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TENDONS AND LIGAMENTS OF THE FORELEG.

From Col. Fitzuygram's "Horses and Stables."

THE
FOOT OF THE HORSE

OR

Lameness and all Diseases of the Feet

TRACED TO AN

UNBALANCED FOOT BONE

Prevented or Cured by Balancing the Foot

✓ BY

DAVID ROBERGE

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Dedication.

TO

ROBERT BONNER,

Whose name is synonymous with everything that is of good report in the realm of horses; who has been my encourager in a very important but little-known field of investigation; who shares equally with me the desire to abolish or mitigate the sufferings of horses which we know to be PREVENTABLE and therefore UNNECESSARY, by the diffusion of a better knowledge of the principles of horseshoeing than what prevails at the present time; who recognizes with me the importance of the art of horseshoeing to the general welfare of society; and would aid in doing all that is possible to promote the highest degree of technical and practical education among horseshoers attainable; and furthermore, as a small but just and honest tribute of personal esteem and gratitude, arising out of an almost constant companionship in study during the past twenty-five years;

AND WITH THE UTMOST RESPECT,

THIS BOOK IS DEDICATED

BY

THE AUTHOR.

PREFACE.

THIS work will be found to be entirely new, and on a different plan from anything of the kind which has yet been presented. The writers upon the subject of shoeing and the management of horses' feet are very numerous, but an analysis of their writings shows that the work of one is often merely a repetition of that of another. The author proposes to lay down a rule for every practitioner or operator upon the foot of the horse. The cuts and drawings are entirely new, differing from any others that have so far been presented to the public. They are the harvest or fruits of the seeds sown over forty-five years ago.

This work on shoeing will show that from one century to another, no science—either medical or mechanical—has yet arrived at the root of the causes from which result the daily ailments and lamenesses. It will cast a new light before the eyes of the veterinary profession, and prove clearly that, instead of the medical science which men have studied from one generation to another, their works have brought forth no recompense. Had they spent their allotted time in the study of mechanical science in reference to the horse's hoof, no doubt they would have found a specific for each and every ailment centuries ago.

The following illustrations of improved methods of shoeing horses—whether for the purpose of preventing diseases and lamenesses or for removing or ameliorating those abnormal conditions when they present themselves—are so simple that any one endowed with ordinary intellect may readily perceive from the various drawings, each suitable to its own disease, how accurately he might arrive at the precise point and make a correct diagnosis, thereby enabling him to prescribe a specific for each case that presents itself.

The accompanying drawings of various postures will enable the operator to form a correct prognosis, as well as an accurate diagnosis, and without being capable of complying with the latter it will be an utter impossibility to assent to the former.

The following mechanical appliances are composed—

1. Of any device which may tend to change the bearing or maintain the equilibrium, such as a shoe formed or constructed in such a manner as the case may require.
2. The hoof itself so modified by paring or rasping as to arrive at the required form.
3. Of any appliance for expanding the hoof, so as to symmetrize the foot proper.
4. The surface on which the horse stands constructed as the case may require, having an ascent or descent, to change the pathological conditions or postures into a physiological stature or attitude.

THE FOOT OF THE HORSE.

Introduction.

REGARDING the introduction of a new theory concerning the foot of the horse, I presume the person claiming its paternal relationship will be expected to make some introductory remarks appropriate to the occasion.

To the best of my knowledge and belief, the theory or system of horseshoeing which I am now about to present to the readers of this book has been in existence about forty-five years.

It is by no means young and crude; it has been in practice for these forty-five years; and now in the full vigor of its ripe maturity I have the honor to present it to all who take any interest whatever in

“That wondrous link in being’s chain,”
the horse.

That inexhaustible subject, *the foot of the horse*, has furnished texts for many a laboriously learned dissertation as well as supplied themes for the pens of ready writers of briefer treatises, both professional and amateur, and yet I have an impression that “the half hath not been told” that may yet be revealed concerning it.

The importance of the horse as a factor in the various civilizations and the different stages of all civilizations, I think has never yet been sufficiently estimated.

Notwithstanding the progress of the equine race in the development of its capacities and possibilities, I deem

it a reasonable inference that when the full requirements of his whole nature from an *educational* as well as a *physical* standpoint are fully appreciated and carried out in practice, not only will there be greater individual achievements in speed and endurance which will shed lustre upon the race, but there will be a great general improvement *all along the line*, very much for the benefit and advantage of the horse as well as of his human proprietor from every point of view.

At the present time, speaking broadly, there seems to be such an inscrutable mystery concerning the foot of the horse and the origin of its diseases that it constitutes a *fatal inheritance* to the whole equine race in domesticated circumstances, that fatal inheritance being the *eternal tendency of his feet* to destroy his natural balance, combined with the lack of knowledge of how to preserve it on the part of his guardians.

From an economic standpoint the horse-raising industry has attained enormous proportions, the census of 1880 showing the existence of eleven millions of horses at that time, and doubtless the last census has shown a great increase in the number, but as it is not at hand I will not risk any misstatement. I merely want to emphasize the magnitude of this industry to show the importance of correct knowledge of the absolute requirements of horses from the earliest period of their *colthood* to the latest day of their *horschood*.

I have an impression that it will be many a day, if ever, before the various utilities of the horse in the armies of the world and in the greater and lesser centres of commerce and population can or will be superseded to any great extent by electricity, steam, or any other force whatever.

Some medical discoveries beneficial to the human race are found to benefit incidentally the equine species, and the comparative pathologist finds so much in common

between the two that he can readily become the efficient medical attendant of both.

It is a regrettable circumstance, however, that while the general progress of human and veterinary medical science has been found to be mutually beneficial, there is one branch of what is called veterinary science in which progress appears to have been fatally arrested. Need I say that this is the branch which relates to the hygienic treatment of, as well as to the diseases and their remedies of, the locomotory system of the horse?

Without going further back than toward the close of the last century, it will be interesting to cite a few facts from a reliable authority upon the state of the knowledge of horseshoeing in England, and to learn if any and what progress has been made therein during the past one hundred years.

Professor Gamgee, in his historical sketch concerning horseshoeing, informs us that toward the close of the last century, "the ablest men at that time who had studied the subject were deeply impressed with the importance of the art of horseshoeing as essential to the state, to agriculture and to commerce, to the efficiency of an army and to the general wants of society."

This was the leading idea that caused the founding of colleges and schools first in France and then in England. The main object was the improvement of the art of horseshoeing; the medical treatment was secondary and incidental. These men regarded the foot as the essential part of the horse; they were observant enough to know that the shoe was an instrument of good or ill, of life or death to the horse, and the *great desideratum* then was felt to be, doubtless what it is to-day, a better knowledge of the art of shoeing horses.

This art must have been in a very unsatisfactory state at that time to have called forth so much of organized effort to place it upon a more satisfactory footing.

Glancing at the first college founded in England, its founders were dominated by the same convictions of the necessity that existed for a system of shoeing whereby the enormous destruction of horse property and values then going on could be arrested.

Professor Coleman, virtually the first principal and professor of the English college, himself declared that "a proper method of shoeing horses was of more importance than the treatment of any, or perhaps all, diseases incidental to the horse."

All through the century this statement or declaration has been repeated and emphasized by every writer of note on the foot diseases of the horse, but notwithstanding all their efforts and their hopes and expectations they were doomed to disappointment, and the waste and destruction of horses, according to Professor Gamgee, was as rife seventy-five years later as the day the first college was established.

The opinion has been often expressed, and I think is very likely to be true, that the destruction of horses and consequently of their value is many times greater from diseases of the feet than from all other causes combined.

The two latest writers of any note upon the subject of horseshoeing have both deplored in similar terms the absence as well as the need of a theory or system that would throw light upon the origin of the diseases of horses' feet, and from the tenor of their observations would have hailed the advent of such a theory as a boon of great importance both to society and to horses.

Professor Gamgee and Mr. Fleming used language very similar to the following: A theory or system of shoeing horses of uniform and universal application that would throw light upon the origin of diseases and put an end forever to ceaseless and useless controversies, which would harmonize conflicting opinions and show the true sequence of the originating cause or causes and

the final effects of disorders of the locomotory machinery of the horse—such a theory or system had not then appeared in either the earlier or the later times.

By some the present century is said to have been the greatest century of progress in the various arts of which we have any historical record, in view of which we might well ask what has been the progress, if any, in the science or art of horseshoeing during that period?

I prefer that this question should be answered by Professor Gamgee, himself a horseshoer and the historian of horseshoeing in the present century.

When he wrote his famous work, as he deemed it, on lameness of horses some twenty years ago, we are informed that he attended the lectures of Professor Coleman at the London college nearly seventy-five years before that time, which must have been shortly after the opening of the college. Professor Coleman had no special fitness for the appointments he held as teacher of veterinary medicine and horseshoeing, having no practical acquaintance whatever with horses, yet this young man of twenty-four years of age was invested with authority to dictate the style or system of shoeing horses to every farrier in the British army and to every horseshoer outside of it. The pupil became a favorite of the teacher, we are told, but this was a poor *makeweight* for the *small quantity* and the poor quality of the teaching. Further, Mr. Gamgee says that the small amount of the teaching was the lesser evil of the two. What he had been taught to believe in and to rely upon as scientific knowledge, when reduced to practice turned out to be mere "verbose trash" or "the expression of crude hobbies."

I commend Mr. Gamgee's observations to the horseshoers of this country. As one of their class he regarded the craft in his day, and probably does so still if he is living, as "a degraded and disbanded craft, a body of

men the victims of bad instruction, and in want of intelligent leadership."

I think I but express the truth when I say the great need of the time to horseshoers, as a body, is higher trained skill in their art, and the "spirit of progress" should inspire them to make efforts to acquire a higher standard of technical education, and that would elevate them as a body in the estimation of the community as much higher than that of the mere veterinary surgeon as the art, or science rather, of shoeing horses transcends in importance to society that of the merely medical requirements of the horse.

As showing what was considered *advanced knowledge* about the middle of the century, a veterinary surgeon named James Turner wrote an essay on *one* disease or lesion of the foot and gave it a name, *navicular disease*. No light was thrown upon the primary causes of the disease, and no remedy suggested beyond the usual firing, blistering, and rest at grass, and, as a last resort, *neurotomy*. From recent works on lameness I don't think much advance has been made beyond this treatment up to the present time.

I had almost forgotten to mention that Mr. Turner recommended *one-sided nailing* in this disease, and this is spoken of as the *unilateral* plan of nailing. Mr. Turner, however, is to be credited with the following estimate of the status of the veterinary profession in his day. He writes: "It has been seized with apathy; no weighty facts of the enduring kind have been chronicled. The remedy and grand requirement of the present crisis is an infusion of fresh vigor and an energetic spirit for research." As horseshoeing was then considered a *branch* of veterinary science, it seems to me that Mr. Turner must have regarded it, as a *dead branch*, as no reference is made to it, though coming clearly within the scope of his remarks.

Twenty-five or thirty years later Mr. Gamgee could review his experience of seventy-five years, and he candidly informs us that he had "oscillated from one set of errors to another during that time," and he describes the system in vogue as an evil of incalculable magnitude. Said he, "Look in our streets, consult owners of horses, and what is the result?" Lameness, the common effect, which damages and destroys more horses than all the other diseases put together to which they are liable. The cause is bad shoeing—the remedy must be good shoeing.

I wish now to say a little about my theory or system and its outcome, the centre-bearing shoe.

I glean from Mr. Gamgee's writings more than from any other that the great desideratum in the art of horse-shoeing to have been considered by all the founders of the French and English colleges, a theory or system, the fundamental facts or principles of which shall be in absolute consonance with the structural fact or principles of the organs of locomotion—a theory or system which shall be of universal application—that is to say, to all horses of whatever kind or description; that it shall throw light upon the origin of departures from normally healthy conditions, and be instrumental in the restoration of those conditions when they have been departed from; which shall, moreover, be easy to understand and acquire, easy of practical application, shall be comparatively inexpensive as to cost, and shall be easily demonstrable.

If this be the theory or system they have been searching for, let them desist from any further search, for it has been found. I claim to have found it many years ago, and I claim also the above theory will be found fully elucidated in these pages.

I have always regarded the horse as a locomotive engine on legs, instead of one on wheels, one being driven

by nerve-force and the other by steam. I never watched a horse's movements without associating with them the ideas of the lever, the level, and the plumb-line at first, and later on of axes of motion, of centres of bearing, centres of gravity, centres of rotation, and so on. A *perfect balance* was soon suggested as the *one thing needful* to keep the horse in perpetual working order.

The idea or principle of PERFECT BALANCE, therefore, is the *master key* of my theory.

I regard a perfect balance of the pedal bone essentially and absolutely necessary to attain or maintain the normal condition of the foot and leg to which it belongs.

This work will show, as well as the language at my command will permit, that not less than fifty-four forms of disease or diseased action which affect the various tissues of which the limb is composed can all be traced clearly and unmistakably to one cause, and that one cause AN UNBALANCED PEDAL BONE.

The discovery of this principle alone would have been one of considerable importance, but I consider the value of this discovery is immeasurably enhanced by the discovery of the centre-bearing shoe, since there is scarcely a lameness of any kind or degree which may not be *immediately* relieved by the application of this shoe, and not only so, but this shoe will facilitate the cure of all curable ailments in a shorter time and without turning the horse out to grass, than by any other means that I have ever heard or read of.

Another brief reference to Mr. Gamgee may be permitted. In his work upon "Horseshoeing and the Lameness of Horses" I find this passage, which shows how closely he verged toward my theory without having touched its mainspring. He writes: "It is perfectly obvious that it would be hopeless to attempt to describe the structures of the whole limb of the horse, or to prove in a detailed manner how the condition of the foot nec-

essarily reacts upon all the joints of the limb above it." My theory was almost within his grasp at that time, although for twenty years before that it had been revealed to me, and later on I had been *teaching* it to many persons in Canada and the United States. Mr. Gamgee had studied well the anatomy and physiology of the horse's leg, but had left the study of its purely mechanical functions to others. It has been my task to describe the structures which he believed would have been a *hopeless attempt* within the limits of his treatise, and I think I have shown in a detailed manner and conclusively how the condition of the foot—in other words, the unbalanced condition of the pedal bone—necessarily acts and reacts *mechanically* upon all the joints of the limb above it.

Honor to Whom Honor is Due.

I suppose I shall find no more fitting opportunity than the present one for the expression of my very deep sense of obligation and gratitude to a gentleman whose name is as familiar as "household words" throughout our broad country, and I have no doubt in regions beyond, to every admirer and lover of the horse. The name of that gentleman is Robert Bonner. If this effort to improve the art of horseshoeing and thereby to benefit society shall eventuate in the success that is hoped for it and believed that it should do, I could not say to whom *the horse and his owner* will be the most indebted, Mr. Bonner or myself.

It has been a severe labor to me to learn a language and write a book of this nature in the "sere and yellow leaf" of my age, and though I long cherished the idea of publishing this theory to the world, yet I verily believe that had I not been reminded from time to time by that gentleman to *work while it was yet day*, the execution

of this purpose might easily have been postponed until it was too late. Shortly after my first arrival in this city from Canada twenty-five years ago I formed the acquaintance of Mr. Robert Bonner, who took an immediate interest in my theory and my mechanical devices for various purposes in connection with the feet of horses. *My material prosperity was assured from that very day.*

I found Mr. Bonner in possession of important facts in relation to the foot of the horse not generally known, and I soon found that I had in him a shrewd and competent critic of my theories and devices.

Thereafter much of that gentleman's time was spent with me in his extensive and valuable library, where it has been his particular pains and I suppose his peculiar pleasure to gather together every publication, of whatever class or kind of books or periodicals of the earlier or the later times, having any near or remote reference to the horse, regardless of merit or cost, and where much "midnight oil" has been consumed in the discussion of our favorite topics. His library was our *debating* ground and his farm our *convincing* ground.

So well posted was he in horse literature that he could lay his hand on any book and his finger on any citation that he wanted in a few moments.

Without having any idea of such a purpose, we might have been said to have constituted a club of two, which might have been called the *Equine Foot Club*, or the *Perfect Balance Club*, or the *Horseshoe Club*, for all our discussions had reference to those questions, and for many years our meetings averaged three more than once in each week. "As iron sharpeneth iron," etc., might have been the motto of our club, for it was in very frequent requisition to remind us of the purposes for which we came together.

Any feasible idea that could be practically tested Mr. Bonner was always willing to test upon his own

horses, which for the last nineteen years have numbered not less than one hundred as an average.

Some explanation is due for the unusual length and the peculiar arrangement of the topics of discussion constituting the first article, which includes our observation on the navicular disease. After considering this matter I concluded to leave them just as they were written. I bespeak a little indulgence in this matter on the part of the reader.

It will be seen that my literary acquirements are not of the highest order; literature is not my *forte*.

As said before, I have had to learn a language in order to be able to write this book such as it is. I hope, however, and believe that the importance and value of the *new information* it conveys will abundantly atone for every lack of excellence discernible in its arrangement or composition. It will be found that some secrets which the foot has carried within it have been yielded up to a close investigation of its *mechanical* construction and arrangement. It will be seen that *mechanical* as well as *physiological* causes are always in operation, tending to produce a derangement of the working parts of the machine, and, further, that mechanical remedies are ever at hand which will infallibly counteract derangement of this machinery, or when deranged restore it again to working order.

A Suggestion to Horseshoers.

There are several very good reasons why every horse-shoer who carries on business for himself should possess a creditable collection of specimens of healthy and diseased bone, of legs of horses below the knee, and hoofs variously mounted and prepared to show the different tissues composing the foot and leg, the attachments and insertions of the tendons and ligaments, and,

I repeat, healthy and diseased specimens of hoofs and bones.

The first reason is the actual and positive knowledge that may be acquired upon the structures composing the leg with their various purposes and functions, and the readiness with which, in case of an argument arising thereon, an appeal can be carried to the specimens themselves.

Another reason, that such a collection would cost very little besides a little time and labor and in a year's time would be worth a good deal more than it cost. Besides, a collection of this nature affords fair presumable evidence that the man owning it has made a study of such matters which have an important bearing upon the question of shoeing either the sound or the lame horse, and he will be regarded as a better authority on such matters than he who owns no such collection. Such a collection would repay in enhanced reputation and increased business many times the value of its cost.

Set a barrel filled with water in the back yard or in a corner of the shop and place in it everything from which you wish to detach the bones and hoofs. In a month's time or less everything will slip easily from the bones, when they can be placed for a few days in *chloride of lime water*, which will give them a better smell and whiten them besides. The hoofs should be cleaned up and trimmed up and be filed up ship-shape for polishing, if you wish to polish them. Before they dry and shrink they should be filled with plaster-of-Paris in any case.

If you wish to polish them nail a strip of thin wood across the bottom of the foot to serve for a handle while doing so. Three grades of fine emery cloth, using the coarsest first and the finest last, should be got. The final rubbing should be given with putty powder and sweet oil, well rubbed on with a flannel rag.

Legs should be got up in cool weather and should be

fresh. I would recommend you to get a *scalpel and forceps* and do the thing right. "If at first you don't succeed, try, try again." You will soon get proud of your achievements in that line, and I hardly need tell you such a collection kept in a glass *cupboard* or *cabinet* would be as *good as gold in both pockets* from the increased business it would bring you, *all other things being equal*.

I should have added that after separating the tendons and ligaments of the leg with small bits of wood the specimens should be allowed to dry in a cool, airy place such as an open shed, and they should be hung near the roof.

Foot Anatomy of the Horse.

1. The most obvious fact about the horse's foot is that its external portion, the hoof, is a very hard and comparatively unyielding substance, and that it forms a complete envelope or inclosure for the protection of the sensitive, living portion of the foot within it.

The next noticeable fact is that within this horny inclosure there is a bone, a very peculiarly shaped bone, which is called the pedal bone, though sometimes it is called the foot bone or the coffin bone. I shall always refer to it as the pedal bone. This bone has three principal surfaces, one which corresponds exactly with the inner surface of the hoof, one that rests upon the horny sole, and the other surface is called articulatory, because two other bones are in conjunction with it to form a joint. The other two bones are the small pastern or coronary bone and a very small bone called the navicular or sesamoid bone.

The Pedal Joint.

2. The joint formed by the three last-named bones is called the pedal articulation or joint. The pedal bone has what may be called a *vital union* with the internal

surface of the horny wall of the foot, by means of a large number, nearly five hundred, of thin strips of tissue running from above downward and *interleaving* a similar arrangement upon the internal surface of the hoof. These little strips are called lamina for the singular and laminae for the plural.

The Foot Constantly Enlarged by Growth.

3. I wish early to emphasize the fact that the foot is constantly enlarging by growth, and that this fact has a paramount bearing upon the theory to be enunciated in this book.

Points on Pointing.

4. The union of the hoof and the pedal bone is of so vital and essential a character that it is impossible to interfere with the functions of one without affecting those of the other.

The foot which enjoys perfect equilibrium to-day will have lost a portion of that equilibrium by to-morrow, and this law goes on increasing every day until the overgrowth of horn has destroyed the horse's due balance so that he can neither stand nor travel at ease; thus showing that this extra growth of horn requires trimming and paring very frequently in order to preserve the balance which results from the maintenance of the proper size and proportions of the hoof.

Any increase or surplus growth of the hoof, whether at the *toe* or the *heels* or the *sides* of the foot, will cause the horse to *point with his foot in the direction of the elevated portion of the foot*. Whether it be with the toe of the hoof or the toe of the shoe, he will *invariably* point in that direction.

Correspondingly, if the *heels* of the fore foot or of the shoe be too high he will just as invariably point or stand

back under himself, which is pointing in the direction of the high heels.

Again, if too high on the *outside* of the hoof, whether it be from the foot or the shoe, or from both combined, he will extend his limb out sideways in order to gain relief from pain caused by his *unbalanced foot*, always remembering that he points in the direction of the elevated part of the foot.

Similarly undue height of the hoof or of the shoe, or of both combined, on the *inside* portion of the foot will cause the horse to cross his legs, by putting one foot in front of or behind the other. These various positions of standing are all symptoms of *loss of balance*, and if not rectified in time are conducive to further troubles, and *lameness* is the usual result.

This of itself should be proof enough of the importance of knowing what is *good form* for a horse's foot, and also of restoring this *good form*. These deviations are the first causes of the multitude of infirmities to which the foot and leg of the horse are perpetually liable from an unbalanced hoof. A perfectly balanced foot means perfect rest while *standing* and perfectly free and easy movements while in motion.

Equilibrium Essential.

5. The equilibrium of the horse is solely dependent upon the condition of his feet. If his feet are in such a shape as to compel him to point *in any direction* for relief, either with one or more feet, he must certainly be off *his physical balance*, in proportion to the degree or the intensity of the primary cause.

Horny Feet and Fleshy Feet.

6. It has often occurred to me that fleshy-footed animals, that is to say, those whose feet mature with the growth of their bodies, such as the elephant, the camel,

and the dog, seem to enjoy an absolute immunity from diseases of the foot and leg except those which arise from accidental circumstances, while the feet of the horse are the very fountain-head of his miseries. The reasons for this can be easily understood when we remember that the feet of fleshy-footed animals, as I said before, mature with the growth of their bodies, and therefore are not subject to changes by growth as are the feet of horses

Why Fleshy-Footed Animals Do Not Point.

7. These feet grow to a size in proportion to the body of the animal and no larger, and they undergo no change in formation or symmetry from their birth until death. Their weight is carried on lines of bearing which are terminated by a cushion in the shape of a hemisphere or half-ball. This form of the cushion enables it to rock over easily, and its elastic properties cause its adaptation to every inequality of surface it has to travel upon. This accounts for their not pointing or resting first on one foot and then another, and for their standing always, unlike the horse, with the axes of their legs parallel to each other. There is an *apparent* but not *real* exception to this rule in the *pointer dog*; he points, but his pointing has nothing to do with the *structure* of his limbs.

More Points on Pointing.

8. I have described four different positions in which the horse may find relief, by extending his limb, from pain produced by an unbalanced hoof or foot. Those four positions would form four right angles, but as this does not describe all the positions in which he can stand to gain relief, I will supplement them with four more. These eight points will describe an octagon, each angle being one of $22\frac{1}{2}$ degrees. The rule is to be con-

stantly borne in mind and it will be frequently repeated that when there is an undue elevation of the foot at any one of these eight points, the foot will *invariably* be pointed in the same direction as that of the undue elevation itself. Thus the horse himself always points to the seat of the trouble with his own finger as it were, and enables you to locate it with ease and absolute certainty.

Explanation of the Chart on Pointing.

9. A fuller explanation of pointing will now be given (see the chart on pointing).

It may be observed that a horse may point with his foot in any direction of the mariner's compass, but for all practical purposes they can be reduced to eight.

1. The inside heel of the hoof or the shoe, or both combined, being too high, the leg will be pointed backward and inward (see Cut 9, Fig. 1).

2. Both heels of foot or shoe, or both combined, being *too high* will cause the leg to be pointed directly backward (see Cut 9, Fig. 8).

3. Outside heel being too high will cause the leg to be pointed backward and outward toward Fig. 7, Cut 9.

4. Midway outside being too high, the pointing will be straight outwardly toward Fig. 6.

5. Outside toe being too high, the pointing will be forward and outward toward Fig. 5.

6. Middle of the toe being too high will cause the pointing to be directly forward toward Fig. 4.

7. Inside toe being too high, the pointing will be forward and inward toward Fig. 3.

8. High midway inside will cause the pointing inward toward Fig. 2, but as there may not be space enough between the two limbs, he may have, as said before, to cross his legs, by placing one foot either behind

or before the other to find relief. This completes the octagonal circuit of the foot. These eight points will be sufficient to explain the rule that I wish to enforce very strongly, namely, *that the horse always points to the exact location or seat of his trouble.*

More About Pointing.

10. These various positions do not apply to one foot alone, as we frequently see horses pointing with both fore feet simultaneously in any of these various directions and with the hind feet as well.

Horses with both fore feet elevated at the *toes* will stretch or point forward with both feet in order to gain relief, and in stretching forward with the fore feet they are compelled to stretch backward with the hind ones in order to *brace themselves* against falling backward. On the other hand, when both fore feet are too high at the *heels*, they will get into a position the exact opposite of that in which they stand when their *toes* are too high; that is to say, they will place their fore legs backward and their hind legs forward in order to prevent themselves from falling forward. Some sapient horsemen regard this position as "*speedy sign*," not knowing that the poor animal, prompted by natural instinct, finds that position its only relief from pain.

Toeing In and Toeing Out.

11. When *high* at both *outside* heels, the heels are turned outwardly and the toes inwardly; this is termed *toeing in*; when *high* at the *inside* heels, the heels will be drawn toward each other, causing an outward direction to the toes; and this is called *toeing out*. This will also cause him to point with his *hind foot* forward of a vertical line at an angle the opposite of that of the forward feet, in order to balance himself. If he were to stand

back with his fore feet and naturally upon his hind ones he would fall forward upon his head. High *midway outside* with both feet will cause him to point straight outwardly with both feet at the same time, a position called *straddling*. This position leaves a space between the limbs in proportion to the elevation of the outside portion of the foot. When too high at the outside toes he will point in an outward direction with both feet. Sometimes he will rest them alternately in all these various positions. Too high at both inside toes, he will point inward and forward, bringing his toes together and leaving a space between the heels. This also produces the condition *toeing in*.

When too high midway inside he will bring both feet together, and in order to brace himself he will stand with his hind feet and limbs wide apart.

Results of Overgrowth of Hoof.

12. We have now described all the various positions in which a horse can stand or travel, caused by an abnormal growth of hoof.

It may be asked why the *horse* should be so easily affected by the inequalities of bearing upon the bottom surface of his foot. This question may be suggested by the fact that he may go apparently sound while in motion, the action of his limbs being perfectly uniform, and nothing be observable to indicate any serious trouble, and yet after a drive or when standing he may assume one or more of those positions we have described. The answer to this question will soon appear.

A Perfect Balance Important.

13. I am perfectly convinced that when a horse enjoys his proper balance he will stand well and stand at ease *all the time*. He will not stretch out nor assume

any of those positions, nor persist in maintaining them if he should assume any of them temporarily. He may after a hard drive rest one hind foot and one forward foot alternately, with the other two feet well under him; but when this is the result of mere fatigue it soon passes away.

Occasionally a horse may be observed standing in the stable, resting *diagonally* upon one fore and one hind foot; this is done to relieve *a pain in the back* from a *twist* which is occasioned by the weight of one quarter being unsupported when he points but one affected leg.

A Little More Anatomy.

14. A horse constantly standing in one of the positions referred to gives evidence of some obscure trouble. In paragraph 2 I made mention of three bones, the pedal, the coronary, and the navicular bones. As already stated, the pedal bone is suspended by laminae to the interior surface of the hoof. Resting upon the pedal bone is the coronary bone, and in conjunction with the navicular bone those bones form a joint called the pedal joint.

The Pyramid of the Pedal Bone.

15. The part which the pedal bone plays in the economy of the foot justifies this brief description of its peculiar construction. There is no other bone like it in the whole system of the horse. Notice the peculiar elevation of its highest part, which is called its pyramidal process, from its resemblance to a pyramid. Its highest point will often be referred to as the apex of the pedal bone. This bone has a remarkably large extent of articulating surface which admits of a sweep of movement extending through nearly half a circle. It should be noted also that this joint is formed on the principle of

the common hinge, which admits of motion only in two directions, and that therefore it has no lateral or one-sided motion. The importance of these points of construction will be seen later on.

16. We will now refer to Cut 1, *a*, to show what constitutes a sound horse with perfectly balanced feet where-in the horny fibres at the *heels* grow in the same ratio as at the *toes*; that is to say, where the growth of the entire hoof is equally distributed as shown by the parallel lines of the outer fibrous structure running from the coronet to the base of the foot, *h, h*.

Above the lines *f, f* is shown a foot of just proportions; just as nature designed it.

The lines *g, g* show that the heels *by mere growth* are advancing toward the centre of the column; and the lines *h, h* indicate that this natural and necessary growth has carried the *toe*, and therefore *its bearing point*, considerably beyond the *true* point of bearing.

Ridges Upon the Hoof.

17. Still refer to Cut 1. The lines *f, f* determine the natural height of the hoof. The vertical line at letter *c* divides the length of the foot into two equal parts when of the proper height.

The ridges circumscribing the hoof should be at an equal distance apart all round, or in lines parallel with each other as shown in Cut 7.

The highest part of the foot is indicated by the widest space between those ridges.

* Letters *f, f* and line *c* indicate a uniform foot, whatever may be its particular formation.

Now that we have a perfect hoof in its different phases, the pedal bone within it, attached by laminae in its proper position, will also be perfectly balanced, as it is nothing more nor less than a duplicate of the hoof in

a miniature form. Having a well-balanced foundation the next bone above it will be in its proper place at its natural angle, so that the axes of both bones will come together as shown in Cut 1, letter *i*.

This conjunction of bones forms the basis of all the movements of the limbs, which will be fully explained hereafter, but is referred to here to show that while these bones preserve their just relation to each other, that is, that their axes of bearing perfectly coincide, the horse will not place his leg forward or backward of the vertical line.

Perfect Equilibrium Necessary.

18. We frequently see feet on which the hoof has been allowed to grow to the length of two inches or more. Now, suppose a case in which the *point of bearing from growth* is two inches beyond its natural point of bearing, then a vertical line *e, e* from the true centre at the bottom of the coronary bone will fall close to the point of bearing near the heels, instead of falling to the centre of the foot, and the toe would be correspondingly forward of the same vertical line (see Cut 1, letter *e*).

It is a necessary inference from these considerations that in proportion to the change of base, be it little or much, whether by growth of hoof or the application of a shoe, so will be the danger to the structures carried upon that base. In other words, the normal conditions of the foot and leg and harmony of movement while in motion depend absolutely upon the perfect equilibrium of the foot.

How Long Will a Perfect Foot Keep Perfect ?

19. Now that we have described a perfect balanced foot and in what it consists, the question may arise, how long will it remain in this condition? I answer,

just as long as it undergoes no changes either laterally, lengthwise, or in height from the coronet to the base of the foot. To demonstrate this view, take a column, say of wood, and four feet long, about the length of a horse's leg. Bevel one end of it at an angle of fifteen degrees and stand it upon the bevelled end, and the column will adapt itself to this bevel or angle by the upper end leaning over in any direction corresponding to the angle of its bevel (see Cuts 14, 15, and 16). In the horse the upper end of the column is fixed, and the lower end being movable it is swung in the direction of the highest part of the bevel, in order to find if possible an even bearing upon the ground, and by that means to keep the bones of the pedal joint in their just relations to each other. This action of the horse is called *pointing*. We may further remark that if the outside half of the hoof be higher than the inside half, or *vice versa*, the horse, in order to keep his limb in a vertical line, would have to carry his weight upon one side or the other, as there is no sideway action of the pedal joint.

The Leg a Pendulum.

20. In a well-balanced foot the articulation of the pedal joint is limited to a given space which is equally divided anteriorly and posteriorly, so that when the limb is in motion it can reach as far one way as the other, like the pendulum of a clock that swings to an equal distance both ways. Now

Unbalancing the Pedal Bone

21. By raising the toe or the heels would have the effect of limiting or blocking the forward or backward movements of the limb. For example, if we elevate the toe unduly the apex of the pedal bone will press against

the anterior surface of the coronary bone, which is followed or accompanied by the end of the coronary bone, pressing with undue force upon the navicular bone and the perforans tendon which lies immediately at the back of it, and a *shock* and *limited action* are the result. This will prevent the horse from getting the foot back under his body while progressing. When the heels are raised the tendency of this condition is to throw undue strain upon the extensor pedis at the apex of the pedal bone, thereby overtaxing the suspensory ligaments from the opposite direction.

The Pedal Joint a Common Hinge Joint.

22. In order to emphasize an important fact in this connection I will again briefly describe this joint. It works exactly like a common hinge, having no side motion whatever. It follows from this that if any undue elevation *at any part of the hoof* takes place by abnormal growth of horn or any other cause, there will be a *distortion* of the pedal joint, and in order to ease the pain occasioned by the distortion the horse would try to get an even bearing of the joint by pointing with his foot in the direction of the most elevated part, and thus distribute the bearing evenly upon the surfaces of the joint by bringing the axes of bearing of the coronary and pedal bones together, as seen in Cut 1, letter *i*. Hence, the primary cause of pointing is an unbalanced pedal joint, which may proceed from the elevation of any other part of the foot as well as from a raised toe, for the reason that there is no other limit to the rotation of the coronary bone posteriorly than the resistance afforded by the extensor tendon at the apex of the pedal bone. In both cases supposed we should have *shock* and *limited action* while the animal is in motion.

Pointing During Motion.

23. The incidence or fall of the foot while the horse is progressing forward will also be directed toward the various positions that the foot assumes while standing. When too high at the toe he will travel short and in advance of his chest, not bringing his limbs back past a perpendicular line, as it would separate the axis of the coronary bone posteriorly from the axis of the pedal bone and throw the apex of the last-named bone against the coronary bone (see Cut 4, letter *a*) to such an extent as to cause pain to the animal, and, *vice versa*, too high an elevation of the heels would have the opposite effect, which is to separate the axis of the coronary bone from that of the pedal bone anteriorly as seen at Cut 3, letter *a*, thus blocking the articulation backward. In this case the horse will not extend his limb forward of his chest while progressing slowly, and still less when moving with greater speed, as the incidence of the foot will be forced in a more vertical direction, being more directly under the shoulder, and the step will be finished too far back under the body.

Wrenching the Pedal Joint.

24. When high outside the inclination of the fall of the foot will be outwardly, as there is no lateral motion or action of the pedal joint. If the limb were thrown straight forward, the whole weight of the animal would be thrown upon the highest part of the hoof, causing a great *distortion* or *wrenching* of the pedal joint, and also a straining of the ligaments which surround that joint. The same effects would be observed if the undue elevation of the foot were upon the opposite side.

Essential Knowledge.

25. Notwithstanding that I have given the causes of horses' pointing in various directions and also how they adapt their gaits correspondingly, it is very essential to know the cause of the elevation or the increased growth at these eight different points. It has already been mentioned that the fibrous structure of the hoof from the coronet down to the base of the foot, as seen in Cut 1, and also the ridges circumscribing the hoof as seen in Cut 7, should be uniform in growth, that is to say, that the fibres should grow at an even distance apart in lines parallel to each other, as far as they extend, in order to constitute a sound and well-balanced foot. It is nothing unusual to find horses with those ridges deviating at various points all around the hoof, coming close together in places, then running apart, leaving quite a space between themselves at another point, the latter indicating a surplus and the former a deficiency of growth. At the point where the lines are farthest apart the hoof always grows faster, and therefore always the *highest*, and where the ridges come close together the hoof is invariably the *lowest*. So it is very evident that without the knowledge of this peculiarity in the growth of feet it will be impossible to *pare* them so as to properly balance the pedal bone and the pedal joint.

Great Irregularities of Growth.

26. I may remark that I have treated horses with such vast irregularities of growth as to necessitate an artificial appliance in order to balance the foot, and to give the joint which may be distorted by an abnormal growth of hoof a free and natural articulation. This will be referred to again later on.

Different Forms of Feet.

27. The cuts will represent different forms of horses' feet, as well as the various shapes they are liable to acquire under different circumstances. These drawings will show that when the feet resemble any of these eight cuts they are liable to acquire ailments peculiar to their formation. In other words, all feet of the same formation are subject to the same class of ailments, and therefore can be submitted to the same remedial measures of treatment, and when in motion their articulations will be affected in the same way.

Objects Made Alike Perform Alike.

28. I have frequently observed that all objects in creation which are *made* alike *perform* alike. It is certainly so with machinery; when of the same construction it works alike. It is equally true, I think, of living beings. Take for example the different species of animals in a profile view, and any one will arrive at the same conclusion that all animals of the same formation will act alike. To prove this theory to be correct, compare the build of the Newfoundland dog with that of the greyhound; the former's build is best adapted for slowness, and the latter's for speed. So that when this rule fails to work among certain animals we must not condemn the rule. In machinery when a certain part gives way, by restoring the duplicate of what gives way the work goes on just the same as before.

The Missing Link.

29. In like manner when the mechanical construction of the horse's foot is fully understood there will be very little difficulty in the application of the remedy.

It is when we fail to discover the part of the machine that is missing, or when we make the wrong appliance, that the living machinery of the horse's leg fails to work. The principle, however, is right, for when, after making different trials, I supply just what is wanted, the horse tells me in his own language, improved action, that the *missing link* has been found.

Intimate Connections of Pedal Bone and Hoof.

30. As said before but cannot be too strongly enforced, the pedal bone and hoof are so intimately connected that the effect of any disproportion of the hoof *must be* transmitted to the pedal bone.

The column of bone constituting the leg has been described as braced by a number of tendons and ligaments, the most powerful of which have their termination in the small pastern and pedal bones, which with the navicular bone form this important joint, so that it is manifest that any effects transmitted to the pedal bone, by any form or changes in form of the hoof, are also transmitted to the pedal joint and to the tendons and ligaments with which it is connected.

Chart of the Foot.

31. It will be remembered that all the deformities of the foot, as far as perceivable, have been traced to eight different parts around the circumference of the foot as seen in Cut 9. I wish to state now most emphatically that to those eight points of division, whether they be too high or too low at either point—as also that the lower circumference of the foot being out of just proportion, by which I mean that the foot may be out of just proportion in length as well as width—I repeat that to these eight points of division of inequalities of

height and to that unequal circumference I attribute the primary causes of all the ailments incidental to horses' feet which are referred to in this book.

Professor Williams and Navicular Disease.

32. In our discussions as to the cause or causes of navicular disease I feel sure that it is perfectly allowable to refer to the views which have been expressed by the most recent writers upon this subject. Professor Williams' work on the "Principles and Practice of Veterinary Surgery" I presume may be considered to be the best work of its kind at the present time, as it is used as a text-book, I am informed, in several veterinary colleges in this country.

"Rheumatoid Diathesis."

33. This means an inherited tendency to a disease *resembling* rheumatism. On page 337 of the work just referred to, the author assigns as the chief cause of navicular disease a *rheumatoid diathesis*, and *concussion* as a secondary or proximate cause. The author also informs us that many able writers held widely different views as to its primary causes. What they held to be *primary* causes I deem to be but secondary.

Sprain and Compression.

34. We regret having to take issue with so distinguished a writer as Professor Williams, but in the interests of truth and progress in correct veterinary knowledge and science as regards foot diseases, we enter the lists with confidence. We dissent from the opinion that the *rheumatoid-diathesis-concussion* theory affords a sufficient explanation of the origin of navicular disease. We have treated all kinds of obscure ailments of the pedal

joint during the last forty-five years, and our earliest theory as to its cause or causes—that is, *that navicular disease is due* to SPRAIN AND COMPRESSION, sprains of ligaments and tendons and compression of bones, and during that time we have never seen any reason to modify that view; on the contrary our experience has been such as to confirm it in the highest degree. Robert Bonner agrees with me.

“Facts are Stubborn Things.”

35. When you know how to *counteract* or *prevent* a certain disease in every instance, and when you know also how to *cure* it where it exists, and to prevent its return, I think you are not very far from knowing something about its cause. I deem that I am justified in saying that my theory as to *sprains and concussion* being the main and common causes of foot diseases of the horse can be sustained by the strongest evidence that I know of—*facts* of observation, *facts* of practice, and *facts* of demonstration, and if there is any other criterion by which the truth of my theory can be judged, I should like to be informed of it. A fuller explanation of my theory will be given as we proceed. If

The Rheumatoid Theory

36. Of Professor Williams is a correct one, why is it the hind limbs are not affected as well as the fore ones, since rheumatism and presumably rheumatoid diseases are *shifting* in their character, and in human experience are not partial as to which extremity they attack?

Relative Advantages of Position of Fore and Hind Limbs.

37. As helping to throw light upon the causes of navicular disease, it will be instructive to review Professor Williams' position on the above interesting ques-

tion. It was stated by that gentleman himself, and as he could not answer it to his own satisfaction I will endeavor to answer it, not doubting that in doing so I shall convey instruction to my readers, and that the professor will *return thanks* for the information at the earliest opportunity.

The following are the two positions the professor has taken upon this matter:

1. That the hind limbs are *less favorably placed* than the fore ones; and that therefore

2. The hind limbs are more exposed to diseases than the fore ones, which means that the fore limbs are more favorably placed than the hind ones, and that in consequence the fore limbs are *less exposed* to disease than the hind ones.

Disadvantages of Position of the Fore Legs.

38. I hold the *exact opposite* of the professor's propositions to be the truth, for the following reasons:

1. The fore limbs have to carry about two-thirds of the weight of the whole body, while the hind ones have to carry but about one-third of that weight, and I would remark in passing that one consequence of this is the increased danger that arises from *knuckling* in the fore extremities over that from the hind ones.

2. There is a lack of *flexibility* in the fore legs between the body and the fetlock which has no existence in the hind extremities.

Observe that when the fore limbs are unfolded, they form a rigid and inflexible column from the elbow to the fetlock. Now two-thirds of the weight of the animal having to be sustained and carried forward by these two rigid columns, the joints below the knee in these columns must receive a greater amount of strain and pressure than the hind ones, which not only have to carry but one-

third of that weight but which enjoy a high degree of flexibility as well. I will now leave these considerations to be *weighed* by the reader, and will return to the subject at a convenient opportunity.

Causes of Navicular Disease.

39. It has been acknowledged by different authors that height and length of the toe is one of the causes of navicular disease, and it has been seen that this cause will produce strain and sprain of the perforans tendon on account of its attachment to the pedal bone in its under and back part, and though recognizing a mechanical origin for this disease to this extent, no one seems to have suggested a mechanical remedy except the *stereotyped* recommendation, *lower the toes and pay attention to the shoeing*.

A Natural Gauge.

40. If a shoe with a *toe calk* is attached to the hoof, the *calk* becomes an instrument, or gauge, by which we can determine by its length and height the degree of strain or rigidity this tendon receives at each finishing of the step. It will be found that the shorter and lower the toe is the less strain there will be, and the longer and higher the toe there will be the most strain, and all will be in exact proportion to the height and length of the hoof or of the shoe, or of both combined, when a shoe is affixed to the foot.

Weight Must be Carried.

41. It should be remembered that when the fore extremities of a horse become diseased he is not relieved from the necessity of carrying weight. His *pointing* enables him to relax the strain upon his tendons and liga-

ments, but his weight has to be sustained by the other tissues just as much as if his feet enjoyed their perfect balance.

Ulceration of the Navicular Bone.

42. When the abnormality of a horse's foot is such that relief is only obtainable with his fore feet back under the centre of his body, or by pointing backward, he will have to carry more weight while in that position than before, so that while relieving the existing pain he overtaxes other parts of the pedal joint, and fever being usually present in lameness, the synovial fluid of the joint becomes absorbed, dryness and friction of the articulating surfaces necessarily result, and these conditions I have no doubt will account in some degree for the condition met with in severe cases of navicular disease called *caries*, or ulceration of the navicular bone.

The Relative Advantages of Position of Fore and Hind Limbs.

43. We will now proceed to the consideration of a few more facts relative to the above question, which throw much light upon the origin of diseases in that obscure region of the economy of the horse.

It will be seen that the fore feet are subject to peculiar difficulties in formation and position, considered in their relation to the hinder ones. One of these difficulties is due to the difference between the *inclinations* of the fetlocks of both fore and hind limbs *from the vertical line* at the instant each step is finished. As said before, the knee when unfolded, and the foot is planted upon the ground, becomes inflexible while carrying weight, causing more strain upon the pedal joints of the fore feet than upon the same joints of the hind feet, where the hock and pastern joints are so formed as to bend and

straighten alternately at each flexion of the hock and fetlock joint, and unlike the fore pasterns are favored by being allowed to retain more of their obliquity at the finishing of the step, which obliquity exempts them from many troubles to which the fore feet are liable from the much greater flexion of their pasterns; in other words, the greater flexion of the hock calls for less flexion of the hind pasterns, while the lesser flexion of the knee requires the greater flexion of the fetlock.

Relaxation of Tendons.

44. The relaxation of tendons is produced in this manner: At the time that the hinder legs are inclined backward, and the toe is about leaving the ground, the hock suddenly straightens and relaxes the back tendons, thus preserving the due obliquity of the pastern. This relaxation of the tendons of the hind pastern allows them to remain more oblique to the finishing of the step than the pastern of the fore legs; and for that reason the former are less liable to navicular or any other disease than the latter.

Mobility of the Hock Joint.

45. We may further observe that there are no two bones of the *hinder* limbs which form a vertical and inflexible line by their union; it is otherwise in the fore limbs. The mobility of the hock joint is constant, and it is due to that mobility, and to not having to carry so much weight besides, that diseases and disabilities are so much less frequent in hind legs than in fore ones.

Hind Limbs Have Greater Facility for Rest.

46. My reasons for believing that the fore limbs are not more favorably placed than the hind ones are not yet exhausted. Note the greater facility which the horse

enjoys for rest when the hinder limbs become lame, as they can be so easily disburdened from weight by simply pointing forward, thus throwing a greater amount of weight upon the fore legs.

A Lame Horse at Grass.

47. Let us glance at the horse after being turned out to pick up his own living.

Many horses have a short neck, and when his natural formation is such he reaches the ground with difficulty while grazing. Observe how the fore extremities will be overtaxed by the extra weight thrown upon them, which otherwise would have been borne by the hind feet. The fore limbs become a pivot, almost a turning-point, over which his body has to be balanced while grazing.

Straddling and its Consequences.

48. Sometimes the horse *straddles* to accommodate himself to circumstances; at other times he will keep one foot far back, midway under his body, and while in that position that foot has a backward angle, and is carrying more than its due share of weight, and the strain upon the perforans tendon is increased always in proportion to the distance of the leg backward. That strain has to be resisted mainly at the pedal joint, and in a lesser degree by the large pastern joint. None of these conditions occur in the hind feet, where, though the leg may be at the same angle backward as the forward one, the pastern remains more oblique, thus exerting little or no pressure upon the navicular bone. It is well to remember that the superincumbent weight thrown on the pedal joint of the fore feet is not the only factor to be considered, it is the lack of balance and due proportion of the hoof itself while carrying weight, which,

owing to its construction, may add to or take from an equal amount of strain imposed by the weight of the animal upon these joints.

More About the Pedal Joint.

49. The pedal joint has many aspects from which it may be considered. We are now able to study its relations to the question of the *leverage pressure* which the navicular bone and the perforans tendon receive under certain conditions.

A Law of Nature.

50. Nature has laws which forbid transgression, and never was it better demonstrated than when the harmony of the parts composing the pedal joint has been disturbed. The horse can enjoy neither peace nor rest if the *balance* of his foot cannot be maintained. The symmetry of the foot is represented in Cut 1, at and above the line *f, f*, where the foot has been supposed to be reduced to its designed height.

When this reduction of hoof is to its due lines of proportion, either by the natural wearing away of the hoof or by the judicious use of the knife and rasp, then, as seen in the same cut at the vertical line *c, c*, the columns of the limbs are placed where they should be and remain, midway between the heel and toe.

An Interesting Problem.

51. Here we may explain why it is that horses cannot exert their full power when called upon to start a heavy load, if their toes are too long. They are forced to place their legs at such an angle backward that the heels cannot touch the ground, and as a consequence they get up on their toes, and they appear to exert their full powers

when in reality they do not. The perforans is not in a position to exert its full power, having no support under the heels. Such a support is necessary in their great efforts to start the load, for the combined action and the exertion of the full powers of the perforans, the perforatus, and the suspensory ligament, and this power cannot be supplied for such occasions, and raising the heels would be a disadvantage as soon as the load was started, or the animal drawing a lighter load. All that can be done in such a case is to keep the toe as short as possible and the heels reasonably high.

An Adverse Force.

52. A clear idea of the amount of force which a horse has to overcome when in progression, through undue extension of the toe—and let it be remembered that the force he has to overcome from this cause is the exact equivalent of the power he has lost in overcoming that force—may be gained by studying the following little problem in mechanics.

Suppose we were to disarticulate a well-balanced foot at the pedal joint and divide it equally through the centre from toe to heel. Three points on that section would enable you to construct a wedge-shaped triangle. The point of the wedge would be at the toe; the other two points, one would be at the centre of bearing on the highest point of the apex (Cut 10, letter *a*), and the other would be at the bottom of a vertical line from that centre of bearing to where the foot touches the ground at letter *k*. Now suppose that the distance between the two *lower* points was three inches: it will be readily seen that if we extend the line at the toe one inch, we shall have created a resisting force equal to one-fourth of the length of the supposed line, and this being a resisting that has to be overcome, it will be the

equivalent of the power which the horse has *lost* in the act of progression.

Leverage Power.

53. From this it will be readily perceived how by mere extension of the toe, either by growth or by the application of a shoe, or by both combined, the leverage can be increased, and injurious influences exerted upon the pedal joint and its connections the navicular bone and the perforans *immediately*, and through those tissues to the other component of the leg remotely. It will be evident that undue height as well as mere extension of the toe will produce an adverse leverage pressure upon the perforans and navicular bone, particularly in a ratio proportionate to the elevation and length of the toe. The least idea we can gain of this undue length and extension is furnished by the horse himself, who always places his leg or legs at an angle proportionate to the elevation or extension.

Difference Between Level Extension and Elevation.

54. It is worthy of remark that a horse knows the difference between a *level extension* of the toe and an elevation at the same part of the foot. With a perfectly level foot, although the toe be longer he can stand at ease *without pointing*; he only feels the effects of a *long* toe while in progression. With an *elevated* toe standing or moving, he is incommoded in proportion to the degree of the elevation, and he shows it by pointing his foot.

Soft Roads and Hard Roads.

55. It has just been stated that height of toe is more injurious than mere length of toe, for the reason that mere length of toe does not materially change the balance of the foot while standing. The axis of the joint

is not displaced as by height of toe, unless it is by standing or travelling on soft ground, like sandy roads into which the heels would sink, and the toe would turn up and cause strain to the perforans tendon. A horse having extra high toes is always placed at a disadvantage on hard or soft roads, and can find no rest for the sole of his foot until the bearings of his feet have been readjusted.

A Question Answered.

56. Many persons wonder why it is that after a three or six months' run at grass horses are often worse than when they were turned out. This has been partly explained already (see paragraphs 47 and 48), but will bear a little further explanation. The chief reason is that many horses while feeding on grass have not the time to relieve themselves by *pointing* and pick up their living too. To relieve themselves from pain they must stop eating, and eating only aggravates their misery. When both feet are affected he cannot reach the ground without serious inconvenience. In such cases they are compelled to straddle, and such a position produces severe strains upon the perforans tendon and the navicular bone.

A Suggestion to Professor Williams.

57. I think I have shown conclusively that Professor Williams has need to revise his observations on the causes of navicular disease; and I hope that he will glean a little information from my observations on the relative advantages of position of the hind and fore limbs as regards their liability to diseases.

The Reason Why.

58. I think it is clearly due to the disadvantages of position that the navicular disease is so much more frequent in the fore than in the hind feet.

When we consider the numerous deformities of the fore feet as compared with the hinder ones, and the consequences in sprains of tendons and compression of bones, and various peculiar manifestations of disease, there can be little difficulty in arriving at a just conclusion as to relative advantages of position of the fore and hind feet, and that the latter escape many ills which the fore ones endure.

Causes of Navicular Disease.

59. At one time this disease was supposed to exist in the shoulder, as the horse so afflicted would move in a manner indicating stiffness in those parts. That was only the usual error of mistaking effects for causes. Even now I believe not only in England but in this country the same error is in constant repetition, and setons are inserted into the shoulder when the lameness has its origin in the foot.

Professor Williams and English Notions.

60. By reading the causes and remedies for navicular disease, it will be noticed that they disagree very widely in their theories as to its causes and the proper treatment.

We believe that all the proximate causes of this disease are traceable to one principal cause, and that is an unbalanced foot in some form or other, of which *pointing* is an infallible sign.

Pointing or extending the limb in advance of the chest is admitted universally by veterinary writers to be one of the symptoms accompanying navicular disease. Constitutional or hereditary causes seem, however, to be more in favor than mechanical ones.

Blocking the Pedal Joint.

61. In referring to a *high toe* as the principal cause of this disease, and remembering, as it has been previously mentioned, that the pedal bone and hoof by their union constitute the foot, the toe of the hoof or shoe being unduly elevated the pedal bone becomes elevated correspondingly, and this causes a *blocking* or pressing the apex of the pedal bone against the lower pastern bone as seen at Cut 4, letter *a*, causing strains of the tendon and ligaments of the pedal joint at the junction of the perforans with the pedal bone (letter *d*).

Many Ailments, One Remedy.

62. It has been already mentioned that one remedy could be applied for different ailments, and the occasion for proving the truth of this statement presents itself *right here*. The proof is simple and convincing when the different diseases are enumerated and their causes explained.

Diseases Produced by a Too High Toe.

63. We will take direct height of toe for illustration, and follow the many localities in the leg which can be affected by a too high toe.

1. We find for one injured part the joint nearest the deformed hoof, that is to say, the pedal joint, which is subject to navicular disease.

2. The lower pastern joint, which is subject to ring-bone from the same cause.

3. A morbid enlargement of the soft tissues often seen between the cavities of the heels, caused mainly by sprains of the inferior suspensory ligament.

4. Knuckling of the pastern.

5. Windgall above the fetlock.

6. Sprain of the perforans.

7. Knee sprung, or curvature of the

8. Thoroughpin above the knee, causing a junction being usually a little above and behind the joint, in some cases appearing on the inside rather than exactly behind.

9. A bony enlargement often to be seen upon the large pastern in front and inclining to the side, called *high ringbone*.

These nine ailments are all produced from one simple cause, namely, *undue height of toe*.

How One Cause Produces Many Diseases.

64. Undue height or length of toe, or both combined, I consider the primary cause of many distinctly diseased conditions, such as sprains and enlargements of the various ligaments and tendons of the leg, bony and other enlargements connected with joints, atrophy or wasting of various tissues, such as the muscular tissues of the shoulders and other parts. You may ask, how can sprains of tendons and bony and bursal enlargements be produced by one simple cause such as you have mentioned? Because the perforans tendon when subject to abnormal tension by undue height or length of toe, or by both combined, and also through accidental or false stepping, causes a compression of the joints directly over the elevated part right down or up the front of the leg, as well as sprains of the tendon itself. Any prolonged abnormal pressure or compression of the joints caused by an unbalanced foot must inevitably change healthy into diseased conditions. Hence, diseased action in bones produces splints, spavins, and ringbones, and small or

anywhere wherever diseased action may
 p rule they occur on or near the joints.

Reference to the Different Localities.

65. There are at least nine different localities on the limb of a horse where diseases of various tissues can be produced by undue elevation of the toe. Simply lowering the heel is the remedy for all those diseases. Keeping the foot at its normal level and balance is also a preventive as well as a curative measure for the ailments of all different localities, which have yet to be referred to at length separately.

One Disease at a Time.

66. It is worthy of note that when a horse is afflicted as above mentioned, he is seldom affected in more than one of those localities at the same time, notwithstanding that he may be liable to all of them. The reason for this is that when a painful sensation exists due to any mechanical cause, the implicated member is used so sparingly as not to tax it any more than possible, and not until the existing ailment has ceased will, as a rule, another appear, although exposed to the same exciting causes. These last ailments are no exception to the general rule, namely, that in all injuries to which the horse is subject in his feet, when they have a mechanical origin, the existing disease becomes a preventive of others.

Pointing Locates the Deformity.

67. It has already been stated that pointing of the feet is a symptom indicating some deformity of the feet, and also that this *pointing* locates the deformity. In treating of the anatomy of the extremities of the leg,

it has been shown that the extensor in front of and flexors at the back of the leg bind together and direct the movements of the last two bones, the coronary and the pedal bones. It may now be added that those tendons, the flexors and extensor, may be seen to serve as *braces* by which the *jointed* column of bones is kept in its proper position. This use of the tendons will be readily recognized, and serves to strengthen my theory as to the chief cause of navicular disease. At every step by the horse when going perfectly sound, these tendons are exerted nearly to their full extremity, but when an abnormal elevation of the toe occurs, as it is perpetually by the growth of horn, these tendons, especially the back ones, must be taxed beyond their normal strength. From whatever point of view taken, when you have the *key of the question*, but one conclusion can be arrived at as to the cause of navicular disease, and that is an undue elevation of the toe.

My First Case.

68. It may not be altogether uninteresting to make some reference to the first case that engaged my attention, and to the circumstances which led me to the study of horses' feet and their maladies, as well as mechanical devices intended to cure or alleviate those maladies. It was that of a horse with feet resembling those of a mule, and who pointed with both fore feet. The symptoms were those of a pronounced case of navicular disease. Standing without pointing, as he would sometimes, having *all toe and no heel*, his weight was supported by the toes only, his heels not coming near the ground. His feet were narrow and circumscribed by deep ridges and furrows. The front part of the hoof bulged out like that shown in Cut 5. In order to obtain support from his heels he would point his feet so as to form an angle of

by forty-five degrees. When at that angle the heels would reach the ground, and assist in bearing weight. When in progression his steps were almost a continued series of tumblings and trippings. The animal was purchased to tread a horse-power machine.

While in the ascending position a still greater space was left between his heels and the slats than when standing on the ground. Under these conditions he travelled still more upon his toes than he did while walking on a level floor. His feet were very long, so I cut them down cautiously and tried him again. Finding no benefit I cut them still more and put on a shoe with raised heels. This improved matters a little, but the calks would slip in between the slats, so I had the calks made long enough to cover the space between the slats when put on sideways, and I then found a remarkable improvement in the horse's way of going. This took place in the fall and winter, and in the spring following he travelled perfectly sound on flat shoes, nothing having been done to him but to keep his feet pared down and in a well-balanced condition.

Column and Base.

69. My success with my first case inclined me to take a mechanical view of all forms of lameness that I met with after that time, and I bought horses for experimental purposes, and my neighbors considered me very *lucky* in my purchases. One of the first mechanical ideas I had about the foot and leg of the horse was that of a column and a base of support, such as the following: Suppose four inches for the base of a column about the same length and breadth as a horse's foot, and a column about four feet high to represent a horse's leg; two of these will represent a horse's fore legs. Let one of these columns be standing perpendicularly. If one-fourth

inch of elevation be placed under one side of the base of the said column (see Fig. 15), it would throw its highest portion, the top of the column, one-sixteenth part of its length from the vertical point (see Fig. 14). One-half inch would throw it one-eighth from a vertical point and one inch would incline it one-fourth from the vertical point, which would be an angle of $22\frac{1}{2}$ degrees. This is strictly applicable to the foot and leg of a horse. The same degrees of *elevation* by growth of horn or by artificial appliances will produce exactly the same degrees of inclination in the limbs of the horse, *if they were free to move at the top*. As they cannot move at the top, the horse points with his feet at the same angle of inclination as if they were free to move at the top, in order to adapt himself to circumstances.

Judgment and Discrimination

70. Are therefore necessary as to the amount of elevation or depression required to produce an equalization and levelling of the treading surface best represented by the term balance. These are easy to acquire by those who will take the trouble to understand the *reason why* for everything they do. Horseshoers should therefore be familiar with the following considerations. When a horse *points* he may do so because his toe is too high, which is the general cause of his *pointing*, but occasionally it is because his toe is *too long* rather than *too high*. It may be remarked that the navicular bone becomes more compressed by the perforans tendon following the fetlock as the pastern approaches the vertical line. The reason for this is that the tendon necessarily follows the angle of the pastern, and when the pastern is vertical it causes the tendon to *press* or to *pry* the navicular bone against the coronary bone (Cut 4, letter *k*), while if the pastern be very oblique the perforans tendon runs

in a straight line to its point of insertion into the pedal bone (Cut 11, from *k* to *f*), and therefore does not press so heavily against the navicular bone while in that oblique position (Cut 11, letters *O* and *E*). Many writers have noted the fact that horses with marked obliquity of pastern are not predisposed to navicular disease, but I am not aware that any one has before explained the reason.

Oblique Pasterns.

71. It will be well to bear in mind that the different obliquities of the pastern can also be produced to a great extent by artificial devices, such as by paring the hoof at heel or toe, or by means of a shoe high at heel or toe. In this way we can produce or prevent the navicular disease to a great extent.

A Mechanical Problem.

72. I want now to trouble the reader and especially the horseshoer with a little problem that I wish them to understand, because it throws much light on the movements of that remarkable bone, the pedal bone, and how the pedal joint is made to act and react upon all the joints above it. It is and must be very clear that upon the elevation or depression of the *toe* at the moment it leaves the ground depends the elevation or depression of the heels. The movements of the toe and heels will produce a tightening and a slackening alternately of the perforans tendon, and a correspondingly oblique or upright pastern, just as surely as night follows day and day follows night, and with the same certainty that the turning of a peg would have upon the string of a violin. A correct appreciation of these movements will enable one to locate the various injuries that affect the ligaments and tendons of the leg with more certainty than where there is a lack of that understanding.

To Lessen the Tension Upon the Perforans.

73. There are lesions of the *perforatus* and of the *suspensory ligament* where a high-heeled shoe, no matter how high or of what form, will effect no immediate relief to the horse, but any injury to the *perforans*, from its intimate and direct connection with the pedal bone, may be *always and instantly* relieved by an appliance that will *lessen the tension* of that tendon.

Navicular Disease and the Form of the Pasterns.

74. We have not quite finished our observations on the *form of the pasterns* in relation to the causes of navicular disease. Two facts of observation have been made that have been too obvious to pass over, I suppose, but no explanation of those facts has been ventured upon that I have seen or heard. Now as I agree to consider them as facts, I wish to give my reasons for that agreement. The facts referred to are that navicular disease is usually associated with upright pasterns, and rarely met with in oblique pasterns. These facts, I think, are susceptible of proof from merely mechanical considerations, and ought, I think, to be sufficient to dissipate the notion that the "*rheumatoid-diathesis*" theory has got the smallest particle of a leg to support it.

Analysis of Pasterns.

75. I will analyze three examples of pasterns: one extremely oblique, one extremely vertical, and one I will call the *happy-medium* pastern (refer to Cut 11). I want to show how the obliquity or uprightness of the pastern joint alters the position of the pedal bone in its relations to the line of bearing, by throwing the *weight* of the animal *off* or *on* to the navicular bone. We shall find that an oblique pastern throws the weight *off* and

an upright pastern throws it *on*, a proposition denied by Professor Williams, but which I will prove if there be any virtue in mechanical principles.

An Oblique Pastern.

76. An oblique pastern is represented at Cut 11. This will enable you to understand the mechanism of the pastern and pedal joints in a few minutes. The movements of these two joints are correlated and reciprocal; they have no separate action. Starting with the large cannon bone, this bone with its burden of weight presses upon the large pastern bone. I need hardly remind you that the pastern joint is formed by the apposition of these two bones. The pressure of this weight causes the pastern to become more oblique, and in consequence of this obliquity the horse is not quite so tall as he was, the sharper angle having somewhat reduced his height. Now observe the movement effected by bending the sharper angle of the pastern joint. The lower end of the small pastern has been raised toward the apex of the pedal bone. This movement is aided by the strain put upon the back tendons, the principal share of this strain being borne by the perforans, which has drawn downward and backward the pedal bone, and has altogether removed the pressure from the navicular bone. The force of the perforans is exerted in a straight line from the sesamoids to its insertion into the pedal bone. Clearly these two joints, the pastern and the pedal, form angles the opposite of each other; and what closes the angle of one opens the angle of the other.

The Upright Pastern.

77. We will now consider the upright pastern and its influences in the production of navicular disease. In this case the conditions producing obliquity are com-

pletely changed. The angle of the pastern joint is less acute, and there is less strain upon the back tendons at the pastern joint. The large and small pastern bones assume an upright position, and instead of the lower end of the small pastern bone pointing toward the apex of the pedal bone, it points downward toward the navicular bone, and very often presses severely upon it; so that that bone, the navicular, has to sustain the combined pressure of the tension exerted by the perforans tendon, and that of direct weight downward, upon, and through the pastern bones. Plainly the more curvature of the perforans at the pastern joint the less we shall have at the pedal joint, and as a matter of course the converse of this must be true, the more curvature at the pedal joint the less at the pastern.

The Happy-Medium Pastern

78. Is neither too oblique nor too upright; it implies a well-balanced foot and limb. Everything else being equal there is harmonious movement in every step. The various forces antagonize each other so equally and smoothly that when any disturbing force, such as an undue elevation of the heel or toe, commences to act on these movements, we can easily imagine such a balance of forces as to make it uncertain which of the two joints will be affected the most—if the pedal joint, it will be navicular disease; if the pastern joint, we shall have injuries of the tissues surrounding it and in intimate connection with it. Now if the reader will refer again to Cut 11, he will perceive that by the elevation of the toe from the point *c* to *a* this movement will be followed by a corresponding movement of the point of insertion into the pedal bone *k* to the point indicated by the letter *a*, and this movement will be followed by the *straightening* of the pastern joint until it coincides with the dotted line *h*.

Respectfully Submitted.

79. I most respectfully submit considerations as to the causes of navicular disease and on the rationale of the obliquity of pasterns, to Professor Williams, whose views are so widely different from my own.

About Overgrowth of Horn.

80. A lack of discretion founded on correct knowledge in disposing of the extra growth of hoof, when the foot grows narrow and high, accounts in my opinion for the fact that so many thoroughbred horses are affected with navicular disease as well as many other forms of lameness. Our successful practice for over forty years has made us firm in this view of the matter. Twenty-five years ago I found Mr. Robert Bonner practising according to this view, and his theory and practice, like my own, have never changed from that day to this. If the

Sacrifice of Much Valuable Time

81. And twenty-five years of close study and experiment should entitle any one's opinions to some weight on any given subject, whether professional or otherwise, then Mr. Bonner's opinions on the theory and practice of horseshoeing should be eminently so, for that is what might truly be said of him.

In the present status of the horseshoeing art he would not do otherwise than superintend and direct the shoeing of his horses, and doubtless it pays to do so, for no man in the country having such valuable stock has less doctor's bills to pay on account of his horses than he has.

But to return to the subject of overgrowth of horn

and foot-paring. A hoof appears in such good shape sometimes that all it needs is to be lowered all round equally (see Cut 1, line *f*, *f*). Lameness appears in such feet sometimes, and when the wall has been lowered even with the sole the lameness has passed away. My inference has been in such cases that a little projection of the wall at the toe had set up just so much leverage and strain upon the laminæ at the toe, and that as soon as this leverage was removed the strain ceased and the soreness or tenderness passed away.

Leverage Upon the Laminæ.

82. This question, too, has been examined from a mechanical point of view, and is susceptible of the following explanation: When the foot is allowed to grow too high or too long, that causes the column or line of bearing to recede from the centre of the foot backward, on account of the toe and heel growing at the same forward angle. Under these conditions, when the foot lands upon the ground, the laminæ at the quarters and heels are forced to carry more than their share of weight, while the toe by its extension forward has created a leverage force and a straining effect upon the laminæ in the region of the toe, which is felt most at each finishing of the step, and in addition to this there will be a corresponding strain upon the perforans tendon always predisposing to navicular disease.

Size, Proportion, and Symmetry

83. Are questions with which he who would undertake to trim and pare a horse's foot should be perfectly familiar. These should always be considered in relation to the *power* of that organ. It always seemed to me that nature must have made some provision whereby that

great constantly growing *toe-nail* of the horse, his hoof, should be kept within due limits, since overgrowth is productive of so many injuries to the horse. It has also appeared to me that a certain size and proportion would be more in harmony with the power or capacity of the mechanism of the foot than any hap-hazard size or form that suited the mere fancy of the shoer.

Passing Strange

84. It has seemed to me, in view of the importance of preserving the natural size, symmetry, and proportions of the horse's foot in order to be able to command all his full services, that these questions have received so little consideration by veterinary writers, the discussion of which ought to throw some light upon the subjects of horseshoes and horseshoeing.

The Natural Size of Every Foot.

85. Before laying down the rule implicitly to be followed in every case, whether the animal be sound or lame, I wish to make a few preliminary observations. In all cases of lameness, of whatever kind or degree of intensity, excepting those produced by accident, which I am not considering, the first thing to be done is to reduce the foot to its natural size. What that natural size is we shall come to presently. The horse running wild over his native plains doubtless could fulfil nature's intention as regards the size of the feet. But the circumstances of the horse being altered, it alters his case. His foot has ceased to enjoy nature's guardianship, and has become an object of the deepest solicitude as to its management and conservation under its present circumstances.

The Pedal Joint of the Horse and the Wrist of a Man.

86. A comparison may be made between these which will serve to emphasize a fact of some importance in the shoeing of horses. The wrist is the nearest large joint to a man's hand, as the pedal joint is the nearest to his foot. If a hammer weighing four pounds be held in a man's hand, we all know that in proportion to the length of the handle will be the loss of power in the wrist. Now, I think it is equally true that the farther the weight of the foot extends beyond the pedal joint, whether it has a shoe attached to it or not, but particularly if a shoe be attached, the greater will be the loss of power in that joint. This prepares us for the statement that the smaller the foot is the greater the power will be, all else being equal. And this brings us to the question of what is the exact or proper size of the foot?

Nature's Footmark.

87. Happily nature has placed a mark in every perfectly formed foot of every kind and degree of the horse species, like Cut 1. At the point of union of the wall with the sole, there is a line of whitish horn which might be called the line of safety. The rule then is that *every horse's foot should be cut down to this line of safety* before having a shoe applied to it. All horn beyond this is an excrescence, a redundancy, and a constantly accumulating force which *diminishes the power* of the horse in proportion to the surplus growth, and is the source of innumerable troubles to the horse. All horn whether of sole or wall beyond this white line can be removed with as much safety to the horse as the paring of the human finger-nail that projects beyond the skin at the end of the finger. When this rule comes into

practical operation and its wonderful results become manifest, there will not be two opinions as to its beneficent effects upon the horse. Writers on the foot have been wishing for a theory that would harmonize.

Conflicting Opinions.

88. But this rule or law will do more than harmonize conflicting opinions, it will unify them. Our best writers cannot agree as to how a foot should be pared. One wants radical cutting, another no cutting at all, and others want every intermediate kind or style of cutting. One would lower the heels, another the toe, and the same with the sole; one wants it cut until it yields to the pressure of the thumb, another would not allow a single particle to be removed.

I have found this rule to be an absolutely safe one in all cases, whether the horse be sound or lame. To the horseshoer I would say that this fact is one of the series of facts which will aid, I believe, in establishing horseshoeing upon a

Basis of Facts

89. That shall be solid and enduring. This can be the only sure foundation upon which horseshoeing can be improved as a scientific profession, for such it ought to be, if ever it takes its rightful place in social recognition commensurate with its importance to the whole community. Upon this foundation of facts, which can be verified in every horseshoer's practice, my own practice has been built for over forty years, and my success has been all that a horseshoer could reasonably hope for.

Examine Thoroughly.

90. I have a little more to say upon the subject of trimming and paring a horse's foot, and as an excuse for some repetitions which I feel it necessary to make I

plead my particular desire to make myself perfectly understood. The nature of the subject will not permit of very condensed remarks, if you wish to do it justice. I repeat that *the white line that marks the junction of the sole and the wall shows precisely the size each horse's foot ought to be*, other things being equal. I deem it a mistaken idea that the size of the foot can be best ascertained by *taking a sight* of the wall while the foot is on the ground, for there is more to judge of by the condition of the sole, and of the extra quantity of the crust or wall, than by merely looking at the external wall of the foot. It is common enough to see the hoof projecting an inch beyond its proper line of demarcation, the white line referred to.

A Surplus of Hoof

91. Is always a detriment to the foot, and was never, I believe, intended by nature to accumulate or project beyond the sole, but was intended to be kept down by continuous wear; the feet being kept moist and mellow by the moisture from the earth, the crust beyond the terminations of the laminæ easily crumbles or wears off while in that condition even with the junction of sole and wall (see Cut 1, line *f, f*). By this provision of nature the foot retains its natural size and symmetry, and I feel assured that but for this provision of nature horses could not perpetuate their kind as do the fleshy-footed animals. As said before these animals never lose the symmetry of their feet, as they mature with the growth and maturity of their bodies. Again I repeat that the size of the foot can be best understood by examining the sole instead of the outside of the foot only, for when a horse runs barefooted the sole never superabounds with excrescence; the overgrowth scales off or is pulverized by friction with the ground during progression.

The White Line of Union.

92. The sole becomes denuded of all surplus growth, and is plainly seen to imbed its margin into the crust just where the size of the foot is marked by the union of the sole and wall. This line of union, so plainly to be seen while holding the foot in the hand, cannot be seen while the foot is upon the ground, and therefore the only way to be sure about the size of the foot is to examine the sole first.

Excrescence of Sole.

93. When the horse has been kept in a stable, the excrescence of the sole does not always scale off, for when kept dry it becomes hard, dense, and tenacious to the sound horn, and has to be cut away like the solid part of the sole down to its proper thickness, and this is where many get deceived.

The Solid Sole.

94. After a horse has been kept in a stall the wall and sole may grow together for an inch or more beyond its proper limits, both in height and length, and sometimes the sole will have grown even with the wall, filling the hollow of the foot, and be mistaken for sound horn, or even the true horny sole, when it is only an excrescence.

The *true horny sole* is about three-eighths of an inch thick, a little more or less according to the size of the horse, and when the *excrescent* hoof is cut away is seen to shine where it is cut, and the shavings are very tough like leather, the fibres adhering to each other, while the surplus hoof is gray in color and very *brittle*.

The Surplus Sole

95. In heavy horses with large feet is often removed by a wedge driven between the scales to cause their separation. The true solid sole could not be split in this manner. Shoes have a great deal to do with preventing the scaling off and the pulverizing of the surplus sole. Viewing the surplus of the sole when a wide-webbed shoe is upon the foot would be apt to deceive any one; therefore when a horse is to be shod, in order to ascertain the exact size of his feet, the shoe should be taken off, and the sole rid of all its excrescences. I repeat, *all horn projecting beyond the line of union of sole and wall should be removed*. The same accumulation of surplus hoof will take place when a horse is barefooted if he is constantly kept in a stable. The same care has to be taken of the feet in such a case as when the horse is kept shod. To avoid the chances of lameness the feet must be kept down to their natural size—there is no other way to do it than that indicated.

Thoroughbred Horses.

96. Thoroughbred horses are great sufferers from overgrowth of hoof, although the *form* of his foot is preferable to that of the flat foot or the convex form. But not only the high-bred horse is a sufferer, but all breeds which have *high cup-feet* are great sufferers from navicular and other diseases.

Flat Feet and Cup-Feet.

97. The reason why navicular disease is more frequent with cup than with flat feet is that while the wall of the cup-foot is growing at an angle that raises the

foot from the ground, sometimes an inch or more, it rarely grows *level*, and it cannot therefore support *evenly* the weight it has to carry.

Level as Still Water.

98. It will readily be seen how and why a foot of this kind should become unbalanced.

Firstly, owners of horses generally are not aware of the great importance, and therefore are not usually impressed with the necessity, of keeping the pedal bone balanced under all circumstances by keeping the foot level, level as still water, for bones so frail and so narrow are forced to carry more weight on one side of the foot than upon the other when the wall projects unevenly.

Secondly, when the wall or crust gets too high it is not capable of so much resistance under weight as when it is even with the margin of the sole, and therefore will *warp* at its weakest part when that weakest part gets a little more weight to carry than its usual share.

Two Sticks of Whalebone.

99. If the foregoing statement is not perfectly clear I think the following simple illustration ought to make it so: Suppose two sticks of whalebone of any given diameter, but one of them double the length of the other, standing vertically, and an equal amount of weight placed on the ends of both. I don't think it will be questioned that the shortest will sustain more weight than the longest *without bending*; and this is what happens when the foot grows too high—it must warp and bend under the same weight that the shorter foot would carry without warping (refer to Cut 1).

The last paragraph relates to the *lateral* disturbance of the balance by mere growth; we would now refer to

the loss of the *forc-and-aft* balance produced by the same cause. The angle at which the heels are constantly growing, as seen in Cut 1, whereby from mere healthy growth the heels approach toward the centre of the foot, is a perpetual source of danger. This angle causes one or both heels to *warp* under the extra weight thrown upon them by their advance toward the centre of bearing. This advance not only *warp*s the heels, but causes a displacement of the pedal bone, by making it higher at the toe than at the wings or heels.

The Causes of Navicular Disease.

100. Various have been the causes assigned as the origin of this disease by different authors, one of which is *heredity*; but my opinion is that if *heredity* has anything to do with it, it is only as far as the *form* and *texture* of the hoof are concerned, for I have often seen two full brothers, one with *cup-feet* troubled with navicular disease, and the other with *flat feet* entirely free from that disease, this being the rule. I think the true cause may be stated to be that imperfect knowledge of the requirements of the horse's feet in relation to shoeing is not only the cause of navicular disease, but of all other diseases of the foot and leg of the horse.

Professor Zundel.

101. The difference in the form of feet as producing different effects has been apparent to some veterinary writers, and they have observed the absence of navicular disease among flat-footed animals. Professor Zundel, a distinguished French veterinarian, in his treatise on "Lameness of Horses," refers to the general absence of navicular disease among flat-footed horses, and notices its very common appearance among well-bred horses, especially those of English breed.

Professor Williams

102. Considers navicular disease the most fertile cause of lameness that he knows of in the best-bred horses, and reiterates an oft-made remark that this disease is "the bane of good horseflesh."

Only One Exception to the Rule.

103. All authors who have written upon the subject of lameness of horses have associated the narrow *cup-foot* with navicular disease, and only one writer is on record who has observed a case of that nature in a flat foot.

A New Theory.

104. So little is known of the true causes of the navicular disease, as is apparent from all the books I have read on lameness, that I shall deem it both a pleasure and a duty to demonstrate as fully as possible the truth of what I cannot help believing will be found to be essentially *a new theory*.

Silent Demonstration.

105. If it were possible I should like to give a *silent demonstration* of the truth of my views upon the most pronounced cases of navicular disease, in the presence of every living writer upon the subject, but as this is not possible I will do the next best thing, and give as good a demonstration as I can on paper which the subject will admit of, and I have the capability of giving.

Unbalanced by Accident.

106. I think I have made it plain that the crust or wall of the cup-foot, by projecting beyond the junction of the sole and wall, affords reasons enough to show that

the foot becomes unbalanced by accident as well as by the practitioner's not knowing anything about nature's rule for reducing the wall of a high foot already described.

Maintains His Own Balance.

107. The flat-footed horse, although not so salable nor so desirable in the market, has been employed in many kinds of work, and has rendered longer and better service than his cup-footed congeners on account of his greater capability of *maintaining his own balance*.

All Diseases Spring from Want of Balance.

108. I present this fact from every possible point of view. I cannot find a single disease of the locomotory organs that cannot be traced to a deviation from a perfect balance at either of the eight points of the chart as seen at Cut 9, which has been drawn the better to demonstrate what is apt to take place with a cup-foot.

The wall is liable to become too high or too low at either of those eight points of its circumference, simply *by projecting beyond its line of union with the sole*.

Hereditary Tendency.

109. Another word about *heredity*. I said before that I believe that any hereditary tendency to the navicular disease is limited mostly to the *texture* of the horn structures. Texture gives the form of the hoof, and the form produces the lameness. I regard it as a proof of this that the different textures of the hoof are found in different forms of feet. The hard, compact hoof or horn is found in cup-shaped feet resembling those represented in Cut 1. When the nails are being driven into them, they *ring under the hammer*, the hoof being

so dense; and the spongy, soft hoof is found in the flat feet, showing that from the rigidity and texture of the horn comes the form, and the form gives the *ease* or the *dis-ease*.

Solid and Spongy Feet.

110. It is obvious that a soft or spongy foot cannot retain the same form or angle under the same weight as that of the firmer and harder kind. The first flattens and conforms itself to the required level of the foot; in other words, more readily adapts itself to the requirements of the pedal bone within it; while the better quality, the hard, compact, and dense hoof as seen in Cut 1, while being secreted, molds itself closely to the form of the pedal bone as it grows and retains that form whether good or bad, regardless of the weight it has to carry or the requirements of the foot as to its perfectly level bearing and due balance in every direction. The hoof being so hard and resistant, the weight is carried mostly or entirely by the highest part to the detriment of the articulation within.

The Influence of Form on Diseases of the Feet.

111. Diseases of flat feet vary as much in their nature as the feet vary in form, proving that the diseases common to either are due to the form of the feet. So much are we convinced of the truth of this theory that we have often said, as regards the three locations of a ringbone: Tell me the formation of the foot and I will tell you without seeing the case on what part of the pastern it is situated, and *vice versa*. Tell me the location of the ringbone and I will tell you the formation of the foot. It is the same with spavin, knee-sprung, knuckling, etc., or of *pointing* in any direction, as those conditions are all produced by a deformity of the hoof.

A Good Thing to Know.

112. Therefore the value of a horse to any one is very much dependent on the knowledge he possesses of this theory; for different forms require different methods of treatment and different modes of shoeing. The chances of the pedal bone being kept balanced and in a state of soundness by the two forms of feet are five to one in favor of the flat foot. The spongy hoof grows more on a level with the ground, and therefore is better balanced, as seen at Cut 2, where the toe of the pedal bone is seen to drop on account of the hoof sprawling and becoming wider in circumference in front than the cup-foot.

An Indispensable Necessity.

113. In the same proportion that it keeps on a level with the ground the pedal bone will be level and therefore properly balanced, without artificial means. This accounts for the comparative soundness of flat feet, and proves that balancing the feet frequently is an indispensable necessity.

Perpendicular Heels.

114. In the spongy hoof, as a rule, the heels grow higher than the toe, thus preventing undue strains of tendons and their diseases, as seen by the grain of the hoof represented in Cut 2. It grows more perpendicularly and therefore raises the heel higher than the toe, which at that point forms a curve ending nearly horizontal. It will be deduced from this that cup-feet are subject to undue length and height of toe, and flat feet to too much height of heel, each form, as I before premised, producing ailments peculiar to its own formation.

Ailments from Too High Heels.

115. I here present a list of the ailments which proceed from the heels being too high (see Cut 2 for this form of foot):

1. *Corn*, on account of treading too much on the heels, which are almost always too high.

2. *Scratches*, caused by concussion to the heels while travelling, which also produces fever in the same region.

3. Knee-sprung.

4. Soreness and some swelling at the apex of the pedal bone.

5. Pointing backward.

6. Ossified cartilages.

7. Quarter-crack.

8. Inability to extend while progressing at high speed, and finishing the step too much under the centre of the body.

It will be observed that the diseases referred to, that is, those caused by high toe and those caused by high heels, are induced by feet of opposite forms, or by the extremes of two evils proceeding from opposite directions.

One Good Turn Deserves Another.

116. One of those strange anomalies we meet with in the horse's foot, we may notice here. It seems somewhat anomalous that either height of toe or height of heels should be in itself a cause of one class of diseases and a remedy in another. For instance, those diseases produced by high toes can be removed or benefited by relatively raising the heels, and those produced by high heels by similarly raising the toes. The remedy for the last-named ailment produced by high heels obviously must be by lowering the heels, and, as explained before,

those different diseases must be looked for in horses which are in the habit of standing with their fore feet back under the centre of the body, in other words *pointing* backward. Some of these diseases will be referred to when we treat of each disease separately.

The Natural Size of the Foot.

117. This important consideration is referred to again in order to give point to some observations I wish to make concerning the size of feet. It cannot be repeated too often that the line of union of the sole with the wall *indicates the limits of a sound foot*, for a horse in a state of nature could not be supposed to travel after the sole had been worn through to the sensitive laminae; pain would necessarily stop him until the soles of his feet had grown again; neither, on the other hand, could he be supposed to travel at all if his feet should get out of proportion by extra growth.

A Comparison.

118. Suppose that an equal number of horses, elephants, camels, and dogs, say six of each, were to be confined in box stalls all in proportion to their relative size, all fed suitably to their wants, and kept in confinement for the same length of time, say for two or three years, every requirement being supplied, but no attention paid whatever to the state of their feet. Under these circumstances which class of animals would live the longest, or rather which would succumb first? The horse only would have suffered by the neglect of his feet. Why? Because the horse, unlike the other animals, having feet which grow at the rate of four inches a year, in two years' time, if he lived so long, his feet would be twelve inches long. No horse could be sup-

posed to survive the pain, irritation, and suffering which the possession of such hoofs would necessarily entail.

Spring Colts and Overgrown Feet.

119. I have seen spring colts hardly able to stand up on account of overgrowth of hoof which has been accumulating during the winter, having been kept within doors, and their feet having received no attention whatever during that time.

Reproduction.

120. It is not very generally known, but it is a fact, that horses in the domesticated state cannot thrive sufficiently to beget offspring, if their feet are not kept down to their natural size by the judicious use of the paring-knife, or by wear and tear on suitable pastures. Horses, under all circumstances that we are acquainted with, *thrive* better when their feet are kept trimmed to the level indicated by the line of union of sole and wall.

Proper Size of Foot.

121. Again the proper size and form of the foot is referred to. I consider the feet have been so described as to enable any one to discern the form that causes either class of diseases, the line marking the size and form of the foot so that any one of intelligence may be able to recognize a normal foot.

The right size for permanent utility, as we have seen, has been limited by nature to where the sole and wall unite, and that size can only be retained by periodically reducing all that grows beyond that line. That which is removed must represent loss or gain of power. The horse's foot being of so small a bulk in relation to its

weight, carrying power, and the velocity it is capable of attaining, requires the nice adjustment to each other of all its component parts in order that no power shall be lost.

Horses' Disadvantages Mechanically Considered.

122. It is a general principle that the smaller the machine and the greater the pressure the more perfect must be the harmony of its component parts. In addition to the smallness of the foot in relation to the weight it has to carry and the speed it is capable of, it has to perform its work under a disadvantage not to be seen in any piece of common machinery. The latter never changes its component parts or any one of them by growing larger every day, no matter whether at rest or in motion. This is a serious disadvantage to the horse, whose feet are growing all the time, at rest or in motion, and necessarily affects the moving power of the horse prejudicially, and the more so the longer it grows. I cannot, therefore, consider it an unimportant question: How much power is lost by a neglect to reduce the extra growth of wall even with the sole?

Loss of Power from Overgrowth of Hoof.

123. We may form some idea of the loss of power alone from the extension and elevation of the foot by mere growth. Remembering that the horse's leg is a lever, let us make a little study about the properties of the lever. We may get different degrees of power by the same weight. The power of a common lever is always in proportion to its diameter. If a lever placed upon a fulcrum four inches from its prying end is capable of raising twelve hundred pounds, being one inch in diameter, how much power will it lose by placing

the lever upon the fulcrum at five inches from the end? Answer, one-fourth of its power is lost; and placed on the fulcrum six inches from its end it will have lost one-half, and *vice versa*, if placed at three inches from its prying end it will gain or have one-fourth more than required, and if placed at two inches from the fulcrum it will have gained double the power.

Now please consider that the horse's weight is carried on four levers or derricks, where at four inches from its prying end it is one inch in diameter as seen at Cut 11. (This represents the distance marked from letter *k* to letter *a*, which is one inch in diameter of the coronary bone, which works the same as a common lever against the length of four inches, that is to say, of the hoof or foot itself.)

The Leg a Lever.

124. The propriety of this comparison will appear when we take into consideration that the tendons or braces of the lever run no farther than the posterior extremity of the foot, which is four inches in length, and to be used as the short arm of the lever, so if we take it for granted that the fulcrum lies where that tendon is inserted, the question of power lost or gained under certain conditions will be easily solved, as we know that the tendon and column of the leg all terminate at the foot bone, while the lower end of the column of bone, the long arm of the lever, *butts* against the same bone as represented in Cut 11 by the line from letter *f* to *a* at the apex.

The Effect of Disproportion.

125. Therefore the power of the horse's lever at that point, that is to say, his leg, is determined by its diameter in comparison to the length of the prying end of the

foot. So we see that if the foot is allowed to grow in length one inch beyond the point of union of sole and wall, which is too often the case, the same proportion of the loss of power is the result; that is, the power of a twelve-hundred-pound-horse motor is reduced to that of nine hundred pounds, and if allowed to grow two inches the power is diminished to six hundred pounds. The reader may say if this is a good rule it should work both ways, and many a time I have proved it to work both ways; when the result would be attributed to any causes but the true one—the removal of the adverse leverage caused by a disproportionate foot. I have many a time caused a horse to gain in flesh while working and drawing a heavier load than before, just by reducing the extra length of his feet, or the short arms of the four levers he walks upon. A commonly observed fact that ought to make this very clear is that when a horse is moving a load the final effort is made upon the point of the toes; the longer the toes the greater the effort necessary to move the load. As said before, the length of the foot may be compared to a hammer in a man's hand; the shorter the handle of the hammer the more power there will be in the wrist. This applies exactly to the case of the horse's foot which we have been considering, and proves to me that lameness very often proceeds from weakness rather than from any positive disease.

Weakness Often Causes Lameness.

126. The best proof that I can give of this is that it frequently occurs in practice that a horse is brought to me lame, and when his feet have been cut down, or in other words when the disproportions of his feet have been reduced, the lameness disappears. It is necessary to understand this in order to understand the rationale

of the centre-bearing shoe, which we shall become acquainted with presently. With a common lever, the nearer the fulcrum is to the prying end the easier the weight can be raised. It is very much the same with a horse suffering from navicular disease and pointing. The fulcrum and prying end of the lever, the toe, are too far apart for the animal to stand easily; lameness is a warning of this disproportion of the foot; and weakness in the pastern joint is evident in its inability to bear the weight imposed upon it.

The Remedy.

127. I am now come to talk of the remedy. In order to prepare you for what I have to say for the centre-bearing shoe, let me revert for a few moments to the properties of the lever. Everybody knows that with a common lever we can move the fulcrum nearer or farther from the prying end and gain or diminish power as we please. In the horse's leg the *fulcrum* is not movable, being formed by the posterior part of the foot itself. But by means of an artificial device attached to the foot we can place the fulcrum—in other words, we may concentrate the bearing to any point of the foot we please.

The Centre-Bearing Shoe.

128. I have been so much impressed with the view that lameness in many cases proceeds from weakness without disease, caused by a disproportioned foot, that the first thing I do in all cases of lameness is to redress the deformity or disproportions of the hoof by cutting the wall down to the smallest compass possible, that is to say, even with the sole, as by this I remove a considerable portion of the leverage occasioned by the greater circumference of the foot; and when to this is added the

attachment of a centre-bearing shoe all the leverage is absolutely taken away, and the fulcrum itself is the small end of the lever, leaving no strain upon the foot in any direction whatever.

Mr. Robert Bonner and Dexter.

129. Twenty-five years ago my success in the treatment of all forms of foot lameness had become so remarkable that when I heard that Dexter, the old king of the turf, was lame, I felt sure that, no matter what the cause of the lameness was, I could restore him to soundness.

My surprise was great when I arrived in this city and found that the old king was fully cured. As an architect understands the structure of a building, so Mr. Bonner understood the structure of the foot; he could perceive the cause, which was a mechanical one; and when *the mechanical compensation* was supplied the healing powers of nature did the rest.

A Good Prescription.

130. Among all the prescriptions to be found in books on *lameness* there are none so good as REST. There is nothing equal to *rest*, nothing so indispensable as rest; yet how strange it must appear when I say that a moderate amount of work every day is compatible with my idea of giving rest to diseased portions of the foot and leg.

It is not always convenient or remunerative to stop using the horse, neither is it necessary; for rest can be given to the injured parts by the centre-bearing shoe. I should not make such a sweeping statement as this if it were not true, as it can be tested so easily by any or every horseshoer in the country.

The Properties of the Centre-Bearing Shoe.

131. If the power of the lever can be increased by moving the fulcrum toward the prying end of it, it can be increased in the same ratio by moving the prying end of a lever toward the fulcrum. In the horse's foot the centre-bearing shoe becomes the fulcrum and there is no short arm of the lever—it has been moved back—and the fulcrum and the prying end of the lever are one and the same thing.

I took out patents in Canada in 1868 on horseshoes so formed as to reduce the leverage of the foot. The use of these for twenty-five years and my observations for a still longer period have but confirmed my earlier convictions that lameness in the first stages comes from weakness induced by overgrown feet.

Mr. Villeneuve's Case and Professor McEachran.

132. A somewhat remarkable case of the character last mentioned was that of a horse belonging to Mr. Villeneuve, of Montreal, Canada. I applied a centre-bearing shoe in that case which surprised every one concerned but myself. This horse had been lame for several weeks of the near fore foot, and had been under the care of the principal of the Veterinary College of Montreal. Prior to my treatment, a seton had been inserted into the shoulder, and as it had not produced the desired effect the owner asked me what I could do for his horse. I replied that I would cure him on the following Monday morning at eight o'clock. At the time appointed, the owner was present with several friends; and as I had a shoe ready for the occasion, the shoe was nailed on and the horse pronounced *cured* in five minutes. I got into the buggy with the owner and the

horse was driven six miles, going perfectly sound all the time; and on our return home the owner drove to Professor McEachran's office, who inspected the horse and could but acknowledge that the animal was not then lame.

The Explanation.

133. The explanation of the cause and the cure in this case is simple enough. The hoof at the outside of the toe was too long and too high compared with the inside heels, and this being re-dressed by the paring-knife a shoe was put on that was *highest in the centre, the centre-bearing shoe*, in fact; this took the weight entirely off the weak spot and enabled him to travel without pain or lameness. The owner complimented me by saying that but for the explanation he could readily have believed that the *age of miracles* had not quite passed away; and the incident is referred to here to prove that lameness *in many cases* where there is no manifestation of disease is often but the result of weakness induced by want of balance in the feet. Horses can bear some amount of neglect in this matter without serious results, but the foot is constantly outgrowing the limits of endurance. Of course this adverse leverage at the toe, or at the inside or outside of the toe, is felt the most when the foot is at a backward angle at the instant it leaves the ground.

Adding Fuel to Fire.

134. I deem it to have been conclusively shown that undue height of the toe causes navicular disease; and pointing with one or both feet to the leading symptom of it; but when length or extension of the toe is conjoined with height it is like *adding fuel to fire*. Obviously the cause of the trouble is of a mechanical nature and should be counteracted by measures of the same nature.

Rustication

135. Is not always beneficial to a lame horse. Everything proper may have been done; but the injured parts might have become so weakened by disease that it is a positive cruelty, although no cruelty is intended, to turn a horse out to grass and compel him to unduly exert his injured limb in order to pick up what may be hardly enough to keep him alive. When the alternatives of choice are hunger or pain, I believe they will often endure the pangs of hunger rather than the suffering and pain caused by the exertions necessary to gather their food.

Injuries of tendons and ligaments need rest to facilitate the healing processes of nature. I believe that for very many cases turned out under such circumstances it is a virtual *sentence of death*, so many of them remaining lame for the remainder of their days.

Long Strides and Short Strides.

136. One of my aims in forming a shoe for the prevention and cure of foot diseases has been to lessen the amount of irritation produced by the movements of the pedal joint while the animal is in motion, as I found that with an injured joint the animal either could not or would not take a long step. A long stride must necessarily produce a long sweep of the joint, and the longer the sweep the greater the degree of pain and lameness.

Rationale of Rocking Motion.

137. This suggested the idea of a *rock-over* motion which would not call for so much movement in the joint. By means of the *rocking* shoe the pedal joint is aided very much in this respect, not having to rotate so far—

a substitute being found for it which is placed upon the external surface of the foot; and the result is more or less of rest to the injured parts, even while the horse is in motion. It must be readily apprehended that as a *forced articulation* is the exclusive cause of the disease under consideration and of its permanent persistence, a limitation of those movements ought to be beneficial; *and it is so.* The rocker shoe enables a horse to resume slow work at once, and it gives him more ease and better health than he could gain by standing in a stall from day to day. Viewed mechanically the rocking shoe shortens the prying end of the lever, causing the weight to be lifted nearer the fulcrum, and increasing the power to lift and rotate the joints of the leg and foot many times over.

A Perfect Balance.

138. Great relief is always obtained immediately by simply lowering the toe, as that causes an abatement of the pain while the animal is in a standing position; that is, supposing the case to be one of navicular disease; but unless the leverage caused by both high and long toe be also judiciously reduced and *kept reduced*, no permanent cure can be effected. No veterinary writer that I am aware of has ever suggested any device, mechanical or otherwise, for the purpose of realizing this intention. Veterinarians will find an important addition to their list of mechanical appliances in the rocker shoe. *With this shoe no horse points*, which proves that the horse enjoys a perfect balance while using it. The locomotive on wheels when in perfect order needs its perpetual supply of oil to maintain the harmonious working of its different parts; the locomotive on legs only requires its bearing and carrying surfaces to be kept *level* and in a *well-balanced* condition by the judicious use of the rasp and knife, to insure perfect equipoise of all the forces

that animate the vital machinery of the horse, and to be *self-oiling* into the bargain.

Points and Facts for Horseshoers.

139. Recognizing the fact that the great need of the times as regards horses and horseshoers is improvements in shoes and shoeing, I will say a little more upon the facts and principles, the practice of which has the indorsement of many who have very large interests in horses, financial and otherwise; and which I hope will aid hereafter in the development of a universal system of shoeing, which will convert a bane into a blessing as regards horses, and thereby emphasize the importance and value of horseshoeing in the public estimation.

A New York College of Horseshoers.

140. The consideration of so many separate diseases prevents my making as full an exposition of those facts and principles as I could have wished, but I shall hope that a start has been made in the right direction; and I hope that some teacher or leader may arise with the literary ability necessary to consolidate all known and established facts into one universal and enduring system of horseshoeing. The establishment of a college of horseshoeing would then become easy of accomplishment. A co-operative company could easily be formed for this purpose.

The following facts and observations will afford some idea of the principles and facts of shoeing with which my name has been identified for the last twenty-five years in the city of New York.

The foot of the horse has different attributes and requirements which ought to be perfectly understood by those who undertake to practise the important art of horseshoeing. Horseshoeing should be a twofold art:

it should embrace hygiene and pathologic shoeing or treatment of the foot. He should be well grounded in the principles of shoeing in health and disease. The locomotory organs as high as the elbow should constitute the rightful domain of horseshoeing; as the first and last necessity of a horse either in health or disease is shoeing adapted to his different requirements whether he be sound or lame. All outside of that domain should be the field of the veterinarian. But horseshoeing will never attain to this ideal eminence until there is a college for teaching the higher branches of knowledge which underlie the true art of horseshoeing, and dominate the locomotory system of the horse. This would involve a high degree of technical education; and that is the great need of the time for horseshoers and their art.

141. Horseshoeing requires the recognition and understanding of three principles, namely, levelling, symmetrizing, and balancing.

Levelling.

The ordinary idea of levelling is simply to remove the inequalities upon the plantar surface of the foot regardless of symmetry or balance. What the *dead level* of its foundation is to a building, the perfect level is to the body of the horse. This is the first requisite of a perfect balance. Men whose proper business is wagon-building sometimes engage in horseshoeing. These men and boys, many of them, could hardly define the limits of the frog, the sole, and the wall, and yet they are permitted to jeopardize values amounting to millions of dollars every day in the week. The college of horseshoers, which should instruct in practice as well as theory, and with power to grant diplomas, would soon correct this evil.

As we have seen, the white line is a safe rule to go by; but after this is reached care must be taken to leave

the foot a perfect level—*not* a plane surface more or less oblique, but a *dead level* fore and aft and from side to side. I have read of sandals and plates; and although iron plates are in vogue in some Eastern countries, I don't think they have reached the acme of perfection there any more than we have in our Western civilizations in regard to horseshoeing. I have read nothing about them anywhere suggestive of the ideas of leveling, symmetrizing, or balancing the foot, their idea being simple *protection* against *wear and tear*. Horseshoeing must reach a higher plane than this before it can satisfy the requirements of European and American communities. My opinion is that when the dead level of the foot and its perfect balance in all directions is fully understood and generally practised, we shall hear of greater speed and capacity for endurance among racing and trotting horses than we have yet witnessed; that there will be physical and mental developments in horses not dreamed of in the common philosophy; that lameness will virtually become a reminiscence; horses will enjoy better health and condition; people who own horses will have less plagues and losses from such property and as a consequence more pleasures and gains; and though last in the list, not the least important result will be a higher respect for horseshoeing as an *art*—for it must needs be through the instrumentality of improved horseshoeing that these *benefits* can ever be brought about.

Symmetry.

142. Symmetry concerns the balance of the foot from another point of view. The foot may be a dead level without being properly balanced. A perfectly balanced foot laterally is one in which the central line of bearing runs through to the toe and divides the foot into two equal halves. This means equal weight on both

sides, and equal weight implies a perfect balance; and this is the just requirement of every horse, and especially so for horses which are kept for speed. The knife and rasp must be in requisition to produce symmetry, which means a perfect *lateral balance*. If the foot is so misshapen as to make it hard to symmetrize, the object aimed at, a perfect balance, must be effected as far possible by the judicious adjustment of the shoe, which will be referred to later on.

Balance.

143. The essential importance of a perfect balance, if we wish to secure perfect ease or perfect action for the horse, cannot be overestimated; and this idea, *beau idéal* I might have said, will be emphasized in the following observations.

You may have a foot perfectly level and yet not perfectly balanced. This must be effected by the perfect adjustment of the shoe in the *fore and aft* direction, *all other things being equal*. These three ideas, levelling, symmetrizing, and balancing, should permeate every nook and corner of a horseshoer's mentality, if he would remove horseshoeing from the domain of empiricism and place it in the region of science and art where it ought to be. It should be his first and last study, as it is the most vital and essential portion of his art.

Lack of Balance.

144. It cannot be denied that many horses shod in the best manner under ordinary methods of shoeing evince a restlessness and uneasiness in their feet, without any sign of active disease, which lack of balance, I think, will sufficiently account for. It is not uncommon for shoes to be removed under the impression that they have been hammered on too tight, or that a nail might

have *crowded* the sensitive tissues somewhere or other, and nothing being discovered, the shoe is reset and the cause of the uneasiness remains as great a mystery as ever.

Mr. Bonner dictates his own shoeing, because horse-shoers have not undergone the technical and manual training which alone would inspire confidence to leave the performance of that work to others without supervision.

Perfect Balance.

145. Further, the value of a perfect balance to horses is seen in the fact that horses have *no inclination* to point with their feet when they enjoy a perfect balance, any more than the animals which have ball pads in their feet.

A perfect balance is perfect repose and rest. It is astonishing to some how horses recuperate their muscular energies while standing on the centre-bearing shoe; and who does not know how the muscular tissues actually waste away under the maleficent effects of a lame foot, producing a condition termed *atrophy*? It would take an abler pen than mine to do justice to this part of the subject.

Effects of an Unbalanced Foot.

146. An unbalanced foot is the fruitful cause of nearly every form of lameness to which the foot is liable, EXCEPTING *those from accidents*. In support of this statement I have given a list of nine different diseases, defects, or deformities (paragraph 63) arising from a want of balance produced by the *toe being too high*.

I will now present you with a category of similar ills which proceed from *the heels being too high*, numbering eight, following which will be an inventory of ail-

ments distinctly traceable to a lack of lateral balance, which will be referred to as *the inside portion of the foot being too high*, numbering twenty-seven; and closing the procession with a catalogue of maladies due to *the outside portion of the foot being too high*, thus making a total of *fifty-four* abnormal conditions which I charge to the account of *an unbalanced foot*.

Maladies Proceeding from the Heels Being Too High.

147. Refer to Cut 2.

1. Corn in one or both feet on account of treading too much upon the heels.
2. Scratches caused by the jarring of the feet and producing fever in the soft tissues between the heels.
3. Knee-spring.
4. Front-foot fissure.
5. Pointing backward.
6. Ossification of lateral cartilages.
7. Quarter-crack.
8. Inability to extend during fast progression; thus forcing the horse to step too much under his body.

Diseased Conditions Due to the Inside Portion of the Foot Being Too High.

148. 1. Warping the hoof, causing contraction of the *outside heels* and widening the *inside heels* at the same time.
2. Bending or bowing the fetlocks, hocks, and knees outwardly.
 3. Abnormal enlargement of tissues and hoof, the inside heel.
 4. Corn on the inside heel.
 5. Quarter-crack of inside heel or quarter.
 6. Deformity of the inside heel by lengthening.

7. Causing the feet to stand too close to each other resting or travelling.
8. Causing ringbone on the inside of the pastern.
9. Causing ossified cartilages.
10. Stumbling both before and behind.
11. Sprain of the suspensory ligament on the outside of the fetlock.
12. Windgall on the outside of the fetlock.
13. Knuckling before and behind.
14. Splent immediately under the knee on the inside.
15. Knee-sprung outwardly.
16. Spavin and deformity of the hoof of the same foot.
17. Soft tumor on the inside and inclining to the front of the knee.
18. Interfering before and behind.
19. Boxing or hitting the knee.
20. Hitching behind.
21. Causing the hind foot to tread between the two fore ones.
22. Causing the head to be carried on the same side that is carried inward.
23. Causing the horse to drive on one line and to cross the road.
24. Bony deposits on the inner and fore part of the fetlock, called *high ringbone*.
25. Causing one foot to rest against or upon the other.
26. Springhalt.
27. Bog-spavin and thoroughpin.

Diseases Caused by the Outside Portion of the Foot Being Too High.

149. 1. Corn on same side.
2. Enlargement of the quarter, and ossification of the lateral cartilage of the same quarter.

3. Increased growth of hoof on the same side compared with the inside.
4. Ringbone partly in front and toward the outside of the pastern.
5. Windgall on the opposite side of the fetlock in both fore and hind legs.
6. Rupture of inside suspensory ligaments of both fore and hind legs.
7. Cause of travelling too wide apart of both fore and hind feet.
8. Cause of an outside spavin, or a *soft spavin* opposite the ordinary spavin.
9. Cause of a bony deposit on the outside of the fetlock, and partly in front of the same, which corresponds with the high ringbone of the opposite side.
10. Ossification of lateral cartilages.

The Why and the Wherefore.

150. Being unduly high on the inside portion of the foot exposes a horse to many more ailments than undue height at any other part of the foot, or circumference of the foot, for the following reasons, which have been given, but which I will take leave to repeat. Anatomical reasons prevent a horse from pointing directly inward. Imagine if you can a horse standing with his fore feet close together. His chest is in the way; he may cross one leg before or behind the other, but he cannot point directly inward; if he did his body would oscillate from side to side whether travelling or at rest, as the base of support would not cover as much space as would be necessary for stability or repose, thereby causing the horse to fall during motion.

Being high on the outside portion of the foot gives him less oscillation and more stability, and enables him to obtain more relief from pointing, while in pain.

The disadvantage of being too high on the inside makes the lameness more sudden and acute when it proceeds from that part than from any other part.

Pointing.

151. Pointing is an instinct of the horse, which he does to find relief, by distributing his weight equally on all parts of his foot, or joint, and in every direction but one he can find relief, and in that one direction he can find *no relief*; and that direction is directly inward; and this is the reason that in those other directions the diseases are not so severe or so numerous.

Symmetrization

152. Calls for a few more observations which I omitted in the paragraph on that subject. Want of symmetry alone is a common cause of lameness. Perfection in the act of shoeing can never be attained until this and all it implies is perfectly understood. Symmetry and balance may be considered as synonymous in their meaning; either implies a just distribution of the weight to be carried by every structure of the leg, as without it one structure would be favored at the expense of another. It implies also an equalized bearing in every joint. If you regard the foot as a circle having two intersections at right angles through the centre, the foot as level as *still water* and the central line of bearing through the leg striking the circle at the central point, you will get my idea of the mechanical requirements of a horse in the process of shoeing.

Twisting the Pedal Joint.

153. According to the rule laid down, the circumference of the wall of the foot, after being balanced, should be at an equal distance all around the margin of the

pedal bone—that is to say, there must be *no fulness* at any one point or scantiness at another; for the reason that when a foot is out of proportion laterally, when travelling on soft roads the narrowest part will sink into the ground, while the broadest part would become correspondingly elevated and *float*, as it were, over the top of the soft ground; and this would occasion a *twisting of the pedal joint*, which would be less likely to occur with a well-symmetrized and, therefore, a well-balanced foot.

Other points of view may be presented of the evils of lack of lateral balance. A foot unbalanced in this way is liable to all of the diseases which have been enumerated as emanating from want of the fore-and-aft balances. Soft roads or soft bedding will not help such cases, but rather aggravate them.

Only Two Classes of Disease.

154. It may be well to remember that the ailments to which the horse is liable are not changed in their nature by different forms of feet, from whatever quarter of the foot they may proceed. They are only accelerated in different degrees by certain forms of feet, as we shall see more particularly when we come to treat of the diseases of the foot separately.

It will be instructive to contrast the effects of the two forms of hoof represented in Figs. 2 and 5. One has a convex and the other a concave outline on the front surface. I have seen horses whose hoofs have curved inwardly half an inch, and some outwardly the same distance, from the straight line. It is well understood, I am sure, that the normal position of the laminated structures is at an equal distance from the top to the bottom of the wall, whether curved inwardly or outwardly, so that it is possible for the points of the toes of the pedal bones in those cases to vary in height

an inch or more. It is a fact that navicular disease is *always* the attendant of the elevated toe, and *never* of the elevated heel; showing the natural and necessary connection between high toe and navicular disease.

I wish to record an observation in reference to a condition met with occasionally when a horse may have both forward feet perfectly sound, yet having a tendency to *grow unequally*. One foot may be like Cut No. 1, the other like Cut No. 2. While No. 1 has a tendency to grow equally all round, No. 2 has a tendency to grow higher at the heel than at the toe. The result of this unequal growth is to be seen when the animal is feeding from the ground by his extending his foot like No. 2 backward of a vertical line, while the foot like No. 1 is extended correspondingly forward. A horse having feet of this nature will necessarily have an awkward gait, the foot like No. 2 being carried more under his body than its fellow, rendering him perpetually liable to break in consequence of this unequal balance of his fore limbs. These faults of action can be corrected by lowering the heels of the foot, like No. 2, until the animal stands upon it as perpendicularly as upon the opposite foot.

Spavin.

PRELIMINARY REMARKS.

155. I hope the spirit of investigation and the desire¹ for proof of the theory I have advanced concerning the origin of the foot-diseases of the horse will be aroused in the minds of all who may read this book, especially the teachers and writers on veterinary pathology, especially the pathology of the foot. I hope I am not too sanguine in thinking that a gleam of light and truth may be discovered here and there in these pages that will assist them in their endeavors to efface some of the un-

certainties and perplexities of the foot-pathology of the horse. Many books have been written upon the general subject of lameness of horses, but hitherto with but *negative* and not very satisfactory results *to horses*.

With these preliminary remarks I will proceed to the consideration of the very common disease called *spavin*.

The Origin of Spavin.

156. The term spavin applies to a bony deposit upon the small bones of the hock joint, on the inward and forward aspect of the leg. Spavin has a common cause with all other bony deposits such as ringbone, splent, and other forms of exostosis—this word is synonymous with bony deposits—which will be referred to later on.

All bony deposits are the effects of an unbalanced pedal bone caused by certain disproportions of the hoof.

All bony deposits *always* manifest themselves in line with the *most elevated part* of the hoof, and *nowhere else*.

Contrariwise all sprains of tendons, and lesions of ligaments and bursal enlargements, are *always* in line with the *lowest part* of the foot, and *nowhere else*; and this leads me to say that I have no objection to my theory being called the *one-bone theory*, from the fact that I maintain that it is to the abnormal displacement of one bone, the pedal bone—in other words, an unbalanced pedal bone—to which all the fifty-four diseases before enumerated are primarily due.

A New Classification of Foot Diseases.

157. If my theory be correct, diseases may be simplified very much in their classification. There are in reality but two classes of diseases in the locomotory organs of the horse, one which relates to *hard* tissues, as

the bones, and the other to *soft* tissues, as tendons, ligaments, and ligamentous structures. Under these two heads all the diseases and abnormalities of the limb and its action can be classified; and all of them of both classes can be traced to one objective point or bone—the pedal bone; the displacement of which by a disproportioned foot is a fact of positive demonstration.

The One-Bone Theory.

158. This proposition I think has been conclusively proved, but it will be proved again and again from different points of view. I care not where I take up the question; whether I reason from the effect to the cause or the cause to the effect, it is always the same conclusion, there can be no other, and for that reason I think it must be right. That conclusion is as true of all other diseases of the foot as of navicular disease, which has occupied so much of our attention. I shall find it necessary in my consideration of the different diseases of the foot and leg to state and restate these *basic* facts, as I might call them, in order to make my arguments complete and conclusive.

Spavin may be referred to as a separate disease or one of a class of similar diseases. The latitude I allowed myself in the discussion of the navicular disease will not be necessary in the consideration of spavin, as many facts are now understood which will throw light on the rationale of both diseases—indeed, I may say of all diseases.

As some further compensation for this discursive style, I hope it will be remembered favorably that I have endeavored to avoid the use of technical terms, and have employed language suitable to readers of average intelligence. All the readers of my book will not be learned men.

Origin of Spavin.

159. Like all other bone diseases, spavin originates primarily in a particular deformity of the hoof at one particular point, which causes a displacement of one particular bone, in one particular direction; and this displacement causes action and reaction in the same direction upon the joints and tissues above it, to produce undue and unequal strain of tendons, ligaments, and ligamentous structures; and a corresponding compression of the bones, which constitute the moving machinery of the leg.

The Hock Joint

160. And its diseases, like the pedal joint and its maladies, seem to have puzzled veterinary pathologists very much in the past; but I think it need not be very much of a puzzle in the future with the key to it which I have, or shall furnish to every reader before I have done.

The subject has afforded the occasion for the display of much brilliant writing on the anatomical and physiological peculiarities of the hock joint; but the purely mechanical aspect of the subject has received but scant consideration. When veterinary writers cannot account for the origin of a diseased condition, they seem to take a sort of despairing refuge in *heredity*.

I suppose I must ask and answer the customary question, What is a spavin? A spavin, then, is a bony enlargement upon the small bones of the hock, on the inner and forward aspect of the leg. This is the best short definition I can give; *the why and the wherefore* of its existence, however, will not be quite so brief. As regards its

Symptoms,

161. In its earliest stage a slight lameness may manifest itself, and there be no symptoms whatever to denote the seat of pain that causes the lameness except a slight increase of temperature, which only the *initiated* could detect. At this stage the cause being understood, and the cure in the form of a rocker shoe applied and kept up, the lameness disappears forever. This will be a *novel theory* and a *surprising fact* to many veterinary practitioners, I have no doubt. As the disease progresses the temperature and the lameness increase. Whether standing or moving, the horse evinces pain, and if he point it will be *forward and inward*, in exactly the same direction as the location or seat of pain in the hock; and if forced to *move over* quickly from one side of the stall to the other, he may *hop over* on the sound leg. When led at a walk, the step, as a rule, is made in front of a vertical line drawn from the hip, and the heel of the lame foot or leg does not dwell upon the ground backward of this line; and sometimes the animal walks on his toe with his flanks drawn in. The horse with a spavin hesitates to lie down, and when down is reluctant to rise.

Some horses affected by spavin in both legs enjoy perfect health otherwise, but require assistance in getting up, and are able to perform much slow work.

Inherited Forms of Hock.

162. There are inherited forms of hock, which possibly predispose to spavin, but which can be counteracted by suitable showing. Before we can fully understand the causes of spavin we must become familiar with the mechanical principles which are involved in

the production of that abnormality. As every form of hock, whether straight, crooked, bent-in or bent-out, is liable to that morbid condition, it might fairly be asked why this is so, and the explanation of this will, I think, unravel some other tangled questions in connection with veterinary foot-pathology.

Suppose we take a horse of perfect symmetry of form: a line falling from the superior to the inferior extremity of either fore or hind limbs should divide that column, including the foot, into two equal halves, and as long as these remain equal, all other things being equal, we shall have a standard form for power.

The most perfect horse to-day will have changed his *angles of bearing* on the ground very appreciably in one month's time. His foot will grow downward and forward one-third part of an inch in one month, and it might have grown unequally. In any case the angle of bearing is changed, and that is sufficient to disturb the equipoise of the pedal bone; and that disturbance acts and reacts upon every joint and every tissue of the limb. There cannot be a deviation from the perfect balance without a corresponding detrimental effect upon the working parts of the machine. Power must be diminished. In the first stages of the departure from the natural balance, it may only amount to fatigue and weakness, passing gradually into lameness, the lameness often disappearing as soon as the foot is cut down and the animal is reshod; in such cases the lameness is said to be intermitting, disappearing after each shoeing, and appearing again when the foot has grown out of normal proportions.

Constant Menace of Danger.

163. The changes which are the most productive of weakness, which terminate in lameness, are those connected with the form of the foot itself. The foot,

through the extreme mobility of the pedal joint, is susceptible to more changes of angle and therefore is more liable of departures from natural conditions than any other part of the machine. It must be obvious that unless both sides of the foot bear equal weight, it is because one side is wider than the other, and that the widest part will have to carry the most weight and sustain the unequal pressure, and that this unequal pressure is a constant menace of danger to both sides of the foot. This condition of the hoof is the precursor of spavin.

A foot having a larger bearing surface on the *inside* than on the outside, and having to stand upon or to move over *soft* ground, will cause a greater compression of the bones of the leg on *the inside* than when standing upon or moving over *hard* ground, for the reason that the narrowest side will sink into the ground while the broadest will remain near the surface.

Long and Short Axes.

164. A foot may be unequally divided in regard to its long axis, that is, from the toe to the heel; yet as long as the foot is kept level and the animal doing only slow work the spavin may develop very slowly indeed, and the lameness may be intermitting in its character; but if, in addition to abnormal width on the inside of the foot, there should be an undue elevation *under the inside toe-nail*, you have all the requisite conditions for the production of a spavin of the first order. That elevation at the inside toe will increase the compression of the small bones of the hock in the exact ratio of its growth; and will give a *twist* to the foot besides that will act on every joint above the foot, no matter whether the ground he travels on be hard or soft.

A Cause of Spavin.

165. Again, a foot may be *equally* balanced with respect to its long axis, and the undue elevation at the inside of the toe will produce compression which terminates in spavin. It is important to take this fact into consideration also, that the greatest amount of compression of the bones takes place at the instant the foot leaves the ground, and that is always at the highest part; so that I think it is demonstrable from this that the *higher and longer* the toe is on *the inside*, the greater will be the force of compression exerted upon the small bones of the hock at the seat of spavin, which is on the inside of the leg also.

Another Cause of Spavin.

166. Again, the condition of *any foot* with an undue elevation at the *inside* toe is sometimes aggravated by a contracted *outside* quarter. This contraction has a two-fold injurious effect upon the outside quarter: it both *shortens* and *lowers* the side of the foot to which it belongs. These combined effects cause more weight to be thrown on the inside part of the foot and increase the pressure upon the inside toe. In this manner the balance on the transverse or short axis of the foot is destroyed, the front part of the foot being made thereby to carry more than its due share of weight, and this factor, therefore, aids in the compression of the small bones of the hock, the final effect of which is spavin.

Great Weight Borne by One Leg.

167. It is obvious that the weight of the animal must be carried by one part of the leg or another. Think for a moment of the weight to be carried on each leg by a horse weighing 1,200 pounds. Eight hundred

pounds has to be carried by the fore legs and 400 pounds by the hind legs. In motion each fore leg has to carry the whole 800 pounds by turns; and each hind leg has to carry 400 pounds in its turn, likewise. Add to this the force acquired by momentum and that of the adverse leverage at the toe that has to be overcome, and you have at least a force of resistance equal to 500 pounds weight, which the jointed bony column of the leg is called upon to sustain at every step the hind leg of the animal takes forward. Consider for a moment that the whole leg may be regarded as a bow, from the stifle to the extremity of the toe, and that the weakest part of the bow is the centre just where the small bones of the hock are situated, and that these small bones receive the first effects of that great compressive and perhaps concussive force of 500 pounds weight, and you will not have far to go to find the origin of spavin. If you are in search of a theory and must have one, I suggest the mechanical origin of spavin rather than heredity, excepting as to conformation. When all the conditions, normal and abnormal, which I have described are allowed to have their full play, the point from which they exert their greatest force upon the bony structures of the leg lies directly under the inside toe hole of the shoe, and of all the bone diseases of the leg, spavin is perhaps the most common result. I might add to this the observation that the conditions that conspire to produce spavin are all aggravated by hoofs of a very hard and compact texture, which will retain their rigid form under all circumstances. In such cases a horse can become spavined without shoes as well as with them.

Other Causes of Spavin.

168. Again, the foot may be perfect, and an ill-made or badly fitted shoe may cause the inside toe to produce the disease or to aggravate it when produced, on account

of its undue height; or they may be fitted too close and short at the outside heel, which produces the same effect, by allowing the shoe to wear faster at that point, and causing the inside toe to take more pressure of weight as it leaves the ground.

Conformation a Cause of Spavin.

169. Conformation may cause spavin to appear on the *inside* or *outside* of the hock, according as the hock is bent inward or outward. It is not that the limb is weaker, but it is the influence which such ill-shapen joints have on the bearing surface of the foot. The bend of the hock outwardly has a tendency to warp the hoof inwardly, and to cause it to become higher and wider on the inside than on the outside. This conformation must constitute a strong predisposition to spavin. A horse with a hock bent outwardly must tread more upon the outside than the inside quarter, and in due time a warping of the quarter must be the necessary result.

Early Bias.

170. In my search for the causes of spavin, I have observed what I think may possibly give the first *bias* to the form of foot most favorable to the production of that condition. I have watched very young colts while at grass, and have noticed how they spread their fore legs and cross their hind ones. With their short necks it seemed as if they were forced to assume this position to enable them to reach the grass. This crossing of the hind legs places the weight of the animal on the outside walls of the feet, and I think this circumstance alone, all else being equal, might give a bias or tendency to the form of the foot and leg most favorable to the development of spavin. Quite apart from heredity, this tendency is given to feet in different stages of colthood;

and they might appear contracted, but, as is usual, the colt is expected to grow out of it; the ultimate effect not being foreseen. These hints will not be neglected by an observant breeder of horses. Causes like these, taking place *after birth*, may be mistaken for those which occur *before birth*. Cases of this character I think would very likely be ascribed to heredity by Professor Williams, as he regards *heredity* as the primary cause of spavin. Should it be doubted whether the bent-out variety of hock predisposes to spavin or not, it might be remarked that the bent-in—commonly called the cow-hock or cat-ham variety—produces bony deposits upon the outside of the hock corresponding to those upon the inside, and which have been named *outside spavin*. Professor Williams professes to have a specimen of this nature, and he admits that he cannot assign any cause for its origin. The composition of this *outward spavin* is first cartilaginous and then bony; but when discovered in the first stage, by simply lowering and narrowing the outside of the foot it can be counteracted and dispersed.

What I Have Never Seen.

171. This shows that even hereditary causes can be counteracted by the exercise of a little mechanical ingenuity, when all the facts are fully understood. I have owned horses of both the bent-out and bent-in varieties of hock, but by shoeing to counteract their natural tendency to spavin they have been kept totally free from that and all other diseases. It is common to see a spavin on one side of a hock, but I have never yet seen one on both sides of the hock at the same time; and I have never yet seen a spavin on either side but that the foot is either the highest or the widest, or both conditions may be combined on the same side as that on which the spavin is located.

It is not an uncommon thing to see shoes and shoeing which intensify all the other causes of spavin; and, as I have somewhere else remarked, no kind or class of horse *having growing feet* is exempt from liability to spavin.

Professor Williams has remarked that spavins are rarely seen on the outside of the hock, and this fact must have made his single specimen specially interesting and valuable; and as the professor does not hazard a single speculation as to its origin, perhaps the foregoing explanation will enable him to supply an omission in the next edition of his valuable work.

Further Observations on Spavin.

172. I will continue my observations on spavin and its causes a little further in order to embody some points and facts of observation attending the development of that disease, which I have not referred to sufficiently in preceding pages.

It will be remembered that no less than twenty-seven morbid conditions have been enumerated as arising from the *inside* portion of the foot being too high; while but eight could be placed to the account of the *outside* of the foot being too high. Now, the reasons for this have already been given, but they will bear a brief repetition, namely, that with troubles on the *outside* of the foot the animal is not obstructed in the act of pointing or resting his foot; while the inside of the foot being the source of his uneasiness, he encounters an insuperable obstacle to his purpose of pointing. This brings me to the effects of the spavined condition upon action.

Compression of Bones.

173. A horse with an inside spavin not only points inwardly while standing, but carries his leg inwardly while in action; and if at speed he carries the spavined

leg between the fore ones. It is easy to understand that this is for the purpose of relieving compression of the bones and its accompanying pain. It must be difficult for some horses to keep their hind legs clear of their fore ones while in action. It may be stated, as an invariable rule, that an animal's right or wrong way of standing is carried out in action, whether it be slow or fast. Further corroboration of the truth of the theory that compression of bones is the cause of spavin may be found in the following considerations.

All writers on spavin refer to the peculiar way some spavined horses have of walking more or less on their toes. The bare fact is usually given without note or comment as to its cause. In the light of my theory, it is easy to conceive that the painful effects of compression are lessened by that action, from the well-known fact that the straighter the hock and limb can be kept the less compression is caused in the front part of the hock. The bow to which I have compared the leg becomes relaxed by straightening out. In proportion to the animal's ability to relax this bow, thereby transferring some of the weight to the back part of the leg, he will find relief from pain.

Symptoms.

174. An observer may notice a horse with spavin extend his spavined leg forward as far as he can, with the view of straightening his leg. It is obvious that that position gives him the most ease. Another method of obtaining ease is by placing the pained leg over against the sound foot, just allowing the toe to touch the ground. This relieves compression, by throwing the pastern into an oblique position; and as the pastern and hock joint have a reciprocal relation to each other, as the pastern becomes *more* the hock becomes *less* oblique, therefore compression is relieved by this position. Look

at the dread a horse with spavin has of lying down or of rising when down. A horse cannot lie down without doubling his leg at the hock, and this causes increased compression at that part; and if the horse is spavined, the pain attending extreme compression must be very great. The limb may be compared to a pair of nut-crackers, which causes more compression the closer 'tis bent. When the animal rises the limb must be doubled up again, like the closed nut-crackers, and of course that is the moment of extreme pain which the animal dreads to encounter. He will be seen to straighten out his leg all he can, and scramble to his feet the best way he can.

I cannot help referring to the old-time notion that firing and blistering would strengthen the hock and prevent the formation of a spavin. How much more rational to keep the foot balanced!

To remove the lameness caused by pain is easier than to remove the spavin. If the spavin is in the *incipient* stage—that is, in its earliest manifestations—correct shoeing will cause its dispersion; but for the fully developed spavin, all that can be done is to remove the lameness and let the spavin alone. It can only be an eyesore while the animal is able to move freely without pain.

Treatment.

175. As regards the treatment of spavin, my practice is first to ascertain and compare the relative widths of the inside and the outside of the foot, so as to be sure that the weight and pressure shall be transferred from the inside to the outside portion of the foot when the shoe comes to be attached. This can be effected by cutting down the inside bearing surface all the way from the toe to the heel; and be sure to have the inside bearing surface a *little* lower than the outside while lameness lasts. Remember to *lower, shorten, and round*

off the inside toe all it will bear; and leave the outside heel a *little* the highest. This is all that can be done without shoeing.

There are some conditions of feet associated with spavin which I have not mentioned. The wall on the inside grows down straighter, and this causes an undue elevation of the inside half of the pedal bone in the same degree, while the outside wall grows more obliquely; it may be inside or outside of a vertical line of the wall at and near the heel. This latter contingency is a loss of support to the pedal bone, causing an unbalanced condition of the foot.

Shoeing for Spavin.

176. The shoe that will compensate for these defects I have named the *shoe-fly* (see Cut 35). This shoe is a modification of the centre-bearing shoe. It is a four-calk shoe, the calks at the heels being set sideways, with the outside heel a *little* higher than the inside, which will give a *tilt* in the direction of the *inside toe*. The shoe at the inside toe should be hammered down thin and the web rounded up, and the two calks should be small and so placed that the toe shall have no bearing at that point—the inside toe—when it leaves the ground. Plainly this shoe will cause the foot to roll over easily inwardly without pressure upon the point of danger. If this process is performed properly, the result is almost an immediate relief from pain and lameness in a large majority of cases; but if a case arises in which it is not effective, put on a centre-bearing shoe, and the result will surprise you.

Blood-Spavin and Thoroughpin.

177. These morbid manifestations are of a similar nature to so-called windgalls; they are the result of injuries to the synovial sacs—or little bags—through

which the tendons have to glide when the horse moves. Their existence, like the spavin, is always associated with a high inside toe. Some cases of this nature are accompanied by a bony enlargement directly on the inside of the hock, which may be large or small according to its development. The cause being the same as that of spavin, the remedial measures are the same—a “*shoe-fly*” or a centre-bearing shoe according to the requirements of the case.

Occult Lameness.

178. It may be well to remark that lameness is sometimes present when there are no visible or tangible evidences of the cause. When both cause and location are unknown it is an *occult lameness*. It is such cases as these which call forth such a variety of opinions among veterinary practitioners. “Who shall decide when doctors disagree?” Lameness may also result from the sprain of any of the lesser ligaments of the joint; but whether it be in the hard or soft tissues, deep-seated or near the surface, whatever the cause may be, the never-failing resource, when properly adjusted, is the centre-bearing shoe.

Interesting Experiment.

179. It may interest some of my readers, who may not be aware of the fact, to know that a man can exert more force against any fixed object by pressing against it with that portion of the hand nearest to the wrist, than if his whole hand be spread and pressed against the same object. I know of no reason why this should not apply to the horse's foot and leg. By removing the area of bearing from the circumference to the centre of the foot the power must be increased thereby, and this result is attained by the centre-bearing shoe. It is plain

that the arm of a man can resist more pressure in a straight than in an oblique line; and I believe this equally true of the horse's foot and leg. The highest part of the centre-bearing shoe should be placed exactly under the centre of the foot, where the foot and leg are equally divided by a straight line from the shoulder. When the foot is wider on one side than the other, you will have to study the line of bearing regardless of the shape of the foot, and place the centre of the shoe as nearly under the axis or line of bearing as possible. The utility and value of the centre-bearing shoe cannot be insisted upon too strongly.

Treatment for All Bone Diseases.

180. From the preceding remarks it will appear that the rationale of the treatment for spavin is the proper one to adopt in all bony formations or other troubles on the outside as well as on the inside of the leg or hock, the only difference being that the *outside* toe of the shoe has to be lowered and the inside heel to be *slightly* raised, that the shoe may roll outwardly instead of inwardly.

Contracted Tendons.

181. I have explained why a horse walks on his toe or toes, and that it is to avoid pain; yet while pain is avoided in this way the back tendons are overtaxed, and they often become contracted and shortened, so much so that the heels are prevented from touching the ground while the animal is travelling. I have observed occasional instances of this nature when the tendons remained of their natural size, and I have concluded that the contraction must have been in the body of the muscle instead of the tendinous portion of it. This condition can only be cured or palliated by raising the heels

of the shoe and lowering the toe of both the foot and the shoe until the heels come to the ground and carry their due share of the weight.

Coming Events.

182. Horses are sometimes seen to stand upon their toes in the stable and go sound when they are at work. As "coming events cast their shadows before," this practice should be regarded as the first premonitory symptom of *dangers ahead* and treated the same as for shortened tendons at once. The only sure way to prevent contraction of the back tendons is not to overtax them.

Egregious Mistake.

183. It is an egregious mistake to suppose that tendons can be lengthened by raising or extending the toe. The only way it can be done without dividing the tendon is to *coax it down*, as it were, by lowering the toe all it will bear and raising the heels with calks sufficiently high to get a bearing upon them, and to lower them little by little as the horse improves. Walking upon the toe proves that the pedal articulation is not evenly divided before and behind. Not until the joint works equally both ways will all unnatural strain of the back tendons be prevented.

Unwise Practice.

184. I cannot forbear to notice the unwise practice, whoever may be responsible for it, of placing a toe calk on the point of the shoe that wears the most, with the view of making the shoe last a little longer. It will be seen upon reflection that this is calculated to weaken the horse's capacity for work, and is the kind of economy

that saves at the spigot and loses at the bung-hole. If circumstances call for raising the toes, the heels should be raised correspondingly. Low heels are apt to cause the toe to *grind*, and this grinding movement will be less in proportion to the height of the heels.

Ringbone.

RATIONALE OF CAUSES.

185. The rationale of the causes that produce the morbid bony formation called ringbone is the next subject for consideration. Whoever understands the causes of spavin will readily understand also that ringbone is essentially the same disease, differing only in location. Like the spavin, it is a bony excrescence produced by exactly the same causes, namely, compression of the bones as its immediate cause, and by a misshapen hoof and an unbalanced pedal bone as its remote causes. Both hind and fore feet are alike subject to ringbone.

Locations of Ringbone.

186. Ringbone is mostly first seen upon the small pastern bone, and may appear on any one of three locations (see Chart 9).

1. In front upon the *middle* of the bone (Fig. 4).
2. A little toward the *inside* of the bone (Fig. 3).
3. A little toward the *outside* of the bone (Fig. 5).

When it occurs on the middle of the bone it is in a direct line with the toe-clip of the shoe (Fig. 4); when on the inside of the middle it is in a line with the inside toe-nail (Fig. 3); and when upon the outside of the middle it is in a line with the outside toe-nail (Fig. 5). When the ringbone starts on the inside, a line drawn from the first inside toe-nail of the shoe (as in Fig. 3) to the seat of inside spavin would cross *directly over*

it. When the ringbone occurs in this location, the foot is invariably of the same abnormal form as that which produces the inside spavin. A proof that the primary cause of ringbone is the parent of spavin lies in the fact that if we treat the foot for ringbone in precisely the same way that we treat it for spavin, the lameness and pain will disappear at once if it be in the early stages. Another proof is that when the ringbone appears on the *outside* in a line with the *outside toe* and the outside spavin, the lameness will also disappear under the treatment prescribed for outside spavin. Ringbone growing upon the *middle* of the lower pastern in a line with the toe-clip of the shoe is always caused by undue length or height of the toe, or by both combined.

High Ringbone.

187. Another form of ringbone, called high ringbone, appears similarly upon the upper and inner portion of the large pastern bone, and in the same relative localities as on the lower pastern. Their centres of morbid activity lie in precisely the same lines as those on the lower pastern.

There can be no other conclusion arrived at than that all these bone diseases, the results of inflammatory action in the bones, though called by various names, proceed from one primary cause, namely, a deviation of the pedal bone from its natural position by irregular growth of the hoof. The vicinity of the joints appears to be affected most by compression and concussion, as it is there these excrescences mostly appear. It is equally true of ringbone as of other diseases, that want of knowing how to pare the hoof and adjust the shoe will but add fuel to the fire and intensify the other causes.

The feet of a ringboned horse will always be found to have the wall projecting more or less beyond the sole.

Ringbone never appears when the foot is perfect in form and balance. I feel justified in saying that if our views and recommendations for the care of horses' feet, from colthood to maturity, should be generally accepted and carried out in practice, ringbones and spavins would soon cease to be seen anywhere except as specimens in pathological museums.

A Remarkable Fact.

188. I deem it worthy of mention in this connection that there is not on Mr. Robert Bonner's farm a single case of ringbone or spavin, and the sufficient reason for the fact is that all his stock is under his own supervision. The colts' feet are pared monthly and the horses' still oftener. I consider this might be a pretty fair corroborative proof of the value as well as of the correctness of my theory.

A Serious Mistake.

189. Ringbone can be produced by keeping horses or spring colts during the winter on extra thick and soft bedding. It is customary with farmers who raise large quantities of grain to spread the straw after thrashing in a barn-yard sometimes from five to ten feet deep or more and then turn the horses and colts onto it, thinking the animals will be in comfortable quarters. This is a very serious error, for the animals could not be situated more favorably for the production of foot and leg diseases, as the heels sink in and the toes turn up all the time. Thick and deep bedding is only fit for horses to *lie* upon, not to *walk* or *stand* upon.

Even cobble-stones would be better for a horse to stand upon than soft bedding. They are even better for lame horses to stand upon than soft ground, for the reason that they can balance their feet better on their

rounded surfaces than on any any other ground, whether they be shod or barefooted. One will often see a horse pawing and feeling with his feet to find an easier position; and they will sometimes dig holes in the ground, in order to stand with the toe down and the heels up, which they will do if you supply them with cobble-stones.

Forty-five Years' Experience

190. Has taught me that an irregular and unbalanced foot is the first cause of ringbone. It has also taught me that a centre-bearing shoe, when applied at the commencement of the lameness, will cause its counteraction and dispersion. In ordinary cases it will in a large majority of instances relieve the lameness, but will not scatter the excrescences. Such is the marvellous effect of the centre-bearing shoe that I hope to be excused for referring to it so often, as it is usually to present some new view of its action or properties which I have not before presented. When a horse is made to travel on a spherically shaped shoe, lame or sound, a less degree of rotation in the joints of the leg is necessary by the rounded surface of the shoe; and the less strain there is upon the joints and their ligamentous connections the more reserved power there will be in the horse for contingencies calling for speed and endurance, besides the immediate relief it gives from pain and lameness.

Firing and Blistering.

191. Nearly all writers on ringbone recommend firing and blistering and a run at grass. What is the rationale of firing and blistering? It is to set up rapid inflammatory action in the bones around the joint, so as to destroy the mobility of the joint, as it is this mobility which produces the pain and lameness. Speed horses

can never go so fast after the mobility of the joint has been destroyed as they could before; therefore whatever benefit is derived from it is limited to slow-goers and draught horses. In a large proportion of horses fired and blistered for ringbone, failure and disappointment are the usual results, for the destruction of one joint only increases the work of the others.

Double Motion.

192. A centre-bearing shoe can be applied for all ringbones, whether they be high or low, and even when they are so low that they involve the pedal articulation. When the latter is the case, the condition termed club-foot is produced. Such a foot in travelling reaches the ground with the heels first and leaves the ground last, with the toe making a double motion. The lower the ringbone is situated, the greater will be the lameness and the more of a club-foot action it will have in walking, and in the same proportion will the shoe be required to rock, so as to prevent the striking of the ground first with the heel and lastly with the toe.

A Disadvantage.

193. The centre-bearing shoe has one disadvantage, and that is in being slippery on wet ground. As to the *principle* of the shoe when modified to suit the various purposes for which horses are used, I feel assured that horses will work better and speed faster than when shod with common shoes. The more perfect the foot and the sounder the horse, the less elevation of the ground surface of the shoe is required; but I am convinced that a slightly rounded surface will facilitate speed whenever or wherever that quality is desired.

Ringbone More Injurious than Spavin,

194. For the reason that the main articulations of the joints are more or less involved than in spavin; in the latter the interference is mainly with the small bones, but not with the principal articulation. A ringbone upon the hind pastern will sometimes force a horse to walk upon his toe, the same as would a spavin, and for the reason, namely, to avoid compression of the bones in front of the pastern joint. This compression, I repeat, is felt the most when the last effort is made by the toe as it leaves the ground, as it is there the pastern turns or rocks over and the pain is felt. To avoid this he not only walks on his toe, but will not allow his foot to stretch backward beyond the vertical line of the articulation. The degree of lameness will always be in proportion to the amount of compression at each finishing of the step.

Heredity.

195. As to the heredity of ringbone, the great Canadian horse St. Lawrence was entirely free from this disease, yet I knew of a son of that horse developing a ringbone after he was twenty years old. I could not deem this case one of heredity; and if a law were to be passed prohibiting breeding from ringbone sires and dams, I certainly would have those animals exempted from the operation of that law who developed no ringbones until after they were ten years old. In the case of ringbone just referred to, if it were hereditary I cannot understand why one hind foot should inherit this disease, to the exclusion of all the others, and why it did not appear at an earlier age. I can comprehend, however, how easy it is for feet to get out of shape when there are *no bed-rock principles* to go by in paring and shoeing a horse's foot. It is chance-work, depending

entirely on the individual experience and judgment of the shoers, among whom there are widely differing degrees of capacity and intelligence. To some, cutting down the foot involves too much labor; in such cases hereditary *indisposition*, I think, would be as good a theory as to the origin of ringbone as hereditary *pre-disposition*.

The Remedy—"Ay, that's the Thing."

196. The centre-bearing shoe applied as directed for spavin gives relief from pain and lameness in very bad cases, but its effects are most striking in the earlier stages, when the pain and lameness disappear absolutely in a few days. Why? Because the bearing of the shoe is transferred from the circumference to the centre of the foot, rotation of the joint being substituted by an external mechanical rotation that relieves the strain of the sensitive parts and multiplies the power.

Percival and Ringbone.

197. If in the early part of this century the one-bone theory had been known and a rational system of shoeing had been built upon it and universally taught and practised, I feel sure that Mr. Percival about half a century ago would not have been able to collect one hundred and fifty specimens of completely ankylosed joints due to the disease called ringbone, nor would all of his successors together up to the present time. That gentleman could see no deeper into the matter than to ascribe a *short pastern and concussion* as the origin of ringbone!

The Rocker Shoe.

198. The rocker shoe is made by welding a piece of iron on each side of the shoe from two to two and one-half inches long—according to the size of the shoe—and

half an inch high as shown in Cut 21. The front and back parts are rounded down to suit the requirements of the case; that is to say, if the horse has a tendency to walk on his toes, make the highest part of the rocker toward the heels; and if he treads too much upon the heels, have the highest part of the rocker toward the toe. The required modifications should be made by degrees, guarding against radical changes or sudden transitions.

Ossification of Articular Cartilage.

DANGEROUS FORM OF RINGBONE.

199. I wish to call the attention of veterinary pathologists to a disease of the pastern joint which, as far as I know, has received no special consideration as a distinct variety of ringbone. It proceeds from the same primary causes as ringbone, but its location is more perilous to the pastern joint than the forms of ringbone which have been described, inasmuch as it is more a disease of the articulation than of the bone. It starts in the articulation and extends to the bone, while other forms of ringbone commence in the bone and extend to the joint. This makes it so dangerous and so extremely difficult to cure. You may obliterate the small pastern joint by firing and blistering if you will, but no such liberty may be taken with the large pastern joint.

While the large pastern joint remains sound, it will compensate for the loss of motion in the small pastern joint; but there is no compensation for injuries to the large pastern or fetlock joint. When that articulation becomes seriously affected, it is incurable. I know of scores of such horses around New York City to-day which but for this one *articular* and *particular* malady would be worth many thousands of dollars in the aggregate.

Peculiarities of Large Pastern Joint.

200. There are peculiarities in the construction of this joint which I must advert to in order to make my observations on this malady intelligible. No joint of the *hinge* variety possesses so large an articulating surface as this joint in the entire system of the horse for its size or admits of such a wide sweep of rotation. Fully two-thirds of the circumference of the bones forming the joint is covered by articular cartilage, and this indicates the wide degree of rotation that it enjoys. A deep groove in the centre of one bone and a high ridge upon the centre of the other indicates that not the smallest degree of lateral motion was intended for this joint. Below the knee there is no provision for lateral motion in any of the joints.

Ball-and-Socket Joint.

201. The three joints below the knee admit of motion only in direct lines. Every provision possible has been made to brace and strengthen the pastern and the pedal joints to prevent any sideway motion and preserve them in their true lines of bearing for carrying weight. It is easy to see what the effect would be if there was any sideway movements of the joint. The legs would get mixed up and bewilder the animal by constantly thinking how to keep his legs clear of each other in rapid motion, particularly when changing his movements. Evidently his fore legs below the knee are designed to rise and fall only in the direct lines of flexion and extension, like a common hinge. His hind limbs have ball-and-socket joint called whirl bone, to enable him to plant his hind feet to greater advantage and to keep them clear of the fore feet.

The remarkable ligament called the suspensory will

be fully described elsewhere; therefore I shall only call your attention to its hammock-like form and capacity for resisting the forces of weight and momentum when both are imposed upon the pastern joint.

Anatomy of the Joint.

202. We will now glance at the nature of the materials which enter into the composition of the joint other than bone. The ends of each bone are tipped with two layers of cartilage, one comparatively soft and elastic, which are the *buffers* of the joint, the other a thin coating of some very hard, smooth material, to enable the bones to glide smoothly on each other. These gliding surfaces are *oiled* as it were by a fluid called *synovia*, of course to prevent friction. While this living hinge *hangs* all right and is kept oiled, there is no danger to the joint. As soon, however, as the foot changes its line of bearing, whether to the left or to the right, whatever might be the cause, this living hinge ceases to rotate with precision around its central axis; the bearing becomes unequally distributed; a wobbling motion is set up; friction ensues; and very soon, if the cause is not removed, the thin cartilage is *fretted* through and the soft elastic buffers are *ploughed* into; disorganization ensues; all the tissues composing the joint become involved in inflammatory action; and the products of inflammation first appear under the skin upon the edges of the joint. At this stage, if the cause can be recognized and the foot balanced, the self-healing power of nature will restore the parts to normal conditions. It is, however, very apt to receive but little notice. When the cause continues in operation, the product of inflammation becomes *gristly* in its nature and eventually changes into bone. When this happens the mobility of the pastern joint is more or less destroyed, generally *more*, and

the animal is valueless for any but the slowest work. A centre-bearing shoe is a helper in such circumstances, but the disease is irremediable. The cartilaginous deposits having become converted into bone, I think I may with propriety name this disease *ossification of the articular cartilages of the large pastern joint*.

Treatment.

203. The treatment in the early or any stage should be precisely the same as for spavin or ringbone. Sometimes the *centre of activity* is on the outside and sometimes upon the inside; but most frequently on the latter. Of course the paring of the foot and the modification of the shoe must be in accordance with the respective locations of the disease.

Splent.

CAUSES OF SPLENT.

204. Splent is the name of another bony deposit, the most frequent cause of which is undue height and width of the inside of the foot. It is often found to be exceedingly painful, the animal *catching up* his leg very quickly when the part affected is pressed upon. It is most frequently found on the upper and inside portion of the large metacarpal or cannon bone, its common name. Splent generally appears on the inside of the leg and but very rarely on the outside. All bony enlargements of the cannon bones are called splent. A bony deposit on the lower portion of the cannon bone is often caused by a blow from the opposite foot, so severe sometimes as to produce lameness. Cooling lotions and a boot are usually sufficient for such cases. The splent, however, just under the knee joint is of a more serious nature, and still more so if the horse is used for fast work. The lameness increases and diminishes in the ratio of the speed.

Causes and Effects.

205. What makes the effects of splent so situated so painful and hard to cure is that the material which unites the small splent bones to the cannon bone becomes elongated and strained at their superior portions by the extra weight they are forced to carry, while the inside portion of the foot is higher than the outside.

It can be produced in a perfect foot in *turning* while going fast, by forcing too much weight upon the inside of the foot and knee when so *turning*. It can also be produced by stepping upon a stone or some inequality of surface while going fast, or by the foot being turned up inwardly. It never occurs when the animal is walking or at slow work. *It is the price paid for speed.*

Firing and blistering in such case should be the last resource, and never resorted to until all others have been tried and found to fail.

Sudden Unequal Pressure.

206. It is not, properly speaking, a disease of the joint, although the small splent bones have a small articulating surface on the upper end. As said before, the trouble is in the very short ligaments which unite the splent bones to the large cannon bone.

The force of the weight and strain from sudden unequal pressure upon these bones not only presses them downward, but has a tendency to force them apart. If the main articulation or lesser articulations of the small bones of the knee are involved, it is but remotely.

Treatment.

207. In some cases of this form of lameness, simply lowering the inside of the foot has removed the cause, and the lameness, the effect, has ceased. I have known

many such kept at fast work to become sound and remain so as long as the feet were kept level and perfectly balanced.

The shoe best adapted for such cases is the centre-bearing shoe, as horses with these shoes on are not subject to sprains or other injuries arising from treading on unequal surfaces, as is the case with any other form of shoe.

The centre-bearing shoe is more than an equivalent for a level and smooth pavement; it gives the foot a pivot to turn upon, which the pavement does not, however level, thereby preventing a *twist* of the pedal articulation; and what prevents that will prevent a *twist* in the knee joint.

Enlargements of the Heels.

ABNORMAL ENLARGEMENTS.

208. These are abnormal conditions, which are incidental and limited to the backward portions of the foot, just as there are diseases which pertain to its forward parts.

These enlargements have no specific designations, but to some they are suggestive of bunions or fungous growths, and are to be met with in every class of horses.

No one will dispute the statement that these enlargements are abnormal. In the same region we may have ossified lateral cartilages and a fistulous affection called quittor.

On the under part of the heels, at the inflection which marks the union of wall and bar, a red stain may often be seen which indicates the presence of a morbid condition called corn. All these conditions may be attributed to the same general cause, namely, undue height of the heels. These abnormally enlarged heels are simply

elongations of the heels as seen in Cut 16. The heel which receives the heaviest *thumps* while travelling becomes larger and longer than its fellow. When this happens the red stain indicative of corn is usually absent. At a slow no lameness may be present, but at fast work lameness is very apt to be manifested.

Symptoms.

209. The symptoms in the forward feet are pointing with the affected foot backward and inward and fulness of the lateral cartilage and the tissue surrounding it, supposing the trouble to be on the inside heel.

The swollen tissues sometimes are so large that it is difficult and dangerous to lower them sufficiently to get a bearing upon the opposite side, and the only way to avoid pressure and concussion is to raise the whole outer part of the hoof sufficiently high for that purpose by means of a shoe.

There are different degrees and forms of enlargement caused by deformities of the hoof in this region. Sometimes the persistent pressure of a deformed hoof causes atrophy, or a wasting away of the soft tissues, or, aided by concussion, the effects may be seen in *hypertrophy*; that is, an unnatural enlargement of the tissues. These abnormal enlargements are very common in our practice, and I feel that no apology is necessary for speaking of them at such length. They are very insidious in their development, and they too frequently end disastrously. Horses are often seen lifting the foot and bending the knee without any other visible or tangible sign of trouble; and, alas! how few there are who can intelligibly interpret that simple sign! In pronounced cases the knee may often be seen half-bent in the endeavors of the animal to gain ease from the pain produced by these deformities.

The Remedy.

210. The remedy in the early stages is to lower the hoof of the afflicted heel and throw a little extra share of weight upon the opposite heel. This will check the growing enlargement and tend to equalize the bearing. In some advanced cases, as shown in preceding remarks, a bearing on both sides cannot be obtained by subtraction of hoof, but it can be by the addition of iron.

It is not only a *law*, but a *fact*, that the horn-secreting processes of the wall, the sole, and the frog are unduly stimulated by concussion of the heel, which strikes the ground first, and that this cause alone, *all else being equal*, will produce a disproportion of size between the two *heels*, as well as between the two *sides* of the foot.

I have observed in some cases of one abnormally high heel that the diagonally opposite toe has been affected by *atrophy* or a deficiency at that point.

Recognizing this as a *law* and a *fact*, it should be easy to apply the right remedy:

Equalize the bearing of both heels *one way or another* as pointed out. When the shoe is to be the principal equalizer of the bearing, one horn of the shoe should be thin and the other thick, the requirement being to transfer the *largest* share of the bearing from the *unsound* to the *sound* heel.

An elongated heel is never seen in a sound foot, therefore it must be a deformity.

The sound has a uniformity of contour of both heels which pleases the eye and satisfies the judgment.

It may safely be predicted of a deformed heel that lameness will be the result sooner or later. It generally occurs upon the *inside* heel. When it occurs on the *outside* it is not so injurious, for the reason that a horse can better prevent pain of the outside heel by pointing backward and outward; and when it is on the inside

heel he cannot point in the direction that gives him the most ease. For this reason, also, the inside heel is the slowest in returning to normal conditions.

Corn.

GENERAL OBSERVATIONS.

211. In my last article I made mention of the fact that corn is one of the morbid conditions incidental to the posterior part of the foot of the horse. At first sight it might seem strange that one cause should produce such widely different effects such as we see in fungous enlargements on the one hand and an invisible condition denoted by a little blood-stained spot upon the other. Horses affected but slightly by corn are not usually considered practically unsound.

Corn is a very prevalent disease among city horses, and on account of its extensive prevalence among all classes of horses, the pecuniary losses arising from this one form of diseased foot must be very great indeed.

If horses are not *predisposed* to this malady by hereditary transmission, they are all equally *exposed* to it.

It is found in all breeds of horses and textures of feet, from the thoroughbred to the flat-footed and cold-blooded horse. Although this is the case, certain forms of feet, all else being equal, are the most disposed to this malady.

Corn and its Causes.

212. The question of corn and its causes has long been considered a mystery. I confess I shall be somewhat disappointed if I do not succeed in removing some portion of its mysterious character, and also if some who have been mystified over the matter do not freely "*acknowledge the corn.*"

I refer you to Cut 2, which represents a foot which has a strong tendency to grow at the heels, a form of foot which is prolific in the production of a certain class of diseases, which includes corn. In our observations on enlargement of heels, we stated that in common with corn it proceeded from undue height of one or both heels. The best proof that high heels are the most frequent cause of corn is that by simply lowering the heels the corn will gradually disappear, without any other treatment. In Cut 2 you will observe that extra height of hoof at the heels has tipped the pedal bone downward and forward, differing in that respect from Cut 1, where the pedal bone is kept level by an even growth of hoof. In Cut 2 it will be seen how, while the direction of the outline of the heel takes an almost vertical angle, that of the wall approaches the horizontal *toward the toe*, and that the pedal bone under these conditions must necessarily become higher behind than it is in front. It cannot avoid tipping forward and downward at the toe, and the effect of this displaced bone makes the horse point backward for relief.

Symptoms.

213. We may ascertain the presence of corn by carefully pressing the heels and other parts of the foot with pinchers, and by comparing the resistance offered at different points of the foot. As corn is commonly found in feet resembling Cut 2, it must be associated with maladies which are produced by a foot of that form. These maladies have been enumerated and need not be repeated. It is not a little remarkable that curing any one of the ailments produced by high heels when our treatment is applied, corn is a frequent accompaniment, but is always the first to yield and disappear, just as if it had been a mere symptom of the other trouble; yet

as an independent malady it is or has been one of the most formidable agencies of destruction to the equine race. Corn is sometimes present in both heels; in such cases, the general treatment for too high heels usually suffices. If present but in one heel, the treatment prescribed for one side is applicable.

Mr. Robert Bonner and High Heels.

214. That gentleman when he finds a horse not extending himself in his usual ways suspects that the heels are getting too high, thereby unbalancing the foot and throwing too much weight behind, which creates the tendency to corn. He lowers the heels at once in such cases; and the freedom with which a horse *extends himself* afterward proves the correctness of his judgment. I do not think it possible for a horse to speed his best with an unbalanced foot and high heels. Horses kept for speed, in my opinion, whether affected by corn or otherwise, should have their heels kept down so as to maintain a perfect balance of the foot.

Corn and Contraction.

215. We very seldom find corn in feet affected by navicular disease. The latter comes from extra height of toe, while corn is the product of high heels. If corn is found in company with navicular disease, it will surely be found on the side of the foot which carries the most weight.

A corn could not possibly be produced any other way, except by simple contraction. In this case the contraction is associated with *high toe and inside foot*.

We have stated before and repeat that all forms of feet, even the soundest, are liable to become the subjects of corn. To prove this I refer you to Cut 1, repre-

senting a sound and perfectly formed foot, where in every part of the wall the horn fibres grow parallel with each other, from the coronet downward, at an angle of forty-five degrees.

Now refer to Cut 2 and notice the difference in the direction of the fibres. The horn fibres grow down at different angles behind and in front of the hoof. There is so much divergence that the wall of the foot in front presents such a concave surface that the balance of the foot is destroyed, the pedal bone displaced, and the leverage produced by the extra height and length of the toe becomes an opposing force to the animal's progression.

Natural Size and the White Line.

216. Corn, as I have stated, can be produced in a perfectly formed foot if the hoof is allowed to grow beyond its natural size. That natural size is no longer a matter of fancy or doubt, but a well-proved question of fact. It is *infallibly* indicated by a zone of whitish horn that marks the union of the sole and wall (see Cut 1, letters *ff, f*).

Above this line is shown a foot of proper height and length, and where the first three bones of the foot and leg are in their true line of bearing with each other, this latter being shown half-way between the heel and toe of the pedal bone at the line *c*. It will be seen that if the wall of the foot is allowed to grow long enough to reach the line *h h*, the heels will be forced to carry a much greater weight than their share. From these considerations it must be clear that the best-formed foot which ever existed, *all else being equal*, can be thrown out of balance, and the hinder portion of the foot made to carry more weight than its share, and the forward part of the foot exposed to an adverse leverage, and the living tissues made the subject of inflammatory

action; all by the mere overgrowth of hoof in length and depth. This is not a matter of opinion or mere speculation; it is a question of fact and demonstration, as easily susceptible of proof as the first problem in Euclid. In order to make my theory *incontrovertible* and *unanswerable*, I refer you to another form of foot which is represented in Cut 6, where the front wall of the foot presents a convex surface from the horn fibres taking a circular direction outward and downward, and the fibres of the heels growing downward and forward, becoming at the heels almost horizontal. The probable cause of this peculiar growth is an increased secretion in front and a diminished secretion behind. The effect, however, of the form of foot produced by this deviation from normal conditions is to almost totally exempt such feet from the liability to corn, on account of the inordinate height and length of toe relatively to the heels.

Other Causes of Corn.

217. But there are other causes of corn yet to be noticed. All else being equal, the shoe itself often becomes instrumental in the production of corn.

1. By being fitted too closely at the heels when applied to a fungous foot, where the constant tread often works the shoe inwardly of the wall at the heels and causes the weight to be borne by the sole and bars.

2. From one of the calks wearing faster than the other, thus causing the greatest weight to be borne by the highest heel, either standing or in motion.

3. A shoe with high heels and no toes will also cause corn.

4. Such a shoe applied to a truly sound and well-balanced foot not only may produce corn, but render the foot liable to any of the diseases produced by high heels.

It is worth remembering, then, that the form of the foot first of all, then the attitude or mode of standing; next the red stain upon the sole, as a positive sign; and lastly the unwillingness of the horse to extend himself will enable any fair observer of horses to diagnose the existence of corn or tendencies to it in its earliest stage.

From all the foregoing considerations I can arrive at no other conclusion than that nearly all diseases of the feet and legs of horses, including corn, are caused by deviations from the natural size and form of the foot; such deviations being aided by certain qualities of the horny structure, by overgrowth, and by imperfect knowledge of the principles of shoeing.

A Remarkable Phenomenon.

218. If any of my readers should go to France and have occasion to examine horses there, they must be prepared for a somewhat—to me—“surprising fact” as regards the symptoms of corn. I learn from Professor Liantard’s translation of Zundel’s work on lameness of horses that “when lame with a corn the horse carries his leg *forward of a plumb line* and keeps it semiflexed at the fetlock.” I presume this must be a *habit*, or perhaps a *custom of the country*, as I have never seen an American horse act that way; the practice in this country being *invariably* to carry the leg *backward of the plumb line*.

Another Symptom

219. Of corn is the horse walking on his toe sometimes as if he were suffering some acute pain in his heel, which he undoubtedly is and is trying to relieve it. Sometimes in doing this he causes the perforans to swell, and the swelling is very apt to be attributed to another

cause, namely, undue height or length of toe. A seeming paradox must be explained here. It would appear as if we could have swelled tendons from high toes or high heels, which would appear inconsistent with our theory.

The horse is suffering from pain in the back part of his foot in both cases, one being the condition called corn and the other an unduly elevated toe, and in both cases he seeks for ease in the most favorable position for obtaining it, that is, walking on his toes.

The Horseman's Compass.

220. What the mariner's compass is to the mariner the horseman's chart should be to the horseman, whether he be a veterinarian, horseshoer, or an amateur of horses (see Cut 9). Where the leg at rest is carried in front of a plumb line, the heels require raising and the toe to be lowered; and when at rest if the leg is carried backward of a plumb line, the toe needs raising and the heels to be lowered.

Morbid Conditions Resembling Corn.

221. There is still another cause in operation to produce a morbid condition resembling corn, and I have no doubt is often mistaken for it, as it is indicated by a blood-stain in the same locality. While this blood-stain is generally produced by a contracted condition of the quarter, it can be and is caused sometimes by *expansion* of the quarter instead of contraction. The laminæ can be torn asunder in an outward direction as well as crushed together inwardly. This must cause pain and a rupture of small blood-vessels and the blood to fall down and stain the horn tissues.

The Remedy.

222. The remedy for this is to lower and narrow the heel at its fullest side, which is generally the inside, if there is hoof enough; if there is not, let the shoe be thicker on the opposite side and thick enough to give a broad surface and height to the outside heel calk, as compared with that of the inside, and to regulate the height of the toe by this treatment. Balancing the foot, however, is not sufficient in all cases, for the treatment must depend upon the severity of the case. In the earlier stages, after balancing the hoof and the adjustment of a rocker shoe, the corn usually cures itself.

Suppurating Corn.

223. If there is evidence that the process of suppuration is going on, an opening should be made to allow the pus to escape, taking care not to cut too deeply so as to avoid cutting the laminae and thereby increasing the inflammation. A warm emollient poultice generally completes the cure.

Severe Cases.

224. If the horse continues lame after the above treatment, the *pus* having been discharged, and the animal is evidently in much pain, it must be regarded as an indication that the soft tissues inside of the hoof are swollen, and that the pain is caused by the pressure of the swollen tissues against its unyielding horny envelope. This condition is best combated by paring away all the hard external surfaces of the frog and sole until what remains will be comparatively soft and yield readily to the pressure of the thumb. This will abate the pain by allowing the walls to expand under the pressure of the

swollen tissues, and the sole and frog being soft and thin will *bulge* a little, and in this way the pressure will be relieved and the pain abated.

In addition to the centre-bearing shoe, it will be important to keep the under surface of the foot moist and supple all the time. To effect this we have but to place between the shoe and the foot a pad of any soft material that holds moisture. I have found a pad of cotton or oakum saturated with a mixture of soft soap and Carolina tar in equal proportions to answer the purpose very well.

Other Contingencies.

225. Sometimes the prick of a nail in shoeing causes inflammation and suppuration. If after evacuating the pus the foot does not get well under the foregoing treatment, lose no time in calling for the best veterinary services that can be obtained. Such cases call for *medical* as well as *surgical* treatment. Underrunning has to be dreaded and guarded against. All such cases and the disease termed *quittor* should be placed in the hands of a good veterinary surgeon.

General Treatment of Corn.

226. The general treatment best adapted to corn after the foot has been properly balanced is a bar shoe made rocker fashion, that is to say, thin at the heels and toe and high in the middle, as in Cut 21. This form of shoe prevents jarring of the heels such as those seen in Cut 22. If the horn will admit of being cut away to the extent of an inch and a quarter of its bearing surface immediately under the seat of corn, let it be done; if the horn will not admit of this, fitting the shoe to meet the indicated requirement will do just as well.

Stringhalt.

CAUSES.

227. In tracing the causes of certain diseased conditions of horses' feet and limbs to their source, we are not a little gratified that we have met with considerable success in this direction. Though not so destructive a malady as many diseases of the locomotory organs, it is yet one which has engaged the attention and the pens of many able pathologists, and so far has resisted all attempts to divest it of its character of impenetrable mystery.

There are two modes of reasoning: one is from cause to effect; the other is from effect to cause. It has seemed to me that all I have read has been reasoning from effects to causes; and I propose to reverse this process and reason from causes to effects.

So far, with English and French writers, its origin has been more a subject of guesswork than anything else—of *fancy* rather than *fact*.

An eminent French writer, Bouley, regards it as "but an exaggeration of a physiological fact," automatic in its operation. Professor Liantard has no opinion whatever of his own to offer, but nevertheless he deems it incurable. French writers generally favor the opinion that it is a disease of the hock joint, but differ as to the particular seat of the injury. One thinks it originates in a *dry spavin*, and another ascribes it to "erosions of the large articular surface of the hock joint." Others have found lesions in *all* the joints of the hind leg, and therefore refuse to believe that it can originate in the *hock joint*.

English pathologists regard some portion of the nervous system as the primary source of the disorder.

Percival conceived it to arise in "the spinal marrow

or in one of the great nervous trunks that pass to the affected leg." Dick located it in the "lateral ventricles of the brain." Williams thinks it is *choreic* in its nature, that is, something like Saint Vitus' dance. This writer also has seen stringhalt associated with "a deposition of melanotic material in the crural nerves of a gray horse," and also with "exostosis on the shaft of the ilium," and with "the pressure of a bone spavin upon the nerves of the hock," and also with rheumatism. Williams has divided the tibial nerves—the nerves which supply the hock joint with sensation—to no purpose. That gentleman, besides giving his own, gives the views of other English writers, some of whom thought they had traced it to a "hypertrophied condition of the nerves given off from the lumbar plexus," and some to "the pressure of exostosis upon a nerve," and others to "paralysis of the muscles antagonistic to those affected with spasms."

A Mysterious Malady.

228. From these brief extracts it appears that every joint of the limb, and the entire nervous system from the brain to the foot and from centre to circumference, has been anatomized and investigated and called upon to yield up the secret source of stringhalt, without a single echo in response. Varnell expressed the despondent feeling of all writers on this subject in the following words: "There is a mystery about the matter which for the present is darkened over with a heavy mist that requires considerable research to clear away."

Personal Observations.

229. As far as I am aware, no curative or preventive measure has ever been suggested for this malady. It occurs nearly always in one or both hind limbs, very

rarely in a fore limb. The value of the animal affected with stringhalt depends upon the intensity of the ailment. In some cases the foot affected is only raised a few inches higher than its fellow, and in others only at the walking gait. Some show it only in trotting, and some only when they are backing. The higher the foot is raised, the more quickly it has to be lifted and returned to the ground. This impulsive action is executed so as to keep time with the movements of the other leg. If the foot were flexed slowly, it would not have time to be raised two or even three feet high and to descend the same distance when in action and cover as much ground as its fellow in travelling low. Hence the higher the foot is raised the more spasmodically the foot must revolve. The limb is sometimes carried so high as to strike against the belly of the horse with the front of the pastern joint.

Professor Liantard and Stringhalt.

230. The learned professor in his observations on stringhalt has allowed a curious error—if it is not a printer's error—to find its way into print. In his work on lameness the professor says that the horse in extreme cases of stringhalt "*brings the front part of the foot in violent contact with the abdomen at every step.*" The horse who can do this is constructed upon some mechanical principle with which I am unacquainted. No horse that I have ever observed could perform this remarkable feat. Whenever I have watched a horse lift his hind leg he has had to flex his hock joint, and his foot is drawn downward and backward while the hock is bent, and is only straightened out when the foot is on the ground. How a horse can kick his belly with his foot without bending his hock is a mechanical mystery I am unable to solve.

Resemblances to Stringhalt.

231. A jerking action of the hind limbs is frequently seen under various conditions other than stringhalt. A wound inflicted upon the extensor at or near the main point of its insertion into the apex of the pedal bone is almost sure to be accompanied by a movement of the leg resembling stringhalt; and so is acute laminitis in the forward feet, as well as navicular disease when the pain is very severe. In all these cases as the disease becomes ameliorated the jerking action passes away.

Exploring for Causes.

232. When I began first to pay some attention to this disease and its causes, over forty years ago, I thought I had made some discoveries as to the causes of lameness, both general and particular, and felt the assurance that if I made a systematic and close study of the mechanism of the horse's hind leg, I might be rewarded by another discovery. I bought stringhalt horses for purposes of experiment and study. I found that stringhalt very rarely came on suddenly. A gradual development of the disease was the rule. My next observation was that stringhalt horses could walk better on perfectly level and smooth ground than on any rough or uneven surface. If the animal was but slightly affected the jerk would be scarcely visible; or from being constant, would become intermittent on smooth ground. None went better or improved on ordinary roads. Then instead of watching at a distance, I kept close to the animal and observed each of its footprints. Then the mechanism of the hock joint became an object of interest and study. I noticed in all cases an indisposition to let the leg go backward of the plumb line of the limb, which I call

pointing in motion. Only in extremely bad cases did I observe any tendency to walk on the toe. But the going even a little better on a very smooth surface suggested that there must be something in the road or in the foot that made the difference.

I then had a level bit of road prepared, and had the foot cut down level to the line so often referred to, wondering what the result would be of bringing the two levels together. I was aware before that time of the effect of a balanced foot upon spavin and some other diseases, but I never dreamt of connecting an unbalanced foot with stringhalt; yet this conclusion was forced upon me by the inexorable logic of facts. That conclusion was that stringhalt was produced by the self-same cause as spavin and many other diseases of the foot and leg, and that the same remedy was applicable to all alike! I own a horse at the present time on which I can produce stringhalt by means of a shoe high on the inside toe; and by removing the shoe the stringhalt disappears. This might be called producing *stringhalt to order*. I confess to having felt more gratification from the discovery of the origin of stringhalt than of all the other diseases together.

My First Case of Stringhalt.

233. The first case I undertook to relieve or cure in New York was that of a horse owned by Mr. Isaac Smith, now a resident of Brooklyn. The horse was a heavy trucker, having stringhalt in one leg and struck his belly at every step, *but not with his foot*. Mr. Smith considered the *cure* as almost miraculous. The treatment was precisely what would have been adopted for spavin. This horse worked for a year perfectly sound, when he changed owners and shoers, and the old malady returned. This teaches that there can be no *abso-*

lute cure for troubles of the feet and legs. It can only be for as long as the foot can be maintained in its normal and healthy conditions.

The Very Worst Case.

234. In 1876 I undertook the cure of the very worst case I had ever seen. He was affected in both hind legs and struck his belly at every step he took. At first starting out of the stable he would hold up one leg so high and for so long a time that you would think the animal would fall over; an incident which has been recorded as having been seen by Colonel Fitzwygram, an English veterinary writer. Both hind feet of this case were badly contracted, and the animal walked upon his toes, never letting his heels touch the ground. This case was treated at home.

A centre-bearing shoe *a little higher in the centre* than usual was placed on each foot. Improvements were visible day after day, and in thirty days all trace of stringhalt had disappeared! As long as we shod this horse he went sound; when he changed shoers his old disease returned as bad as ever. Professor Liantard's comment on this case was that "the horse had returned to his old habit;" as if stringhalt was nothing but a *habit*, which a horse could adopt or return to to suit his own sweet will. Has the deformity of the foot and imperfect shoeing nothing to do with the matter? Is going lame merely a habit? Does a horse undergo pain and suffering simply to indulge in a habit? Is pointing the limb nothing but habit? If stringhalt be a habit, as a rule it can be easily controlled.

I have cited these cases to show that this malady has a common cause with all other ordinary ailments of the foot and leg, produced by overgrowth of hoof and unscientific treatment of the foot; and a further proof of

their identity of origin is the fact that the self-same mechanical methods of shoeing and treatment are appropriate in all diseases that spring from an unbalanced condition of the feet.

I am not surprised that Professor Liantard should regard stringhalt as incurable and merely habit. When he has perused these pages he may possibly find some reason for revising his list of incurable diseases in the next edition of his work on "Lameness of Horses."

Still a Mysterious Malady.

235. The whole of the mystery of stringhalt has not yet been cleared up. Although we know the cause of it and have it in our power very largely to counteract it and to *cure* it relatively, yet the questions as to the exact manner in which it affects the nervous system or whether it has any favorite location are still involved in as much mystery as ever. I believe I have shown incontestably that diseases of bones and ligamentous structures can be traced to the same fountain-head as to cause. To these two classes of structures I think may fairly be added a third class, namely, the nerve structures. I don't know of any better proof that can be given for the identity of the cause or causes of the three classes of disease than that the self-same mechanical appliance—the centre-bearing shoe—is the all-sufficient remedy for the diseases in each class with scarcely an exception. All writers agree in the opinion, in which I also agree, that whatever the original cause may be, the disease must be attributed to some derangement of or interference with some portion of the nerve structures, either in its large or small branches. At this point agreement ends and the widest diversity of opinions begins. Do I assume too much in supposing that I have furnished a fresh starting-point for future investigators?

Observations on Stringhalt.

236. Perhaps, too, the following observations may aid in the discovery of the *exact location* of stringhalt. The domain to be explored is a pretty wide one—that of the nervous system. Some one with the necessary qualifications may yet succeed in clearing up the mystery attending this question. However that may be, I think an important advance has been made in removing stringhalt from the list of incurable diseases, and I fully believe it will be absolutely prevented in that *good time coming* for horses when the requirements of their feet will have become fully understood and science will have taken the place of empiricism in the matter of shoeing.

Symptoms of Stringhalt and Spavin Compared.

237. In studying the hock joint and its mechanism, I observed some striking differences between the effects of spavin and those produced by stringhalt upon the movements of the leg.

1. Walking on the toe is common in spavined horses, while no sign of this is ever seen in stringhalt, except as a very rare exception.

2. A spavined horse when turning round or moving sideways will touch the ground *lightly* with the toe, and for about one-half of the step will drag the toe along the ground; whereas a stringhalt horse will jerk his leg up and allow it to descend quickly, neither dragging the toe nor stepping upon it lightly.

3. A spavined horse on first starting out drags his leg until it gets *warmed up*; while a stringhalt leg is lifted spasmodically from the start.

4. In a bad case of spavin the horse straightens his

hind extremities while lying down, evidently to relieve pain, while the stringhalt horse doubles up his extremities, just as if they were perfectly sound. Nevertheless the various parts of the hock joint are simultaneously compressed by one common cause, namely, the undue height and length of the toe. The tendons which pass over the hock becoming attached to a foot with a long toe exerts an undue force of compression or strain upon every substance, texture, or tissue which enters into the formation of that joint. It is the action of the flexor and the extensor tendons combined that keeps the hock joint and the pedal joint in their proper positions and angles toward each other. It ought to be plainly seen what a powerful influence leverage at the toe must have upon the movements and functions of the hock joint. This fact can be stated as follows: As you lengthen or raise the toe, or both, the spasm is increased; as you diminish the height and length of the toe the spasm is diminished.

Treatment of Stringhalt.

238. In early or mild cases simply balancing the foot will suffice. In advanced and inveterate cases the centre-bearing shoe properly adjusted simply works wonders.

It must not, however, be understood that *every case absolutely without exception will receive benefit from it*. I have met with *one case*, and *but one*, that received no benefit from the centre-bearing shoe; so that I conclude more exceptions to the rule may be found in practice hereafter. Why that one case was not amenable to the treatment successful in every other case is as great a mystery to me as the *exact location* of the disorder. To this I may add that I have never yet seen a case of stringhalt associated with a well-balanced foot.

Mechanism of Hock Joint.

239. I desire to record one more observation upon stringhalt and its *possible* if not *probable* location. It can easily be observed that the lower part of the leg, that is, the leg below the hock, can only be raised or bent while the pastern and foot are folded together backward and downward, and that when the pastern joint has reached its limits in folding the hock joint has reached its limits of flexion or folding likewise; and any effort beyond this natural limit to flex the hock must cause an abnormal compression which will be felt principally at the hock joint. I have watched the leg when it has been lifted as high as it was possible to lift it, when the leg would vibrate for an instant, as if the forces of the flexors and extensors were about equally balanced, and required a short interval for the forces to act which draw the leg downward. In consequence of the severe strains and compression to which the hock joint is so much exposed as an agent of the propelling power, I am inclined to the opinion that the *proximate* causes of stringhalt will be found in immediate connection with the hock joint.

Stringhalt Suddenly Acquired.

240. Professor Williams records an *aggravated* case of stringhalt as being acquired in one night and becoming worse with age. It might be interesting to state that I had a similar experience with a horse of my own many years ago. I drove a horse about forty miles one day in Canada, in the month of March, when the snow was slushy under the horse's feet, which had not been shod for several months. It may not be known to every reader that farm-horses in Canada usually go all the winter without shoeing, as long as the snow lasts, as

they remain sharp and are rarely reset before spring; therefore the feet grow long, and this was the case with my horse. After a forty-mile drive this horse developed stringhalt in one night. The longer a foot has been shod the more snow it will gather at the toe, and becoming hardened into a ball at the toe sets up a leverage which strains the back tendons, and in proportion to the strain will be the *compression* upon the hard structures of the hock joint. That that joint was the seat of trouble in this case was shown by the successful treatment. The hock was enveloped in a mass of very fine hay which was held in position by several very long and heavy bandages. The *sweating process* which I adopted was caused by using *hot beef brine*, kept up for several hours. The legs were then dried and kept warm with dry bandages until next day at noon, when the horse was so much better that he was driven sixteen miles, only showing some degree of stringhalt in *one* leg. The sweating process was renewed upon the hock of the unsound leg, and the horse went as well as usual the next day.

Hock Movements.

241. Observers of the horse's hock movements have noticed that some horses lift their hind feet higher sometimes than at others, and higher than is necessary at all times, considering it waste of power when they do so; but why they do it has not been so readily perceived. My theory throws light on this little problem, as well as a few others. I deem it a fact that cannot be disproved—indeed, it is one that is susceptible of the clearest proof—that a long and high toe combined with undue height of the inside half of the foot predisposes very strongly to higher lifting of the foot, which necessarily involves a greater flexion of the hock. Young and sound horses when they acquire feet of this form

describe what has been called the half-moon circle with such feet upon the ground. It is also worthy of notice that when the inside half of the foot is unduly high and the inside toe high and long with it, just at the instant the toe leaves the ground the foot is jerked up suddenly and lowered slowly; and if the heels are raised instead of the toe, conjointly, the movements of the foot and leg are reversed—the foot is raised slowly and lowered suddenly.

Effects of Snowballing.

242. It is common enough to see horses in winter raised on one or both hind feet higher than usual, the effect of snowballing. Colts and young horses often show a disposition to stringhalt after balling at the toe. The sole of the foot, which is not meant to carry the whole of the superincumbent weight, is certainly made to do so when a snowball gets packed between the shoe and the foot and stays there. After such cases, when the old horn has been removed, red stains appear which show very plainly that there has been an effusion of blood from the sensitive sole into the horn tissues. In my opinion this is due to snowballing.

Quarter Crack.

HOW SPLIT HOOF IS PRODUCED.

243. Much learning has been wasted, *as far as the horse is concerned*, in discussing the proximate and remote causes of split hoof, just as there has been over every other disorder of the foot. An unbalanced foot is the parent of a numerous progeny of maladies more or less destructive to the horse, and split hoof, as I prefer to call it, is a member of the family. The cause and cure could be very briefly stated, but I presume it will be

expected of me that I should give some account of the *how and the why* of its production.

Professor Williams and Split Hoof.

244. In glancing at what Professor Williams has said about split hoof, I was surprised at how *little* he has to say about it. All he has to say will hardly furnish me with a text of sufficient scope to give point to my own observations. But for the use I make of his utterances, I hope it will be deemed a sufficient compensation if I present him with a few *surprising facts* and a few theoretic novelties.

"A brittle condition of the wall caused by a perverted condition of the secreting structures," and that "it rarely happens on the outside." This is the sum total of the information to be found on split hoof in a book designed and used as a text-book in veterinary colleges in this country and in England! I have an impression, however, that the subject has not been quite exhausted in the utterances above quoted.

What is the matter with recent writers on lameness? The spirit investigation seems to be dead or slumbering as regards foot diseases. One writer evidently would willingly hand over all foot diseases to the horseshoer; the foot he considers the domain of the horseshoer. These veterinary agnostics seem to have become sullenly indifferent to the consideration of foot diseases.

"Come, let us Reason Together."

245. To begin with, I take issue with Professor Williams as to the cause of split hoof. I deny that a perverted condition of the secreting structures is the cause of split hoof. But even supposing it were, what in the learned professor's opinion causes a perverted condition

of the secreting structures? There must have been a cause for this, but as the learned professor has not delved so deeply into the category of secondary causes, I will assume the rôle of *preceptor* to the *professor*. A contracted or *wired in* condition of the quarters is a much more obvious immediate cause of split hoof than a perverted condition of the secreting structures. The nearest proximate cause of split hoof is a contracted condition of whichever quarter the *split* may affect; and the extent of the *split* depends upon the angle or degree to which the wall is bent from its normal shape. No one has ever seen a *split hoof* in a normally shaped foot. The fact is demonstrable that the heel which approaches nearest to the centre of the foot, whether it be the outside or the inside, will receive more weight than any other part of the foot when the foot is placed upon the ground. It is also a fact that the quarter receiving this weight is pressed inward against the frog tissues. Another factor in the problem is this, which is equally demonstrable with the rest, that when the lower margin of the hoof is *contracted* the upper border around the coronet becomes *expanded*. Moreover, the upper margin of the hoof is very thin, gradually becoming thicker as it descends. These conditions being associated, you will not have long to wait for a split hoof. You know that a split in the quarter *always* begins at the top and extends downward.

The secretions have nothing to do with the cause of the split, the split being produced by purely mechanical causes; but after the split has taken place the lesion may and does interfere with the secreting structures. *Perverted* secretions! Why, as soon as the contracted quarter is expanded and the expanded upper margin of the hoof is contracted, the split is invisible and the secretions show their *integrity* by giving you an inch of new hoof in about three months.

This may be a surprising fact to the professor, but it is a fact nevertheless.

Rationale of Split Hoof.

246. We have seen that a contracted quarter is the proximate cause of split hoof. To what causes, then, are we to attribute the contracted quarter? There are two classes of causes—predisposing and exciting. I will deal with the predisposing first. The most powerfully predisposing cause is neglecting to cut and to keep cut the wall even with the sole of the foot, that is, at the line of union between sole and wall; for it is then that the foot is in its strongest and best form *for all purposes*. When the foot is allowed to grow beyond the line referred to, in that same proportion will the foot become weak and become more liable to splitting from *purely mechanical causes*. All horn beyond this line is excrescent, and until cut off is a perpetual menace of danger to the horn structures above that line. The higher the foot is allowed to grow the greater the danger. The slightest divergence from a perpendicular bearing will carry one heel inward toward the centre of the foot. The first quarter that yields must be the weakest. From the moment it begins to give way, an additional burden is thrown upon it by the superincumbent weight, and the strongest part of the hoof has the least to carry and therefore is less exposed to injury than the weakest quarter. All this can be prevented absolutely by keeping the foot down to its natural level. An additional cause to this in promoting weakness in the quarter is *concaving* the shoe too far back. The heel is apt to get on this inward bevel and bulging at the coronet and a split hoof may be the result.

I would here enter my protest against a very common practice, that of so-called *easing the heels*. This is

a mistake, as a few moments' consideration will show. Supposing a foot perfect in all respects, *casing the heels* unbalances the foot to that extent immediately even before the shoe is attached. A constant see-saw motion is set up when the horse is travelling, which necessarily loosens the nails in the front part of the foot, and this will account for many shoes being lost on the road. The gaps between the heels and the shoe admits sand and dirt, and the grinding and friction produced by the motions of the horse must wear the inside quarter the fastest, as it is the thinnest and weakest of the two and, other things being equal, is the most liable to become warped and bent and therefore the most susceptible to a split near the coronet. For a proof of this, inspect a shoe which has been worn by a horse with *cased heels*, and you will find a crease in the web of the shoe and a highly polished surface which is deeper on the inside than the outside quarter.

Another powerfully predisposing cause of weakness of the inside quarter is the common practice of having less nails on the inside than on the outside of the foot, the alleged reason being to allow the foot to expand and contract on one side, if it could be not permitted on the other. The truth of the matter is this: Theoretically the hoof contracts and expands at every step, but the amount is very trifling in a foot of the natural size. The loss of this trifling degree of expansion and contraction is a much less evil than nailing the foot more on one side than the other.

The Treatment.

247. If the split extends but a short distance, it can be cured in most instances by the application of a shoe closely fitted to the affected quarter, having one hole nearly under the crack. A space is to be left between

the shoe and wall at the bearing point under the crack, from an inch to an inch and one-half on each side of the crack and about one-eighth of an inch in depth, either by cutting the hoof or depressing the shoe. The centre of the depression should be immediately under the crack. The draft of the nails will bring down the hoof sufficient to close the fissure at the coronet. In somewhat advanced cases the rocker shoe is the best, as seen at Cut 21. In exceptionally bad cases, when the foot is split throughout from top to bottom, the centre-bearing shoe is preferable, as this causes as much ease and rest to the foot even while the horse is at work as the common shoe does when he is at rest in the stable.

I cannot help reiterating the remarkable properties of the centre-bearing shoe. Whether at rest or in motion, it receives the weight of the animal and concentrates it at a single point, that point being at the centre of the foot, which enables the weight to be carried with greater ease than it can be carried in any other way. I have never yet met with a split hoof so bad that it did not yield to the combined effects of a strong hoof expander and a centre-bearing shoe, without any other appliance or aid whatsoever. They all surrender *instantly* to this method of treatment, and the horse goes to work *right away*. I was going to compare this method with the methods recommended in works on lameness of horses, but my intention has changed, as I now think the sooner they pass from the memory of mankind the better it will be for horses.

Post-Natal Influences.

248. I don't know any more suitable time or place than the present for recording some observations which have reference to the causes of several distinct diseases of the foot besides and including split hoof. The influ-

ences of heredity, or as some prefer to call them prenatal influences, have very little to do, in my opinion, with the majority of cases.

I propose to show that we need not go so far back as heredity for the origin of many diseases, since there are so many reasons to be found *for their being* in post-natal influences if we study the horse's independent existence. The sucking colt has to spread his fore legs to obtain his sustenance from the dam, and as soon as he begins to eat grass he is too frequently handicapped by a short neck and long legs. He has to spread his legs and lower his body so as to be able to reach the grass, and in doing so his weight is carried by the *inside* of the fore feet. The colt's foot is small-cupped and comparatively soft and yielding to pressure. Under this *mechanical* pressure the inside of the fore foot gets a *bias in the wrong direction*. The outside of the foot may or may not preserve its normal shape, but the inside becomes the lowest, inclines inward, and wears away the most. This changes the form and the form changes the angle of bearing, and the unequal bearing becomes a strongly predisposing cause of contraction, split hoof, and other ill results when the requisite knowledge for correcting or counteracting those tendencies are absent. In this way I believe many a deformity of the feet has a beginning, and is an inheritance, if it be one at all, which has its sources in imperfect human knowledge rather than in a predisposition derived from its progenitors.

Atrophy of Bone.

249. The deformity of the hoof is followed by a corresponding deformity of the pedal bone. That the bones of very young animals are softer and more liable to be pressed out of shape by unequal and unnatural pressure upon the hoof, I think will hardly admit of

question. Be that as it may, it is a verifiable fact that in very many feet which have been examined after the death of the animals to which they belonged, the inside wing of the pedal bone has been found to be smaller—in some considerably smaller—than the outside one; a condition termed atrophy, or wasting of the bone. I deem it a reasonable inference in such cases that the deformed hoof and the malformed pedal bone stand in relation to each other, as cause and effect. My view is that in consequence of the unequal pressure the hoof and the wing of the pedal bone immediately over it at the inside quarter are both alike obstructed in their natural growth and development, and that they never recover from their retarded development, but adapt themselves as well as they may to abnormal conditions. Later on, when shoes are applied to their feet and there is no recognition of the true state of things weak inside quarters and an unbalanced pedal bone with their attendant evils, contraction and split hoof, are the very common consequences.

Keep it Down.

250. These observations, if correct, point to the necessity of caring for and paring the colt's feet almost as soon as they are foaled. Judicious paring will counteract the effects of straddling, so injurious to the feet of colts. The rule for cutting cannot be more simple: *Don't let the wall project beyond the sole—keep it down*, or the penalty of neglect may be a deformed hoof, a malformed pedal bone, and a diminished market value. I know of horses to-day which in consequence of a weak inside quarter have to wear an expander all the time to give them equal bearing on both sides of the foot; with this equal bearing they can do fast work comfortably, without it they are cripples.

Subject Not Exhausted.

251. I have not yet exhausted the subject of split hoof and its causes, but I could not say less and do it anything like justice. I could not dispose of the subject in eighteen words. Cut 17 is an illustration which will show that when both quarters are split at the same time, it is because they are both contracted at the same time. The plantar surface of such a foot shows both quarters bent in immediately behind the wings of the pedal bone, as shown by the dotted transverse line; and that the resistance of the wings of the pedal bone is what causes this short inward curve of the quarters, at the said dotted line, and renders the quarters liable to split opposite and above the dotted line referred to. It goes by saying that when the hoof assumes this contracted form it is much more liable to become split than when the heels have been kept wider apart.

As regards treatment, I think enough has been said to prepare the shoer for successfully coping with any case of split hoof that arises in or on the *quarters*.

Front-Foot Fissure.

252. We have been considering split hoof when it occurs in the quarters; we have now to consider a form of split hoof which is found in the front of the foot, a most pestiferous and difficult form to deal with when there is a want of knowledge in relation to its causes; and without that knowledge there can be no just appreciation of the remedy.

Lest I should be accused of magnifying this evil and the difficulties attending its cure, I will give the exact words of Professor Gamgee in regard to it, to be found in his work on "Lameness and Shoeing," than whom a

more trustworthy writer does not exist. He says: "The origin, cause, and really bad features of these cases is disease of the coffin bone. It was only by numerous dissections of feet thus affected that any right conclusion could have been arrived at on these very troublesome and partially incurable forms of foot disease. During thirty years of practice I attained no knowledge worth consideration about these feet with fissures in front. All that was evident was that the horses so affected were worked in a miserable plight, with a foot bound up and subjected to innumerable operations, until they were at length sent to the slaughter-house."

Rationale of Causes.

253. There are two different causes for this ailment, which, although producing fissures in the same part of the hoof, vary very widely in character, so much so that it is important those causes should be distinguished one from the other. One cause of this disease originates in an accidental injury to the coronary band from which the fibrous portion of the horny wall is secreted; the other springs from an unbalanced condition of the pedal bone. In the first case it might be called the *extrinsic* and in the latter the *intrinsic* cause. We will explain the rationale of the extrinsic cause first. Any accidental injury to the coronary ligament, whether serious or trivial, happening at or near the centre of the foot, is very apt to cause a fissure at this point: first, because the hoof is very thin at its junction with the coronary ligament, and, secondly, because there is more movement in the hoof at that particular point than at any other part of the hoof when the horse is in motion, and from this the fibres are more liable to be rent asunder there than at any other point; and however small the beginning, it will continue until a new bond

of union is set up between the coronary ligament and the wall of the hoof. At the finishing of every step the coronary ligament is strained and the fissure kept open. As before remarked, the fibrous, tough portion of the wall is derived from the coronary band by secretion, and there being a break in the continuity of the *secreting* structures, there is a corresponding break in the continuity of the *secreted* structures; and that is the way most front fissures have their origin when the cause is *extrinsic*.

Causes Intrinsic.

254. We will now trace the chain of *intrinsic* causes which lead to this deplorable effect of imperfect knowledge; and in order that the reader may have a clear comprehension of the rationale of those causes, we shall have to refer again to the mechanical principles involved in the construction of the foot and the source of its mechanical derangements. Let it be remembered that the limbs of the horse are so constructed that all the ailments of the foot affect more or less every other portion of the limb of which it forms a part.

The foot is the fulcrum of the entire limb, and any alteration in the bearings of the fulcrum will have corresponding effects upon the levers and pulleys connected with it.

All for Want of Balance.

255. It will be readily understood how undue height of the heels predisposes to split quarters; now you will be prepared for the fact that undue height of the heels also produces a strain upon the extensor tendon just where it is inserted into the apex of the pedal bone. As surely as strain upon the perforans tendon is produced by a too high toe, just as surely a strain is produced upon the extensor tendon by too high heels.

Position of Pedal Bone.

256. The next factor in the question is the peculiar part played by the pedal bone. Let it be recalled that this bone receives the insertions of the two most powerful tendons of the leg, and that this bone is the medium through which or by which the movements of those tendons are reciprocated. It cannot be difficult to understand how the forces conveyed by these two tendons can be equalized and balanced by the *set* of the pedal bone; and how any alteration of this *set* would destroy the balance of the forces between these two tendons, no matter whether it was by raising or lowering the heels or by raising or lowering the toes.

Leverage at the Heels.

257. Another factor in this problem of front-foot fissure must now be introduced. How adverse leverage is produced at the toe has been described. Adverse leverage at the heels must now be considered. While the leverage at the toe produces a direct strain upon the perforans, leverage at the heels has the same effect upon the extensor, and at no point is that strain more acutely felt than directly in front at the apex of the pedal bone, where the movements voluntary and involuntary caused by the progressive movements are greater than elsewhere in that region of the hoof, and therefore the most acutely felt. The extensor at this point is exposed to strain and injury from both a high heel and a high toe. The high heels produce a direct strain; that from the *high* toe arises from a doubling-up of the pedal bone, which causes its apex to press against the lower end of the small pastern bone. In short, the pedal bone is always "between the devil and the deep sea." It is only

safe when it enjoys a perfect balance. This leverage at the heels is produced by long shoes and high calks so commonly to be seen on heavy, slow horses. As constant dropping wears away stones, constant undue strain upon tendons, whether in front or behind the leg, will weaken them. The strain upon the perforans produces the morbid condition termed navicular disease, when the same species of strain produces inflammation in the region of which the apex of the pedal bone is the centre, and this creates the conditions which lead to front fissure at the coronet. In this case a perversion of the secretions precedes the split hoof; in the quarters the split hoof takes precedence of the perverted secretions. The most important of the tissues at this point are the laminae, from their double function of secretion and of connecting media, for whatever impedes or destroys the secretions will soon cause disconnection. Defective secretions will soon make a defective hoof, and therefore liable to split upon the slightest provocation.

Peculiar Form of Foot.

258. Please refer to Cut 2. This is a form of foot which I deem naturally predisposed to front-foot fissure; it has preternaturally high heels independent of shoeing, and has to be shod *just so* to prevent its flying asunder.

This form gives a constant *tilt* to the pedal bone forward at the apex and downward at the toe, producing strain upon the extensor, and leading to that form of split hoof which runs through the hoof from top to bottom, or from bottom to top, and sometimes half-way through from either end. This kind of foot is mostly seen in heavy horses which could not travel without shoes, and the shoe, therefore, becomes a necessary part of the foot, but the shoe should be formed so as not to

interfere with the natural balance of the articulation. When the principles involved in the theory I am endeavoring to explain are fully understood, there will be no difficulty in adapting shoes to this particular form of foot that will not only cure these fissures, but, what is of far more consequence, will absolutely prevent them.

Concussion.

259. The shock and concussion produced by undue height of heels become greater as the heels of the shoes are longer, and in the same proportion will the strain be increased on the extensor just where it unites with the pedal bone. This often causes a *shortening of the step* or lameness even before any fissure has taken place. About this time a warning symptom may be detected at the spot where the split occurs. It is that of a slight depression, a *scaly and ridgy* surface, and pain being evinced by pressure of the finger. I might also refer to the *gap* made as the foot touches the ground when the heels are long and high, between the toe and the ground, varying from one to three inches in different horses. This is one effect of the loss of balance upon the pedal bone. With unusually low heels, the toe reaches the ground first. The best shoe for such a foot as this must meet its particular requirements. When the hoof cannot be lowered, the shoe should be made lower and shorter at the heels; this would lessen the gap referred to, where as a rule the gap is much wider than in feet formed as in Cut 5, which are apt to go on the toe instead of the heels.

To Prevent Slipping.

260. In shoeing feet as shown in Cut 2, for slippery ground, side calks should be preferred to heel calks, welded one inch forward of the point of the heel of the

hoof, as seen at Fig. 26. No matter about the length of the heels or branches of the shoe; the shorter the bearing part of the shoe is at the heels for such forms of feet, the less concussion they will be subjected to; the less strain, and therefore the less inflammation, there will be in the region of which the apex of the pedal bone is the centre, just where it is united with the extensor; and therefore the less interference there will be with the secreting structures, and both split hoof in front and at the quarters will be prevented by that mode of shoeing. If the horse is shod with a common shoe, the toe calks should be set back to correspond with the heel calks.

The centre-bearing shoe, however, is the *standard shoe* for every species of split hoof, whether in front or at the quarters, for all forms and textures of feet and for every breed of horses.

Shoeing for Front Fissure.

261. The following directions for shoeing for front fissure should be duly considered and thoroughly mastered, if they are to be dealt with effectually. The shoe should be a bar shoe; the bar, however, is not intended for the frog to press against, but for the purpose of giving firmness to the shoe, as the front part of the shoe must be hammered down thin. The shoes are to be made rocker-fashion, and according to the size of the foot so must be the size and extent of the rockers. Large horses sometimes require the rockers to be from one inch to one inch and a quarter high in the centre, and from one and one-half to two inches from the centre in the long direction, and the ends tapered so that each rocker shall be the segment of a circle, and of course they should be both of the same size, and set on evenly so as not to *wabble*.

A Solid Foot.

262. No part of the rim of the shoe should be allowed to touch the ground while the horse is in motion, for if the toe is allowed to press upon the ground when the foot is raised, the fissure is forced apart and is made to gape at every step, and no horn could grow down solid under such circumstances. It is intended to keep the foot as *solid as possible*, and thereby to prevent motion in its divided parts, so that growth of horn may be facilitated rather than retarded. The slight expansion and contraction natural to a healthy foot must be sacrificed for a short time for the sake of a greater gain. Solid growth of horn can only be promoted by preventing motion in the divided parts.

No Easing Off.

263. As regards nailing on the bar shoe described, it is important that the shoe should fit snug and firm at the heels, having a solid bearing at the quarters, where the *casing-off* process is usually indulged in. No *casing-off* is to be practised here, as it would nullify all that could be done besides. Motion at the quarters especially would produce motion in the divided parts at the fissure. The nailing, therefore, should be carried well back to fulfil the above-mentioned intentions. So much for the heels; now for the toe. A suitable space is to be formed at the toe by cutting the wall an inch or more on each side of the centre of the toe to allow the draft of the nails at the toe to close the fissure at the coronet. This can be understood and carried out by any handy farrier having care and judgment. Of course the length and depth of this interspace must depend upon the size of the foot, the extent of the fissure, and

the skill of the operator. The frog must not bear upon the bar of the shoe, for the reason that bearing at that point would counteract the closing of the fissure at the coronet.

Rationale of the Rocker Shoe.

264. The rationale of the rocker shoe in these particular cases admits of a little further explanation. But for the repose given by this shoe to the pedal articulation, the coronary bone by its forward and backward movements would press against the fissure every time the toe left the ground, and thereby check the growth of *solid matter*. We are not seeking to unite the divided fibres—they can never be united. It is the nascent undivided horn fibres that need protection. This is the essential element of the curative process. It may as well be observed also that the smaller the compass of the ground-bearing surface of the foot, the more firmly can a shoe be attached to it; and furthermore, the smaller the compass of bearing the less degree of articulation of the joint is required. It is equally true in the proportion in which the bearing is drawn to a central point. Strain will be lessened and repose given to the articulation, either in action or at rest, thus giving nature a chance to exert her self-healing powers. The centre-bearing shoe can be thus demonstrated to be in fact and theory both the best safeguard against injuries that has yet been invented or discovered, as far as my knowledge of the matter extends.

Professor Gamgee.

265. Professor Gamgee concludes his article on front-foot fissure by the statement that he had made numerous dissections of feet affected by that disease, and that "he had become satisfied that the front part of the coffin

bone was the seat of mischief," and that he thought was "a complete solution of the matter." Whatever the professor may consider a *complete* solution of the matter, I could only regard as a *complete* solution of the matter a rational history of its primary and secondary causes, and the discovery of a device which will absolutely prevent or cure it. Whether the professor's "complete solution of the matter" can be judged favorably by this criterion or not, I will cite the professor's own words: "Usefulness and care is all that can be looked for under the best management; perfect cure should not be expected, as *it can rarely be accomplished.*"

It has been my more fortunate experience to cure every case of split hoof, whether at the front or at the quarter, that I have had to treat during the last twenty-five years right here in the city of New York, by the methods and according to the principles described in this article. My motive in making this comparison is not the desire to belittle others or to exalt myself. It has been done purely for purposes of instruction. Professor Gamgee is vastly my superior in intellectual ability and literary attainments. He has done what he could to improve and to advance the vocation of horseshoeing, appreciating as he does its great importance to society; but that it has not been given to him to discover the *basic facts* upon which a new and enduring system of horseshoeing in full accordance with the laws of nature and, fortunately, the requirements of civilization, his own language, cited elsewhere in these pages, is a sufficient answer. I believe the time will come, but not yet, when the principle of shoeing for all horses of whatever class or kind, and kept for whatever purpose, will be that of light or heavy metal plates, having on the ground surface varying degrees of curvature suiting the requirements of each case. From the few experiments I have made upon racing and trotting horses, I

believe that here is an unexplored region for experiments that promise a rich return in the development of speed without waste of power. If ever this principle becomes common, we shall have fewer accidental injuries to the feet, and diseases from other causes be almost totally unknown. I believe emphatically this principle will be embodied in the horseshoe of the future.

Knuckling.

266. Knuckling is an ailment common to all breeds of horses and horses used for every purpose.

There is a certain conformation to the pastern or fetlock joint which must be regarded as a predisposing cause of this ailment. Horses with short and upright pasterns are more subject to this malformity than those with oblique pasterns. Cut 5 represents an ankle which is always liable to knuckling, for the want of knowing how to keep the foot properly balanced by the paring-knife and the shoe. This complaint is sometimes of an intermittent character, from the fact that sometimes, more perhaps from accident than design, the foot gets tolerably well balanced, and the horse goes better till it gets out of shape again.

Why Colts Knuckle.

It has been observed that yearlings often knuckle during the winter, and return to their normal form in summer, by simply having had their feet worn down on harder surfaces than can be found during the winter season. Why is this? The explanation is easy enough. When colts are housed during the winter the feet grow long, as in Cut 1, as well at the heels as at the toe. The heels by their forward growth reach to nearly the centre of the foot and cause the foot to rock backward,

thus straining at the back tendons, which presses the pastern joint out of its proper angle, and as long as it continues so the condition is termed knuckling.

Prevention in Colts.

267. Colts from a country free from snow are not so disposed to this deformity, for enjoying more field exercise the walls of their feet are more apt to wear even with the sole than those of their snow-bound cousins which are kept within doors all the winter. Colts running at pasture, you may be sure, will escape many troubles which others endure. As a rule they never become knuckled. The remedy is very simple for the cure or prevention of such malformation in colts. Cut their feet down to the line of safety; practise this *early and often*, and you will never be troubled with the contingency termed knuckling as long as you do so. The reason why should be plain enough. When the wall is pared evenly with the sole, the foot enjoys its due balance and there is no rocking backward, and therefore no undue strain is put upon the perforans, and there is no pressing of the pastern joint out of its proper position.

Keeping the wall on a level with the sole at the line of safety is the all-important rule either to prevent or to cure knuckling. It should be done once every month at least, and twice a month would be better. This rule applies to horses and colts of all ages. It should be known to all horse-breeders that colts suffer much from untrimmed and unbalanced feet, and as a consequence their owners suffer in the region of the pocket-book; for the consequences of untrimmed feet are that the colts do not thrive so well, and that the muscles of their hind quarters do not attain their due degree of development for want of sufficient exercise, which the colts are indis-

posed to take while their feet are in trouble. Many horses remain deficient in their hind or fore quarters as long as they live, for this very reason.

Retarded Development.

268. Fulness and perfection of the hind quarters depend very much upon the condition of the feet. Six or twelve months of retarded growth at one or two years of age can never be regained. We have said that perfect feet formed like Cut 1 were subject to knuckling; it might also be stated that *extra low* heels are another cause of knuckling. The wall of a perfect foot grows higher all round its circumference, and for that very reason it can be *pared* and yet left in an unbalanced state (see Cut 1, and the dotted lines from *g* at the heel to *h* at the toe). The heel, by being cut too low relatively to the toe, will draw down the back tendons, and their *tension* will press the fetlock forward, causing it to take an opposite angle, which is knuckling. The remedy in this case is to cut the toe down to correspond with the heels, and thus balance the foot.

Symptoms.

269. In perfectly sound feet otherwise, knuckling is preceded by the following symptoms. The horse commences to point more or less with the affected foot forward of a plumb line, in order to relieve the strain upon the back tendons caused as already explained. As the knuckling increases the pointing decreases, as knuckling gives more ease to the back tendons than pointing. From that time the perforans tendon becomes relieved, and the extensor tendon and the apex of the pedal bone receive the weight from the small pastern; from the anterior surface of the latter and to

relieve this contingency the affected foot is drawn backward, and instead of pointing forward he points backward.

Causes.

270. I have seen some horses knuckled in both hind legs from causes which perhaps are not commonly suspected. When a horse points with both fore legs at a forward angle, the horse extends his hind legs at a backward angle. Now, if his hind pastern be of the upright variety the strain upon the perforans will cause the knuckling position, which will not occur if the hind pasterns are oblique. The cure of the knuckling in the hind feet in such a case is the cure of the front feet pointing, for when the latter is cured the former passes away.

Rocking Backward.

We have seen that knuckling in young colts is caused by the foot getting long and rocking backward over the heels. It is plain that the effect of rocking backward is to lower the heels and strain the perforans. Now paring a well-formed foot too much at the heel has precisely the same effect. The same backward rocking effect is produced by a short shoe when the horse is travelling over soft ground where the heels sink deeper than the toe. This latter cause is usually intermittent, appearing only when the horse has been too long shod, and usually disappearing with the next shoeing. The permanent remedy for this is keeping the foot short, and level from side to side. The remedy for the colt's feet is the frequent use of the paring-knife and rasp, with the view of keeping them in good shape, that is to say, perfectly balanced all the time.

Veterinary Surgeons and Horseshoers.

271. I have read a recent work on lameness of horses, the compiler of which ascribes knuckling *mainly* to *traumatic causes*. This surprised me very much, as in my experience in horseshoeing the causes of knuckling have been *mainly* the other way. The unlearned reader is informed that *traumatic* is a general term characterizing diseases which proceed from wounds and accidental external injuries. Lest the scope of my work should be mistaken, I would again refer to the line drawn between diseases which are caused by accidents and those which arise from *intrinsic* causes. The former class is considered to belong to the province of the veterinary surgeon, and the latter to that of the horseshoer. Diseases called traumatic require medicinal treatment as well as surgical. My work treats of those diseases which I consider have a mechanical origin, and my remedial treatment is always mechanical, not medicinal. As a horseshoer, not as a veterinary surgeon, I name the diseases which I think arise from defective modes of shoeing and of management of the feet, and although this embraces a pretty wide field of discussion and investigation, it does not cover all the ground concerning the general subject of lameness of horses. The history of horseshoeing shows what it has been brought to by the dictation of *leaders in veterinary science* during the last one hundred years. May it not be possible that improvements may proceed from the ranks of horseshoers themselves? According to Professor Gamgee the modern veterinary surgeon thinks more of his *dignity* than of his *duty*, and is willing that everything relating to horseshoeing and foot diseases should go to the horseshoer. Although penned by a horseshoer, the veterinary surgeon may find a stray fact or two in this

book, here and there, that may be of service to him in his professional work. At least I hope so.

Causes of Knuckling.

272. As these causes have not been referred to by writers on lameness of horses, I hope to be forgiven for referring to them, as so little seems to be known outside of traumatic causes, which are always visible and palpable. For one case arising from these visible and palpable injuries to the perforans tendon, there are scores of instances which exhibit no sign of any external injury whatever by which they may be accounted for. And the book referred to is said to be the latest scientific work on the lameness of horses. Every one in the following category of causes is in itself a distinct cause of knuckling, and some of them combine and produce the same effects:

1. A long toe standing or travelling upon soft ground, or standing on soft bedding, will cause the foot to rock backward and strain the perforans tendon. Be it remembered that whatever causes a strain to the perforans tendon is a cause of knuckling.

2. A high toe will strain the perforans on any kind of surface.

3. A long and high toe combined will produce the same effect in a still greater degree while travelling.

4. A contracted outside heel corresponding with full inside toe will lower the heels and cause strain to the perforans.

5. Both contracted quarters, like Cut 17, will strain the perforans.

6. A shoe fitted short at both heels will cause them to wear faster than at the toe, thereby causing strain to the perforans.

7. A shoe too thin at the heels, any shoe thinner at

the heels than at the toe, will produce strain upon the perforans, according to the shape and growth of the foot.

8. A shoe fitted too tight at the outer heel, will wear fast at that point, and cause strain to the perforans.

9. The whole inside half of the foot, being higher relatively than the outside half, will produce strain upon the perforans tendon, and will derange the functions of the pedal articulation. In short, any cause or causes combined that derange the seat of bearing in the pedal articulation and cause strain upon the perforans tendon will produce the abnormal condition termed knuckling.

The Horseman's Compass.

273. If you will now glance at the chart on pointing, you will readily perceive how these causes can be easily understood by any one who can tell the difference between an upright and oblique position. Raising the heels in order to relieve the perforans tendon is good as far as it goes, but it goes such a very little way; else why do we see so many knuckled horses in our streets, either standing or travelling? Can nothing more be done to prevent or cure this dangerous weakness as well as unsightly deformity of the limb? By the aid of the chart referred to we shall gain a clear insight into the causes of knuckling, both proximate and remote, which could not be gained without it. When a horse commences to knuckle, if it proceeds from being too high on the inside half of the foot, whether it be before or behind, he will either stand with his feet close to each other, or cross his legs, resting one foot upon the other; and he will travel with his feet unusually close together. The effect of this form of the foot will also cause the knee-sprung condition with an outward direction of the knee.

Oblique Pasterns.

274. Near the beginning of this article it was stated that feet formed like Cut 2 are not subject to knuckling, the reason being that such forms of feet are always too high at the heels, which prevents knuckling. Now this form of fetlock has knuckling associated with it occasionally, and that is when the whole inside half of the foot becomes higher than the outside half. It has also been remarked that pasterns formed like Cuts 12 and 13 were entirely exempt from this ailment. The reason for this exemption is that the obliquity of such pasterns is too great for the fetlock to be forced by any mechanical means, to leave its low oblique angle for an opposite one. Long and low oblique pasterns are not so sensitive to changes in the form of the feet as the more upright ones. The straighter the pasterns, all else being equal, the more readily it becomes affected by changes in the bearing of the hoof.

To Prevent Knuckling.

275. Knuckling is at all times easier prevented than cured. It is easy to cure in its early stages; but when it has become chronic it is not easily disposed of. A recent writer on knuckling, in summing up his views, stated that "the prognosis is *always* one of a very serious character, and the disease is *never* otherwise than exceedingly refractory to treatment." I have had a more fortunate experience in such cases; and I hope and expect that when the writer referred to shall have had a deeper insight into the mechanism of the foot and the causes of its derangements, and shall have become acquainted with the mysterious properties of the centre-bearing shoe, he will record a more successful experience in the next edition of his work.

The Foot the Essential Part of a Horse.

276. Some writers think that working the animal too young must be considered a cause of knuckling. Those who assign this as a cause of knuckling never mention the cause or causes of weakness which produce this tendency to knuckle.

When the foot is of the proper natural size and proportion, work, by which I mean a vigorous exercise of the muscular energies, will improve the tone and general condition of the animals; while the same amount of exercise or work, all else being equal, exacted of a horse whose feet are out of due proportion and ill-shapen and unbalanced would make him dispirited and unthrifty. The foot—the well-balanced foot—is the essential part or property of the horse. When a young horse becomes knuckle-jointed, I have invariably found that the walls of the foot were projecting beyond the sole in a greater or less degree, thus compelling it to work under the disadvantages of a leverage force at the toe arising from a disproportioned hoof.

Treatment.

277. When the case is a serious one, and the heels have to be raised, shorten the toe at the same time as much as possible. A four-calk shoe works best, the calks being set back, bearing in mind to have the outside calk the largest in order to brace the outside of the foot. Never yet has a pronounced case of knuckling been cured by raising or lengthening the toe, or by welding a piece of iron to the shoe projecting more or less from the front of the foot, as recommended by some writers on knuckling.

Curb.

LOCATION.

278. The hock joint is not only the seat of several diseases such as bone spasm, bog spavin, thoroughpin, and probably stringhalt, but is also the location of a diseased condition, the common name of which is curb.

Definition.

Curb is a hard callosity in its advanced stage, or but a mere soft swelling in its early stage. It is formed on the back of the hock, a little below the point of the hock, or os calcis as we shall sometimes call it. The limb in its efforts at or in propulsion—for the hind legs are the propellers of the system—at the instant that the toe leaves the ground produces the greatest amount of strain upon all the tendons of the leg, but especially upon the powerful tendon that finds its lower attachment upon the posterior surface of the os calcis or backward bone of the hock. Curb thus claims kinship in the manner of its production with navicular disease and split hoofs, inasmuch as they all occur at the termination of tendons, where there is the greatest amount of indirect motion, and consequently where the greatest degree of strain is exerted upon those tendons. The point of the hock is a fulcrum, and so is the navicular bone, and the greatest force is exerted in a lever between the fulcrum and the lifting point or short end. The moment of greatest strain to the large tendons in both fore and hind legs is when the toe leaves the ground in the act of flexing the limbs preparatory to a forward movement. Harmony is nature's first law in the movement of a machine; while harmony reigns, all goes well. I need not state the converse of this proposition.

Limits of Endurance.

279. Every piece of machinery constructed of steel and iron, as the locomotive engine for instance, has a limited capacity for strain and endurance. It is even so with the locomotory machinery of the horse. Tendons and ligaments have their limits of strain, and bones have their limits of resistance to compression. Any strain of one or compression of the other beyond those limits will result sooner or later, as the cause is persistent, in various morbid manifestations—one of which is the spot designated as the seat of curb. They are liable to appear alike on hard or soft structures. All the bony deposits are essentially of the same nature and produced by the same cause, compression, and all the lesions of ligaments and tendons are essentially of the same character, being produced by undue strain. And what is equally clear and demonstrable is the fact that both these classes of disease are produced by the same identical cause—an undue elevation and extension of the toe.

Deranged Machinery.

280. The altered bearing of the foot on the surface of the earth, through the operation of this cause, produces derangements of the forces and functions of every tissue and every joint composing the limb; and as long as this fact remains an unknown factor in the category of causes of foot and other diseases, so long will the horse continue to be a martyr to human ignorance rather than the victim of a cruel and unrelenting law of nature.

The various bones of the hock joint are bound together by straps and bands very strongly at every point where strength is needed most, as it has need to be to carry weight and resist momentum, and exert the pro-

pulling power besides. Ligaments and bands resist strain in every direction; but they all have their limits of resistance. It is obvious too that the os calcis, or highest bone of the hock, is the fulcrum of the lever which lifts the leg preparatory to a forward movement, and being so, the liability to strain is greater at this point than at any other portion of the tendon. I hardly need say that unusually violent movements, such as rearing, leaping, sudden reining-in, etc., with or without the adjunct of a high toe will greatly increase this liability. Furthermore the seat of curb is an important *centre of action*. The tendon of the largest muscle of the leg ends exactly at that point. The point of the hock combines the properties of the pulley and the lever, and the nearer the *forces lifted* the greater the strain will be upon the *lifting* forces. That the *sprain* of the tendon produces the inflammatory symptoms and products at this point I think cannot be gainsaid. It matters little whether it is in this, that, or the other tissue principally; all the tissues adjacent to the sprain are involved. That the substance of the os calcis is affected by inflammatory action cannot be doubted, and possibly forms the basis of that permanent enlargement which characterizes curb.

A Fertile Region.

281. Not only curb is produced in the manner described, but throughout the whole course of the perforans from the hock to its insertion into the pedal bone, and from the insertion of the extensor into the apex of the same bone back again to the hock, a *region* is bounded by these two tendons which is fertile in morbid manifestations of one kind or another. Between the toe and the knee of the fore leg and the toe and hock of the hind leg seem to concentrate nearly all the ills which hitherto

seem to have been the horse's *fatal inheritance*. All along the line down the back of the leg you can trace lesions of the soft structures, and all the way up the front of the leg may be traced masses of morbid material on the surfaces of the bones, all the results of undue strain upon the tendons and ligaments as the active, and compression of the bones as the passive, agents in the production of these diseased conditions, and all from one and the self-same remote cause, and not very remote either—an abnormally long toe. We cannot conceive that curb has any cause peculiarly its own; that is, separate and distinct from other morbid conditions of the limb. They all belong to the same family. The family likeness is stamped upon them all. Nothing stamps their identity of origin so much as the identity of the remedy. The adverse leverage at the toe produces the strain; remove the leverage at the toe and the strain is relaxed; place on the foot a centre-bearing shoe, and every particle of strain is removed from the previously overstrained ligaments and tendons. I state this as a matter of fact and demonstration, and challenge any one to disprove its absolute truth.

A Fixed Fact.

282. This is not a theory, but a fixed and unchangeable fact, which must and will have general recognition, not only as a fact but as a *factor* of the first importance in the methods of management and protection for horses' feet. In all cases of curb, immediate relief is given by cutting down the foot to the white zone so often referred to, and by placing on the foot a rocker or a centre-bearing shoe; no animal need be idle longer than a few days, and if the case is not severe he will be able to continue his work *right along* without lameness, and suffer no disadvantage whatever. The general adapta-

bility of the centre-bearing shoe to all forms of disease and diseased action is one of its most remarkable features, and of course confers upon it a property of great value, and constitutes it a boon of no mean importance to the horse and his owner. Its good effects are simply marvellous. The "half hath not been told" of its beneficial influences. In most cases of curb, spavin, and so-called navicular disease, its good effects are *instantaneous* in their operation. It is not at some future time that the good effect may be expected, but *right there and right then*. The animal walks away with a long stride, doubtless feeling *a glad surprise* at the novel experience of *feet without pain*.

Curb Varies.

283. It is proper to say that curb varies very much in size and degree. At first it seems to be small and uneven in circumference; but if the subject of it is kept at work regardless of the enlargement it will become larger, and the longer it is neglected the harder it will be to remove. The lameness consequent upon curb varies also very much in degree.

Curby Hock.

284. This term is applied to hocks which have a slight enlargement at the seat of curb, but in which no lameness is present.

Any deviation from the straight line of the hock upon its outer surface denotes either a coarsely formed os calcis due to heredity, or a condition due to the effects of curb of which the evidences of its former existence had not entirely disappeared. Veterinary experts often differ in their opinions on this very question; and for this reason a curby-looking hock will always be an object of suspicion.

Curby Hock and Sickle Hock.

285. The term curby hock is also associated with the form of hock sometimes called *sickle hock*, from the anterior outline of the limb resembling the agricultural implement called a *sickle*. From a mechanical point of view, this form of hock is not the best calculated to withstand any violent exertion; the toe, the bearing-point, being so far forward greater force is required to act upon the foot than would be the case if the cannon bone stood more vertically. In a sickle-shaped hock, the angle formed by the thigh and leg bones being much more acute than when the cannon bone is upright, as the leg is lifted the point of the os calcis is thrown more obliquely backward, and the flexors of the leg are compelled to lift it at a double disadvantage, having to act against the transverse angle of the leg and the point of the os calcis as well. The strain upon the tendon at the seat of curb must be very much intensified, and whatever increases that strain must increase the liability to curb in the same ratio.

Characteristics of Pointing in Curb.

286. We have treated very many cases of curb in different degrees of development. A horse with curb stands pointing forward with his hind feet, and travels the same way, that is, with his legs under his body, rather than by letting them swing back goose-fashion. He also steps short and throws as much of his weight as he can on to his forward feet. This he does, of course, to favor his affected limb or limbs. I have seen some horses so severely affected and so lame as to walk upon the hind toe entirely with the view of straightening the limb and obtaining ease. With these very severe

cases, a centre-bearing shoe modified as in Cut 11, where the central and very highest part of the ball comes directly under the insertion of the perforans at letter *k* and line *p*, proves more effective than any other kind of treatment I have even seen or heard of. I have never yet seen a case where inflammation would sooner subside than from the application of that very simple device.

Sprain of Back Tendons.

VARIOUS EFFECTS FROM ONE CAUSE.

287. In our discussion of the nature and causes of curb, we have shown that many forms of lameness may justly be attributed to one primary cause; that none of them have a distinct and separate cause from the others; and if but one ailment affects a limb it must be at the expense of other portions of the same limb, and sometimes of the other limbs. It must be obvious that the different segments of the column of bone could not be kept in a vertical position without the use of *stays and braces* in the front and at the back of the column. These *stays and braces* are mainly the perforatus and the perforans at the back of the leg and the extensor in front of it. Each effort to propel is always dependent upon the anterior and posterior braces for support, and not only the front and back parts of the column are exposed to contingencies arising from derangements of the machinery in these two directions, but, as already pointed out, there are as many points from which danger may proceed as there are points in a mariner's compass.

The Pointing Compass or Chart.

288. For practical purposes we have reduced these points to eight; and from one point alone we have shown that as many as eight different forms of disease can pro-

ceed or be produced; that point and that cause of diseases being a toe which may be too long or too high, or both conditions combined. As a proof of the truth of this proposition we will show that sprains of the back tendons are due to the self-same cause to which I have ascribed the production of curb, namely, a straight long or high toe. I repeat that to one cause, a long or high toe or both in combination, may be fairly attributed ninety-nine one-hundredths of the cases of sprain that occur among horses, whether it comes in the form of a curb or any other lesions of soft tissues as the tendons and ligaments below the knee, or the hock.

The Centre-Bearing Shoe

289. Will be a valuable auxiliary to veterinary surgeons in the treatment of sprains of every class and kind, and it ought to prove a welcome addition to his somewhat limited resources in cases of this nature. The dreaded permanent enlargements and shrinking and shortening of tendons will be considerably reduced in number and severity. More rapid cures will be effected without turning the patients out to grass half cured. Blistering, and firing and blistering, will be in less frequent requisition. From the humanitarian point of view I deem this will be a considerable gain; I do not care to regard it from any other. A large percentage of loss must be attributed to inefficient mechanical methods of treatment, in conjunction with the purely medicinal. The only suggestion of any mechanical aid in the treatment of sprains which I have read of in books is that of simply *raising the heel*. This is not sufficient. As will be seen, the peculiar property of the centre-bearing shoe is to relieve *sprain* from any and every direction from which it might come.

It should not be forgotten that, however perfect the

foot may be, there is no absolute safeguard for it against such accidents as stepping into a hole heel down first. Very many accidents, however, may be averted by the feet being kept in good form and perfect balance. The best feet grow rapidly, and many of them require paring every fourteen days. The tendency of natural growth is always and ever to give undue length of toe, and to unbalance the foot by the growth of the heels forward and downward. Without principles to guide or rules to follow, but the *rule of thumb*, in paring and balancing the foot, the best feet are just as liable as the poorest to the perils which beset the horse with unbalanced feet.

The next form of foot most conducive to sprains is represented in Cut 5. In this form the toe is always high in comparison with the heel. We seldom, if ever, find a horse suffering from sprains of tendons whose heels have a tendency to grow higher than the toes, as in Cut 2. These are simple but important facts as regards horseshoeing, neither hard to understand nor difficult to apply; and if utilized as I hope they will be throughout our broad land, they will be as valuable in the prevention of many accidental injuries as they are in the remedial treatment of every other.

Treatment of Sprains.

290. The treatment should be exactly the same as that prescribed for curb or ringbone, having its seat in the central line of the pastern.

1. The wall should be lowered even with the sole at the white line so often referred to.

2. The centre-bearing shoe should be modified to suit the degree of lameness or the circumstances of each particular case. Remember that the greater degree of lameness will require a greater depth of the ball. In

an occasional case it may require to be cone-shaped. Then as the pain and lameness diminish the shoe must be lowered. Even after recovery, this style of shoe should be worn, as it is the best safeguard against the return of the injury.

Racers and Trotters.

291. In cases of racers and trotters, fever and lameness will become manifest, if there is not a sufficient *roll of the shoe*; with this the fever and lameness will disappear. As to the length of time that should be allowed to elapse before a horse is worked, it may be said that as soon as the fever has abated, and sometimes before it has altogether abated, the animal should be started a short distance to test his capacity for work, and if found to work well the distance can be increased at each succeeding trial. When the injuries are limited to sprain, and there is no decided rupture or severe laceration of the tendon, the chances are that he will follow his races without much risk. I have followed several individual cases with strained tendons treated as just described for more than two years, doing their work, and trotting close to 2:20. The swelling, which at first was spread more than three inches over the tendons, had during that time and while at work been gradually lessening and by the end of that time had entirely disappeared. As a rule, enlargements and blemishes disappear after this mechanical method of treatment, and firing or blistering, or both, are absolutely dispensed with. Why enlargements remain after the old style of treatment is that the tendons have lost a portion of their natural strength during their illness, cannot stand the work so well *after* as *before* the injury, with the same old form of the foot and the same old style of the shoe. Like causes will always produce like effects, all else being

equal. "Constant dropping wears away stones," and the constant pegging and straining at the toe when it leaves the ground for a forward step keep up the irritation and consequent enlargement.

Windgalls.

GENERAL OBSERVATIONS.

292. To the list of injuries caused by a straight, long, or high toe or both combined can also be added the morbid swelling called windgall. The fact that they are equally distributed on both sides of the fetlock goes to show that the foot was perfectly straight and well-balanced laterally while they were coming. But windgalls are not always found on both sides; sometimes they are seen on one side only, and always on the side on which the foot is found to be the lowest relatively to the other side. They are at first soft and puffy swellings varying in size from a peanut to a walnut, and sometimes they are larger, and the fluid they contain is doubtless the product of inflammation in the tissues at that point. They are more frequent and serious when they are associated with long oblique pastern. It is not wise to disregard their first appearance. The judicious manipulation of a wet bandage will disperse them at first, but the longer they stay the harder they are to be got rid of.

Treatment.

293. Windgalls when caused by a long or high straight foot, or both combined, can be best prevented or cured at first by the self-same treatment as that prescribed for strain of the back tendons, no other being necessary; and when it occurs on one side only it should be treated as spavin would be treated upon the same

side. A horse's foot always kept short, that is to say, the wall kept even with the sole, very rarely, if ever, has windgall. Windgall is another product of overgrowth of the wall at the toe; so that the slightest appearances of a puff at the fetlock should be regarded as a sure sign that the toe needs shortening and lowering.

The Ear-Marks of the Family.

294. There is a species of windgall that makes its appearance in another locality, but it has the ear-marks of the windgall family. It is found in the hollow spot between the os calcis or point of the hock and the lower end of the thigh bone. It also is the product of a high or long toe, or both combined. It is somewhat globular in form, and varies in size from two to four inches in diameter. Lameness is its common attendant, but the lameness does not depend upon the size of the swelling, that is to say, that a small swelling may be attended by lameness, and a large one otherwise. I repeat, the treatment for all windgalls should be the same as that for sprains of tendons; except the one-sided windgalls, which should be treated for whichever side they happen to be on, as an inside or outside ringbone should be treated.

Mr. Quintal's Case.

295. In 1869, I treated just such a case as that last described for Mr. Joseph Quintal, a wholesale grocer of Montreal, Canada. The animal was a very valuable one, and all that the best professional skill could do or advise to be done had been tried unstintingly. The owner was very reluctant to allow any non-professional to treat the case. That reluctance, however, was overcome by a friend of that gentleman who had become acquainted with me and my theory. I simply applied a

ball shoe and nothing else was done. In three months the swelling had entirely disappeared.

Originating Causes.

296. This ends the list of ailments the first parent or originating cause of which is to be found in a straight long or high toe; and the best proof that they are all the progeny of one parent is that they all can be prevented, cured, and immediately mitigated by the self-same methods of paring and *preparing* the foot, and by the application of the same mechanical remedy, with but slight modifications, the centre-bearing shoe.

Acute Laminitis.

GENERAL OBSERVATIONS.

297. This disease is more common to city horses than horses in the country. As a rule, it is very destructive to horses which have been the subjects of its attack, for after an acute attack a great many horses die, and the few which recover temporarily have never a very good time of it afterward. Their feet become ridgy and deformed, and the condition termed drop sole is a too frequent sequel of the disorder. There is a remarkable peculiarity attending this disease, which so far as I know cannot be said of any other specific disease of the foot or which arises from intrinsic causes. Sometimes diseases of the lungs or bowels will seem to quit either of those regions, and intrench themselves, as it were, in the feet. Learned pathologists, of which I do not profess to be one outside of the foot, call this transmission of disease from one organ to another *metastasis*. I have remarked that during some of these attacks of laminitis the tendency of the entire system is to shed the hair very freely, and it always seemed to me the

hoof itself could part company with the foot with a very little provocation. Hair and hoof, remember, are composed essentially of the same substance; it only differs in form.

Causes.

298. Laminitis may be brought on by long drives which cause great exhaustion; by standing too long on the feet in railway cars, on steamboats, and on ship-board in sea voyages. Getting chilled when heated, by a sudden cold breeze from a lake, or by the sea, or on a ferry-boat, or by drinking too much cold water when heated—in short, any circumstance under which the horse is exposed to a chill, whether it be from cold air externally, or from drinking too cold water internally.

A Not Uncommon Cause

of laminitis is driving a newly purchased *green* horse from the country in order to test his capabilities before he has been put into working condition—laminitis is the usual consequence.

The Cause of Causes,

299. However, is the unbalanced condition of the feet. When the foot is in a healthy condition, the laminæ of the feet will sustain great weight without yielding, all else being equal; but any departure from normal conditions, or any undue taxation of their strength, will compel them to yield to a superior force. In normal conditions there is less leverage force at the toe to harass and distress the laminæ, but with an overgrown toe and a disproportioned hoof generally two forces come into play, the effects of both being to derange and disorganize the laminated structures. The front part of the foot

is the area of disturbance, the storm-centre as it were, from which proceed some very deplorable consequences to the horse. The overgrown toe sets up leverage, the direct effect of which, at every step the animal takes, is to cause a separation of the laminae at the region of the toe. In addition to this there is a force acting in the opposite direction to this; that force being the combined effects of weight and momentum pressing upon the toe of the pedal bone, causing its displacement and a separation of the laminae in that region. Both these forces can be counteracted by keeping the foot to its normal level, thereby removing the leverage from the toe, and placing the sole immediately under the pedal bone upon the earth, from whence it will receive direct support, and the laminae will be kept in the position nature assigned them.

Area of Laminated Structures.

300. I have made a little calculation as to the area of the laminated structures which may or may not throw some light upon the functions of these structures, which are very much in dispute at the present time. A medium-sized foot of the horse contains about ten square inches of double laminated structure. This double arrangement has two functions or purposes to serve; one is to provide the means for its own protection, and the other is to assist in supporting the weight of the animal while standing or in motion. It is obvious, I think, that any undue strain upon these laminae by superimposed weight will either weaken or destroy the secreting functions. While they lie in close apposition to and with each other, they can only fulfil the functions for which they were intended. Whatever causes *tend* even to separate them *tend* in that degree to promote disease and disorganization, especially in the front region of the

foot first, and eventually to the whole foot. The horse has no need of any hoof beyond the termination of the laminated structures. The line of utility has to be drawn somewhere, and that is where it is drawn.

Observations Wise or Otherwise.

301. If it is admissible to personify nature and speak of her intentions, I should say that when she made the horse she made ample provisions for the protection of his feet while roaming the plains. Where man's dominion begins nature's ceases as far as the wear and care of the hoof is concerned. It may be thought a rather far-fetched illustration to compare the claw and bill of a canary-bird to the foot of the horse; but they are formed out of essentially the same natural substance. The bird's bill and claws are growing all the time, and so is the toe-nail of the horse, for that is what it is. He has but one toe on each foot, and his toe-nail is always growing too long. When the bird's bill or toe-nail grows too long, it must be either worn off or cut off. The bird keeps its *little bill* in order itself by removing the overgrowth pretty frequently, for that is what it does when we say it is sharpening its bill. Biddy, the hen, keeps her claws sharp by *scratching* for a living. The human finger and toe nails require to have their overgrowth kept in check, and the horse is no exception to the rule.

Bootmaker and Cobbler.

302. The fact needs but little explanation that the horse loses by domestication an important natural attribute—that of being able to keep his own feet in repair. Nature is his master-bootmaker; but the horse is expected to be his own cobbler, and would be, if you gave him his liberty on the plains.

In domestication he is pretty well taken care of in all else besides the feet—there all his troubles begin. Why? Simply because the fact is not apprehended as it ought to be that his toe-nail is always growing, and he can neither cut it off nor wear it off himself. Any principle or rule for this necessary, nay all-important operation to the horse seems to be utterly unknown. By growth the foot changes its angle of bearing every day. Perpetual growth of horn is a perpetual menace of danger to the horse, and the only thing to counteract this is a just appreciation of the horse's requirements in this regard and the frequent and judicious use of the paring-knife. Why are not elephants, camels, dogs, and other fleshy-footed animals subject to the same classes of disease as the horse? Because the horse has the good or bad fortune to have a foot that doubles its size in one year, while the area of the laminated structures never increases one iota. This accounts for horses coming from the country into the city and becoming so easily foundered or weakening the laminæ of the feet. Straining and weakening of the laminæ of the feet will always be in proportion to the extra growth of hoof beyond nature's line of demarcation—the line which marks the junction of sole and wall.

A Valuable Suggestion.

303. I desire to make a suggestion which would prevent a great deal of suffering to horses and of losses to horse-owners. Horses may arrive from the country in perfect condition as to their feet; they may be shod well as ordinary shoeing goes; and yet most of them are seen to favor their feet all they can, as they are driven over hard roads and harder pavements. Why? Because travelling over hard roads and city pavements is a new and anything but an agreeable sensation to them after

the soft roads and the softer turf of the country. On the soft turf the toe and heel sink into the ground alternately, and that greatly eases them as they pass over the ground. This is the rolling motion that nature gives them. It obviously lessens the chances of strain and concussion. When they get into the city, these favorable conditions are all changed. A hard, unyielding piece of metal is nailed to the foot, and he is driven over hard city pavements. Every step he takes the laminae receive a double shock of concussion, one at the heel and another at the toe, as he places his foot down upon the first and quits it from the last. To obviate every chance for worry or disease to the horse, the first shoes he should get on in the city should be the centre-bearing or rocker shoe. With these he would become accustomed to the hard pavements and city life generally, and he can be shod afterward with common shoes if desirable, with more safety to himself and more satisfaction to his owner.

Other Causes of Laminitis.

304. Various are the secondary causes of laminitis; yet all more or less dependent upon one primary cause. We have been considering laminitis as produced by an overgrown toe—this causes a loss of balance in the antero-posterior direction of the foot; laminitis can also be produced by a loss of *lateral* balance. The lack of lateral balance will produce a foot so deformed that instead of its being planted flat and level upon the ground, as it should be, it is planted on a *bevel* on account of its being unduly high on some part of its circumference other than the toe.

A little common horse-sense should teach any one that when a horse points his foot it is invariably pointed toward the spot from which the uneasiness proceeds.

By this sign or symptom the seat of pain can be located unerringly in the *laminæ* right over the elevated portion of the foot. It is no doubt due to this circumstance that horses show soreness very often after a drive when no swelling is to be seen in the limbs, and which usually passes away after soaking the foot or after a night's rest. Furthermore the *laminæ* can become inflamed by any form of foot which lessens their power to carry the weight which is necessarily imposed upon them. These laminated structures are the fulcra or props upon which the great lever, the limb, rests in the last effort made when the foot leaves the ground, and what is called concussion is no doubt a spraining of the *laminæ* in proportion to the weight they carry, augmented by the momentum of speed.

Bony and Fleshy Enlargements,

305. Together with undue strains and sprains and compressions of bones, are all to be attributed to the different abnormal growths of the foot, and it must be obvious the sprains of the one class of tissues and the compressions of the other must be communicated through these media, the *laminæ* which form the connecting link between the hard and the soft tissues. Certain modes of shoeing must not be overlooked as productive of inflamed *laminæ*. For instance, a shoe fitted full at the toe and long at the heel unduly strains and lessens the power of the *laminæ*. Concussion or undue straining of the *laminæ* is also produced by *undue length* of the toe as well as undue length of the heel. A long and wide toe clip to secure large shoes in their place is additional exciting cause, especially when hammered down tight upon the toe. The constant pressure of the toe clip augments the other causes which centre at the toe, and would of itself prepare the foot for greater embarrassments.

Some other predisposing causes must also be noticed. Too much or too little sole-bearing, and burning the sole, will cause fever in the laminæ.

Uneven calks and snowballing will also cause inflamed laminæ. Inflammation of the whole foot may result from the point of the frog being left to grow so high as to come into contact with hard roads.

The point of the frog often becomes so hard and dry from constant pressure as to inflame the soft tissues lying between the navicular bone and the frog. Coming between the weight above and the hard frog below, they are crushed as if they were between the two jaws of a vise. The characteristic of a healthy frog is its elasticity. It is often observed by the shoeing smith that a horse will not stand upon the floor barefooted until the point of bearing, in that case the point of the frog, is removed. When that is done he can stand with ease.

The Reason Why

306. So many kinds and degrees of injuries terminate in the laminæ of the feet is that the foot is confined within a comparatively unyielding grasp of horny substance, and injuries which would scarcely be noticed on other points of the system often become destructive to the animal when happening within the foot. Swelling, the result of inflammation in other parts, where it is unconfined gives relief to pain; but when the swelling is confined as it must be within the hoof, the pressure and the pain are augmented in manifold degrees. Need I remind you that even the prick of a nail has caused the loss of many valuable animals from this very cause? Many degrees of inflammation are also observable within the foot. Sometimes it passes away; and there is no tissue or structure within the foot that is not liable to its attacks. The sensitive and insensitive tissues of the

sole, as well as those of the wall, sometimes receive the brunt of the attack, the secretions are suspended, and *pumice of foot* is the result when it does not actually destroy the animal. Chronic inflammation in the laminal tissues of the wall often has its sequel in a partially disorganized condition termed *seedy toe*. Disconnection has destroyed secretion; and disconnection can be traced to cover an area of four or five square inches, nearly one-half of the whole foot. Extreme cases of *pumice foot* and of *seedy toe* are considered incurable; and yet many cases deemed incurable can be arrested and ameliorated very much by the centre-bearing shoe.

Symptoms of Acute Laminitis.

307. The horse has an agonized expression of countenance; while standing on his feet he trembles with pain; compel him to move backward and his feet are not lifted off the floor, but dragged backward without lifting; compel him to move forward, and his step is irregular and made with pain and hard breathing; his feet are kept in advance of his chest, so as to place the bearing upon his heels and to keep it there, as the region of pain is the front part of his feet. His hind limbs are called upon to aid his forward ones to their utmost ability, and all advances are made by the hind feet being kept forward under the body.

The Remedy.

308. All diseases of the laminae having a mechanical origin, the best remedy yet found is one purely mechanical. Need I say that the centre-bearing shoe is the remedy for this as for all other diseases of the foot which have a mechanical origin? In every stage of this disease from the first to the last degree of inflammation,

except the horse is in an actually dying condition, this shoe will give instant relief from pain. In many cases where the animal would not or could not rise, these shoes have been applied to the feet, and when he has been assisted to rise he has stood and walked easily and comfortably. Detailed directions for applying the shoes have been given so often that it is not necessary to repeat them here. "The half hath not been told" of what I could say on this one particular topic.

Centre-Bearing Philosophy.

309. I must find room to expatiate a little on what I consider the philosophy of the centre-bearing shoe. Each time I refer to it, it seems as if some latent merit suggested itself from a new point of view. Its immediate effects are so remarkable upon the horse's foot and limb that even with myself it becomes a source of wonder and surprise with every fresh victory it achieves. A centre-bearing shoe has two distinctly beneficial effects upon a laminitic foot: In the first place, the protection it affords the sole against contact with the ground by covering the whole of the under surface of the foot. In the second place it has the peculiar effect of balancing the foot in such a way that all the tendons and ligaments and laminated structure, even the very bones themselves, seem to fall into their proper places, and to be relieved of all strain and effort in the movements of placing the legs one in advance of the other. It is like supplying the limb with an extra joint, and that joint of such a character that it admits of motion *in every direction*. The whorl-bone joint, as some call it, is a ball-and-socket arrangement that admits of describing some portion of a circle, but the ball without the socket admits of describing a full circle! Unlimited motion in every direction!

I consider it a supplementary joint. The one point of bearing is where the long and the short axes intersect each other. This enables the animal to balance himself fore and aft, and from side to side, with equal facility, and so evenly that if every joint in the limb, any one or all of them, have suffered by being out of the line of bearing, they appear to *fall into line* at once and smooth rotation is the result.

Sideway Movements.

310. Whether the horse wishes to move forward or backward, or turn from right to left, or from left to right, the movement does not incommode him in the least; in fact he can make sideway movements much easier than he could in sound health without the ball shoe. These sideway movements try a crippled horse very severely with flat shoes on his feet covering an area of twenty square inches of bearing surface; since the first three joints of the leg from the bottom admit only of fore-and-aft motion, and the knee joint only admits of very limited lateral motion; so that the horse when he finds himself able to swing round a circle or take a long stride must indeed experience an agreeable surprise.

Broad's Laminitis Shoe.

311. A Mr. Broad, a veterinary surgeon of Bath, England, has constructed a shoe which he calls Broad's laminitis shoe. I have examined a drawing and read a description of this shoe in Professor Williams' work on veterinary surgery. Wishing to judge it by its effects, I read Mr. Broad's own description of it. The application of the shoe *must* be made within three days after the attack, and must be accompanied by *poultices* and *soakings* and *whippings* every day, to compel exercise

for several weeks, and after that time the horse, if he is alive, may be turned out to grass for twelve months, and the result even then is not always of the most encouraging character. Although some of Mr. Broad's friends have written approvingly of his shoe, his shoe has encountered much hostile criticism among the members of the veterinary profession. Mr. Broad is entitled to some credit for the spirit of progress he has evinced in regard to laminitis. Because a horse with laminitis goes upon his heels to save his toes, Mr. Broad puts on a shoe with a very thick, heavy toe and a very thin heel, under the idea that the *weight* of the shoe prevented jarring to the foot, and the very thin heels supplemented the horse's wish to get as much as possible over on his heels. This is all I can discover about the shoe and its effects upon the laminitic foot. I hope Mr. Broad will read this book. He will find that it does not matter whether the horse has been attacked for three days or three weeks; if the horse is able to stand upon his feet to have the shoes attached to them, let him put on a pair of centre-bearing shoes and he will find more benefit to the horse in one hour than in twelve months' use of his shoe; and all the soakings, poulticings, and whippings and turning to grass for six or twelve months dispensed with—nay, more, in from three to six days the horse can be doing his usual work if the centre-bearing shoe is kept upon him all the time.

Seedy Toe.

312. Sometimes separation of the laminae takes place between the internal surface of the hoof and the front part of the pedal bone; a chronic case of this nature has acquired the name of seedy toe. The laminated structures, wherever they have become disunited, appear to have become dried up and powdery, which doubtless

suggested the term seedy toe, but for which dry-rot is just as appropriate. It is deemed incurable by veterinary surgeons, but it really is no more incurable than a quarter-crack or a toe-fissure. Give nature a chance, remove all *mechanical* obstacles to her work of healing, that is all the assistance she needs in most cases—and particularly in this case. Put genial pressure on the sole, and get the pedal bone back to its place and keep it there by suitable measures so that the work of secretion may go on without friction or disturbance of any kind. It takes a year to grow four inches of wall, but with the shoeing I recommend the horse can do his work all the time instead of being turned out to grass for that period.

Shoeing for Seedy Toe.

313. First pare down to the *white line* and remove all dead matter from the interspace between the wall and the pedal bone. Have a half-ball shoe fitted and ready for nailing on when everything else is done. Let there be plenty of nail-holes in the shoe from half an inch to three-quarters of an inch apart, and slanted to suit the wall so that the nails will get a *good grip*. Have ready sufficient gutta-percha to fill up the space between the plate of iron and the sole. Make a mould of the space by softening the gutta-percha in hot water and pressing it between the shoe and the sole until it is a perfect mould of the space. Then remove one-eighth of an inch from the lower edge of the wall all round the foot, so that the *whole sole* may get direct pressure. Now put your mould in place and nail on your shoe, drawing on the sole with care and judgment evenly all round, so that the whole weight should be borne upon the sole as nicely balanced as possible. Nail the shoe well back at the heels and forward at the toe, with the view of mak-

ing a solid block of the foot for the time being. If this operation has been done properly, in one month you will find one-third of an inch of new horn grown down from the coronary band. The last two cases I have described were two of the very worst cases of the results of inflammation in the feet that I have ever met with where the hoofs had not been cast off. What deduction can be drawn from these cases? Fairly, I think, that if horses so diseased as these could be snatched from the jaws of death in one case, and from comparative uselessness in the other, how easy it must be to cure or palliate the trouble in horses less severely affected by the same disease! I deem it a certainty that fully ninety per cent of the horses that perish yearly from this cause alone could be saved for many useful purposes and a very large percentage absolutely cured if treated before the pedal bone has dropped through the sole; and even these could be made to do slow work nearly as well as when sound.

Pumice Foot.

314. One of the worst cases of pumice foot I ever saw was treated by me several years ago. The centre of the foot bulged three-quarters of an inch below the level of the wall. A high rocker shoe set him to work immediately; he went as well as ever over the pavements, and is now *in prime condition*.

It may be well to remember that the soreness remaining after an attack of laminitis and partial recovery is limited to the laminae which attach the pedal bone to the wall, and that the action and reaction caused by the heel and toe bearing of the common shoe increases the soreness and lameness in proportion to the hardness of the roads upon which the horse has to travel. The proof of this is that a horse so affected travels much better on soft or sandy roads for the reason that action and re-

action is less felt on surfaces that yield to the pressure of the heel and toe. After an attack of laminitis the hoof, as a rule, grows faster and higher at the heels than at the toe, and takes the form represented at Cut 2. In such cases the heels will have to be pared more than the toe.

A Comparison.

315. The different effects of the centre-bearing and the common shoe are worth a few moments' consideration. With a common shoe the soreness decreases as the animal passes from hard roads to soft; but with the centre-bearing shoe the soreness diminishes rapidly upon the hardest of roads; the horse never looks for a soft spot to walk upon, proving clearly, I think, that the action and reaction of the common shoe is the cause of the permanent disability of laminitic cases after they have partially recovered, and keeps the foot weak and liable at any time to another attack.

The Most Important Consideration.

316. After an attack of laminitis the due balance of the foot is the most important consideration, as much for its cure or amelioration as for its future prevention. All writers note the susceptibility of the horse to this disease after one attack. I think I have shown in the preceding paragraph why this is so, but the following observations may not be out of place.

Besides the twofold part the laminated structures have to play in the economy of the foot as secreting and connecting media, they are the first to receive impressions favorable or otherwise from the external world, and they are the last to receive directions, as it were, from headquarters—the brain. They have need to be constantly on the *qui vive* against dangers, for there is no structure of the foot so exposed to danger as are

these laminated structures. They bear the brunt of the first hostile attack from external sources, and they have no more deadly enemy, metaphorically speaking, than an overgrown hoof, which begins by destroying the natural balance, which throws the whole machinery of the foot and leg into confusion, for the reason that the laminæ—like the *king-pin* of a machine—form the connecting link between the moving and balancing forces of the limb, and therefore those of the whole body. Verily the foot is the essential part of the horse, and verily, verily the laminæ are the essential part of the foot. What horse or house can stand without foundations?

The Happy Medium.

317. I think it has been sufficiently demonstrated that if you leave the heels too high, he will strain the laminæ at the heels, and if you leave the toes too high he will strain the laminæ at the toes, and either the one condition or the other will equally impede his progression in proportion to the degree of the disturbance. The *happy medium* in this case is an even balance and a justly distributed weight; in other words, a due proportion of the superficies of united laminæ to other portions of the hoof. To prevent slipping the half-ball four-calk shoe, Cut 44, will be found the best substitute for the centre-bearer.

Concluding Observations.

318. In concluding this article on laminitis, I wish to affirm my absolute conviction that a *centre-bearing* shoe is preferable to any other kind or modification of shoe for all cases of lameness, arising from whatsoever cause. Not for one form of lameness only, but for all forms. It supplies the one thing needful to improvement or recovery in all cases of lameness—quietude and repose

of the inflamed tissues, without which there can be no reasonable expectation of the patient's recovering.

After the horse's recovery, the centre-bar, the rocker, and the half-ball four-calk are about equally good, excepting in the winter, when any four-calk shoe will be preferable to the rocker.

I regret to say the centre-bearing shoe or any modification of it has a disadvantage in deep soft ground or deep snows; under such circumstances it is no better than any other form of shoe. But for this the centre-bearing shoe and its modifications would be the universal shoe. Under all other circumstances it is susceptible of universal application to sound horses to keep them sound, and for lame horses to make them sound. Many feet after a severe attack of laminitis get so deformed and shrivelled up that there is no such thing as paring or making them level enough for the affixing of any other kind or form of shoe than the centre-bearing shoe.

Contraction.

GENERAL OBSERVATIONS.

319. This disease presents itself in so many different forms that to treat of every form separately would occupy more space than I can devote to the entire book. I shall, therefore, confine myself to four leading forms or types of this disease.

Hoof-bound, the common but expressive name for contraction, has been observed as an abnormal condition of horses' feet for centuries and has engaged the attention of the best veterinary physicians of all times. The value and importance of the horse in the wars of ancient Greece about twenty-three hundred years ago must have been well appreciated, when a great general of the Grecian army, Xenophon, a profound historian and writer on the

most momentous questions and problems of human existence, should feel constrained to write a treatise upon the foot of the horse. Many measures have been devised to rectify its abnormal conditions, but nothing has had a permanent effect but the conditions which were sought to be rectified. Like the poor they have been with us always. Until the true mechanical principles governing the movements of the foot were discovered, it would have been impossible to formulate uniform and certain rules which could be applied to that organ either in health or disease. All that has ever been known through the ages has been matters of individual experience. Not until now has there been any well-proved basic facts upon which a uniform and universal system of theory could be based, which there might be if all horses' feet are constructed alike.

The Effects of Contraction

320. Are visible mostly in the fore feet. Its first effect is to diminish the width of the foot, and as it becomes narrower it increases the length. This change in width and length is in various degrees and forms, and the more marked the change the more injurious will be the results.

The Causes of Contraction

321. Are various; sometimes it results from a diseased or disabled limb, whatever the cause of that disablement may have been. Whatever produces lameness for any length of time, such as wounds, kicks, or blows, and keeps the limb out of use, is sufficient to produce *atrophy* or wasting of the tissues composing the limb. The muscles show the first symptom of *atrophy*. Exercise is necessary to keep these and all the other tissues of the limb from shrinking in size, and for maintaining

them in a normally healthy condition. As a rule, when there is lameness there is fever in the feet, and continued fever in the tissues of the foot will cause a wasting away of those tissues, as much as and perhaps more than those upon the outside of the foot. The processes of secretion of the various hoof structures being weakened and checked by *crowding*, the hoof itself becomes shrunken to the size of the shrunken tissues within the hoof. Whatever disease causes a prolonged state of inaction will thus cause a diminution in the size of the foot.

Favoring the Feet.

322. The hoof of a lame foot, from being so constantly favored, always grows more vertically during disease than when going sound and carrying the usual weight.

Work and extra weight keep the hoof expanded in that proportion, so that the variation in size between a foot carrying weight and a foot in disuse is not always due to the latter circumstance, for a foot may and does under extra weight expand faster than the latter contracts under less weight and thus increase the difference in size.

The change in horses' feet, then, the effect of disturbance to their natural development affects the size of the feet rather than the form; that is to say, the circumference of the foot is not necessarily made oblong, and the frog also, though becoming smaller in size, may retain its normal form.

Narrow Feet Increase Leverage.

323. Hoof-bound, the effect of disease, is very frequently only a simple diminution in size of feet, without lameness or other serious result, but when the *lateral diameter* of the hoof has been diminished the

results must be more or less serious, as the foot then becomes longer and increases the leverage at the toe. Contraction appears under different forms, and each form produces ailments and morbid conditions peculiar to that form. In some cases the ailment is limited to one side of the foot only, and appears most frequently upon the *inside* of the foot, as seen at Cut 15, *a*. At other times the foot is oblong like Cut 16, *a*. Again it appears contracted at both heels as in Cut 17, while Cut 18 represents the contraction of one heel only.

Type of Contraction No. 1.

324. It ought to be very evident indeed that a horse cannot travel with ease with a foot wider on one side than the other, which implies lack of lateral balance; for if this balance is lost the *narrowest* part will sink into soft ground first and give the ankle joint a *twist* at every step. When the foot contracts upon one side only, the angle of the contracted wall becomes more vertical at first than that of the opposite wall, and so unbalances the foot by the elevation of the pedal bone, of course on the same side as the wall which is the most vertical, and lameness is the necessary result. When this takes place on the *inside of the foot*, it gives rise to many more forms of lameness than when it occurs on the *outside half of the foot*. The reason for this has been fully explained, and briefly stated here is that the horse cannot point inwardly for relief so easily as he can outwardly. It must be a matter of importance to understand well the different effects caused by contraction, when diseases and morbid conditions numbering a quarter of a hundred can be traced to one form or type of contraction—that one being associated with an undue elevation of the *inside* half of the foot. Briefly stated, contraction from heel to toe, as in Cut 15, *a*, would elevate the same side of

the pedal bone, by the wall of the foot becoming more vertical. This is the first type or form of contraction. The second is that of a partial contraction of one side, as at Cut 18.

Type of Contraction No. 2.

325. This form of contraction only affects one-fourth of the foot's circumference. From behind the central transverse line of the hoof just opposite the wing of the pedal bone, the hoof commences to contract and falls inward beyond the vertical line; thus, instead of elevating the pedal bone on one side, it causes a *sinking down* of the pedal bone at that very point. The different effects of these two forms of contraction are so remarkable that I feel that I cannot do justice to the subject or myself, if I do not give them a little further consideration.

We have already stated that contraction from heel to toe, as seen at Cut 15, *a*, elevates by its vertical form the pedal bone on the same side. You may ask how it is that contraction causes elevation in one case and depression in another. It is this way: when one heel only contracts at the quarter, and not beyond it, it always loses its vertical angle for an angle more or less acute inward. The support of either side of the hoof is therefore diminished in proportion to the outer or inner angle or direction taken by the wall at the quarter. An outward or an inward direction taken by the heels has the same effect as the process of lowering the heels, while the vertical wall, all else being equal, will elevate that side of the foot.

Overweighing.

326. When the heel or quarter fails to support its due share of weight, that which it fails to carry has to be carried by the *front* half of the same side, that is,

from the central transverse line of the foot to the toe, which thus becomes overweighted, and this has a crushing or flattening effect upon the same side of the pedal bone, the tendency being always to crush it to a level with the crushed wall at the quarter.

Shoeing for Two Forms of Contraction.

Both these two different effects of contraction—one being of the whole side of the foot, and the other being of one-quarter only—can be both cured and prevented by the same method of treatment, and until this is accomplished a modified shoe should be worn which would both prevent and cure the lameness.

A shoe for a foot resembling Cut 15, *a*, should be made *thinner inside*, if the hoof cannot be lowered enough without it, and, *vice versa*, *thick* inside for the opposite condition resembling Cut 18. This form of the foot being low on the inside is the same as being high on the outside, and is the cause of all the diseases attributed to high on the *outside* half or portion of the foot.

Mechanical Expansion.

327. Besides producing the eight diseases referred to, the heel by lapping and pressing against the frog prevents its due growth and development, and not only hinders the secreting processes but is also the cause of their vitiation, and we have as a result the disease commonly called *thrush*. That portion of the frog which lies under the contracted quarter dwindles away or perishes altogether *first*, proving that contraction is the proximate cause of *thrush*. It is also proved by the fact that mechanical expansion of the contracted quarter causes a rapid cure of the thrush with no other application besides water; and a renewal of healthy frog tissue speedily follows. Quarter crack is of very frequent

occurrence in feet of this character, as also are the morbid conditions termed corn and ossified lateral cartilages. If only one foot is affected the horse will point that one foot in the direction of the highest side, and not only that but to the *highest point* on that side. The hoof of a contracted foot is not only deformed, and the softer tissues within it *atrophied*, but the very bone itself becomes *atrophied* and deformed. In this form of contraction one of the wings of the pedal bone is often seen to be smaller than the other, and there can be no mistake as to its cause, since it is always found on the contracted side.

Dexter's Pedal Bone.

328. When Dexter passed into the hands of Mr. Robert Bonner he was lame from a contracted foot. The outside quarter of the off fore foot was the location of the cause of his lameness. Mr. Bonner had that quarter expanded mechanically and the lameness disappeared immediately. It had always been suspected, but not known positively until after the decease of Dexter, that the wing of the coffin had been affected by the contracted quarter (see Cut 31). This cut, by Mr. Bonner's permission, was outlined from Dexter's pedal bone, and one may not only learn from it how bones can become affected by the contraction of a hoof, but it may be interesting to some that it represents the pedal bone of the first horse who trotted one mile in $2:17\frac{1}{4}$.

Cut 32 is a profile drawing of the same bone and is the exact size of the original.

Type of Contraction No. 3.

329. The third type of the deformity of the foot caused by contraction is the oblong form, where the lateral diameter becomes transformed into length, as seen in Cut 16, *a*.

Feet when so contracted resemble those of the mule. Both sides of the foot become vertical and compress the laminated structures, and the pedal bone as well. Continued lateral pressure alters the shape of the pedal bone, transforming its width into length, corresponding to the shape of the outer wall. The lameness is usually proportionate to the change in the shape of the hoof, for when the foot becomes narrower by compression, the navicular bone is crowded too much for natural action and the pedal articulation becomes obstructed, and permanent obstructions are often the result. Another distinct effect produced by this form of contraction is that of straining the back tendons, caused by the extra length of the foot which the change from breadth to length has produced.

Thus we may have three distinct effects from the *muliform* type of contraction:

1. Compression of the laminated structures.
2. Changes in the form of the pedal bone by which it has been made less wide and more long, thus occasioning encroachments upon the articulating surfaces of the pedal joint.
3. Undue strain of the perforans tendon resulting from an elongation of the foot at the time the toe of the foot leaves the ground.

No Remedy.

330. For alterations in the form of the pedal bone there is no remedy, but lameness may be overcome by the use of a shoe so modified as to require less motion in the pedal joint, and to reduce the leverage upon the perforans tendon caused by the extra length of the foot. That shoe is the full centre-bearing as seen at Cut 21. A rocker or centre-bearing shoe limits the movements of the hinge-like articulation and gives it comparative rest; and it shortens in the same propor-

tion the under surface of the foot, which therefore lessens undue strain of the perforans tendon at every step. A lateral expander gives freedom to the lateral laminae, and liberates the crushed and imprisoned frog; and by removing pressure from the secreting structures reconstruction of healthy tissues rapidly follows. By these means extremely bad cases of this form of contraction have been relieved of pain and lameness, and may be again when the mode of operation is generally understood as I wish it to be.

Type of Contraction No. 4.

331. The fourth form or type of contraction seems to combine some of the characteristics of the three forms already described, and yet has some peculiarities of its own sufficient to distinguish it from the others. This is the peculiar effect of a dry, hard sole. Whether horses be shod or barefooted, the growth of the horn goes on just the same, and all the time. Two horses standing on the same dry floor for six months, one shod and the other unshod, will have their feet contracted in about the same time and in the same degree. The effect of leaving the feet unpared is that the slant or the forward angle at which even healthy feet grow causes them to warp or contract in proportion to the weight they have to carry, as seen at Fig. 1.

The Problem Solved.

332. Here are the factors in the problem of contraction and its causes proximate and ultimate:

1. The bearing-point of the heels has been carried forward toward the centre of the line or axis of bearing (see Cut 1, letter E).
2. The bearing-point of the toe has been carried for-

ward several inches beyond the same axis of bearing. The necessary effect of this mere growth of hoof, whether the animal is standing still or in motion, is to place more weight upon the posterior half of the foot than its proper share. In fact, it has unbalanced the foot, and this unbalancing of the foot favors one portion at the expense of other portions of the limb. The higher or longer the walls grow the less calculated they become to sustain weight, and as if this were not a sufficient cause of mischief another factor comes into play to augment the danger. The wall has been growing, and the sole has not been idle, and what one would think ought to prevent contraction actually becomes one of its auxiliary causes. Dry, hard, and dense horn, all else being equal, will cover a less area of space than the same horn if in a moist and elastic condition; hence it is that as the sole becomes dry and hard, its mechanical contraction from this cause pulls in the walls laterally and thus aids in the work of general contraction.

A Digression.

333. Too many owners of horses, who are probably not very well posted in such matters, attribute to bad shoeing those results which ought to be laid to the account of neglecting to have the horses' feet pared down and shod regularly and sufficiently often. I have known some who would allow their horses to go two or three months without paring or shoeing, and then wonder why the horse went so badly, and could find no blame for any one but the shoer. They were probably not aware of the fact that the injuries caused by the overgrowth of hoof even while the horse is standing still are much greater than hard work would be with feet kept to the natural size.

A Growing Hoof a Growing Evil.

334. We have seen that overgrowth of sole as well as overgrowth of wall is a source of danger. At the risk of being thought tedious I must make a few more remarks upon this condition of the foot, wherein the sole plays so conspicuous a part. A growing hoof is a growing evil, and the longer the space of time between each paring or trimming the foot, even supposing it to be done passing well, so will be the magnitude of the evil. Even the wall itself without any aid from the sole has a constant tendency to contract. Nature supplies moisture sufficient to the interior of the wall as far as the laminated structures extend, and no further. The longer the walls grow after being deprived of naturally supplied moisture, the dryer, the more dense, and more compact it becomes, and therefore the more mischievous in its effects. It not only contracts itself, but its self-contracting force is so great that the sides and quarters of the hoof above it are drawn inward with such a powerful grasp that contraction is the result; and this force increases as long as the hoof continues to grow.

Remove Excrescences.

335. It is when the bottom of the foot is filled with overgrown sole that the wall and widest part of the pedal bone are drawn together from side to side by the shrinking of the overgrowth of both wall and sole. They are virtual excrescences, and should be removed as fast as they appear. Moisture will *aid* in removing these sources of danger. Under anything like natural conditions the sole exfoliates or sheds off in *flakes*, and would be kept down in this way if no shoe were attached to the foot and the animal running wild. The true sole,

if never left thicker than its natural thickness, has no tendency to contract at the transverse diameter of the foot, and therefore could never cause a round foot to become oblong.

Penalty of Neglect.

336. The fault, then, is in neglecting to pare the foot monthly or oftener if it needs it. Owners of horses cannot be impressed too deeply with the importance of this fact as one of the absolute requirements of the horse, the neglect of which are penalties of a very serious nature, and which are exacted to the *uttermost farthing* from the horse and his master both; from one in the form of suffering and disability, from the other in vexation, disappointment, and pecuniary losses. If the owner cannot or will not allow the feet to be pared oftener than once a month, moisture should at least be supplied to the sole, which would prevent its attachment to or cause its detachment from the wall and thus ward off one of the ill effects of an overgrown sole; but nothing can be done for the overgrown wall but to *cut it* down. In all my forty-five years of experience, I have never seen a contracted foot where it has been kept down to its natural size by frequent paring.

Another Cause of Contraction

337. Is a shoe concaved too much near the heels (see Cut 17). Contraction in this case is produced by the shoe being fitted too full at the heels, and the heels being allowed to rest upon the concave instead of the level surface of the heel of the shoe. Sometimes one heel only becomes affected (see Fig. 18), where one of the heels is so full as to rest on the seated part of the shoe easily, while the opposite side from not being so

full rests upon the *slanted* surface and is forced inward at every step. The *doubling* in at the quarters is the effect of the resistance offered by the wings of the pedal bone. The pedal bone fills the front half of the foot only. All behind and between the wings of that bone are soft, elastic tissues, that yield to the mechanical expansion of the quarters. The effect of heels contracted, as in Fig. 17, is that when both heels so converge toward each other they cease to carry the weight imposed upon them, and they sink down, and the tendency of this sinking is to strain the perforans tendon. Of course the effect will be in proportion to the intensity of the cause. Now, as the weight of the animal should be carried equally by the fore and hind portions of the foot, whatever causes an unequal distribution of this weight is pernicious and productive of mischief. With two converging or contracted heels sinking down, nearly the whole labor of the limb devolves upon the front half of the foot. A horse with feet so contracted is liable to all the ailments attributed to extra height of the toe, by its causing undue strain upon the perforans, and its necessary accompaniment, compression of the bones in the front aspect of the leg. Standing or travelling, a horse with a foot of this character is always pointing, trying to find that support for his heels of which he has been deprived by contraction. The animal wears his shoe mostly at the toe, and his feet and even his shoulders are mostly carried in front of a vertical line, so much so that his chest has the appearance of being sunken in, and for that reason such cases have acquired the name of *chest founder*. This character of feet will cause horses to paw their bedding into a heap so that they can elevate their heels upon it, and thus relieve the strain upon the perforans which causes so much uneasiness. Frequent stumbling, too, is the effect of this kind of contraction.

Ridges on the Wall.

338. When the heels are contracted as in Cut 17, the hoof secretions are increased in the front part of the coronet, the result of undue stimulation through the extra weight thrown upon the laminæ in the front part of the foot. The secretions of the hinder half of the foot are diminished from this very cause. The difference in the rates of growth are to be measured by the relative distance between the ridges at the front of the hoof and those at the back part. It will be usually seen that they are pretty close together at the heels, but wider apart on the front of the hoof (see Cut 7).

Mechanical Expansion.

339. In order to show how a foot can be modified in form by mechanical appliances, I will briefly describe one of the cases which afforded me an opportunity of considering this problem. The case was one of utter disablement from work, and his weight was carried entirely upon his toes; it would compare unfavorably with Cut 5. The feet were cut to the white line, and rolling-motion shoes attached. The highest part of the curve was one inch higher at the heels than elsewhere. As will have been seen, it was not placed in the centre of the foot, but at the back part under the heels, and it brought the limb from pointing in front of a vertical line from the shoulder to the back of the vertical line. The extra height of the heels was a compensation for the pedal bone being held too high by the convex form of the front outline of the hoof. Fore-and-aft balance being obtained, the lateral balance was sought for by a self-acting expander. The very next day that horse travelled twenty-five miles, and never lost a day's work for many a day. In this operation two purposes were

in view: one was to stop the pointing; and the other, by raising the heels a little higher than the toe, to stimulate the secretion of horn in the region of the heels, which would strike the ground first; and increased secretions in the back region of the foot would be attended by diminished secretions in the front region of the foot. At the end of one year the convex outline had disappeared entirely for a straight one. The secretions had so increased at the heels and diminished in the front of the foot that the tendency of the wall was observed to become a *concave* surface, and to counteract this tendency we had to lower the heels and raise the toe when a little over a year before we had to lower the toe and raise the heels; proving that a horse in regard to his feet can be pretty much what we make him.

General Principles of Treatment.

340. It is impossible to give directions which will suit every form or kind of contraction, since every case has some individual peculiarity or requirement. General directions only can be given, but any intelligent horseshoer or amateur can readily perceive what modifications of the treatment may be necessary for exceptional or individual cases. The first thing to do, having a contracted foot to treat, is to ascertain to which particular class or form of contraction the case belongs. The chart on pointing, and the palpable and visible evidences before you, ought to render this an easy matter. Remember,

The Objective Point

in all you do is to *balance the pedal bone*. Upon the perfect adjustment of this bone everything else depends. After cutting to the white line the foot may require to be propped up here or there, and that propping up is to

be effected by an extra thickness of the shoe at the lowest part. That lowest part may be at the toe or the heels or the inside or outside of the foot; but wherever it is, the shoe must be made thicker or thinner as circumstances require for the express purpose of equalizing the bearings of the pedal bone. There must be no torsion or distortion of the pedal joint; and it can always be known, *by the horse ceasing to point*, whether the pedal bone is properly adjusted or not. This fact is an important guide in the operation of balancing a foot; when the balance is *all right*, he virtually tells you it is by standing erect upon it. A perfect balance is the desideratum, lengthwise and crosswise both. Having got the lengthwise balance in the manner indicated—that is, by means of a properly constructed shoe—we promote the restoration of the lateral balance by means of a self-acting expander, a small steel instrument which exerts a lateral pressure outwardly when placed in a proper position between the heels of the hoof. This expander works slowly but surely, and in perfect harmony with the shoe, in restoring natural balance to the foot in every direction. If these simple measures are applied with care and judgment, in nine cases out of ten your horse can go about his usual work *right away*, and continue at it every day, and he will be the happier and his owner the richer as a consequence.

Expander all the Time.

341. I have owned several fast horses with feet so deformed that without an expander being worn constantly they would not speed so fast, on account of the hoof returning to its old form, and thereby losing the balance to some extent. Feet formed so as to resemble Cuts 17 and 18, when once expanded will by careful monthly shoeing be very likely to retain their natural

form. When the feet have become very deformed the expander should remain in use until there is an entire change of hoof, which takes about a year's time to accomplish. It does not take so long if the deformity is less pronounced. As to the management of the feet while the expander is in operation, moisture to the foot is not objectionable, but it is by no means indispensable, as the outward pressure is constant, and wet or dry the hoof as fast as it is secreted becomes remodelled without failure to its natural form.

The time to begin the use of an expander is when the feet show that they are getting *out of shape*. It will be an easy matter then to restore them to *good form*. Horses of every age and description or form or texture of feet, as long as they live, are amenable to treatment. I have had some cases that were *very aged* who, after their feet were expanded, would *hop, skip, and jump* like colts at play. Horses raised under the careful watching and management and shod upon the principles and practice I am endeavoring to inculcate, may be taken to market as perfect as the day they were foaled.

The First and Last Cause.

342. I cannot emphasize too strongly, that neglect to pare the horse's foot down to the white line, and sufficiently often, is the *first link* in the chain of causation which leads to *all* the horse's misfortunes, his miseries, his diseases, and his disablements, first, last, and all the time. It is the *underlying* and the *overlying* cause. If there is ever to be a *good time coming* for horses, that good time will never come until one of two things shall have happened; either nature must change her laws for the better protection of horses' feet, or mankind must change its views in relation to the same question. The latter contingency, though difficult, will be more likely

to happen than the former one. The age of miracles has passed. It requires but that the breeders and educators, the owners and shoers of horses should have the simple but eternal fact engraven upon their understandings, that the foot must be kept within certain well-defined limits of growth, not only for the purpose of developing the horse's magnificent capabilities but in order to keep that insignificant-looking little horny box from becoming in the future what it is in the present—a veritable Pandora's casket from which all his troubles and miseries proceed. When this ONE FACT shall have permeated the minds of all who are concerned in the truth and education of the horse and in utilizing his various capabilities, and though last not least the horse-shoers—then shall the horse's millennium have arrived.

Knee-Spring.

GENERAL OBSERVATIONS.

343. All text-books on veterinary pathology show how very little is known of the causes which produce this morbid condition. No disease can be very intelligently discussed if the causes are not fully understood. The locality and general appearance of the trouble require no statement; what is wanted to be understood is the cause, the prevention, and the remedy when called for. All this might be stated in a few sentences; but as this book is intended to be primarily one of instruction for every class of horse-owner and particularly for horseshoers, I must present some rational exposition of its causes. Any diseased condition, I presume, stands the best chance of being successfully treated when its causes proximate and remote are fully understood.

In our various essays on particular forms of disease we have endeavored to trace the secondary causes to

their fount and origin, and we have no wish to shirk the task in this case. It is a source of trouble to me that I have so much material for the work and so small a space, unless I produce a big book, which I have read somewhere is a big evil. I prefer to start the game at once, than beat about the bush. AN UNBALANCED FOOT IS THE PRIMARY CAUSE OF KNEE-SPRING—excepting those which are the result of natural conformation. Some horses have a natural tendency to this defective form of limb, but in nearly all cases it is an acquired blemish, and fortunately there are few cases beyond the reach of mechanical remedies.

Causes.

344. When describing the various directions in which a horse points, we have shown that he is solely dependent upon his feet for the maintenance of his equilibrium. We may now add that he is also dependent upon the due obliquity of certain parts of one limb for perfection in other parts of the same limb; I refer to due obliquity of the pastern joints. Regarding natural conformation as a strongly predisposing cause of knee-spring, we can trace this predisposing cause to an oblique pastern, and in support of this view we can trace also the forward angle or undue straightness of the hock to the self-same cause, namely, undue obliquity of the pastern.

Knee-Spring and Straight Hock.

345. We find that the knee is affected in its forward angle by an oblique pastern as seen in Cut 12, and the forward angle is altered in the hind limb by an oblique pastern as seen at Cut 13. In the fore limbs it is called *knee-spring*; in the hind *straight hock*; and this is how it comes about. The back tendons become strained under

weight, on account of the obliquity of the pastern. The extensor tendons are not as powerful at the knee as the flexors, and are, therefore, overcome by the latter, the knee being pressed forward by the obliquity of the pastern; and the same rationale applies also to the hock joint.

Straight Hock and Calf-Knee.

346. The opposite condition of pastern, that is, of the upright pattern, produces the form called *calf-knee*, the opposite of knee-spring. In knee-spring the limb falls *forward* and in the calf-knee *backward* of a vertical line. And so of a hock with straight pasterns, it falls backward of a vertical line—in other words it becomes more crooked as the pasterns stand straighter. This being a rule, it strengthens our theory.

Knuckling and Knee-Spring.

347. The rationale of knuckling explains the causes of knee-spring as well as of straight hock. To account for this is easy when we consider that all the back tendons or hinder braces of the leg become relaxed by the forward angle taken by the pastern in the position of knuckling. In this relaxed condition of the perforans neither the knee nor the hock has any support backward except what is afforded by the broad band which encircles the knee and a few small ligaments. These bands are called annular ligaments because they surround the joint like a ring. Both knee and hock can bend backward until they have *taken in the slack*, as it were, of the flexors, unless they are altogether too slack. If the flexors should be too slack in consequence of knuckling, the knee or the hock will have nothing to support it backward but the bands and ligaments referred to, for the fetlock is resting on the extensor tendon, or apex of

the pedal bone, or upon both, and none at all on the back tendon, which is the cause of the undue slackness of the perforans. This reference to knuckling has been made to enable the reader to distinguish between knee-spring when the result of natural conformation, and when it is a consequence of some morbid condition of the limb. As to the acquired causes, we can trace the defective condition termed knee-sprung to three distinct deformities of the foot:

1. Height of toe, accompanied, as a rule, by feet resembling Cut 5.
2. Height of heels, accompanied, as a rule, by feet resembling Cut 2.
3. Height of inside heel or of inside toe, or both combined.

It will be seen that we attribute knee-spring to two opposite forms of feet, namely, undue height of toe and undue height of heels. This will be easy of explanation when we reach the symptoms. Meanwhile I would remark that the fetlock as well as the knee is dependent upon the formation of the feet for their proper and natural angle of bearing; and not only may the feet be of different forms that produced the defects called knuckling and knee-spring, but the symptoms accompanying either form of the feet may vary in character accordingly. This brings me to

Symptoms.

348. When an undue height of the toe is the cause of knee-spring, there are three distinct symptoms which will denote that cause unerringly, namely:

1. The foot lands upon the ground toe first, and as a result the shoe wears mostly at the toe and frequent stumbling is the result.
2. The horse, while standing or in action, points in

front of a vertical line drawn from the point of the shoulder.

3. The feet, as a rule, resemble that in Cut 5.

When knee-spring is produced by undue height of heels—

1. The horse when at speed, lands with his heels upon the ground first, and wears his shoes most at the heels, just the opposite of the high-toe habit.

2. When at rest the horse stands with his fore feet backward under his body, which we call pointing backward.

3. When at speed he travels with his fore feet under his body, showing that the articulation of the pedal joint is not equally divided; that the flexion contrary to that caused by too high toe, occupies more of its share of the articulation and prevents the natural extension of the limb in travelling.

Lateral Balance

349. Has an important bearing on knee-spring. A horse may be knee-sprung from too high a toe, or too high heels, and yet preserve his *lateral* balance. The legs swing in direct lines like a pendulum, and when they do so, this form of knee-spring usually yields to the simple process of balancing the foot. No permanent injury may result from either of the two causes named. Balance the foot and leg by paring. If the toe is too high, apply a modified centre-bearing shoe rolled at the toe and raised at the heel. In this way you stop the pointing, and to stop the pointing is to straighten the knee. For a foot too high at the heel, the same result is attained by lowering the heels until the horse stops pointing backward, and if the heel cannot be lowered sufficiently without it, a shoe should be applied hammered down thin at the heels.

Complicated Causes.

350. Knee-spring can also be the result of a complication of causes, the most common complication being a high inside heel and a high inside toe, constituting the whole of the inside half of the foot being too high. When this is the cause, less weight is borne on the *outside* of the knee joint and more weight is thrown upon the inside of the knee joint. This is a disagreeable complication. The symptoms by which we can distinguish this cause from the others are seen in the changed aspects of the knee. In the latter case the knee bends forward and outward, leaving a wider space between the two knees, while in the two previous cases the knee bends directly forward only. You will also notice that when the knee bends forward and outward the heels approach each other inwardly, and of course the toe turns outwardly. This injury to the knee caused by the height of the inside half of the foot has some resemblance to the hock when the latter is affected by spavin, which it should be remembered is produced by height of the inside toe. Knees bowed outwardly are analogous in form to hocks bowed outwardly. The knee-sprung horse suffers more when the undue height is on the inside than when upon the outside half of the foot. The lower row of the small bones of the knee being narrower than the upper row, they suffer the most, and callosities and bursal distentions and bony deposits frequently make their appearance in that region of the knee joint. A horse so affected travels with his feet close together, as the flexion of the knee is difficult; and as the cause continues the difficulty of flexing the knee increases. Partial or complete ankylosis is the usual result in a majority of such cases.

The Remedy

351. For knee-spring in the last case described is to lower the inside half of the foot; this gives immediate relief.

Sloping Stalls.

352. The sloping of the stall has been considered to have something to do with causing knee-spring. It may or it may not have, depending on circumstances. The sloping backward would help the horse if his heels were too high, and be detrimental to the horse whose heels were too low. I have no doubt that many horses have changed owners whose satisfaction or dissatisfaction with their horses had some connection with the circumstances referred to. The best box-stall for all horses comes very near to one partly or wholly covered with cobble-stones, when or where the horse can select a suitable spot upon which to balance himself, and so prevent the uneasiness he is compelled to endure under other circumstances. It may be noticed that a knee-sprung horse will often go down-hill lame and up-hill sound, which proves at least that one cause of knee-spring is high heels.

Essay on Cutting and Interfering.

HORSEMAN'S COMPASS.

353. In preceding pages, when explaining the causes of pointing, we have attributed this abnormal position of the horse to an unbalanced hoof caused by an undue height of the foot, at any one of eight points of the earth's compass; and have also shown how the disturbing cause which produces disease can be immediately located. We have shown that within this hoof three bones form a joint, called the pedal joint, or the pedal

articulation. We have seen that this joint is limited to one kind of motion, namely, that of a common hinge, which only opens in straight lines, there being no provision for any lateral motion whatsoever. This kind of motion, when speaking of the horse's movements, is called flexion and extension.

Articulations.

354. When the foot is properly balanced, and the articulating surfaces are equally divided, they enjoy their due limits for flexion and extension; but let there be any disturbance of the balance of the foot, and there will be an impediment to the free articulation of this joint.

Shock and friction from treading on uneven surfaces will be the result. It hardly need be said that it is all-important to prevent shock and friction to this joint, as this is the beginning of sorrows to the horse. It does not admit of a question that an unbalanced foot, from whatever point it may proceed, whether from alterations in the bearing surface of the hoof or of the shoe, or of both combined, will interfere with the smooth working of the pedal joint, by causing the foot to reach the ground with either the toe or heel first, a contingency which no other animal besides the horse that we know of is subject to. In this respect the ball pad of the fleshy-footed animals furnishes a remarkable contrast to that of the foot of the horse, whose foot pad is on the inside of the foot, a peculiarity seemingly inherited only by the equine race. The pad of the ball-footed animals is always perfectly adapted to its immediate requirements, requiring no supervision whatsoever; it matures with their maturity, "grows with their growth and strengthens with their strength"—a perfectly finished instrument of progression as long as the animal lives; but the horse's

foot is the very antipodes of all this, it changes its angle of bearing from day to day. It is a perfect and yet unfinished instrument. To keep it perfect calls for never-ceasing watchfulness and care from the day of its birth to that of its death.

Pointing.

355. The first indication of the foot and, therefore, of the pedal articulation being out of balance is the act or fact of pointing with his foot while standing. This is a pointer or indicator of something going wrong with the pedal articulation. This is the first point, and anything wrong in this joint will act and react on every joint above it. The second indication of disturbed balance is the manner in which the limb moves while the animal is in motion. In perfect motion the animal swings his legs backward and forward in straight lines with the precision of a pendulum, moving to and fro with perfect regularity and ease, at equal distances both ways. In the perfectly balanced limb the heel touches the ground first, and the toe is the last to leave it in each stride, and this applies to the fore and hind feet alike. When the toe becomes too high, this regular swing changes to a more forward action and less backward action, the extension depriving the flexion of some of its share of articulatory surface.

Contrast this movement with the effects of high heels. The order of pointing is reversed, and the manner of motion is changed with it. His legs will extend backward instead of forward, detained as it were under his body. All else being equal, balancing the foot will balance the articulation, and you will have a perfectly rhythmical movement immediately. What better proof can be given that perfect action or motion of the limbs depends absolutely upon a perfect balance of the foot? It is an incontestable fact that when the

feet are in perfect form, the limb flexes and extends the same on one side of a vertical line of the shoulder as the other, in a straight line, as said before, like the swing of a pendulum. These remarks apply to hind as well as fore feet.

Examine the Foot.

356. The form or condition of the foot is the same of all irregular action. Two general causes account for this—natural conformation, and mechanical causes arising from loss of balance. There is one exception to this rule: The elbow of a horse, due to natural conformation, may incline too much outwardly for perfect symmetry, and in such a case the limb will flex outwardly and *wabbling* action will be the result; and *vice versa*, when the elbow lies too close to the ribs the legs will flex inwardly and cause *wabbling*. The former is called *outside wabbling* and the latter *inside wabbling*.

Form and Interfering.

357. Deviations from straight lines in the articulations of the limbs are caused, first, by two distinct forms or parts of the foot. One relates to the form of the foot at the toe and the other to the form of the foot at the heels. As said before, a perfect foot with perfect action lands on the heels first, and the toe is the last to leave the ground. The form has very much to do with the prevention of interfering when the limbs are in motion, whether it be due to the shape of the toe or the heels. The horse as a rule, when the foot is perfectly circular in form at the toe for several inches on both sides of the toe, and of equal length and height at both heels, flexes and extends or swings his limb as much one way as the other in a straight line. But if instead of the perfectly circular toe there is a projection or bulg-

ing at either side of the toe, the foot will no longer swing in straight lines but swing either inwardly or outwardly according as it happens to be the inside or outside of the toe which is the fullest. Fulness of *inside* toe causes the foot to swing or wobble outwardly. Fulness of the *outside* toe causes the foot to wobble inwardly, *and strike the opposite limb*. It will be remembered that extra *height* at either side of the toe will produce the same effect as extra *fulness* at either side of the toe; now both defects combined increase wobbling or interfering in that proportion.

The Shoe-Fly Shoe.

358. It was to remedy or overcome interfering that a shoe called *shoe-fly* was patented by me many years ago. A drawing and indorsement of this shoe is to be seen in a Report on Horseshoeing made recently to the Agricultural Department by Professor Holcomb, D.V.S. Interfering increases when the extension of the foot occupies more of the articulating surface than its proper share, and still more so when it is partly sideways; that is to say, when the outside toe is full and high compared with the inside heel, as this gives the heel an inward twist at every step.

Modes of Interfering.

359. Another mode of interfering is caused by the form of the heels. The instinct of the horse while travelling with heels of different lengths or heights of the same foot causes him to plant his foot inwardly or outwardly of a straight line, in the endeavor to avoid a shock and twist caused by the highest or longest of the two heels.

A long or high outside heel or both combined with a straight pastern causes the foot to be planted upon the

ground on the outside of a straight line, or on the same side as that of the highest heel. Still further to illustrate this, the foot with high outside heel, in order to avoid a shock as the foot lands, articulates and extends it away from the other leg. The *inside* heel being high or long, or both combined, the foot is articulated too near the opposing leg, and that also is done to avoid a shock. By adding fulness of the shoe to height and length of the inside heel, the same effect will be produced and intensified. Interfering will always be in proportion to the severity of its cause. These remarks apply to all feet, fore or hind, with straight pasterns.

There is one exception to the above rules—that is, in cases of oblique pasterns, where the highest calk should be on the inside heel to prevent interfering. The explanation is this: with an upright pastern, the high outside heel causes the horse to travel further apart, or while travelling to point outwardly, while the high inside heel applied to an oblique pastern causes the fetlock to rotate outwardly and clear the way for the coming foot. When cutting is the effect of fulness at the outside toe, narrow the hoof first at that point; then, if he still cuts, under-hem the shoe at the outside toe; and if the cause exists at the inside heel, through being too long, too high, or too full, lower the hoof at the heel, and shorten and narrow the inside heel of the shoe one inch or more. Height and length on one heel will tell on hard roads the most. Both height and length will cause a shock, but the height of the heel will cause a greater shock than mere length. The fulness of the shoe at the heels will produce the same effect upon soft roads by projecting beyond the circular line, thus covering a greater surface of ground, and therefore will sink less into the ground than if the shoe be short and narrow, which is the condition of the opposite heel. This accounts for a horse travelling wider behind.

An Erroneous Idea.

360. I wish here to correct a mistaken idea which some horsemen entertain in supposing that loading the *outer* half of the shoe will cause the horse to *widen* his gait behind. Such an idea is opposed by every mechanical consideration. Suppose you were to load a pendulum, swinging in straight lines, on one side: would it not carry the *weighted* side nearer to the line of gravitation? Of course it would. If the weight had been upon the *inside* it would have carried the leg more outwardly. Yet in spite of this the extra weight of the entire shoe and the momentum it created overcame the lesser disadvantage. But there is another reason why the gait is widened under such circumstances. The greater the superficies of iron upon the ground, without any reference to the mere *weight* of the shoe, the wider will be the action, for the reason that the foot will be raised more on the *outside* than on the *inside* of the foot on soft ground, and this of itself will cause the horse to point outwardly, whether standing or travelling.

Most Speed Most Danger.

361. The annoyance of interfering and cutting is very much increased by the increase of speed. Low speed means low cuts, high speed high cuts. Interfering and cutting at road gaits have been sufficiently explained except the shoe which should be used generally for interfering, which will now be referred to.

The Standard.

362. The shoe I call *shoe-fly* is the standard shoe for this purpose, and apart from its tendency to slip is preferable for road-work and speed, as it can be made lighter than the four-calk shoe (Fig. 35).

The four-calk shoe is made on the *shoe-fly* principle, and is less liable to slip than the shoe-fly (Fig. 36).

A common shoe with a toe piece set full on the inside toe in a bias position as in Fig. 37.

General Maxims.

363. Raising the *inside heel* prevents cutting to a long and oblique pastern.

Raising the *outside heel* prevents the same to a short pastern.

Bear in mind that the mechanical rule laid down, namely, that raising the inside of the foot causes the tread of the feet to come closer together, and *vice versa*, is not broken by this apparent exception to the rule. In the case of the oblique pastern, the object of raising the inside heel is to cause the fetlock to *rotate* outwardly, of course—that is, away from the opposite leg when passing it, a movement which is only practicable in the hind leg without mechanical assistance on account of its having a ball-and-socket joint in the limb which admits of such movements, which the fore limb has not.

The Ball-and-Socket Joint.

364. This kind of joint in the hind limbs gives greater freedom of movement to those limbs than that possessed by the fore ones. The fore limbs must move in straight lines; the hind ones have the power to vary their movements according to circumstances, which the fore ones have not.

Thus when there is any disturbance of his balance in the hind limbs he can adjust the bearings of his feet better, and thus remove some of the extra weight from the highest part of the foot when it leaves the ground. The *screwing* of the toe or *twisting* of the limb outwardly

is one effect of the ball-and-socket joint (the whirl bone).

Natural Conformation.

365. In general, cutting and interfering can be obviated or overcome by mechanical means, but the rule is not without exceptions, especially when their causes spring from natural conformation. There is no certainty that any mechanical remedy will correct these faults. Interfering and forging can be inherited as well as the general form of the animal. The least that can be done for these exceptional cases is to apply the centre-bearing shoe, as this will cause the foot to leave the ground from the centre rather than the outer edge of the foot and thus give the legs a little more freedom of movement. As a rule we find interfering to prevail largely among horses whose knees and hocks are bent inwardly, and also among those who are narrow-chested and narrow-hipped.

Cutting at Speed

366. Is done on two different parts of the limb, one at the inner part of the hind legs, and mostly that of the inner pastern; the other is called high speedy cut in the region of the knee joint. The shoe *shoe-fly* or one of its modifications is the best preventive, but while a horse may travel free from cutting at a slow gait, he may for various reasons cut or hit the inside of the hind limb against the forward foot when at speed. As to one cause, he may be too high or too full or both combined at the inside toe of the hind foot, compared with the outside heel of the same foot; which means that, all else being equal, a low and narrow outside heel will produce the same effect as that of a full and high inside toe; and both defects combined will increase the chances of cutting twofold.

In the chart on pointing we have shown how a full and high toe inwardly will cause the horse to point exactly in the same direction—that is, forwardly and inwardly. And we have also shown that any mode of pointing or standing is carried out when the horse is travelling, whether fast or slow. With hind feet so formed, the horse in his attempt to land his foot upon the ground at right angles will not do so by reason of the *wrench* and pain it gives him, and to avoid this, in his endeavor to equalize bearing it passes too near the fore foot. To state the cause is to suggest the remedy. If the cause is at the inside toe, lower and narrow it; if at the outside heel, raise it, or combine both measures if the shape of the foot calls for it. It will easily be understood how a horse having a high outside heel, in order to avoid a shock upon that heel, will plant the foot *outwardly* instead of *inwardly*, which direction will prevent contact with the forward foot. Here is a cause and a remedy in few words.

Another Cause

367. Of cutting at high speed is the fore foot moving outwardly away from its vertical line of action by a high outside toe, and being carried into the way of the hind foot; it is made to occupy the space which the hind foot should have occupied. The remedy for this should be obvious enough—that is, to balance the foot first, and if this is not sufficient, lower the outside half of the foot a little; this will give the tendency to carry the foot inward, and leave room for the coming hind leg.

Hitching.

368. Defects in hind limbs are not limited to the production of lameness, and interfering with either its fellow leg or the forward one of the same side but gives

rise to that peculiar and disagreeable species of action called *hitching*, but which I prefer to call *running of the hind extremities*. Hind feet of the form last described are very apt to cause a horse to break while at speed. A perfect balance of every foot is the surest groundwork for the development of the highest speed.

Forging.

369. We have been showing the importance of the connection between the two arts of shoeing and driving horses. An exemplification of this is to be seen by what follows in this article. Though the defective action called forging can be controlled to some extent by checking, it can also be prevented by a certain mode of shoeing. The effect of checking is first that the vertebral column or backbone becomes more or less bent downward according to the height of the checking; and further, the bending downward of the backbone gives a greater obliquity to the shoulders, causing the fore feet to point forward standing or in motion, and this causes an obliquity in the corresponding angle of the hind extremities. There is, therefore, under such circumstances a greater distance between the hind and the fore feet, and consequently there will be the less chances of forging.

Checking also causes the fore feet to be carried higher than before, while the hind feet will be carried less high; this also diminishes the chances of forging. The theory that checking prevents forging by separating the hind feet from the fore ones is analogous to the theory that a horse whose body is long in comparison to his height seldom forges; and *vice versa*, a horse short in body compared to his height is very apt to forge.

Shoeing for Forging.

370. The rationale of checking having been explained, we will describe our method of shoeing to counteract forging. The first aim is to cause the fore feet to be carried farther forward and the hind feet farther backward.

This is to be done by raising the toes of the fore feet, as this will cause them to *point forward* whether standing or travelling. Next, raise the heels of the hind feet, which will produce the opposite effect, namely, *pointing backward*. This will cause the feet to be kept farther apart while travelling.

With many horses this last method will answer, when again with some long and crooked hind legs and sprawl-gaited horses the gait will have to be shortened, and this can only be accomplished by adding a toe piece to the hind shoes, sometimes set full at the toe, with no heels, and by applying high quarter rolling-motion shoes to the fore feet. This rolling-motion shoe on the fore feet will cause them to rock over quicker than would a flat shoe, and thus enable them to be kept out of the way of the hind feet, and so prevent striking. The toe calks on the hind shoe will shorten the stride of the hind feet, and this circumstance will tend to shorten the stride of the forward feet also. Remember, it is the extra length of the stride that causes the annoyance; and if you succeed in *shortening* the stride your object is gained. Also, bear in mind that, everything else being equal, the lighter the shoes the better.

Extreme Cases of Forging

371. May call for the checking and shoeing processes combined, and when they do they very rarely fail of their purpose.

How to Locate the Lameness of Horses.

GENERAL OBSERVATIONS.

372. Whoever wishes to become a master in the art of locating foot lameness of the horse should make a careful study of the chart on pointing. This chart will furnish points of knowledge and rules for guidance which are indispensable acquisitions to whomsoever would become experts in this heretofore difficult art.

The Language of Motion.

373. The observer should look at a horse both at a walking and an easy trotting pace; sideways, coming toward and going from. When lame of one foot forward only, we may notice that the rise and fall of the sound foot to and from the ground will be followed by the same motions of the head, that is to say, the head will rise and fall with the foot. For the lame leg the head is raised when it is placed on the ground, and comes down when the lame foot is raised from the ground.

The same rule applies to the hind extremities, only it is the haunch that rises and falls with the sound leg instead of the head. These do not include all the symptoms of lameness, for the horse may be lame of the two forward feet or of the two hind feet separately.

Elastic Movements.

374. The symptoms of the two last forms of lameness, whether it be the two fore or two hind limbs which are implicated, are as follows: when trotting the step is short and just the reverse of elastic—that is to say, there is *no spring in the action*.

The bounding and springing action is only to be seen in sound limbs. When the lameness is very painful this peculiarity of motion is to be seen in the walk or the trot of the affected animal.

Must Keep Time.

375. If the fore limbs are the affected pair, they are moved with very short steps and kept low to the ground, while the hind ones are raised high after the fashion of the stringhalt horse and pointing under the body, and *vice versa* ; if lame in both hind legs their action will be short and low, while that of the fore ones will be high and *choppy* after the fashion of the high-stepping coach horse. This unusually high action of the sound limbs is to be accounted for in this way: they must keep time with the lame feet; so what they lose in stride they gain in height.

In a severe case of laminitis in the fore feet this high movement of the hind legs is quite remarkable from the fact that it resembles so closely the movement of stringhalt.

See-Saw Motion.

376. A trotting horse may be lame in two legs of the same side at one time. When so affected the head and haunch see-saw alternately—that is, the head is raised when the lame fore foot is planted on the ground, and the haunch is raised while the head lowers when the lame hind foot is planted on the ground. The latter alternate motion is what causes the see-saw. The rise and fall of the head becomes very much increased or almost double in the case of two legs on one side being affected, than what it is when but one foot is affected, whether it is before or behind.

Diagonal Lameness.

377. The horse is sometimes lame diagonally, that is, of one fore and one hind foot crosswise at the same time. In this case the whole body follows the rise and fall of the diagonally sound limbs, that is, the head and haunch lower at the incidence or fall of the diagonally sound legs to the ground, and become elevated as the sound legs rise from the ground; on the other hand, when the diagonal lame feet fall to the ground the whole body becomes elevated.

Exceptions to the Rule.

378. It must be observed that the symptoms of lameness indicated in the chart on pointing are not absolutely infallible in *all cases* of lameness, as I have seen horses lame in all four feet at the same time, and yet that *did not point with any foot or in any direction*.

For example, every foot may be equally too high at the toe. The tendency of high toe being to point, the horse finds that the vertical position of all the limbs is the easiest, as by pointing with one limb in such a case he would increase the pain in the limbs which did not point.

Least of Two Evils.

379. To point with every foot the horse would place himself in a weak position for carrying his own weight, just as a common four-legged table, with its legs all parallel and inclined in one direction, would not carry as much weight as if its legs were all vertical; it is even so with the horse—he can stand easier under the weight of his body if all his legs are kept vertical than if he pointed any one of them; and the animal is wise enough to prefer the least of two evils.

Trotters and Pacers.

380. This rule of the rise and fall of the whole column of the body, following the incidence or fall of two sound feet on the ground at one time, applies to the trotting and the pacing gaits, with this difference as regards the pacer: in the trotter when lame of two legs the body see-saws, while in the pacer the body follows the fall of the sound feet on one side, and the rising of the body is concurrent with the falling to the ground of the lame foot. This rule is invariable.

Lameness Without Pointing.

381. A horse may be lame in all four feet, by being too high on one side of each foot, as well as by being too high at each toe, and yet show no tendency to point.

When a horse is too high in the heels of all four legs, it is the same as regards pointing. The explanation is the same: the pointing of one foot would intensify the pain in and overtax the strength of all the other feet.

Absolute Symptoms.

382. These illustrative cases show that a horse may be stiff or otherwise defective in every limb, and yet show no symptom of it by pointing. The pointing symptoms can only be relied upon absolutely in cases where the horse is lame in one or two limbs only.

Lameness Without Pain.

383. A horse may exhibit some degree of lameness when there is no evidence of disease, pain, or fever, from the fact that the inside half of one of the hind feet, compared with the outside half of the same foot, is too high.

It is plain that such a foot hanging vertically could not touch the ground with both heels, and in order to do so he must carry his leg forward and inward, and this is just what he does standing or travelling. Just so much as it recedes from the vertical line, so much shorter than the opposite leg will it become.

This, as said before, is done to strike the ground with both heels. On account of this treading inwardly, an uneven gait of the *hip* is produced, which has often been mistaken for a painful lameness and for *hitching*.

Anchylosis.

384. Furthermore, a partial or complete anchylosis of the knee, the hock, the fetlock, or the pedal articulation may cause an unevenness of gait, which though unattended by fever or pain is sometimes mistaken for lameness caused by pain. In such cases the horse moves his leg with an outward and forward movement in order to clear the ground, which of itself gives rise to a suspicion of lameness. In general, lameness may be considered the language of pain; but I think it ought not to be considered invariably so. I might instance a case of this character belonging to myself, which from an injury to the fetlock caused it to become more oblique than that of the opposite leg, thereby causing uneven action. Some would mistake this for a painful affection, yet it never afforded the slightest evidence of pain or inconvenience while travelling.

Lameness from Loss of Balance.

385. Having traced some forms of lameness to loss of balance in the direction of the heels and toe, we will now show how lameness is to be diagnosed when it is produced by an unequal balance of the foot in its lateral aspects. Balance is essential in both directions.

In order to ascertain whether or not a lameness has its origin in a lateral half of the foot, and which lateral half that is, whether it is on the inside or the outside, we should select a suitable piece of inclined ground upon which to *try the case*. The animal should be jogged *across this incline* to and fro. The weakest side of the foot will be shown by the animal going more lame in one direction than he does in the other; and it will be found that the affected side will be that on the highest side of the incline. I became acquainted with this fact by my experience with a ringbone horse many years ago on a road which was high at the sides and low at the middle. On one side of the road he went lame, on the other sound. This mere fact of observation at first, like many others, developed in time into a fact of considerable importance in relation to the horse's foot, its structure and its requirements in health and disease, as an aid in diagnosing the causes of lameness, in pointing out the absolute necessity of perfect balance for perfect action, and in leading to the invention of the centre-bearing shoe.

Do the Best You Can

386. If there is no suitable inclined ground to be had. When we are in doubt as to which side of the foot is the source of the lameness, we should have the horse jogged round in a very small circle. Trot him both ways of the circle; he will go better one way than another. If he goes most lame in trotting to the left, the cause of the lameness will be in the outside half of the near fore foot being too high; and if he goes most lame in trotting to the right it will prove that the outside portion of the foot is too high, and therefore the cause of the lameness and, *vice versa* the cause of lameness being due to the inside of the foot being too high.

One More Lesson.

387. The horse should be slowly trotted led by the halter, the observer viewing him sideways. It will be easy to imagine a vertical line from the point of the shoulder. If a horse travels with one or both feet in advance of this vertical line, letting his toe reach the ground first, as when afflicted with navicular disease, it indicates undue height of the toe; and if he travels backward of the vertical line, it indicates undue height of the heels.

Unfailing Signs.

388. A horse travelling lame *down-hill* indicates undue height of the heels, and going lame *up-hill* shows undue height of the toes.

First and Last Words.

389. Whoever wishes to become a master of the art of locating foot lameness of the horse should make a careful study of the chart on pointing. This chart will furnish points of knowledge and rules for guidance which are indispensable acquisitions to whomsoever would become experts in this heretofore difficult art.

Tendons and Ligaments of the Leg.

THE SUSPENSORY LIGAMENT.

390. (See Fig. 1, letter D.) I take the liberty of citing from Professor Williams' work on Veterinary Surgery the following description of this remarkable ligament (page 1, letter A): "A broad strong band of white fibrous tissue, arising from the supra-posterior

part of the cannon bone, lying in the hollow bounded on either side by the small cannon bones; it extends downward, bifurcating above the fetlock, becoming attached to the lateral parts of the sesamoids; thence it is continued downward to the tendon of the extensor-pedis at the antero-inferior part of the os suffraginis, where its divisions become united and are generally lost in the substance of that tendon."

The Perforans Tendon.

391. (See Fig. 1, letter B.) Lying next to the suspensory ligament is the flexor pedis perforans, having a short ligament attached to it which is called the check ligament, because it is plainly its function to limit or check the action of the perforans upon the pedal bone. This check ligament has its upper end attached to the top of the cannon bone in company with that of the suspensory. The perforans passes down over the sesamoid at the fetlock joint, which serves the double purpose of a pulley and a fulcrum like the small bone at the navicular joint; over which it passes next and finds an independent insertion into the lower posterior part of the pedal bones.

The Perforatus

392. (See Fig. 1, letter A) is the hindermost tendon. From the knee it runs over the sesamoids at the back of the fetlock joint, forming a synovial sheath at that point for the perforans to glide through easily and over the fulcrum formed by the sesamoids; after which it divides into two parts, which grasp the lower pastern, and its distinctive character is lost in the band which surrounds the lower pastern joint; it becomes virtually a part of that annular band.

Extensor Pedis.

393. (See Fig. 1, letter E.) The extensor pedis lies directly in front of the leg below the fetlock and finds its insertion on the upper border of the apex of the pedal bone.

Functions of Tendons and Ligaments.

394. The functions of all these tendons and ligaments are to secure all the necessary minor and reciprocal movements, without friction and concussion or injury of any kind to the entire system of the animal, in its greater purpose of locomotion. Harmoniously combined action is necessary to secure this. Balance is the ruling power of the whole. Balance is the governing principle of all machinery moving or otherwise, and the living machinery of the horse is no exception to the universal dominance of this principle. Without balance the horse begins to go to pieces; and when this balance, for *want of knowing how*, or other causes, is not restored, the animal is on the road to ruin, and sooner or later, generally sooner, becomes a complete wreck, not from lack of constitutional vigor but from the deterioration of his locomotory machinery, for want of balance in his foot or feet. The *set* of the pedal bone determines the balance, or the want of it, of the entire limb, and this *set* is dependent obviously upon the perfect form of the hoof—and the perfect form of the hoof upon the balance of its bearing surface; therefore all the machinery of the limb for perfect work depends upon the perfect form of the hoof. This has been more fully enlarged upon elsewhere in these pages. The due adjustment of that bearing surface depends upon man's knowledge of its requirements and of his disposition to meet them.

The pedal bone plays a very important part when

the horse is at speed. It is the medium through which all the tendons and ligaments act and react on each other, and weight is transmitted from one tendon or ligament to the other during the backward or forward movements of the limb while at speed.

Rationale of Movements.

395. The rationale of these movements may be expressed in the following terms: There is less weight upon the perforans while the limb is extended and just as it lands upon the ground, and in that proportion there is more weight thrown upon the suspensory ligament and perforatus; and contrariwise, as the body passes over the foot the weight is thrown back on to the perforans and carried to the finishing of the step backward, and therefore lessening the strain upon the suspensory ligament. Plainly the suspensory ligament and perforatus limit the forward and the perforans checks its backward action.

Transmission of Weight.

396. This view of the transmission of weight from tendon to ligament and from ligament to tendon during motion receives confirmation from what may be observed in the movements of one leg while pointing. When he changes the direction of his foot, either forward or backward, it is to gain relief from pain by shifting the weight from one structure to another. Thus, if the toe is too high the horse points to relieve the perforans, which means throwing more weight on to the suspensory ligament and perforatus; and in like manner when the heels are too high he points backward, which relieves the suspensory ligament, throwing weight on to the perforans.

The Reason Why

397. May be explained once more in order to make this treatise complete in itself.

By raising the toe the *check ligament* of the perforans is called into play; and as the tendon, from the part of it where the check ligament is inserted to the pedal bone, becomes strained, the pressure against the pastern joint exerted by the strain forces of that joint forward, and this presses the upper end of the lower pastern bone in a forward direction, which presses unduly against the extensor tendon; and when carried to extreme flexion the *upper* end of the small pastern bone will press upon the apex of the pedal bone, and its *lower end* will take a backward direction, and press against the navicular bone, creating stress and strain, distress and pain in both the extensor and the perforans; and the animal can only relieve himself by pointing in a forward direction.

Normal and Abnormal Conditions.

398. Under normal conditions each structure carries its own share of weight, but under abnormal conditions these structures have to help each other as best they may, to call the healing power of nature into play. It will be readily comprehended from this explanation what intimate relations exist between the perforans tendon and the suspensory ligament, and how the simple act of pointing backward or forward will shift the burden of weight from one structure to the other as circumstances require.

The Ultimate Link.

399. To trace this chain of causation to its ultimate link, we have but to add what has almost become a formulated expression—namely, that pointing of the foot

of the horse invariably locates the highest part of the circumference of that foot or hoof; that that *highest part* is always coincident with and indicates unerringly a disturbance of the natural balance of the limb; and that by the removal of this disturbing cause, all else being equal, the natural balance of the limb is restored, and the cause or causes of the lameness being removed the effect or the effects cease.

Fair Deductions.

400. From the foregoing considerations, I think it is a just conclusion that the suspensory ligament is most liable to injuries when the limb is inclined forward at the instant the foot lands upon the ground; and on the other hand, the perforans tendon is the most exposed to injury when at a backward angle at the moment the toe leaves the ground.

Critical Junctures.

401. The instant of landing upon the ground forward, or the moment of quitting the ground backward, are the only points of time when these structures are the most exposed to danger, for it is then each one is left to its own resources, as it were, of strength and endurance. At those critical junctures they are unable to help each other. When at rest they sympathize with and help each other in their misfortunes and troubles, by taking an extra share of the weight which must be carried under every circumstance by one or by both structures alternately.

Injuries to the Suspensory Ligament.

402. (See Fig. 1, letter D.) I wish again to refer to the fact that the design and scope of this work is limited to diseased conditions and abnormal action of the limbs

which have their prime source in an unbalanced hoof and pedal bone. This I regard as my legitimate field of inquiry. Horseshoeing is my vocation. I am not a professional veterinarian, whose functions I have no desire to usurp.

When either the perforans tendon or the suspensory ligament becomes injured, their respective symptoms other than pointing will manifest themselves in the following manner: if it be the suspensory ligament, a swelling will be felt above the bifurcation which is halfway between the knee and the fetlock; if either of the lower branches of the suspensory, the swelling will be below the fetlock. These symptoms, taken in conjunction with the pointing backward, point to the common injuries of the suspensory ligament.

Predisposing Causes.

403. Take an unbalanced foot for a starting-point and it is easy enough to trace its connection with an injured suspensory ligament. Undue height of either or both heels is the strongest predisposing and exciting cause of the injuries to every part of the suspensory ligament superior and inferior, or, to make it very plain, above or below the fetlock joint, which is susceptible to undue strain.

Undue height of both heels is apt to produce sprain of both of the inferior lateral ligaments at the same time; and if but one of those ligaments is sprained it is as a rule caused by undue *height, or of height and width combined*, on the side *opposite* to the injured side. It is well to know and to remember that when any part of the suspensory ligament is affected by sprain, the lower articulations of the limb are not impaired, because the suspensories play no part in flexing and extending the limb; their office being to uphold and suspend while

the work of flexion and extension is being accomplished by other instrumentalities.

In common sprains of the suspensories the horse in standing or moving will be apt to point backward instead of forward, and in walking will finish the step well under his body, although he will go lame on a trot. He may walk also comparatively free from lameness. In a complete rupture of either the superior or the two inferior suspensories, the fetlock will go down to the ground, or very near it, and the toe will be turned upward from the ground accordingly, which clearly shows the function to be that of supporting the limb. When but one lateral branch is ruptured, the fetlock will become partly lowered, and the swelling, it is pretty safe to say, will be on the injured side.

Hard and Soft Roads.

404. Some writers have observed that sprains of the suspensory ligament are more likely to occur on hard roads than soft roads. I presume there must be a reason for this circumstance, and I present the following as the most rational explanation that I am able to give. On a soft road the heels are more likely to sink in than on a hard road, and while the heels remain sunk and the toe elevated above the level of the heels, the perforans and the suspensory have a more equal share in carrying the weight than when the heels and toe are more on a level. The perforans is thus compelled as it were to carry a little more weight until the critical juncture is over and the toe reaches the ground. Another cause of injury to the suspensory ligament is landing with the heels upon some high and hard substance while the legs are at their most forward angle, and the heels strike the hard ground so suddenly that an instantaneous relaxation of the perforans follows, leaving the suspensory to bear the brunt

of the danger. Then there are such causes as running down hill; stopping short; and jumping fences by throwing too much weight upon the heels. Accidents of this nature are always liable to happen to horses if they are shod in the highest degree of perfection; but those liabilities are always increased when the horse is shod and left too high at the heels.

Injuries to the Perforans.

405. (See Fig. 1, letter B.) The perforans tendon, it will be remembered, has a twofold duty to perform, that of partly supporting the pastern joint and of flexing the foot. It is therefore exposed to injuries in connection with injuries to the pedal and pastern joints.

When the perforans is strained, the horse points forward, either standing or in motion, in degree of the intensity of the injuries, whether the injury be to the check ligament or to the perforans itself. A frequent seat of trouble is just at the point of junction of the check ligament with the perforans. The reason for this is explained when we consider its twofold function—as a *suspender* of the pastern and as a flexor of the foot. Any swelling of the perforans or its sheath will prevent it from gliding freely and without pain through the sheath provided for it at the back of the fetlock joint and the cannon bone, and over its fulcrum at the navicular bone, and thus prevent flexion of the foot by the pain it occasions. Swellings arising from injuries to the perforans make their appearance on the inside or outside of the leg, and very rarely or never at the back. Further, in order to distinguish between injuries to the perforans and the suspensories, it will be found in the former case—the perforans—that the painful flexion of the foot causes the toe to be *dragged* instead of being

bent and raised, and the toe will frequently hit the ground as a result.

Mischievous Energy.

406. I have shown you how injuries to the suspensories are brought about by undue height of either heel separately or by both high heels together. I shall now point out how undue length or elevation or both contingencies, acting at the same time upon the toe, are the principal cause of lesions to the perforans. The factors in the problem are simple enough: 1, obstruction to the full and free motions of the joints; 2, peculiarities of action; 3, the shape of the foot; 4, the nature of the ground travelled upon; and, 5, the rate of speed at which the horse is going. These causes can all act separately or in combination with each other, but separately or combined the point or points from whence these causes can exert their greatest mischievous energy are at or in the region round about the toe.

Injuries to the Perforatus.

407. (See Fig. 1, letter A.) There is a remarkable difference between the structure and functions of the perforatus and the perforans. The perforans has a ligament to check its action below the knee, which the perforatus has not, which shows that the perforans has more severe tasks to perform than the perforatus.

The action of the perforans, though mainly governed by the will, appears to have an automatic or involuntary function along with the suspensory in preventing the undue obliquity of the pastern, whether at rest or speed; and the perforatus having no check ligament below the knee, and requiring none or it would be present, has evidently less severe tasks to perform. On this account

it is less liable to injuries or to undue strain than either the perforans or the suspensory. When in action at speed, it is the perforans that takes the lead and has the principal share of the work to be done.

The perforatus, through being situated at the hinder part of the leg, is exposed to various injuries such as blows, kicks, and accidents of various sorts. A not uncommon injury is a heavy shoe when travelling a long distance, the horse becoming excessively fatigued by having to flex his leg with an undue and unnatural *dead weight* at the end of his foot, and the consequent inflammation and swelling of the sheaths through which the perforans glides in its necessary movements. Whenever its functions become impaired by injuries to its sheaths, which is common enough, dragging the toe is concomitant in this case as well as injurious to the perforans. When the perforatus is injured, the animal does not necessarily point forward, but seeks relief by standing with his toe pointed vertically, thus throwing whatever weight he may upon the perforans. As the perforatus is the hindermost tendon, swellings from its injuries always appear at the back of the leg, unlike the perforans and the suspensories, whose swellings appear at the inner or outer aspect of the leg. Only in rare and exceptional circumstances does the perforatus become the subject of strain.

408. (See Fig. 1, letter E.) What has been said of the perforatus with regard to its liability to injuries on account of its external situation upon the leg is equally true of the extensor pedis. Its function is simply to extend the foot and keep the toe pointing upward while the foot is landing upon the ground.

This keeping the toe pointing in the right direction till the posterior part of the foot touches the ground is a function of considerable importance. It is very easy to suppose that without this safeguard the toe would

strike the ground first, and stumbling and falling would be very frequent consequences. This function of the extensor shows why a horse stumbles less at a fast gait than at a slow one. The faster he goes the farther he extends himself, and the longer the stride the greater will be the distance between the ground and the point of the toe *when his heels first touch the ground*.

This simple fact of observation led me to study this problem a little closer. In paragraph 395 I presented my view of the manner in which the weight of the animal is transmitted from one structure to another during the stride at a fast pace. It was shown that at a critical moment the whole of the weight had to be borne and carried mainly by the suspensory and perforatus ligament, in proof of which it was shown that immediately after the heel landed the perforans became relaxed, and then gradually resumed its burden of weight as the body passed over in the long stride. This movement will be better understood if we view it in the light of the last-named function of the extensor pedis. Until the moment that the heels touch the ground, the toe is held up by the extensor. The elevation of the toe and the tightening of the perforans are concurrent; and the falling and straightening of the toe are followed immediately by a relaxation of the perforans.

How to Distinguish an Injured Tendon.

409. (See Fig. 1.) The pain and suffering caused by injuries to the tendons and ligaments, as has been shown, have symptoms in the manner of pointing the leg. It, however, sometimes happens that sprains of the different tendons and ligaments take place, and there being little or no discrimination as to the particular structure involved, the treatment must be altogether empirical and uncertain.

There may be some novices in diagnosis among my readers who will appreciate the few plain directions given in the following paragraphs.

It will be necessary to manipulate the structures at the seat of the injury by passing and pressing with the fingers over the affected part, both while the foot is on the ground and while it is flexed. The animal will flinch suddenly when you press the injured spot.

It will be well to study the drawing of the leg and its tendons very attentively. It will be seen that behind the upper half of the cannon bone there are four structures, two tendons and two ligaments, which are liable to become affected separately or together. They are usually affected separately. The lower half of the cannon bone has but three structures behind it, namely, the suspensory ligament lying close to the bone, the perforatus on the outside, and the perforans between the two. The check ligament makes the fourth structure behind the upper half of the cannon bone. The usual seat of injury to the check ligament is just where it joins with the perforans, and is the result of undue strain (see Fig. 1, letter O).

In order to get accustomed to manipulating morbid structures intelligently, the novice should practise on healthy legs occasionally. He would not then be so likely to make mistakes when called upon for a prompt and correct diagnosis.

When the leg is flexed these structures can be readily separated from each other by judicious manipulation, and the injured one and the injury readily discovered; and if it be borne in mind that the suspensory ligament lies directly behind the cannon bone, and that the check ligament, the perforans, and the perforatus follow in the order they are named, it will be scarcely possible to make any mistake.

Rational Remedies.

410. If there be no intelligent appreciation of the merely anatomical arrangement of the structures, what hope can there be of a rational application of the right remedy?

General Observations.

411. Not knowing exactly how to dispose of the following somewhat unconnected observations, I present them in a group, hoping they will be found not altogether destitute of food for thought and reflection in relation to the needs and requirements of the horse in modern civilization.

Rocker Shoe Invaluable.

412. Heels which have a tendency to grow down vertically and to project backward, resembling those in Cut 2, should especially be looked after and kept down, if you desire to prevent suffering to the horse or loss of the value of his services to yourself. Such feet are always better for being shod with shoes which rock backward. The rocker shoe is both a preventive and a cure for all injuries caused by undue height of the heels.

How to Prevent Pain and Loss.

413. The simple ability to discern and differentiate the effects produced by undue height of the toe, or of undue height of the heels, upon only two structures of the leg, namely, the suspensory ligament and the perforans, would prevent immeasurable miseries to the horse and enormous losses to all horse-owners and horse-breeders. The ability to do this implies the ability to adjust the pedal and other articulations of the

foot and leg, whereby the full flexing and extending movements of the leg are permitted, and by these means the horse could enjoy as much freedom of movement as that enjoyed by the fleshy-ball-footed animals.

Prevention of Injuries.

414. While the prevention of injuries to the suspensory ligament must be sought for in the judicious lowering of the heels, the prevention of injuries to the perforans tendon must be attained by lowering and shortening the toe, and in some cases by raising the heel.

Temporary High Heel.

415. The temporary high heel causes a relaxation of the perforans; and the suspensory ligament, its intimate friend and neighbor, helps it by carrying a good part of its weight whether standing or travelling.

Prevention of Strain During Motion.

416. Shortening and rounding of the toe will always prevent straining of the perforans while in motion on hard roads.

The shoe best adapted to this purpose is the rolling-motion shoe, which in thousands of instances during the last twenty years has been tried and proved and never found wanting.

It Must Follow

417. That a shoe rocking both ways, that is, at the toe and heels, will prevent injuries by undue strain to both the perforans and the suspensory ligament. If by any means the foot can be so balanced as to cause these two structures to carry an equal share of the weight at any

or every incline of the limb, our object is gained. The only instrumentality by which this has ever been, and I verily believe ever will be, accomplished is the centre-bearing shoe.

Rocking Movements.

418. A shoe made to rock both ways answers very well on hard roads, by rocking backward when the foot lands upon the ground, and forward when the foot leaves the ground. The rocking backward favors the suspensory ligament, and the rocking forward spares the perforans. The majority of injuries happening to runners on a hard track, I am convinced, is due more to the shape of the foot than to the hardness of the road. It is a very common idea that hard roads are the cause of lameness. It is the *unbalanced foot* that is the cause, for when a lame foot is balanced and the centre-bearing shoe affixed to it the horse goes free from lameness over the same road almost instantly, and the harder the road the better he goes!

Eight Running Horses.

419. I remember having to shoe eight running horses all on the same day, all of whom were lame from running. I shod them all with light steel ball shoes, the highest part of the convex surface being but a quarter of an inch above the circumference of the shoe. Two weeks later they were reported to me all going perfectly sound and free from lameness excepting one.

A Drawback.

420. The centre-bearing shoe has one drawback, and that is that it will not rock on soft ground—that is to say, on ground such as a ploughed field would present. The property that makes it so valuable on *hard* ground

renders it valueless on soft, deep, *plastic* ground. Horses have been shod with centre-bearing shoes one inch high in the centre and have travelled without lameness on the hardest of roads, and yet as soon as they struck soft ground which deprived the foot of the power to roll over they went as lame as ever. The explanation is simple and the truth shall be told. On hard roads when the foot can rock there is no straining of the tendons. On soft grounds the tendons suffer strain and pain from the foot becoming imbedded in the soil and being deprived of the power to rock.

A Problem to be Solved.

421. The bottom of the foot is all that comes in contact with the surface of the earth, and yet the appendage to the foot has never yet been discovered which is perfectly adaptable to every variety of surface over which the horse travels.

On hard roads for sound horses, there is no shoe equal to a plate of steel or iron, slightly convex on the bearing surface for ease and safety to the horse.

An iron plate perfectly flat, I have read, is in use by some Eastern nations. Slipping is said to be the disadvantage of this shoe, but apart from this defect a flat plate is as good as, if not better than, the common shoe on hard roads, and decidedly better than the common shoe on soft roads, inasmuch as the weight of the horse is carried more upon the centre of the foot than it can be with a common shoe.

A flat plate shoe on ordinary soft ground rocks nearly as easy as a ball shoe on hard ground, by the dirt packing into the centre and spreading around the edges as the body passes over, and will be easier for the tendons and ligaments on deep soil than a ball shoe, for the reasons already stated.

A Cup Foot

422. Shod with a light running plate, if tender or lame, travels best on ground just soft or deep enough to allow the foot to rock. The heels sink into the soft ground and get supported in the centre; the foot rolls over to some extent, and the toe beds itself into the ground in much the same way that the ball shoe acts on the hard ground. The weight is carried on the centre and equally balanced between the two weight-carrying structures, the suspensory ligament and the perforans, instead of being *jerked* to and fro as it were by angular instead of circular bearings and movements.

A Splendid Auxiliary.

423. It will be seen what a splendid mechanical auxiliary the centre-bearing shoe and its various modifications may become in the hands of a wise and progressive veterinarian. There is hardly an instance of a horse being lame, whether the cause be accidental or arising from defective shoeing, without his receiving immediate benefit from the application of this shoe; and the manner in which it facilitates the curative process is something unprecedented in veterinary experience.

Last Words.

424. Surely, in the nature of things, there must be some basic facts, or central principle, upon which a truly rational system of horseshoeing can be built up and established; or around which the numerous scattered and disjointed facts pertaining to the true economy of the horse's foot may gravitate as to a nucleus, and find a bond of union and crystallization into a true and

perfect system of hygienic and therapeutic horseshoeing, which being in accordance with the rest of nature's laws must be as enduring as nature herself.

This book embodies the results of my observations and practical every-day experience in the shoeing of sound and in the treatment of lame horses for the last forty-five years; and I feel a sense of gratitude commingling with my feelings of pride and pleasure that I am enabled to contribute something toward "a consummation so devoutly to be wished."

THE END.

INDEX.

EXPLANATION.—I have given the principal subjects in the order in which they were written preferably to giving them an alphabetical arrangement.

Under the head-line of General Facts, Principles, and Observations, the subject of navicular disease will find its place. This subject had become so interwoven with the facts and principles with which it was so closely connected that I found it impossible to draw a line where the subject of navicular disease could properly be said to begin or end, except from the first to the last paragraph of the article.

But if the reader perceives any disadvantage in this lack of arrangement of topics, I think he will derive one advantage from it in another respect.

The navicular disease has been made the *main question*; and as the origin of this disease is identical with that of all other diseases of the foot and leg of the horse, the elucidation of this question renders the consideration of every subsequent topic a perfectly easy matter.

Under the principal heading of General Facts, Principles, and Observations all the paragraph headings up to 154 are arranged alphabetically. From that number on the minor topics are to be found, numbered in the order in which they were written, under the principal headings which give the names of the diseases to which they respectively refer.

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ILLUSTRATIONS OF EACH SHOE.

THE centre-bearing shoe (Cut 42) is represented by the section of a globe which may be from four to six inches in diameter, the depth of the curve varying from one-eighth to one inch.

The half-ball (Cut 19). This form is best understood by supposing the full centre-bearing shoe to have a slice taken off it at any depth, which would leave a hole in the centre and give a bearing on the circumference of the hole so formed.

The central bar (Cut 24). The basis of this shoe is a common bar shoe. A flat bar of steel three-fourths to one inch wide, and of sufficient thickness to carry the weight of the animal, is first given the required curvature, and is then to be welded over the centre of the shoe, that is, if the foot is regular in circumference; but if the foot is otherwise, the central bar must be welded to the shoe so that the *foot* may be balanced rather than the *shoe*. The central bar in other words should be in a direct line with the axis of bearing of the limb—let the point of the toe be where it will. This shoe will be the substitute for the centre-bearing or ball shoe on all occasions, as it prevents slipping.

The common four-calk front shoe describes itself (Cut 20). It works like the rolling-motion shoe and prevents slipping.

The common four-calk hind shoe (Cut 28) for curb, and prevents strains of back tendons.

Rolling-motion shoe (Cut 29). This shoe is thicker at the heel than at the toe; the toe portion is curved and the heel uncurved, for horses when pointing forward.

Rocking shoe, for horses high at the heels (Cut 21), for corn.

Four-calk shoe for spavin (Cut 18). For stringhalt or spavin the inside calk is set back to allow the toe to fall in an inward direction.

Rocking bar shoe, one heel cut off for corns (Cut 22).

Dexter's pedal bone (Cut 31).

Profile view Dexter's pedal bone (Cut 31).

Drawing of a contracted foot (Cut 33).

Drawing of a perfect foot (Cut 34).

Wing of pedal bone atrophied (Cut 41).

Line of flexion of hind leg shod with high or low heels (Cut 25).

Half-ball shoe with four calks (Cut 44). This modification of the centre-bearing is an important one, as it prevents slipping. A horse with this shoe, whether sound or lame, will travel better on the road at all gaits and rates of speed. I have known of many tender-footed and sound horses having their speed improved by the use of this shoe, and I have no doubt when this style of shoe can be made lighter that it will be a most important factor in the development of speed.

Bar shoe for front-foot fissure (Cut 26).

Rocker shoe made by welding calks two-thirds of the shoe's length, beginning at the heel (Cut 23).

Grab shoe (Cut 30). The outer edge of the shoe to be of one even thickness all the way round, but scooped at the toe from the outer edge to the inside edge down to a thin edge.

Flat shoe—bevelled at the outside toe to allow the foot to rock outwardly to prevent interfering (Cut 35).

Front four-calk shoe, to prevent interfering and slipping (Cut 36).

Common shoe with toe calk for heavy slow horses, to prevent hitting or interfering, same as shoe (Cut 37).

Pivot shoe for a club foot or bad ringbone (Cut 39).

Movable pivot to apply to the heel of a shoe to give a horse rest to his tendons while standing in the stable (Cut 40).

It will be instructive to contrast the effects of the two forms of hoof represented in Figs. 2 and 5. One has a convex and the other a concave outline on the front surface. I have seen horses whose hoofs have curved inwardly half an inch, and some outwardly the same distance from the straight line. It is well known that the normal distance of the laminated structures is at an equal distance from the top to the bottom of the wall, whether curved inwardly or outwardly, so that it is possible for the points of the toes of the pedal bones in those cases to vary to the extent of an inch or more in height. It is a fact that navicular disease is *always* the attendant of the elevated toe and *never* of the elevated heel; pointing clearly to the natural and necessary connection between high-toe and navicular disease.

NO. 2.

This cut shows that the toe of the pedal bone C is left too low by an extra growth of hoof at the heels.

- a. Apex of the pedal bone. hh. A foot five-fifths in advance of the centre line ee.
- b. Coronary bone.
- c. Pedal bone.
- d. Pedal joint.
- e. Centre of foot, between toe and heel.
- ff. Natural height of hoof.
- gg. A foot grown forward.
- i. Axis of the joint.
- j. Sesamoid bones.
- k. Navicular bone.
- l. Flexor tendon.
- m. Extensor tendon.

NO. 1.

This cut shows an overgrowth of hoof evenly pared.

- a. Apex of the pedal bone.
b. Coronary bone.
c. Pedal bone.
d. Pedal joint.
e. Centre of foot, between toe and nail.
ff. Natural height of hoof.
gg. A foot grown forward.

NO. 3.

No. 3 shows the toe of the pedal bone c downward by too high heels.

NO. 4.

No. 4 shows the toe of the pedal bone c too elevated by too much hoof left at the toe h.

NO. 5.

This cut shows the toe of the pedal bone c raised by an extra growth of hoof at the toe, fig. h.

NO. 6.

This cut shows a difference in height between heels and toe on account of the grain of the hoof growing horizontally at the heels and vertical at the toe.

NO. 7.

This cut shows the uniformity of the ridges
circumscribing the foot by an even
growth of hoof.

NO. 9.

A chart showing that a horse points to these eight
directions to find relief, caused by extra height of
hoof at either one of those figures.

NO. 10.

This cut is to show that the strain of the perforans depends on the distance between its insertion at K to the prop line or apex at a.

NO. 11.

This cut is to show that obliquity of the pastern depends on the balance of the hoof and that raising the heels causes its obliquity and *vice versa*.

NO. 12.

Cut 12 shows a natural cause for kneesprong by an oblique pastern.

NO. 13.

This cut is to prove that the hock depends more or less on the obliquity of the pastern for its angle ; that is, oblique pastern causes a straight hock, and *vice versa*.

NO. 14.

This shows that high heels has caused the leg to point back of a vertical line from the point of the shoulder.

NO. 15a.

A hoof contracted on one-half only. Make that side of the pedal bone the highest.

NO. 16a.

A hoof becoming oblong by contraction.

NO. 15.

This shows that a well-balanced foot causes the leg to stand vertical.

NO. 16.

This shows that an extra high toe causes the horse to point in front of a vertical line drawn from the shoulder.

NO. 17.

A hoof contracted at both heels.

NO. 18.

A hoof contracted at one heel only.

These Shoes were Patented in 1869 and 1870 in the United States—the
Centre-bearing Shoe in Canada, England, France and Belgium.

NO. 18.

NO. 18.

A four-calk shoe for a spavin. The inside calk set further
back than the outside calk.

NO. 19.

A half-ball shoe.

Side view.

NO. 19.

A half ball shoe without calk.

NO. 19.

A half-ball shoe with a centre piece welded near the centre, to cause it to wear and to rock easily also.

NO. 21.

NO. 21.

A rocking shoe thinner at both heels and toe. Called a rocker.

NO. 22.

A rocking bar shoe for corns

NO. 23.

A rocking shoe made by welding the calk on each side.

NO. 23.

Side view.

NO. 24.

NO. 24.

A centre-bar shoe to replace a centre-bearing or ball shoe.

NO. 26.

NO. 26.

A shoe with the calks set one inch from the points of the heels.

NO. 26.

NO. 26.

NO. 28.

NO. 28.

A common four-calk hind shoe for curbed or swelled tendons.

NO. 29.

NO. 29.

A rolling motion shoe rolled at the toe only, for nevacular disease or for a horse pointing.

NO. 30.

NO. 30.

A grab shoe—a shoe made to roll, while it prevents slipping.

NO. 31.

View of the bottom of the Dexter pedal bone, with one contracted wing.

NO. 37.

A shoe with the toe set on the bias to prevent cutting. Set full on the inside.

Side view.

NO. 32.

A profile view of Dexter's foot or pedal bone.

NO. 33.

A foot before expanded.

NO. 34.

A perfect foot after expanded.

NO. 35.

NO. 35.

A shoe rolled on the outside toe to prevent slipping;
called shoe-fly.

NO. 36.

NO. 36.

A four-calk shoe to prevent cutting. The outside toe calk set
back of the inside one in place of No. 35 shoe

NO. 38.

A centre-bearing shoe for a club-foot or
for laminites.

NO. 38.

Side view.

NO. 40.

A movable pivot attached to the shoe,
for to rest the tendons while standing.

NO. 40.

A pivot

Side view.

NO. 44.

NO. 41.

A pedal bone, with one contracted wing.

NO. 42.

NO. 42.

A shoe made like a half ball, rocking in all directions,
Called a ball shoe or centre-bearing shoe.

NO. 44.

A shoe made half-ball with calk
to prevent slipping.

NO. 44.

A half-ball with-
out calks.

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VETERINARY TEXT BOOKS

The following is a choice list of the Veterinary Books used as students' text books in the Veterinary Colleges of America. For further description of them, see author's index.

Anatomy.

Chauveau's Comparative Anatomy, Cloth...	\$7.00
Strangeway's Veterinary Anatomy, Cloth...	5.00
M'Fadyean's Anatomy of the Horse, Cloth...	6.50
Ballou's Compendium of Equine Anatomy and Physiology, Cloth.....	1.00
Interleaved.....	1.25

Physiology.

Smith's Manual of Veterinary Physiology, Cloth	4.25
Smith's Comparative Physiology, Cloth (net)	5.00
Sheep (net).....	6.00

Hygiene, Quarantine, &c.

Walley's Meat Inspection, Cloth.....	4.00
Smith's Manual of Veterinary Hygiene, Cloth	3.50

Operative Dentistry.

Liautard's How to Tell the Age, Cloth.....	50
Hinebauch's Veterinary Dental Surgery, Cloth.....	2.00
Sheep	2.75
Huidekoper's Age of Domestic Animals, Cloth (net).....	1.75
Clarke's Horses' Teeth, Cloth.....	2.50

Exterior of the Horse.

Harger's Exterior of the Horse, Cloth.....	6.00
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Obstetrics.

Fleming's Veterinary Obstetrics, Cloth.....	6.00
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Lameness and Shoeing.

Liautard's Lameness of the Horse, Cloth...	2.50
Zundel on the Horse's Foot, Cloth.....	2.00
Fleming's Practical Horse-shoeing, Cloth...	75
Percival's Anatomy of Horse's Foot, Cloth..	7.50
The Horse's Foot, by David Roberge, svo., Cloth.....	5.00

Materia Medica and Therapeutics.

Dun's Veterinary Medicines, Cloth.....	5.00
Morton's Manual of Pharmacy, Cloth.....	3.50
Tuson's Pharmacopia, Cloth.....	2.50

Theory and Practice of Medicine.

Robertson's Practice of Equine Medicine, Cloth.....	6.50
Law's Veterinary Adviser, Cloth.....	3.00

Gresswell's Theory and Practice of Equine

Medicine, Cloth.....	3.50
Williams' Principles and Practice of Veterinary Medicine, Cloth.....	5.00
Courtenay's Manual of Veterinary Medicine and Surgery, Cloth.....	3.50

Cattle Practice.

Steele's Diseases of the Ox, Cloth.....	6.00
Law's Veterinary Adviser, Cloth.....	3.00
Hill's Principles and Practice of Bovine Medicine and Surgery, Cloth.....	10.00
Walley's Four Bovine Scourges, Cloth.....	6.40

Canine Practice.

Hill's Management and Diseases of the Dog, Cloth.....	2.00
Mill's Dog in Health and Disease, Cloth.....	2.25
Steele's Treatise on the Diseases of the Dog, Cloth.....	3.50
Mayhew's Dogs and Their Management, Boards.....	75
Ashmont's Dogs: Their Management and Treatment in Disease, Cloth.....	2.00
Youatt on the Dog, Cloth.....	2.00
Mills' Comparative Physiology, Cloth.....	3.00

Surgery.

Fleming's Operative Surgery, Pt. I., Cloth...	3.50
Williams' Surgery, Cloth.....	5.00
Liautard's Surgery, Cloth.....	7.50

Entozoa.

Neumann's Parasites and Parasitic Diseases of the Domesticated Animals, Cloth.....	8.00
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Miscellaneous.

Fleming on Roaring, Cloth.....	2.00
Fleming's Animal Plagues (first series), Cloth	6.00
Second series, Cloth.....	4.80
Koch's Tuberculosis, Cloth.....	1.00

Dictionaries.

Thomas' Medical Dictionary, Cloth.....	3.00
Sheep	3.50
Keating's Medical Dictionary, Cloth.....	75
Tucks	1.00
Gould's Medical Dictionary, Plain Leather, (with Index).....	3.25
Half Morocco.....	4.25

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