MANUAL

for

ARMY HORSESHOERS

U. S. War Department
1920

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MANUAL

FOR

ARMY HORSESHOERS

PREPARED AT THE CAVALRY SCHOOL

April, 1920

WASHINGTON
GOVERNMENT PRINTING OFFICE
1920

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War Department

No. 683

Office of The Adjutant General

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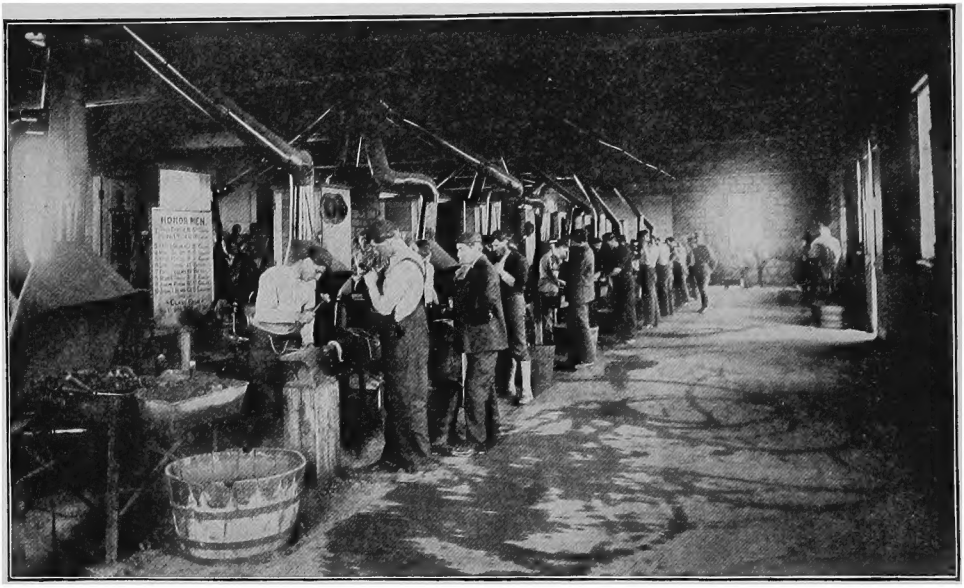

INTERIOR OF THE SHOEING SHOP.
Cavalry School.

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WAR DEPARTMENT,
WASHINGTON, *April 10, 1920.*

The Manual for Army Horseshoers, 1920, prepared at The Cavalry School, Fort Riley, Kans., for the use of students of the Department of Horsemanship, as well as for the Army at large and the National Guard, is published for the information and guidance of all concerned.

[461.1, A. G. O.]

BY ORDER OF THE SECRETARY OF WAR:

PEYTON C. MARCH,
General, Chief of Staff.

OFFICIAL:
P. C. HARRIS,
The Adjutant General.

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ILLUSTRATIONS.

Interior of shoeing shop, Cavalry School ..... Frontispiece.

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In this revision the following authorities have been consulted: Sisson's Anatomy; Smith's Physiology; Dollar on Horseshoeing; The Exterior of the Horse, by Goubeau and Barrier; Strangeway's Anatomy; Adam's Horseshoeing; Rudolph Jordan, jr., The American Trotter and Pacer.

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MANUAL FOR ARMY HORSESHOERS.

CHAPTER I.

HORSESHOERS' TOOLS AND THEIR USES—THE FORGE.

(Plate II.)

1. The *clinch cutter* (fig. 1) consists of two parts—the blade and the point. The blade is used to cut or to raise the clinches, being placed under the edge of the clinch and struck with the driving hammer. The point is used to punch nails and stubs out of the hoof. It is often placed in the crease of the shoe, under the head of the nail to be withdrawn, and struck smartly with the hammer. The blow raises the nail sufficiently to enable the pinchers to grasp the nail head.

The *pinchers* (fig. 2) are used to remove shoes and to draw nail stubs and improperly driven nails.

The *driving hammer* (shoeing hammer) (fig. 9) should be used only to drive horseshoe nails, to wring off nails after they have been properly driven, and to make clinches.

The *nippers* (fig. 4) are used to remove the surplus growth of wall.

The *shoeing knife* (fig. 3) is used to pare away the dead horn near the white line; to make a seat for clips; to remove loose particles from the sole; to relieve pressure on corns and cracks; and to open the sole and wall for the escape of pus or for the removal of foreign bodies.

The *horseshoers' rasp* (fig. 5) is used to remove the necessary amount of horn in the preparation of the foot; to even clinches; to make a slight groove under each clinch; to run lightly over the clinches in order to smooth them; and for rasping metal. The rasp that is used on the hoof should never be used at the bench; use an old rasp for working on metal.

The *rounding hammer* (fig. 10) and *fitting hammer* (fig. 11) are used in fitting and in turning shoes. The rounding and fitting ham-

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mers have one flat end called the face, and one pointed or convex end called the peen.

The *hoof tester* (fig. 7) is used to locate injuries or soreness of the sole. Place one point on the sole and the other on the wall; press by closing the handles; shift the points and continue until the horse flinches. The pinchers may be used for the same purpose, but are not as satisfactory.

The *clinching tongs* (fig. 6) are used to turn the clinches downward on feet with very thin or tender walls.

The *clinching block* (fig. 15) is used in turning down the clinches, in drawing up the nails, and in clinching. An excellent clinching block for use in shoeing shops can be made as follows: Take a bar of steel 1 by 1¼, and 4½ inches long. One end of the bar is made smooth and flat. The other end, including about one-third of the length of the

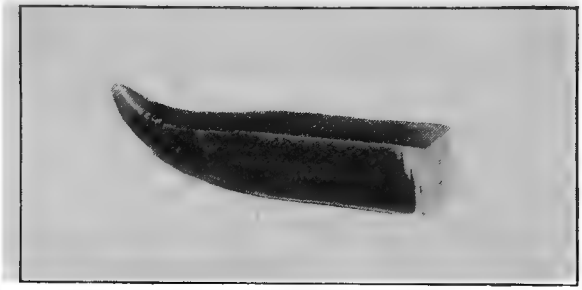

PLATE I.—CLINCHING BLOCK.

bar, is drawn to a tapering point, three-eighths of an inch in diameter at the point. The point for a distance of about 1 inch is slightly curved. Length of the finished block about 5½ inches. This block is too heavy for field service.

Many experienced shoers prefer to use the pinchers instead of the clinching block for clinching.

The *tongs* (fig. 8) are used in handling hot metals.

The *pritchel* (fig. 16) is made by hand from round or octagonal steel, and is used for opening the nail holes in horseshoes. The point is drawn the same size and shape as the shank of a nail halfway between head and point, so that the hole punched in the shoe will fit the nail snugly and not allow any motion. Examine the nail carefully and learn the exact size for the pritchel. To draw out the point of the pritchel, heat it to a cherry red and, placing the pointed end flat on the face of the anvil near the far edge, strike with the hammer held at an angle to properly change the upper

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face, turning it as necessary so that the finished point will be of the shape desired. Never heat the pritchel beyond a cherry red; cool it gradually by placing it in the coal at the edge of the forge and never in the water. The face of the horseshoers' anvil should have a round edge near the base of the horn on the far side. This edge is used for sharpening tools.

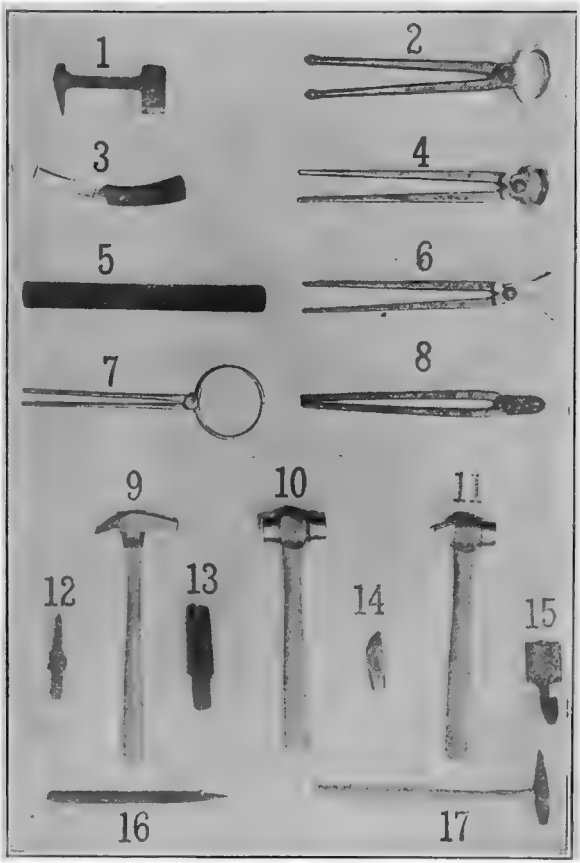

PLATE II.—TOOLS.

Hardies, the straight (fig. 12) and the half-round (fig. 13), are used to cut hot metals. Their principal use for horseshoers is in cutting off the heels of shoes, and for this purpose a sharp cutting edge is required. When the hardy becomes dull the edge is drawn out on the face of the anvil in the same manner as the pritchel. A sharp edge is then put on by hot rasping, using the smooth side of the rasp. After sharpening, the *cutting edge* should be tempered

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as follows: Heat the blade of the hardy slowly to a cherry red; hold the cutting edge under water so that about one-half inch of the blade is immersed, and, when there is no longer any sizzling, plunge the whole hardy under water and remove it at once; rub the blade on the floor to remove loose flakes of metal and to give it a slight polish; now carefully observe the change in color as the remaining heat in the body extends back to the edge; the color will be first straw, then copper, and finally blue; as soon as the blue color has

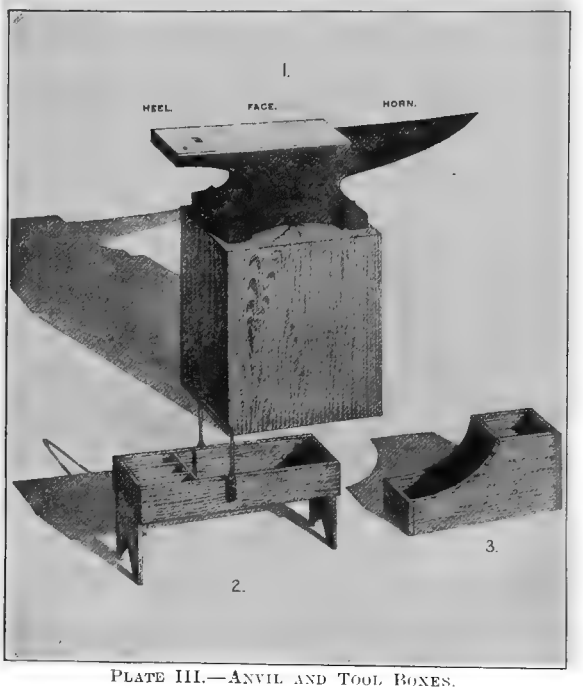

PLATE III.—ANVIL AND TOOL BOXES.

reached the cutting edge, place the whole hardy under water and leave it there until thoroughly cooled.

The *creaser* (fig. 14) is used to crease shoes and to repair damaged creases.

The *countersink* (fig. 17) is used in hand-made shoes to punch holes of sufficient size to receive the heads of the nails; these holes are completed by the use of the pritchel (fig. 16).

Horseshoe nails retain the shoe on the foot. These nails (furnished in several sizes) are machine-made and pointed; they are slightly concave on one side and flat on the other: there is a short

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bevel at the point on the concave side. In driving the nail into the hoof the *flat side is held faced outward.*

2. The horseshoer's anvil.—The working parts of the anvil (Pl. III, fig. 1) are the *horn*, the *face*, and the *heel.*

The face, or the upper plane surface, is of steel, and is welded to the iron body. The anvil is firmly fastened to a wooden block, which is sunk into the ground to a depth that will bring the surface of the face at a convenient working height above the ground—from 30 to 36 inches.



PLATE IV.—THE CHAMPION FORGE. FOR GARRISON USE.

The horn is used to open and to shape shoes; the face to level the web and for welding; and the heel to straighten heels of shoes and to turn calks. Clips are ordinarily drawn on the edge of the face, but in the anvil shown there is an attachment near the base of the horn which is used for this purpose. The square hole in the face (hardy hole) is a socket for hardies; the round hole (pritchel hole) permits the passage of the pritchel through the nail hole of the shoe.

The flat surface at the base of the horn is relatively soft iron and is used to lay hot metals on when cutting them with a chisel.

The anvil should weigh from 125 to 150 pounds.

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Figure 2 shows the tool box issued by the Quartermaster Corps. Its use is readily understood, and the only instruction required is that all tools should be placed in the box, handles out. An objection to this box is that it is easily tipped over. On this account many shoers prefer the pattern shown in figure 3, although the tools are not as near to the hand.

3. Plate IV shows a portable forge. In this forge air is forced through the fire by a fan (F), Plate V; the latter is made to revolve by the driving gear as shown. The twyer ball (T) (Pl. VI) corre-

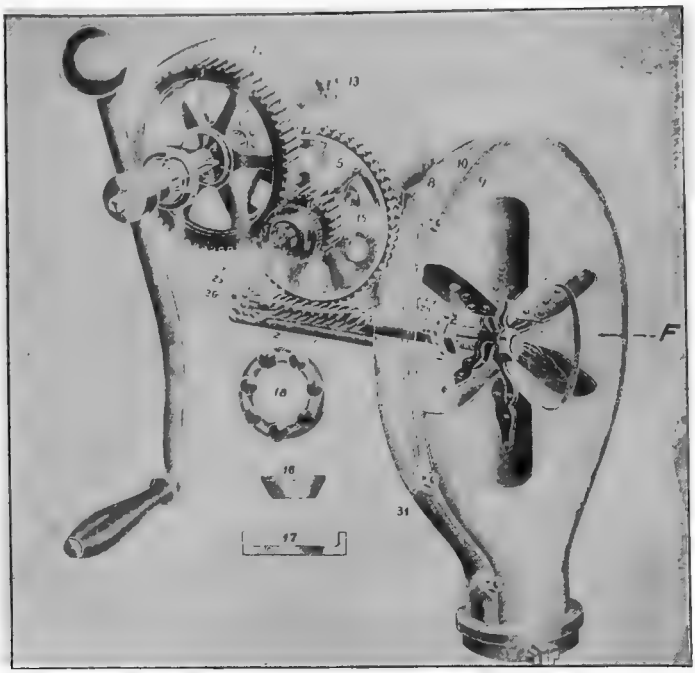

PLATE V.—THE BLOWER. FOR GARRISON FORGE.

sponds to the grate of a stove. Firmly attached to it and extending toward the worker is an iron rod by which the ball may be rocked. The end of this rod is shown by the small circle in the center of the twyer ball. A crater (C) should be made around the twyer ball in order to confine the fire. Clay may be used for this purpose, but cement is better.

4. The field outfit issued by the Ordnance Department is designed especially for portability, and is packed in two chests. Chest No. 1 (22 by 18 by 13 inches) contains a small knock-down forge with fan

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and drivewheel and a complete set of forge and shoeing tools. Weight of chest, packed, 122 pounds.

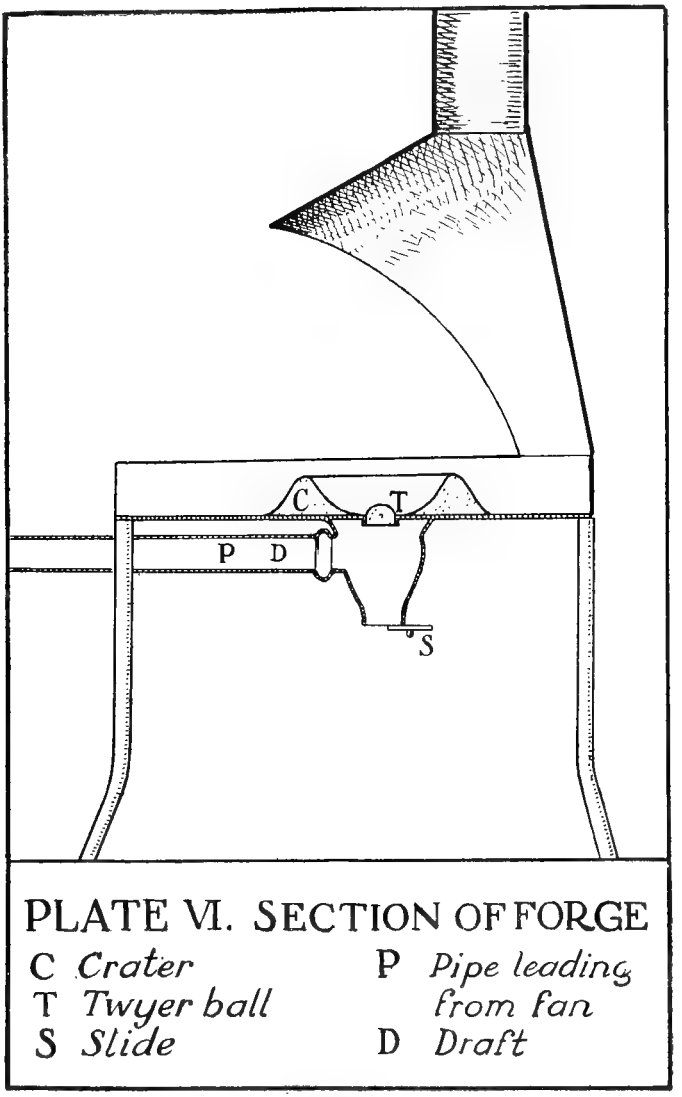

PLATE VI.—SECTION OF FORGE.

Chest No. 2 (21 by 17 by 10 inches) contains a small anvil and block, water bucket, leather shoeing box, and apron. Weight of chest, packed, 68 pounds.

The field anvil weighs 17 pounds.

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Chapter II.

THE FIRE—HEATS.

5. The fire.—Coal, charcoal, coke, or even wood, may be used as fuel to create the necessary heat in the forge.

Before building the fire the crater of the forge must be thoroughly cleaned, removing all dirt, ashes, and unconsumed fuel. The twyer ball should be rocked vigorously, and the slide (S) opened. A few blasts will aid in removing the accumulated dust. The ball is often so heated as to fuse, and melted metal and clinkers may close the openings around the ball, preventing the passage of the blast. The obstructions must be removed by the use of the poker.

Coal is banked around the twyer ball in the form of a crater, in the center of which dry particles of any inflammable material are placed and ignited. When these particles are burning, coke or wet coal (if no coke is available) is gradually placed on the fire and the fan is revolved slowly, care being taken not to cover so closely that the flames are smothered.

When the fire is burning brightly, it should be built up around the edges with wet coal, which will in time become coke. (See Heats.) This coke is next burned and is replaced by wet coal, thus keeping up the supply of coke. Green coal is of little use in heating iron or steel for the reason that it does not give a high degree of heat, that it sticks to the metal, and that it emits a smoke which interferes with the work.

A clear fire without smoke is essential for good work, and the higher degrees of heat can only be obtained from such a fire.

The depth of the fire should be about 9 inches; the metal is then supported at the place of greatest heat, about 6 inches above the twyer ball.

If the metal is too near the twyer ball the heat is affected by the cold blast.

To bank a fire, cover thoroughly with the fuel and *open the slide below;* this will keep the fire alive for several hours. Whenever the fire is left for more than a few minutes the slide should be opened.

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6. Clinkers.—Heated steel or iron gives off particles or scales which remain in the fire. These melting particles bind together particles of burned coal, gradually becoming larger and finally forming what is called a clinker. Clinkers give off but little heat and obstruct and spoil the fire; they must therefore be removed as fast as they form. Their presence will be shown by a tendency of the fire to spread and an unusual throwing out of sparks. If indications of clinkers appear, open up the fire with a poker, and as soon as the air touches the clinker it will turn black and become a solid mass which can be lifted out entire. Trying to drag out the clinker without opening up the fire only results in breaking up the clinker and making the fire worse than it was before.

7. Heats.—There are four degrees of heat that are to be considered by the horseshoer, and they are generally designated as the *black*, the *cherry red*, the *white*, and the *welding* or *sparking heat*.

The *black heat* is when the shoe is hot but shows no color, and is used in making minor changes in shaping, leveling, and in the final opening of the nail holes.

The *cherry red heat* is when the steel or iron shows a bright cherry-colored glow. It is used in the general shaping of the shoe, in pointing the pritchel, in opening nail holes, and in sharpening tools.

The next degree of heat is called the *white heat*, because the steel or iron then shows almost that color. This heat is used when it is necessary that the metal should be very pliable and easily worked, as in drawing toe clips, cutting off the heels, in drawing the heels of the shoe, in hot rasping, and in turning heel calks.

The *welding heat* is sometimes called *sparking heat* for the reason that the metal then gives off small particles which explode or spark above the fire. As soon as the sparks appear watch the metal closely, and when the part to be welded has a bubbling (fluxing) appearance it must be withdrawn from the fire and worked immediately. The success of a weld depends entirely upon the proper heat of the parts at the exact moment the weld is attempted.

A newly made coal fire can be used for ordinary heating, but for a welding heat coke is required. Coke is ordinary coal from which the gases have been driven off by gradual heating. It will be found ready at hand around the edge of the fire. As coke does not smoke, there is no trouble in observing when the metal has reached the exact welding heat.

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Chapter III.

WORKING AND SHAPING IRON.

8. The plate shoe.—As a preliminary to instruction in shaping and preparing a shoe *for the foot*, it is best for beginners to become familiar with the use of the tools, the use and control of the heats, and in working and shaping iron.

This is accomplished by practice and in making a bar out of old shoes, and then making a plate shoe from this bar or from a bar of steel, using an old shoe as a model.

The use of old shoes for this purpose is an economical measure and serves the purpose satisfactorily.

9. The various parts of a shoe are commonly spoken of as follows: The toe is that portion between the first nail hole on one side and the first nail hole on the other side. The quarters are the portions in which the nail holes are punched. The heels are the remaining parts of the shoe. A side is one-half of a shoe, and includes one heel, one quarter, and one-half of the toe.

The *web* is the bar or material of which the shoe is made. The surfaces of the shoe or web are the lower, or *ground surface*, and the upper, or *foot surface*.

The foot surface of the shoe is divided into the *bearing surface* and the *concave surface*.

The *bearing surface* is that part of the foot surface which is actually in contact with the foot.

The *concave surface* is that part of the foot surface which is concaved so as to prevent contact with the foot.

10. The following are the successive steps to be followed in making a plate shoe:

(1) To make the bar.
(2) To bend the bar at the center where the toe will be.
(3) To shape the sides of the shoe.
(4) To center the toe.

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(5) To draw out the heels.
(6) To punch out the nail holes.
(7) To cut off the heels.
(8) To finish the heels (hot rasping).
(9) To make any necessary corrections to secure a correct fit.
(10) To level the shoe.
(11) To finish the shoe.

11. To make the bar.—Take an old shoe and place it in the fire so that the toe will rest about 6 inches above the twyer ball, where it will obtain the maximum heat, and heat it to a white heat. Remove from the fire and lay the center of the toe flat across the cutting edge of the hardy. Strike the shoe directly over the hardy, cutting it in two.

Next, take another old shoe and heat it at the toe to a cherry red heat. Place it on the anvil, ground surface up, across the shoulder of the anvil, one-half resting on the face of the anvil and the other on the horn. Strike directly over the center of the toe, bending the two sides of the ground surface toward one another so as to form nearly a right angle. Remove the shoe from that position and lay one-half, foot surface down, on the face of the anvil, and strike on the elevated half, closing it down to within about half an inch of the other half. Now, take one of the halves of the cut shoe and insert it between and parallel to the sides of the bent shoe, with the heel of the half shoe thrust in against the toe of the bent shoe. Close the sides of the bent shoe firmly against the inserted half by striking blows on the side of the bent shoe near the toe. This must now be welded to form a solid bar.

The welding is accomplished as follows: Place the metal in the fire and subject to a moderate blast. It should be so placed that the different pieces to be welded will receive approximately the same amount of heat in order to have them ready at the same instant. Rock the metal in the fire frequently to insure heating it thoroughly and uniformly. When the metal begins to throw off sparks (the sparking heat), increase the blast so as to bring the surfaces of the metal to a fluxing condition rapidly. When the surfaces of the metal take on an oily, greasy appearance and begin to bubble and run (the welding heat), showing that the whole surface is molten, remove the metal quickly from the fire, place on the face of the anvil, and with a few quick light blows start the weld. Follow this with heavier blows to complete the weld.

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Heavy blows on the metal when starting the weld will force the flux from the adjoining surfaces so that there will not be sufficient to form the union.

In welding the bar, first heat and weld closed end, and then with successive heats weld the bar its entire length. Now, with as many white heats as may be necessary, draw out and shape the bar until it is about 12 or 13 inches long and half as thick as it is wide. If the old shoes used for this are of the average size (No. 3) and have had an average amount of wear, the bar produced will be about $\frac{3}{8}$ by $\frac{3}{4}$ by 12 inches, which will serve very well for use in making the plate shoe.

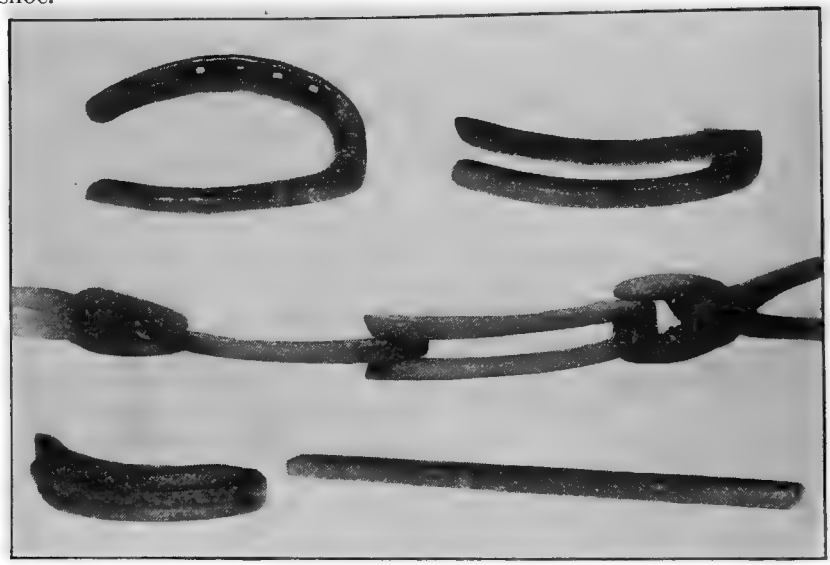

PLATE VII.—MAKING THE BAR.

The plate shoe can be turned from the bar made as described above or from a bar of $\frac{1}{2}$ by $\frac{1}{4}$ inch steel, which is much more easily worked than the heavier service shoe.

Take a bar of metal about 12 or 13 inches in length.[1]

12. To bend the bar, where the center of the toe will be.—Place the bar in the fire so that the center is directly over the draft. When cherry red, remove from the fire, holding the nearest end with the

[1] The length of bar required to make a shoe *for a foot* will be found by measuring in a straight line on the sole of the foot from the edge of the wall at the center of the toe to the extremity of either bulb of the frog. A little more than twice this distance will be the length of the bar required to make the shoe.

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tongs and lean the other end on the edge of the anvil farthest from you. The bar is held on edge and at an angle of about 45° with the face of the anvil. The tongs grasp the bar about 2 inches from the end and an equal amount projects over the edge of the anvil, so that the point struck will be midway between the points of support.



Strike lightly with the hammer at the center of the upper edge of the bar, and gradually bend the bar until it is right-angled, or L-shaped.

If, after bending, the L is not flat, but twisted, it must be leveled on the face of the anvil.



The shoe should be kept approximately level throughout the various steps in making and fitting.

This is done by laying the shoe flat on the face of the anvil with the bulging or convex side up and striking lightly on the bulging part.

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Remember to use only light blows on red metal. Heavy blows leave irregularities that are difficult or impossible to remove.



13. To shape one side.—Place one-half of the L in the fire, and when heated seize the cold half with the tongs and hold the heated side diagonally over the horn of the anvil, the left hand near the base and held low, the heated end projecting about an inch over the horn.



Begin striking at the end of the heated portion and, keeping the right hand steadily in position, shape the steel by gradually moving it beneath the hammer. Move the steel over the horn by raising the left hand and carrying it toward the point of the horn; that is, as the toe is approached, shift the work toward the point of the horn.

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As the shoe is moved toward the point of the horn the hammer forms the curve on the side of the horn.



The horn of the anvil is so constructed that the diagonal curve across the center conforms to the shape of the heels and quarters of a shoe for the average-sized foot and the curve near the point is shaped like the toe. For a very large shoe begin near the base of the horn.



To shape the opposite side, proceed in the same manner.

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14. To center the toe.—After both sides have been turned see if they are of equal length; that is, see if the toe is in the center. If not, then heat the toe and, grasping the longer side with the tongs, hold



the shoe over the point of the horn so that it is correctly centered and strike just beyond the horn.

15. To draw out the heels.—Heat the heels to a white heat. Hold the shoe on the horn in the same position as for shaping and upon a diagonal that will insure close contact. The blows, however, are



struck on the part resting on the horn, and the heel is brought toward the hammer by lowering the left hand.

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In drawing out the heels the ground surface of the shoe should be made slightly narrower than the foot surface.



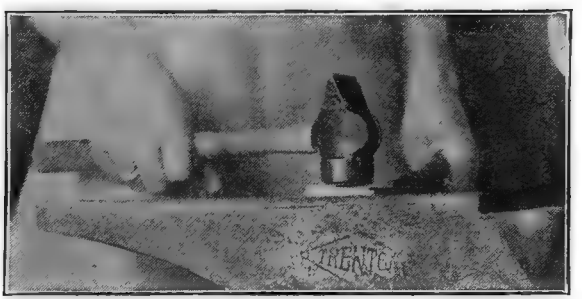
Notice that to draw out one heel the ground surface is on the left side when the heel rests on the horn.

To draw out the other heel the ground surface is on the right side, and the shoe is changed to the opposite diagonal of the horn.

In both cases strike on the edge of the ground surface, and as a result this surface will be the narrower.

For a left-handed man the anvil is reversed and the operation is identical, substituting right for left and left for right.

This drawing out narrows and at the same time thickens the heel. To restore it to its original thickness, work on the face of the anvil. Hold the ground surface down so as to preserve the bevel.



The drawing of the heels is governed by the width of the web of the shoe and the width of the buttress of the foot for which the shoe is made.

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16. To punch out the nail holes.—Apply the shoe to the model; if the heels are of proper length and the shoe is an approximate fit, the nail holes are punched out.

Examine the pritchel, and if it is not of the proper shape, point it before using. (See Tools, par. 1.)

The nail holes are started on the ground surface with the countersink because the point of this tool conforms to the shape of the head of the nail. The point should not be driven more than three-fourths through or the shoe will be bulged and ruined. The tool is held leaning outward to conform to the direction which the nail should follow and the hole is started a little outside of the center of the web.

Heat one side and first start the hole nearest the toe. Its proper position can be learned by examining a service shoe of the same size. The hole at the bend of the quarter is next started, and finally the hole midway between the two. The plate shoe, if made from steel on account of its light weight, requires but six nails, three on each side. For shoes larger than No. 3, if made from the bar of iron, eight will be required.

Heat the other side and proceed as before.



The nail holes must not be placed too far back. A shoe nailed back of the turn of the quarter will prevent the expansion of the foot and eventually cause contracted heels.

If, in punching the nail holes, bulges appear near them on the edges of the bar or shoe, they must be removed by working over the horn. (Same position and means as for drawing heels.)

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Punch out the nail holes on the ground surface, holding the pritchel outward, driving the point just barely through the web;



then punch out the holes on the foot surface, holding the pritchel leaning inward, and guarding against opening the holes too large from this surface. Again pritchel the holes from the ground surface, so that their final shape will conform to that of the nail. The pritchel is held more nearly upright as the holes are punched successively from toe to heel.



In pritcheling out a nail hole, to avoid blunting or breaking the point of the pritchel, that part of the shoe where the nail hole is to be is held over the pritchel or hardy hole.

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17. To cut off the heels.—Apply the shoe to the model and note how much must be cut from the heels. Care must be used, however, not



to cut them too short. It is better to have them too long and to cut them off again if necessary.

After heating to a white heat, place the ground surface on the hardy at an angle of about 45° so as to cut the heels off to conform

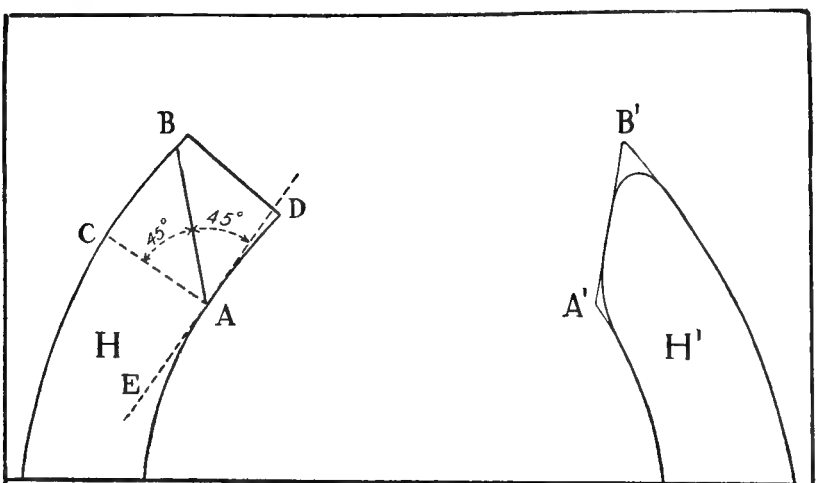

PLATE VIII CUTTING OFF AND FINISHING THE HEELS

H *Unfinished heel.*
CA *Square cut.*
ED *Direction of web at A.*
AB *Diagonal cut.*

H' *Finished heel.*
A' & B' *Angles removed by hot rasping.*

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more nearly with the shape of the finished heel. This will greatly reduce the amount of hot rasping.

In fitting a plate shoe for a foot the nail holes should be punched *before* cutting off the heels so that if necessary the toe can be centered to correspond to the nail holes.

18. To finish the heels (hot rasping).—The heels are now finished by hot rasping. The shoe is placed in the vise with the ground surface toward you, and the heels are rounded, carefully preserving the slight bevel (the foot surface being longer and wider than the ground surface).



Care must be used to leave no sharp edges on the heels that might cut the horse.

19. To make any necessary corrections to secure a correct fit.—The shoe is now ready for its final trial and is applied to the model.

If it does not exactly conform to the model, it will have at least one of the following faults, which must be corrected according to the explanation given in each case.

20. Too wide at the toe.—Heat the toe and hold it on the extreme point of the horn, the center of the shoe resting on the horn of the



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anvil. Strike lightly near the toe on the side farthest from you, then reverse the toe and strike as before.

Whenever the width of the shoe is to be changed, or a heel or a quarter is to be thrown in or out, first make a guide mark on the anvil. To do this hold one heel against the edge of the anvil toward the horn and draw the shoe across the anvil so that the other heel will make a mark on the face. Repeat this after the change is made and a comparison of the two marks will show the amount of the change.

21. Too narrow at the toe.—Heat the toe and hold it on the horn of the anvil so that there will be a small space between the shoe and the



horn. Strike lightly along the toe, not confining the blows to any one spot.

22. One heel and quarter too narrow.—To throw out a heel and quarter from a given point: Heat the quarter and, holding the heel on



the horn, strike on the spot from which it is desired to spread or throw out the heel and quarter.

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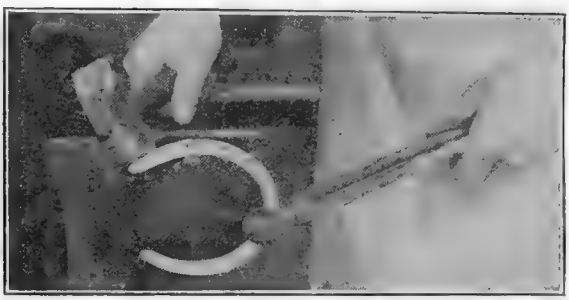
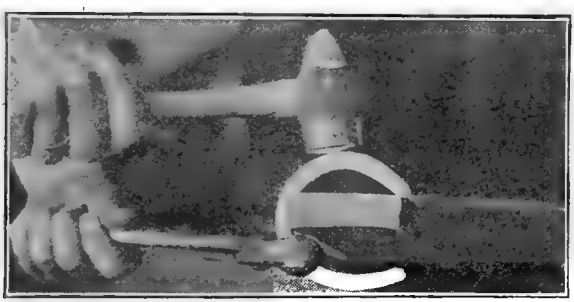
23. One heel and quarter too full.—(*a*) To throw in a heel and quarter from a given point: Heat the quarter and hold it over the point of the horn of the anvil so that the shoe will rest upon its inside edge *at the point* from which the change is to be made. Strike near the heel on the part projecting over the horn.



(*b*) To throw in one side without changing its general shape: Heat the side that is to be thrown in and close the shoe bodily (par. 26), which operation will affect the hot side only.

(*c*) If neither of these methods accomplishes the desired result, the quarter must be reshaped over the diagonal of the horn.

24. A bulge in the quarter.—Heat the quarter and hold over the heel of the anvil. Strike directly over the bulge.



This will remove the bulge, but will also slightly straighten the quarter, which must later be reshaped.

25. A short straight place in a quarter.—Heat the quarter and hold the straight place on the point of the horn, as shown in paragraph 23, but strike alternate blows on each side of and close to the point to be rounded.

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26. Both quarters too full (with the general shape correct).—Heat the whole shoe and, holding it on edge on the face of the anvil, strike down on the elevated quarter. This will narrow or close the shoe, but will not change its general shape.



27. Both quarters too narrow (with the general shape correct).—Heat the whole shoe and, holding one heel on the face of the anvil and one on the side, strike on the toe. This will open or spread the shoe without changing its general shape.



A perfect fit having been obtained, the nail holes are repunched if necessary, and the whole shoe neatly finished with the rasp.

28. To level the shoe.—Heat the shoe uniformly until it begins to show color. Grasp one heel of the shoe with the tongs; remove from the fire and place on the face of the anvil, foot surface up. Beginning at one quarter and striking light overlapping blows with the peen of the rounding hammer, go over the concave surface of the shoe. Next, beginning at one heel, and striking light overlapping blows with the face of the hammer, go over the bearing surface of the shoe. This should remove any bow or bulge toward the foot surface of the

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shoe, but has a tendency to concave the whole shoe toward that surface. To remove this and to complete the leveling, reverse the shoe on the anvil and strike light blows with the face of the hammer over the heels. Only very rarely will it be necessary to strike the shoe over the quarters or toe. If, however, this is found to be necessary, in order to level the shoe, great care should be taken to strike directly over the crease so as not to damage the concaving and not to close the crease. Take the shoe with the tongs near the toe on the far side and examine it by sighting over the foot surface. To assist the eye in this extremely important as well as difficult examination, lay the shoe, foot surface down, upon the face of the anvil and rock the shoe in different directions to see that the foot surface is not convex. Place the eye in the same plane as the face of the anvil to see that the bearing surface is not concave. If any unevenness remains after the above operations, it can be removed by replacing the shoe on the anvil and striking over the highest point. A crooked shoe will not stay on the foot and is apt to cause lameness.

29. To finish the shoe.—The shoe now should be properly made and fitted, according to the methods prescribed. Any sharp or rough projection which might injure the horse must now be rasped off.

To finish the shoe, place it cold in a vice, foot surface nearest you, the jaws of the vise gripping one heel and the opposite toe and quarter. With the smooth surface of the rasp go over the outer edge of the foot surface, rounding it slightly.

Reverse the position of the shoe and repeat the operation on the other toe, heel, and quarter.

Rasp smooth any other places requiring it.

This produces a bright line around the outer edge of the foot surface, which shows up the outline of the shoe very clearly and is of considerable assistance in the inspection of the shoe on the foot. It also makes a neatly finished job.

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Chapter IV.

ANATOMY AND PHYSIOLOGY OF THE HORSE'S FOOT.

30. By *anatomy* of the foot is meant a description of the various parts entering into its formation; and by *physiology* is meant the functions or uses of these parts.

31. The horse's foot is composed of four parts: (1) The bones; (2) certain elastic structures of cartilage (gristle) and fat; (3) the layer of highly sensitive flesh or quick (*the corium*) which covers this bony framework; (4) the box, or case of horn, called the hoof, which incloses and protects the sensitive parts.

32. Bones of the pastern and foot.—The bones of the pastern region and foot form a column extending downward from the fetlock joint into the hoof, and are named as follows: The long pastern bone (*first phalanx*), the short pastern bone (*second phalanx*), the coffin bone (*third phalanx*), the navicular or shuttle bone. (See Pls. IX and X.)

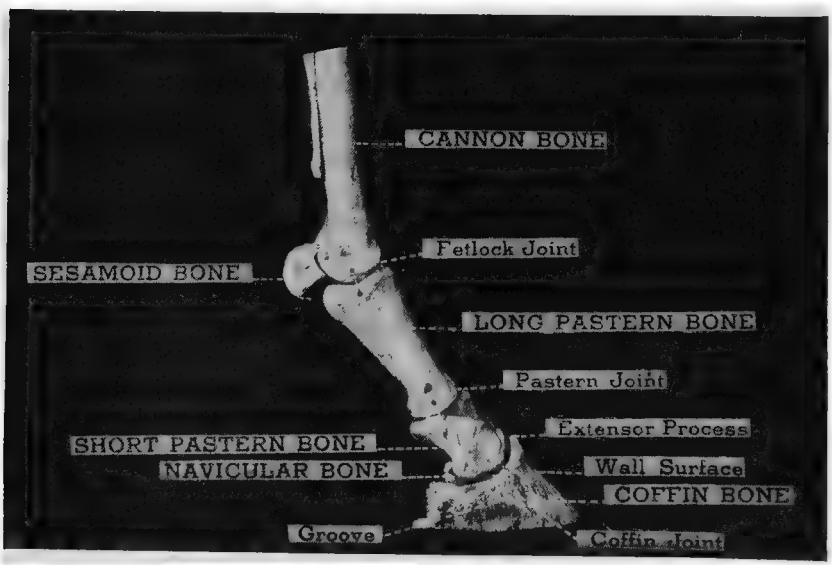

Plate X.—Bones of the Foot and Pastern Region.

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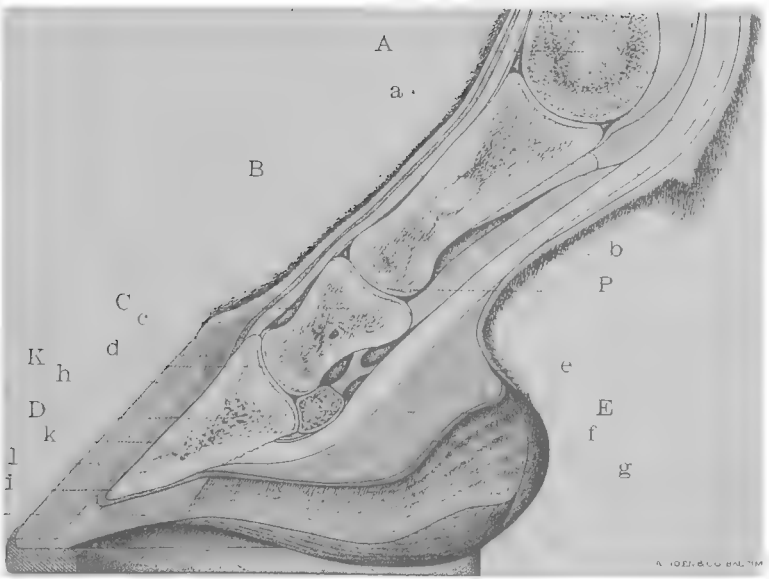
PLATE X



PARTS OF THE HOOF AND PASTERN.

A. Cannon bone.
B. Long pastern.
C. Short pastern.
D. Coffin bone.
E. Shuttle bone.
F. Fetlock joint.
K. Coffin joint
P Pastern joint
a Extensor tendon
b. Deep flexor tendon.
c. Periopiic ring.
d. Coronary band.
e. Plantar cushion.
f. Sensitive frog
g Horny frog.
h. Periople.
. Sensitive sole.
l Horny sole.
. Sensitive laminae.
. Horny wall.
Wl. White line.
x. Ergot.

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The *long pastern bone* reaches from the fetlock joint above to the pastern joint below. Its upper end articulates with the lower end of the canon bone, forming the fetlock joint. Its lower end articulates with the upper end of the short pastern bone, forming the pastern joint.

The *short pastern bone* follows the direction of the long pastern bone downward and forward, and lies between the pastern and coffin joint, its lower end being within the hoof.

The coffin bone is of irregular shape, is situated within the hoof, and is similar to the hoof in form. The surface of the front and sides is known as the *wall surface*. It has a number of small openings for the passage of blood vessels and nerves, and is roughened to give attachment to the sensitive *lamina* which cover it.

On each side of this surface is a groove running forward to an opening; an artery and a nerve enter the bone, and a vein leaves it through this opening.

At the top of this surface, in front, is a projection called the *extensor process*, to which is attached the extensor tendon of the foot. On each side of the coffin bone is an extension to the rear called the wing. The lateral cartilages are attached to the outer and upper borders of the wings and the ends of the navicular bone are attached to the inner surfaces.

The lower surface of the coffin bone, called the *sole surface*, is concave, half-moon shaped, and smooth, except at the back part, which is roughened for the attachment of the deep flexor tendon of the foot. It is called the *tendinous surface*. The upper surface, called the *articular surface* or *joint surface*, articulates with the short pastern bone and navicular bone, and with them forms the coffin joint.

The *navicular bone* is of irregular shape, situated behind and below the short pastern bone and behind the coffin bone, forming a joint with both. The extremities of the bone are attached to the wings of the coffin bone; the lower surface is covered with cartilage, which forms a smooth surface for the movement of the deep flexor tendon, which bends the joint; for this reason the bone is usually called the "shuttle bone."

33. Elastic structures of the foot.—All of the structures of the foot, except the bones, are more or less elastic or "springy" and yield when pressure is applied; but certain parts have a very high degree of elasticity, their special use being to overcome the effects of con-

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cussion or jar when the foot strikes the ground and to prevent injury, and these parts are referred to as the elastic parts of the foot. These are the *lateral cartilages* and the *plantar cushion* or fatty frog, as it is sometimes called.

The lateral cartilages are two large elastic plates of cartilage, one attached to the top of each wing of the coffin bone. They extend backward and upward so far that their upper borders may be felt under the skin above the coronet at the heels.

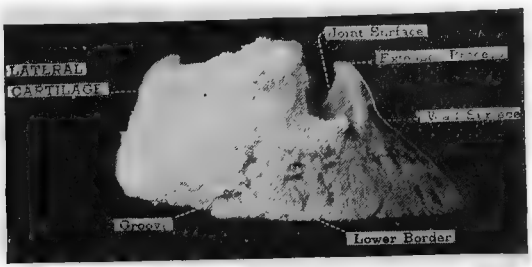

PLATE XI.—COFFIN BONE OF HORSE; SIDE VIEW.
a, *b*, front and rear extremities of cartilage.

The plantar cushion (fatty frog) is a very elastic wedge-shaped pad, which fills up the space between the lateral cartilages on the sides, the frog below, and the deep flexor tendon of the foot above. The point, or front part, of the plantar cushion extends forward to the ridge which separates the sole surface from the tendinous surface of the coffin bone and lies just below the lower end of the deep flexor tendon. The base, or back part, is covered by the skin above the heels. If the frog comes in contact with the ground when the foot is planted, the plantar cushion acts as a buffer and prevents jar. (See Pl. IX.)

34. Sensitive structures of the foot.—Over the bones and elastic parts of the foot is found a complete covering of very sensitive flesh. From each part of this layer of flesh some portion of the hoof is secreted or grown. The sensitive parts are: The coronary band, the perioplic ring, the sensitive laminæ, the sensitive sole, and the sensitive frog.

The *coronary band* is a thick band of tough flesh, about four-fifths of an inch wide, extending entirely around the top of the hoof from one bulb of the heel to the other, and lying in a groove (coronary groove) on the inner upper surface of the wall. The surface of the

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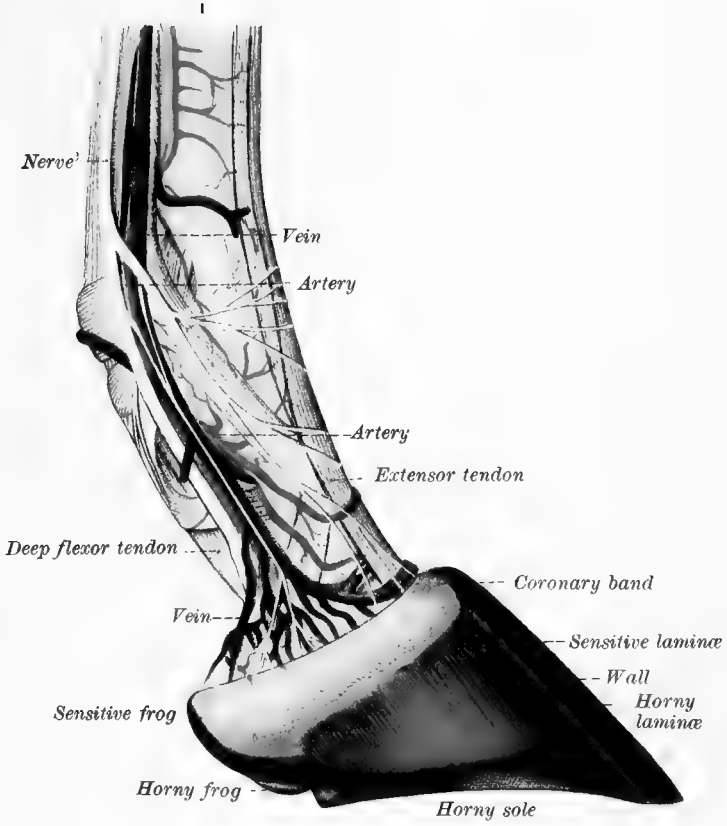

FOOT OF THE HORSE
One-half of hoof removed

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coronary band is covered with small pointed projections, called *villi*, from which is secreted or grown the horny wall of the hoof.

The *perioplic ring* is a narrow band of flesh running around just above the coronary band and separated from it by a faint groove in the wall. From the fine villi on the surface of this ring the delicate fibers grow which form the *periople* or hoof varnish.

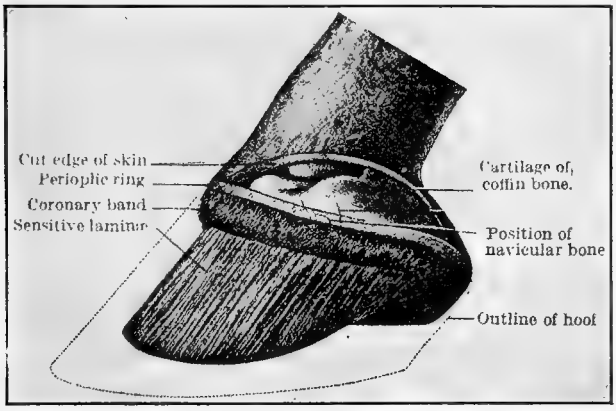

PLATE XIII.—SIDE VIEW OF FOOT OF HORSE AFTER REMOVAL OF HOOF AND PART OF SKIN.

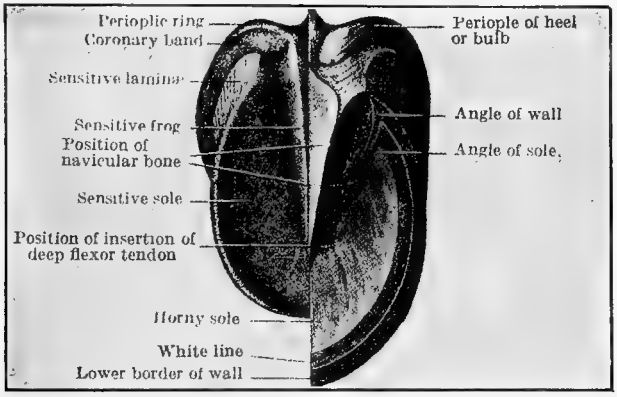

PLATE XIV.—GROUND SURFACE OF FOOT OF HORSE AFTER REMOVAL OF HALF OF HOOF TO SHOW SENSITIVE STRUCTURES.

The *sensitive laminæ* (fleshy leaves) cover and are firmly attached to the wall surface of the coffin bone and to the lower part of the outer surface of the lateral cartilages. From these delicate leaves

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of the flesh grow the *horny lamina*, the inside lining of the horny wall.

The *sensitive sole* covers the sole surface of the coffin bone, is covered with villi, and secretes the horny sole.

The *sensitive frog* covers the lower surface of the plantar cushion, and from its villi the horny frog is secreted.

35. The hoof.—The *hoof* is the outer horny covering of the foot. It is divided into three parts—the wall, sole, and frog. In the healthy foot these parts are firmly united.

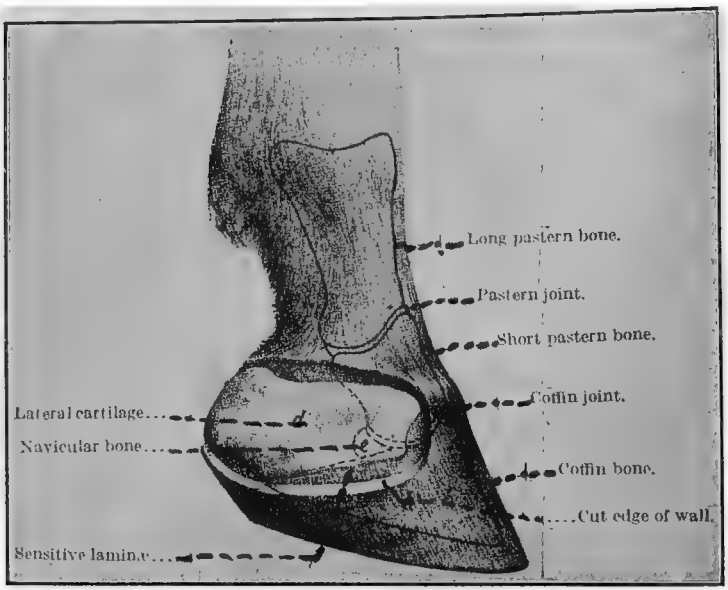

PLATE XV.—FOOT OF HORSE, SHOWING SURFACE RELATIONS OF BONES AND JOINTS.—THE CARTILAGE IS LARGELY EXPOSED.

The *wall* (except the bar) extends from the edge of the hair to the ground, and is divided into the *toe*, *quarters*, and *buttress* (or *heels*). (See Pl. XVI.)

The *toe* is the front part of the wall. It is steeper in the hind foot than in the fore. The *quarter* extends backward on each side from the toe to the buttress or heel.

The *buttress* is the rear part of the heel and may be defined as the angle formed by the union of the wall and bar. The *bar* is that part of the wall which extends inward and forward from the buttress to within about 1 inch of the point of the frog.

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The hoof is thus made stronger by the ends of the wall extending inward to form the bars. The bars are weight carriers, and they also act directly on the wall to produce expansion when weight is placed on the frog.

The wall has two surfaces and two borders.

The outer surface of the wall is covered by a thin varnish-like coat of fine horn, called the *periople.*

The inner surface is covered with from 500 to 600 *laminæ* (leaves). These are thin plates of horn running downward and forward. Between them are fissures into which dovetail the sensitive laminæ. The horny laminæ and the sensitive laminæ are firmly united, and this union (*a*) binds the wall of the hoof to the coffin bone and its cartilages; (*b*) suspends the weight of the horse from the wall as in a sling; and (*c*) thus prevents the bones from descending on the sole.

The upper border of the wall has a deep groove (the coronary groove) in which lies the coronary band. The lower border is known as the *bearing surface, or spread.* It is the part that comes in contact with the ground in the unshod foot and to which the shoe is fitted in the shod foot.

The *horny sole* is a thick plate of horn, somewhat half-moon shaped.

The upper surface is arched upward, and is in union with the sensitive sole from which the horny sole grows. The lower surface is hollowed and is covered with scales or crusts of dead horn, which gradually loosen and fall off.

The outer border of the sole is joined to the inner part of the lower border of the wall by a ring of soft horn called the *white line.* This line is also called the *guide line*, as it shows where the nail should be started in shoeing.

The inner border is V-shaped, and is in union with the bars except where the sole joins the point of the frog. The sole protects the sensitive parts above, and it should not bear weight, except a very narrow strip on its border along the white line, an eighth or a tenth of an inch in width.

The *frog* is a wedge-shaped mass filling the V-shaped space between the bars and sole and extending downward, more or less below the bars and sole. The lower surface has two prominent ridges, separated behind by a cavity called the *cleft*, and joining in front at the point of the frog. These ridges terminate behind in the *bulbs* of the *frog.*

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Between the sides of the frog and the bars are two cavities called the *commissures.*

The upper surface of the frog is the exact reverse of the lower. It has in the middle a ridge of horn called the frog stay, which assists in forming a firm union between the horny and sensitive frogs.

The function of the frog is to assist the plantar cushion in breaking the jar or concussion, to prevent slipping and to produce expansion and contraction upon which normal blood circulation in the foot depends. (See pars. 37 and 38.)

36. Structure of horn.—The *horn* of the hoof consists of fine fibers, similar to the hair in structure, held together by a cementing substance. The horn fibers run in a parallel direction downward and forward and are straight in the wall and sole and wavy in the frog. The fibers of the frog are finer, softer, and more elastic than those of the wall and sole.

The wall wears away at the lower border, or, if the animal is shod, the growth is removed in preparation for shoeing. The sole and frog scale off when the fibers have reached the proper length; they should not be cut except when necessary in the treatment of a diseased condition. (See Exceptions, par. 47.)

37. Moisture.—The wall of the healthy hoof is, by weight, about one-fourth water, the sole more than one-third, and the frog almost one-half. This water is supplied by the blood and preserves the horn in a tough and elastic condition. The periople, which covers the wall, prevents the evaporation of water, and therefore should never be rasped. (See Exception, par. 52.) As there is no similar covering for the sole and the frog, the layers of horn on their exposed surfaces dry out and die. The dead layers are hard and brittle, and gradually fall or flake off; but, as they preserve the moisture in the layers of live horn beneath, as little as possible should be removed in preparing the hoof for shoeing.

38. Expansion and contraction.—When the foot is placed on the ground the frog comes in contact with the ground and is forced upward, compressing the plantar cushion against the deep flexor tendon and the bony framework above. This compression causes the plantar cushion and frog to spread out to the sides, pressing outward energetically the cartilages, the bars, and the walls at the heels and quarters. This is called *expansion.* It does not occur in a foot so shod that the frog can not come in contact with the ground.

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When the weight is removed from the foot the plantar cushion and frog return to their normal shape, allowing the cartilages and the quarters to return to their original positions. This is called *contraction*. Upon the alternate expansion and contraction of these parts of the foot, nature relies for necessary beneficial effects.



PLATE XVI.—RIGHT FORE HOOF OF HORSE; GROUND SURFACE.

1. Bearing surface of the wall. 2. Horny laminae. 3. Angle of wall (buttress). 4. Bar. 5. Horny sole. 6. Angle of sole. 7. Point (apex) of frog. 8 Cleft of frog. 9. Commissures. 10. Bulbs of frog. 11. White line (junction of wall and sole).

The elastic lateral cartilage is merely a flexible extension of the wing of the coffin bone and would appear to have been specially designed for expansion and contraction at the quarters. It is also to be noted that the bars are a provision for this same purpose, since expansion and contraction could not take place if the wall formed a solid unbroken ring around the hoof.

Expansion and contraction diminish the jar to the foot and leg. The action is increased as the horse increases his gait. This action also assists in the circulation of the blood through the foot. When expansion occurs the blood is forced out of the veins of the

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foot up into the pastern region, where the valves prevent its return. When contraction occurs and the parts resume their normal shapes and positions, fresh blood is drawn from the arteries for the nourishment of the tissues of the foot. For this reason the horse should have daily exercise to give the tissues of the foot their proper nourishment. When the horse is taken out to work he should be walked at first to allow the circulation to adjust itself to the change from rest to work.

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Chapter V.

NORMAL SHOEING.

By normal shoeing is meant the shoeing of a sound foot of a horse with proper gaits.

39. Raising the foot.—In preparing to raise a horse's foot never approach the animal suddenly, for he will not only be startled, but a sudden pull at his foot will probably disturb his balance, and the lifting will be more difficult for both man and horse.

To raise the forefoot, the shoer stands with his back to the horse's head and places his inside hand on the horse's shoulder. Then, bending over, he runs his hand gently down the back of the leg until the fingers, with the thumb on the outside, are just above the fetlock. The shoer's shoulder is pressed against the shoulder of the horse, forcing the weight upon the other fore foot. (Pl. XVII, fig. 1.) A slight grasp of the hand on the tendons is usually sufficient to induce the horse to raise the foot.

The shoer next straddles the horse's leg and holds the foot upon his knees, standing so that his body is about opposite the horse's shoulder, and in close to him, so that the horse's leg is not pulled outward in a strained position. The shoer's toes should be turned in to give strength to the position. (Pl. XVII, fig. 2.)

40. Raising the hind foot is performed in two different ways. In the first method the shoer, standing at the horse's flank and with his back to the animal's head, bends until his shoulder presses the horse's thigh, runs his hand gradually down the tendons and grasps them as in raising the fore foot. In the second method, the one generally employed, the shoer stands as in the first method, but with his outside foot advanced (Pl. XVIII, fig. 1); the hand nearest the horse is placed upon the animal's hip, gently pushing him over and forcing the weight upon the opposite hind foot; meanwhile the other hand is run slowly down the back tendons from below the hock. The leg is grasped under the fetlock and is slightly raised forward. The shoer now swings his inside leg under the horse's leg (Pl. XVIII, fig. 2), presses it with his knee and extends it to the rear to the posi-

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tion shown in Plate XVIII, figure 3. Care must be exercised that the foot is not held too high nor carried too far to the rear or outward, for the discomforts of these strained positions will induce the horse to pull his leg away.

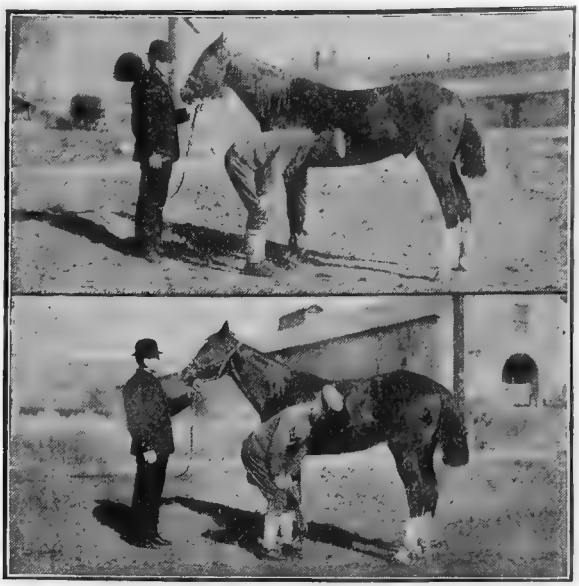

PLATE XVII.—RAISING THE FOOT.

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41. Preliminary examinations.—Three careful examinations should be made before old shoes are removed from the horse:

(1) Of the action of the feet when the horse is in motion.

(2) Of the shape and position of the feet at rest.

(3) Of the evidence of wear on the old shoe.



PLATE XVIII.—RAISING THE FOOT.

For the first examination, the horse having free use of his head, should be led at a walk and at a slow trot upon *level* ground. Uneven ground will produce modifications of the natural gait, and a tight rein or a short hold on the halter shank will also alter the free, natural motion. The shoer assumes a squatting position and ob-

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serves the feet as the horse is led past him, away from him, and toward him. The manner in which a foot leaves the ground, its path in the air, and the manner in which it is planted should be closely watched in order to detect any of the defects of gait which can be remedied by intelligent shoeing. (See Ch. VII.)

42. For the second examination, the horse should stand at ease on the floor; the shape of each foot and leg should be observed from the front, from each side, and from the rear, care being exercised that the leg, at the time, is bearing its proper share of the animal's weight.

The shoer first studies the natural pastern conformation. Is the pastern slanting inward (toe in), is it vertical (straight), or is it sloping outward (toe out)? (Pl. XIX, figs. 1, 2, and 3.)

Having decided this point, he then studies the position of the "pastern axis" and the "foot axis."

As seen from the front we may consider that the "pastern axis" is the imaginary line exactly splitting the long pastern in two, and that the "foot axis" is the line exactly splitting the foot in two: that is, the line from the center of the toe to the center of the coronet. (The foot axis may be drawn on the hoof wall in chalk.)

These two axes should be in prolongation or appear to be one straight line *no matter what the natural pastern conformation* (figs. 1, 2, 3, and 5), and if the shoer finds this condition satisfactory he will simply need to prepare the foot evenly for shoeing, as explained later. But if the two axes do not appear as one straight line there will be a break at the coronet. This is a proof that the foot is not level and that the horse is not standing correctly. If the line is "broken out" (fig. 4) the prolongation of the pastern axis falls to the outside of the foot axis and the inner wall is too high, and the fault is remedied by nipping off more of the inside wall than of the outside. If the line is "broken in" (fig. 6), the prolongation of the pastern axis falls to the inside of the foot axis and the outside wall is too high and should be trimmed down more than the inside. The dotted lines in the figures show the amount to be trimmed off.

It will be noticed that the "broken out" foot *looks like* the "toe in" and the "broken in" foot *looks like* the "toe out," but in the natural conformations there is no break at the coronet.

43. Standing at the side, the shoer should notice the height of the foot, the length of the toe, and the slope of the line of the toe; that is, the front line of the hoof as seen from the side.

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Here again we have three cases of natural pastern conformation: The "sloping," the "regular," and the "stumpy" (figs. 7, 8, and 9); but the line of the toe should, nevertheless, be parallel in each case to the pastern axis as seen from the side.

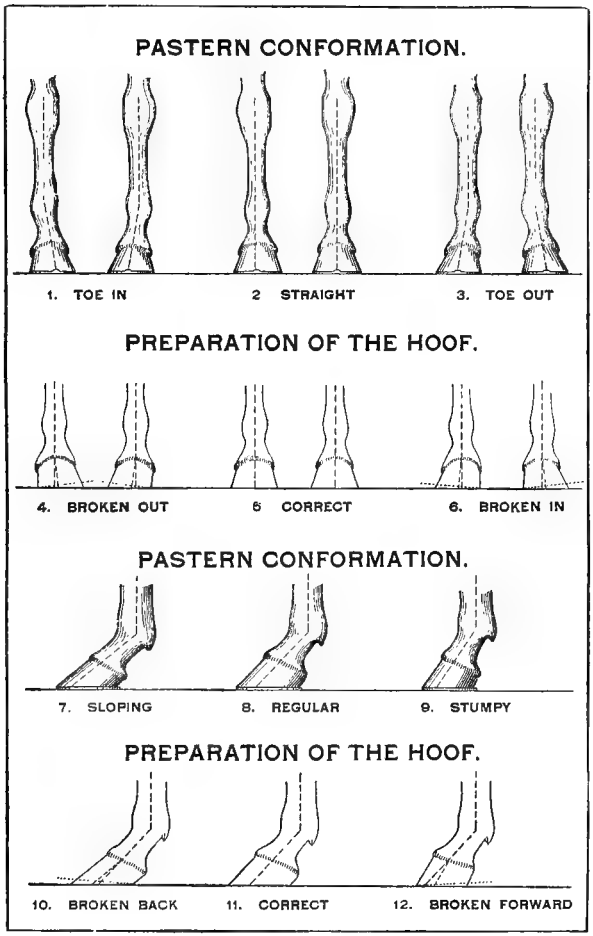

PLATE XIX.—THE FOOT AXIS AND THE PASTERN AXIS.

By careful sighting from the side draw a chalk line between the second and third clinches, with exactly the same slope as the line of the toe. This mark will generally have the same direction as the horn fibers. Now stand back and determine if this mark and the "pastern axis" as seen from the side are one and the same line. If so, trim

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off the surplus growth evenly. If not, the line will be broken at the coronet. In "broken back" (fig. 10) the prolongation of the pastern axis falls to the rear of the foot axis and the toe is too high and should be trimmed more than the heel; in "broken forward" the prolongation of the pastern axis falls in front of the foot axis and the heels are too high and should be trimmed more than the toe.

The "broken back" *looks like* the sloping pastern and the "broken forward" *looks like* the stumpy pastern. The break at the coronet, however, is the sure guide.

For the third examination the foot must be raised.

44. The wear of the old shoe should be carefully noted as a check on the preceding two examinations. If the shoe has worn normally, its position on the foot was undoubtedly correct. If one side of the shoe shows more wear, (*a*) that side may have been fitted too closely; (*b*) there may be some fault in gait which should have been noted in the first examination; (*c*) the foot may not have been properly leveled in the last shoeing; (*d*) the quarters, as frequently happens, may have grown unevenly since the last shoeing. Horses with long, sloping pasterns wear the shoe more at the heel, while those with short, upright pasterns wear the shoe more at the toe. There is a slight scuff at the moment of breaking over, which produces a normal wear at the toe, greater than elsewhere, but overworked horses and those suffering from disease show more than this normal wear.

45. Removal of the old shoe.—The clinches are cut off or straightened with the clinch cutter and hammer. The sharp edge of the clinch cutter is placed under the edge of the clinch and struck with the hammer until the clinch turns up flat against the wall or is broken off. If even one clinch is left holding, it may break off that portion of the wall to which it is fastened.

Beginning at the heel, each side of the shoe is loosened with the pinchers and, gradually working toward the toe, is separated from the hoof until all the nails are free except those at the toe. The shoe is then firmly grasped at the toe with the pinchers and is pulled toward the center of the foot. If pried over the toe toward the outside of the foot, part of the hoof may be broken off. Any stubs of nails remaining in the foot must be removed.

46. The preparation of the foot.—The following are the different operations which must be performed in the preparation of the foot. They should be taken up in the order given, as each step depends upon those which precede it.

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With the horse standing evenly on its feet, examine the foot and pastern axes to determine the necessary changes, if any, to be made besides the removal of the surplus growth of horn.

47. To determine the amount of horn to be removed from the foot, and to facilitate the use of the nippers.—Take the knife in the right hand, back of the hand down, the blade coming out at the little finger, palm of the left hand supporting the wall of the hoof and the left thumb on the blade to assist in cutting and to prevent slipping, pare away the dead horn of *the white line* and of the *wall* and *sole* bordering the white line until live horn is reached, being careful *not to go farther back than the last nail hole.* The knife must never be used on the bars or the frog. The bars strengthen the hoof and assist in its expansion. Cutting, therefore, weakens them and prevents them from performing their function. *Never* use a knife on the hoof of a horse that has been running barefoot, nor on flat feet, either natural or diseased.

The only two exceptions to this rule which prohibits the use of the knife on the frog are permitted in cases when its use is absolutely necessary to preserve the frog and to insure proper shoeing. One exception is that the knife may be used with great care to remove ragged parts of the frog, which if left on would permit of an accumulation of filth and disease or which might tear off in work and damage the frog. The second exception is that the knife may be used with great care to remove part of the frog when it extends over and covers the buttress. This is done to secure a proper seat for the heels of the shoe on the buttress.

48. To remove the surplus growth of horn from the wall.—In removing surplus growth of horn it is safer to lower the toe first, for, if the heels be lowered and, later, it is found that a corresponding amount of horn can not be cut from the toe, it will be impossible to put the foot at the proper angle without the use of heel calks or a thickened web at the heels.

Taking the nippers in both hands so that the handles are perpendicular to the plane of the bearing surface, begin at the last nail hole and cut until the white line shows plainly and live horn has almost been reached; start with a thin cut or bite and gradually increase the depth of bite to the point of the toe; continue along the opposite wall to the last nail hole on that side, gradually diminishing the bite.

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49. To level the foot.—Grasp the rasp with the right hand, the left hand near the far end, left palm resting on the upper surface to act as a guide. Place the coarse side of the rasp against the ground surface of the wall on the right half of the foot, and with long, even strokes, smooth off the foot where it has been cut with the nippers. Then work on the buttress and bring it to the same level as the quarter and toe, removing such horn as may be necessary and no more. As a guide to beginners in taking down the heels, it will be found that, in the average foot when properly prepared for shoeing, the height of the wall at the heels is approximately one-third of the length of the wall at the toe. Beginners usually bear too strongly with the right hand and remove more with the hind part of the rasp than with the front part. Avoid this fault. Frequent tests should be made to avoid removing too much of the horn. For this purpose take the foot in both hands and press with the thumbs near the white line; if the sole yields ever so slightly no more horn should be rasped away or lameness will result. Work carefully and slowly on the flat foot, which has a thinner sole than the cup-shaped foot.

For the left half of the foot reverse the hands on the rasp and proceed as above. This half will be found more difficult at first on account of the awkward position, and as a result the work will often be slighted. Experience with beginners shows that the right-handed man leaves the left half too high four times out of five.

To determine the level of the foot, the shoer raises the foot to a position for sighting over the bearing or ground surface; let the foot hang naturally and do not press against it with the thumb, as this is apt to disturb the pastern and foot axes and make the foot appear level when it is not; sight over each side separately, from the buttress to the toe, and note any irregularities which may appear in these two surfaces; now continue the plane of the quarter and heel, on one side across or through the horny frog to the opposite side of the foot, for the purpose of determining whether or not the two sides are in the same plane. This may be done with the eye by drawing an imaginary line, or by placing the smooth surface of the rasp on a level with the bearing surface of the foot, as indicated by the line *e*—*f*. To determine the level of this plane, draw an imaginary vertical line through the cleft of the frog, as shown by the line *c*—*d*. If the latter line (*c*—*d*) is perpendicular (forming right angles) to the line *e*—*f*, the plane of the foot is level. Both sides may be in the

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same plane and the foot not level. In such a case the plane is canted. The line *e*—*f* represents a canted plane, and it will be noted that it does not form right angles with the vertical line *c*—*d*. The true or level plane will be found at the line *a*—*b*, which line forms a perfect right angle with the line *c*—*d*. (Pl. XX.)

50. Place the foot on the ground and examine it from all sides and note carefully the following: Does the foot stand at the prescribed

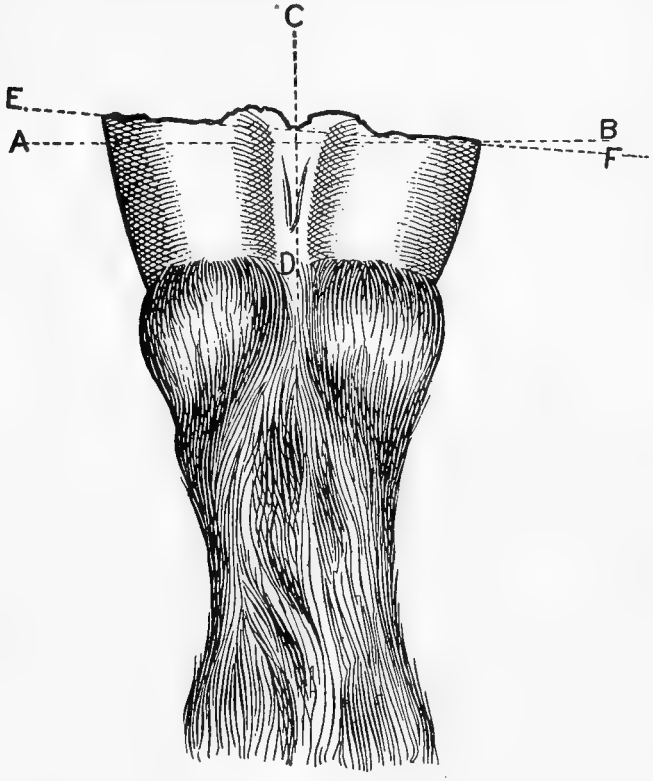

PLATE XX.—LEVEL OF THE FOOT.

angle; are the quarters equal in height; is the foot either broken out or broken in? If any of these conditions is not correct, the necessary changes should now be made.

The *bearing surface of the foot* is defined as that part of the ground surface of the foot which rests against the shoe, including the wall, the white line, and about one-eighth of an inch of the sole.

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When the leveling of the foot is completed, observe whether the sole is level with the wall at the inner angle of the buttress; if it is, remove from it a thin plate of horn, about a sixteenth of an inch thick, with the knife, being careful not to cut the walls or bars. This is to prevent pressure on the sole, which might result in corns at this point.

51. Plate XXI shows the appearance of a foot before and after preparation. This is the near forefoot of a field artillery wheel horse, and was selected on account of the clearly defined bars. It is to be observed that in leveling the bottom of this foot, it being a case of flat foot, the rasp trims off the sole inside of the proper weight-bearing surface. The shoe should *bear* upon the latter surface only.

52. As will be explained later under Nail Driving, the nails should enter the bearing surface of the foot at the outer edge of the white line, and come out of the wall at a height of about one inch. This distance will vary up to $1\frac{1}{2}$ inches for large feet. In the service

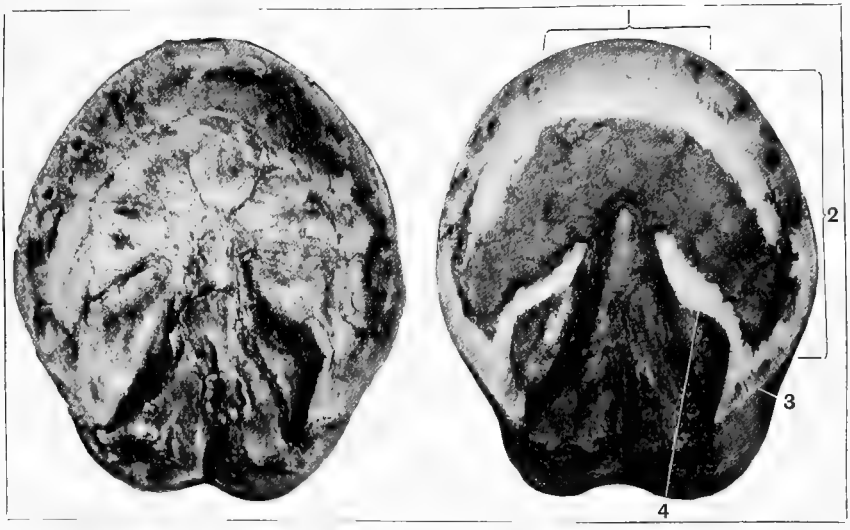

PLATE XXI.—PREPARATION OF THE FOOT.

Appearance after old shoe is removed. The foot ready for the new shoe. 1, toe; 2, quarters; 3, buttress or heels; 4, bars.

shoe the distance of the crease from the outer edge of the web is fixed for each size shoe. This distance is correct in the majority of cases, allowing the nail to start into the foot at the proper place; but many horses have feet of such shape or thickness of wall, that,

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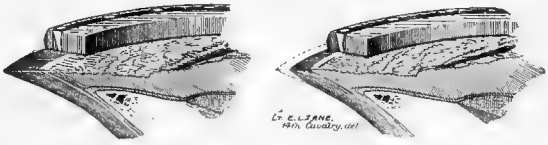
if prepared normally without removing any of the outside wall, there is a greater distance from the outer edge of the wall to the white line than this distance on the shoe. Consequently a shoe nailed on to a foot of this kind would cause the nails to be driven between the white line and the outer edge of the wall. This is objectionable because the horn of the wall is less elastic and more brittle as it approaches the outer surface, and frequently the bite of the wall (that portion outside of the line of nails) cracks open or breaks off, materially damaging the foot.

Heavy horses with wide feet and horses raised on soft, marshy pastures usually have flat feet. The *natural* flat foot, although particularly liable to bruises of the sole, must be classed as a sound foot and must be distinguished from one that is flat as a result of disease.

On account of its shape, the natural flat foot is sometimes called "flare foot." The wall in such a foot wears away (or is trimmed away) at a more oblique angle than in the ordinary foot. In the above cases where the width of the bearing surface of the wall exceeds the width of the bearing surface of the shoe, from the nail holes to the outer edge, it will be necessary, in the preparation, to remove a part of the outer surface of the wall in order that the nails may be driven in the outer edge of the white line.



The preceding figures clearly explain this case. It must be remembered that only in the above cases is it permitted to rasp the outside of the wall.

The amount of horn to be removed from the outer wall is determined by the width of the wall on the bearing surface of the foot. The height to which the outer wall should be rasped in this operation must be governed by the flare, or by the thickness of the wall at this particular point. It should not exceed once and a half the width of the wall on the bearing surface.

53. In general.—The foot should be prepared so that it will approximate as nearly as possible to a state of nature, and only such trimming is allowed as is absolutely necessary for the purpose of fitting and securing the shoe.

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54. The shoe.—When horses are in constant use, it is necessary to prevent the too rapid wear of the hoof. The modern shoe, beyond all question, is the best means to accomplish this result, although it somewhat interferes with the natural contraction and expansion of the foot. When shoes are left on the feet for too great a length of time, corns and other ailments result. Ordinarily a shoe should be renewed once a month. The heavier the shoe, the greater the labor of the horse. Hence, except in special cases, the lightest shoe that will last about four weeks is the best shoe. The shoe should carefully follow the form of the foot. If the wall is broken, the shoe should be fitted so that the nail holes will fall over the outer edge of the white line. The web of the shoe should be wider at the toe than at the heels. At the toe the width should be about twice the thickness of the wall of the hoof at that point. The length of the shoe is regulated by the bulb of the frog, and the thickness of metal is made sufficient to wear about one month.

The bearing surface of the shoe must be level, smooth, and accurately shaped to support the bearing surface of the foot. When the foot surface of the shoe is wider than the bearing surface of the foot, the inner part of the shoe must be concaved to avoid excessive sole pressure which is harmful. Care must be taken to concave only enough to remove sole pressure. If too much space is left between the shoe and the sole, small pebbles, grit, and dirt may collect, producing sole pressure at those points. Concussion of the sole against the inner edge of the foot surface of the shoe invariably produces soreness. The outer edge of the foot surface of the shoe should be slightly rounded.

This adds to the appearance, produces a better fitting shoe, and to a marked degree prevents cutting if the horse travels close. The width of the crease of the shoe should be uniform, and its depth about two-thirds of the thickness of the shoe. The crease makes the shoe lighter in proportion to its width and is an aid to prevent slipping. Nail holes should be punched to fall over the outer edge of the white line.

Clips are semicircular ears drawn upward from the outer edge of the shoe to prevent its slipping. A clip extends above the upper surface a distance equal to the thickness of the shoe, or sometimes farther on hind shoes. When leather is interposed between the shoe and the bearing surface, the clip must be correspondingly raised. Toe and side clips assist the nails in holding the shoe in place.

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55. Normal shoes.—By a normal shoe is meant a shoe for a sound foot of a horse with proper gaits. The service shoe (Pl. XXII) is, of course, a normal shoe.

In the Army six sizes of machine-made shoes—Nos. 1, 2, 3, 4, 5, and 6, front and hind—are issued. Each size is made in five different weights, as follows: "Extra extra light," "extra light," "light," "medium," and "heavy."



PLATE XXII.—NORMAL SHOE

For riding horses in garrison service the "extra extra light" or "extra light" weight is generally the most desirable shoe to use. It will wear a reasonable length of time and is light in weight, permitting jumping and other fast work without unnecessarily fatiguing the horse. The "city head" nail is the best for use with this weight shoe.

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For riding horses in field service the "light" weight is in most cases the best shoe to use. This heavier weight shoe will give better protection to the foot, resisting the shock or concussion caused by the foot striking the ground, to a greater degree than the lighter weight shoes. Another advantage of this heavier weight shoe for field service is the greater amount of wear it will stand. The "regular head" nail is best for use with this weight shoe.

For draft animals, as the work to be done both in garrison and field service is limited to slower gaits and is more confined to the roads, the necessity for fast work is not so great. On the other hand, as the work is usually done on hard surfaces, the necessity for heavier shoes which will afford more protection to the feet by absorbing the shock, becomes greater. The "medium" weight shoe will be found best in the majority of cases. The "regular head" nail should be used with this shoe.

It will be noted that the heels are much longer than necessary, but they are manufactured in this manner so that the extra length can be used in turning heel calks or in making a bar shoe. It often happens that a larger size is required for the front than for the hind foot of the same horse.

Four other shoes belong to this class:

The *calked shoe* (Pl. XXIII, fig. 1) is used to enable the horse to secure firm footing on slippery or ice-covered roads. Its use must be confined to actual necessities, for the calks raise the frog from the ground and prevent natural expansion and contraction. Permanent contraction of the heels, corns, and even sidebones result from the *constant* use of this shoe.

When calked shoes are necessary, it is best to use the bar shoe on the front feet to maintain frog pressure. The hind feet are less susceptible to diseases caused by lack of frog pressure.

Sharpened calks (fig. 2), for use on ice, are even more to be avoided on account of treads and injuries caused by interfering and by kicking.

The *plate* (fig. 3) is merely a light-weight shoe turned from bar steel.

The *snow shoe* (fig. 4) has a smooth, concave ground web, which, to a great extent, prevents the accumulation of snow and mud, and also gives firmer footing. The figure shows a shoe turned from the issue shoe.

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The *polo shoe* (fig. 5) has a flange on the outer edge of the ground surface which prevents slipping.



PLATE XXIII.—NORMAL SHOES.

Fig. 1. The calked shoe. Fig. 2. The sharp calked (or ice) shoe. Fig. 3. The plate shoe. Fig. 4. The snow shoe. Fig. 5. The polo shoe.

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THE SERVICE SHOE.

56. Selecting the shoe.—The foot having been prepared, leveled, and made ready for the shoe, estimate the size of the shoe required. To do this it is necessary for the beginner to place it on the foot and note the position of the nail holes, being careful not to take a shoe in which the last nail hole will be in the rear of the bend of the quarter.

Select a shoe of the proper size and weight, or the nearest available.

Now examine the pritchel, and if it is not of the proper shape point it. (See Tools.)

57. The successive steps in fitting the shoe.—The successive steps in fitting the shoe should be taken up in the following order:

(1) Draw the toe clip.
(2) Shape the toe.
(3) Open the nail holes.
(4) Shape the quarters.
(5) Make the seat for the clip.
(6) Make the first trial for fit.
(7) Make any necessary change in outline.
(8) Draw the heels.
(9) Cut off the heels.
(10) Finish the heels (hot rasping).
(11) Make final trial for fit.
(12) Concave and level the shoe.
(13) Finish the shoe.

58. Drawing the toe clip.—Fitting hammers with two different styles of peen are considered in this work. The one with the round-edged peen is shown in the following cuts. For the fitting hammer,



with spherical peen (rounding hammer), see Plate II, paragraph 1. Having procured a shoe of the desired size and having noted the

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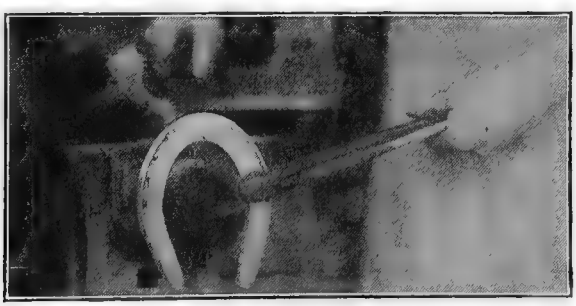
general changes to be made in its shape, especially at the toe, place the toe of the shoe in the fire, ground web down. When the toe is



white hot take the tongs in the left hand, seize the shoe near the heel on the side nearest you, remove it from the fire and place it on the face of the anvil ground web up, center of toe projecting over the anvil about an eighth of an inch, heels held at an angle of about 30°. With smart strokes with the peen of the hammer drive down the center of the toe until a small shoulder appears underneath; place this shoulder against the far edge of the anvil, holding the shoe so that the heels form an angle of about 45° below the face. Hold the right hand low and with strokes toward you along the face of the anvil, using the heel of the face of the hammer, draw out the toe clip, bringing the heels closer to the anvil as the clip is drawn. Be careful that the clip is in the center of the shoe. The clip, when finished, should be a little higher than the thickness of the shoe, and thickest at the base, tapering gradually to the point.

59. Shaping the toe.—The toe is then opened, as may be necessary (par. 21), being careful not to injure the clip. To open the toe of a



large shoe where the horn of the anvil is too small for the usual method, hold the shoe as shown above, but pull the quarter on the

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side opposite you firmly against the horn. Then strike on that quarter near the toe, bringing the hammer toward you and keeping up the pull on the tongs. The other side is opened in a similar manner after reversing the shoe. This method is frequently used in fitting the very large shoes required for heavy draft horses.

60. Opening the nail holes.—In the service shoes it will not be necessary to use the countersink for nail holes, because the crease is wide enough to take the nailhead. Use the pritchel to open the holes, as in paragraph 16, but pritchel the foot surface *first* in order to give the nail holes the proper slope and to remove the slight burr left on the machine-punched shoe, and the ground surface *last*, so that the hole will be finished in the shape of the nail. For the first work the shoe may be placed anywhere on the face of the anvil, because the service shoe is thick enough to prevent any chance of spoiling the point of the pritchel; but for the last work the pritchel or hardy hole must be utilized, as previously explained. The toe clip generally makes it difficult or impossible to place the nail hole nearest the toe over the pritchel or hardy hole. For these nail holes shift the shoe to the nearest end of the face of the anvil and hold the nail hole slightly outside of the edge.

It will generally be found that the work up to this stage can be done with the heat remaining from that required for the toe clip. Beginners, however, may find it necessary to reheat the shoe in order to open the nail holes. In this case, place the shoe in the fire with the clip up, to avoid burning it.

61. Shaping the quarter.—The quarters will usually be found too full, and if so must be heated and shaped over the horn by the method explained in the plate shoe, except that the shoe is slightly turned so that blows will fall on the *edge* of the foot surface in order to avoid closing the crease.

62. Making the seat for the clip.—Cool the shoe and apply it to the foot. In order to secure a neat fit at the toe it is necessary to make a seat for the clip, which otherwise will stand out its full thickness. Now is the time to prepare this seat. Place the shoe in position with the clip accurately centered, and, using the knife, scratch a small mark on the edge of the wall at each end of the clip. Put the shoe aside and *carefully* whittle away the edge of the wall between the two marks. Work slowly and test frequently by replacing the shoe, so that you will cut away just what is necessary and no more. (See Seedy Toe, par. 92.

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63. Making the first trial for fit.—Now make the first trial of the fit. If the toe is correct, note where either of the sides needs reshaping.

The outline of the finished shoe must exactly follow the outer edge of the hoof to the last nail hole, and gradually widen from that point so that about an eighth of an inch of the upper surface will show at the end of the heel. If, however, a foot is found to have a portion of the wall broken off when the animal is brought to the shop, the shoe must be fitted so that the nail holes will fall on the outer edge of the white line. If the toe has been broken, the shoe is fitted as just explained, but, of course, there are no nail holes to act as a guide. The toe clip is omitted and side clips are used if necessary.

64. Making any necessary change in the outline.—Any changes that are now found to be necessary should be made as described in Chapter III, paragraphs 19 to 27.

65. Drawing the heels.—The width of the heels of all finished shoes must conform to the width of the buttress. In shoeing a foot with a very wide buttress it is often unnecessary to draw the heels at all, but in some cases they must be drawn as explained in the plate shoe. (Par. 15.)

The web of the service shoe from the end of the crease back to the end of the heels is narrower than the web of the toe or quarter. Ordinarily it will not be necessary to draw (or narrow) the heels to fit the foot. The sharp edge on the outside of the ground surface of the web, from the end of the crease back to the end of the heels, should be rounded to conform to the bevel of the toe and quarter.

The shoe is placed on the horn of the anvil in position as for drawing the heels. Strike light blows with the hammer on the edge near the ground surface. The shoe when fitted should cover the buttress and allow for expansion. The heels of the hind shoe should be rounded, but not drawn, as the web is much narrower than that of the front shoes.

Remember that the bearing surface of the shoe *must cover the buttress* and you then have a guide for the width of the drawn heels.

In the issue shoe, the outer edge is bevelled as far back as the end of the crease, but is square from that point to the end of the heels. In *finishing* the shoe, bevel the square part also.

66. Cutting off the heels.—The finished heel should extend back, covering the buttress, and even with the bulb of the frog. The heels should be marked and cut off as explained in Chapter III, paragraph 17.

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67. Finishing the heels (hot rasping).—The heels are now hot rasped, as explained in Chapter III, paragraph 18.

68. Making the final trial for fit.—The shoe is now ready for the final trial for fit. Place the shoe on the foot and note the outline of the shoe and the length, width, and finish of the heels. If these are found to be correct the shoe is ready for concaving and leveling. While the shoe is on the foot note the amount of concaving that will be necessary.

69. Concaving and leveling the shoe.—The bearing surface of the shoe, upon which rest the wall, the white line, and not more than an eighth of an inch of the sole, must be level, fit exactly to the hoof (without any air space), and extend back even with the bulb of the frog. The part of the upper surface inside of this bearing surface must be concaved (hammered down while the shoe is hot) in order to avoid *any possibility* of sole pressure which would produce lameness. At the heels there should be no concaving, but the sharp inside edge should be *slightly* rounded. Concave and level the shoe as explained in Chapter III, paragraph 28.

70. Finishing the shoe.—As explained in Chapter III, paragraph 29.

71. The calked shoe.—The successive steps in making and fitting the calk shoe are taken up in the following order:

(1) Make the necessary changes in the toe.
(2) Weld on the calk.
(3) Draw the toe clip.
(4) Open the nail holes.
(5) Shape the quarters.
(6) Make the seat for the toe clip.
(7) Make the first trial for fit.
(8) Make any necessary change in the outline.
(9) Cut off the heels if necessary.
(10) Turn the heel calks.
(11) Make final trial for fit.
(12) Concave and level the shoe.
(13) Finish the shoe.

72. To weld on the toe calk.—The issue toe calk has a sharp nib or point on that surface which is applied to the ground surface of the shoe. Heat the toe of the shoe to a white heat and, placing it on the face of the anvil with the ground surface up, hold the calk with the tongs across the toe and far enough back so as to allow for turning the toe clip. Strike the calk lightly over the nib to

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mark its place. Now, with a fine-pointed pritchel, start the hole, then replace the calk, the nib in the hole, and with a few sharp blows of the hammer secure the calk so that it barely touches the shoe. If driven forcibly against the shoe, the nib does not grip securely.

Return the shoe to the fire, calk up, and tilt or rock the shoe forward and backward to insure equal heating of both shoe and calk. When the proper heat—fluxing—(see Heats) has been obtained, place the shoe on the face of the anvil, foot surface up, with the nib end of the calk farthest away. Strike light blows on the foot surface over the calk to unite the metal, the first blow being struck over the near end of the calk. Now, reverse the shoe, holding the toe away and the calk broadside to you, and strike heavier blows on the calk to complete the weld.

73. To turn in a heel calk.—Heat the heel to a white heat. Remove the shoe from the fire with the tongs, holding it near the toe; place the shoe at any convenient part of the face of the anvil with the ground surface down, a half to three-quarters of an inch of the heel projecting over the heel of the anvil. Strike on the part of the heel projecting over the edge and turn it at a right angle to the shoe. The height of the heel calk should correspond to that of the toe calk. The calk is squared by working on the face of the anvil; place one side on the face and strike on the upper side.

74. To weld on a heel calk.—To use heel calks with the bar shoe, it will be necessary to weld them on after the bar has been made and the shoe fitted. This is done as follows: Select a calk of the same dimensions as the toe calk used, but only half as long. Place the calk, nib to the rear, on the ground surface of the shoe, just forward of the bend at the heel, about the center of the web, and running parallel to it, mark the proper position of the nib on the shoe and proceed to weld as described for the toe calk.

75. Fitting.—The calked shoe is fitted in the same manner as the service shoe, with the exception that the heels are made a little longer and are slightly turned out from the end of the buttress in order to give a wider support to the foot and to thus prevent as far as possible the rocking of the shoe. For use on ice the calks are sharpened, but a horse so shod must never be turned loose with other horses.

The use of the calk shoe is prohibited except at times when local conditions make its use absolutely necessary to prevent slipping.

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76. Polo shoe.—This shoe is made from rib bar steel, which is obtainable in the bar shape only. It is made with a flange, or rib, on one surface of the bar, and is graded numerically according to size and weight of bar. No. 4 bar is the best size for polo shoes.

It is made as explained in the plate shoe, Chapter III, but with the rib on the outer edge of the ground surface. Low heel calks are frequently used on the hind shoe. This shoe takes a strong grip on the ground, and, in its effect on the foot, approximates more nearly the plain shoe in that it does not lessen the base of support at the foot as the calk shoe does.

77. Nail driving.—The nails issued for use in the Army are machine-made, and the sizes in general use are Nos. 4, 5, 6, and 7. No. 4 nail is used for plate shoes; No. 5 nail for a No. 1 and 2 shoe; No. 6 nail for a No. 3 and 4 shoe; No. 7 nail for the shoes of heavy draft horses; and No. 8 nail, and sometimes even No. 9 nail, for the shoes of some of the largest heavy draft horses.

Each size of nail is made with three different patterns of head, as follows: "Plate head," "city head," and "regular head." The "city head" is best for use with light-weight shoes, such as extra extra light and extra light, these shoes having a shallow crease. The "regular head" is best for use with the heavier pattern shoes that have a deeper crease. The "city" and "regular head" differ in that the head of the nail on the "regular" is larger than that on the "city." The "plate head" is best for use with stamped or countersunk shoes. The head is larger and more tapering than the "city" or "regular head" nails. The shank of nails of all three patterns is the same.

One side of the shank of the nail is flat; the other side is concave and also has a bevel near the point. This bevel, as it enters into the horn, forces the point of the nail in the direction of the other side (flat side). Therefore always hold the nail with the *flat side toward the outside edge of the shoe.*

By driving nails into the wall of the foot some of the horn tubes are destroyed, and the higher the nails are driven the greater the injury to the wall. Nails should, therefore, come out at a height just sufficient to hold the shoe ordinarily not exceeding 1 inch. On the other hand, if the nails come out too low the shoe may be lost and the wall seriously damaged. In order to damage the wall as little as possible, both the size and the number of the nails should be as small as will secure the shoe properly.

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The outside of the white line is the correct place to start the nails, and shoes should be fitted with this end in view. Nails thus started come out evenly on the wall, are low, and at a strong angle.

To the experienced shoer the feel and the sound of the nail and the amount of force required in driving are important guides.

The nail is held between the thumb and fingers to steady it in starting, and, if going properly, it imparts to the fingers a characteristic sensation called the "feel of the nail." A nail driven into healthy horn gives off a distinct sound which the shoer soon learns to recognize. All nails going properly must be driven with considerable force. A nail driven with slight resistance, i. e. "going easy," is either in an old nail hole or *serious damage* is being done because the nail is entering the soft sensitive structures of the foot (pricking).

Nail heads must be sunk in the crease until they are flush with the ground surface of the shoe. If this is not done, the heads may project unevenly and throw the foot off the level. They will also wear quickly and cause a loose shoe. Hence the importance of using the correct size and pattern of nail to conform to the size and shape of the nail hole and the nailhead seat.

78. Securing the shoe.—The shoe is placed upon the bearing surface of the foot and held firmly in position with the left hand, back up. A nail is placed between the thumb and forefinger of the left hand, *the flat side faced outward*, and the thumb and the fingers are then extended along the right side of the shoe until the nail is held squarely in the center of the most convenient nail hole, usually the third (the third hole on the left side for a left-handed man); with a toe clip on the shoe the second nail hole is generally used. The nail head is tapped lightly with the driving hammer. The nail should be held firmly to determine the feel, and the thumb and forefinger should not be removed until the nail, going soundly, needs no further guidance. The shoe is then grasped more firmly and the nail is driven with slightly increased force. The middle finger, placed on the wall of the foot, and removed before each stroke of the hammer, determines the exact location at which the nail emerges.

With the claw of the hammer the point of the nail is then bent upward until it stands at a right angle to the wall. Next, the head of the hammer is grasped in the hand and the claw is pushed firmly downward, clutching the nail point. A half turn downward and

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a slight pull wrings the point off close to the wall, leaving enough nail to form the clinch. In wringing off nails the hammer is held in the hand nearest the nail point.

As the first nail when driven may cause the shoe to shift, it is essential to place it exactly in the center of the nail hole. If the shoe has altered its position on the foot a pressure on the opposite side of the shoe by the palm of the hand and a few light blows of the hammer on the lower border of the wall where the first nail is driven will move the shoe back to place.

The second nail should be driven on the side opposite to the first nail. When these two nails have been driven the foot should be allowed to rest upon the floor, and the foot and shoe should be carefully examined from all sides. Are the positions of the nails correct? Is the foot axis correct? Does the shoe fit properly? Is its length correct? Does the horse stand evenly upon the ground surface of the shoe? The shoer should not resume his task until he is satisfied in all particulars. If any irregularities exist this is the time for correction. When the shoe has been properly set drive the remaining nails, the fourth nails on either side being driven first. As each is driven *the point is promptly wrung off*. When all the nails have been driven the heads are forcibly hammered well into the crease, securing the shoe evenly upon the foot.

The clinching block is then placed under a nail point. When the driving hammer strikes the nail on the head the nail point is bent over toward the bottom of the foot, and the nail is drawn up into the wall, tightening the shoe upon the foot.

In seating the nailheads into the crease or nail hole, and in drawing up the nails and turning the clinches, begin on either side of the foot and take the nails in the following order: The toe nail, then the heel nail; change to the other side of the foot and take the toe nail, the heel nail, and then the quarter nail or nails; change back to the first side and finish with the quarter nail or nails. This secures the shoe evenly against the foot without drawing the shoe unduly tight on one side, as is the case when one side is completed before the other side is begun.

For very thin-walled or tender feet it is best to seat and draw up the nails one at a time, alternating from side to side and beginning at the toe.

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If the pinchers are used instead of the clinching block, they should be held as shown below.



PLATE XXIV.—HOLDING THE PINCHERS FOR CLINCHING.

After all the clinches have been formed the foot is brought forward upon the knees. With the rasp the clinches are made of equal length, being in length about the width of the nail at this point.





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The end of the nail is brought to a thin edge by filing off the corner on the underneath side and thus forming a short bevel which assists in making the clinch smooth with the wall. A *slight* groove is made in the wall under each clinch. With the clinching block held firmly under each nailhead in turn, the clinch is bent down and hammered in with the driving hammer. It is well to clinch the inside of the foot first, thus removing danger of the upturned clinches tearing the opposite leg. Finally, the smooth side of the rasp is run lightly over each clinch to take off the rough edges that might cause interfering or pick up bedding or other material. Much filing of the clinches weakens them and results in a cast shoe. When finished the clinch should be a trifle longer than the width of the nail at the point where it comes out of the wall.

The rasp is now run lightly around the outer edge of the hoof to smooth off the sharp or rough edge of the wall where it meets the outer edge of the shoe.

The outside wall of the foot *is never rasped* except in the exceptional cases mentioned in paragraph 53.

The toe clip should be hammered back against the wall of the toe after the inside has been clinched on the off feet and the outside on the near feet. In other words, hammer back the toe clip when the right arm is free.

After the shoeing has been completed the foot is again allowed to rest upon the ground, and again carefully examined from all sides.

Plate XXV shows the near forefoot of a newly purchased Cavalry horse. The shoe, as may be seen, has been on for about three months, and the foot is broken back. The lack of symmetry at the heels shows that the shoe was probably not correctly fitted, and that it certainly was not in proper position when nailed on.

The shoer, having learned to fit normal shoes, is prepared to take up the study of shoeing to correct faults in gaits and shoeing as an aid in the treatment of diseased feet.

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PLATE XXV.—FOOT IMPROPERLY SHOD AND NEGLECTED.

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79. Inspection of shoeing.—The horses shod during the day should be ready for inspection at afternoon stables, or other convenient time, in the shop or stable, with their feet cleaned.

The horse should be examined on a level floor, as otherwise it is impossible to determine whether he is standing correctly or not.

1. The following examination should be made while the foot is on the ground:

(*a*) *Pastern and foot axes.*—View the foot from the front and side to determine whether the axes are correct. (Pl. XIX.)

(*b*) *The fit of the outline of the shoe.*—Does it correctly follow the outline of the wall to the last nail hole, and from there extend outward, allowing proper space for expansion? (Par. 63.) Note particularly whether the wall has been rasped to fit the shoe. (Par. 52.)

(*c*) *The toe clip.*—Is it in the center? Is it of sufficient strength, height, properly finished and seated? (Pars. 54 and 62.)

(*d*) *The nails.*—Are they evenly driven, the proper height and distance apart? Have any old nail stubs been left in the wall? (Pars. 77 and 78.)

(*e*) *The clinches.*—Are they of proper size? Are they well turned and set in? Are they smoothed off and not rasped sufficiently to weaken them? (Par. 78.)

2. The foot should then be raised and the examination continued in the following manner:

(*a*) *The shoe.*—Is it the proper size and weight? The last nail hole not farther back than the bend of the quarter? (Par. 56.)

(*b*) *The preparation of the foot.*—Has enough horn been removed? Has too much been removed? (Par. 47.) Is the foot level? (Par. 49.)

(*c*) *Bearing surface of the foot.*—Does the shoe rest evenly on the wall, covering the buttress and showing no air spaces at any point? (Par. 69.)

(*d*) *Concaving of the shoe.*—Is the shoe concaved enough, and not too much? No sole pressure at any point? (Par. 69.)

(*e*) *Use of the knife.*—Has the knife been used on the bars, sole, or frog other than authorized in the exceptional cases? (Par. 47.)

(*f*) *The nails.*—Are they well seated in the crease? Are they the correct size? Are they all of the same size? (Pars. 77 and 78.)

(*g*) *The heels of the shoe.*—Are they the correct width and thickness, properly rounded, without sharp edges or points? Is their length even with the bulb of the frog? (Pars. 18 and 69.)

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3. In cases where animals have been shod with calk shoes the following should also be noted:

(*a*) *Toe calk.*—Is it properly secured and of proper height and length?

(*b*) *Heel calk.*—Are they of the same height as the toe calks? Are they properly turned and finished?

After becoming accustomed to making the daily inspection, the time necessary should not exceed five minutes for each horse.

80. Preparing the foot for going barefooted.—When the soil, the nature of the work, and the condition of the feet permit, it is advisable to remove the shoes and allow the horses to go barefooted.

Going barefooted rests the feet, favors freer expansion, toughens the horn, and assists nature in restoring the foot to its natural condition. However, the feet must have sufficient horn to allow for wear.

Preparation.—Remove the shoe and prepare the foot as for normal shoeing, except that about two weeks' growth of horn is left on to provide for wear. After the wall has been properly lowered and leveled, round the outer edge of the bearing surface from the bend in one quarter to the other with the rasp. The amount of rounding depends upon the thickness and slope of the wall, but generally from one-third to one-half the thickness will be sufficient.

An oblique or flare foot may require about three-quarters the thickness of the wall to be rounded off in order to obtain the correct shape and slope.

When horses are going barefooted, their feet should be inspected frequently, at least every 10 days, and any feet requiring it given prompt attention.

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CHAPTER VI.

DISEASES OF THE FOOT—CAUSES, SYMPTOMS, TREATMENT—PATHOLOGICAL SHOEING—THE MAKING OF PATHOLOGICAL SHOES.

81. Information in this chapter is for the guidance of the Army horseshoer in his capacity as an assistant to his veterinarian. No treatment herein prescribed should be attempted except when directed by the veterinarian or organization commander.

82. *Pathological* shoeing is shoeing for the relief of diseased feet. The bar shoe (Pl. XXVII, fig. 1) is most commonly used because it produces frog pressure, which increases blood circulation and thus assists nature's method of building up diseased tissue. *Removing pressure* means trimming the bearing surface of the foot in such a way that the shoe can not cause pressure upon diseased parts. (Pl. XXVI.)

THRUSH.

83. *Thrush* is a diseased condition of the frog, characterized by an offensive discharge and a maceration, or softening, of the horn.

Causes.—Filth and moisture, particularly when animals stand in stables saturated with urine. It is both a cause and a result of contracted feet: A cause, by reducing the size of the frog and lessening frog pressure; a result, because the small frog of a badly contracted foot is poor in quality and has a lessened resistance to disease. It is frequently caused by high heels.

Symptoms.—At first there is simply an increase of moisture in the cleft of the frog, accompanied by an offensive odor. As the maceration proceeds the discharge and odor become more marked, the cleft deepens, the horn spreads, becomes underrun and loosened, and the sensitive structures are exposed. Lameness is usually absent but it may be severe in very badly contracted feet and in mild cases when the animal is traveling over loose stones.

Treatment.—Dry, clean stalls are essential. Pare away all loose underrun portions of horn, then dry-clean the frog thoroughly with oakum and paint with strong tincture of iodine; when the iodine dries cover the frog with a pine-tar dressing. The astringent pow-

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ders, such as burnt alum, three sulphates (equal parts of sulphate of copper, iron, and zinc), calomel, etc., can also be used. In badly contracted feet shoeing with bar shoes, leather pads, and tar and oakum is advisable to restore the frog to a healthy condition.

CANKER.

84. *Canker* is a chronic disease of the sensitive frog and sole, characterized by enlargement and a spongy, vascular (bloody) condition.

Causes.—Filth and moisture, commonly resulting from neglected thrush; injuries which expose the soft structures and do not receive proper treatment and protection.

Symptoms.—The diseased area is covered with a foul, moist, cheesy material, and the villi are greatly enlarged and softer than normal. The moisture causes a softening and loosening of the normal horn at the edges of the diseased area, which thus becomes larger, until the entire frog, bars, sole, and even the wall may become diseased and have a general spongy appearance and bleed readily. Lameness is usually absent.

Treatment.—First pare the foot down thoroughly, removing all underrun horn, and give it a good cleaning with a strong creolin solution. The soft, spongy material must then be entirely removed with the knife or scissors. Bleeding is usually profuse. A pressure dressing of cotton and oakum can be applied to check the hemorrhage and left in place for a couple of hours. It should then be removed and the foot wiped dry with cotton and covered with pine tar, which keeps moisture away and is an antiseptic, protective dressing; over this a large mass of oakum should be applied and held firmly in place by a foot bandage. Place the horse in a well-bedded stall, which is to be kept dry and clean. The treatment should be repeated at intervals of four or five days, keeping the foot thoroughly trimmed and applying large masses of oakum to produce much pressure over the diseased area. As the parts become normal the soft, cheesy material becomes gradually firmer and more flaky, and the new horn fills in from the edges or from small centers until the entire area becomes covered with a healthy horny layer.

CORNS.

85. A corn is the result of bruising the sensitive sole or sensitive laminæ of the quarters or bars, and appears as a reddish spot in the

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angle formed by the wall and the bar, usually on the inside of the front feet, seldom in the hind feet.

Causes.—Stepping on stones and other hard objects; pressure of shoe on sole, due to lowering the wall too much; shoes too short or left on too long, in which case the wall overgrows the heels of the shoe; heels lowered too much; rapid work on hard roads, especially when the feet are hard and dry, causing a great amount of concussion and subjecting the foot to injury; high heels which remove the frog too far from the ground, thus preventing the proper expansion of the foot; contracted heels.

Symptoms.—Lameness may or may not be present. The horn is discolored, and where bruises and inflammation are severe great lameness is shown and suppuration may occur. When pus is present it burrows into the surrounding soft structures, causing a separation of the horn and making its exit at the heel or around the coronet. This usually greatly relieves the pain and lameness.

Treatment.—Locate the seat of injury and its probable cause by removing the shoe, cleaning the foot and thoroughly testing it with the hoof tester or pinchers. Level the foot if uneven, and if no lameness is present, reshoe, first removing the pressure over the diseased area by trimming or lowering the horn; protect and soften the horn by the use of a leather pad, tar, and oakum. If lameness is present, reduce the inflammation by soaking the foot in cold water or by poulticing it. This treatment usually gives prompt relief. If the lameness increases, pus is probably forming and the underrun horn must be removed, exposing the sensitive structures and providing for perfect drainage. Antiseptic washings and dressings should now be used, the diseased parts being kept clean and protected. A good treatment is carried out as follows: First soak the foot in a tub or pail of creolin solution for a quarter to half an hour, then apply cotton saturated with tincture of iodine and cover with a foot bandage. Repeat dressing twice daily. When pus formation ceases and lameness is no longer present, shoe with a bar shoe, after removing all pressure, and apply a leather pad, tar and oakum.

In emergency cases where the bar shoe can not be made, the open shoe can be used to good advantage by cutting off one branch of the shoe about one-half inch in front of the corn. This will produce the so-called three-quarter open shoe, and avoid shoe pressure on the corn.

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INJURIES OF CORONET AND HEELS (TREADS).

86. These are caused by the animal overreaching—that is, striking the heel of the front foot by the toe of the hind foot. Cavalry horses and lead and swing artillery horses are likely to be stepped upon by the animals following when the column is brought to a sudden stop. They are also caused by the animal resting the heel of one foot on the coronet of another, by stepping upon and thus bruising or wounding the coronet, and by contact with hard or sharp objects.

Symptoms.—Lameness is usually present. The skin is lacerated at the heel or coronet and the parts are sensitive. There is frequently a separation of the hard and soft structures. These wounds, especially those at the quarter and toe, are usually severe and badly infected, and hence dangerous because they are so close to the important underlying structures (joints, tendons, etc.). They require close attention.

Treatment.—Remove all loosened portions of horn, and dress as a wound. Repeat twice daily and protect by foot bandage.

PUNCTURES OF THE FROG AND SOLE—PRICKS IN SHOEING.

87. Causes.—Punctures of the frog and sole are caused by the animal stepping on nails, glass, sharp sticks, etc. Pricks in shoeing are of two kinds:

(*a*) From the nails being driven into the soft structures, causing immediate lameness.

(*b*) From the nails being driven too close, causing a bulging of the inner layer of horn and pressure on the soft structures. Lameness may be in evidence at once, but usually develops slowly and may not appear for several days.

Symptoms.—Lameness, more or less severe. If the animal has been recently shod always suspect the nails. Clean the foot thoroughly and remove the nails one at a time, examining each nail for moisture. Test each hole with the hoof tester or pinchers; when the sore spot is pressed the horse will flinch. If the nails are all right, examine the rest of foot thoroughly in the same manner.

Treatment.—Whether an old or recent wound, trim the horn from about it to establish drainage, clean the wound thoroughly with a strong antiseptic solution, and apply an antiseptic dressing. This may be applied as a wet pack; that is, cotton saturated with the antiseptic or a poultice made with a strong antiseptic solution. If

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the pus burrows under the wall and escapes at the coronet, the underrun portion of the wall must be removed to allow perfect drainage. Repeat drainage twice daily until pus formation and lameness cease, when the horse can be shod and put to work, protecting the foot with tar and oakum and a leather pad. In all punctured wounds of the foot there is danger from infection with the germs of tetanus, or lockjaw, which are usually present in the soil.

QUITTOR.

88. A *quittor* is a diseased condition of the lateral cartilage or other deep-seated structures of the foot, with the formation of sinuses (tubes).

Causes.—Suppurating corns, punctures of the sole, frog, or coronet, in which the cartilage or other tissues are injured primarily or secondarily by the burrowing of pus.

Symptoms.—Swelling of the coronet, with one or more openings (sinuses), which communicate with the diseased area and discharge pus. Marked lameness is usually present. Lameness and pus formation are increased by exercise.

Treatment.—Provide for perfect drainage by removing all underrun horn, trimming away dead tissues, etc.; treat with antiseptic foot baths and apply wet antiseptic dressings. The sinuses may be injected with strong tincture of iodine and a wet pack of one one-thousandth solution of bichloride of mercury (one tablet to a quart of water) applied. Repeat dressing twice daily. Perfect rest is essential. If this does not effect a cure an operation will be necessary.

SAND CRACKS.

89. Sand cracks are splits in the wall of the hoof running in a parallel direction to the horn fibers. They are classified as *toe*, *quarter*, *heel*, and *bar cracks* (broken bar), according to their location. Cracks which affect only the upper border of the hoof are called *coronary cracks*, those affecting the lower border of the hoof are called *low cracks*, while those extending from one border to the other are called *complete cracks*. Horses that have weak quarters are predisposed to it, also those with brittle horn.

Causes.—Excessive dryness of the hoof, causing brittleness; lack of frog pressure; contraction; long toes; heavy shoes; large nails and nails set too far back. Those cracks which start at the bottom, usu-

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ally due to shoeing, are of little importance. Those which start at the coronet are usually troublesome, especially when conformation and feet are faulty.

Symptoms.—A fissure or crack in the wall at toe or quarter. The fissure may be shallow and not cause lameness, or it may be a deep one which extends through the thickness of the wall and, owing to pinching of the sensitive laminæ, causes lameness, frequently with extensive laceration and hemorrhage.

Treatment.—First remove the shoe and soften the horn and reduce the inflammation by cold foot baths or poultices. Then cut away the hard overlapping edges of the horn to prevent the pinching of the laminæ. Shorten the toe, lower the wall, and trim away the bearing surface of the wall so that it does not rest on the shoe for half an inch to an inch on each side of the crack (Pl. XXVI). Apply a bar shoe, providing considerable frog pressure, and keep the foot soft and elastic by applying tar, oakum, and a leather pad. Keep the wall surface soft, especially over the crack, by daily applications of pine tar or an oil. Blisters to the coronet are beneficial by stimulating the growth of horn. A run at grass, barefooted, for two or three months is decidedly beneficial.

In case of toe crack the operation is the same. In shoeing, the wall is cut away at the toe to prevent pressure. A bar shoe, rolled at the toe and with a clip on each side of the crack, is recommended. The bar shoe serves two purposes:

(1) Ordinarily it is not possible to drive the proper number of nails on the side of the affected quarter, but the bar keeps the shoe in place on account of the firm nailing on the other side.

(2) The bar gives frog pressure and expansion, which are desirable because quarter cracks usually result from a weak and drawn-in quarter.

FALSE QUARTER.

90. This term is given to a faulty condition of the hoof in which the horn is thin and weak, and extends from the coronet to the ground surface of the wall.

Causes.—Most commonly caused by barbed wire cutting into and destroying the horn secreting layer of the coronary band.

Symptoms.—The horn of the affected part is usually concave, rough and scaly in appearance, and is much thinner than the adjacent healthy parts of the wall. Owing to the weakened condition of the

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wall, cracks may appear when the horn becomes hard and dry and cause lameness.

Treatment.—This is confined to protection of the weakened area by the use of the bar shoe, removal of pressure, and keeping the foot

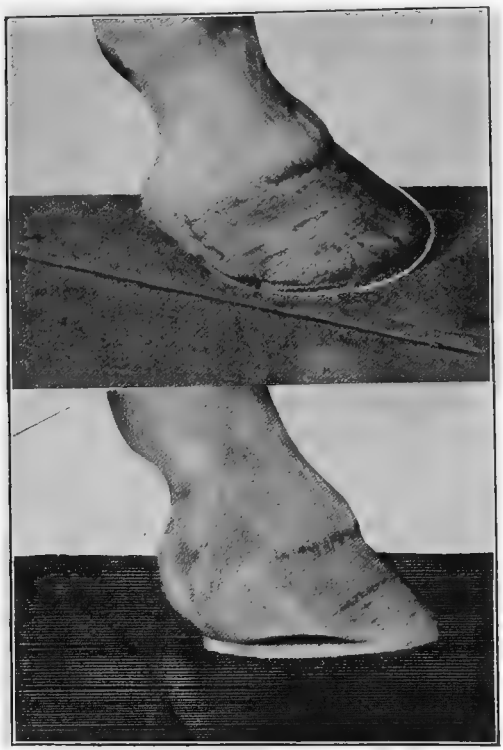

PLATE XXVI.—QUARTER CRACK.

soft and elastic, preferably by the use of tar, oakum, and leather pad. Should a crack appear and lameness result, treat as directed under quarter crack.

LAMINITIS.

91. *Laminitis*, or *founder*, is an inflammation of the sensitive laminæ, usually of the front feet, and may involve the adjoining structures. The pain is very acute, because the swollen laminæ lie between two hard surfaces (the coffin bone and the wall) and are pinched by them. There are three forms: *Acute*, with pronounced symptoms; *subacute*, in which the symptoms are mild, and *chronic*,

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resulting from the acute, with structural change of the feet and chronic lameness.

Causes.—These are many and varied. Concussion, chilling of the body from standing in a breeze while overheated, drinking large amounts of cold water after severe exertion and while in an exhausted or overheated condition, grains eaten to excess, and improper foodstuffs such as musty hay and grain, wheat and new oats, green foods such as alfalfa, clover, and corn eaten to excess.

Symptoms.—In the acute form all four feet may be affected, but the disease is usually limited to the front feet. The animal stands in a fixed position with the front legs advanced, the weight being carried on the heels; the pain is greatest at the toe because the laminæ are largest and most vascular at that place; the hind legs are advanced under the body to relieve the forefeet of weight. Occasionally the animal sways backward, elevating the toes to further relieve them of weight and reduce the pain. He is moved with difficulty because the movement increases the pressure and pain in the feet which remain on the ground. The feet are hot, and the arteries of the canon and pastern have a distinct throb. The animal groans with pain and sweats profusely. The pulse is full, strong, and rapid, beating 60 to 80 per minute. Constipation or diarrhea may be present. Temperature 102° to 106°. In some cases the animal stands persistently; in others he may lie for hours at a time.

Treatment.—*Subacute (mild) laminitis.* This form may be conveniently treated in the field by standing the animal in a pool of water, preferably in a running stream, and removing the shoes if the command is stationary; in garrison by removing the shoes and standing the animal in a soaking stall, wet clay, or water hole. After the feet have been soaked they should always be immediately dressed with cosmoline or other prescribed hoof dressing to prevent evaporation.

Feed laxative diet and give potassium nitrate.

Acute laminitis.—Place the animal in a well-bedded box stall; if in the field, in a soft, grassy, shady spot if possible. If he does not lie down, throw him. This affords great relief by resting the feet and reduces the pain and inflammation. After once experiencing the great relief afforded by lying, the animal will then usually lie of his own accord. Remove the shoes. Give a laxative of 1 or 2 pints raw linseed oil, and give potassium nitrate in 1 to 2 ounce doses three times a day. Apply cold wet packs to the feet and legs as high as the knees and keep them wet. Feed laxative diet. As

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soon as the pain has diminished moderate exercise is beneficial. This may be gradually increased as the animal improves. If recovery is not marked after five or six days apply a bar shoe with a wide web, well rolled at the toe and concaved, and then a blister of cantharides around the coronet; repeat the blister if necessary. Use no toe clips.

Chronic laminitis is permanent laminitis resulting from one or more attacks of the acute form of the disease. In the chronic form there is always inflammation, sometimes more, sometimes less, but never as severe as in the acute form. Laminitis frequently produces great structural changes in the feet, due to loosening of the union between the horny and sensitive laminæ, and a rotation backward of the coffin bone due to increased tension on the flexor tendon. These changes consist of dropped sole, increased height of the foot at the quarters and heels, seedy toe, and a chronic type of inflammation as noted above. When such changes result the usefulness of the animal is greatly lessened, but by careful shoeing he is able to do slow work satisfactorily.

In a case of chronic laminitis, pay special care to the concaving and use a bar shoe rolled both at the toe and at the heel; this is a modified form of the *rocker-motion* shoe. This shoe produces a uniformly smooth breaking over, without much jar.

LOOSE WALL OR SEEDY TOE.

92. Loose wall or seedy toe is a separation of the horny wall from the sensitive wall. The white line becomes thickened and shows a mealy condition.

The separation usually starts in the white line of the toe or inner quarter.

Causes.—Most commonly the result of generalized laminitis with structural changes in the feet; localized laminitis caused by nail pricks in shoeing and stepping on sharp objects; injuries to the wall from blows; pressure from heavy, deep-seated clips; deep hoof branding with irons; excessive moisture, causing disintegration (crumbling) of the horn fibers; foul standings; and by a horn-destroying parasite.

Symptoms.—A soft, flaky condition of the horn, lameness usually being absent. If there is marked crumbling of the horn with the formation of a cavity between the horny and sensitive laminæ,

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lameness may result from injury to the sensitive structures by dirt, and infection and pus formation may occur.

Treatment.—Remove the unsound horn, clean the cavity, protect the foot by means of a leather pad and apply a dressing of tar and oakum. Use a bar shoe, well rolled at the toe; no nails should be driven in the diseased part, but, instead, side clips should be used, care being exercised that they bear only on the healthy horn. Stimulate the growth of horn by applying a blister of cantharides or mercury to the coronet.

NAVICULAR DISEASE.

93. *Navicular disease* is a chronic inflammation at the point where the tendon of the deep digital flexor passes over the navicular bone.

Causes.—Faulty conformation, in which the limb is placed under the body and carries excessive weight; faulty conformation of the feet in which the heels are high and narrow, resulting in excessive concussion; long toes, in which the strain on the deep flexor tendon is increased; standing on inclined surfaces, such as stalls and picket lines with an upward slope, thus increasing the strain. It invariably affects the front feet because the weight upon them is greater than on the hind feet.

Symptoms.—Lameness, which is slight at first, but gradually increases in severity. While traveling, the affected leg takes a shorter step and the toe strikes the ground before the heel comes down. In some cases the lameness may disappear for a day or two. When resting, the animal points the toe, and if lame in both feet the limbs are advanced and the feet rested alternately. If kept in a stall with a soft floor a hole is usually dug and the animal stands with the toes in the hole, the heels resting on the edge. This greatly relieves the strain on the diseased area. As a result of the constant standing on the toes the frogs atrophy (waste away), the heels contract, and the wall at the heels becomes higher than normal. The shoe shows abnormal wear as far back as the second or third nail holes. Pressure over the navicular area with the hoof tester or pinchers causes marked pain. *Bar shoes also greatly increase the lameness.*

Treatment.—The disease is incurable, and treatment merely serves to diminish the effects, though in the first stages treatment may be beneficial. The inflammation should be reduced by means of cold foot baths and poultices, followed by the application of blisters

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around the coronet, after which the animal should be turned out on soft ground for several months. When necessary to use the animal, prepare the feet normally and shoe with the rocker toe (Pl. XXIX, Fig. 1) or a four-calked shoe (Pl. XXVII, Fig. 4), with the toe calks slightly lowered. Keep the feet soft by the use of foot baths, poultices, or the application of a leather pad, tar, and oakum.

SIDEBONES.

94. *Sidebone* is an ossification (turning into bone) of the lateral cartilage, frequently resulting from improper leveling of the foot. Horses with flat feet and weak quarters are predisposed to this disease.

Causes.—This disease is common in heavy animals working on hard pavements and is due to concussion; improper preparation of the foot in shoeing, one side being left higher than the other, thus increasing the concussion on the lateral cartilage on the high side; injuries to the region of the quarter and heels by treads, wire cuts, etc.

Symptoms.—A hard unyielding condition of the lateral cartilage, with or without lameness. The affected side of the foot contracts, as a result of lack of expansion. Lameness is increased by fast travel on hard roads and by a hard, dry condition of the hoof.

Treatment.—If lameness is present, first remove the shoe and level the foot, then reduce the inflammation by cold foot baths and poultices, followed by the application of a blister and a rest of four to six weeks. If lameness persists repeat the blister and rest. In shoeing an animal afflicted with sidebones level the foot carefully. If the foot is affected on one side only and contraction has resulted, the hoof of that quarter should be lowered about one-eighth inch and the web of the shoe widened sufficiently to extend out to where the normal foot would be. A plain shoe with rolled toe is recommended. *Frog pressure produces soreness and must be carefully avoided.*

CONTRACTED FEET.

95. *Contracted feet* refers to an unnatural shrinking or narrowing of the feet at the quarters and heels. It is most frequently seen in the front feet. The feet of some horses are naturally narrow, resembling in shape the feet of a mule.

Causes.—Lack of frog pressure is always the primary cause; contributory causes are lack of exercise and lack of moisture, thrush,

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the continued use of heel calks, concaving the bearing surface of the shoe back to the heels, and opening the heels with the knife.

Symptoms.—The foot, instead of being wide at the quarters and circular in shape, becomes narrow at the heels, which in very bad cases may overlap, the frog atrophies and is frequently affected with thrush. Lameness may be present as a result of the pinching of the sensitive structures by the walls of the hoof.

Treatment.—Frog pressure is essential. If the feet are extremely dry and hard, they may be softened by standing the animal in moist clay or in water, or by the use of wet bandages around the coronets (swabs). After the feet have been soaked they should always be immediately dressed with cosmoline or other prescribed hoof dressing to prevent evaporation. If the animal is to be used on soft ground let him go barefoot, or shoe with the tip (Pl. XXVII, fig. 3); otherwise use the bar shoe with leather pad, tar, and oakum, packing the oakum very tight under the frog.

DRY FEET.

96. This is a troublesome condition, occurring most frequently in dry weather.

Causes.—The moisture of the foot normally comes from the blood, and depends largely upon the circulation, and a certain amount of it comes by absorption from the ground. Shoeing, by raising the frog from the ground, lessens the circulation and interferes with absorption of moisture from the ground. Sudden changes in weather, alternation from wet to dry, and soaking the feet in water cause a softening of the perioplic covering and facilitate the evaporation of moisture from the wall. Working in sandy ground wears away the periople and facilitates evaporation, and rasping the periople produces the same condition.

Symptoms.—A hard, dry, and inelastic condition of the horn. This increases concussion and frequently causes inflammation of the sensitive structures and produces lameness.

Treatment.—Soften the feet by poultices or by foot baths and then apply an oily covering to the wall surface; or pack the cavity between the branches of the shoe with wet clay two or three times a week. This is preferable to soaking in water, as it supplies moisture to the foot and does not soften the periople. Work the animal on soft ground as much as possible.

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An excellent dressing for dry, brittle, or contracted feet is made of the following:

Creolin	4 ounces.
Pine tar	4 ounces.
Raw linseed oil	24 ounces.

Mix and apply to both wall and sole twice a week. When the animal is shod the foot should be prepared and then a coating of the dressing applied to the sole *before* nailing on the shoe. At other times the dressing should be applied at *evening stables.*

Or,

Pine tar	4 ounces.
Cosmoline	4 ounces.
Neat's-foot oil	24 ounces.

Melt together over a slow fire. Apply the same as the preceding dressing.

A blister of cantharides around the coronet is beneficial by stimulating the growth of horn fibers.

97. In this chapter have been treated the common foot ailments of the Army horse. Pathological shoeing for drop sole resulting from laminitis, for bowed tendons, and for other troubles that can not be permanently cured has been omitted from this text book. The Army horse must be ready for hard service. When his feet are incurably bad he should not be nursed, but should be placed on the inspection report.

THE MAKING OF PATHOLOGICAL SHOES.

THE BAR SHOE.

98. This shoe, as previously stated, is more frequently required in Army shoeing than any other special shoe. It is made from the issue shoe, and the general fit and shape when finished are the same with the exception of the bar across the frog.

Select an issue shoe of the desired size and weight to admit of turning the bar.

It is advisable for the beginner to fit the shoe to the outline of the foot before turning the heels for preparing the bar, as the shoe is more easily fitted before welding the bar and the shoer can estimate the amount of stock required for making the bar.

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99. To prepare the heels of the shoe before turning in the bar.

(*a*) **Scarfing.**—This is accomplished by holding the shoe on the face of the anvil (either surface on the face) and striking on the



Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

PLATE XXVII.—PATHOLOGICAL SHOES.

Fig. 1. The Bar Shoe. Fig. 2. The Calked Bar Shoe. Fig. 3. The Tip. Fig. 4. The Four Calked Shoe.

upper edge of the extremity of the heel, the hammer held at an angle of about 45° with the plane of the upper surface. This will result in a bevel between the upper and lower surfaces of the heel

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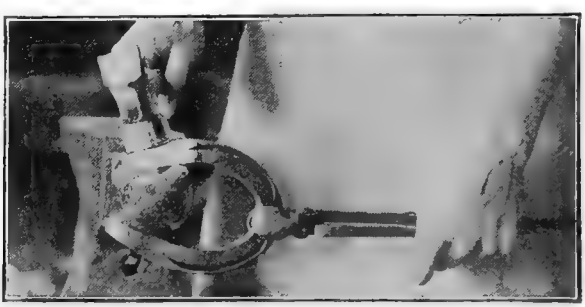
about a half inch in length. Scarf the other heel in the same way, except that the scarf is made on the opposite surface.

(*b*) **Pointing the scarf.**—To insure a smooth weld. This is done by holding each heel in turn so that it will rest at an angle upon the face of the anvil near the heel, and striking on the upper edge at the end.



This cut shows the smith working on the heel of the shoe farthest from his hammer hand, which was done simply to aid the photographer in producing a photograph that would show the angle of the scarf most distinctly, while at the same time give a good view of the position of the tongs and the hand holding same.

100. To turn in the bar.—Hold the shoe with the tongs at or above the toe; place the inside edge of the heel to be turned on the point



of the horn, the quarter nearly horizontal, with 1 inch or an inch and a half projecting over the horn, depending upon the length of the bar required.

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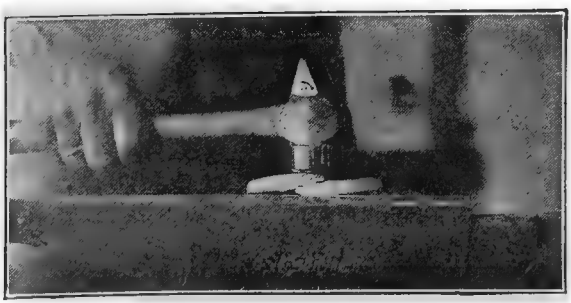
Strike on the upper edge of the portion projecting over the horn, lowering the hand as the bend progresses, and turn in the desired length at a right angle.



The length of the bend should be a little more than one-half the length of the finished bar, as the ends must overlap for welding. Turn the other heel in the same manner.



101. To prepare the bar for welding.—Close the shoe bodily until the scarfed points overlap and then hammer the points down until they fit closely, leaving no space for coal dust to accumulate.



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102. To weld the bar.—Place the bar in the fire and heat to a welding heat (see Heats), tilting or rocking the shoe forward and back to insure an equal heat on both sides. When the proper heat has been obtained (fluxing), place the bar on the face of the anvil and strike a few light blows on one point; then reverse the shoe and strike on the opposite point. This will bind the points together.

Reheat the bar to the welding heat and, taking the same position, complete the weld by heavier blows, reversing the shoe so that both sides will be flattened. After the weld is completed the bar is shaped by holding one corner on the point of the anvil and striking on the center of the bar and then reversing. This will set the center of the bar forward, give it the correct shape at the heels, and prepare it for beveling. The front half of the ground surface of the bar must be hammered down (beveled) to a point as shown in Plate XXVII, figure 1.

103. Fitting.—The bar shoe is fitted as is the service shoe, and the same heats are used. A little more allowance, however, is made for expansion on account of the added frog pressure.

104. To open the toe.—The shoe is heated throughout to an even heat and held upright with the bar on the face of the anvil. The blows



are struck along the toe, thus opening the toe and quarters without changing the bar.

The toe may be opened as in the service shoe.

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105. To widen the heels.—By lengthening the bar.

(*a*) **When the quarters are too long.**—Heat the bar and the heels to a cherry heat. Hold the shoe in the tongs at the toe and place inside edge of the heel on the point of the horn, resting at the point from which it is desired to turn the heel into the bar. Strike on the end of the heel projecting over the horn. Then reverse the shoe and proceed in the same manner with the other heel.



(*b*) **When quarters are of the correct length.**—Heat the bar to a white heat and draw it out by working on the face of the anvil. This will lengthen the bar and at the same time reduce its thickness. After drawing out in this manner, the bar must be leveled with the



upper surface unless the frog is so large that it will produce the desired pressure. The bar may also be drawn on the point of the horn, working on one half and then reversing; this method thickens the bar and should be used if the frog is very small.

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106. To close the heels.—By shortening the bar.

(*a*) **When the quarters are of the correct length.**—Heat the bar and heels and, holding one heel on the face of the anvil, shoe perpen-



dicular, strike on the elevated heel. This will shorten the bar, also narrowing and straightening the quarters.



(*b*) **When the quarters are too short.**—Place an inside edge of the triangular part of the bar on the point of the horn and strike on the part projecting over it. This will turn part of the bar into the heel.

(*c*) **When the quarters are too long.**—Hold the shoe upright, the center of the bar on the point of the anvil, and strike on the toe.



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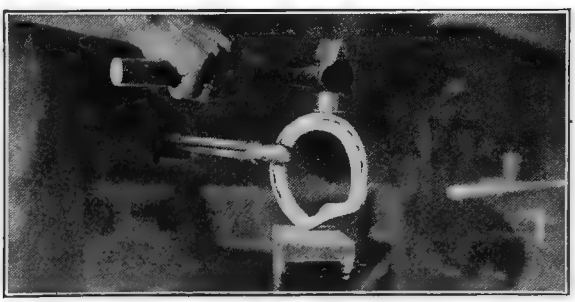
This will push the bar toward the toe and shorten the shoe, bringing the heels closer together.



107. To lengthen the quarters without changing the bar.—Draw out the heels on the horn of the anvil as in the service shoe.

108. When one quarter is longer than the other, to bring the shoe back to its proper shape: Heat the shoe throughout, and, holding it upright with the point of the heel of the longer quarter on the face of the anvil, strike on the upper edge of the shoe directly over the point resting on the anvil.



109. Thinning the bar is often necessary in the case of a large frog. To accomplish this, the bar is welded at about one-half the required length and then drawn out on the face of the anvil, its lower surface being leveled with the ground surface of the shoe.

110. In the case of an exceptionally large frog, it is necessary to curve the bar below the ground surface to allow sufficient room and to prevent too much pressure. Toe and heel calks (Pl. XXVII, fig. 2) must be used with this shoe to insure a level ground surface.

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111. To curve the bar.—Hold the shoe so that one end of the bar rests on the edge of the face and the other on the horn of the anvil and strike on the center of the upper surface.



THE TIP.

112. The use of the tip for contracted heels leaves the foot in more nearly a state of nature than any other shoe. It is sufficient for ordinary work, and is easily applied. It should be thin, only thick enough to hold the nails, and not be flexible. The best tip can be made from an old shoe uniformly worn, the quarters being cut off just in front of the fourth nail hole. Using the rasp across the toe, lower the toe the desired amount as far back as the tip extends. The heels of the tip should be thinned. If after the tip is secured in place the walls back of the tip extend below its ground surface, they can easily be lowered level with the tip by use of rasp.

The tip may be made from bar steel (Pl. XXVII, fig 3). In such cases two nails on a side are sufficient, the nail holes being punched to correspond to the first and third nail holes of a service shoe.

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Chapter VII.

GAITS AND GAITING.

113. General principles.—In shoeing horses for the purpose of confirming or altering gaits, it must be remembered that there are almost as many variations in gaits as there are horses, and that methods which are suitable in one case may be unsatisfactory in another. There are certain important principles which, properly applied, will be of material assistance in gaiting the majority of horses. Shoeing alone will not always accomplish the desired end, but it always helps. To shoe a horse so that he will be properly balanced and will travel squarely requires skill, patience, and careful use of special shoes. Where weight is used, it is always best to start with a small amount of weight and gradually increase it until the desired result is accomplished; otherwise injuries may result from overtaxed, strained, or ruptured ligaments.

When all four feet have been shod, the animal is taken out and again examined on level ground at a walk, trot, and gallop.

The horseshoer must bear in mind that seldom will shoeing alone produce the desired gait or action, but that much depends on proper riding and on the physical condition of the horse.

In all cases of shoeing to prevent injury to a leg or foot by another, if, with careful riding, moderate corrective methods in shoeing do not accomplish the desired results, shoe normally and use boots to protect parts liable to injury.

The use of boots or bandages will render blows of one foot against another foot or leg painless, give the horse confidence, and if the blows are mild, with the use of boots they will only slightly affect his gait.

114. Gaits.—The gaits in the Army are the walk, trot, and gallop. Other gaits, such as the pace and single-foot, are occasionally found, but they are not authorized nor desired.

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115. The walk.—The walk is a four-beat gait, in which the horse lifts one foot at a time, in diagonal sequence, as, left front, right hind, right front, left hind, and plants them in the same order.

116. The trot.—The trot is a two-beat gait with a diagonal movement, in which the horse springs alternately from one diagonal pair of feet to the other, as, right front and left hind to left front and right hind.

117. The gallop.—The gallop is a three-beat gait, in which the horse springs into the air from one front foot and has all four feet off the ground at the same time. The diagonal hind foot is the first to strike the ground, then the other hind and its diagonal front strike simultaneously, and last the foot from which the spring was made.

118. The pace.—The pace is a two-beat gait with a lateral movement, in which the horse springs alternately from one lateral pair of feet to the other, as, right front and right hind to left front and left hind. The feet as a rule are not lifted as high as in the trot.

If the horse shows a tendency to pace, shoe as follows:

First method.—Preparation of the feet normal. In front, use a medium-weight shoe (Pl. XXIX, fig. 2), well rolled at the toe. For the hind feet use normal preparation and shoes.

Second method.—Preparation of the feet normal. Use a heel weight shoe (Pl. XXVIII, fig. 2), and roll the toe. For the hind feet use normal preparation and shoes.

A confirmed pacer can very rarely be converted into a trotter by shoeing. He has no place in the service.

119. The single-foot.—The single-foot is a four-beat gait, in which the feet leave and strike the ground in the order, left front, right hind, right front, left hind. In front the action is high, with a short forward extension. Behind, it is low, with an outward swing to the feet.

A single-footer may be induced to trot by shoeing as follows:

In front: Prepare the feet leaving the toes a trifle long. Shoe with heavy toe-weight shoes (Pl. XXVIII, fig. 1).

Behind: Preparation and shoe normal.

As an aid to induce the single-footer to take the trot it is best to start at a walk and ride the horse with a loose rein and a mild bit up a gentle slope. Just as he increases the gait the rider should seize one of his ears. It is found in practice that this plan distracts his attention and allows the weighted shoe to produce the effect intended. Whenever the horse returns to the single-foot, he should be brought down to the walk and started again with the grasp on

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the ear. This method may sometimes be found of use, but, like the pacer, the single-foot horse should have no place in the service.

In general, when a horse has been shod to improve his gait, he should be ridden with the snaffle bit, which admits of greater freedom of movement. The reins should be held with a light hand, and the horse should be forced up against the bit by the use of the legs.

120. Faults in gaits and corrections for same.—Faults in gaits may be attributed to one or more of five *general causes:*

(1) Improper or careless riding.
(2) Weakness or fatigue.
(3) Diseased feet or limbs.
(4) Poor conformation.
(5) Improper shoeing.

The correction for the first two cases is obvious.

The third case requires special treatment and pathological shoeing.

The fourth case can not be cured, but it may be corrected temporarily by special shoeing.

The fifth case can be corrected by proper shoeing.

121. Various positions and conditions of the feet and their effects on gaits.—Toe too long (poor conformation or faulty preparation of the foot) retards the breaking over of the foot, decreases the height of the action, and increases the forward extension.

Toe too short (poor conformation or faulty preparation of the foot) quickens the breaking over of the foot, increases the height of the action, and decreases the forward extension.

Toes turned in (poor conformation, or feet too high on the inside quarter), causing the foot to break over on the outside of the toe and inducing an outward swing in the forward extension of the foot.

Toes turned out (poor conformation, or feet too high on the outside quarter), causing the foot to break over on the inside of the toe and inducing an inward swing in the forward extension of the foot.

122. Forging.—Forging or clicking is a fault in gait at the walk or trot, in which the shoe of a hind foot overtakes and strikes the bottom of a front foot on the same side.

It occurs far more frequently at the trot than at the walk.

The clicking sound is caused by the toe of the hind shoe striking against the ground surface of the front shoe, usually near the toe.

Causes.—This fault may result from one or more of many causes, but, generally speaking, it is caused by too slow action of the front feet as compared with that of the hind.

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The causes may be divided into two classes—*temporary* and *permanent.*

Temporary causes.—Faulty preparation of the front feet, leaving the toes too long or trimming the heels too low, using shoes that are too heavy, allowing shoes to remain on too long, fatigue, debility, rough ground, poor horsemanship, reins held too loosely, the horse not kept up to the bit. Young horses whose muscles and gaits are undeveloped are apt to forge.

Permanent causes.—Faulty conformation, such as horses with relatively short bodies and long legs, horses that stand higher at the croup than at the withers, and horses that stand under in front or behind.

Corrections.—The general principle involved in the correction for forging is to hasten the breaking over of the front foot and to retard the breaking over of the hind foot.

Two methods are given, the first being milder than the second, though neither is severe.

Temporary forging can usually be corrected by removing the cause, normal preparation of the foot, and a slight modification of the shoes.

First method.—For the front feet use normal preparation of the feet and light-weight shoes with rolled toes (Pl. XXIX, fig. 2).

For the hind feet use normal preparation of the feet and shoe normally.

Permanent forging can not be permanently cured, but it may be prevented temporarily.

Second method.—For the front feet, use normal preparation, except that the wall of the toe is shortened and rounded with the rasp to conform with the rocker toe shoe.

Shoe with rocker-toe shoe (Pl. XXIX, fig. 1).

For the hind feet, leave the toe of the foot a trifle longer than in the normal preparation, use a normal weight shoe, square the toe, and set the shoe back from the toe, allowing two-thirds the thickness of the wall to extend over the edge of the shoe. This projection of the wall must be slightly rounded off after the shoe has been secured to the foot in order to prevent chipping.

INTERFERING.

123. Interfering is a fault in gait in which the horse strikes any part of a leg from the coronet to the knee in front, and to the fetlock behind, with the shoe or foot of the opposite leg.

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The striking usually occurs at the inside of the fetlock joint, and more often in the hind legs that in the front. Lameness frequently results from such injuries.

Causes.—The causes may be divided into two classes—*temporary* and *permanent.*

Temporary causes.—Faulty preparation of the feet; usually trimming the inner wall too low, which throws the fetlocks in (broken in); failure to remove large wings or flares on the inner quarters; fitting the shoe too full on the inner quarters and rough or careless clinching, allowing the nailheads to protrude below the shoes; using too heavy shoes; fatigue, especially in young horses whose muscles and gaits are undeveloped and in horses during convalescence from debilitating diseases.

Permanent causes.— Faulty conformation, found in horses that toe out behind (cow hocked) and in horses with narrow chests that toe out in front (splay footed).

Horses with normal conformation that have correct standing positions and are properly shod do not interfere.

Corrections.—The general principle involved in correction for interfering is to increase the clearance between the limbs by removing any rough or projecting surface on the inside of the foot or shoe and by inducing the feet to break over at the center of the toes, thereby reducing lateral swing.

The temporary causes can be removed by proper preparation of the feet, levelling, using the proper weight shoes, removing large wings or flares, smoothing rough clinches, rounding the edge of the shoe and fitting it close at the inner quarter, seating the nailheads well into the shoe.

It is often of advantage to bevel the ground surface of the inner branch of the shoe by hot rasping, and then rasp the nailheads to conform with the bevel after the shoe has been secured to the foot.

The permanent causes may be counteracted temporarily by special shoeing, but when the special shoe is removed the fault will almost invariably return.

For mild cases use the *lateral extension toe shoe* (Pl. XXVIII, fig. 6). This shoe will cause the foot to break over toward the outside and will tend to straighten the action.

For aggravated cases use the *interfering shoe* (Pl. XXVIII, fig. 3). This shoe will raise the foot on the inside toe and cause the horse to stand slightly toeing in and at the same time will throw the

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fetlocks out. When he moves, the breaking over will be at the center of the toe.

124. Stumbling.—Stumbling is a fault in gait in which the horse fails to raise the foot sufficiently to clear the ground. It occurs either in breaking over, in the forward extension, or in planting the foot.

It results from one or more of many causes.

The causes may be divided into two classes—*temporary* and *permanent.*

Temporary causes.—Fatigue, induced by long marching and carrying or pulling heavy loads; faulty preparation of the foot, toe too long; faulty shoeing, shoes too heavy or fitted too full at the toe; laziness, particularly when going down hill; rough ground; and poor horsemanship. Young horses whose muscles and gaits are undeveloped are apt to stumble.

Permanent causes.—Poor conformation, horses with light fore and heavy hind quarters, and horses with stiff shoulders.

Diseases of the feet and limbs frequently cause stumbling, such as navicular disease, contracted feet, corns, thrush, sand cracks, sidebone, ringbone, sprained muscles, contracted tendons and ligaments, also weakness during convalescence from debilitating diseases.

Corrections.—The general principle is to remove the cause by proper care and handling of the horse and by correct shoeing.

For stumbling in front feet, use normal preparation and shoe with light-weight rocker toe shoes (Pl. XXIX, fig. 1).

For stumbling behind, use normal preparation of the feet and light-weight shoes with low heel calks.

If the stumbling is a result of diseased feet, a shoe must be used that will tend to cure the disease in combination with the rocker toe; as, for example, a foot affected with corns or contracted feet must be shod with a bar shoe made with a rocker toe (Pl. XXVII, fig. 1; Pl. XXIX, fig. 1).

For aggravated cases of stumbling, a shoe with low heel calks provided with a bar and rocker toe may be used for the fore feet.

125. Paddling.—Paddling is a fault in gait in which the breaking over of the foot occurs at the outside of the toe and the foot is carried in an outward circle during the forward extension. It is confined principally to the front limbs and occurs most frequently in horses with wide breasts and turned-in toes.

Causes.—Faulty conformation.

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Correction.—No known method of shoeing will cure a confirmed case of paddling.

In mild cases, or when a young horse shows a tendency to paddle, the following method of shoeing may be beneficial: Normal preparation of the feet; shoe with a three-calked shoe (Pl. XXVIII, fig. 4) with the toe calk on the outside.

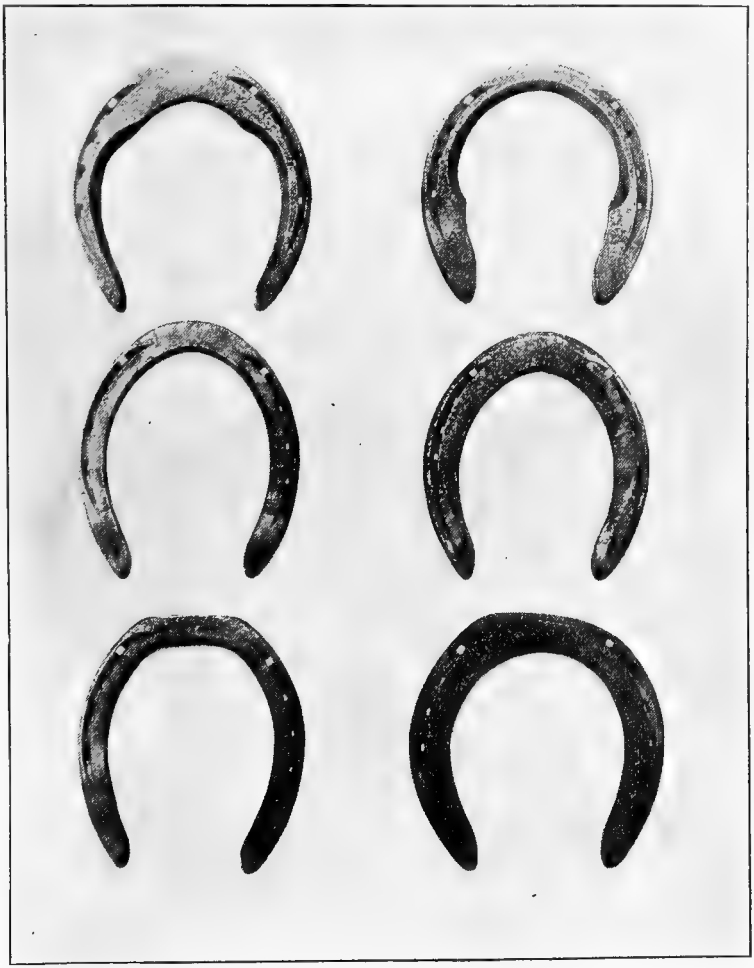

PLATE XXVIII.—SPECIAL SHOES FOR GAITS.

FIG. 1. The Toe Weight Shoe. FIG. 2. The Heel Weight Shoe. FIG. 3. The Interfering Shoe. FIG. 4. The Three Calked Shoe. FIG. 5. The Square Toe Shoe. FIG. 6. The Lateral Extension Toe Shoe.

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126. The making of special shoes for gaits.—In the methods given for making these shoes mention is made of various weights of shoes to be used. In these cases it is not intended to prescribe the weight

Fig. 1.

Fig. 2.



PLATE XXIX.—SPECIAL SHOES FOR GAITS.

Fig. 1. The Rocker Toe Shoe. Fig. 2. The Rolled Toe Shoe.

of shoe as classified in paragraph 55, but rather the weight of shoe which is actually light, medium, or heavy, *compared with the shoe normally worn* by the horse.

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These shoes are all made from the service shoe or from bar steel. The methods described are for the service shoe, but will apply as well for the bar. Any exceptions are specially mentioned.

127. The toe-weight shoe (Pl. XXVIII, fig. 1.)—This is a shoe with the inner part of the web cut away from the quarter and heels, leaving the greatest width and weight at the toe. It may be purchased machine made.

Select a heavy front shoe. Heat to a white heat and with hammer and cold chisel cut away one-half of the web between the crease and the inner edge. The cut extends from the heel to a point opposite the second nail hole, thence obliquely to the inner edge of the shoe. This cut at the toe must be made obliquely because a square cut would weaken the web at that point and cause it to break after but little wear. The creaser may be used instead of the cold chisel. The cut edge of the web is finished by hot rasping.

When made from bar steel the bar is drawn out with the hammer instead of by chiselling to produce the desired widths of web.

The drawing takes place as the shoe is being turned.

This shoe induces a low action and a greater forward extension of the foot.

128. The heel-weight shoe (Pl. XXVIII, fig. 2).—This is a shoe with the inner part of the web cut away from the toe and quarters, leaving the greatest width and weight at the heels.

Select a heavy front shoe. Proceed to cut away the web as in making the toe weight, except that the oblique cuts start opposite the last nail holes.

This shoe induces a higher action and lessens the forward extension of the foot. Rolling the toe gives a more decided effect.

When made from bar steel, the same method is employed as in the case of the toe-weight shoe.

129. The rolled-toe shoe (Pl. XXIX, fig. 2).—This is a shoe with the toe rolled or beveled from near the inner edge of the ground surface to the outer edge of the foot surface, the curve of the bevel being much greater at the outer edge of the ground surface than at the inner edge.

Select a light shoe; heat and place on the anvil, ground surface up. Begin beveling at the outer edge by striking light blows with the hammer along the toe of the web, and gradually working back toward the inner edge.

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This shoe increases the rapidity of breaking over of the foot by shortening the ground surface of the shoe at the toe and lessening the labor of the flexor tendons. It increases the height of the action and decreases the forward extension of the foot.

130. The rocker-toe shoe (Pl. XXIX, fig. 1).—This is a shoe with the toe bent, or rocked upward. The bend at the center of the toe includes the outer half of the web.

Select a light-weight shoe; heat and place on the anvil, ground surface up, one-half of the web at the toe extending over the front edge of the anvil. Strike light blows with the hammer upon the projecting web until it is bent down to an angle of 45° from the foot surface of the shoe. Care must be taken not to draw the toe.

The shoe acts similarly to the rolled-toe shoe, but its effect is much greater.

131. The square-toe shoe (Pl. XXVIII, fig. 5).—Select a light-weight shoe. Heat the toe, grasp one quarter with the tongs, and hold the toe across the point of the horn (similar to the method shown in par. 20 for narrowing the toe), except that the web at the forward end of the crease on nearest quarter is the point in contact with the anvil. Strike light blows on that part of the toe which is over and beyond the horn. Reverse the shoe and repeat on the other half. If properly done this will leave a square toe. Side clips may be used if necessary to assist the nails in preventing the shoe from shifting on the foot.

This shoe gives better support to the foot when approaching the breaking-over point and increases slightly the rapidity of breaking over. On account of its reduced length the shoe does not cover the whole bearing surface of the wall at the toe.

Used behind, in a case of forging, this projection deadens the sound of clicking.

132. The lateral extension toe shoe (Pl. XXVIII, fig. 6).—This is a shoe with a squared toe which extends obliquely from an angular extension on the inside toe to just forward of the first nail hole on the outside toe.

Select a light shoe; heat the toe and place across the horn of the anvil so that the inner edge of the web at the toe fits close to the horn. Strike light blows directly over the toe to slightly thicken the web. This thickening of the web will give sufficient material for drawing out the extension. Place the shoe on the face of the anvil, foot surface up, and strike light blows on the web between the center

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of the toe and the first nail hole on the inside, drawing out an angular extension about one-eighth of an inch wide at the point. Finish by hot rasping. The hot rasping must be more vigorous as it approaches the first nail hole on the outside toe, so that the finished shoe will be widest at the extension and narrowest at the opposite side of the toe.

This shoe causes the foot to break over at the center of the toe and to extend forward in a straight line.

133. The interfering shoe (Pl. XXVIII, fig. 3).—This is a shoe with a low calk near the toe on the inside.

Select a shoe of light weight, and a calk one-eighth of an inch high and about 1 inch long. Weld on the calk to the ground surface of the inner web, close to the crease, extending from just in front of the first nail hole to the second nail hole and parallel to the web.

This shoe raises the inside of the toe slightly, producing a toe-in effect (Pl. XIX), which changes the breaking-over point of the foot toward the center of the toe and throws the fetlocks slightly outward, thereby increasing the clearance space between the limbs.

134. The three-calked shoe (Pl. XXVIII, fig. 4).—This is a shoe with a low calk near the toe on the outside and calks on the heels.

It is made similarly to the interfering shoe, except that the toe calk is on the outside instead of the inside, and with the addition of the heel calks. The heel calks are of the same size as the toe calk and are welded on about three-quarters of an inch from the ends of the heels, and in the center of and running parallel to the web.

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CHAPTER VIII.

SHOEING REFRACTORY HORSES.

135. Most horses that can be classed as refractory in shoeing have been brought to this condition by improper handling when green and unaccustomed to the sights and sounds of a shoeing shop.

When a young horse has been assigned to an organization, a common practice is to send him at once to the shop with instructions that he be shod by quiet means if possible, but by force if necessary.

No greater evil exists in the mounted service. It is as much our duty to gradually train a young horse to submit to shoeing as it is to patiently drill him to surrender to the bit and to work in the saddle or harness.

Rough methods not only ruin the horse's disposition, but subject the shoer to constant danger of injury.

136. Shoeing young horses.—The first step should be to teach the young animal that raising his feet will do him no harm, and this lesson should be given at the first grooming. The method of raising the forefoot and the hind foot, as explained in this manual, should be thoroughly understood by all enlisted men and be a part of the instruction of every recruit.

When the young horse surrenders his foot, lower it again quietly and pat him; later use the brush on the soles of his feet; next tap the soles lightly with the currycomb; finally, take the shoer's position and go through the same steps. This complete instruction may be a matter of a day or of many days, depending upon the animal's disposition, but it should not be slighted nor hurried.

In the department of horsemanship at the Cavalry School the following method is used with young horses that are disposed to kick when their hind legs are first handled. The horse is equipped with a cavesson, which is held by the animal's trainer. A surcingle is placed around the girth. The man that grooms the horse takes hold of the surcingle with the inside hand, in order to move with the horse and be secure against injury. With the outside hand he strokes

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the haunches and legs, gradually working downward. In the meantime the trainer pats the horse on the neck, but corrects him sharply with the cavesson whenever he displays temper. This method is almost invariably successful.

The second step is to let the young horse grow accustomed to the shop. While the horseshoer is at work on a *quiet horse* the young horse should be led into the shop and held by the man who has been grooming him and raising his feet.

The animal *should not be tied*, nor should he be held by any other man than the one he knows and trusts.

When the animal shows neither timidity nor excitement the shoer begins work on the feet. Frequently the removal of the surplus growth of horn is all that can be accomplished without excitement or resistance. At the first sign of either, work for that day should be abandoned and the horse removed from the shop.

The shock of the hammer is conveyed to the joints of the pastern bones, and the green horse, startled thereby, will struggle to free his foot. The shoer can usually handle a forefoot easily unassisted. If a good helper holds the hind leg in a comfortable position on his thigh and holds the hoof firmly with both hands, the shoer can work with more certainty, the shocks of nail driving will be taken up, to a great extent, in the helper's wrists and arms, and the horse will stand quietly.

Patient, quiet work will eventually succeed and thereafter each shoeing is more easily completed.

137. There are, however, certain highly nervous horses in nearly every organization that are refractory as a result of previous bad handling, and in the emergencies of active service there may be insufficient time to quietly prepare new mounts for shoeing as explained above.

In these cases some form of restraint is required, but in each instance no more force should be employed than is absolutely necessary—*the gentlest method should be tried first.*

The cavesson, as a means of correction, will usually make a horse stand still and is to be preferred to the twitch. The war bridle (par. 138) when properly used is an excellent method of restraint. The twitch, although effective, is a brutal instrument, and should never be used except upon an animal otherwise unmanageable; moreover, after repeated use of the twitch the horse dreads any approach of the hands to his muzzle, and can be bridled only with the greatest

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difficulty. Severe use of the twitch will also permanently disfigure the animal's appearance.

138. The war bridle.—The war bridle is made of small rope, preferably five-sixteenths inch three-strand hemp, about 20 feet in length, with a 4-inch loop at one end.

Fig. 1.

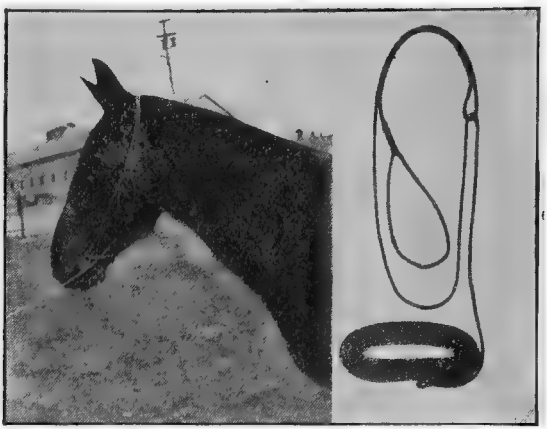

Fig. 2.

PLATE XXX. Fig. 1. The war bridle adjusted. Fig. 2. The war bridle.

To adjust the bridle.—Stand on near side of the horse; place the loop in his mouth, inclosing the tongue and the lower jaw, and hold it in position with the left hand. Carry the rope up on the off side, over the poll and down on near cheek to about opposite the eye; then double it back over the poll, leaving a bight hanging. Pass the running end of rope through the mouth between the upper lip and the gum, and up through the bight on near cheek, then down through the lower part of the loop. Draw the bridle snug without changing the position of the bight.

Effect.—A pull on the rope tightens the bridle, producing pressure on the poll and to a lesser degree on the mouth. This has a very strong moral effect on the horse and induces him to stand quietly.

Methods of use.—For the nervous restless horse that will not stand to be shod: A helper holds the rope, standing close to the horse's head and on the same side with the shoer. When the horse attempts to move or pull his foot away a few light pulls on the rope will quickly quiet him. The helper should use his voice in the quieting. When the horse stands quietly the rope is held loosely. Whenever he moves again, light pulls and the voice will quiet him.

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For the timid untrained horse and for the refractory or vicious horse: These horses can not be bridled and taken immediately to the shop for shoeing. A certain amount of preliminary training will be necessary to educate and accustom them to the use and effect of the bridle. This preliminary training will extend over a period of time, depending upon the tractability of the horse, but usually three or four days will be sufficient. The following system of lessons is recommended as being suitable in the majority of cases.

These lessons should be given daily and for one-hour periods.

First day.—With the horse in the stable or corral, quietly and without hurry put on the bridle and allow him to become familiar with it.

Second day.—Repeat the first lesson and then take a position in front of the horse and out of striking distance from the front feet, holding the rope in both hands. A helper with a light smooth pole (preferably bamboo), about 6 feet in length, slowly and quietly places the pole on the neck of the horse close to the withers, and lightly passes it around all parts of the body and legs. If the horse submits quietly to this, the assistant then attempts to stroke all parts of the horse's body with the hand in much the same manner as with the pole. If the horse becomes unruly or kicks, the man handling the bridle must stop it quickly by a sharp pull on the rope. Throughout the lesson both men should try to soothe the horse by gently patting and talking to him, and refrain from excitement or hurry in any of the movements.

Third day.—This lesson should be given in the shoeing shop. Repeat the first and second lessons, and then slowly and quietly pick up the feet and tap lightly with the shoeing hammer.

Allow the horse to remain in the shop in company with other horses for a few hours to become accustomed to the surroundings.

Fourth day.—The horse is now ready for shoeing, and can be handled as described above for the nervous horse.

Results.—The *war bridle* not only makes it possible to shoe a refractory horse without difficulty, but if used properly it produces a lasting beneficial effect on the horse. The gentling given him in connection with the moral effect of the bridle usually remains with the horse, and he is quieter and more submissive as a result of the experience.

Great care must be taken in using the *war bridle*. Used properly it is excellent, but it is a very powerful instrument and capable of doing considerable damage if used improperly. Only such force

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should be used as is absolutely necessary. When the horse submits or relaxes, in the slightest degree, the rope must be immediately relaxed also to reward him and relieve him from pain.

This bridle has been used extensively at the Cavalry School Shoeing Shop and with such success that it has entirely replaced the shoeing stocks and the twitch to control horses.

It is not always so effective with mules. On some mules it will have the same effect as on the horse; on others the twitch must be resorted to. On account of the lasting good effects, however, it is best to try the war bridle on the mule before using the twitch.

The blind is often found to be of considerable assistance in quieting animals, especially mules.

139. If it should become necessary to tie up an animal's foot the rigging described below should be used.

THE HOBBLE.

The surcingle.—Two 3-inch rings are sewed on the outside of the issue surcingle and are so placed that when the surcingle is adjusted the rings will hang down in the position of the quarterstrap rings of a saddle.

A rope $\frac{3}{4}$ inch in diameter and about 20 feet long; an eye-splice should be made at one end.

This rigging can be easily made in any organization. For use in the field the rope is replaced by a lariat. The cuff and surcingle together weigh only 2 pounds 5 ounces, and can readily be packed in a saddlebag.

TO RAISE A FOREFOOT.

140. Place the hobble around the pastern, the rings above the heels. Pass an end of the rope through the rings and pass both ends over the horse's back to a helper.

The horse's head, as usual, should be held by the man that grooms and trains the animal.

This man should stand on the side of the foot to be raised in order to avoid injury if the horse strikes.

The shoer gently but forcibly flexes the knee and raises the foot, while the helper takes in the slack of the doubled rope. If the horse is fractious, the helper passes both ends through the ring on his side. Grasping the rope close under the surcingle ring with the hand

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nearest the horse's head, and holding the ends securely against the hip in the other hand, the helper is secure against injury, can move with the horse and control the slack to the best advantage.



PLATE XXXI. RAISING FRONT FOOT OF REFRACTORY HORSE, ALSO HIND FOOT, FIRST METHOD.

If a helper is not available, the shoer secures one end of the rope to the **D** rings (by the eye or by a knot), passes the other end through the surcingle ring on his own side and, after raising the foot, ties a half hitch.

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TO RAISE A HIND FOOT.

(FIRST METHOD.)

141. Place the hobble around the pastern, the rings above the heels. Draw the horse's tail to one side and make a loop in it; fasten one end of the rope in the loop by a "single sheet bend." Pass the other end through the D rings and draw it to the rear, where it is held by helpers. The horse is tied, but the head is held as usual. When the shoer raises the foot, the helpers draw in the slack of the rope and the foot is supported (by the animal himself) in a good position for work. If he kicks he can do no harm, as his foot must move along the rope. After one or two such efforts he will ordinarily stand quiet.

If helpers are not available, the end of the rope may be secured to a post or tree, but must be fastened in a manner to permit of prompt release in case of a protracted struggle, during which the horse might throw himself and be injured.

Mr. Churchill, instructor in shoeing, used this device for 14 years in civilian practice with unfailing success. (See Pl. XXXI.)

TO RAISE A HIND FOOT.

(SECOND METHOD.)

142. Place the hobble around the pastern, the rings to the front. Put the surcingle around the neck in front of the shoulders, loosely, so that it will not bind and choke the animal. Make the rope fast in a ring on the surcingle, pass the free end through the rings on the hobble and back through the ring on the surcingle, and draw the foot forward and upward. This is an inconvenient position of the foot for an inexperienced workman, but it prevents the animal from kicking and guards both the animal and the shoer from injury. With a little care the animal can be quickly and properly shod.

If the rigging is not at hand use a 1-inch or 1½-inch rope, preferably the latter size, as smaller rope is apt to burn the animal. Make a loose collar with a short piece of rope, pass a loop of a long rope around the pastern and draw the foot up as described above. If only one piece of rope is available and it is not desired to cut it, tie a bowline loosely around the neck, pass the end of the rope around the pastern and through the bowline, and proceed as above. In using a rope without the cuff the shoer should raise the foot and adjust the

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PLATE XXXII.—HORSE IN STOCKS.

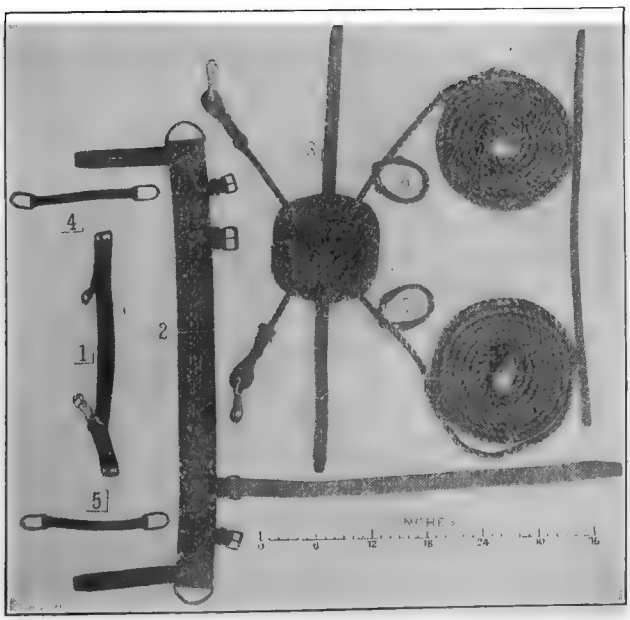

PLATE XXXIII.—HARNESS FOR THROWING HORSE.

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rope in the hollow of the pastern while an assistant takes up the slack; if the foot is raised by means of the rope alone, even a large rope running through the hollow of the pastern is apt to burn.



PLATE XXXIV.—THROWING THE HORSE FOR SHOEING.

143. When it is found that a horse is so vicious that it is dangerous to shoe him unless he is rendered helpless, two courses are open. One is to put him in the stocks; the other is to throw him and tie him down.

The latter method is a *last resort*, to be used only when quieter methods have been tried and proved unsatisfactory.

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The harness used in the farriers' branch of this school to throw horses for minor operations has been found to answer the purpose and does not harm the horse. Throwing and "hog tying" a horse without other appliances than a rope should be avoided, as this method usually burns the horse badly and has been known to result in permanent injury.

The throwing harness (Pl. XXXIII) consists of:

(1) Bellyband with snap hooks for front hobbles.

(2) Breast strap with suspending neck strap.

(3) Saddle pad with crossed ropes, each 20 feet long.

(4 and 5) Front hobbles.

(6 and 7) Hind hobbles.

(8) Check strap, used to connect the saddle pad with halter crown strap.

The harness is shown in detail in the illustration. The scale of inches will enable any good saddler to manufacture it accurately, and Plate XXXIV also shows clearly the manner in which it should be adjusted and used.

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Chapter IX.

FIELD EXPEDIENTS AND PRACTICAL SUGGESTIONS.

144. Shoeing has been described in this book under the assumption that all of the necessary tools, fuel, shoes, and other supplies were available. This will not always be the case.

In the field, shoeing equipment is usually limited, and at times may be reduced to practically nothing. This must not prevent the horseshoer from keeping his horses shod. Except under very unusual conditions of roads, horses must be shod if they are to be worked. The shoer must use his ingenuity, utilizing any implement or means at hand to accomplish the purpose, and it may be safely stated that he *can* accomplish it by one means or another. The degree of his success, however, will depend upon his ingenuity and his will to do the job.

If a forge be lacking, the fire can be built on the ground. Wood, corncobs, buffalo chips, practically any kind of inflammable material, can be used instead of coal to produce a cherry red heat which is sufficient for shaping the shoe and cutting off the heels. In place of the anvil, a piece of iron pipe, or steel rail, or even a block of wood can be used. Wire cutters can be substituted for the pinchers, the shoeing knife for the rasp, and a horseshoe will serve as a clinching block. There are so many substitutes for the driving hammer that it is needless to mention any.

If a forge or other fire is available for only a limited time, the most advantageous use that can be made of it is to obtain heat for cutting off the heels, opening the toes, and making a bend to the quarters. The shoer can prepare many shoes in that manner in an hour, and later complete the fitting "cold." Shoeing can be done "cold" completely, except cutting off the heels.

In Mexico, after an exceptionally hard march in the mountains (110 miles in 43 hours), the toes of all the horseshoes in a certain troop were practically cut through. There were no shoeing tools.

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The whole troop was reshod that night with the assistance of wire cutters and stones.

145. To sharpen the rasp.—To resharpen the rasp is an economical measure at any time, greatly prolonging the usefulness of the rasp, but it is particularly applicable to field service where supply is difficult.

The following method is suggested: Remove the temper from the teeth on the coarse side by holding the rasp over the fire above the coals with the coarse side down. When the teeth commence to show color, remove from the fire and allow to cool slowly. When cool, place the rasp in the vise with the coarse side up. Take a flat mill file and run lightly over the points of the teeth to insure uniformity in length. Next, with an 8-inch three-cornered saw file, the teeth are pointed (sharpened) by running the file at a right angle across the rasp on the front side of the teeth, and completed by filing lightly on the back of the teeth. After completing the filing reheat the teeth to a cherry red heat (holding the rasp above the fire, coarse side down), and cool quickly by immersing the rasp in water. (Any small file will serve in place of the above.)

146. Important field measures.—When troops go into the field, one front and one hind fitted shoe with 24 nails for each animal should be included in the equipment of his rider or driver. If possible, an extra supply of shoes and nails should be carried on the supply wagons.

On the march, officers and noncommissioned officers and the riders and drivers of all animals should be constantly on the lookout for loose or cast shoes; any animal requiring attention should be removed from the column and attended to immediately, unless the exigencies of the march prevent. By these careful measures many animals will be saved which, if compelled to continue the march unshod, would be rendered unserviceable.

After a march the feet of each animal should be inspected by the responsible officer and by the horseshoer as soon as possible after reaching camp; all animals whose feet are found to be in need of attention from any cause should be attended to with the least possible delay.

In case no shoe is available, the animal may be enabled to continue the march temporarily by the use of a piece of canvas, leather, gunny sack, or hide used as a covering to protect the foot.

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147. To obtain speed in shoeing.—When the shoer has mastered the principles of shoeing as set forth in this text and has become fairly skillful in the art of shoeing, the following method will assist him to save time and obtain speed:

The work is divided into four operations—preparation of the feet, fitting the shoes, nailing on the shoes, and clinching, each operation being taken up in order and completed for all four feet before the next is begun.

In fitting the shoes, heat two at a time (fronts then hinds), and when fitted mark each shoe with the hammer so that it may be recognized later for nailing on.

Fitting one shoe at a time and then nailing it on to the foot allows the fire to die down and much time is lost in rebuilding it.

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