sidebone Shoe



Broad Web Rolled Toe Shoe



Unilateral Sidebone Shoe



Shoe Fitted With Rim Pad To  
Absorb Concussion



IRREGULARITIES CAUSED BY AN EXCESS OF MECHANICAL FUNCTION.

This type of foot will more often than not measure wider than long and the ground surface of the foot will not be split equally anterior/posterior in relation to the axis of the pedal joint. Because of this, combined with the heels being very open creates a series of problems all caused by an excess in the mechanical function of the hoof. Some of the problems are low weak heels, shearing of the laminae, thin soles, distal sessamoid lameness and sandcracks. When this type of foot meets the ground and is loaded, the mechanics within the foot will over react. This is because of the lack of containment within the hoof capsule which allows the heels to over expand the sole to flatten and the frog to overload. This continuous excess of mobility causes the heel to wear away thus causing the hoof pastern axis to break back. The broken back axis will then apply pressure to the navicular bursae through the deep flexor tendon.

### Foot Preparation

Foot preparation in these cases follow the usual form of dressing the foot to the foot fall and correcting where possible the hoof pastern axis. This will not solve the problem on its own, however, because until the excess of mobility the checked root cause of all of the problems will remain.

### Shoeing

The type of shoeing required will vary considerably and is governed by the amount of structural damage that has been incurred and the fact that one has to deal with more than one problem simultaneously. In the minor cases where the foot has been too mobile for only a short period one incurs a broken back axis and an anterior/posterior ground surface imbalance which if left will cause the shearing of the sensitive laminae around the toe area. In these cases one shoes the foot with length at the heel so that a). the shoe is made to measure slightly longer than wider, this will reduce mobility and remove the pressure from the heel of the foot.

b). help to obtain the correct anterior/posterior ground surface measurements and eventually the heel will grow enough to return to the correct dimensions.

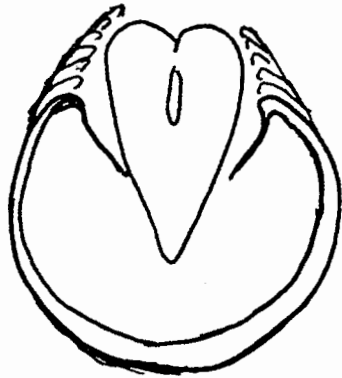
If the problem goes unchecked a range of more serious problems may occur.

For example:-

1). If the broken back axis is not dealt with it will first compromise the blood supply to the lower foot which in turn will reduce the growth rate of the horny sole (thin sole).

It will also increase the concussion on the navicular bursae through the deep flexor tendon, which will result in distal sessamoid lameness. In shoeing these cases I would use an "Egg Bar" shoe, this will give the animal maximum support at the heel of the foot and also remove the point of impact from the heel of the foot, this will allow the foot to grow and enable you to eventually obtain the correct hoof pastern axis.

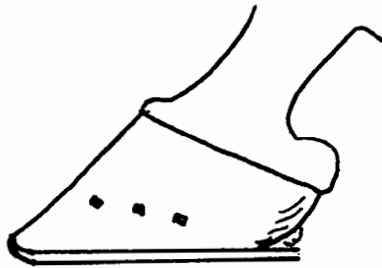
2). If the shearing of the laminae of the toe is not checked it will develop into a sandcrack. These are found in a foot which is extremely mobile, in these cases one must firstly reduce the mobility of the hoof capsule, this is most important because if the hoof is allowed to continue to move to any degree the sensitive laminae will be pinched by the sandcrack. Correction is achieved by applying a shoe with a frog pressure plate. This will allow the frog to load without the foot having to flex too much - a form of arch support. Once the shoe is applied the sandcrack must be excavated and immobilized. The reason for the excavation is that the edge of the crack being flat the outer edge acts as a pivot, thus opening the inner surface. Immobilization can be achieved by either screwing a plate over the crack or by placing two rows of screws in the wall and lacing them together with wire. The latter is best covered with acrylic, but one must leave a channel behind the acrylic down the length of the crack or the crack will continue to split. This immobilization will allow the horn to grow without either pushing or pulling apart.



Overexpanded Foot With Collapsed Heels



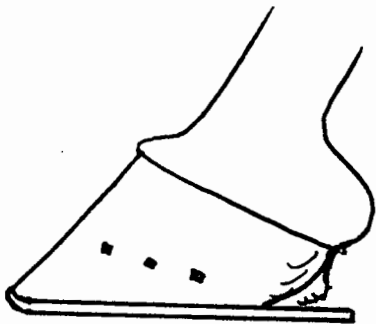
Arrows Showing Excessive Movement



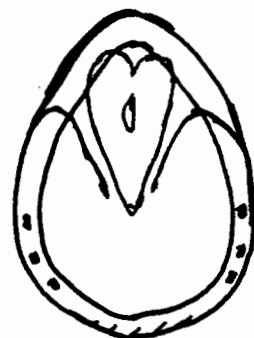
Support Of Heel With Open Heeled Shoe



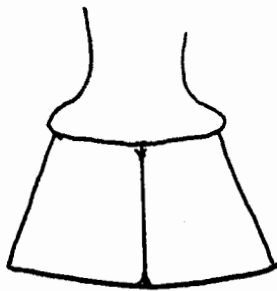
Shoe To Measure Longer Than Wide



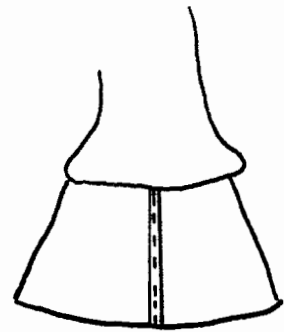
Support Of Heel With Egg Bar Shoe



Egg Bar Shoe



Sandcrack



Sandcrack Excavated

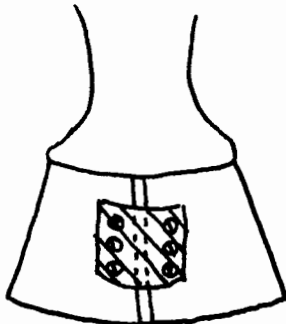
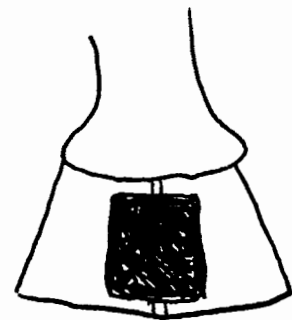


Plate Method



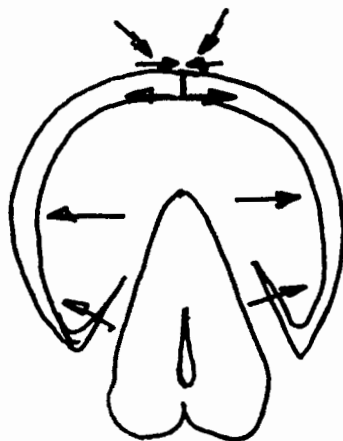
Lace And Acrylic Method



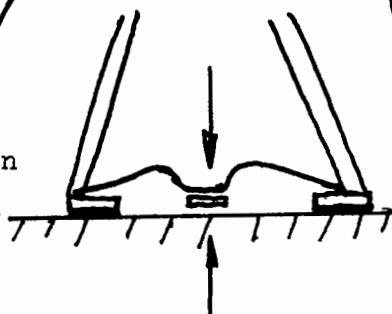
Pressures And Stresses



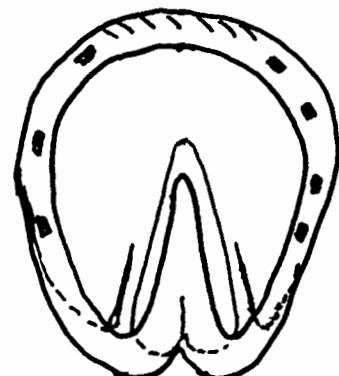
Pressures And Stresses Relieved



Arrows Indicate Direction  
Of Movement When Foot Is  
Loaded



Function Of Arch Support



Arch Support Shoe

## Conclusion.

The horse, although quite durable is like a finely tuned piece of mechanical engineering, which with skilled and regular maintenance will give 100% and do so for a considerable length of time. If however, the maintenance is either neglected or done incorrectly the efficiency and working life is reduced.

The Farrier is one of the team of mechanics along with the rider, the person who feeds the horse and the Veterinary Surgeon, each being specialists in their own right, but must however work as a team to maintain maximum efficiency.

An irregularity in the shape of the hoof capsule is in the first instance an early indication that there is something wrong or about to go wrong, with the correct analysis and accomodation can either be rectified or stabilized. Rather like a squeak in a piece of mechanical engineering being the first indicator that something needs lubricating!