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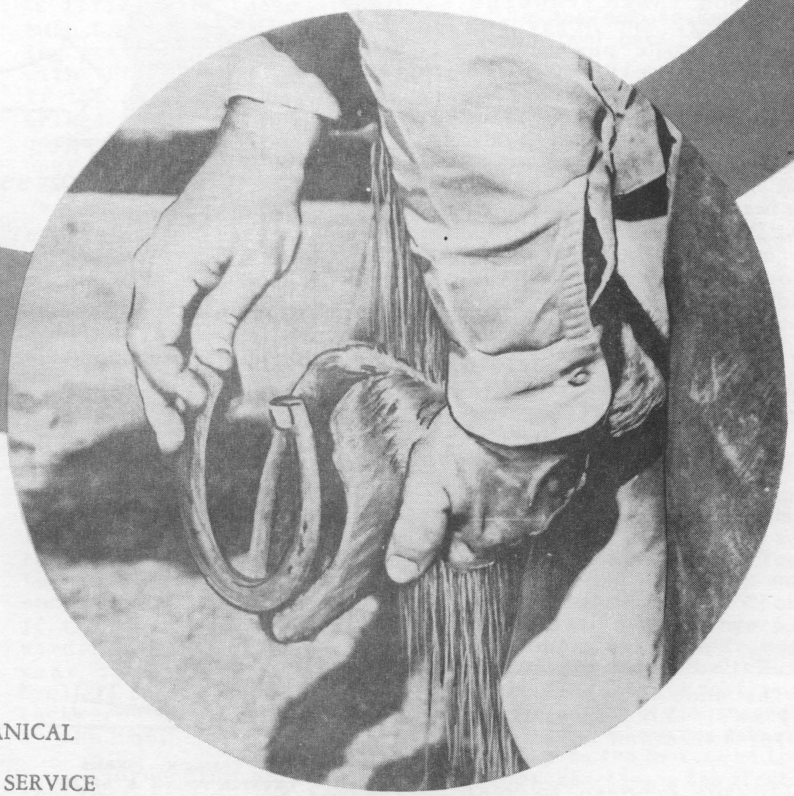
Care of HORSES' FEET



THE AGRICULTURAL AND MECHANICAL
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Care of HORSES' FEET

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Horseshoeing is an ancient art. But the declining number of horses in the United States during the past 25 years has been accompanied by an even greater decrease in the number of horseshoers. Furthermore, practically no printed information on horseshoeing is available. For these reasons, it is hoped that this review of the principles of horseshoeing and foot care will be useful to horse owners of the Southwest.

IMPORTANCE OF FOOT CARE

The value of a horse depends on his ability to perform work. To this end, four sound feet are indispensable. Oddly enough, foot troubles and the necessity for shoeing are largely man-made.

The wild horse seems to have been practically free from serious foot trouble. But with domestication these troubles began to appear. The horse was brought from soft pasture to hard roads; from self-regulated exercise to enforced work; from healthy pasture to filthy housing where he was often made to stand in his own feces and urine or in mud; and from a light, self-limiting maintenance ration to the heavy, artificial diet necessary for work. Even the basically sound horse frequently breaks down under the artificial environment and misguided "care" of man. The horse with a conformational defect is almost certain to break down under the conditions imposed by domestication.

REASONS FOR SHOEING

Shoeing is a necessary evil. Nailing an iron plate to a horse's foot does not make walking easier for him. The added weight of a shoe does not make for agility. While the foot and leg are engineered to minimize shock and road concussion, shoeing only increases them. Nail holes made in attaching the shoe help to weaken the hoof wall and may provide entries for infection or separation.

Allowing a horse to wear the same shoes too long also invites trouble. Since the hoof wall grows out perpendicularly to the coronary band, the horse's base of support actually grows out from under him if shoes are

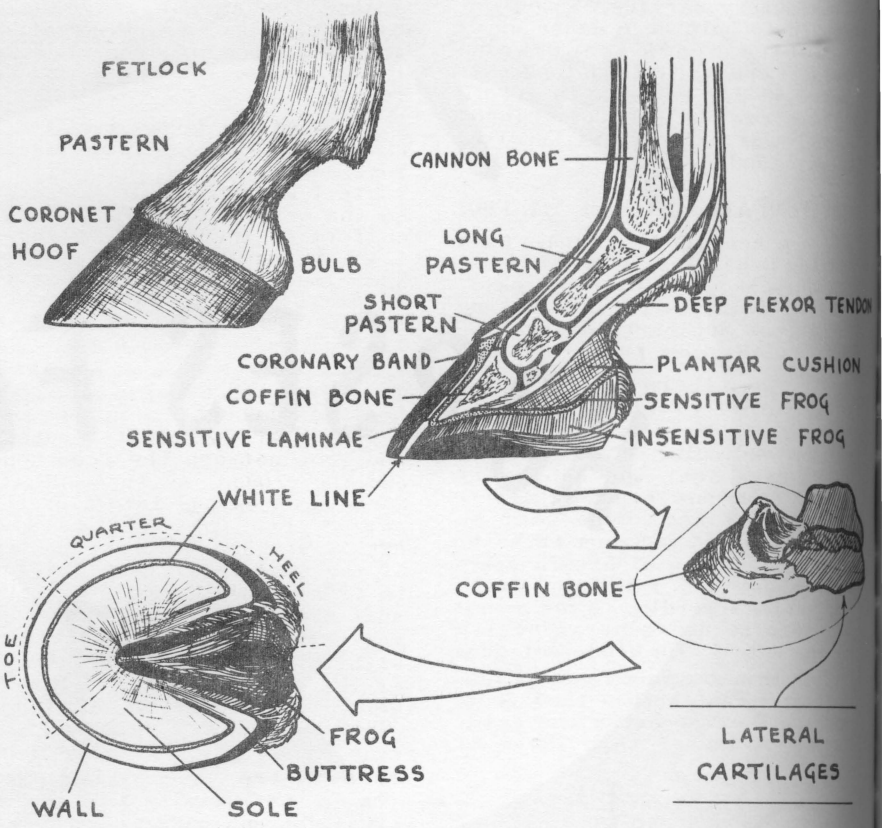


Fig. 1 Parts of the horse's foot.

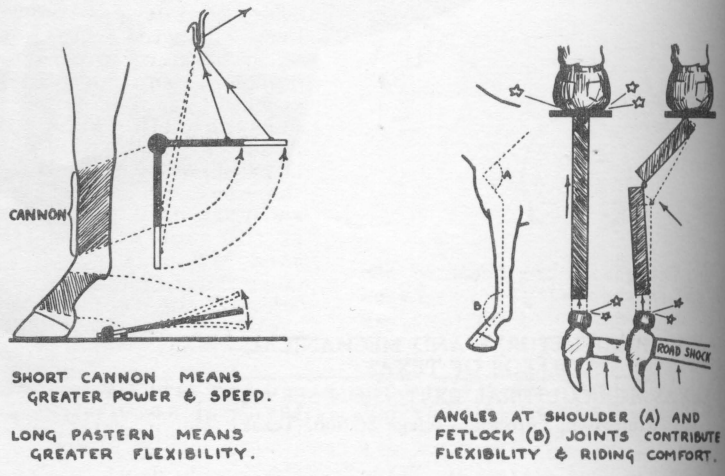


Fig. 2 Desirable conformational features.

left on too long. This transfers excessive strain to flexor tendons. Shoes worn too long grow thin and become loose, bend dangerously and may shift, causing shoe-nail punctures or "corns."

Shoes protect the hoof against excessive wear when unusual work is required. They provide better traction under unfavorable conditions of terrain, such as ice and mud. They help correct defects of stance or gait, often making it possible for an unsound horse to render satisfactory service. Shoes may be used to help cure diseases or defective hoofs (contracted heels, thrush, divided tendons). They also may be used to afford relief from the pain of injured parts (hoof-wall cracks, bruised soles, tendinitis).

STRUCTURE AND ACTION OF THE FOOT

A knowledge of the foot and leg is helpful in understanding horseshoeing and foot care. Certain features of anatomy and physiology are particularly important (Figure 1).

The fibers of the hoof wall, which closely resemble hairs, grow parallel to each other but perpendicular to the coronet. This means that the hoof wall itself grows out perpendicular to the coronet and, hence, at an angle of 45-55 degrees with the ground. The rate of growth averages about 3/8 inch per month but varies according to the amount of exercise and general health of the animal. The hind feet grow faster than the fore feet; unshod feet grow faster than shod feet; and the feet of mares and geldings grow faster than those of

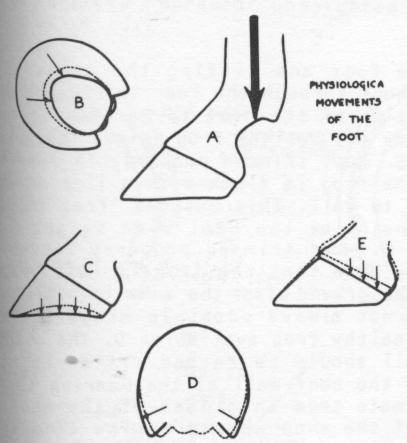


Fig. 3 Changes in the shape of the hoof occur when weight is placed on it. B. The coronet narrows and drops backward. C. The sole, normally concave, flattens. D. The hoof expands laterally at the heels. Preservation of this essential movement always must be taken into account in fitting the shoe. E. The overall height of the hoof decreases. These movements actually occur almost simultaneously as weight is placed on the foot.

stallions. All these factors cause variations in growth rate. For example, perhaps the feet of stallions grow more slowly partly because stallions get less exercise than do mares and geldings. Perhaps unshod hoofs grow faster partly because their movements are not limited by being nailed to inflexible shoes. And since hoofs must grow against the ground - must actually *raise* the horse by growth - perhaps the hind feet grow faster partly because they have less horse to raise.

Normal hoofs grow uniformly around the coronet. A crooked foot grows and wears unevenly. At the bottom of a crooked leg there always will be a crooked foot.

When the horse puts weight on a foot, changes occur in the shape of the hoof. These physiological movements are essential to the health of the foot and the comfort of the animal. Figure 3 illustrates these changes which are almost simultaneous but may be divided into four steps for ease of description. Most important of these movements is that represented by D in the drawing. This lateral expansion at the heels is brought about by compression of the plantar cushion and frog between the foot bones and the ground. As these elastic structures expand laterally they carry with them the lateral cartilages and the rear portion of the hoof wall. When the foot is lifted, all these structures snap back to their original resting positions. Shoeing interferes with this movement, particularly if the shoe used is too big and brings the posterior nail too far backward toward the heel. It is easy to see why the formation of bone in the lateral cartilage ("sidebone") limits this lateral expansion and causes lameness.

FLIGHT OF THE HOOF IN MOTION

The "foot axis" is an imaginary line drawn longitudinally through the center of the foot. From the front, the foot axis bisects the pastern and hoof. From the side, it runs parallel to the anterior border of the pastern and hoof (Figure 4). Normally, the foot axis is a straight line when viewed from front or side. In the case of this normal-angled foot, wear on the hoof or shoe is fairly uniform and gait is likely to be normal. If the foot axis is "broken forward," faulty gait results and wear is excessive at toe and heel. If the foot axis is "broken backward" excessive wear occurs at the toe.

"Grounding wear" occurs as the foot is brought to rest on the ground at the end of the stride. Slippage, which occurs as the ground slows the forward momentum of the foot, is responsible for much of the wear which the hoof or shoe incurs. "Swinging-off wear" occurs as the foot breaks over and just before it is lifted from the ground at the beginning of the stride.

Because the horse normally places the heel on the ground before the toe, just as man does, a heel that is too long strikes the ground early and is subjected to excessive slippage at the end of the stride. Grounding wear, therefore, is excessive at the

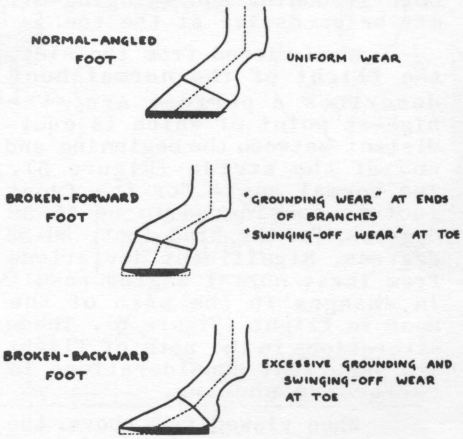


Fig. 4 The "foot axis" is represented by a dotted line running longitudinally through the pastern and hoof. As viewed from the side, it runs parallel to the anterior profile of the pastern and hoof. In the normal foot, the foot axis is a straight line. A foot having a "broken" axis is subject to uneven wear and an abnormal path of flight.

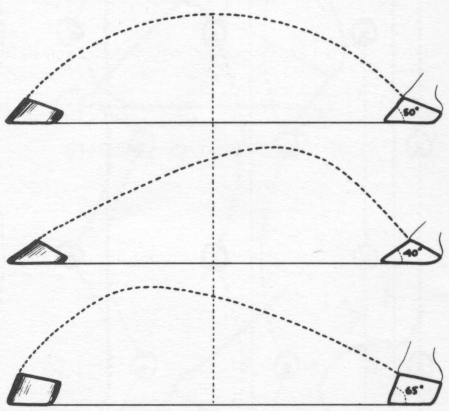


Fig. 5 Path of the foot in flight as viewed from the side. Drawing at top represents a normal path of flight. Other figures represent changes resulting from abnormal foot angles. A low heel causes delay in setting down the foot, thus increasing the length of the second half of the stride. A long toe delays break over, causing the foot to be lifted hastily and shortening the first half of the stride. A long heel touches the ground earlier than normal, exerting a premature halting action and shortening the second half of the stride. A short toe causes earlier-than-normal break over, lengthening the first half of the stride.

heel of the foot that is broken forward. A foot with axis broken forward breaks over earlier before the beginning of the stride and is consequently subjected to excessive dragging along the ground before it is lifted. This accounts for the excessive swinging-off wear at the toe of the broken-forward foot. If the heel is unusually short and the toe unusually long, as in the case of the broken-backward foot, both grounding and swinging-off may be excessive at the toe.

When viewed from the side, the flight of the normal hoof describes a perfect arc, the highest point of which is equidistant between the beginning and end of the stride (Figure 5). The normal angle for the front foot is considered to be 45-50 degrees; for the hind foot, 50-55 degrees. Significant deviations from these normal angles result in changes in the path of the hoof in flight (Figure 5). These alterations in the path of flight are important considerations in corrective shoeing.

When viewed from above, the normal hoof moves forward in a straight line (Figure 6, A). Deviations from normal conformation and stance result in deviations in the path of flight of the hoof (Figure 6, B-E).

Abnormalities of the feet and lower limbs may result in two-dimensional changes in the path of flight of the hoofs. These changes constitute the causes of many gait defects such as interfering and forging.

PREPARING THE FOOT FOR THE SHOE

Figure 8 illustrates some of the points to be considered in trimming the hoof and fitting the shoe. The shoe should be fitted to the hoof; the hoof should never be fitted to the shoe. After the shoe has been nailed to the hoof, ends of the nails should be clinched alternately from one side to the other, not in rotational succession. This insures uniform "seating" of the shoe.

CORRECTIVE SHOEING

A knowledge of normal shoeing is prerequisite to an understanding of corrective shoeing.

Corrective horseshoeing is an effort to improve or correct defects resulting from inherited, conformational faults. It also is practiced to alleviate pain and to encourage healing in diseases and injuries of the feet and lower legs.

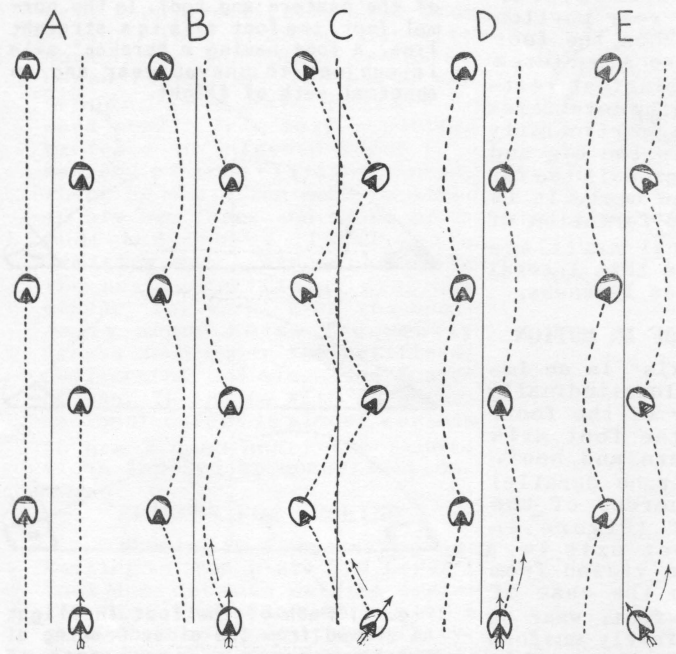


Fig. 6 Path of foot in flight as viewed from above. A. The normal foot moves forward in a straight line. B. The "base-wide" foot is carried forward in a series of inward arcs. C. The splayed foot is carried forward in inward arcs which ordinarily are larger than those resulting from the simple base-wide condition. D. The "base-narrow" foot is carried forward in a series of outward arcs. E. The "pigeon-toed" foot is carried forward in a series of outward arcs, often of greater radius than those of the simple base-narrow foot. In each drawing, the point at which the foot breaks over before moving forward is indicated by a shaded area at the toe. This break over point is an important consideration in corrective shoeing.

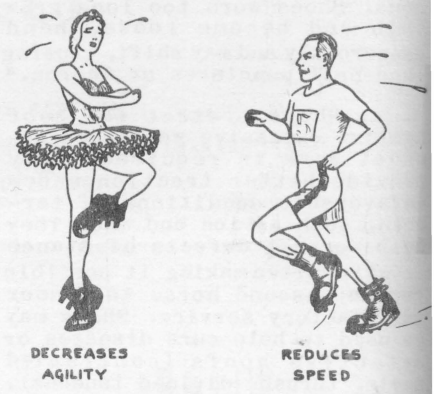


Fig. 7 The effect of added weight on agility and speed.

THE INFLUENCE OF WEIGHT

Weight, regardless of how added, always decreases agility and reduces speed (Figure 7).

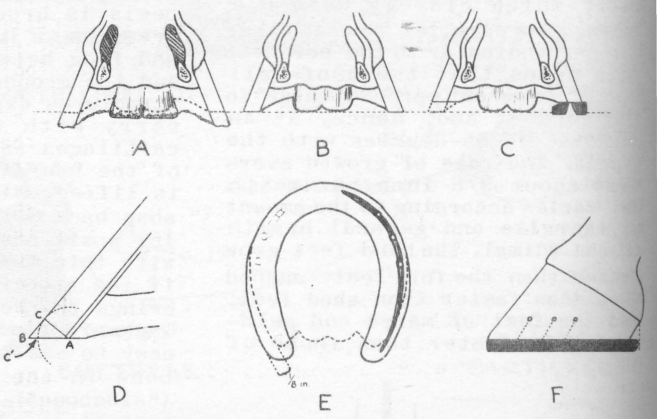
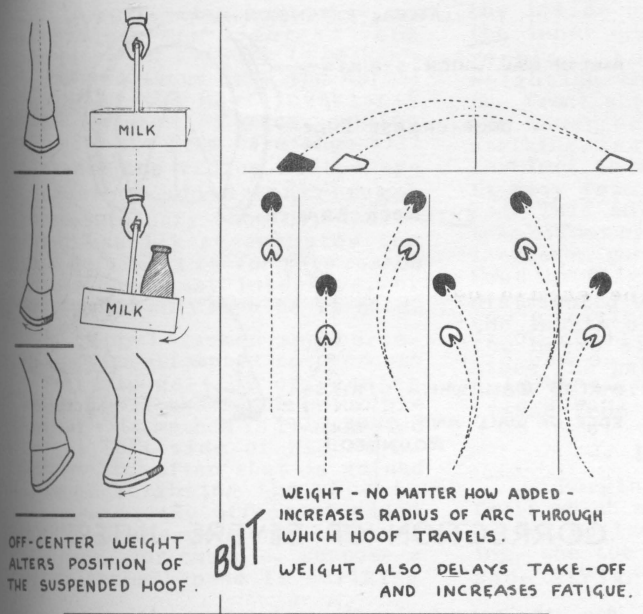


Fig. 8 Trimming the foot and fitting the shoe. A. Cross section of a hoof through the rear third. Dotted line represents portion of the hoof to be trimmed away. Do not trim away any healthy frog unless there is clearly an excess. B. Hoof trimmed properly to remain unshod. Note that the frog is flush with a line drawn across it from wall to wall. This assures "frog pressure" and aids expansion at the heel when weight is placed on the foot. C. Hoof trimmed properly for application of a shoe. Note that the frog is left long enough to contact the ground after the shoe is applied. This, of course, is not always possible since there may not be enough healthy frog available. D. The sharp edge of the hoof wall should be rasped off so as to reduce the width of the hoof wall at the bearing surface to the approximate true thickness of the wall. E. The outer edge of the shoe should follow closely the outline of the trimmed hoof at the toe and around the wall to the bend of the quarter. From this point to the rear the shoe should widen gradually until, at the heel, it extends laterally 1/8 inch beyond the hoof wall. This provides support for the expanded hoof when weight is placed on the shod foot. A nail placed too far to the rear would seriously impair this important lateral expansion of the foot at the heel. F. The branch of the shoe when viewed from the side should not project beyond the upper part of the hoof at the heel. Nails, represented by dotted lines, should be driven in the direction of hoof fibers in order to minimize fiber cutting and consequent weakening of the wall.



INFLUENCE OF WEIGHT ON FLIGHT OF THE HOOF

Fig. 9 Left, effect of off-center weighting on the foot. At the top, the unweighted foot held above the ground is viewed from the front. If the foot and leg are normal, the foot will hang evenly when it is raised - as does a balanced, empty milk-carrying case. If the foot is weighted on one side, the suspended foot will swing toward the unweighted side - as does an unbalanced milk carrier. If the foot is weighted at the heel, the suspended foot will swing away from the weight, toward the toe. (Shaded portions represent the weights.) Right, weight added to the foot increases the length of the stride by centrifugal action on the arc through which the foot travels as viewed from the side (top right diagram). Since most deviations from the normal path of flight take the form of lateral arcs, these too are affected by adding weight to the foot. By centrifugal force, weight increases the radius and length of the arc through which the foot travels. (White hoofs represent unweighted hoofs; black hoofs are weighted.)

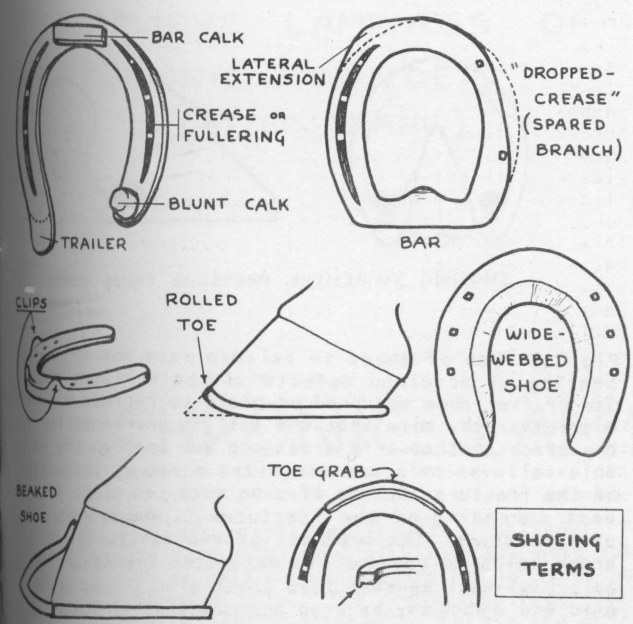


Fig. 10 Corrective shoeing terms.

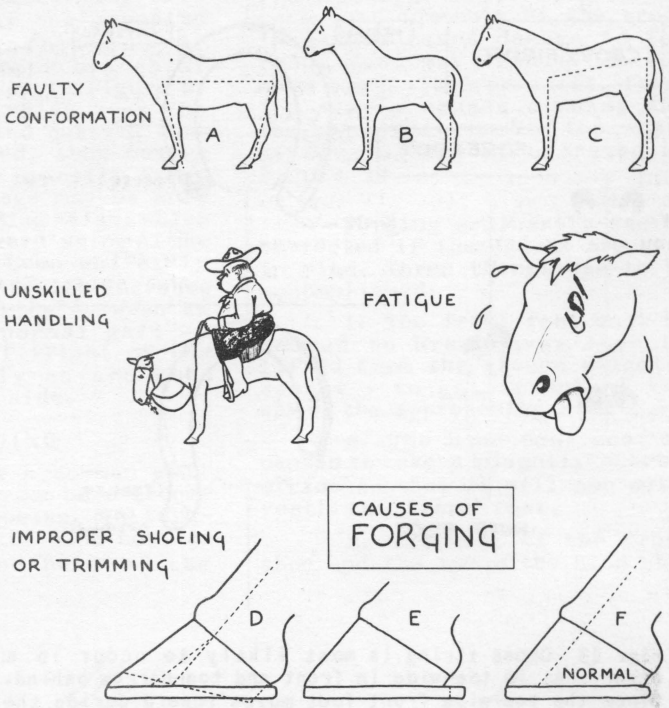


Fig. 11 Causes of forging. A. "Standing under." B. Short back, long legs. C. Long hind legs, short front legs. D. Heel trimmed too low. E. Heel of shoe left too long.

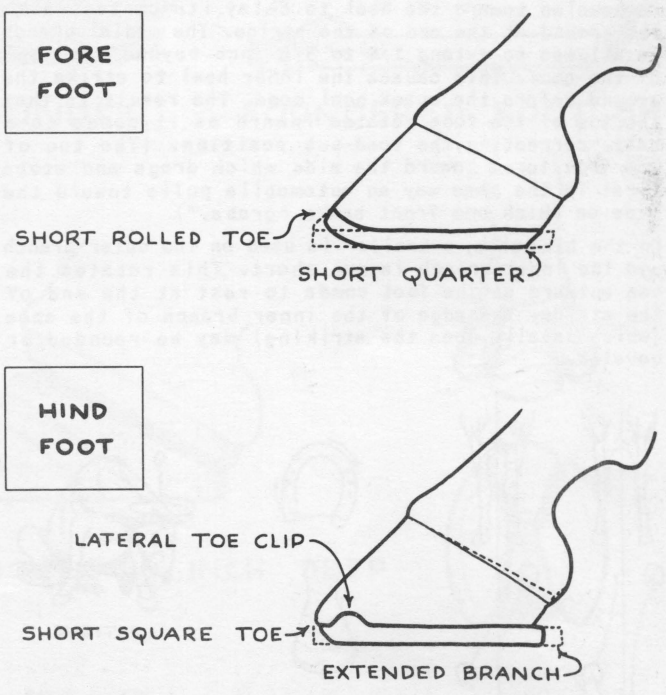


Fig. 12 Shoeing to correct forging. The rolled toe encourages the front foot to break over and be lifted sooner. Shortening the quarter (heel) of the front shoe removes the part most frequently struck by the hind foot. Shortening the toe on the hind foot removes the part that usually does the striking. The toe clips are to prevent the foot slipping forward on the shoe. In severe forging, the heel of the hind shoe may be extended. Since the horse, like man, puts his heel down first, longer shoe heels strike the ground sooner, braking the foot and shortening the stride.

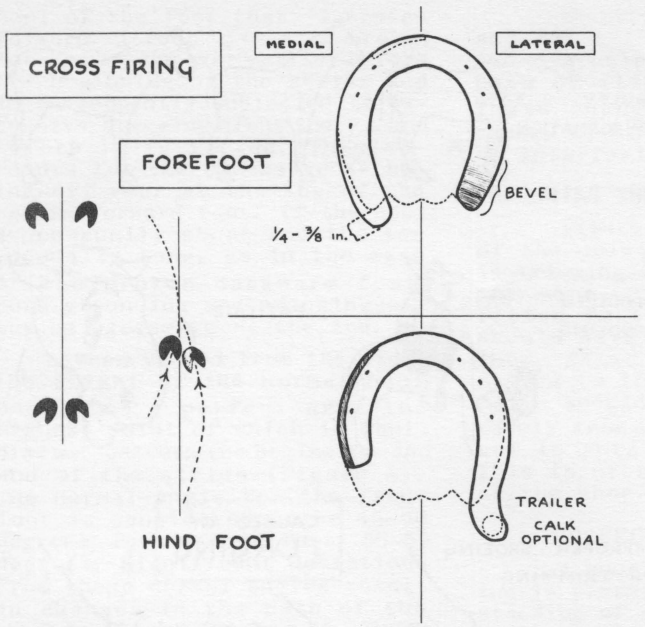


Fig. 13 Cross firing is most likely to occur in a pacer that is toe-wide in front and toe-narrow behind. Since the toe-wide front foot moves inward during the *first* part of its stride, and the toe-narrow hind foot moves inward during the *last* part of its stride, diagonal feet are likely to meet (cross fire) in the pacer with this conformation. Correction is aimed at reducing the lateral deviations of the feet in flight. On the front shoe, a grab (Figure 10) is used on the medial side of the toe to encourage the foot to break over more nearly straight. The lateral branch of the shoe is beveled toward the heel to delay its contact with the ground at the end of the stride. The medial branch is allowed to extend 1/4 to 3/8 inch beyond the heel of the hoof. This causes the inner heel to strike the ground before the outer heel does. The result is that the toe of the foot rotates inward as it comes to a halt, correcting the toed-out position. (The toe of the foot turns toward the side which drags and stops first in the same way an automobile pulls toward the side on which one front brake "grabs.")

On the hind shoe, a trailer is used on the outer branch and the inner branch is cut short. This rotates the toe outward as the foot comes to rest at the end of the stride. The edge of the inner branch of the shoe (which usually does the striking) may be rounded or beveled.

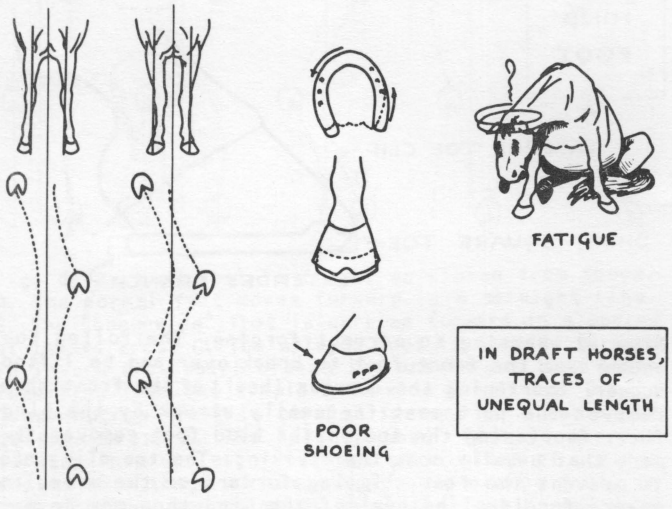
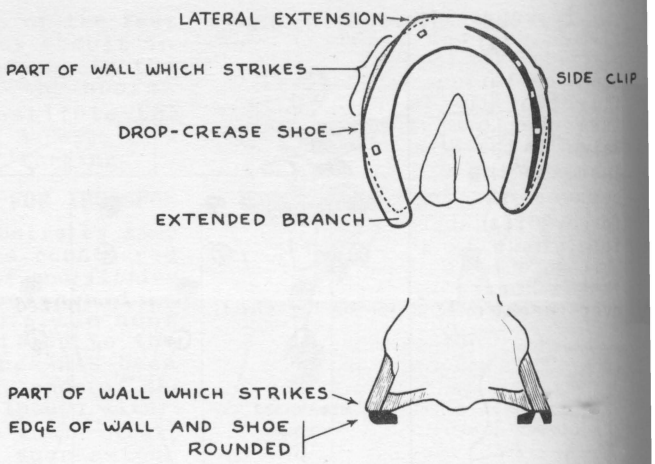
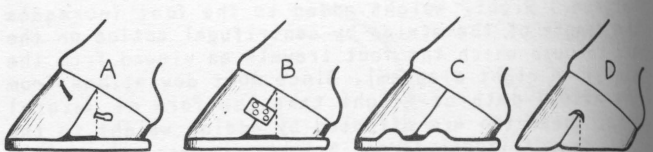


Fig. 14 Causes of interfering

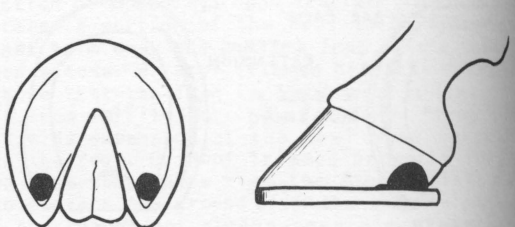


CORRECTION OF SEVERE INTERFERING

Fig. 15 Interfering is most common with the toe-wide foot which breaks over to the inside of the toe and pursues an inward arc forward (see Figure 14). A lateral extension on the inner side of the toe encourages the foot to break over at the center of the toe. The extended inner branch of the shoe causes the toe to rotate inward at the end of the stride. These two changes minimize the inner deviation in the path of flight of the foot. By dropping the crease and sparing the inner branch of the shoe, then rounding the overhanging edge of the hoof wall, the part of the hoof which did the striking is removed.



TREATMENT OF FRACTURES OF THE HOOF



SHOEING TO RELIEVE PRESSURE FROM CORN

Fig. 16 Use of shoes to relieve pain and encourage healing of acquired defects of the hoof. A. and B. Use of flat shoe and brad or plate to relieve complete quarter crack. Note that the wall is shortened beneath the crack so that this area does not bear on the shoe. This relieves pain and minimizes movement (spreading) of the fracture. C. Use of shoe with two clips to prevent spreading of the fracture. D. Management of a partial crack. The crescent groove at the top of the crack helps to prevent its extension toward the coronet. Hoof wall beneath this crack also should be shortened and a shoe may be used advantageously, lower left, *most common locations of corn. Lower right, the wall* and sole around the corn should be trimmed back slightly so that they do not bear on the shoe.

In corrective horseshoeing, always use the *lightest shoe practical for the work to be done*. Since deviations from the normal flight of the hoof invariably take the form of arcs, adding weight in the form of a shoe will increase the radius of the arc because of added centrifugal force. Ordinary shoeing, therefore, usually accentuates the gait defect. It is for this reason that a horse may interfere, or over-reach, only when he is shod.

Many horsemen and horseshoers have attempted to overcome defects in gait by off-center weighting of shoes. The principle behind this method is illustrated by the left side of Figure 9. However, too often what is gained through weighting the shoe is overcome by the effect of added weight on the path of flight of the hoof. For example, suppose a splay-footed horse is striking the inside of his foreleg with the inner edge of the opposite forefoot (interfering). By weighting the inner branch of the front shoes, as in Figure 9, the inner edge, which does the striking, is rotated outward when the foot is raised, thus moving it away from the opposite foreleg. This advantage may be more than offset by adding weight which increases the inward swing of the foot in flight. Even uniformly distributed weight will increase the length of stride -- even in the horse with normal gait -- since the path of flight of the hoof is normally an arc when viewed from the side.

FORGING

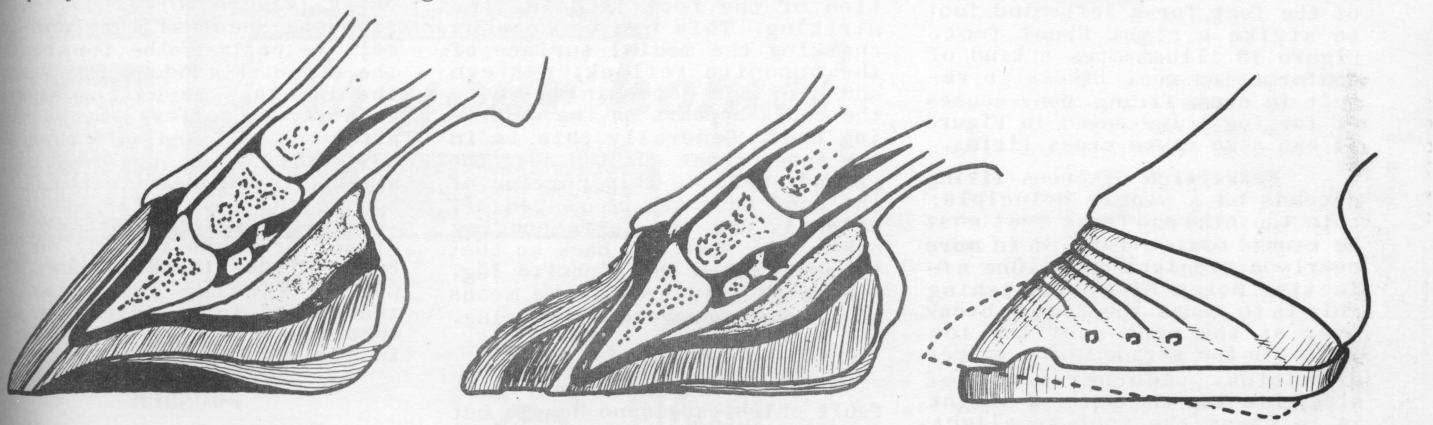
Forging is a common gait fault which often can be overcome by corrective shoeing. In forging, the toe of the hind hoof or shoe strikes the heel of the front hoof or shoe. Forging occurs most commonly at the trot. In severe cases damage to the front foot may result. In the more common, milder cases, forging simply causes a noisy and inelegant gait. Some of the causes of forging are illustrated by Figure 11.

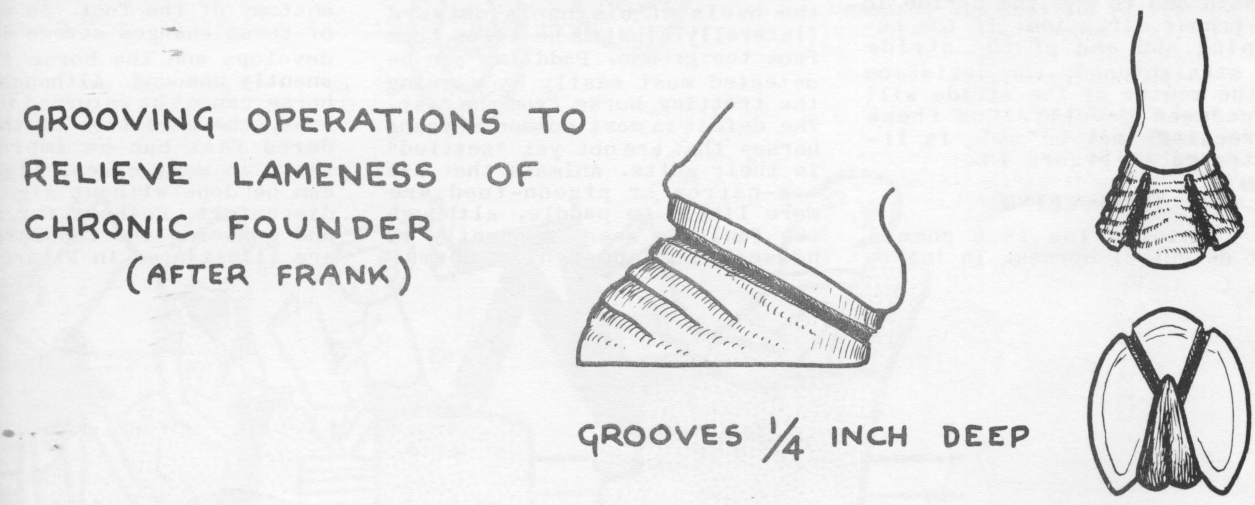
Forging ordinarily can be corrected if the causes are kept in mind. Three things are to be accomplished:

1. The front foot must be caused to break over then be lifted from the ground slightly sooner - to get it out of the way of the approaching hind foot.

2. The hind foot must be caused to take a slightly shorter stride so that it will not quite reach the front foot.

3. The heel of the front shoe and the toe of the hind shoe





CHRONIC LAMINITIS (FOUNDER)

Fig. 17 Top left, cross section of normal hoof. Top center, cross section of hoof with founder. Note downward rotation of coffin bone, separation of front hoof wall, and "dropped sole." Top right, the foot should be trimmed with heel shortened to rotate the coffin bone back toward its normal position. The front wall of the hoof may be rasped back to conform more nearly to its normal outline and the edge of the wall at the toe should be shortened slightly so it does not bear on the shoe. (This tends to perpetuate the separation of the wall.) A wide-webbed shoe is used (Figure 10) to help support the fallen sole. Lower right, grooving operations to provide flexibility and reduce lameness.

must be shortened so they are are less likely to meet.

Figure 12 illustrates how these are accomplished.

The added weight of shoes may cause a horse to forge although he did not forge when he was barefooted. This is because added weight delays the take-off of the foot and increases the length of the stride.

CROSS FIRING

Cross firing is basically the same gait defect as forging except that cross firing occurs only in pacers. In cross firing, the toe of the hind hoof or shoe strikes the heel of the *diagonal* front hoof or shoe. This is because, in pacing, both feet on the same side are brought forward simultaneously. Obviously, there also must be some lateral deviation in the paths of flight of the feet for a left hind foot to strike a right front foot. Figure 13 illustrates a kind of conformation most likely to result in cross firing. Many causes of forging illustrated in Figure 11 can also cause cross firing.

Correction of cross firing depends on a single principle: both the hind and front feet must be caused to move forward in more nearly a straight line. One effective means of accomplishing this is to cause the foot to break over at the center of the toe and *begin* the stride in the proper direction. Another means of straightening the path of flight is to cause the foot to alight with the toe pointed straight forward and to *end* the stride in the proper direction. If the beginning and end of the stride are straightened, the deviation at the center of the stride will be reduced greatly. How these corrections may be made is illustrated in Figure 13.

INTERFERING

Interfering is a common gait defect of horses. In interfering, the horse strikes the inner surface of the hoof or lower leg with the hoof of the opposite side. The fault most often involves the forelegs, but occasionally may be seen in all four legs or, more rarely, in only the hind legs. Like forging, interfering simply may be a nuisance or it may produce injury. Also like forging, interfering may result from shoeing a horse that did not interfere without shoes. Here, again, the added weight is responsible by increasing the radius of the inward arc through which the foot travels (Figure 7). Figure 14 illustrates some of the causes of interfering.

Mild cases of interfering ordinarily can be corrected by squaring slightly the toe of the hoof or shoe. In more severe cases an attempt should be made to determine exactly which portion of the foot is doing the striking. This can be done by chalking the medial surface of the opposite fetlock, pastern and hoof and determining where the chalk appears on the offending hoof. Generally this is in the inner front quarter near the ground surface. This portion of the hoof then can be resped off slightly and the corresponding part of the shoe cut back so that it cannot reach the opposite leg. Figure 15 illustrates the means of correcting severe interfering.

PADDLING

Paddling is a minor gait fault which causes no damage but is unsightly and objectionable. In paddling, the horse tosses the heels of his hoofs outward (laterally) just as he lifts them from the ground. Paddling can be detected most easily by viewing the trotting horse from the rear. The defect is most common in young horses that are not yet "settled" in their gaits. Animals that are toe-narrow or pigeon-toed are more likely to paddle, although the fault is seen frequently in horses with apparently normal conformation. "Tight longeing" - exercising young horses in a circle on a short rope - may encourage the development of paddling. Although the fault is exceedingly difficult to correct in older horses in which it is well established, it may be overcome easily in young animals by removing the cause, if known. If a toe-narrow conformation is at fault, the horse may be shod with light, square-toed shoes or with shoes having lateral extensions on both sides of the toe (Figure 10).

DISEASES AND INJURIES

Special shoeing and hoof trimming techniques are useful in the treatment of certain acquired abnormalities. For example, the pain of inflamed tendons on the rear of the legs can be relieved and healing promoted by using a shoe with blunt heel calks (Figure 10). These calks raise the heel of the foot and relieve part of the tension on the affected tendon. Similarly, the lameness resulting from a corn may be relieved by shoeing after the wall and sole near the corn have been trimmed back slightly. This permits the horse to use the foot while the corn is healing and without bringing direct pressure to bear on the corn. Figure 16 also shows the use of shoeing and trimming techniques to relieve pain and encourage the healing of cracks in the hoof wall.

FOUNDER

Founder often is accompanied by irreversible changes in the anatomy of the foot. As a result of these changes severe lameness develops and the horse is permanently unsound. Although such a horse cannot be returned to soundness, the condition of the foundered feet can be improved so that, in many cases, light work can be done without significant discomfort. Methods for shoeing and grooving the foundered hoof are illustrated in Figure 17.

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