NOTES ON THE PURCHASE, MANUFACTURE, AND INSPECTION OF UNITED STATES ARMY SHOES AND SHOE LASTS

PREPARED UNDER THE DIRECTION OF THE
QUARTERMASTER GENERAL
OF THE ARMY

FOR THE INFORMATION AND
GUIDANCE OF OFFICERS OF
THE QUARTERMASTER CORPS

WASHINGTON
GOVERNMENT PRINTING OFFICE
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U.S. Quartermaster Corps

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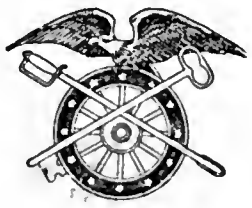

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PREFACE.

It is believed that it might be of some future value to reduce to writing deductions made from personal observations, results obtained from actual tests, and knowledge gained from practical acquaintance with the general conditions surrounding the manner and method of the purchase, manufacture, and inspection of shoes for Army purposes at the Boston depot during the emergency created by the World War.

The questions considered and determined have been varied and numberless, and many situations having arisen demanding careful study and nice distinction in judgment for their proper adjustment, it is felt that the experience thus acquired has undoubtedly resulted in obtaining the best possible shoes of the several types adopted, and that the data relative thereto should be of inestimable value in future endeavors of a similar character, even though the volume of production might not be as great.

It is also felt that shoemaking knowledge of a high standard—speaking from a standpoint of merit rather than from a commercial standpoint—is to be found in the Shoe Branch, and that there will be no more opportune time than the present to analyze the successful accomplishment of the stupendous task placed upon this branch of the organization, since as the emergency work is completed the organization will dwindle to a great extent, many of the inspectors entering other walks of life, while some of the older and more valuable men of the branch, especially those long connected with the service, are getting well along in years, and an expression of their views on the proper method of making Government shoes is of great importance.

There have been 35 different shoe manufacturers, each with an inspector in charge stationed at his respective factory, making the same type of shoe, yet it has been found that the product of each manufacturer has had some process carried out in some respect differently from each of the others. A comparison and study of the operations performed and the work accomplished at each factory, together with discussions with the various contractors, have, it would appear, resulted in ascertaining the proper manner of performing each and every operation, and the reason why any given operation should be executed in the manner prescribed has been determined by means of actual experience, the conclusions becoming self-evident, thereby rendering it unnecessary for future inspectors to spend any great amount of time or energy in experimenting.

PURCHASE, MANUFACTURE, AND INSPECTION OF UNITED STATES ARMY SHOES AND SHOE LASTS.

Chapter I.

HISTORICAL SKETCH.

During the entire existence of this country as a nation the question of properly protecting our soldiers' feet has been a subject of much concern. All are familiar with the distressing plight of the Revolutionary Forces during the winter at Valley Forge, when the soldiers were compelled to swathe their bruised and bleeding feet in strips of blanket, or whatever other material was to be had. These conditions were due in a great measure to the limited facilities for producing shoes in large quantities, as at that time they were made entirely by hand, which involved a slow, laborious process.

During the Civil War similar conditions were avoided by the use of machinery, particularly the McKay sewing machine, a then recently perfected invention for attaching the bottoms of shoes, which permitted their manufacture with greater rapidity and in larger numbers. Because of the ideal industrial conditions existing in New England, its short, swift rivers and comparatively dense population, the North was in a much better position to make use of this invention than the South, and it is thought that the advantage thus gained aided materially in the success of the northern cause.

Previous to the introduction of the McKay machine, shoes were of the hand-pegged or hand-nailed type, while by the use of this machine the outsole, upper, and insole were united by a waxed thread. Since the ridge of stitches laid on the insole by the latter process was a frequent cause of discomfort to the wearer, this type of construction was considered unsuitable for Army shoes and was displaced shortly after the Civil War by the hand-welt shoe, which also possessed greater flexibility. By this method the welt and upper are sewed to the channeled insole, leaving an inside surface on which no stitching appears, but since the process was slow and expensive its use in Army shoes was discontinued about the year 1878 and the so-called standard screw shoe adopted. In this form of construction the outsole is fastened to the insole by means of a heavy threaded wire which is mechanically screwed through the parts to be fastened and automatically cut off at the required length. This method of uniting the soles forms a very secure fastening, but it makes an extremely rigid bottom, and as the metal fastenings act as free conductors it has the additional disadvantage in cold climates of causing great discomfort, if not actual suffering, to the wearer.

After a period of experimenting with the metallic fastened shoe the welt shoe was again adopted for the Army, but with the difference that, while the welt was still sewed by hand, the outsole was attached to the welt by the use of the Goodyear lock-stitch machine, which had in the meantime been developed.

In order to facilitate production, the specification was changed during the Spanish War to permit both welt and outsole stitching to be done by machinery. This, on the whole, has proved by far the most satisfactory method yet devised from the standpoint of durability and rapidity of production.

The method of construction having been definitely decided upon, efforts were directed toward improving the Army last. In May, 1912, a board of officers consisting of Maj. E. L. Munson, Medical Corps; Capt. W. J. Glasgow, General Staff; Capt. J. R. R. Hannay and Lieut. B. F. Miller, Infantry, convened at Fort Leavenworth, Kans., designed an experimental shoe, the last of which differed from that then in use in the following respects:

1. The inner line of the sole in front of the ball was straightened.
2. Part of the waste space from the end of the little toe to the front end of the shoe was eliminated.
3. The width of the heel was reduced approximately one-sixteenth of an inch in its upper portion, leaving the heel seat corresponding to the bearing surface of the heel on the ground the same as before.

The straightening of the inner line of the sole was intended to give more width in the forepart to provide for the spreading of the soldier's foot when carrying a heavy burden. The results obtained from the testing of this shoe were so satisfactory that both shoe and last were adopted for Army use and have ever since been referred to as the "Munson."

In the recent Great War, since the development of trench warfare seemed to require a shoe of heavier and more waterproof construction than the Munson shoe then in use, the Army adopted a shoe copied largely from those used by the Allies. This was commonly known as the "Pershing," a very heavy shoe, the soles of which are metallic fastened and which is probably more waterproof than the regular welt shoe, and therefore suitable for trench warfare or for use where very little marching is required. However, the lack of flexibility and the conductivity of its metal fastenings make it an unsatisfactoy general-purpose shoe, especially where rapid marching is necessary. While this type of shoe lends itself to rapid manufacture, and its heavy construction results in greater durability and therefore economy of material, this economy is more than offset by the reduced effectiveness on mobile troops.

Since the signing of the armistice the Army shoe has again reverted to the Goodyear type, and while it is of heavier construction than the former welt shoe, yet it provides comfort, neatness of appearance, and durability, the latter feature of which may be increased by the insertion of hobnails and the addition of heelplates. Inasmuch as the possibility of salvage is an important item in the life of the Army shoe, the Goodyear stitching is especially satisfactory, since the worn sole of a welt shoe can be more easily and advantageously replaced than that of any other type, the new sole being attached by stitching or nailing, either by machine or by hand, while the removing of the worn sole of a standard screw shoe is only accomplished with difficulty and the new sole can only be attached by nailing.

Chapter II.

PURCHASE OF UNITED STATES ARMY SHOES.

SCOPE OF SUBJECT.

The matters taken up under purchase are to be considered only in so far as they exert an influence on production, and the statements set forth are in the nature of suggestions tendered from experience, aiming at an even closer cooperation between the Purchase Branch and the department having charge of production.

KNOWLEDGE OF NEEDS OF THE ARMY.

It should be appreciated that the problems confronting the purchasing officer are numerous and intricate. The very foundation upon which the success of his task depends is an accurate knowledge of the needs of the Army. It is not a difficult proposition to estimate to a reasonable degree of exactness the average life of the average Army shoe, and knowing the size of the standing Army one ought to figure out with corresponding accuracy the requirements of the Army for a definite period. This refers to the needs under normal conditions, it being assumed that arrangements will be made whereby emergencies are to be taken care of by the manufacture and storage of a certain number of shoes. However, a mere knowledge of the quantity of shoes to be manufactured is insufficient. The purchasing officer must also have at hand an accurate schedule of the apportionment of the shoes according to sizes and widths.

TARIFF OF SIZES.

During the recent emergency mistakes in ordering, coupled with insufficient knowledge of conditions confronting the Army in France, resulted in an excessive accumulation of small-sized shoes, a condition which was overcome by the issuance of an emergency tariff affecting all uncompleted contracts. Any change of tariff on contracts in the process of production causes the disruption and practical suspension of both the factory and production organizations and becomes a source of expense to the manufacturer and to the Government. The Government must provide for the distribution of additional shoe lasts to meet the change in deliveries as provided for under the new tariff. The contractors must purchase new dies, cartons, and cases, and those not cutting their own soles must revise their sole-leather commitments. Previous to the application of the new tariff manufacturers were able to purchase cut soles in assorted sizes at so much per pair, regardless of size, but the great demand for large sizes having been made known to the tanners caused the

latter to set a price on each size sole, resulting in an unforeseen expense to the contractor.

It is suggested, in the event of a similar emergency, that manufacturers be permitted to complete contracts in process, the special requirements being taken care of by additional contracts or open-market purchase orders. The arguments in favor of this procedure are, first, that production will not be disrupted; second, that the Government will receive shoes of sizes and widths that will eventually become useful; and, last, that the Government will be saved the expense of an adjustment to the manufacturer for the damage incurred.

KNOWLEDGE OF MATERIAL.

Of importance second only to a knowledge of the number of shoes required for a given period is the purchasing officer's familiarity with materials appropriate to the conditions under which the shoes are to be worn and foresight as to what these conditions will be. The garrison shoe, the trench shoe, and the marching shoe, for instance, have been planned for widely varying purposes, each of which necessitates consideration of appropriate material, weight, and construction. Knowledge of material required should be acquired from one having had actual experience, either in the making or handling of the same. A distinct advantage to the Government would result from a knowledge on the part of the purchasing officer of the amount of material required and available for proposed contracts. Difficulties arising from a shortage of material would be obviated by apprising the tanners of sole and upper leather and the shoe finding houses, directly or indirectly, of contemplated contracts, since the producers, having been informed of the quality and quantity of material prescribed, could immediately place themselves in readiness to meet said requirements. This is especially desirable in regard to upper leather because of the fact that it is not an easy matter to produce suitable upper leather in large quantities at a short notice without some minor defects arising from time to time in the leather, either in the line of color or general quality.

COST OF MATERIALS.

Another feature which should be elaborated on is the relation between a sufficient notice to the manufacturer and the question of the cost of the shoe, it being presumed that a contractor called upon to submit a bid within a period of 10 or 15 days from the date of receiving notice of impending awards would not be given sufficient opportunity to obtain as low figures on his estimated cost of material as in a 30 to 60 day interval, and would be compelled to submit a bid less advantageous to the United States; moreover, an early notice to manufacturers as to the quality and quantity of materials to be used will ordinarily result in materials of higher standard and facilitated production.

OPPORTUNE TIME FOR PURCHASING.

The actual purchase of any type of shoes in large quantities should, when possible, be made at a time of year known to the shoe trade as "between runs." a period when the market is more often

at its lowest ebb and the manufacturer is in a position to take contracts at a lower figure in order to equalize his overhead. This requires that the purchasing agent should at all times be in a position to purchase whenever he could do so advantageously, and that having a fairly accurate knowledge of the materials to be used he should follow the market quotations to some extent. The necessity of the purchasing officer's knowledge of the cost to the manufacturer of the type of shoe anticipated can hardly be overestimated. With a knowledge of the prevailing market quotations on the items to be used, plus a schedule at hand of the quantity of each material required for a pair of shoes in accordance with each set of specifications, an approximately correct estimate of the cost of materials to the manufacturer can readily be compiled.

COST OF MANUFACTURING.

The other three factors upon which the manufacturer bases his bid are labor, profit, and overhead. A comparative study of the cost to contractors in manufacturing Government shoes, made under the supervision of the Boston depot on contracts completed March 1, 1919, showed that the total cost for the various operations ranged from a minimum of $0.5663 to a maximum of $0.6427 per pair, with an average of $0.609. It is not intended, however, that this average quoted should influence to any great extent the prices on future contracts, since the unsettled labor conditions existing up to the present time render the adopting of even a semistandard for this item a present impossibility, it being necessary to ascertain the schedule of costs applicable at the time of each and every award.

OVERHEAD.

Of the four factors upon which a bid is based, the most difficult to estimate is the question of overhead, which may be divided roughly into five classes: First, cost of administration, consisting of general executive overhead (this is generally less in a small factory, where one chief executive accomplishes tasks that range from the duties of the president down to those of a foreman); second, cost of manufacturing, including wear and tear on machinery; third, losses in factory organization; fourth, losses on special facilities; fifth, losses on the curve of costs.

The so-called "losses in factory organization" may be explained by stating that during the process of manufacturing any type of shoe, the personnel of the factory, becoming more and more accustomed to that type of work, turn out each task with increased speed. Each department is brought to a state of efficiency in cooperating with the other departments. Work leaving one department arrives at the next at the proper time. Upon the adoption of a different type of shoe, however, the machinery requires intricate readjustment and employees are also forced to accustom themselves to new conditions. There is a period of readjustment. In a word, the harmony of the organization has been interrupted.

"Losses on special facilities" covers the costs of rearranging the factory, moving around departments, and installing new machinery.

The "losses on the curve of costs" require a more detailed explanation, and should be divided into three groups, consisting of loss on labor, loss on upper leather, and loss on sole leather. It is necessary to distinguish clearly between the loss on labor as mentioned under the curve of costs and the loss in factory organization previously explained. This subdivision refers, generally speaking, to the individuals who actually perform the work. It is an accepted fact that employees working upon Government contracts because of the exactness of workmanship required, are better paid than those working upon civilian orders, and that upon the termination of a contract the employees are usually unwilling to return to the former wage scale. One of two conditions must then result, either the manufacturer is deprived of many of his experienced workers or he is forced to maintain the same standard of wages at a diminished profit. Upon starting on a new contract each laborer is forced to produce more slowly, which, if he is on a piecework schedule, results in the beginning in his individual loss, but if on a time schedule results in a loss to the manufacturer. The cutting of the upper and sole leather at first is somewhat in the nature of an experiment which continues with increased efficiency as the contract proceeds. These losses on the curve of costs, generally speaking, are finally overcome by corresponding gains in the latter portion of the contract, providing it is of sufficient magnitude.

At the time it became necessary to terminate Government contracts, after the signing of the armistice, the estimates compiled in order to compensate the manufacturer for overhead on contracts that were terminated was 37½ cents for each pair of shoes undelivered. A set of figures compiled at this office from investigations made at the factories resulted in an estimate of 38 cents per pair, apportioned as follows: Losses due to administration costs, including all costs of general executive overhead, 5 cents; manufacturing costs, including losses on clicking dies, upper leather patterns, miscellaneous dies and patterns, and losses in operating costs in factory, 1 cent; losses in factory organization, plus rejects, 15 cents; losses on special facilities, such as cost of moving around departments, rearranging factory, loss on machinery while idle, etc., 5 cents; loss on curve of costs, 12 cents (labor 5 cents, upper leather 3 cents, sole leather 4 cents); total, 38 cents.

While the cost of labor and material is in proportion to the number of pairs of shoes being manufactured, this is not true of the overhead expense, since the majority of its constituent elements, such as salaries and heating and lighting expenses, are practically fixed. This results in a large percentage of overhead per pair when the output is small and in a corresponding decrease with an increased output.

ADVANTAGE TO PURCHASING OFFICER OF ABOVE KNOWLEDGE.

The necessity for the purchasing officer having knowledge of the cost to the manufacturer having been previously referred to, the question arises as to what value this information would be. In the past manufacturers contemplating bids would often collaborate, the result of such discussions frequently being an increase of the price previously decided on. With a knowledge on the part of the Government of the cost to the contractor, the purchasing officer would

be in a position to refuse bids involving excessive profits, and, moreover, the incentive to underbid on the part of the competing companies would be increased.

PURCHASE OF LASTS.

Inasmuch as shoes can not be made without lasts it is obvious that a general survey of the last situation should be taken previous to the awarding of contracts. Records on file should show the number of pairs of each style of lasts in existence in each zone, and, in addition to this, the number of pairs in use on contracts already awarded in order to determine the quantity available at any given time. A table of the numbers of lasts required for making a given number of shoes in a given time, together with perfected data on the manufacture, distribution, and storage of shoe lasts, devised and arranged by the writer, and made use of during the late emergency, is on file and available at this office. By following out the information contained therein, all causes arising from delays occasioned by the nonreceipt and inadequacy of numbers of lasts would be eliminated.

KNOWLEDGE OF FACTORY CONDITIONS.

The greatest difficulty contended with after the award of the contracts has been the daily capacity of the contractor. In the past contracts have been awarded requiring a daily production which the manufacturer, through insufficient amount of machinery or operators, or owing to lack of factory organization, was utterly unable to attain. An actual knowledge on the part of the purchasing officer of the daily capacity of a prospective contractor would enable him to award contracts which would result in the most facilitated production. During the war this office was able to obtain a degree of efficiency only by entirely disregarding the production as required in the terms of the contracts and figuring production on the daily capacity of the contractor, and the existing factory conditions.

In accordance with the terms of contracts previously awarded, a manufacturer who failed to deliver shoes within the time specified was subject to penalty. Invariably in deciding whether the penalty was to be imposed, fine judgment had to be exercised in order to protect the interests of the Government without injuring the manufacturer. During the emergency when contracts were practically forced upon contractors it did not seem equitable to fine a man who was called upon to make more shoes per day than his daily capacity and factory conditions would warrant.

SUMMARY.

It is felt that a great part of the confusion and annoyance encountered in the manufacture and inspection of shoes could be obviated providing the suggestions hereinbefore mentioned were carried out, and that a high spirit of cooperation could exist among the three parties concerned, the Purchase Branch, the Production Branch, and the contractor. Peculiar situations in the past have arisen where the manufacturer felt favorably toward one and ill disposed toward the other, in which case the result would appear in the finished shoe; but if the high standard established is to be maintained, all ideas or feelings of conflict must be entirely eliminated.

Chapter III.

NECESSITY FOR INSPECTION OF MATERIALS USED IN, AND THE CONSTRUCTION OF, ARMY SHOES.

OBJECTION TO INSPECTION.

A considerable number of people, including several manufacturers, sincerely believe that the somewhat elaborate system of inspection of Army shoes is entirely unnecessary inasmuch as the manufacturers are honorable business men who would construct shoes in accordance with the written specifications without the presence of Government inspectors in their respective factories. It is believed that this feeling is based upon the theory that the system in question required too great an expenditure of money, which must of necessity be raised by taxation.

COST OF INSPECTION.

It has been definitely ascertained that in the manufacture of shoes of any grade or in any quantity it is inevitable that a certain percentage will be ruined beyond the possibility of repair, while another certain percentage will be partially damaged. This condition is due to careless workmanship and will prevail as long as shoes are made by human hands. An examination of the general conditions prevailing in the manufacture of commercial shoes, a study having been made of several concerns, showed that the amount of damaged civilian shoes, including both wholly damaged and partially damaged, varies from 3.5 to 5.2 per cent. Assuming that this same percentage held true on Army shoes, the financial loss to the Government would approximate at least three times the cost of inspection.

In support of this statement the following data is presented regarding the actual cost of the inspection of shoes manufactured under the supervision of the Boston depot from April, 1917, to April, 1919, inclusive:

Total pairs of shoes manufactured	18,912,093½
Average price per pair	$5.45
Total value	$103,115,384.44
Cost of inspection	$1,118,992.90
Cost of inspection per pair	$0.05916
Cost of inspection per dollar	$0.0108

From the figures as given above, showing the percent of inspection cost at the Boston depot, the deduction may be made that if only one pair of shoes out of every 92 pairs were defective, said one pair having been rejected by the inspector, the Government would not have sustained any financial loss by reason of the cost of inspection.

MUTUAL UNDERSTANDING OF SPECIFICATIONS.

Under the present system of inspection, upon receipt of a contract for the manufacture of shoes, the entire contract, with all its specifications and other instructions, is given a very careful study by the officer in charge, and when it is found that the responsible officer and interested Government employees have a thorough, mutual understanding of the requirements of the contract steps are then taken to get in touch with the contractor for the purpose of insuring his thorough understanding of said requirements in order to avoid any disagreements or misunderstandings before actual production is started.

GENERAL DUTIES OF FACTORY INSPECTORS.

From time to time as the material is received and the progress of the work advances, Government inspectors are installed in the factory, each skilled in his line, whose duties are to examine every piece of leather that goes into the shoe, to stamp each sole-leather part with a Government stamp, and to supervise the assembling of the several parts and the proper performance of each operation during the process of construction. Inspectors assigned to factory duties serve in an advisory capacity, and their acceptance of any inferior material or defective workmanship in no manner obligates the Government to accept the same.

FINAL INSPECTION.

After the shoes are finished they are then shipped to the Zone Supply Officer in order that final inspectors may pass upon their actual acceptance or rejection. While it is always assumed that every operation of the shoe has been rigidly inspected before the final product is delivered to the Government, it frequently happens, especially where the volume of production is large, that no matter how vigilant a resident inspector may be a certain percentage of shoes which are unsatisfactory for one reason or another find their way into the Army Base, where they are eliminated in the final inspection room.

The reason for having final inspection at the Army Base rather than at the factory of the contractor is to remove the inspector who has authority to finally accept or reject the completed product from any influence that might consciously, or unconsciously, affect his judgment.

It is stated, without fear of just criticism, that the difference in the standard of the shoe since the present system has been adopted has warranted the change from the old system of having final inspection at the factory of the contractor. By this method every precaution is taken, and the Government is reasonably certain that its interests are properly protected and that its soldiers will receive nothing but the very best.

RESULTS OF INSPECTION.

The policy of the Quartermaster Department in placing trained inspectors in factories of private corporations engaged in the manufacture of shoes for the United States Army has amply justified itself

during the years 1917, 1918, and 1919, and the expert inspection of materials and the supervision of construction by Government inspectors have saved many thousands of dollars to the Government by the rejection of inferior material and shoes of defective workmanship, and have, in the opinion of the writer, prevented discomfort to countless numbers of soldiers to whom but for the careful inspection given there might have been issued defective and ill-fitting shoes with rough, broken, or uneven interior surfaces.

PRACTICES LEGITIMATE AND OTHERWISE.

Although isolated instances may be quoted of unscrupulous contractors who have deliberately attempted to defraud the Government by the use of inferior material, false stamps, and bribery, these attempts have been promptly discovered and the offenders brought to justice. It must not be inferred that all manufacturers nor, indeed, any considerable number of those who assumed contracts to make Army shoes were dishonest, as such is far from being the case; yet it often happens that contracts for shoes are issued to concerns whose specialty is the manufacture of civilian shoes of the cheaper grades, and practices common and considered legitimate in a factory making this grade of shoes are, to say the least, unsatisfactory when durability of the finished Army shoe is considered.

It should be borne in mind that after a contract is awarded to a manufacturer it is usually turned over to his order department, which in turn passes the same over to the superintendent of the factory in which the shoes are to be manufactured. Either through a mistaken sense of duty to their employer or lack of knowledge of better methods, these superintendents or their assistants often attempt to employ the foregoing methods in constructing Army shoes, so that it is only through the insistent watchfulness of the inspectors that this is prevented. The shoes that are partly damaged, if proper care is taken in repairing, can be made good by replacing the damaged part with a new part. This method entails a loss of time and money to the manufacturer, and also reflects upon the efficiency of the foreman. Consequently, it is here that certain practices commonly referred to as "tricks of the trade" are brought into play. These practices will be touched on in detail further on. A competent inspector at this stage of the game saves the Government much more than the cost of his services.

UPPER LEATHER.

It often happens that a prospective contractor submits with his bid a sample of upper leather showing the grade and tannage from which he proposes to make the shoes if his bid is accepted. Upon receiving a contract it may be found that he has committed himself for a sufficient amount of leather of the tannage submitted but that it is what is known as "table run," and the sample submitted to, and approved by, the purchasing officer represents but a very small portion of the amount committed for. If this leather is rejected in the side, the contractor must go into the market and purchase suitable leather, oftentimes at an increased cost. If it is used, the percentage

of rejected pieces is so great that the loss to the manufacturer is considerable. The only place where defects of this nature can be detected is in the cutting room. Here the upper leather inspector stands firm but tactful, according the contractor fair treatment, while securing for the Government a full measure of value.

This situation has given rise to many vigorous protests on the part of contractors against what they claim to be unfair inspection. Although all complaints received from contractors of this or any other nature are promptly, carefully, and impartially investigated by Government representatives, it has rarely been found necessary to reverse the decision of the inspector.

FINDINGS.

It may be, and indeed often has been, found that contractors have been furnished by subcontractors with findings inferior in quality to those which they have purchased. Through the watchfulness of the inspector and the established practice of periodically testing samples of thread and all other findings used in Army shoes, it has been possible to maintain the quality of these findings at the specified standard.

ATTITUDE OF MANUFACTURERS.

Manufacturers who have achieved a most enviable reputation in the business world for honesty and integrity in their dealings will at first resent the presence of Government inspectors in their plants, claiming that as they possess the requisite knowledge of shoemaking no advice is needed, so that to place inspectors to watch them must be to impute an intention to evade the honest fulfillment of their contractual obligations. Superintendents and their assistants often entertain this same feeling of resentment, though for somewhat different reasons. In the course of later events, however, these same manufacturers have become appreciative of the valuable assistance rendered by the inspectors, who, because of their intimate knowledge of the requirements of the Government, are able to show the way out of the many difficulties which arise.

NECESSITY FOR MORE THAN FINAL INSPECTION.

Final inspection reveals only the general appearance of the shoe as to color, workmanship, and the approximate weight of the bottom construction, consequently if the Government were to buy shoes the quality of which appealed only to the eye, as would be the result if final inspection alone were relied upon, there would be no limit to which the contractors might go in the use of inferior leather, both in sole leather and upper leather, and also in the quality of findings, as well as in the technical workmanship in parts of the shoes which are not disclosed after the sole is laid, namely, broken rib on inner sole; torn canvas; wrinkled canvas; inner soles to which the welting has been sewed twice, thereby weakening the rib; insufficient number of stitches; lack of proper tension at the inseaming operation; liability of trimming inseam too close, thereby weaken-

ing the seam; defective and improper forepart bottom filling; insufficient amount of cement; defective inner soles, middle soles, outer soles, heels, vamps, counters, and top lifts.

UNIFORMITY OF INSPECTION STANDARDS.

It is believed that the interests of both the Government and the contractors demand that a uniform method of inspection be maintained in the several zones in order to insure equality in the bid for, and the manufacturing of, Army shoes. It can be seen that if the inspection in one zone is of a high standard while in other zones the same standard is not maintained, the contractor doing business in the zones where the lower standard prevails has a decided advantage over his competitor who manufactures in the zone where the higher standard is insisted upon. Obviously this advantage must work to the detriment of the interests of the Government in the way of an inferior grade of finished product.

The present system of inspection as now carried out in this zone is the result of research and represents the combined judgment of many capable men employed by the Government during the war. It is believed to be the best and most workable that has been devised, yet no claim of absolute perfection nor of infallibility is made for it. Suggestions for its improvement from whatever source have always been carefully considered, and all criticisms have been welcomed, except when they have come from an obviously biased source and have been of a destructive rather than of a constructive nature. Any attempt to overthrow the system of inspection as now installed by the adoption of anything less restrictive, in the opinion of the writer, would result in the acceptance of shoes of inferior quality.

Chapter IV.

INSTRUCTIONS TO INSPECTORS.

QUALIFICATIONS OF AN INSPECTOR.

The very nature of the work which the inspector is called upon to do makes it important that he possess many high qualifications. If his duties are to be performed in a manner which will insure justice to the manufacturer and safety of the Government's interests, he must be a man of more than the average degree of intelligence, possessing sound judgment, an even temperament, and more than a general knowledge of the science of shoemaking.

RETENTION OF EFFICIENT INSPECTORS.

At one time during the emergency the shoe inspection force working under the direction of the Boston Depot reached a total of 470 men gathered from the principal shoe centers of New England. Among this number were many whose knowledge of shoemaking was complete and whose years of previous experience made them familiar with most of the problems which are to be encountered in the course of the proper making of a shoe. The services of these men proved of inestimable value to the Government, and by a system of checking at this office the work of each man was carefully tabulated with reference to the results obtained, the method of obtaining them, and the absence or presence of friction between him and the factory executives. It was possible, by a simple process of elimination following the decrease in the volume of production, to retain in the Government service only men of proved ability, although many of this class preferred to return to the ranks of private employees.

CONDUCT OF INSPECTORS.

The manufacture of shoes as established to-day is conducted at the expense of tremendous nerve energy by those responsible for its successful accomplishment. In view of the fact that the interests of the contractor and those of the Government, as represented by the inspector, will at times seem to be diametrically opposed, and that occasions must arise when it would seem a complete deadlock has been reached, it is hardly to be wondered at that the patience of both parties often nears the point of exhaustion. Having these conditions in mind, this office has insisted upon the observance of the following general instructions and words of advice governing the conduct of factory inspectors:

1. At the outset you should have an appreciative understanding of the treatment you owe to, and should by right receive from, contractors in order to insure cooperation between the contractor and the Government in connection

with the method and manner of the construction of, as well as the material used in, Army shoes.

2. As you are to act as a business agent of the Government, clothed with authority which to a certain extent is arbitrary, it is expected and demanded that you conduct yourself at all times in a manner consistent with the great interests which you represent.

3. Your actions should be such as to encourage the highest opinion of the character of the inspection force.

4. As you are in a measure a public servant, your conduct and actions when outside the factory are subject to public criticism. It is therefore insisted that you refrain from any action that would tend to bring the name of the inspection force into disrepute. Card playing or gambling in public or on the premises of the contractor, the use of profane language, the use of intoxicating liquors, and the frequenting of questionable resorts are positively forbidden under penalty of dismissal from the service.

5. The degree of your success will depend in a measure upon the manner in which you exercise your authority. You should be tactful and circumspect in your intercourse with the contractor and also his employees. Be tolerant of the views and opinions of others, and always welcome an opportunity to explain your reasons for any decision you make.

6. Exercise patience, and by your zeal impress upon the contractor and his executives the importance of your duties.

7. You must keep within the contract requirements in your demands, and be reasonable, but firm and untiring, in your efforts to protect the interests of the Government.

8. If you are arbitrary and unreasonable in the use of the power that is vested in you, you may expect to receive like treatment from the contractor. On the other hand, if your conduct is such that you impress the manufacturer that in your endeavor to protect the Government's interests you are not unmindful of the duties you owe him, you will usually observe the good results arising from your endeavors reflected in a higher grade of finished product. Ever be mindful of the fact that working together produces better results, while antagonism or indifference on the part of either will result in an inferior grade of shoes.

9. You, as an agent of the Government, are only interested from a merit standpoint, while the manufacturer is not only interested in the matter of merit but in the matter of profit. You should take into consideration the fact that unless manufacturers could operate at a profit, the making of Army shoes would be an unattractive proposition, and no reliable individuals or corporations would be available to meet the needs of the Government.

10. A manufacturer is a component part of the Government, and as such has a right to demand that you, in your zeal to protect the Government's interests and to obtain a high-grade article, do not injure him in his business by unreasonable demands or personal peculiarities.

11. Be courteous—it is a valuable asset.

12. You should realize that a man who has made shoes for years and is a successful shoe manufacturer feels that he personally knows, or at least has available in the form of high-salaried executives, all the knowledge of the general and technical questions of successful shoemaking obtainable. If you, through lack of thorough knowledge of the point involved, make a demand not founded on a sound, logical basis, the fact at once becomes apparent to the manufacturer. This will result in the impression that you do not understand your work, and may produce a feeling on his part that he could easily deceive you, and might result in a desire to do so. If a question arises and you realize your inability to solve it, admit the fact and be anxious to do so, as it breeds the conclusion that you go only so far as you are absolutely sure. If the proper spirit prevails, it is not difficult to solve the usual problems you will be confronted with, as ordinarily the manufacturer or your brother worker knows the solution. Be sure, then proceed, thus insuring the Government against damage.

13. If the tanners and producers of shoe findings furnish proper material and the manufacturer and his superintendents are working to obtain results, the grade of the finished product depends upon you. If you are indifferent, unreasonable, arbitrary, or overimpressed with your own importance, the quality of the shoe will suffer.

14. What a manufacturer says about you, your work, or your knowledge is of no importance if you are obtaining results, but it is important and desirable that you obtain these results, if possible, without friction.

15. Every point in the specifications that may seem ambiguous or open to more than one interpretation has been officially interpreted by this office. Every inspector has been informed and instructed regarding these points, therefore you must never argue with a manufacturer concerning such matters. He may still insist that he is right and that the specifications are wrong. You will then respectfully inform him that the scope of your authority does not permit you to change the specifications. While this office will insist that the deserving inspector be treated with due respect and consideration, instances will occur when even abuse and vituperation may be accepted with calm dignity, having in mind the adage: "He that has no case must abuse his opponent."

16. Avoid giving the impression that you are placed in a plant in the capacity of a spy or that the honorable intentions of anyone are in question. Do not hastily conclude that every violation of the specifications is deliberate. Even with the most earnest cooperation on the part of the manufacturer and his superintendent it is difficult to always maintain a high standard of workmanship and material. While you should ever be watchful and alert for dishonesty as well as poor workmanship, you must reserve judgment until such time as proofs of chicanery are positive. Impress upon the minds of those with whom you come in contact that you consider the interests of the manufacturer and the Government identical. Inasmuch as rejected shoes are a source of much loss to the contractor, all your efforts are devoted to complete such a shoe that no subsequent inspection or test will reveal cause for rejection.

17. Never seek quarrels—trouble comes unsought. Experience has shown that the best results are obtained where there is a minimum of friction between the inspector and the factory executive. Harmony should prevail, therefore do your part to preserve it.

18. By reason of having unrestricted access to all parts of the manufacturing plant at which you may be stationed you will necessarily gain knowledge of secrets of manufacture which may and probably have been costly to acquire, and which under no circumstances should be disclosed by you to other individuals or manufacturers.

19. You must refrain while on the streets or in public places from discussing either with your fellow inspectors or others the manners and methods and the systems in vogue in the factory in which you are stationed. It is not permitted that you should make any unfounded accusations as to the motives or intentions of the contractor.

20. On the questions of strikes at the factories or management of operators you must hold a neutral position and in no wise interfere with the management.

21. You are to work in full accord with the organization in the factory under your supervision to get the best results and the greatest returns.

22. All questions that arise must be handled in a diplomatic manner with the superintendent and officials so that no loss of production or quality of goods shall result.

23. You are not permitted to make any complaints of poor workmanship direct to the workman. When, in the course of your inspection, you find a cause for complaint, you should at once report the matter to the superintendent or foreman of the department and also to the inspector in charge. If an immediate improvement is not noticed, the inspector in charge will take the matter directly to the head of the firm or his personal representative. This usually brings about the desired results.

24. The inspector in charge is held responsible for the manner in which the inspectors under him perform their duties, and should report to this office concerning their diligence, adaptability, efficiency, and their promptness in reporting for, and their absence from, duty.

The advice contained in the foregoing is the result of a careful study of the experiences of many men and many minds, and it is felt that the consistent application of the same can not but result in value to the contractor and to the inspector.

DUTIES OF INSPECTORS.

In addition to the daily reports, inspectors will make weekly reports of the number of pairs of shoes lasted on each Saturday. Full and complete reports are required, together with such special reports

as may be desirable. These reports will be used to compile production charts; therefore each factory and each article for each factory must be reported on a separate sheet. The care taken by inspectors in preparing and forwarding said reports will greatly assist this office in obtaining correct figures on which to base future inspection.

All letters addressed to this office must show on the letterhead the name of the contractor as well as the name of the city or town in which the contractor is located. This should be filled in in the space marked "place" in the upper right-hand corner of Government shoe inspector's letterhead.

You must be thoroughly familiar with every detail of the manufacture of the article which you are to supervise, as well as with the practical workings of the machinery and appliances used in the manufacture and the final finished product.

Specifications must rule on all Army shoes. Inspectors have no authority to waive a half iron in bottom stock or one-tenth of a millimeter in upper stock. Every inspector or contractor deviating from specifications in any way must be able to produce authority in writing from the Zone Supply Officer permitting such deviation.

When detailed on a contract, you are to understand that your daily period of duty at the factory must include at least eight working hours per day, and that you shall be absent during none of the important operations of the manufacture, day or night. Before going to the factory you should thoroughly familiarize yourself with the specifications and standard sample requirements in every minute detail. You must be prompt to notice any deviating therefrom, which, together with anything coming to your attention at variance with the interests of the Government must be promptly and fully reported in writing.

Your duties will take you through the entire process of manufacture, from the inspection of the raw material to the final factory inspection of the finished product.

The greatest care must be taken at all vital points of construction where workmanship is covered up when the shoe is completed. Such points as assembling, lasting, inseam trimming, welting, standard screwing, heelseat nailing, topsole nailing are considered in this class. Any time that trouble develops at any of these points every shoe should be inspected if necessary to properly protect the Government's interests.

Any shoes that come through the factory that, in your estimation, are below standard in workmanship or materials, must be held up, and you should forward samples and full particulars of the defect. You will be advised in writing as to the acceptance or rejection of the sample.

In case of shipment of materials that are delayed to or from the factory you are to inform this office in order that proper action may be taken. If for any reason whatever shoes are held up, a special report should immediately be prepared showing the numbers of pairs held up and the reason for so doing. The envelope in which these reports are inclosed should be prominently marked "Special reports." These special reports should be made whenever material is held up.

Contractors are expected to and must deliver shoes as per contract, and they can not shift their responsibility to subcontractors. Any

manufacturer having contracts with the Government is expected to use the proper material, and it is the duty of the inspector to see that such obligations are carried out.

Assure yourself that the shoes examined at the factory are up to Government standard, especially as to quality of workmanship and materials. Check up each operation against the specifications to insure fulfillment of all details.

You are to make reports to this office of any cause that is hindering the production or make any suggestions to this office that, in your opinion, will facilitate the shipment of the goods.

Sealed samples, gauges, measures, and all stamps sent to you are the property of the United States Government, and you are charged with their care and are held responsible for their return.

Every inspector employed by this depot is given an identification card and badge. Both card and badge are to be carried at all times. When in the factory inspectors will wear the badge in a prominent place, so that employees will know who the inspector is and will respect his authority.

Chapter V.

UPPER LEATHER.

SCOPE OF SUBJECT.

The first and most important question which engages the attention of the inspector is that of upper leather. The scope of the following notes will be restricted to leather intended for Army shoes, omitting data applicable to civilian work alone. An attempt has been made to furnish material that would provide an officer, charged with the successful completion of Government shoe contracts, with a clear conception of the fundamental principles governing the selection of upper leather for Army purposes. With a proper understanding of these he should have no difficulty in dealing with the problems which are inevitable, and it is hoped that the facts hereinafter set forth may prove equally valuable to the inspectors charged with the responsibility of carrying out his orders.

DRY VERSUS GREEN SALTED HIDES.

While it is not intended to deal extensively here with the detailed processes of leather manufacturing, yet, in view of the fact that Army specifications permit the use of leather tanned from dry hides as well as from green salted hides, it is thought well at first to touch briefly on their relative merits for upper leather. Hides reach the tanners in two conditions, namely, the green salted hide and the dry hide. Green salted hides are such as have been treated by the use of salt to prevent decomposition. They reach the tanner before putrefaction commences. Dry hides are those which, on being removed from the animal, are washed free from blood and dirt and then hung in the sun to dry. It often happens that hides hung in the hot sun, without a sufficient current of air, will dry too quickly. In this case they become so hard on the outside that moisture from within can not escape. This often results in the destruction of the center substance; consequently leather tanned from such hides will ordinarily be of a very poor and brittle fiber and may be of such nature that the grain and flesh can be easily separated. The first process before tanning dry hides is to soak them for at least two days in water containing caustic soda or like substance. When sufficiently soft they are removed from the vats and roughly fleshed, after which the soaking is continued, sulphide of soda or formic acid being used to hasten the softening. If often happens that during the soaking process bacterial action occurs which results in a loss of the hide substance, porous parts, and also in damage to the grain.

Green salted hides, on the other hand, are washed of blood and dirt and then tanned. A moderate amount of pure fat or oily substance may be used to advantage. Unless heat is used the leather will absorb naturally only the softer oils and fats which serve to coat the fibers, making them more pliable. The harder parts will remain on the surface to be removed by a process termed "slicking." This is said to increase the weight of the leather by about 10 per cent. In some tanneries the stuffing is hastened by placing the leather in large drums, permitting harder fats and waxes to be used, as the action of the drum forces them into the substance. This method has been known to increase the weight of the hides as high as 50 per cent instead of 10 per cent.

The wisdom of permitting the use of leather made from dry hides in the construction of Army shoes has often been questioned. Inquiries made of shoe manufacturers and men in the leather trade reveal the almost unanimous opinion that the leather produced from green salted hides is distinctly superior in quality to that made from dry hides. The wide experience gained during the war has resulted in this office taking the same position. Assuming that this opinion is well founded, and in view of the fact that the conditions in the leather market are again approaching normal, it would seem advisable that in future awards the permission to use dry hides in upper leather be withdrawn.

TANNAGE.

The question of the proper type of leather from which to make Army shoes is always open to much controversy, because of honest differences of opinion which have developed among tanners, manufacturers, and other men in the trade. In endeavoring to produce an ideal leather different methods are used, each of which may possess some one or more of the ideal qualifications. The three leathers which have been used by the Army since 1917 are bark, full chrome tanned, and chrome vegetable retanned. For Army shoes we are interested in the leather which, in an emergency, can be produced the quickest and in the largest quantities, with the certainty that it will be satisfactory in every respect. Chrome leather can be produced very quickly in large quantities. Starting at any given date chrome leather can be produced, roughly speaking, within two weeks. Bark leather would require at least three months. Chrome vegetable retanned leather, when properly made, would require at least three to three and one-half weeks. Therefore, in the event of any serious emergency, the ease and rapidity with which full chrome and chrome vegetable retanned leathers can be produced speaks volumes in favor of their adoption for Army leather for general shoe purposes. Regarding wearing quality, chrome leather, when properly made, will wear as long, and perhaps longer, than leather made by the old-fashioned bark process. Furthermore, chrome leather, because of its general nature, is less susceptible to heat, moisture, and perspiration. Bark leather, unless it is kept constantly filled with grease, will dry out hard and bony and is very apt to check and crack. The general use of mineral acids in the bleaching process in making bark leather tends to leave minute traces of acid behind, which in time may eat away the very life of the leather.

BARK LEATHER.

Bark-tanned leather was used in the manufacture of Specifications 1309 and 1324. There are many advocates of bark-tanned leather and there is no question but what it possesses many good qualities. Generally speaking, however, it is the standard leather of the past generation. The number of tanners producing bark leathers for upper purposes is decreasing year by year. This is due primarily to economic conditions: First, to produce bark leather in large quantities means a large sum of money tied up because of the length of time required for the bark-tanning process; and, second, as the timber supply of the country continues to diminish, difficulty arises in the procurement of the bark-tanning materials. For these and similar reasons bark leather is fast disappearing from the market. The good points of bark leather do not need to be discussed here.

FULL CHROME LEATHER.

Full chrome tanned leather was used in the manufacture of Specifications 1258 and 1206. The reason for the substitution of the chrome leathers is that the latter process produces a leather better fitted for general service and at the same time makes it possible to construct lighter weight shoes. Of the chrome leathers the one most generally used to-day for uppers for practically all types and descriptions of men's civilian shoes is the full-chrome tanned. Practically 90 per cent of all upper leather used to-day is chrome, and, in spite of the introduction in the last five years of chrome vegetable retanned leather, this percentage will undoubtedly grow larger. Like many new commodities, chrome leathers have been criticized more or less unfavorably. Unquestionably certain people find more comfort in wearing shoes from bark-tanned leather because of its general porosity, and would probably wear chrome-leather shoes with great discomfort. On the other hand, there are thousands of people who wear the chrome leathers without any discomfort whatever. From the very fact that such large quantities of chrome leathers are being used in the construction of shoes, ranging from the very lightest women's shoes up to the very heaviest work and sport shoes, is evidence enough that the chrome leathers are satisfactory for general use.

The first requisite of good chrome leather is that it shall be thoroughly tanned. Whether this has been done is not determined by the appearance of a fresh cut, but can be absolutely determined by taking a piece of leather and placing it in a vessel of boiling water for several minutes. If, after this test, the piece of leather, when dry, retains its original pliability and does not curl up, it can be safely assumed that the leather is thoroughly tanned. Leather which is thoroughly tanned can be finished in any manner with absolute certainty that the resulting product will be soft, pliable, and strong, and will possess all of the characteristics of good leather. Leather which is not thoroughly tanned, no matter what method is followed in finishing, will invariably be hard, bony, and stiff, lacking in strength, and generally speaking, will not be well adapted to the making of any type of shoe.

The coloring of chrome leather is a very important operation. The color should be obtained by the use of aniline dyes; that is, a good

strong base color, and then, if it is necessary, in order to produce uniformity of shade, it is a good practice to put on a light pigment topping. This topping should be of such a nature that it will not rub off easily or be too susceptible to water.

There has been much criticism against chrome leather for civilian purposes on the ground that it causes foot trouble. This trouble, it is believed, is not due to the use of chrome leather for uppers, but rather to the fact that shoes were made on lasts that were fundamentally wrong for certain types of feet and also because if improperly constructed shoes. An unlined shoe, made of fairly heavy chrome upper leather, 2 and 2½ millimeters in thickness, on the right type of last, would cause a minimum amount of foot trouble. No last and no leather exists which is adaptable to each and every foot. Foot trouble does not come from wearing shoes of bark, chrome, or chrome retanned leather, it comes from wearing improperly constructed and poorly fitted shoes.

The following comprises a statement of the upper leather requirements and special instructions for the guidance of upper leather inspectors on shoes to be made in accordance with Specifications 1258, which are typical of those calling for full chrome leather.

Instructions for Upper Leather No. 1258.

1. Tannage, full chrome side leather.
2. Color, russet.
3. Finish, full grain.
4. Weight, maximum, 1½ millimeters; minimum, 1¼ millimeters.
5. Size, not to exceed 20 square feet.

Tannage.—To be full chrome tanned and the leather must conform to the physical and chemical tests of full chrome-tanned leather.

1. The leather to be soft, pliable, of close texture, and strong fiber.

(*a*) Leather of a hard, tinny nature will not be acceptable.

(*b*) Leather that has not good tensile strength will not be acceptable.

(*c*) Leather with tender grain will not be tolerated.

2. The leather must be full chrome tanned; that is, it must be sufficiently chrome tanned so that it will stand the boiling test.

Color.—The color to be the United States Army standard, what is generally termed "russet."

1. The sides must be of uniform shade.
2. The leather must have a good strong aniline color for a base.

(*a*) Leather with a weak dye color as a base and a heavy pigment color as a topping will not be acceptable.

3. Leather from which the finish is easily removed by rubbing or water, leaving a light colored bottom will not be tolerated. This indicates that the leather has not been properly dyed and that the color was obtained by the use of pigments.

4. There are so many ways in which a good durable finish can be obtained that it is not necessary to specify any particular method.

(*a*) It is generally understood among tanners and shoe manufacturers just what constitutes properly finished leather, therefore, it is demanded that all Army upper leather shall possess all of the characteristics that go to make up first-quality leather.

Finish.—The leather to be full grain.

1. Snuffed leather will not be accepted.
2. The finish is to be attractive and of a durable nature.

(*a*) The finish should not be of such nature that it is easily rubbed off and should not be too susceptible to water.

3. The leather to be boarded.
4. Flesh side of the leather to be buffed or shaved to a smooth surface and no excessive amount of flesh will be tolerated on any parts of the side.

Weight.—The backs to be 1½ millimeters in thickness; bellies and shoulders not less than 1¼ millimeters.

Size.—The size not to exceed 20 square feet and shall not be what is generally termed "flanky" or loose-fibered leather.

Vamps.—To be cut only from those portions of the side that will yield leather of the proper weight and quality. Vamps are to be firm and of even texture. No vamps are to be under 1½ millimeters in thickness.

Toe caps.—To be cut only from leather of firm texture, free from imperfections, and of good quality.

Outside back stays.—To be cut from the same quality and weight of leather as used for vamps.

Quarters.—To be cut from those portions of the side that will yield leather of a substance and character suitable for quarters. Quarters are to be soft and pliable. Flanky, loose, or open-fibered leather will not be acceptable. Quarters cut from leather generally classified as hard, tinny, or bony will not be accepted.

Tongues.—To be cut from those portions of the side that will yield leather suitable for tongues. Tongues are to be soft, pliable, and serviceable. Leather of extremely loose or stretchy nature will not be acceptable.

Side lining.—To be cut from leather of suitable character, from 1 millimeter to 1¼ millimeters in weight.

Inside back stay.—To be of good quality leather and of proper weight, 1 millimeter minimum and 1¼ millimeters maximum. May be cut from the same leather as used in the uppers, provided same is of proper weight and quality.

Inspection.—In so far as possible the upper leather should be carefully inspected before cutting not only for the protection of the Government's interests, but also those of the shoe contractor. Before a shoe contractor starts to cut Army shoes he should have a thorough understanding of what will be acceptable in each part of the upper. Having this information before him he can procure from the tanner properly graded leather. The question of cutting figures belongs entirely to the shoe contractor. From the Government's standpoint the only things to be considered and kept constantly in mind are:

1. Leather of the highest quality and of proper substance for the component part of the shoe must be used.
2. Only leather that will give good service is to be used.
3. The leather is to be free from any blemish that will seriously impair the wearing quality of the shoe.
4. The leather is to be free from any blemish that seriously impairs the general appearance or comfort of the shoe.

The first thing to consider is whether each part of the upper is cut from the portion of the side that will yield leather of the proper substance and quality—that is, a vamp should be cut from leather that will yield good vamps—quarters are to be cut from leather that will produce quarters possessing the proper qualities. The same rule that applies to high-grade shoemaking, the right stock in the right place, should be observed.

The question of imperfections, open scratches and grubs, healed-over scratches and grubs, cuts and other blemishes, must be ruled upon along the following lines:

1. No imperfection that will impair the wearing qualities of the shoe. interfere with the wearer's comfort or give the shoe an unsightly appearance will be allowed on any part of the upper.

(*a*) Under the question of appearance you must consider not only grain damages, but also the general color of the leather. The leather must be of good even color, that which is generally termed "Russet." The parts of the shoe must be carefully matched.

Shoes constructed of variegated colors will be rejected. In order to carry out the above there should be a sufficient number of inspectors to make it possible to inspect each and every part of the upper before it is stitched. Every piece of leather going into the upper of the shoe is to be carefully inspected in a manner that will thoroughly safeguard the Government's interests and at the same

time should not be so complicated that it interferes with the production.

Each inspector is to keep an accurate record of the parts inspected; that is, the case numbers and the number of rejects. This will take the form of a daily report which must be turned in to the inspector in charge, who, in turn, will keep a record of all of the case numbers and the name or number of the inspector who has passed upon the various parts.

CHROME VEGETABLE RETANNED LEATHER.

Chrome vegetable retanned leather was used in the manufacture of shoes under Specifications 1257, 1269, 1271, 1323, 1324, 1351, 1352, and 412–2–9. It is doubtless true that vegetable tanned leather possesses many of the desirable qualifications of good upper leather. For generations this method of tanning has been approved as producing the ideal leather for all purposes. There are to-day many tanners who strongly urge its superior virtues. In view of the fact that it has for so long withstood the test of durability and of the high degree of perfection to which this method of tanning has been developed, it is not to be wondered at that there are many who advocate its use in the making of Army shoes. The fact that this was the leather popular with our forefathers, when walking, and rough roads were more common than to-day and utility was the first consideration, commends its use in Army shoes.

It can not be denied, however, that chrome-tanned leather has largely superseded vegetable-tanned leather in the manufacture of all kinds of shoes. This may be due to the great reduction of time which, of course, means a corresponding reduction in the cost of production of leather tanned by this process. Doubtless, however, much of the popularity of chrome leathers is due to the changed conditions under which civilian shoes are worn to-day, when appearance and comfort are given first consideration.

One of the reasons for the popularity of leather tanned by the chrome process is that the nature of the hide is changed so that it becomes very pliable, a feature which is not so pronounced in vegetable tanned, but, being characteristically tender on the grain, it is not so suitable for the rough wear which an Army shoe might receive. The process of chrome tanning does not affect the gelatinous part—that is, the material that fills the interstices between the fiber and which is called the hide substance—in the same way as the vegetable-tanning process. This hide substance, which is turned into tanno gelatine by the latter process, is not similarly affected by the former process, consequently the leather is not so well filled. Another feature of chrome-tanned leather is that being nonabsorbent it does not take up the moisture of the foot, and since the moisture can not escape it causes the foot to be cold, damp, or even wet, according to the constitution of the wearer. Vegetable-tanned leather, however, being porous permits the foot to breathe, and being more absorbent takes up the moisture.

It would seem that the ideal qualifications necessary in civilian shoes for present day wear are found in chrome tanned leather, but shoes of the types called for in Specifications 1257, 1269, 1271,

1324, 1352, and 412–2–9 require something more. These added requirements are found in the vegetable retanned leather. Therefore, the chrome vegetable retanned leather, possessing as it does the combined good qualities of both processes, was found to be ideal for these shoes. The leather thus produced is extremely tough, yet pliable. It possesses the water resisting qualities of the chrome tanned, yet is of such a nature that it permits the foot to breathe.

An examination of the reclaimed shoes seems to indicate the superiority of this combination tannage from the standpoint of durability, as in most instances the upper leather in shoes made from chrome vegetable retanned leather was found to be intact even though both heel and double sole were completely worn away, while in shoes of Specifications 1258, in which full chrome tanned leather was used, the vamps were found to be badly checked and often broken away, although the bottom construction had not been seriously impaired.

The following comprises a statement of the upper-leather requirements and special instructions for the guidance of upper-leather inspectors on the new garrison shoe 412–2–9, which is typical of the chrome vegetable retanned specification:

SPECIFICATIONS 412–2–9.

INSTRUCTIONS PERTAINING TO UPPER LEATHER.

Tannage.—To be chrome vegetable retanned, cowhide side leather.

1. The leather to be soft, pliable, of close texture, and strong fiber.

(*a*) Leather of a hard, tinny nature will not be acceptable.

(*b*) Leather that has not good tensile strength will not be acceptable.

(*c*) Leather with tender grain will not be tolerated.

Finish.—Light snuffing in order to remove slight grain imperfections is permitted.

1. The finish is to be attractive and of a durable nature; that is, it should not be easily rubbed off or not too susceptible to water.

Color.—The color to be russet and conform to that of the standard Garrison shoe.

1. The color is to be uniform.

2. The leather must have a good, strong, aniline color for a base.

(*a*) Leather with a weak dye color as a base and a heavy pigment color as a topping will not be acceptable.

(*b*) Leather from which the color is easily removed by water or rubbing, leaving a light colored bottom, will not be tolerated.

Weight.—The weight of sides to be 2.5 millimeters.

1. The weight of the individual parts:

	Minimum.	Maximum.
	Millimeters.	*Millimeters.*
Vamps	2.0	2.5
Quarters	1.8	2.2
Foxings	1.8	2.2
Tips	1.6	2.2
Counter pockets	1.6	2.2
Tongues	1.2	1.4
Eyelet facings	1.2	1.4

Vamps.—To be cut only from those portions of the side that will yield leather of the proper weight and quality. Vamps are to be firm, fine, and uniform in texture.

1. Vamps shall be free from any imperfections that impair the service, appearance, or comfort of the shoe.

(*a*) Vamps are to be free from grubs except in that portion which is completely covered by the tip.

2. Regarding the weight, the specifications state a minimum of 2 millimeters and a maximum of 2½. This does not imply that this variation is permissible in a single vamp—it simply indicates that it is desirable to use lighter weight leather for the small sizes and heavy weight leather for large sizes.

Tips.—To be cut from leather of the same quality as called for in vamps.

Quarters.—To be cut from those portions of the side that will yield leather of a substance and character suitable for quarters. Quarters are to be soft and pliable. Flanky, loose, or open fibered leather will not be acceptable. Quarters cut from leather generally classified as hard, tinny, or bony will not be acceptable.

1. Quarters are to be free from grubs except in that portion which is completely covered by the outside counter pocket.

Counter pockets.—To be cut from those portions of the side that will yield leather suitable for counter pockets.

1. Counter pockets are to be of good quality. Flanky, loose, or open fibered leather will not be acceptable.

Tongues.—To be cut from those portions of the side that will yield leather suitable for tongues. Tongues are to be soft, pliable, and serviceable. Leather of extremely loose or stretchy nature will not be acceptable. Tongues may be split but must be of acceptable quality.

Inspection.—The specifications for the material for uppers on the Garrison shoe dated April 15, 1919, state:

"Vamps, tops, counter pockets, tongues, tips, and eyelet facings to be cut from the best chrome, vegetable retanned cowhide side leather. Slight grain imperfections may be removed by a light snuffing of the leather. Where, in the opinion of the Government, however, it is apparent that the leather has been snuffed too deeply, it will be rejected in the side. No inferior leather shall be used, but leather for different parts need not be of the same thickness or the same quality, inasmuch as each part is subjected to different degrees of wear. Tongues may be cut from the softer and lighter parts of the sides, but no tongues can be cut from leather of weak fiber. Shoes to be made with the grain of the leather on the outside."

1. It is clearly stated that the parts of the shoe are to be cut from the best chrome, vegetable retanned leather.

(*a*) Leather of the best quality and of the proper substance to be used for each part of the shoe.

(*b*) Only leather that will give good service is to be used.

(*c*) Leather is to be free from any blemish that will seriously impair the wearing qualities or the appearance and comfort of the shoe.

2. The first thing to be considered is whether or not each part of the upper is cut from that portion of the side that will yield leather of the proper substance and quality; that is, a vamp should be cut from leather that will yield good vamps, quarters are to be cut from leather that will produce quarters possessing the proper qualities. The same rule that applies to good shoemaking, the right stock in the right place, should be observed.

3. Every piece of leather going into the upper of the shoe is to be carefully inspected in a manner that will thoroughly safeguard the Government's interests.

4. Each inspector is to keep an accurate record of the parts inspected; that is, the case numbers and the number of rejects. This will take the form of a daily report which must be turned in to the inspector in charge, who in turn will keep a record of all of the case numbers and the name or number of the inspector who has passed upon the various parts.

SIZE OF HIDES.

Having considered the relative merits of the various tannages, the next point to be touched upon is that of the size of the hides. Specifications for Army shoes calling for side leather in all instances, except the 1258 shoe, do not specify definite limits for the size of the upper-leather sides.

Specification.	Size or type of hide.	Specification.	Size or type of hide.
1271	Cowhide.	1351	Cowhide or kip.
1323	Do.	1258	20 square feet maximum.
1269	Do.	1351	25 to 45 pound cowhide.
1309	Cowhide or kip.	412-2-9	Cowhide.
1324	Do.		

Concerning the limit of 20 square feet per side, as called for by Specifications 1258, it has been demonstrated that this is too small when shoes of a rather heavy nature, like the 1269, or the new garrison shoe, are called for. In the past it has been hard to hold the tanners to the 20 square feet limit for the 1258 marching shoe. The experience of this office has been that with hides running from 25 to 45 pounds, generally called extremes, some of the most desirable leather obtained would run over 20 square feet. When cowhide leather is specified tanners, with all due justice, could work in buff hides, which run from 40 to 60 pounds, or they could even use heavy hides, 60 pounds and up, although when one gets up into the 60-pound hide class there are bound to be large sides which would be very undesirable in quality. In order that the best class of raw material shall be used it is very desirable to set a maximum limit for size. It is recommended that 24 feet shall be the limit of area for all Army shoes, specifications of which call for cowhides.

QUALITY OF UPPER LEATHER.

The importance of the general quality of the upper leather is a point which is second to none. After a shoe is made up it is practically impossible to pass any judgment regarding this, since the only defects which can then be detected are serious grain damages. The liberal use of cement in the manufacture of lined shoes to-day causes otherwise poor uppers to appear as of better quality. It has been the aim of the department to keep the vamps free from grubs, and this is practically impossible unless the individual vamp is looked over on both the flesh and grain sides. These facts ought to be perfectly plain even to the most uninitiated in shoemaking practice. Leather going into Army shoes should not only be inspected in the full side but also each individual part of the shoe should be examined with care, otherwise the specifications, instead of being a safeguard of the Government's interests become of little or no use.

For the specific purposes of shoes of the type adopted for the Army, the ideal leather should possess certain qualifications which might be named in the following order of merit: It must be tough, otherwise it will quickly tear, especially at the lace holes and in the parts of the vamp subjected to great strain. This qualification would not be so essential in the tops of quarters which are not subject to such strain, but in the vamps it is indispensable; otherwise it would be impossible to properly last the shoe. It should be pliable and able to withstand fatigue. This pliability is essential for comfort, but its importance may be modified according to the part of the upper for which a particular piece of leather is to be used. This consideration often decides its acceptance or rejection. It should be able to withstand abrasive wear. It is very likely that Army shoes

may very often come in contact with sharp stones, briers, field stubble, etc.; therefore leather otherwise desirable, being tender on the grain, is unsuitable for this purpose.

Some leathers have considerable tensile strength, yet if bent many times in the same place they give way, the fibers being too short, too rigid, and too compact to enable them to adapt themselves to the movement of the leather. Such material, however, may have qualifications which would make it desirable for other parts of the shoe, as, for example, the toe cap or counter pocket, which are not subject to this flexing.

The question of waterproof leather is governed by the climatic conditions of the section of the country in which it is anticipated the shoes are to be worn. Obviously shoes which are to be worn in the dry, arid regions of the Southwest need not be waterproof. Leather should not be air-tight or the foot will always be damp and cold, owing to the condensed moisture. This moisture sets up a chemical reaction which soon destroys the fiber of the leather. A desirable feature of shoes of russet leather is that it should be possible to clean them, and they should be capable of taking a high polish; therefore the question of paint or pigment used by many present-day leather manufacturers is important.

Few manufacturers make a line of shoes in which can be used leather of the same nature as that used in the Army shoe. It is obvious that unless all the leather of this kind which is purchased can be cut and accepted for Army purposes, a considerable financial loss will result to the contractor. For this reason, as well as for the safety of the Government's interests in this matter, the upper-leather inspector should, before actual cutting starts, examine the leather in the side, carefully considering its adaptability for Army purposes. He should note the weight, general nature of the fiber and grain, the number of grubs, wire scratches, grain damages, amount of pigment, depth of snuffing, and the amount of grease. If in his opinion the number of rejected pieces cut from this leather would be excessive, he should so inform the contractor and strongly advise against its use.

While inspecting leather in the side, it is likely that the inspector will meet with leather tanned from hides having a wide range of quality. It is difficult to find any one hide that will possess all the desirable qualities.

A hide is said to be well grown when those parts which are considered as offal, that is, bellies and flanks, are of a substance and quality approaching that of the bend portion. The percentage of good material cut from these hides is high. A hide in which, for any reason, the percentage of poor material in these parts exceeds the normal is said to be badly grown, and much of it will necessarily be rejected.

The bellies and flanks should not be too loose, as in a measure this would indicate a badly grown, poorly nourished hide. Such leather should show a large percentage of rejects.

Oftentimes cowhides and kips are badly scarred by wire scratches and other grain damages. In attempting to remove these blemishes the surface is often buffed too deeply, thus making the grain tender. There should also be an absence of harshness.

A square hide should show a better percentage of acceptable cut parts, as being wide across the back it offers a greater area of the

higher grade material. The long, narrow hides will offer more of the poorer parts, such as the neck, the belly, and the flank. Also it is usually found that these parts are much poorer in quality than in the corresponding parts in the square hide.

INSPECTION OF INDIVIDUAL PARTS.

It is of great advantage to the cutter when the hide is split to a uniform weight, as it results in a better matched shoe.

After having inspected the upper leather in the side, and having satisfactorily conferred with the superintendent as to the advisability of cutting it, the cutting-room inspector should carefully examine each individual part cut from this leather. In doing this the strain which each part will have to bear during the course of manufacture and in the wear thereof should be considered. The principal strain during the process of manufacture will be in the lasting. The particular strain which affects the upper most in this operation is the heel to toe tension set up by the pulling-over machine. For instance, if a shoe is being lasted and one of the quarters stretches in the direction of this strain while the other does not the seams will be crooked. Also on the garrison shoe the ears will be crooked. If both quarters on one shoe stretch and those of the other do not, then one shoe will come further forward on the last than the other, with the result that the cap on that shoe will be shorter. If the vamp is cut with the stretch in the direction of heel to toe, it will be difficult to pull them over properly, as the vamp will increase so much in length that the shoes will not mate. If the vamp is cut with the diagonal stretch, it would be impossible to keep the seams straight. In a word, therefore, vamps should be cut tight. If the tip is cut with the stretch lengthwise, it will be difficult to get the proper tension at the pulling over; also the bed laster will have difficulty in lasting the toe.

On the russet marching shoe the vampers will also have difficulty in stitching an upper on which either the quarter or vamp stretch from heel to toe. The strain to which the different parts are subject in wear must be considered. For example, in a quarter, that part which is supported by the counter and counter pocket is subject to the least wear, therefore the poorest parts should be placed there and the best quality should be at the forepart of the quarters, otherwise the vamp, being cut from prime material might by contrast make the quarter look poor. Vamps should always be cut of the strongest material since the constant flexing of the foot at the joint is a severe strain on the leather. It is also often subject to considerable abrasive friction at the joints. Its edge, where it meets the welt, should be able to resist the wear. The tip and vamp should be similar in quality. If a vamp is cut so that all its parts are not uniform, then the poorest part should be under the tip or on the extreme end of the inside wing. A small defect may with safety be accepted under the tip. The caps should be of stout material, but as they do not receive as much strain as the vamp they need not be as heavy.

Upper leather should be resorted from tannery sorting, the lighter weights to be used for the small sizes, the extreme heavy weights in the large sizes, and the intermediate weights in the intermediate

sizes. Vamps, quarters, and counter pockets should be cut to pairs as far as possible. They should be cut from the firm part of the hide and should be of uniform color and match marked, leaving only the gussets to be taken from the heads, bellies, and flanks. Gussets should be cut with an absence of stretch from top to bottom, so that in service they will not be pulled out of shape.

It was brought to the attention of this office that certain tanners contemplated the selling of special tongue stock to shoe contractors for the garrison shoe. This should be absolutely prohibited. If full sides or partially cropped sides are used, as will generally be used for the garrison shoe, there is no need whatsoever of any special stock being used for this purpose. If permission is given to use such leather the practice would become general, and it is impossible to conceive of the poor leather which might find its way into the shoe. Strict measures, therefore, should be taken to keep this type of leather from getting into the hands of the shoe contractors.

In order to make the position of this office clear regarding the use of light leather, which should only be used for tongues in the construction of the garrison shoe, the following ruling has been made:

No sides shall be cut in connection with the garrison shoe which, because of weight and quality, are suitable only for tongues, neither shall any sides be cut that will not yield some minimum weight vamps of the proper quality or quarters of a minimum weight of 2 millimeters.

Chapter VI.

SOLE LEATHER.

There is no type of leather, the quality of which must be determined quickly and accurately, that presents any more difficulties than sole leather. The question of whether the use of dry hides should be permitted in the soles of Army shoes has been the subject of much comment pro and con by shoe manufacturers, tanners, and Government officials.

DRY VERSUS GREEN HIDES.

Prior to 1917 green salted hides alone were provided for, but the use of dry hides was allowed during the emergency, due, in the opinion of the writer, to the scarcity of green salted hides. The question of whether dry or green salted hides produce the better leather has been decided, and the question was not decided along the lines of fancy or opinion, but by results obtained from actual experience.

When a tanner goes into the market to buy hides on the assumption that he is going to produce a leather of general high quality, he considers nothing but a first-class green salted hide. When a tanner goes into the market to buy dry hides, he knows quite well that the leather they will produce will be greatly inferior to that which green salted hides would produce, and that the price he will receive for the finished product will be less than that he would receive if he had used green salted hides. It is granted that a good dry hide when properly handled will give leather that will compare quite favorably with that produced from the average green salted hide, but after comparing the leather generally obtained from dry hides with that obtained from green salted hides the results from a point of quality seem to be largely in favor of the product obtained from the use of the green salted hide. In other words, in the use of leather made from green salted hides one naturally expects to meet stock of a general high quality, while in the use of leather made from dry hides one invariably finds leather of a generally lower average.

The question as to why green salted hides produce better leather than that obtained from dry hides may be answered thus: Dry hides, as a general rule, come from cattle raised in hot countries. When a hide is taken off, in order to make sure of its preservation, it should be thoroughly salted. In this manner decomposition is prevented and the hide maintains more easily its general strength of fiber and pliability. Hides properly salted and handled can be kept in safety for a considerable time in the green state. In the countries in which dry hides are produced this fact is generally

overlooked, and the hides when they are taken off, instead of being properly salted, are not salted at all, but are simply dried out. If a hide is dried out soon after its removal from the animal there is not a great deal of danger from decomposition, but decomposition of hide substance is so rapid that oftentimes the hide has rotted in spots before it is dry. When the hide is dry these rotted spots can not be detected, and hides which to all appearances seem in good condition oftentimes turn out to be useless for any purpose. The usual method of drying these skins is to suspend them in the sun from stakes by the head and tail. It often happens that in the hot sun they dry so quickly on the outside as to become casehardened. In this condition the surface drys and hardens before the interior substance is dry and the moisture, being unable to escape through the hardened surface, rots the interior substance. As the result of this, in the finished product it is oftentimes an easy matter to separate the grain and the flesh.

It can be seen at a glance that in the use of dry hides one is taking chances. In addition to these rotted spots, which either cause large holes in the hide or patches where the grain is damaged, there is also the question of sores and various insect bites which are detrimental to the quality of the leather. When dry hides are used, before they can be tanned, they must be thoroughly soaked in order to make them soft enough. This can be accomplished only by a prolonged soaking and by mechanical manipulation, such as wheeling, which is always accompanied by a considerable loss of valuable hide substance. This is one of the main reasons why leather from dry hides always feels more empty and harsh than that obtained from green salted hides.

In the conclusion that green salted hides only should be used for Army sole leather, the following reasons are the most important:

(*a*) The general average quality of leather made from green salted hides is much higher than that obtained from dry hides.

1. There are more imperfections in dry hides, such as various insect bites, sores, damaged grain, rotted places, and slaughter cuts caused by careless stripping of the hide.

(*b*) Leather from dry hides never commands top market prices.

1. Whether the leather made from them is for upper or sole leather it always goes into the cheaper grades.

(*c*) In the use of sole leather made from green salted hides the fact is established at the very outset that the best and most uniform raw material has been used in its manufacture.

1. It has been proved by experience that soles cut from leather tanned from high-grade green salted leather have given the least trouble in regard to inspection.

2. The proper place to remedy difficulties is to go back to the raw material from which the leather is made.

(*d*) The use of sole leather made from green salted hides will lessen the cost of inspection and also increase the efficiency.

1. There will be fewer rejects and the danger of inferior stock being used will be greatly reduced.

It is to be admitted that to draw a line of distinction between individual soles, i. e., to tell whether one sole was cut from green salted stock and another from dry, is a rather delicate proposition. The problem is to be considered only in a large way. Anything that will tend to raise the general standard of the Army shoe and at the same time lessen the expense and increase the general efficiency of inspection is worthy of consideration. When the best raw materials

are demanded and insisted upon there leaves very little room for misunderstanding regarding general quality. In view of this it is believed advisable, in writing specifications for any type of Army shoes, that it should be clearly stated that all leather, whether intended for the uppers or the soles of the shoes, shall be tanned only from green salted hides of the highest quality.

THE VALUE OF A HIDE.

The value of a hide is sometimes greatly affected by careless or unskillful handling of the butcher's knife in skinning the animal. Cuts made in this manner are sometimes so numerous that the value of the hide is often reduced one-half. This condition is found to exist more frequently in country hides. Grub holes often lessen the value of a hide. The results of this may be seen in the finished hide in the form of a hole of varied size or in a healed-over scar, either of which makes that portion of the hide in which they are found practically worthless.

The cattle tick causes the most serious damage to the surface and inner substance of the hide since it injures the fiber beyond any possibility of filling with tanning material. The tick is most prevalent in warm climates, and one finds the hides decreasing in quality in direct proportion to the distance from the equator. Of the domestic hides Texas ones show the most tick bites, but through Government supervision the tick is being practically eradicated from all our Southern States.

The substance of the hide varies with the breed, the age, and the sex of the animal, bull hides and buffalo hides, for instance, being coarse and heavy. Also as the animal grows older the hide grows coarser. Bull hides are usually heavy both in the shoulders and the belly and relatively lighter in the butt. Cow hides are thin in the shoulder and belly but stouter in the butt, while steer hides present the most uniform substance and fiber.

TANNAGE OF HIDES.

It is important that sole leather be thoroughly tanned. Hides vary in thickness, some parts being heavy, other parts being thin. They also vary in texture, some being tight and offering resistance to penetration. The hides should remain in the pits until even the heaviest and tightest parts are thoroughly tanned. Some tanners do not always wait for this. During the past emergency it was not uncommon to find slack tanned sole leather. As it was impossible to accept leather of this description the discovery of it at factories making Army shoes caused a serious delay at a time when production was of very great importance.

Leather not thoroughly tanned may be easily detected by examining a section of the sole. The untanned portion will be uncolored by the tanning liquid. Should there be any uncertainty, cut a thin section, put it in water and hold to the light. The untanned portion being really rawhide will be transparent, while the tanned part will be opaque.

Leather that is sold by weight is often adulterated to increase its weight. Filling the body of the leather with some foreign matter, which serves no useful purpose except to increase the weight, is

a practice which has become very common and apparently tanners do not deny it. Glucose is one of the substances commonly used for this purpose. This may be found in small quantities in most of the present day tanning material. Where it was certain that no glucose was purposely added by the tanner, the testing of many samples showed the presence of a little over 1 per cent, while tests of other samples showed the presence of over 16 per cent. (Above figures taken from report of Department of Commerce, Technologic Papers of the Bureau of Standards No. 138.) The objections made by those who disapprove of the use of glucose are, first, the leather has a fictitious weight, and second, that it is easily soluble in water and readily absorbs moisture; therefore, it is not so suitable for footwear as it becomes saturated in less time and takes longer to dry than it otherwise would.

Epsom salts is another substance used for this purpose by some tanners. It is usually drummed in at the same time as glucose. The disadvantages of its use are that the manufacturer buys as leather that which is not leather. The salt, being readily soluble, quickly dissolves leaving the leather porous and much poorer in quality than it appeared when accepted by the inspector. Exhaustive tests are at present being made by the Bureau of Standards at Washington to determine the relative wearing qualities of sole leather treated by this method and that which is untreated.

Where Epsom salts is used it sometimes makes its presence known by the appearance of a bloom on the surface of the leather. This is caused by spew which comes from the body of the leather. In the case of Epsom salts this occurs when the leather is allowed to become damp. When dried, the salts will remain on the surface in the form of white crystals.

OAK-TANNED LEATHER.

Since the specifications call for soles of oak, hemlock, or union tannage, it is thought well to touch briefly on the different qualities of these tannages.

The best oak extract is obtained from the bark of the English oak. The quality of this extract varies with the age of the tree, also with the location of its growth. When oak bark alone is used the color is a light fawn. It is the most flexible sole leather and does not become hard through repeated wetting. The time taken to tan by this process is so long that the price is usually higher than that of other tannages. It is considered an ideal leather, although, owing to its tendency to soften when subjected to dampness, it wears away more quickly when worn in rough, damp places. To offset this fault, valonia, an extract made from certain parts of the acorn cup, is sometimes used in conjunction with oak bark. This makes a more tense and rigid leather. Such leather when wet does not soften as does leather tanned from oak bark alone; therefore it will wear longer in rough, damp places.

HEMLOCK-TANNED LEATHER.

For tanning hemlock leather the extract from the bark of the hemlock fir is used. Also the wood itself yields a tanning agent. Hemlock bark and wood contain so much resin that the extract can not

be dissolved without heat. In the process of tanning some of this resin is deposited in the leather and, without doubt, tends to make it brittle but waterproof. Leather that is tanned with hemlock bark will resist water and should wear well in damp places, but the rigid nature of its fiber makes it less suitable for welt work, as the fine stitches often break it. It is not suitable for insoles, as it does not readily lend itself to the channel-cutting process, and it is not considered adaptable for middle or outer soles, and should not be accepted for said purposes, but it can be safely accepted for top lifts and prick lifts and is preferred over other tannages for this use because of its firmness.

It was formerly possible to tell hemlock tanned leather by the color but as much of the extract is now bleached, or if this is not done the leather itself is bleached, the color is lighter than formerly, thereby making it almost impossible to determine the tannage by its color.

UNION LEATHER.

Union leather is tanned with an extract commercially known as Chestnut Oak, which is obtained from the chestnut or rock oak, used in conjunction with hemlock or quebracho. The leather thus produced ranges in color from dark brown to pink. The oak lightens the dark red of the hemlock. This leather being softer than hemlock is more mellow and is suitable for use on welt work.

QUALITY OF SOLES.

Sole leather may be firm or soft according to the nature of the hides from which it is tanned, the degree or nature of the tanning materials used, or the degree of rolling.

The ultimate value of a sole depends upon its water-resisting qualities, which are controlled by the degree and character of the tannage. Slack tanned leather will absorb water very readily, while heavily tanned leather will be very resistant.

The wearing quality of sole leather is dependent upon the type of hide, the degree of tannage, and its water-resisting powers.

Hides vary greatly according to the time of the year the cattle are slaughtered. The hides taken off in the fall are the best, spring hides generally poorest. It is evident that the texture of the spring hide is not quite as firm as that of fall hides, and there may be some slight difference in the appearance of the fibers which might raise the question of general quality.

The degree of tannage can be determined accurately by chemical analysis. The best way to arrive at a set of constants would be to take a side of average sole leather of good tannage and cut from it a strip 3 inches wide, extending from the extreme point of the butt to the extreme point of the head, and another strip at right angles to this, extending from the extreme point of the belly to the backbone. Subdivide these strips into pieces 3 inches square and number consecutively from butt to head and from back to belly. The 3-inch square pieces may be divided into equal pieces $1\frac{1}{2}$ by 3 inches, one piece to be used for the water-resisting test and the other for the chemical analysis.

The water-resisting powers of sole leather may be determined by weighing a piece of leather and placing it in water at 60° F. and reweighing at the end of 15 minutes, replacing in water, and weighing at the end of every 15 minutes until complete absorption has taken place. Thus the rate at which absorption takes place can be determined as also the account of absorption.

The specific gravity of sole leather may be determined in two ways, first, by taking a piece of leather and determining its volume by measurement, and from its weight calculating its specific gravity; and second, by the immersion method, i. e., by weighing the piece of leather suspended in water and thereby obtaining its volume by displacement.

From the water absorption figure a curve can be plotted from the time and absorption figures. Properly tanned sole leather will give a curve which will be gradual and approximate a straight line.

Excessively rolled stock will be water resisting at first, but after a certain point is reached the absorption will become extremely rapid.

Undertanned stock will absorb water rapidly and will give a very low absorption value.

Having the above information regarding one particular tannage, other tannages of standard type may be examined by taking 3-inch square pieces from the vital parts of the bend and comparing the same with the standard side.

With a series of standards to go by, various tannages could be studied and their adaptability for sole leather for Army shoes definitely determined.

These tests are of such a nature that they can be readily made, and the information gathered from them is valuable in that it furnishes a solid basis for comparison. Having a set of standards as outlined above, from an inspection standpoint the element of unjust personal ideas would be replaced by tests that would in a measure get down to the fundamental value of the leather.

The selection of the side upon which the first tests are to be made must be done in the following manner: Select a particular tannage of one particular sole-leather producer which is generally acknowledged to be the highest grade upon the market. The results obtained from this tannage will be considered as standard, say 100 per cent, and subsequent tests to be recorded on other tannages as plus or minus percentages above or below the standard. After a sufficient number of tests of this nature are made, definite limits can be established, i. e., the specific gravity and the rate and amount of absorption for a certain length of time to lie between certain fixed limits.

ROLLING.

Certain tannages are soft and mellow, while others, like hemlock, are firm and hard. The amount of tanning materials the leather contains determines, in a large measure, its degree of solidity. A soft, loose piece of leather subjected to a thorough rolling process becomes harder and harder the more its fibers are compressed, but the hardness obtained entirely by the rolling process does not increase the actual wearing qualities or resistance to water.

One of the important problems that confronted the inspector during the war was that of rolling sole leather. The question was raised why a manufacturer should wish to roll leather which had already been rolled by the tanner. The reason may be understood by first considering why the tanner rolls leather. It is because it improves its appearance and makes it more salable. If leather were only dried after coming from the tan pits, without being either set out or rolled, it would have a crumpled appearance and not be very solid. The setting out makes it smooth on the surface, and the rolling makes it appear to be firmer and better filled.

The amount of rolling done by the tanner is usualy regulated by the requirements of his customers, it being understood that the manufacturer can further compress it if he so desires. Furthermore, a manufacturer who makes a variety of civilian shoes prefers to roll the cut parts to the degree of solidity that will best adapt them to the various uses to which they are to be put.

It has been shown that leather can be injured with great ease when wet. This being so, it is agreed that anything that can be done with the leather which will delay its saturation must add to its wearing power, and hence to its value. Before leather can become saturated, the water must percolate between the fibers. These spaces contain a quantity of hide substance as well as other gummy matter deposited by the tanning agent. In proportion to the completeness with which the spaces are filled the percolation of the water will be made more difficult.

When a hide is removed from the vats, this interfiber substance is saturated. When it dries it shrinks and leaves a corresponding space unfilled. It is argued that, through compression, the shape of these spaces is changed by contracting them to meet the hardened Tanno gelatine, thus making a firmer and better filled leather. The danger of this practice lies in rolling the leather too wet, rolling the leather too dry, and the use of too much pressure.

Leather should never be rolled when soggy, as when this is done a portion of the tanning agent, which is then in solution, will be squeezed out, thus undoing some of the work of the tanner.

The interfiber substance when tanned is very hard and is insoluble in water, therefore to roll leather when dry would simply be to crush the fiber, which is also dry, and grind it to dust against the hard hide substance.

Leather should not be rolled too hard, as obviously when the fibers are compressed sufficiently to fill the space left by the shrinkage of the hide substance, any further pressure will have the effect of bruising and straining the fiber and robbing it of its nature. Thus, if leather is rolled at all by the shoe manufacturer it should only be done when it is mellowed or, as it is sometimes called, "mulled." This means that not only has water percolated between the fibers but it has been absorbed by them sufficiently to render them soft and pliable. However, it should not be necessary for the manufacturer to roll leather. If the tanner has prepared it for Army shoe purposes and used a large proportion of the more filling tanning extracts, it should already be so rigid and well filled that any further compression would reduce rather than increase its value.

INSPECTION BEFORE AND AFTER ROLLING.

During the war occasions arose when it was deemed advisable to permit the rolling of soles. In view of this fact it is not inconceivable that similar occasions might arise in the future. Should such be the case, a ruling should be made that the soles must be inspected before as well as after rolling, for the reason that soles that would not be accepted before rolling might be so altered in appearance after being rolled, as to create a doubt in the mind of the inspector relative to their acceptability. They should be inspected after rolling to insure that the fibers have not been injured and that they still measure up to the specified iron.

DESIRABLE CHARACTERISTICS IN SOLES.

Sole leather inspectors should seek flexibility in soles. It has been ascertained that the foot of the average walker will be flexed two thousand times in walking a mile, therefore a sole will be bent and straightened an equal number of times. Leather must be flexible to stand this strain otherwise it is liable to break where the bending takes place. This is not uncommon in leather tanned with pure hemlock. It may also occur in oak tanned leather where too great a proportion of Velonia has been used. The amount of nature left in the fiber is also important. This may be tested by cutting a thin section of the leather and rolling between the finger and thumb. If the nature is gone from the fiber it will crumble to dust, but if it still retains its nature only the filling will be rubbed out. A good test is to note how fine a stitch can be taken on the Goodyear stitching machine and how much strain this finely stitched leather will stand. When attaching the soles of welt shoes many stitches are taken to the inch, and if the fiber is robbed of its nature the sole will break away in wear along the row of stitches. When the fiber of the leather has lost its nature the leather quickly grinds away in wear, whereas leather that has a lot of nature left in the fiber wears longer as it does not break away. This lack of nature is caused by the tanning agent contracting the fiber too forcibly. Hemlock has this tendency. It is especially true with acid-tanned leather.

The fineness of the fiber is another test of the quality. To illustrate: If two pieces of leather, one having a fine fiber and another having a coarse fiber, are held against a revolving, grinding stone or other abrasive surface it will be found that the long-fibered piece wears away much more quickly than that having the fine fiber. This is explained by the fact that the cutting of one of the coarse fibers destroys a much greater proportion of leather substance than does the cutting of a fine one. Therefore, in selecting sole leather, fineness of fiber is an important index of quality. A simple method of estimating the length of the fiber is to bend the sole in the direction of the grain. If the fibers are short, the surface will hardly be disturbed. If the fibers are long, the grain pipes or forms in ridges, the piping increasing in size in proportion to the length of the fiber.

It is important that the leather be nonabsorbent as, in addition to the liability that the wearer may have damp feet, leather is much easier to bruise when wet than when dry; therefore it is more quickly cut by rough stones and gravel when wet, thus reducing the wearing

quality. Here again the desirability of having an apparatus for determining the water-resisting powers of leather makes itself manifest.

MULLING.

As the term "mull" will be more or less frequently used in dealing with the process of construction, a brief explanation of what it means may be of some value. It has already been explained that the spaces between the fibers are more or less completely filled with a material termed "Tanno" gelatine or hide substance. When leather is immersed, the water quickly percolates the spaces and surrounds the fiber, but leather is not mulled until the fibers have absorbed enough of this water to render them soft and pliable. For an illustration: A vial is filled with grains of rice, representing the fiber. If water is now poured into the vial the water quickly filters between the grains, but some time must elapse before the grains themselves absorb this water and become soft. This is also true of the fibers of leather.

The approved method of mulling is to permit the leather to soak until it has taken in all the water it will. This will usually be when air bubbles cease to rise to the surface. The leather should then be removed from the tank, put in a damp place, and covered with damp burlap for from 12 to 24 hours before using.

UNITS CONSIDERED UNDER SOLE LEATHER.

Under the classification of sole leather are placed all those parts which are used in the construction of the bottom of the shoe, namely, the outer sole, middle sole, inner sole, top lift, prick lift, heel lift, counter, and bottom filler.

OUTER SOLE.

In examining outer soles presented for inspection the inspector should ever have in mind the usage which this part of the bottom must undergo in the course of manufacture and wear. Leather for this particular unit should possess flexibility. It should be able to withstand the constant bending to which it is subjected in wear. It should possess a tough, closely knitted fiber to insure maximum resistance to the grinding, abrasive wear of rough, graveled roads. It should be well filled to insure the greatest possible resistance to water penetration. The specifications plainly state the weight of the outer sole. The item permits of no question or deviation. The outer sole must be cut from the best part of the hide, i. e., the bend. The bend should not be longer than 52 inches, nor wider than 28 inches. The grain should be fine and free from any imperfections which might injure the wearing quality. Such imperfections include open grub holes, brands, or deep open grain scars. Soles having soft spots or slaughter cuts must not be accepted. The specifications, however, permit the use of soles having heeled-over grubs and wire scratches. It is particularly emphasized in the specifications that the outer soles must be of the best quality, and when a manufacturer accepts a contract for making Army shoes that is what he agrees to furnish. The inspector must accept nothing less.

MIDDLE SOLES.

Specifications state that middle soles shall be cut from full-grain oak or union tanned leather backs of the best quality. They should be fine and firm, free from brands, cuts, or holes. This office interprets the specifications for middle soles to mean that in every respect, with the exception of weight, they should be of the same fiber and quality as the outer sole.

INSOLE.

The most important purpose of the insole is to act as a base to which the upper and the bottom are attached, hence the character of the material must be carefully examined. It has been said that the insole is the foundation of the shoe. The outsole may be of the very best material, but what advantage is this if the insole is deficient? When the outsole is worn through it can, with more or less ease, be repaired, but a faulty insole renders the shoe useless, even while the outsole is in good condition; yet it can not be repaired unless the shoe is remade. Therefore, in selecting insoles, great care should be exercised to insure efficiency.

A prime requisite for a Goodyear insole is flexibility. The belly, therefore, and parts of the shoulder of special tannages, are most suitable for this class of insole. Goodyear insoles should preferably be from oak tanned leather. The fiber must not be too fine or it will break away at the inseaming operation. The fiber must not be too long or the seam will pull out of shape. The material must not be too soft or a grinning seam will result. One of the requirements of an insole is that it be of sufficient substance so that after being channeled the required depth there will be sufficient material left to hold down the heavy upper to the outline of the last. Insoles presented for inspection should be carefully examined for the following qualifications: Flexibility, ability to hold the stitching with a strong tension, ability to withstand great stress, i. e., the tendency to break away with constant bending, and ability to withstand dampness. An examination of many reclaimed Army shoes shows a pronounced tendency of the insole to crack on the grain side. This is due to the alternate wetting and drying from the moisture of the foot. Experience with civilian shoes shows that this tendency is less pronounced in shoes having the grain lightly removed by buffing, and it would seem that a corresponding result should be obtained in Army shoes by the adoption of a similar method.

The center of the belly—that is, the part between the two shanks—contains the best leather for insoles. It is more even in substance, less liable to stretch, has most strength in its fiber, and is most mellow. When inspecting insoles cut from shoulders care should be taken that the fiber is of suitable length for the purpose, as soles cut too near the backbone are apt to be too short fibered. The slightest tendency to crack on the grain should be sufficient cause for rejection.

This office interprets the specifications to mean that the minimum iron on bottom stock relates to the piece of stock after it has been through what ever operations are necessary to prepare it for use in bottoming the shoe, i. e., if the operation be splitting, fleshing, or leveling, this is to be done before the selection is put before the

inspector, and the minimum iron in specifications will regulate the acceptance of stock after fitting.

TOP LIFTS.

Top lifts shall be cut from leather of the same quality as the outsole and from the bend portion of the hide. It must be firm and of fine grain, free from any defect that will lessen the wear. In view of the fact that the top lifts are not subject to flexing in wear, it is permitted to accept top lifts of hemlock tannage, as in some respects this tannage is the one best adapted for this purpose. Top lifts that have been put through the condensing or compressing process must not be accepted.

PRICK LIFTS.

Prick lifts shall in all respects conform to the requirements of the top lifts, except that the maximum weight need not be so great.

HEEL LIFTING.

It is expected and required that the heel lifting be of good substantial leather suitable for the purpose. Obviously, the same texture and fiber need not be expected in the heel lifts that is required in an outsole or middle sole, yet they should be of a firm substance and free from holes or cuts. Heels should never be built with the front higher than the back, therefore, if good results are to be obtained, the front of the lift must not be heavier than the back. As both sides of the heel must be alike in height, lifts should not be accepted with one side heavier than the other. Lifts should be clean of flesh, otherwise it will be impossible to obtain a good finish.

GOUGE LIFTS.

Former specifications for Army shoes required the use of a rand at the bottom of the heel so that it might conform more readily to the convex surface of the heel seat. During the process of manufacture and wear of the shoe, this rand was found to show a strong tendency to break out, and was therefore discarded in favor of the gouged bottom lift. This lift, to be satisfactory, must be properly gouged so that when the heel is compressed the under surface will present an appearance and shape similar to the heel upon which the rand has been used. It must be sufficiently gouged or in the compressing there will be an excessive pressure in the middle of the heel while the edges will not receive enough to make them solid, and the finished heel may check.

WELTING.

It is important that the proper substance be used in welting. Shoulder welting of proper fiber and flexibility is found most suitable for Army shoes. The welting must be full grain and cut from leather tanned for this purpose. No buffalo leather will be accepted. The inspector should see that the welting is not too hard or bony, as this kind of material makes good inseaming almost impossible. It should not be too soft or spongy, as it will take up and stretch in the inseaming operation. The inspector should guard against an

excess of short laps. It has been found that in a roll of welting there may occur a number of splices of inferior welting, and in such cases the entire roll or hank should be rejected. The proper groove and bevel are important.

COUNTERS.

Counters must be of good quality sole leather, made flat, and must conform to the standard pattern furnished. The inspector must examine the counter for flesh cuts and soft spots. Extremely hard, bony shin counters should not be accepted, as it is difficult to make such counters properly conform to the shape of the last. The principal use of the counter is to brace the heel section of the shoe, as without it the upper will be crowded down over the heel. It also serves to center the foot over the heel when walking. Therefore, a counter must be sufficiently rigid to perform these functions. The skiving of the counter is important. Unless the edges are skived to a proper weight at the bottom it will be impossible for the laster to secure a good heel seat; if the ends are too thick the butts of the welts will bulge; if the top edge is too blunt the counter will present an unsightly appearance on the outside and will very likely injure the foot of the wearer at this point.

BOTTOM FILLERS.

Bottom fillers are for the purpose of filling the cavity existing between the ribs of the channeled insole. The value and necessity of this filler is evident. It facilitates the making of an even bottom both inside and out. It serves to prevent the foot pressure from forcing the insole down and forming ridges and hollows. It also helps to make the shoe more damp-proof.

The use of Besto or Arabol, preparations of ground cork and cement, have superseded that of the solid filler in civilian shoes and may be considered satisfactory for that purpose, but after experimenting with both kinds it was decided that the solid filler best answers the purpose for the Army shoe.

It is required by the specifications that fillers be of sole leather and must be 4 iron in thickness. It is not necessary that leather for fillers be of the same nature or fiber as are those parts which are subject to abrasive wear.

The inspector should see that fillers are of proper weight, free from holes, and sufficiently rigid to prevent creeping.

The bottom filling as at present used in the Army shoes comes in two parts, i. e., the forepart filler and the shank filler. These should join at the waist. The forepart filler is skived with a scarf at the breast, while the shank filler is correspondingly skived in order that the two might lap and leave an even joint. While every precaution is taken by the inspector to insure the proper lap at this joint, it is sometimes found in the finished shoe that they are lapped in such fashion as to leave a depression at this joint, or they may overlap to such an extent as to leave a bunch. Either of these faults is serious. To overcome this, it is recommended that a one-piece filler be used that will completely fill the space between the channels extending from the extreme end of the toe to that part of the upper on the heel seat which is broken over in the lasting.

Chapter VII.

FINDINGS.

THREAD.

In the making of Army shoes three kinds of thread are used—cotton, linen, and silk. There is considerable difference in the fiber from which these various threads are made. The fiber from which linen thread is made is obtained from the stalk or stem of the plant. Cotton fiber differs from flax in that it is obtained from the fruit of the plant. Cotton fiber is quite free from any joint or unevenness, there being only one cell in its entire length, hence it is smoother than flax; and, on account of its fineness, it can be spun into much finer yarn.

The method of obtaining flax fiber is by "retting." This process consists of exposing the plant to the elements until the woody tissues surrounding the fibers are decomposed. Care must be used that over retting does not occur, as in that case the fiber will become brittle and weak. Flax fiber also suffers deterioration in the bleaching process, therefore the whiter it is bleached the weaker it usually is.

Cotton withstands the damp better than flax. From experiments made it would appear that alternate moistening and drying on hot cylinders has little or no ill effect on the cotton fibers. It also has been concluded that the tensile strength of cotton is not injured by the bleaching process.

Linen is the thread most commonly used for bottoming purposes, although in the cheaper grades cotton is used. Of late cotton is being used more extensively for upper stitching purposes, even in the better grades of shoes. Those who favor the use of cotton for upper stitching claim that it possesses all the characteristics required in a shoe such as that made under Specifications 1258. These qualifications are tensile strength, ability to withstand dampness, and nonelasticity of the thread. As regards the tensile strength, it is claimed that a good grade of cotton with the proper twist is equal to the same size linen thread. The twist has an important bearing on the strength. If two finished cotton threads of uniform size are twisted, both of No. 40, one having three cords and the other made up of six cords, the one having six cords would be found to be the stronger. This is due to the more intricate twist. Regarding ability to withstand dampness, cotton is superior to linen.

Silk is also considerably affected by the bleaching process, actual tests showing that although the strength of a certain size yellow silk is 7½ pounds, the same size white is 6 pounds, while a black is only 5 pounds.

Compared with silk, cotton is less elastic, hence a tight seam may be secured with less tension than with silk. This tightness of the seam is important, and if there is any free play between the parts, cotton will stand much better than would silk, as it is well known that the latter has a tendency to cut off. The stitching operator favors the use of cotton because it possesses a uniform thickness, smoothness, and softness; also there is an absence of any tendency to curl. For this reason it is possible to use a needle with a smaller eye as there will be less friction caused by the passage of the thread, and a good cotton can not be much affected with the slight friction which does take place.

One of the undoubted points of superiority of silk over any other thread is the appearance of the stitch. To some extent this appearance may be imitated by the use of the silk-finish cotton.

Threads may have either a left or a right hand twist, the object being that the twist will throw the loop in the direction of the point of the shuttle, thus reducing the chances of missing a stitch. The left hand twist is recommended for single needled machines and also for the right hand needle of double needled machines. In the left hand needle of the two needled machines the right hand twist should be used. It should be remembered that cotton threads are made up of from two to nine strands. The tendency to untwist in use is most marked in those having the least number of strands. As, for example, when six strands are used, these are first wound in pairs and the pairs are then wound in an opposite direction. This method results in less tendency to untwist. This is not so of silk.

Even on the higher grades of shoes, when cost is not considered, silk is not used for both top and bottom threads due to the greater elasticity of silk.

A tighter seam may be obtained by using cotton in the shuttle. The fact that this combination is most universally used in civilian shoes would seem to indicate that it is sufficiently strong. For heavy work, such as shoes made under Specifications 412–2–9, linen, if intelligently used in the stitching operation, should be most satisfactory.

The color of the thread is a matter which should be given considerable attention by the inspector, as in the past it has often been found necessary to reject shoes at the final inspection owing to the decided contrast between the color of the thread used and the color of the upper. It is desirable at all times that threads which show on the outside should closely approximate the upper in color.

At frequent and irregular intervals laboratory tests are made of thread and stay tape which are taken directly from the machine. Silk and cotton threads are given a tensile test and they are required to stand a pull of 12 pounds. If after this any doubt remains regarding the quality, a further test is made by the use of acids. Specifications make no mention regarding the tensile strain which linen thread must withstand, nor can it be found that any standard exists. Under these circumstances the tests must be more or less perfunctory. It is recommended that tests be made of a number of the recognized higher grades of linen threads and from the results of these a fair standard be established which may govern all future tests.

NEEDLES.

The needle used in stitching uppers has several important parts. The gauge of the needle must be such that it makes a hole sufficiently large for the thread to pass through the leather without undue friction and that the lock may be drawn into the correct position without unnecessary tension on the top thread. The particular gauge required will depend upon the thread being used and the nature of the material being stitched, it being evident that the lock made with a soft silk would easily pass through a hole that would be too small for a hard linen thread. Also the softer and lighter materials used in shoes of Specifications 1258 would not require as large a hole as the heavier material of shoes of Specifications 412–2–9. The hole made by the needle should be completely filled by the thread, but should not be so small that the thread is injured as it is drawn through the material.

The eye of the needle is important since the thread must pass through it continuously in forming the stitch. It should be as large as possible for the gauge of the needle. This is so that the thread will not be injured by the friction in passing through it even when the hole made in the leather is sufficiently large. It is also important that the needle have a well-finished eye as, manifestly, if any small burr or roughness is left it will have an injurious effect on the thread as it passes through. This latter feature is considered of such importance by one large manufacturer that girls are employed to place each needle in a holding device and smooth finish the eye by passing back and forth through it a thread coated with a fine abrasive. This eliminates the possibility of issuing needles to the operators which may have improperly finished eyes.

Needles are made with different shaped points, and the selection of the point best adapted for the work is important. When linings of shoes of Specifications 1258 are being stitched the round point should be used, as this style point does not cut the material, but merely pushes its way between the threads. For stitching uppers of Army shoes the best results are obtained with the triangular point.

The strength of an upper seam is gone when the loops of the stitch are destroyed, hence the stitch which is least exposed to injury would seem to be the one which would last the longest. Observation and inquiry from stitching-room experts lead to the conclusion that the triangular-pointed needle is the one which secures the most protection for the stitch, because when the stitch is being made the thread sinks into the cut made by the needle, thus affording more protection to the stitch and insuring longer life.

LACES.

Laces must be of fast color and tubular weave. They must be able to withstand a tensile strength test of 120 pounds. At irregular periods tests are made at this office of laces taken at random from those being used in the factories making Army shoes. These tests are made to determine the tensile strength, durability of the color, and the manner in which the metal tips are attached. After testing for the above qualifications, a section of the lace (about 2 inches long)

is taken and from it the threads are separated and counted. The number of threads have been found to vary, but in no instance where the number of threads is less than 88 has the lace been able to successfully meet the required test of 120 pounds. In addition to these periodical tests, the inspector at the factory is required to make daily examinations of the laces and assure himself that no laces are being used that are not of the specified length and color.

TACKS.

All heel-seat tacks should be of a length sufficient to firmly attach the parts without leaving any unnecessary surplus of metal on the inside of the heel seat. Tacks used for attaching the insole to the last should be not larger than 2½ ounce, as any larger size leaves the grain of the insole broken when withdrawn and may quickly destroy the bottom of the last.

HEEL NAILS.

Heel-attaching nails should be of Swede's iron No. 14, of proper length for the purpose. They should be of the type known as "half rough" to enable them to more firmly grip the fibers of the leather. Owing to the great thickness of leather in the soles of garrison shoes, it is not necessary that the heel nails should clinch or burr on the inside of the heel seat. It is sufficient that they barely show on the surface.

EYELETS.

Corrected Specifications 412–2–9, June 2, 1919, state that eyelets must have celluloid tops. This style eyelet is much to be preferred to the one which is merely enameled, as the latter soon wears off leaving the metal surface exposed, thus causing the laces to be quickly worn away. The diameter of the hole of the eyelet is stated in the specifications but the length of the barrel is not. Where the eyelet facing and quarter are properly leveled a barrel five thirty-seconds of an inch gives the ideal clinch. A longer barrel would leave a series of rough edges at the clinch in addition to which the clinch would not be so strong.

SHANK.

One of the useful purposes served by the shank is to assist in preserving the arch of the instep. The opinion has been advanced that the shank used in the present Army shoe tends to make it too rigid, but when it is considered that the point where the shoe is flexed in walking is at the joint just in front of the shank, this opinion does not seem to be well founded. It is not difficult to imagine that the duties of a soldier might include walking over hard, broken surfaces, digging, or climbing ladders. In this case a rigid shank would be desirable. Hence the opinion is advanced here that the design of shank as used well serves this purpose. Shanks should be as wide as possible without interfering with the inseam. They should be of

the length required to properly lap the forepart filler, and should reach from under the heel far enough forward to give support to all that part of the sole which does not rest upon the ground.

The size of the shank and steel should be as follows: Thickness of steel, one thirty-seconds of an inch; width of steel, five-eighths of an inch; length of steel, sizes 5 to 6½, 3¼ inches; 7 to 8½, 3½ inches; 9 to 10½, 3¾ inches; 11 to 12, 4 inches. The leatherboard must extend to the back of the heel in the shoe to meet the edge of the vamp that is turned over in lasting and fill the cavity in the center of the heel. Leatherboard should be one-eighth of an inch in thickness.

Chapter VIII.

PREPARATION OF BOTTOM STOCK.

Everything that can be done to assist the subsequent operations should be attended to in the sole-leather room. In order to accomplish this the sole-leather inspector should keep in touch with the making-room inspector, through the inspector in charge, relative to the manner in which the prepared units of bottoming leather meet their respective requirements. One of the most important matters to consider is the amount of skiving or fleshing. The substance of sole leather varies so sharply that unless it is first made level it is difficult to obtain satisfactory results in the attaching and finishing. For this reason, as well as for the purpose of removing any surplus flesh, each insole, middle sole, and outsole should be uniform in weight from heel to toe. This work *must be done before soles are submitted for inspection*, as a sole must measure up to the required iron after skiving.

INSOLE.

After the insole has been inspected and stamped it is rounded to conform to the shape of the pattern furnished for the particular size of shoe for which it is to be used. In rounding care should be taken that the sole completely fills the pattern and that it is so clamped in the machine that there will be no possibility of it being dragged to one side by the action of the rounding knife. Either of these faults will result in an irregularly shaped insole that will not fit the bottom of the last.

The insole is next channeled. The most approved method of performing this operation is by the Johnson or Economy system, by which two channels are cut, one from the outside and one from the inside. Having in mind the extension required by specifications for the finished edge, the best results are obtained by using the following measurements: Width of the outside channel $2\frac{1}{2}$/16 inch on the outside ball, 3/16 on the toe, 3/16 on the inside ball, and $4\frac{1}{2}$/16 to 5/16 on the butt. These dimensions may be varied slightly according to the thickness of the upper. The distance between the base of the outside lip and that of the inside should be one-eighth of an inch. The two lips are then turned up and fastened to form a rib to which the welt and upper are afterwards attached, either by stitching or by cementing them together. If a good grade of cement is used the latter method is preferred. When the cementing method is used, however, careless operators sometimes fail to roll the outside lip back to its full extent on the toe. This is a serious defect and is sufficient cause for rejection.

The insole is next feather edged; that is, the edge is slightly beveled on the grain side. The object of this is to eliminate the possibility of any discomfort caused by the rough edge coming in contact with the foot. It is sometimes found that the strength of the lip is weakened by the use of a feed wheel having teeth too large or too sharp, a condition to be guarded against by the inspector.

The insole is next reinforced by the addition on the flesh side of a strip of 9-ounce canvas, coated on the underside with cement. The canvas should extend from top of lip on one side across insole to top of lip on opposite side. Serious difficulty has been experienced in the past with the use of insoles gemmed with canvas extending to edge of insole, causing an air space or bubble between the channel and the canvas which is liable to tear the canvas when the welt is sewed on. Great care should be taken that the canvas is tightly formed in at the base of the inside channel, otherwise it will tear at the inseaming operation, thus becoming useless for the purpose intended.

WELTING.

Shoe manufacturers generally prefer to purchase welting that has been grooved and beveled, ready for attaching without further fitting at the factory. Of late, however, the practice of buying plain welting and grooving and beveling it at their own plants to better adapt it to their individual use has become more common. This grooving and beveling has a very important bearing on the success of the inseaming operation, as the durability of the welt may be affected by the depth of the grooving. Inquiries made of welters, foremen, and welt manufacturers result in the conclusion that the proper depth of the groove is one-third of the thickness of the welt. A hard, firm welt may be more easily worked with a slightly deeper groove. It has been demonstrated that the best results are obtained with Army grade welting that has a groove three-sixty-fourths of an inch deep. The correct bevel should start from a point directly opposite the inside wall of the groove. The inspector should give careful attention to this particular detail irrespective of whether the contractor buys welting grooved and beveled or has these operations performed in his own factory.

OUTSOLES AND MIDDLE SOLES.

The outsole should be properly fleshed and made level. As these soles are to later undergo a fitting operation known as rough rounding it is not customary to round them by pattern in the sole-leather room, but the sole-leather inspector should see that in casing up outer and middle soles they are large enough to furnish sufficient material to permit the proper performance of the subsequent operation. The inspector in charge should keep the sole-leather inspector informed regarding such matters.

The specifications ordinarily permit the use of middle soles of less than 7 iron if for each one-half iron decrease there shall be an increase of 1 iron in the outsole, but no middle sole shall be accepted under 6 iron in weight. Where the manufacturer takes advantage of this clause the inspector should see that in casing up the correct

combination of soles is made, and that a case of light middle soles is not combined with a case of outsoles, the iron of which has not been correspondingly increased.

For the purpose of eliminating the loud and disagreeable squeak which so often developes in a shoe of this type, the specifications should require the middle soles and outsoles to be thoroughly cemented together. To make this method more effective, the grain of the middle sole must be roughed. A coat of cement must be applied to the roughened grain side of the middle sole and another to the flesh side of the outsole before putting them together. This serves, also, to prevent the two soles from slipping out of place at the rounding and stitching operation.

Soles are next placed in the molder and given sufficient pressure to form them to the shape of the bottom of the last. This process increases the effectiveness of Goodyear stitching. It helps to make a tighter inseam, as much of the strain required to bring the heavy double sole and welt together is thereby eliminated. During all the operations the soles should be sufficiently mulled and in proper temper, and should leave the sole-leather room in the correct state of mellowness for the processes which follow.

HEEL BUILDING.

In order to obtain the most uniform results in the finished heel the lifts should be graded for weight. When this is not done the height of the heel will vary.

After the heel has been built it is placed in a machine which subjects it to a tremendous pressure. As the pressure adjustment is constant at the point required to produce a given height heel, it follows that if the heel is built too high this pressure will be additionally increased. For the reason explained under "Rolling of leather," this pressure can not but result in injury to the fibers thus compressed. On the other hand, if the heel is built too low, sufficient pressure will not be exerted to properly solidify the heel.

The lifts must be in proper temper and be well pasted on both sides before being compressed. The proper degree of concavity should be given the bottom lift. Heels are to be made with a straight breast line. In some factories the breasting is done in the sole-leather room. There is an advantage in this method as the machine on which this work is done can be adjusted to cut an exceedingly fine chip, thus leaving the fullest possible length of the heel. It also eliminates the danger of cutting the sole at the shank through inaccurate adjustment or improper grinding of the knife, as often happens when the heel is breasted after being attached to the shoe.

Chapter IX.

FITTING.

SKIVING.

For appearance, comfort, and strength the edges of the different sections of the uppers are generally reduced in thickness before being stitched together, the various seams calling for special treatment in the width and depth of the scarf. On seams like the back, which after skiving are stitched together, then opened out flat, the scarf need not be wide or deep, but it should be sufficient to make it easy to lay the seams down smoothly without straining the stitch. The greatest thickness of material should be left just where the stitches are laid and yet have a seam that will lay down flat when opened out. The extreme edge should be left with the necessary thickness to firmly hold the stitches, otherwise the operator must run further in from the edge. This lengthening of the stitch increases the difficulty of making the seam lay flat. Lapped seams, such as are provided for on the garrison shoe, are stronger than the closed seam. They are used for attaching tips, vamps, counter pockets, and tongues. The edge of the quarter which is to be uppermost need not be skived; the underneath edge, however, the part which overlaps, should be skived as deeply as is consistent with safety and strength. The primary object of the skiving in this case is comfort, and the width of the scarf should depend on the substance and the laps allowed. The bottom of the quarter and counter pocket should be skived sufficiently to reduce to a minimum the difficulty of wiping in the heel seat and to secure the flat effect so much desired at this point. For the sake of appearance, edges left raw, such as the straight edge of the tip, the front of the quarter, and the edges of the counter pocket, should also be skived. The skiving knife in this case should be set a trifle heavier than the minimum weight called for in the specifications for the particular piece being skived. This avoids the clumsiness of an unskived edge and makes a more uniform tension possible. To facilitate the folding in of the surplus material at the toe, the vamp and tip should be skived at this point. Care should be taken that the scarf is only of such width that when the shoe is welted the needle will pass through the unskived part. Specifications for skiving the edges of the different parts follow. This will vary slightly according to the substance of the material to be skived.

Specifications 412–2–9 state in regard to upper leather skiving:

Quarters are to be skived at the back on the flesh side with a scarf three-sixteenths inch wide to even the uppers to a uniform thickness; the quarter where skived is to be not less than 1.5 millimeters in thickness. Quarters are to be skived on the bottom where the heel seat is lasted in on the flesh side

with a scarf not over five-eighths inch wide, the skived part of the quarter to be not less than 1.5 millimeters in thickness when skived. Vamps are to be skived on the flesh side at the point where the vamp joins the quarter in the shank with a scarf three-sixteenths inch wide, this part to be not less than 1.5 millimeters in thickness when skived. Vamps are to be skived at the throat on the flesh side with a scarf one-fourth inch wide, the edge of the throat of the vamp not to be over 1 millimeter in thickness. Vamps are to be skived at the toe with a scarf five-sixteenths inch wide to allow for proper lasting of toe. Counterpockets are to be slightly skived on the flesh side with a scarf three-sixteenths inch in width and to measure on the skived part not less than 1.5 millimeters. Tops of quarters are to be slightly skived on the flesh side. Tongues may be slightly skived at the bottom where the tongue joins the vamp at the throat on the grain side with a scarf not to exceed one-fourth inch in width, and the tongue to measure not less than 1 millimeter in thickness where skived.

ASSEMBLING.

The fitting-room inspector will see that the various parts as accepted by the upper-leather inspector are correctly assembled. Careless handling at this point may cause an interchange of parts, which might result seriously if not discovered before the fitting began. Notwithstanding that all parts of the upper have previously been inspected and accepted, the fitting-room inspector is to consider it a part of his duties to note the weight and quality of the parts in so far as it is possible while checking up the workmanship. If pieces are found of inferior quality, it will not be too late to prevent their incorporation into the shoe. Both upper and under threads in use on the different machines must be inspected at frequent intervals during the day and their finish, size, and color carefully observed.

It will be noticed that the throat and the wing of the vamp are to be skived to different degrees of thickness, thus making two operations necessary. It has been found in some instances that in order to eliminate one operation some foremen have altered these weights without authorization. Such practices must be guarded against. Gussets should be split to a uniform weight, preferably on a belt knife. Side facings should be split to a weight corresponding to the gusset.

CRIMPING.

Vamps should be crimped to a proper break to conform easily to the shape of the last on a machine of the Lockett type or equal, avoiding excessive side pressure and heat. Vamps should be allowed to remain set between the jaws a sufficient period to insure effective crimping. Not more than one pair of vamps should be crimped at once, as the outside vamps will stretch and the location marks become misplaced. During this operation it often happens that the plates become overheated, due to carelessness on the part of the operator; consequently it is recommended that a discarded vamp be placed upon the outside of the vamps which are to be crimped, thus preventing any excessive heat that may be in the plates from burning the grain, making it brittle and tender.

TYPE OF STITCH.

There are different types of stitches used in the upper fitting of boots and shoes, namely, the chain stitch, the lock stitch, and the union special double lock stitch. The specifications usually state

that the stitching on all parts of the upper, except that closing the back seam and the seam made in stitching the eyelet facing to the quarter, shall be done with a lock stitch. This makes no mention of the barring row, which experience has fully demonstrated is most satisfactorily done with a Puritan chain stitch. While there can be no question as to the all-round superiority of the single lock stitch for use on unlined uppers, such as the shoes made under Specifications 412–2–9, yet there were many contractors whose factories were equipped with the union special double lockstitch machine for tip stitching who claimed that a seam stitched with it had greater tensile strength than any other, and also possessed greater elasticity. This latter feature is desirable in tip stitching, as the strain of the pulling-over machine at this point stretches this seam to some extent, and it being universally conceded that the single lock stitch is the least elastic of all seams it follows that any undue longitudinal strain will cause the stitches to break.

For the purpose of ascertaining the relative tensile strength of seams made with the different types of stitches, tests were made for the Union Special Machine Co. by J. E. Howard, Government expert, August 3, 1894. Assuming the correctness of these tests, the union special lock stitch is stronger than either the chain stitch or the single lock stitch, the latter being the weakest of the three.

Furthermore, a claim was made that as the union special undoubtedly forms a lock stitch the wording of the specifications could not be interpreted to mean that its use was prohibited. The objectionable feature which decided against the use of this type of stitch was that it formed a ridge of thread on the underneath surface which might easily cause discomfort, if not serious injury, to the wearer. The cause of this ridge may be traced to the fact that the entire double lock of the stitch remains on the under surface instead of being drawn into the material. In addition to this, in practice the single lock stitch is found to be sufficiently strong.

To assist the inspector to more intelligently pass on the quality of the workmanship and to make criticisms of a helpful nature, it is of value that he shall have some knowledge of the mechanical processes utilized in the various stitching machines. Reference has been made to the eye and the point of the needle. In addition there are two grooves in each needle, one long and the other short. The object of these is to allow the thread to pass through the material with as little friction as possible. Consequently the long groove should extend up the needle as far as will be necessary for it to enter the work on its downward motion. On the short groove, which is always the one next the shuttle, this is not the case, as while the friction is here reduced to a minimum, there must be enough so that when the needle begins to rise the thread will be held by friction while the needle ascends without it. During this motion the thread passes through the eye from the long groove side, leaving a loop through which the shuttle thread is passed and thus forming the stitch. In a lock stitch it is necessary that the top and bottom threads cross to form the lock. Different methods are used to accomplish this. The under thread may be wound on a spool and inclosed in a shuttle which is shot through the loop formed when the needle rises. This type of shuttle has a pointed end and has a reciprocating motion.

Sometimes the bobbin remains stationary and is inclosed in a case which has a rotary motion. Such cases have a hook which enters the loop thrown by the needle, gives it a half twist and passes it over the bobbin, thus forming the stitch. This type of bobbin is the one most commonly used for fitting uppers. The advantage of the rotary over the reciprocating shuttle is that the speed is increased since the latter only forms a lock on its forward motion and must return to its original position before commencing another stitch.

The zigzag stitch used on the back seam is made by the needle bar having a swaying motion in a line crosswise to the direction of the feed. A stitch is placed when the needle is at the extreme of its motion in one direction, the next stitch being made when it reaches the end of its journey in the other direction. The work is fed forward between the stitches. This zigzag motion can be used or instantly changed to the straightaway stitch, simultaneously doubling the number of stitches at the wish of the operator.

To secure uniformity of the stitch, different mechanical devices are provided which move the work forward as each stitch is formed. One of these is the drop feed. With this type the feed rises, grips the work, moves it forward, drops down and returns to its original position. The type of feed most commonly used on upper closing machines is the feed wheel, having on its edge a series of teeth which grip that portion of the work which is directly under the needle and move it along as it revolves. After the devices which regulate the length of the stitch are adjusted to provide a stitch the desired length, it is important that the operator permit the work to pass under the needle naturally, that is, he should neither push it along nor retard it.

To vary the length of the stitch the motion of the wheel is either increased or decreased. In connection with this a means is provided for pressing the work against the feeding device. It also serves to prevent the work from being pulled out of position when the needle is being withdrawn from it. In addition to this it presses the parts together and makes it possible to obtain a tight seam without undue strain on the thread.

There are two types of pressure devices used—the foot pressure and the wheel pressure. With the foot the pressure should not be more than necessary, as the friction against its flat base tends to stretch the material. With the use of the wheel pressure this friction is reduced to a minimum, as it revolves when the work moves forward.

Between the top spool and the eye of the needle the thread controlling devices are placed. The principal ones are the tension and the take-up. It is believed that all are familiar with the object and the method of controlling the tension device. The take-up device consists of a lever through which the thread passes. This lever drops when the needle descends and rises soon after the needle. After the under thread has passed through the loop made by the needle the slack thread is taken up and strained tight by the upward motion of the lever. The length of the take-up motion should be governed by the amount of loop required on the different machines. The lever always takes up the same amount of slack, but since the thickness of the material varies, to insure the same tension for each stitch a take-up spring is provided which should be suitably adjusted to balance with the tension.

The matter of speed is important. The operator in endeavoring to accomplish a greater amount of work may increase the feed motion. In addition to lengthening the stitch this makes it more difficult to guide the work. Also when the tension is set to properly function at a given speed any excessive speed will result in the bobbin thread being pulled to the surface. When the inspector finds that unsatisfactory tension is not immediately corrected by the use of the spring adjustment provided for this purpose, he should at once insist that the services of an expert machinist be secured.

CLOSING THE BACK SEAM.

The zigzag is the stitch most commonly used for butted seams and it is the one used for closing the back seam of the quarters. It has been mentioned that this stitch on some machines may be instantly changed to a straightaway by the operator. Having in mind the fact that when inserting the foot into the shoe without the use of a pull strap the first and most severe strain comes on the top of the back seam, the opinion is advanced that in closing this seam 1 inch of straightaway stitching at the top gives added strength. Manufacturers were averse to using this method on Army shoes, claiming a superiority for the Singer zigzag stitch. However, this opinion may have been somewhat influenced by the fact that with the latter seam the rubbing down operation is eliminated.

Before stitching the counter pocket it should be carefully centered on the back seam, the top of the backstay being set flush with the top of the quarter. When this part is attached with three rows of stitching, two operations are required, using a double-needled machine for one and a single-needled for the other. Best results are obtained by using a single needle first, as it facilitates the springing on of the counter pocket. The other two rows may then be placed with the double-needled machine. After the counter pocket is fitted it should be crimped, it having been demonstrated that uppers thus crimped conform more readily to the shape of the last and the foot at the heel as is evident in the lasting operation.

TIP STITCHING.

Care must be taken that the tips are attached to the vamp in a manner which will enable the laster to pull the tips straight without twisting the ears of the blucher points. They should be so placed that on the finished upper the distance between the edge of the tip and the blucher point will be equal. They are more accurately placed when stitched on a flat-bed machine. Tips are perforated with a row of holes three thirty-seconds of an inch in diameter and stitched with four rows of linen thread, two on each side of the perforation, using a 40/3 cord polished upper and 50/3 cord unpolished linen under thread, and not less than 10 nor more than 12 stitches to the inch.

STITCHING EYELET FACING TO TONGUE.

To avoid the thick bunch formed by the lap seam used in patterns of earlier designs the zigzaz stitch is used here and a butted seam is formed. To prevent this stitch running, it is required that it be carried onto the tongue for a short distance, say two or four stitches beyond the eyelet facing.

TONGUE STITCHING.

Tongues are stitched to the vamp with two rows of stitching, one row to be stitched from the outside on the extreme edge of the tongue, the work then to be turned over and the other row to be stitched at the extreme edge of the vamp, the object of this being to prevent the lap at the throat of the vamp from rolling back when the foot is inserted. As the shuttle thread on the latter row is the one which shows on the surface, it is necessary that it should be fitted with the same thread as used in the top spool. Care must be taken that the part of the tongue where the slot commences is accurately laid on the location point, otherwise it will affect the fit when attached to the quarter.

EYELET ROW STITCHING.

The tongue is split at the side so that it may be turned up and attached to the quarter to form a part of the facing, having a tendency to make this part more water-tight. The operator carefully places the upturned side of the tongue and the tab together, arranges the fold, and places the tab on the location points on the vamp. It is then ready to stitch. Unless the parts are carefully held in their proper position, the result will be a baggy or otherwise ill-fitting tongue. Attached to this machine is a knife which, working in conjunction with the needle, removes the surplus material on the outside of the stitch.

VAMPING.

Vamping is done with four rows of stitching, using 10 to 12 stitches to the inch. Owing to the width of lap allowed by the pattern and the necessity of the fourth row being so placed that it passes close to the edge of the lap of the vamp, preventing any possibility of its curling back, it is necessary to use a single-needled machine here if uniform appearance of the rows is to be maintained. It is important that the inspector keep in close touch with this operation. He should examine the location marks on the vamp and being assured that they are properly placed and that the brads in the die have not been sprung, he shall then see that the quarter is placed accurately on these marks. The quarter should not be merely laid on the vamp when stitching but should be sprung on so as to correctly form the curve made by the two extreme points and the center point.

BARRING.

Barring is most satisfactorily done with the Puritan wax-thread machine. This machine is equipped with an attachment which automatically stops after it sets five stitches. When the thread is cut after the stitches are laid, a sufficient length of thread should be left to prevent the stitch from running. Plenty of wax should be used. The ridge formed by the lock of the chain stitch underneath should be gently pounded by a wooden mallet on a wooden surface. Not only does this pounding serve to reduce the ridge but it also sets the lock tighter. To be effective, this should be done immediately after the barring and when the wax on the thread is in a plastic state.

MARKING.

Before leaving the fitting room, and at a period most convenient, the quarter should be distinctly stamped on the flesh side with the name of the contractor, number of the specifications, the number of the contract, the name of the zone in which the shoes are manufactured, and the size and width of the shoe. In addition to this, it should have on the flesh side a size and width mark, made with a steel cutting stamp which must cut into the surface of the leather. It is necessary that this mark shall be distinct, as when shoes are reclaimed it may often be the only possible means of identifying the size and width.

SUMMARY.

Garrison shoe Specifications 412–2–9 clearly set forth the kind of thread and the number of stitches required for each operation. It becomes the duty of the inspector to carefully watch each operation in the fitting room and see that the various pieces are fitted according to the location marked on each; that the proper number of stitches and the proper threads are used; and, most important, that at all times and on all operations the proper tension is maintained and that the thread does not ride on the surface of the leather. If it is found that in the lasting room difficulty is had in properly lasting uppers due to ill fitting, an examination of the location marks should be made, to see if the crimping has stretched them. If the fault is not here, examination of the dies should be made to see if the brads have become sprung. Throughout all operations only the smallest possible needle that will carry the thread should be used. It is believed that a number 6 Singer gives the best result on the size of thread used on this shoe. Quarters should be laced up at least four eyelets with the space not to exceed five-eighths of an inch before going to the lasting room. Care should be used in eyeleting to see that the eyelets are properly spaced, since there is danger when the quarters are eyeleted up one side and down the other, that the holes may not come opposite each other. It is important that the proper clinch of the barrel is obtained. If the barrel of the eyelet is too long, rough edges are left at the clinch; if too short, the eyelet is apt to pull out.

CHAPTER X.

LASTING.

PRINCIPLES OF LASTING.

The high state of perfection which lasting machines have reached has brought about their general use in the shoe factories of to-day, and even in the shoe centers where the higher grades of shoes are made the hand laster is fast disappearing. Since the end striven for in the lasting machine is to approximate as closely as possible the methods and results of hand-lasting, it follows that the principles of lasting, which never change, might be more readily understood from an explanation of the methods of the old-time hand laster.

First the draft strains should mold the upper to the contour of the last; they should be taken in the order which will make them the most effective; they should be taken at the proper time and in the place that will be least adversely affected by after strains. The strength of each pull must be in the right proportion and relation to the after strains. The upper must be molded over the last in such a way that it fits closely into the hollows and retains the curves and lines of the last when the latter is withdrawn. The difficulty in this is due partly to the elasticity of the leather. The contraction which takes place when the last is withdrawn may result in the shoe losing its shape, therefore if the upper is to retain its shape it must be drawn over the last according to certain scientific principles.

ASSEMBLING.

Before commencing the process of lasting the shoe is assembled. At this point the various parts are brought together and embodied in the shoe. The inspector must see that the different units correspond in size and width and that the last and upper are properly marked according to the tag. Having satisfied himself regarding these details, he should insist that the insole be tacked on flush with the outside of the last, using for this purpose the proper size tacks. The insole should never hang over the inside edge, neither should it extend over the toe nor be set back from the toe. There is usually one-twelfth shrinkage allowance at the heel to permit the trimming of the insole after it is tacked on the last. This trimming must be done smoothly and evenly, leaving the seat the shape of the bed without any angles or corners.

Counters should be pasted on both sides. The approved method is to insert the individual counter into the receptacle containing the paste rather than to insert the paste into the counter pocket by means of a brush. This prevents the counter pocket from working down

over the heel seat and also prevents the inner surface being pushed down when the shoe is put on. When the counter is inserted it should be carefully centered. The upper is then placed over the last. The back seam having been centered, it is raised above the seat sufficiently to permit breaking over a correct amount—that is, four-eighths to five-eighths of an inch—and fastened with a tack in the back.

Army shoes are designed to be made with a soft box, the reason for this, no doubt, being to prevent any liability of the hard box injuring the toe of the wearer. In doing this appearance has been sacrificed to a considerable extent, as when the shoe is removed from the last the toe often falls in and presents a crushed and wrinkled appearance. In order to eliminate this latter fault, it is advisable to insert between the tip and the vamp a generous coat of good quality rubber cement. This serves to hold the tip of the shoe up when the last is taken out and leaves a soft box with absolutely no danger of injuring the foot.

PULLING OVER.

After the shoe is assembled the hand laster would turn the shoe bottom up, take the toe of the uppers in the pincers and strain it over the edge of the insole and fasten it with a tack. This must be the first strain, because it centralizes the upper on the last and at once enables the operator to see if it is correctly fitted and attached. No tacks are placed at the side until the upper has been centered. When the strain is taken, the upper stretches and will, at some points, come forward on the last, and as this longitudinal strain is the only one which could mold the upper to the back of the last, it would be impossible to set up effective heel to toe tension if any cross strains had been taken first. It must be the first strain taken, because there is no other strain which will make so much of the upper fit against the side of the last. Seeing the importance of this strain, it is necessary that it be of the correct tension.

It may be stated as a guide that as strong a tension as possible should be set up, provided that the laster can always bring the upper down to the most hollow part of the last between the toe and the instep with his fingers. The effect of bringing the upper down to the last at this point is to increase the heel to toe tension, therefore if the latter is too strong it will be difficult to bring the upper down to the wood. This heel to toe tension may be so great that it is impossible for the cross tension to bring the upper down. In this case when the shoe is removed from the last the sides will fall in. It is of very great importance that the strain be put on gradually. It is often through want of care in this detail that lasters crack an excessive number of tips.

In lasting by hand the next draft or pull would be taken crosswise at the end of the cap on the inside, the third pull being the opposite end of the cap at the outside, but with the Rex pulling-over machine the first three strains are taken at one operation, although in both cases the importance of the proper ratio must be borne in mind.

The next pull should be at the ends of the counter. These being flat, they should first be strained toward the toe and pulled up until

the top edge fits against the sides of the last. The counter should fit the upper and be so skived that it will not be necessary to pull up an excessive amount, as any increased thickness to work in around the last increases the difficulties of obtaining a smooth, flat seat.

SIDE LASTING.

The side lasting may now be commenced, but here great care should be used that in taking the strains the heel-to-toe tension is not disturbed. It is advisable to last the inside quarter first, since, on account of the shape of the last, it is the least liable to be overstrained. When the outside has been lasted both quarters should be the same height. It equalizes the tension between the counter tack and the tack at the tip if the first pull in side lasting is made at the inside waist just back of the joint. If this pull is taken at right angles to the edge of the insole it tends to remove any fullness of the upper between the joint and the instep. The form of the last is more likely to remain in the finished shoe when the strain is taken here, as the leather is then molded around the joint instead of being pulled over, as would be the case if the draft were made at the joint. The reason why the strain should first be taken at the inside joint is that, since the last is hollowed so much at the outside, there is a great tendency for the upper to slip to that side, causing the ears to be crooked. Since the inside is more convex this danger does not exist. An examination of the Munson last shows a considerable hollow between the outside joint and the point of the instep. It is obvious, therefore, that if, when lasting the outside, the upper is strained over the joint it will stand away from the last and form a bridge or straight line over this hollow. To overcome this, the first strain should be taken behind the outside joint at a point well toward the heel; then the upper will be molded into the hollow and better retain the shape of the last.

Although it is important that the strains be set up in the order described, this alone will not insure the best results unless they are set in a correct ratio.

Most upper leather has some stretch, and after the shoe is removed from the last a contraction takes place. It is therefore a principle of lasting to mold the upper to the last with uniform tension if uniform contraction is to occur. This fact may explain why operators who work exclusively on Army shoes are able to obtain better results than those who are constantly shifting from civilian to Army work, as the latter do not develop the sense of touch that indicates when the correct strain has been applied to each draft.

MACHINERY USED IN LASTING.

Having set forth as briefly as possible the fundamental principles of lasting, our attention now turns to the machines so generally used for this work. The lasting machines used on Army shoes are those comprising the Rex system. The Rex pulling-over machine contains all the devices which are essential for correct hand pulling over, and consist of—

1. The "rest" against which the bottom of the last is placed.
2. The automatic heel rest, which adjusts itself to the length of the last.

3. Five pairs of pincers, two at either side and one in the center.
4. The updraw device, which has compressed air chambers to prevent the tension being put on suddenly and springs to regulate the tension.
5. A device which causes the pincers to lay the upper over the edge of the insole with adjustments for different widths.
6. A device for straightening the tip and another for straightening the upper if necessary.
7. A device for releasing the grip of the front pincers to enable the upper to be brought to the last by the cross strain.
8. A device for delivering and driving the tacks.

The latter machine has one great advantage over handwork inasmuch as the tensions are put on simultaneously and no tacks are driven until the upper is straightened down on the last, therefore the work can be handled more quickly and less expensively.

The second machine in this system is the Consolidated Hand Method Lasting Machine, or, as it is sometimes called, the "Nigger-head," for side lasting. The improvements of this machine have been so great that it may now be properly termed a mechanical marvel and no description could clearly convey all its intricate adjustments. Among the principal devices may be mentioned the following:

1. The pincers which grip the upper, together with a device which controls the strength of the grip.
2. The device which gives the pincers the necessary motion. The pincers must remain open until they have reached the lowest position near the edge of the insole. Then, after gripping the upper, they must rise, and in so doing they must strain the upper to the last, putting on an even tension regardless of the amount of material to be pulled up. They must next draw the upper over the edge of the insole and release its grip.
3. Device which regulates the updraw tension required for the various leathers.
4. Device for regulating the strength of the overdraw according to requirements.
5. Devices which deliver and drive the tacks. The pincers may also be given a twist motion, such as is required for pleating the surplus material at the toe when used for toe lasting. It is also provided with two raceways which deliver tacks of different lengths.

Although it is not possible under all circumstances to do work on this machine equal to the best hand lasting, it is admitted that if the conditions are correct satisfactory results may be obtained by a competent laster, as each and every principle of hand lasting may be employed.

If a hand laster is observed on a good class of work, it will be noticed that he first takes the stretch out of the material, then lets it contract before taking the final strain. This not only causes the stretch to be more evenly distributed, but reduces the amount which the upper would stretch in wear. This stretching of the material is usually ignored with this type of lasting machine.

Assuming that the shoe is now lasted, with the exception of the toe and the heel seat, it is next sent to the bed lasting machine. The principal features of this machine are the wipers at the toe and heel. The shoe is placed on a jack and toe rest, both of which are adjustable in height. The seat wipers are on a carriage which may be adjusted to any length of shoe as well as any angle of shank. The wipers consist of two plates having a hinge motion at the back. These set parallel with the bottom of the last and are moved forward by a lever, pressing the material down flat over the last. As

the plates move forward the ends toward the shank are brought closely together. Good results can be obtained with seat wipers only when they are properly set. The operator, therefore, must see that they exert an even pressure at all parts of the seat. They must not be set at such an angle that either the front or the back touch while the opposite end does not. Care must be taken that that part of the machine which holds the back of the heel is pressed firmly in place, otherwise the shape of the counter will be distorted. At the toe there is another pair of plates similar to the seat plates. With these the upper is worked into the shoulder. It is important that the proper adjustment be made to gather the surplus in, seating it in a manner that will leave a suitable shoulder for the welter to sew to. This is necessary to avoid full toes, so called. When the toe is well blocked in, a wire is drawn around it and held by two anchor tacks, one at either side of the tip. It is important that this wire be drawn tight enough to hold the upper in place, also that a sufficient wind be taken around the anchor tack to prevent loosening of the wire, and that the wind be started on the inside of the anchor tack and finish on the outside, as this preserves the line of the inseams.

An important feature of the bed machine is the toe hold. This consists of a plate of the correct shape and thickness attached to an adjustable arm. It should fit snugly behind the upturned lip at the toe, the object being to brace it against the pressure of the wipers as it crowds the upper onto the shoulder at this point. It also prevents the insole being pushed back or buckled. Obviously the usefullness of this device depends upon its shape and the care with which it is placed in position. It is important that the toes be wiped in, leaving no wrinkles or pleats visible. This is accomplished with the aid of the spreader, a small hand tool, which, as its name implies, assists in evenly disposing of the surplus material.

When the assembler places the counter in the shoe it is assumed that it will be properly mulled. Ordinarily when the shoe reaches the bed machine the counter will be in just the proper condition for molding the seat. If, however, for any reason the seats are not lasted before the counters become dry, it will be impossible to obtain a smooth, square-edged seat. It is advisable, therefore, for the inspector in charge to make such arrangements as are possible to insure that no more shoes are assembled or pulled than can be bed lasted before the bed-machine operator quits work for the day.

Only a sufficient number of tacks should be used to securely fasten the seat. More than that would serve no useful purpose, but would increase the amount of metal on the inside. It should be borne in mind that the heel-seat nails are later to pass through these parts. Before the shoe is taken from the machine the seats should be thoroughly pounded. Before leaving the lasting room each shoe, in so far as possible, should be examined to make sure that there is a sufficient amount of upper drawn over at all points to insure catching by the welter's needle; that the right amount of upper and counter are drawn over at the seat; that the canvas has not been destroyed or misplaced; that the lip at the toe has not been weakened; and that the seat tacks are placed at a proper distance from the edge of the insole.

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Chapter XI.

MAKING.

While the following principles are fundamental and may be applied in part to all classes of shoes, they are touched upon here with particular reference to Army shoes manufactured under Specifications 412–2–9, and should be so considered except in such cases where for the purpose of illustration or comparison some other specification is mentioned.

TRIMMING TOES.

The surplus material at the toe and the vamp should now be removed. This is for the purpose of facilitating the welting of the shoe around the toe. This may be done either by hand or by a machine having a knife which makes a chopping motion, but unless the knives are kept well sharpened and the toe of the shoe held firmly in place on the machine, the toe will be pulled away from the insole, and thus destroy the good work of the bed laster.

UPPER STAPLING.

Before the shoes are welted, it is advisable to remove the lasting tacks which are placed temporarily to hold the upper. Mention has been made of the contraction which takes place in the upper leather after the tension is released. If some means were not provided to overcome this, the upper would spring back when the tacks were withdrawn. It is customary, therefore, before pulling the tacks to fasten the upper to the lip of the insole by means of a small thread-like wire which is passed through the parts and forms a staple. This work is done on the United States Machinery Co. upper-stapling machine. The tacks, with the exception of the anchor tacks, are then pulled.

INSEAMING.

This operation consists of attaching the welt and upper to the lip of the insole which has previously been prepared in the sole-leather room. The method used is the chain stitch, which passes horizontally through the substances, leaving the loop in the groove of the welt. The needle is curved and has a barbed point. The stitch-forming device consists of a looper which, by a circular motion, lays the thread in the barb of the needle when it emerges from the work. When the needle is withdrawn and again starts its journey it leaves behind a loop through which the next stitch is drawn, the work being fed along in the meantime. This machine is provided with the necessary devices required for almost perfect work. Before starting to attach the welt the inspector should see that it is properly

mulled. A channel guide is important, because if the needle be correctly set and its point the right shape the guide will indicate just where the point of the needle will come through. It also serves to steady the work when the needle strikes it. A welt guide is necessary to feed the welt and hold it in position so the needle strikes through the groove. There is also an arrangement whereby the pressure of the welt guide is removed so that the work can be carried along to form another stitch.

A tension device is necessary so that regardless of any variation in thickness of material, such as the toe, for example, a uniform tension of the stitch will be put on at all parts of the shoe. This is the most important device of all, as the strength of the seam depends not so much on the length of the stitch or the size of the thread as upon the tension used. Experience teaches that many operators of this machine will, whenever it is possible without detection, release the tension, as this reduces the liability of breaking the thread, particularly when sewing around the anchor tack. The inspector, therefore, must give this detail careful and constant attention, testing the machines at frequent intervals, especially when an operator changes from civilian to Army work. In this latter case it is also well to see that the operator has changed to the thread specified for Army work, as a lighter thread is usually used for civilian work. When the shoe is sewed, there must be an entire absence of hinge action between the welt, upper, and insole, otherwise the shoes must not be accepted.

The machine is provided with a heating system which serves not only for waxing the thread, but also for keeping warm each part of the machine with which the waxed thread comes in contact, such as thread roll, looper, and needle, otherwise these parts would become coated with hardened wax and it would become impossible to work the machine. This machine, with its many improvements, has been brought to a degree of perfection that enables it to do work of the most satisfactory nature, yet the results attained depend in a very large measure upon the skill and carefulness of the operator. He must carry the shoe perfectly level at all parts. He must so regulate the feed that the proper number of stitches is taken. The stitch must be laid at the base of lip on the insole, and directly in the bed of the groove of the welt.

It will sometimes be noticed that the welt has been dropped in places and that the stitch is laid up on the side of the groove. As a result there is a weakness at this part, and when the welt is beaten out the bevel may be seen from the outside. Assuming that the canvas was properly formed in in the sole leather room, the welter may still tear it by changing the level at which he carries the shoe.

The needle most commonly used on Army work, and which has been found to give the most satisfactory results, is that known as the medium low point, No. 41. It may be found that after striking a tack the point of the needle will be left with a burr. This will sometimes tear the canvas. The inspector should ever bear in mind that this seam, being the most difficult to repair, should be formed with the maximum of strength, and, as it is shortly to be hidden from any subsequent inspection by the operations which follow, he should carefully scrutinize each shoe before permitting it to pass.

At this stage in most factories a cobbler is maintained for the purpose of patching and cobbling insoles damaged by the welter. He is usually a hand worker, more or less skilled, and is obsessed with the idea that no insole is ever damaged sufficiently to justify its rejection. The lip may be entirely gone, but he will simply cement a piece of canvas over where the missing part was and sew through it. He may hide torn places with a coat of wax. Short pieces of damaged welt are cut out and other pieces substituted. These practices are common in civilian shoes, and when the loss of time, labor, and the expense of a new insole are considered they may be understood though hardly justified. The inspector must guard against such methods in Army shoes.

No shoes should be repaired on which the lip has in the least given away from the insole. No insole which has been sewed more than once, leaving two sets of holes, should be accepted. Neither should work be accepted where the welter has gouged deeply into the substance of the insole. When the canvas has been torn without injuring the lip itself it may be permitted to replace the torn part with a new piece and resew the welt, using the original holes. In a similar manner drop stitches may be replaced. The welts should be butted with a scarf not less than five-eighths of an inch long. They should then be pounded and fastened with a tack of suitable length. This serves to hold the welt secure at this point. This is done so that a proper line may be maintained along the seam at the breast of the heel.

TACK PULLING.

When the welt has been sewed on, the tacks used to hold the insole, likewise the anchor tacks used to hold the toe-bracing wire, must be removed. This may be done either by hand or by machine. The work is usually performed by boys or girls, and what might otherwise be classed as a most simple operation often gives cause for much complaint from final inspectors. Owing to the gross carelessness of those employed on this work many tacks are left in the shoe. Sometimes the heads are knocked off and no further attempts are made to remove the tacks. As it is impossible to withdraw these tacks after the insole has been covered up, and in view of the serious results which might occur to the wearer should one be overlooked, the importance of this operation must not be underrated. Owing to the vigilance of the final inspector many shoes are rejected for this fault.

INSEAM TRIMMING.

The seam must now be trimmed of all surplus upper stock and insole lip to assist the middle or outer sole, as the case may be, to lie flat upon it and reduce the strain required to bring the welt and sole together when they are Goodyear stitched. This work is sometimes done by hand, but may be much better done by the improved new model United Shoe Machinery Co. inseam trimmer. The cutting implement in this machine consists of a steel cylinder sharpened on its edge by a device which may be adjusted at any time. It rotates at high speed in a direction at right angles to that in which the shoe is fed along. It cuts a smooth even edge and

may be adjusted to a very fine degree. The danger to be avoided in this operation is of cutting the seam too close to the stitch. Care should always be taken that enough material is left above the stitch to prevent any weakness. Even with a minimum of care with this machine the inseam may be perfectly trimmed.

WELT BEATING.

It will now be necessary to beat out the welt. This is done with a small power hammer which rapidly rises and descends, the shoe usually being held bottom up, the welt resting on a small horizontal bracket which is beveled to a thin edge to fit close to the upper. This operation should be performed as soon as possible after the welt has been sewed as it will then be in proper temper. In no case should the welt be allowed to dry before beating out. A certain result of this would be to severely strain the stitch and cause a grinning seam. This latter defect may sometimes be caused at this operation by the thin edge of the anvil pressing too far into the seam and forming a lever which strains it. When circumstances are such that it is found impossible to beat out the welt before it becomes too dry, it should be rewet before being beat out.

CEMENTING THE INSOLE.

The bottom of the insole should now be brushed with a generous coat of best quality cement. In addition to holding the forepart bottom filler in place, this cement adds to the damp-resisting qualities of the shoe.

FILLING THE BOTTOM.

The forepart filler, having previously been coated with rubber cement on the grain side, may now be inserted. This, however, should not be done until such time as the solvent in the cement has evaporated. Cause for much complaint has been found in the careless manner in which this work is usually done, due, no doubt, to a failure to fully realize its importance. If the forepart bottom is to be properly filled, the filler must be the right size and shape. As each size filler requires a separate die, manufacturers are inclined to provide as few sizes as possible. Even when a sufficient number of sizes are supplied they sometimes become mixed through careless handling, and fillers are put in shoes which are either too small or too large. Sometimes it is found that the schedule of sizes as arranged by the superintendent must be rearranged.

To be satisfactory the forepart filler must easily fill the space between the channels. It must not ride on the inseam, as this would interfere with the laying and stitching of the sole. It must extend far enough into the shank to be lapped by the shank filler.

Much controversy has been had with superintendents who have taken advantage of the clause in the specifications which permits the use of a plastic filler as an adjunct to the solid filler. Experience shows that this method of filling is neither desirable nor feasible and should be discouraged as far as possible.

The shank filler may now be put in, care being used to secure the proper lap required for a safe and even joint with the forepart

filler. The specifications state that shank fillers must be cemented in, no tacks being used. This method of attaching the shank is impracticable, it being found impossible with the use of rubber cement alone to attach the steel shank sufficiently firmly to remain in place until the sole is laid. Shoes have often been found by the sole layer with shanks missing in some cases and in others misplaced. Since the shank filler must extend to the back of the heel cavity, no possible objection can be raised to attaching the shank at the seat with two tacks of suitable length.

The entire filled bottom should now be brushed over with a heavy coat of rubber cement and permitted to dry.

SOLE LAYING.

In this type of shoe, with two heavy soles, some difficulty is found in laying and stitching soles to the welt. Owing to the tension required in stitching them together, the welt seam, being the weaker, gives to the strain, often showing a grinning seam. This may be overcome by thoroughly cementing middle soles and outer soles together, then molding them, and, after coating the surface of both bottom filler and middle sole, laying sole on the machine with suitable pressure. The soles should be in proper temper.

The shoes should be allowed to remain under pressure until the sole is firmly in position. Attention should be given this operation to see that the sole is laid in the proper position. For economical reasons manufacturers seldom provide soles which allow any surplus, therefore, the operator must be careful that the sole is evenly laid as a slip to either side will result in a shortage which will usually make it impossible to maintain the specified extension after the edge is trimmed.

ROUGH ROUNDING.

Shoes are next sent to the rough rounder. This very useful machine shapes the sole and welt and also cuts a groove which serves as a guide in which the Goodyear stitcher lays the stitch. It is fitted with a guard which works against the inseam and governs the width of the extension. It should be set so as to leave an extension of one-sixteenth of an inch wider than that required on the finished shoe, as this amount is the minimum which can be trimmed and yet make a smooth edge. By the use of a pedal attachment an additional guide may be used which leaves the welt wider at the forepart. For the varying widths required by Army shoe specifications an adjustable attachment is provided which enables the operator to trim the welt wide at the outside ball, gradually diminishing the width toward the toe. This must be adjusted according to requirements.

The cutting device is a small chisel, about one-quarter of an inch wide, which makes a number of overlapping cuts as the shoe is fed along. By means of an adjustment the groove may be cut the desired distance from the edge. This operation also serves to more closely unite the welt and sole, which is an advantage to the Goodyear stitcher.

GOODYEAR STITCHING.

A desirable feature of a well-stitched edge is good appearance. This depends on the uniformity of stitches and the depth to which they are sunk into the welt. This is determined by the adjustment of the mechanism which affects the length of the stitch and the tension.

The stitch used is a lock stitch. The thread which shows on the welt passes through a pot of semiliquid wax, the shuttle thread being usually waxed when it is wound on the spool. One or all of three causes may affect the life of this seam, namely, inferior thread, loose tension, or an awl or needle too large. The danger from the first of these is practically eliminated by the frequent laboratory thread tests made at this office. If the tension is loose there will be a play between the parts which soon cuts the thread. The inspector, to guard against this should frequently examine the shoes to see that the lock is drawn a proper distance below the surface.

It is not admitted that the lock stitch is equal to the handmade stitch, since the hole for the former must be large enough for the lock to pass through while the hole for the latter can be smaller than the two threads. It is the boast of old time hand workmen that after completing a well-made hand stitch the loop of each stitch may be cut at the surface of the sole without affecting the usefulness of the seam. This is because the thread, being crowded into such a small hole, grips the fibers of the sole, the principle being much the same as that which enables the wooden peg (which has neither head nor clinch) to hold the parts together. It will be seen from the above that the right-size awl and needle are important. For Goodyear stitching a No. 47 needle used in connection with a No. 43 awl has been found to give satisfaction.

The tension on the wax stripper should be so adjusted as to allow a full flow of wax and insure the thread being thoroughly saturated. A sole stitched on a Goodyear lock-stitch machine under proper conditions may be worn to the thinness of a dime and yet hold the stitches.

A suitable wax and its proper application are important. Threads for sole stitching are made of many strands. If when being drawn through the hole the friction is greater on any particular strand, that strand will stretch and double up, causing an obstruction that often results in a breakage. It usually gives a fuzzy, ragged appearance to the stitch. There is always considerable amount of friction set up when a thread is passed through a small hole, but by using a suitable wax the unequal stretch is prevented, and by binding the strands together loose twisted threads are prevented from splitting on the barb of the needle. Friction is also appreciably lessened, since by binding the fibers together the diameter of the thread is reduced. Wax also lessens the wear on the thread by acting as a lubricant. Suitable wax also helps to make a seam waterproof by cementing the stitch to the leather and in the case of the inseam filling any spaces which might exist. It also helps to preserve the thread from dampness and from sharp grit which undoubtedly often damages it. Wax should possess adhesiveness and have as low a melting point as is consistent with cleanliness in its use. Brittle wax soon leaves the thread; hard wax strains the leather and weakens the thread; wax

with too much oil or grease in its composition will dissolve at too low a melting point, resulting in a splashing of the work and the parts of the machines with which the thread comes in contact.

LEVELING.

The machine most commonly used and preferable for this operation is the United Shoe Machinery Co. automatic leveler. The shoe while still on the last is placed on a spindle and toe rest. A concave roller, attached to an arm having a vibratory motion, is rolled back and forth lengthwise over the sole. In addition there is a rocking motion which adjusts the roller to the convexity of the bottom and the hollow of the shank. It is important that the pressure be applied evenly at all parts of the shoe. If the toe rest is set too low the roller passes over the end of the toe without exerting any pressure, and when the shoe is removed from the machine and viewed sidewise it will be found that a hollow exists on the bottom where the pressure was first applied, leaving the part toward the toe in its original position. The pressure may be adjusted to suit the requirements, and it should be sufficient to conform the bottom to the shape of the last, leaving no depressions or humps either inside or outside.

The roller should extend far enough back to roll down the butts of the welts and ends of the counters. An additional feature of this work is that, with correct pressure adjustment, the Goodyear stitch is rolled down and the diameter of the needle hole is reduced by pressing the leather closer around the stitch.

PULLING LASTS.

The lasts should now be withdrawn. Instances have arisen when operators, for the purpose of saving time, would pull lasts without first removing the blocks. This method results in a severe straining, if not the actual breakage, of the throat; therefore, the inspector should watch this operation for this fault.

HEEL SEAT NAILING.

In many factories the seat nailing is done immediately after sole laying and while the shoe is on the last. When this is done, it is impossible to know just how the nails appear on the inside until sometime later when the lasts are withdrawn. It follows, then, that if the adjustments on the machine have become displaced, many shoes may be improperly nailed before the fault is discovered. When seats are nailed off the last it is possible to examine each shoe immediately after the operation is finished. Furthermore, the ideal clinch is obtained when shoes are nailed off the last as the points are driven against a cup which turns them back into the leather. The objections raised against nailing seats off the last is that there is a liability of the soles becoming displaced before stitching, but the fact that it is successfully done in some factories is evidence that, with the liberal use of good cement, this danger may be avoided. Whichever method is employed, shoes must be carefully watched to insure the nails being placed far enough in to catch the insole and far enough out to catch the counter. A fault in either direction

would be serious and not easily discovered until the shoe is completed.

The nail should be of such length as to properly clinch without leaving any roughness on the inside. It should be borne in mind that the clinch will vary according to weight of the sole, counter, insole, and upper.

SEAT TRIMMING.

When block soles are used, the heel part of the sole may be so unlike the heel of the shoe that it is necessary to shape this part to assist the heeler in putting the heel on correctly. If the seat of the sole projects more on one side than on the other, or if the sole projects unevenly at the seat, it will be difficult for the heeler to maintain a uniform pitch or to avoid the heels inclining to one side. The heel seat is, therefore, trimmed usually on a machine with a rapidly rotating cutting tool. A little practice soon brings skill in this operation, and cause for complaint is seldom found.

REINFORCING NAILS.

The shanks are reinforced with brass nails, five on the inside and four on the outside. Care should be taken that they are properly and smoothly clinched on the insole and slightly countersunk on the outsole. The length of nails most commonly used, and which appears to give the best satisfaction, is $6\frac{1}{2}/8$.

HEEL ATTACHING.

Heels are attached to the garrison shoe by the method known as surface nailing, i. e., the nails are driven through the toppiece. To accomplish this, the toppiece must first be fastened to the heel. There are several machines in use for attaching the heels, the one most commonly used being the McKay. This machine is provided with adjustments for regulating the pitch, i. e., the forward slant of the heel. It also has adjustments for regulating the swing. The pressure may also be adjusted so that the front and back of the heel may receive different amounts of pressure. It has a device which automatically delivers the nails into a plate having the required number of holes which are located in the position corresponding to that in which the nails are to be driven. The shoe is placed on a swinging arm, having a steel heel rest, and placed in a clamp, and by a movement of the treadle a pressure is applied and the nails driven through the parts to be fastened.

Heels should be attached even and straight, and with a pressure so distributed that the entire surface of the toppiece and the center of the sole touch when the shoe is set on an even surface. Nails should be of the proper length to barely show on the insole and leave no roughness.

HEEL SLUGGING.

Slugs should be seven-sixteenths of an inch in length.

If it is found that this operation causes the heel to check, it would be well to see if the awl is making a hole deep enough for the length of the slugs. Checking heels at this operation may be over-

come by so adjusting the length of the slugs that the point comes in the middle of the lift.

Slugs should be at proper distances from the edge of the toppiece and should extend close to the breast of the heel on either side. There should be one outside row all around and an inside row three-quarters around. They should be evenly spaced so as not to present a crowded appearance. Seven to the inch gives this result. The slugs used are 125 steel slugging wire.

The slugs are simply a length of wire cut from a coil, no attempt being made to form either a head or a point. The machine has adjustments for varying the length of nail and for varying the distance between them. The slugs should never be set so low that they can not be scoured without removing the grain from the toppiece.

HEEL SHAVING.

Heels are shaved on a machine the principle of which is similar to that of a lathe, the heel being placed in contact with the revolving knives.

The principle of the knives differs somewhat, those on the "Ultima" being molded to the reverse shape desired for the heel, and sometimes termed "shell cutters," are sharpened from the inside, and the shape of the heel is not much affected by indifferent grinding. In the McKay machine the knives are flat pieces of steel sharpened from the outside, being ground to a template, and careless grinding may result in changing the shape.

The shape of the bevel should be governed by the nature of the material being cut, a long, hollow bevel giving the best results on soft, mellow leather, while for hard, brittle material the short, thick bevel is better.

The material used for pasting the heels is sometimes of such a nature as to quickly dull the edges of the knives. The knives used in the Ultima are ground without a guide, and unless a similar amount is taken off each blade there will be an unpleasant bumping when the heel is being trimmed. This is avoided in the McKay, since the cutters are ground to a template and even amounts are removed from both blades. In the interests of economy the knives should be ground as soon as they become dull. It will then not take long and the heels will be left with a smooth surface, reducing the scourer's labor to a minimum.

Heels should be well trimmed at the corners near the breast. It can be done on the shaving machines without danger of damaging the upper, whereas there is no guard on the scouring machine to prevent this. There is a small guard for the toppiece to fit against, and this may be adjusted so that the knives trim in close to the top, or vice versa. There is also a guard which enables the seat to be trimmed close or left full. The McKay machine is provided with rand cutters, which work in conjunction with the heel cutters. This does satisfactory work on low, straight heels. In the Ultima a separate rand cutter is provided, which shapes that part of the sole which comes next to the upper. When correctly used it is of great assistance to the scourer. A well lasted heel seat is the basis of good heel shaving as the counterguard follows around it. If

the sides differ in shape or there are humps in it, the result will show in the heel.

The speed of the machine is important. If this is too low there will be a pronounced tapping sound. If it is too high it may cause the whole machine to vibrate. The result in the heel would be, in this case, to leave a surface covered with a series of small ridges, usually described as "shivers." Where two knives are used 6,000 revolutions are generally considered necessary.

When the heel is shaved it should present a smooth, square surface. The knives should not cut too deeply into the top piece, as the bead remaining must be scoured off, thus reducing its size. The rand should be trimmed full and free from flesh.

HEEL SCOURING.

Nothing less than the best possible work should be accepted from the shavers, because although indifferent shaving may be corrected by the scourer he can hardly be expected to produce good results if he is required to do the work which properly belongs to the shaver.

The object of heel scouring is to produce a smooth, hard heel, suitable either for padding and brushing or burnishing with a hot iron. The principle of all heel scouring machines is the same. The heel is held against a revolving wheel, covered with a thick felt, over which is temporarily placed an abrasive. The wheel is broad enough so that the full height of the heel can be scoured at once. The shape of the rolls should follow as closely as possible that of the cutter so that the retaining of the shape of the heel will depend more on the machine and less on the skill of the operator.

Two grades of abrasive are used, a coarse for the first scouring and a finer for the second. With the first scouring the mark of the cutters should be removed and any unevenness or humps should be shaped. In a like manner the second scouring should remove the mark of the coarse scouring and leave the surface free from scratches. The materials which are used for abrasives vary in hardness and fineness. Such materials as sand, quartz, flint, emery, and carborundum have been used. Of those mentioned carborundum is far the best. The improvements made in the producing of abrasives has greatly lessened the labor of the scourer.

It is more difficult to shape heels by scouring when damp, as in this condition the coarse abrasive will only make deep scratches while fine abrasive would only glaze the heel. The reason for this is plain when it is understood that the principle of the operation is not a cut but a knock which chips or tears off fine particles. Also the fact should be borne in mind that leather swells and shrinks when wet and dry, consequently a heel scoured when wet will, when it dries, crack and check. It is a mistake to use too coarse an abrasive on the first scouring as it increases the difficulty of removing the scratches with the fine wheel. In maintaining the shape of the heel best results are obtained by starting the scouring at one corner and going around the heel to the opposite corner with a continuous swing. When the heel is scoured in sections, a flat place is apt to result where the heel is taken off the wheel and a fresh start made.

Scouring is an operation which requires skill and judgment, as the operator has neither guard to prevent injuring the upper nor a guide

to indicate when a sufficient amount has been removed from any particular part of the heel. A careful operator will maintain his rolls in correct shape and see that they run true. This greatly aids in maintaining the shape of the heel and securing a smooth surface. No more should be scoured off the top than is necessary to obtain smoothness.

BREASTING.

Unless the heel has previously been breasted in the sole-leather room, this operation must now be performed on the shoe. It is usually done with a knife or gouge having the shape required, the pressure used to force it through the heel being applied either by foot or by power. The operator should grind the knife in such a manner that it will conform to the convex shape of the sole in the shank. He should be careful that the guard is properly set and that the knife does not sink too deeply into the sole. There is danger here of seriously damaging the shoe.

EDGE TRIMMING.

The object of finishing the edge is to improve its appearance and, by compression, to give it a permanent mold. It also increases the life of the sole by making the edge better able to resist water. The compressing and molding are done by means of the edge-setting iron, but, to facilitate this, it is necessary that the edge undergo some preparation, therefore it must be trimmed to the shape desired. This is done with a tool mounted on a shaft and made to revolve at a high speed. The edge of the sole is then shaped by being drawn along while held in contact with the revolving cutter.

The cutter is made from one solid piece and has 16 blades. When sharpening the cutter two things are important—if the cutter is viewed sidewise it will be seen that the cutting edge of each blade is higher than the back of the blade, otherwise it would not cut; if more is ground off one blade than another, they will not be in a perfect circle, and good work can not be done on account of the bumping which results. The careful workman will immediately remedy this fault. To ascertain which of the blades is out of a true circle a piece of emery is held against the revolving cutter. When the cutter is examined it will be found that the edge of the blade which protrudes is nicked to a depth corresponding to the extent of its excessive length. The blade may then be ground until the nick is removed therefrom. The other important detail is the angle of the cutting edge. The angle as it is in a new cutter is scientifically correct, and when resharpening the cutter this angle should be maintained. To insure this the post on which the cutter is held when being ground should be moved along as the blades wear away.

Fitted against the inside lip of the cutter is a thin circular disk called a shield which prevents cutting the upper. Shields are made in different sizes and care should be used in selecting the proper size. The bed of the cutter is measured in forty-eighths of an inch and the size of the cutter should correspond to the combined irons of the bottom stock. The edge trimmer should correct any such irregularities of extension as are left by the rounder and by improper sole

laying, but in doing so he should never reduce the extension below the measurements specified for this shoe.

The successful trimming of the edge depends as much on the proper condition of the leather as upon the keenness of the cutter edge. When a hand knife is used by hand the action is similar to that of a very fine saw, whereas that of the edge cutter resembles that of a chisel. If the leather is hard, dry, and firm, the resistance to the blow will be such that the result will be in the nature of a tear and the edge will be coarse. If the leather is of a soft, mellow tannage, resistance will not be so great and the edge will be comparatively smooth. It is, therefore, advisable to counteract the hardness by wetting the edge. After wetting, the edge should be allowed to stand until the fibers absorb the moisture. Judgment must be used in this, as it is plain that if the leather is too wet there will be no resistance to the blow of the blade and the fibers will simply be knocked down by the cutter.

The inspector should see that the proper-size cutter is used at all times. The edge must be smooth and even, with the proper extension at all points. It must be trimmed square from heel to heel and the joints at the heel left even without any humps or shoulders.

EDGE SETTING.

For the purpose of further improving the appearance the edge must be made more solid and more waterproof, for, as left by the trimmer, the edge is too soft and open and will quickly absorb water and lose its shape. To overcome this the edge is compressed and burnished or set by the edge-setting tool. To insure best results the edge iron must closely follow the shape and size of the trimming cutter. It is moved over the edge with an oscillating motion, describing a part of a circle as it travels backward and forward, considerable pressure being used, thus compressing the face of the edge. The iron should be the shape of the trimmed edge, for if it is too convex only the center of the bed will be compressed, while if it is too flat only the margins will be compressed, the center being untouched.

The iron has two flanges, or lips, one to fit on either side of the sole. These are important, for the tendency of the bed of the edge is to give way before the pressure and squat out. This is prevented by the lips, since, being unable to expand, the leather is compressed, thus bringing the fibers into a smaller space.

To compress an edge satisfactorily it is necessary that the bed of the iron, as well as the angle of the inside and outside lips, agree with the corresponding parts of the trimming cutter. The impossibility of compressing leather by rolling when dry has already been shown, and this is equally true of edge setting. To successfully set an edge, therefore, it should be in suitable temper. If the leather is too wet, it would not stand against the pressure and the edge would be pushed out of shape. Pressure is absolutely necessary since without it no compression is possible. It should be uniform, otherwise the compression will not be uniform. The amount of pressure is usually governed by the nature of the leather and by the skill and strength of the workman. It is advisable, however, to use as much

pressure as possible without pushing the edge out of shape. There is an advantage in this, as the greater the pressure used the fewer number of times the heated tool will have to pass over the edge.

Heat is of great assistance in setting the edge, as however well an edge may be molded by a cold iron it quickly loses its shape when wet, while edges set with a hot iron retain their shape after prolonged soaking. This refers only to such edges as have been set when properly mulled. Since it is possible, however, to scorch the leather, the heat must be regulated. It is an accepted principle of edge setting that the more moisture leather has absorbed the less heat should be used. Some workmen using more pressure and skill may use a hotter iron than the slower workman who must pass the iron over the same place many times. The inspector must insist that the proper size iron is used at all times, and should see that the correct amount of pressure has been applied to uniformly compress and mold the edge to a firm, hard surface without pushing it out of shape, and that the stain used is of proper color and substance.

HEEL FINISHING.

There are two methods in use for finishing heels, one requiring the use of a heated tool, such as the "Expedite," the other using a revolving pad, the heat being supplied by the friction of the pad on the heel.

The principal feature of the "Expedite" is a wheel comprising a series of plates, each plate rounded on its face and mounted on a separate spring to enable it to adapt itself to the shape of the heel. The plates are heated with gas. A film of wax is evenly spread on the wheel by a brush which automatically moves across its face. This wax is transferred to the heel in the required amounts when the latter is held against the revolving wheel. The advantage of this method over the friction method lies in the fact that the wax and stain may be better worked into the leather where heat is used, also, since heat is of assistance in compressing leather which is in temper the surface is made harder and is better filled and more lasting.

After being waxed by the hot iron the heel is then padded and any lumps or excess of wax are removed and the surface made smooth. It is then polished by being held lightly against a bristle brush. By the use of the "Expedite" a harder wax may be used. This adds to the permanency of the finish. Soft, greasy waxes show finger marks and the luster soon fades.

By the friction method the pad and brush alone are used. The pads used are wheels made of felt, leather, rags, or bristles. They are, in addition, covered with a drill which may be removed when worn. The method of padding is to wax the pad by holding against it a cake of wax. The heel is next applied to the pad and its surface soon becomes coated.

The heel should be covered with a very thin film of wax. More than this is a waste, as the excess must afterwards be removed. Wax must be spread evenly, leaving no lumps.

The heel is next held against a brush wheel which gives it the polish. The amount of friction set up will depend upon the elasticity of the pad used and the speed of the shaft. When the speed is excessive the operator can not use sufficient pressure to adapt the pad

to the shape of the heel without setting up so much friction that the wax and stain is removed from the heel, giving the surface the appearance usually described as "starved," or the wax may be burned by the heat that is generated.

When a heel is padded it must afterwards be polished by removing the excess of wax. This is usually done on a brush fixed on the same shaft as the pad. One of the most common faults of padding is the use of an excess of wax. When this happens to be a very hard wax it will be difficult to soften and remove it with a brush, consequently such heels do not look as smooth as when they left the scourer.

The success of the heel-finishing operation depends in a large measure on the wax used. The wax which is considered to have the best polishing qualities is Canauba. This wax is very hard and its good qualities are sometimes lessened when it is mixed with a softer wax of the cheaper grades.

SCOURING THE TOPPIECE.

The toppiece should now be scoured a sufficient amount to smooth down the rough edges of the slugs, care being taken that no more of the grain is removed than is absolutely necessary.

CLEANING AND DRESSING.

It is very evident that in designing the Army shoe much thought was given to the question of appearance, and as the value of the shoe is often judged by its appearance the inspector should, throughout the entire process of construction, ever have this feature in mind.

This office has expended much effort among the leather manufacturers in endeavoring to have delivered to contractors leather which not only has all the requirements of quality, but, in addition, will possess a finish which will be durable, offering a resistance to wear and water, and capable of taking a high polish.

Shipments of shoes received for final inspection on recent contracts plainly indicated by the slovenly manner in which the uppers were cleaned and the carelessness in dressing that contractors fail to attach sufficient importance to the matter of appearance. This condition was general, and although a warning was sufficient to bring about immediate improvement in most cases, in others it was found necessary to take more effective steps before results were obtained.

The construction of the shoe now being complete, it should be carefully treed, cleaned, and dressed to remove the dirt, wax, and stain accumulated in the passage through the works, and to give to it the bright, smart appearance of a dress shoe. The shoes should be placed on a tree foot and carefully cleaned by the dry method, no acid or other chemicals being used. It is not permitted to partially clean the shoes and cover up the remainder with a coat of pigment.

The shoes should next be dressed with a colorless dressing and polished with a cloth. The bottoms of the soles should be cleaned without the use of acid, and the edges and heels brushed.

During the passage of the shoe through the works it is inevitable that the uppers will receive scars, scratches, nicks, and cuts more or less serious in their nature. In all factories a department is maintained wherein these damages are repaired or camouflaged, as the case may be. The inspector should give attention to this department and prevent the repairing of any damage which is of such a nature that the wear of the upper will be affected thereby. Harmless grain scars may be repaired, but it must be done in a thoroughly workmanlike manner and to the satisfaction of the inspector.

Before packing, the contractor should have each shoe carefully examined on the inside for tacks, buckled insoles, wrinkled heel seams, missing eyelets, and torn throats, as any of these faults will cause the rejection of the shoes by the final inspector.

Chapter XII.

FINAL INSPECTION.

Notwithstanding the fact that every effort is made by the inspectors stationed at the factory wherein Army shoes are being made to attain the highest possible grade of product, it should be borne in mind that the scope of their activities must necessarily have limits which are governed, in a measure, by conditions existing at each factory, such as the layout of the factory, the equipment, the nature of the cooperation offered by the factory personnel, and the number of shoes being made. In view of the number of operations required to construct a shoe, it is apparently impossible to inspect every operation on every shoe without maintaining a large unwieldy force, especialy where shoes are being made in large quantities. It is the practice of factory inspectors to devote the greatest attention to the character of the material being used and to those vital operations upon which the life of the shoe depends and which, in the finished product, are hidden from view. For this reason it is considered necessary before the shoes are accepted by the Government to submit them to a final inspection for the purpose of discovering any existing defects which may have escaped the vigilance of the factory inspector. This inspection is made at the supply base by competent and skillful shoemakers and under ideal conditions, every facility being offered for the rapid and efficient performance of the same. When it is stated that in some instances the rejections at final inspection total as high as 10 per cent, the importance of the work may be appreciated.

The system of final inspection as installed at this zone is the result of careful thought and knowledge gained from actual experience. Every possible precaution is taken not only to prevent any shoes which show inferior material or defective workmanship being accepted by the Government, but also by means of a very efficient checking and recording system to guard against any loss either through errors in invoices or in goods actually received. Furthermore, it is possible by this same system to trace any single pair of shoes of an invoice of many thousand pairs or, if desired, the name of the individual who accepted or rejected them. A careful record is kept of the number of pairs of shoes inspected each day by each individual, also the total number of pairs accepted and the number rejected, together with the reasons for such rejections. If during the course of final inspection a tendency toward a lower standard in any detail becomes apparent, though not sufficient to warrant rejection, this fact is immediately communicated to the manufacturer of the shoes in question, which usually results in a noticeable improvement, otherwise more effective measures are taken. In this manner

it is possible to prevent any unreasonable deviation from the high standard which it is aimed to maintain. If desired it is possible by simply referring to the records on file at this office to ascertain at any time the general character of the product furnished in the past by any manufacturer, the number of shoes rejected on any given invoice, as well as on any contract, and also the efforts made to keep his product at the required standard. This information is available in connection with the awarding of future contracts.

It may be safely asserted that the great care taken to safeguard the Government's interests in this department is fully warranted by the results, and what at first glance might seem a somewhat elaborate system becomes simple in its operation and is carried out by a surprisingly small number of inspectors, made possible by the adopting of ideal conditions such as a large, well-ventilated workroom; perfect light; large, roomy benches; an electrically operated belt conveyor; and a power strapping and nailing machine.

The final inspection department is separated into two distinct forces, inspection and clerical, each equally dependent on the other.

INSPECTION.

This force is under the supervision of the inspector in charge of final inspection, who is in constant touch with his men, advising them whenever a question arises as to the quality of material or the seriousness of any damage in the construction of shoes.

It is essential that his assistants shall be skilled in all branches of the shoe industry, from the cutting and sorting rooms to the treeing and packing, and be able at all times to detect any defect in material or construction.

The inspector is required to keep an accurate record of sizes, widths, and number of pairs of shoes received, accepted, and rejected by him during the day, to note the name and location of the contractor, the contract to which they must be applied, and make a detailed report of the same.

Previous to the installation of the present system of final inspection, it had been the custom of manufacturers to ship shoes to this base in fiber or wood containers of various shapes and sizes. This practice, with its resultant confusion and delay, was changed by the adoption of a standard incorporated in the specifications which required two sizes of wood packing cases and two sizes of cartons for the packing and shipping of each type of Army shoe.

Before assuming his duties with this branch the final inspector must be thoroughly informed regarding the nature of the work which he is to perform and also should have an intelligent understanding of the importance of the responsibilities placed upon him. He is instructed to carefully examine all shoes and reject any that do not comply with the requirements of the specifications either in the quality of workmanship or material. It is impressed upon him that no excuse will be considered from any inspector who accepts a shoe below the standard required. Having been properly instructed, he is assigned to work on an inspection table with an experienced man, where he receives a further course of instruction under the

direction of the inspector in charge, and after proving himself competent he is then assigned to a separate table and handed a copy of the following rules:

INSTRUCTIONS—FINAL INSPECTORS.

1. Use two work sheets, original and duplicate.
2. Write plainly contractor's name, city or town, contract number and specification number on top of sheet, also full name on bottom of each sheet, these entries to be made on spaces designated for same.
3. Take down each case number with size and width, on both original and duplicate sheets.
4. See that shoes correspond in every detail with stenciling on the packing case.
5. Any errors in stenciling should be brought to the attention of the inspector in charge immediately.
6. Total sheets after invoices are completed and turn same over to clerk after final inspection is accomplished.
7. Report to clerk every night the number of shoes inspected, the number of shoes accepted and rejected that day.
8. All work sheets must be accurate in every detail, with particular attention given to contract numbers, sizes, and widths of shoes, as an error in these reports would often be the cause of extra expense to the Government.
9. Shoes are to be taken from cartons and examined in respect to the following:

(*a*) Be sure that shoes taken from carton are mates and of the same size and width as stenciled on outside of case, and that case contains exact number called for in that particular case.
(*b*) See that inside quarter markings are correct.
(c) See that outer sole markings are correct.
(*d*) Examine heel seat, backstay, and pull strap.
(*e*) Examine outside edge of shoes from heel seat to toe.
(f) Examine toe, turn shoe over and examine breast of heel and bottom stock.
(*g*) Examine Goodyear stitching, heel nails, and slugging.
(*h*) Examine inside edges of shoes from toe to heel seat.
(*i*) Put hands inside shoes, feel for tacks, buckled insoles, wrinkled and loose linings.
(*j*) Bend quarters back, test tongue, and examine for broken throats.
(*k*) Examine stitching and fitting at all times.
(*l*) Stamp inspector's name on left quarter of each shoe.

10. Shoes are to be rejected for the following reasons:
(*a*) Inferior upper leather, bottom stock, or tongue stock.
(*b*) Inferior fitting.
(*c*) Buckled inner soles.
(*d*) Wrinkled or loose linings.
(*e*) Tacks in inner soles and heel seats.
(*f*) Broken throats.
(*g*) Mismated or not match mated tips, tops, and vamps.
(*h*) Eyelets missing or not properly spaced.
(*i*) Ears crooked, or ripped at the throat.
(*j*) Inner soles broken at the heel seats.
(*k*) Loose heels and heel seats.
(*l*) Low, high, or soft counters.
(*m*) Grinning seams.
(*n*) Short or narrow inner, outer, and middle soles.
(*o*) Extension of edges.
(*p*) Improper breasting of heels.
(*q*) Heels not up to the required height.

11. The general construction of shoes and the quality of stock should be noted at all times.
12. All defective places on rejected shoes should be chalked showing the cause of the rejection.
13. The inspector shall apply his stamp on the inside of the left quarter of all accepted shoes.

REJECTED SHOES.

Shoes after being rejected are sent by the inspector to the reject shoe department, where they are once more examined by the inspector in charge, who notes the extent of the damage or quality of material and then decides whether or not they can be repaired to the satisfaction of the department.

If he so decides, a tag stating the cause of rejection and giving permission to repair the same is attached to the shoe, which must still bear the original tag when returned. If, however, in the opinion of the inspector in charge the shoe can not be repaired in a satisfactory manner, the trefoil stamp is placed upon it, denoting final rejection.

At stated intervals the shoe branch forwards a release for the number of pairs of rejected shoes held by the reject shoe department. On receipt of this release these shoes are packed and turned over to the shipping branch, to be returned to the contractors.

The release, stating the number of pairs and the contract to which they apply, is indorsed and returned, a copy being retained by the reject department for future reference.

EQUIPMENT.

The equipment for inspection in this department and the facilities for handling the shoes are most complete. Each inspector has a laborer to assist in opening the wooden cases and stamping all accepted shoes.

One packer will handle the daily output of two inspectors. Each inspector has a separate table upon which the shoes are placed for inspection after being taken from the wooden cases.

The shoes are rigidly inspected in single pairs, and if accepted are passed to the assistant, who applies the acceptance stamp, repacks the shoes in the cartons, and then passes them to the bench of the packer. The packer must repair any damage to the wooden cases, repack the shoes, tack on the covers, and after stenciling his name and the date of the operation he places the case on a power conveyor, which carries it to a wire-strapping machine.

Here the case is received by two men and, with the aid of the machine, a wire band is securely fastened around the cover and bottom at each end. It is then passed on by conveyor to a machine where the cover and strapping are firmly attached to the case, after which it is turned over to the Warehousing Division.

CLERICAL FORCE.

The duties of this force begin when shoes arrive from the different contractors. Before any work is distributed to the inspectors all cases are checked on a receiving sheet, stating the box numbers, number of pairs in each box, the sizes and widths, and the contract on which they apply.

This receiving sheet is checked against the shipping memorandum received from the contractor, and if any errors, such as wrong contract numbers, cases missing in the invoice, or cases improperly stenciled, are discovered, the contractor is immediately notified and the error corrected before the shoes are inspected.

After the inspection of each invoice is completed the inspector turns his work sheet over to a clerk whose duties are to check up said sheets and make an analysis of each invoice on cards provided for that purpose. A copy of said analysis card is forwarded to Distribution Division, and all invoices forwarded from the Finance Branch are compared therewith.

ADVISABILITY OF DEPOT INSPECTION.

The question of whether or not the actual final inspection should be made at the factory of the contractor or at some other place outside and beyond the control of the contractor has been the subject of much discussion. Instances have arisen from time to time which have confirmed the opinion which the writer has held for a long time—that the final inspection of shoes at the factories of the contractors where made is injudicious from more than one point of view.

In the first place, it is thought that depot inspection tends to remove the inspector from any conscious or unconsicious factory influence with which he might have to contend, and which is capable of influencing even the most careful and honest men to some extent, thus causing a falling off in the quality of the finished product.

In the Government receiving depot an inspector works perhaps on goods from one factory in the morning and on those from another factory in the afternoon, in the course of a week having an opportunity to handle the product of every factory shipping to the Army Base. Not only is the inspector under this arrangement not granted an opportunity for prejudice favorable or otherwise toward any contractor, but the contractor is removed from the danger of the impression that the inspection at any one factory is more stringent than at some other. The mental advantage upon the inspector, too, is apparent. The products of each factory differ in some respect from those of others, some being especially commendable or perhaps especially worthy of unfavorable criticism in one respect, some in another. As a result of the comparisons made between these the inspector unconsciously, but none the less effectively, standardizes his work.

A survey of the records and reports from some factories under factory inspection has shown as high as 80,000 pairs of shoes with no rejections, an acme of perfection in shoemaking which the Quartermaster General had not hoped to see reached. Furthermore, before adoption of the depot form of final inspection a series of tests in the nature of reinspection was made, the results clearly demonstrating that the quality of shoes accepted under factory inspection was much inferior to those accepted under depot inspection.

Chapter XIII.

PRODUCTION.

RATE OF PRODUCTION.

The first factor which influences the rate of production is the tariff. A standard tariff should be uninterruptedly maintained throughout the contract. As has been stated, any change of tariff affecting contracts in the process of production results in confusion and in varying periods of suspension. Since the latter condition, as well as the additional supply of patterns, dies, and possibly material, is a source of expense to the contractor, it has a tendency to cause resentment on his part and to disturb the customary harmony which should prevail between the Government and the contractor. With such an atmosphere it is impossible to obtain 100 per cent efficiency of production, and a period of four to six weeks is required for the restoration of normal conditions. Under no circumstances should the tariff on contracts in the process of production be altered since it not only involves the needless expenditure of an adjustment with the contractor, but causes a delay in deliveries which is not afterwards overcome.

The proper method of meeting a shortage on any given sizes and widths is by the issuance of additional contracts, leaving existing contracts undisturbed. This avoids the period of absolute suspension of operations, resulting in expense to contractor and Government alike, and causing that attitude of resentment on the part of the contractor which results in less efficient production for some time following. It is evident from past experiences that the shoes manufactured under the former tariff will eventually be used and thus time will be saved on some future order.

The second factor which influences the production is the amount of material available for constructing the shoes called for by the specifications. It is again stated that the importance from a production standpoint of a sufficient notice of anticipated contracts to the producers of leather and shoe findings can not be overemphasized. Occasions have arisen where material called for in specifications was unobtainable in the market, necessitating a change of specifications. Any shortage of material retards production, whether at the beginning of the contract or after operations are well along.

The third factor which influences production is the supply of lasts. An adequate supply of lasts should be available at the contractor's factory sufficiently early to assure no delay from this source either in commencing operations or when striving to meet the maximum daily production. When the contracts are awarded a résumé must be immediately taken of the number of lasts by sizes and widths

in the zone, the number required for the newly awarded contracts, and the number available for meeting the requirements. If the number available is insufficient, arrangements should be made for transfer from other zones. If this is impractical, purchase must be made from last manufacturers. Whether the supply is to be augmented by transfer or by purchase, 30 days must be allowed for delivery.

The fourth factor influencing the rate of production is the factory capacity of the contractor. Probably the greatest difficulty with which the Production Branch has to contend is the case of the contractor whose factory facilities are absolutely inadequate for meeting production as specified in the terms of the contract, or where contracts have been awarded to manufacturers already hopelessly delinquent on previous contracts. During the emergency there were very few instances of deliveries being made on schedule, and in some cases it was only through the most strenuous efforts on the part of the Production Branch that the deliveries as made were obtained.

Aside from the inadequacy of factory facilities, it is admitted that the shortage of labor was great, but it is felt that in many instances commercial work was allowed to interfere with Government work. In case of a similiar emergency the writer would suggest that steps be taken to give Government work preference over civilian. In order to accomplish this it is first absolutelv necessary that the Government have at hand an estimate of the daily capacity of the contractor; second, that the quantity of outstanding civilian orders be known; and third, that the Government be kept informed of the acceptance of any additional civilian orders. This consideration of the capacity of the contractor will do away with the possibility of unjust criticism of the Production Branch, which is unable to compel a contractor to produce in excess of his capacity.

Since the signing of the armistice the matter of delinquencies has not improved to the extent hoped for, but this in a way has been due to the general atmosphere of unrest and unsettled market conditions. Manufacturers must be made to understand that the terms of a contract must be lived up to, and unless deliveries as specified are made at the time designated the requisitions of the Army can not be met.

Upon the efficiency of the inspection organization the Government must depend for the quality of the delivered shoes as well as for information as to production statistics. It is important, therefore, that this consist of a group of well-trained men working under competent supervision. In order to render the position of inspector sufficiently attractive to be filled by the type of man desired it is necessary that the position should be an all-year one, as the salary allowed is insufficient to permit the inspector to loaf any material part of the year. This could be accomplished if the number of shoes to be made each year was distributed over the 12 months in nearly equal allotments.

Finally, it may be said that it is important that the daily construction and delivery of shoes be in proportion to the size and width distribution of the tariff. From the simple fact that shoes are ordered in accordance with a standard tariff and certain deliveries specified, it is a proper assumption that deliveries should be made in proportion to the sizes and widths specified in the tariff, otherwise

a contractor might make all the small sizes and widths first or last, resulting in drastic shortages for meeting requisitions.

During the emergency this situation arose many times, and finally a system was devised for its correction which consisted of submitting to certain contractors a master chart showing the number of shoes by sizes desired put in on factory sheets each day, and six charts (one for each width) showing the number by size on each width, sufficient lasts only being issued to insure the work being put in as requested. After this system had been installed for approximately five months, it was found that difficulties from this cause had been practically eliminated.

This system is worked out on a 100,000 basis, it being a simple matter to apply it to any smaller or larger contract. In case of a 50,000 contract the quantities are divided in two. It should be borne in mind that all work is put in on a basis of 24 pairs of one size and width to a case, consequently to equalize the work it might be necessary to make 24 pairs of a given unit every second, third, or fourth day in order to insure deliveries somewhere near in proportion to the standard tariff.

Since the system formerly employed in recording deliveries of shoes against the proper contract according to sizes and widths was inadequate, a system was devised which would not only provide for the recording of each pair of shoes by size and width against the proper contract, but which would show the date of anticipated deliveries. The recording of both the above facts is of primary importance not only for the purpose of having a knowledge by sizes and widths of the shoes delivered but as a means of estimating the quantity which is due at any particular date.

In preparing a set of sheets for recording the deliveries of shoes, the following has been the method made use of, and found most effective, by the Boston zone:

First. When a contract consists of more than one award a set of delivery sheets must be made out for each.

Second: Deliveries are posted according to contract price.

Third: A separate sheet is allowed for each width and is divided off lengthwise into the run of sizes called for in the tariff, while down the side of the sheet appear the dates by weeks of the deliveries to be made.

Fourth: Red figures show the shoes due at the different periods and black figures the deliveries made. Under these circumstances it is possible to obtain in a very short space of time the number of shoes due on all contracts on any size and width, any overdelivery is at once apparent, and, when recorded, should be preceded by the symbol (—).

OVERPAYMENT.

The contract price for each size and width of shoes on the same award is uniform, with the understanding that shoes are to be apportioned according to the tariff provided. If the average size delivered, however, is smaller than the average size which should have been delivered the Government has suffered a loss, and the contractor is obliged to refund his overpayment.

Upon completion of a contract a résumé of deliveries per size and width is compiled, and from this the average size and width of the entire delivery is computed. In figuring the average size due or delivered on a contract the number of pairs on each size is multiplied

by that size, and the results thus obtained are added. This grand total is then divided by the total contract delivery.

In the case of an overpayment the average size delivered, subtracted from the average size due and divided by the average size due, is multiplied by the price per pair, giving the overpayment on each pair delivered. This overpayment, multiplied by the total deliveries, gives the total overpayment on the contract.

FORMULA FOR ESTIMATING OVERPAYMENT ON SIZES.

1. Multiply the deliveries actually made on each size by that size.
2. The sum of these products = x.
3. x divided by the total actual deliveries = the average size actually delivered.
4. The average size due less the average size delivered = "the difference."
5. "The difference" divided by the average size due = the percentage of overpayment.
6. The percentage of overpayment multiplied by the contract price per pair = the overpayment per pair.
7. The overpayment per pair multiplied by the total actual contract delivery = the total overpayment on sizes.

N. B.—In case of the average size due being less than the average size delivered the former is subtracted, showing an underpayment.

The overpayment on the average width is computed in a similar manner excepting that each width must be represented by a number. If the tariff runs from A to EE, the following scale should be used: A 1, B 2, C 3, D 4, E 5, EE 6.

FORMULA FOR ESTIMATING OVERPAYMENT ON WIDTHS.

1. Multiply the total actual deliveries on each width by the number representing that width. (Deliveries on A width should be multiplied by 1, on B width by 2, and so on.)
2. The sum of the products thus obtained divided by the total contract delivery=the average width actually delivered.
3. The average width due less the average width actually delivered="The difference."
4. "The difference" divided by the average width due=the percentage of overpayment.
5. The percentage of overpayment multiplied by the contract price per pair= the overpayment per pair.
6. The overpayment per pair multiplied by the total actual contract delivery=the total overpayment on widths.

N. B.—In case of the average width due being less than the average width delivered the former is subtracted, showing an underpayment.

DELINQUENCIES.

In recording the delivery of shoes against the time alloted it has been found that the best results are obtained by using the lasting reports submitted by the Government inspector each day. This report is made up by the inspector in charge at the contractor's plant and is based on the actual number of shoes lasted each day. As the average length of time consumed in completing and delivering Army shoes after the lasting operation is seven days, it is possible to ascertain what the delivery on each contract will be one week in advance. Should circumstances warrant it, the lasting records could be rendered in detail to show the number of shoes lasted per size and width, but it is believed that this is unnecessary at the present time.

Government shoe contracts stipulate that deliveries shall be completed on a certain date, and contain the proviso that the contractor shall reimburse the Government for any expense caused by delinquent deliveries for which he is responsible. In several instances the Government has found it necessary to hold up production, in which case it would be unjust that the contractor should be fined for the delay incurred. In many more instances, however, the contractor has been found at fault in postponing the beginning of operations through failure to provide for material required.

In requesting additional time for the delivery of shoes the contractor must state in detail the reason for such request, and furnish any data bearing upon the matter.

The expense incurred by the Government through delinquent deliveries consists of the salary and per diem expense of maintaining each inspector at the factory beyond the expiration of the final delivery date. If a manufacturer is awarded contracts the delivery dates of which follow each other in close succession he can not incur a delinquency expense, since the inspection force must be retained at his factory to care for the future contracts.

In figuring a delinquency charge it must be assumed that the inspection should be completed in every department of the factory previous to the completion date. With this in mind it is a simple matter to compute the number of days between the date that the inspectors in the several departments of a factory should have completed their duties and the date when they were recalled to the zone supply office.

Chapter XIV.

MANUFACTURE OF UNITED STATES ARMY MUNSON SHOE LASTS.

One of the most important factors governing the manufacture of shoes is the question of shoe lasts. At the time of the declaration of war the Government owned approximately 75,000 pairs of Munson shoe lasts. This supply, however, being entirely inadequate for manufacturing the several millions of pairs of shoes contemplated, large contracts for the manufacture of lasts were awarded to various last makers throughout the country.

MODELS.

Previous to the awarding of any large contracts the Government furnished last manufacturers an 8 C Army last model, sometimes referred to as the "Old St. Louis Model." When new lasts were required, this model was sent to the firms to whom the contracts for the manufacture of lasts had been awarded, and all sizes and widths were graded from this one model. Accompanying said model was a specification sheet covering the measurements and construction of lasts. Various manufacturers made copies of this model from time to time, until eventually several models of apparently different types were in common use, varying in measurements, construction, and appearance to the extent that further use of the same could not be allowed if the finished shoes were to be uniform in appearance and measurement.

On or about June 1, 1917, it was deemed advisable to abolish the use of these plural models by adopting one standard model. Realizing the prior trouble experienced from grading all sizes and widths from one size and width, and desiring to prevent any variation from the standard adopted, it was decided to make a model for each respective width on size 8. These models were made by the United Last Co., and approved and accepted by the War Department. This model was called the new 1154. The new model was made more woody overhead throughout and on the big toe joint just under the inside ball. The stick length remained the same as the old model, five-eighths extension on all sizes. A slight change was also made in the sole pattern.

Having adopted a new model, all the old models should have been called in and destroyed, but this, however, was not immediately done, practically all the last manufacturers retaining their old models, with the result that when new contracts were given out several manufacturers, to save the time and expense of drafting and grading new models, continued to use the old models, ignoring

the new ones, and thousands of pairs of lasts continued to be made on the old models.

This state of affairs, caused solely by the association of so many foreign models, all of which were descendants of the old model, became of a serious nature. After carefully considering the entire situation and studying conditions as they actually existed it became apparent that some decisive and immediate action would have to be taken, since if existing conditions were allowed to continue and shoes were still made on mismated lasts trouble would be sure to follow, it being apparent that there were two distinct models with many deviations from the original and varying from a half to a size and one-half, with styles noticeably different, all working together. The greatest variation in measurements in most instances was due to the fact that lasts made on the old model were slim and in some cases had shrunk as much as three-fourths of a size. If a manufacturer, in making and grading his turning model, should get the waist point down from the true waist point, a slight slimness would result. Having these conditions in mind it was decided to sort and remeasure all lasts and discard those which did not measure in accordance with the specifications for the new 1154.

In April, 1918, a new last, Specification 1308, Munson metallic last, was made for use in construction of the metallic fastened shoe. The model last was made a little larger throughout, with the exception of the heel measurements, being approximately one-half size larger than the 1154. The extension was seven-eighths on all sizes.

In the past it was customary for last manufacturers to order their models without any notification to this office, consequently in no instance were master models, prior to their receipt by the last manufacturer ordering them, inspected by Government inspectors. Although it is difficult to conceive how any contractor would proceed to manufacture lasts under his contract without first having minutely measured the master models, this has happened from time to time. Under the provisions of past awards for the making of lasts it was not deemed necessary or advisable to assume the responsibility of ascertaining for the manufacturer whether or not his master models were perfect. This opinion was governed to some extent by the fact that several manufacturers kept their models under different circumstances, and the inspection and measurement should at all times be made at the place where the models were ordinarily kept by the particular manufacturer. It was customary, however, to inspect the models from time to time at the factories of the contractors where a slimness or other defect was discovered during the process of manufacture, and in several instances where differences were discovered in the models an investigation disclosed that they had been kept near open windows or exposed to varying weather conditions, and that upon subjecting the models to conditions under which they ought to have been kept the measurements would prove correct.

It is the opinion of the writer that in the future all zone supply offices having charge of the production of lasts should be supplied with standard models on all widths made by one reliable last concern. These models should be made in full sets, entirely finished,

and ready to turn from. By so doing absolutely no variation could exist and each last would be sure to measure correctly.

When a contract is awarded the model lasts should be measured and inspected at the depot, after which they should be forwarded to the manufacturer in question and should be kept at his factory for a reasonable length of time prior to using to insure their return to original measurements in case of exposure to dampness or extreme heat. After the contracts are finished all models and patterns should be returned to the Government to be held for future use.

BLOCKS.

The curing and preparing of last blocks is a science in itself. If the blocks are not properly prepared prior to their manufacture into lasts more or less trouble is sure to be encountered.

Ordinarily a block cut in August of one year, if properly cured, would be ready for delivery in November of the year following, taking approximately 15 months from the time of the cutting of the wood until the delivery to last manufacturers. At this time, however, there is what is termed "a new process," wherein blocks cut in August are ready for delivery the following February or March. This latter method, however, is in an experimental stage and was not used during the period of the war.

At the time the Government first required lasts in large numbers it was discovered that there was a shortage of blocks, occasioned by the fact that conditions existing on and after August, 1914, resulted in the block manufacturers arriving at the conclusion that there would not be as many calls for new styles for commercial use as usually and consequently reducing the output of last blocks, causing a shortage which was afterwards overcome to some extent by the use of blocks not fully cured and referred to as "green blocks."

A Government contract having been placed with a last manufacturer working on commercial orders raised the question as to whether the contractor would use the best grade blocks for Government orders or for commercial orders, with the result that in some instances the Government received the so-called "green blocks," the same being evident from the finished product, not being noticed, however, until some period of time had elapsed after the manufacture thereof.

Under ordinary conditions, particularly where an ideal type of last is required, after the blocks are received at the factory of the manufacturer they should be kept there for a period of 30 days under conditions approximating those under which the block will be turned into a last, in order that the block may become tempered to the average atmospherical conditions existing at that particular plant.

No last block should be used that contains more than 5 per cent of moisture. It has been scientifically ascertained that a last will, when exposed to heat and dampness, eventually reach the stage where it will contain but 5 per cent moisture, and if lasts are turned from blocks containing a greater per cent, say 7 or 8, the lasts being turned strictly in accordance with the measurements as set out in the specifications, they will, when exposed to the elements, swell and shrink, but will eventually shrink until they contain but 5 per cent moisture,

thereby causing the lasts to be smaller in measurement than the standard. Too great a stress can not be laid upon this particular point, and it is a question which caused a great amount of trouble and annoyance during the entire period of manufacturing lasts in large quantities. After lasts had been used for a period of 10 to 12 months, we were continually finding that they had shrunk to measurements much smaller than the standard less the permissible variation.

Upon investigating conditions at the factories of several manufacturers it was discovered that they were receiving their blocks in carload lots and were moving them from the car to the turning machines without allowing the same to lay in the factory sufficiently long to become tempered. There can be no question that lasts made under such conditions will eventually shrink to a greater extent than allowed under the permissible variations.

Each zone supply office should have a device for ascertaining the moisture contained in any given block, permitting the testing of blocks from time to time during the performance of any future contracts, and it might be added that if such an instrument had been available during the years 1917 and 1918 thousands of dollars might have been saved to the Government.

There are several ways of testing out blocks, but the most accurate and thorough method known to date is by a delicate weighing and electric heating device. Two or three blocks are selected, from the middle of which two or three small lengthwise strips are sawed. These are weighed and put inside the electric heating device, where they are subjected to a temperature of 220° F. and then weighed again. The difference between the first and second weighings equals the weight of the moisture. This divided by the original weight gives the percentage of moisture.

Models should be carefully checked up and should measure perfect in every detail. If measurements are found correct as per specifications they are ready to go to the turners and are then placed in the lathes. At present we have models only on size 8 for all widths, and all sizes are graded from each respective model. If turning models were furnished on sizes 5, 7, 9, and 11 on all widths a greater degree of accuracy would be maintained than at present, because of the fact that lathes will not hold their grade so accurately when running four or five sizes either side of the model, whereas if sizes 5, $5\frac{1}{2}$, 6, and $6\frac{1}{2}$ were turned from a size 5 model and 7, $7\frac{1}{2}$, 8, and $8\frac{1}{2}$ were turned from a 7 model, and so on up, no deviations from the true model could possibly exist providing the operator used due care in adjusting his machine. In placing models in the lathes great care should be taken that they are located properly and on exact centers. Lathes should be carefully gone over and any part or parts showing excessive wear should be repaired before being used. With lathes properly adjusted, instructions should be given the contractors that lathe operators must watch their work carefully and must not run lathes at high speed. This oftentimes happens, as men are paid on a piece basis and naturally try to get out as much work as possible. Nothing will throw lasts out of proper measurements so quickly as turning lathes at high speed. The block revolving against the cutter rebounds so quickly and with such a jerk that the knives cut deep irregular lines in the last, destroying the pattern

edge and rendering the last practically worthless. The whole last should be turned at the same rate of speed. A majority of last manufacturers turn the portion from the toe to the waist point at a greater speed than that from the waist point to the heel. This should not be allowed on Government lasts. Ordinarily cutter knives are ground after turning 100 pairs of lasts, and it is very important that the inspector should see that the turning machines are tested every time the cutters are ground, as this will have a tendency to correct many slight variations which might otherwise become apparent.

All block lasts should be turned one-eighth larger than the specifications call for when finished. This allows one-sixteenth waste when the block is sawed and one-sixteenth waste when scoured, or, as some last manufacturers term, "grinding." Any last leaving a turning room and measuring less than one-eighth larger than it should when finished should be watched throughout the works. How important this is and what actually happens to substantiate this point will be explained later.

SHAVING DEPARTMENT.

As fast as lasts are turned they are sent to the shaving department, where toes and heels are made. The first operation is to place all toes against a surface cutter, which cuts the stub on an exact bevel with the bottom. In executing this operation great care should be exercised, as more or less damage can be done in trying to trim too closely, resulting in the undercutting of the toe and making an irregular bottom. After surfacing, paper sole patterns are applied to all lasts, toes marked in, and finished. In applying sole patterns particular attention should be directed in measuring the length, beginning at the heel (less heel margin allowance) and thence forward to the toe. After toes are finished heels are cut and trimmed up on a heel saw, a machine specially designed for this work. In some factories the heels are made before the toes are finished, resulting in many lasts coming short on the stick length. Once heels are made, then toes cut in accordance with paper patterns, nothing can save the last if it has been cut too close on the heel, whereas if the toes are finished first the heel-saw operator has an opportunity to get his stick length by saving a little more wood and still not throwing out the natural heel curve. In a number of instances it has been noticed that heel-saw operators were more or less careless and sometimes cut so deeply into the heel that the margin allowance and base line of the heel were cut entirely through, thus destroying the pattern length and throwing the heel curve out of alignment, also making lasts short. The work of the heel-saw operator should be closely watched by the inspector, as upon him depends the stick length of the last.

BLOCK DEPARTMENT.

From the shaving department blocks are taken into the block-sawing department, where they are sawed and fitted to the last. Aside from sawing, nearly all the other minor operations are easily

performed. Blocks should be sawed so that the inside ball line will be cut deep into the main body of the last, thus enabling the last to be drawn more freely when the block is disconnected. The band saw in severing the block from the main body of the last should not cut over one-sixteenth scarf as specified. Any wider scarf would produce an indentation in the block line, which could not be erased without injury to the last. After the blocks are severed they should be attached to the last in accordance with specifications covering this operation.

IRONING.

It is the duty of this department to attach the heel irons or entire bottoms as required by the specifications. There is one feature of the 1308 specifications which it is felt might be improved, either by special instructions to inspectors or by a change in the specifications. The present 1308 specifications state:

> Heel iron to have a margin of not less than one thirty-second of an inch at extreme back (illustrated in diagram).

It is suggested that the following clause be substituted for the above:

> Heel iron to have a margin of not more than three sixty-fourths inch and not less than one thirty-second inch at extreme back (illustrated in diagram).

This suggestion is occasioned by the receipt of many lasts with margins varying from one thirty-second up to and including one-sixteenth of an inch, and indeed in some instances approximating one-eighth of an inch. Since a margin of this size results in some difficulty in the lasting operation, it is considered necessary that the above restriction should be applied. Under no circumstances should the margin be filed after irons are attached.

A great amount of difficulty was originally encountered in the manner of attaching the iron bottoms of the 1308 last to the wood. The specifications read as follows:

> Bottom of lasts to be plated with No. 20 gauge galvanized iron, to be attached with 4 screws and 6 nails in forepart and 3 screws and 2 nails in heel seat (see diagram for position of nails and screws). Screws to be one-half inch No. 5 wire.

It was found that owing to the labor situation, which made it necessary to break in many new hands for this particular class of work and to the fact that very few last manufacturers at that time were making McKay lasts, practically all the manufacturers were boring screw holes either with power augers or awls, after which the screws were driven in with hammers. This resulted in many instances in the iron bottoms starting from the lasts in the course of handling at the warehouse or in the factory, a condition which was overcome by sending written instructions to all last inspectors, copies of which were forwarded to the manufacturers, as follows:

1. You are instructed to watch carefully the attaching of the iron to the bottom of the last.
2. Holes for screws should be made with an awl smaller than wire of screw.
3. Do not permit boring devices removing part of wood.
4. You are to reject lasts where screws are driven in by hammer or other device.

SCOURING.

Last scouring or grinding is a delicate operation, and final results rest largely on the work of this department. It is an easy matter for a scourer to take off one-eighth or one-fourth of a size on a last almost without noticing it, so one can readily understand what the result would be if lasts came to the scourer slim in measure or less than scouring allowance (one-sixteenth). Oftentimes lasts turned a trifle under the one-sixteenth allowance will go through providing they are marked to scour thin, thus enabling the scourer to grind them lightly.

In order to demonstrate what would logically transpire if lasts were turned slim or under measurement in the beginning, reference is made to an incident that occurred at a last factory where a contractor turned nearly half of his order before the inspector arrived at the factory. Upon the arrival of the inspector he ascertained on going through the turning department that some operators were turning lasts as high as three-quarters of a size full and as low as finished measurements, in the latter case leaving nothing for finishing. On looking over four or five hundred pairs nearly 200 were found to have been turned finished measure. Upon discovering this condition of affairs it became necessary, first, to get the lathes running uniform and grading properly; second, to measure all lasts on the floor, those found under being blue penciled to signify light scouring; and, third, to reject such lasts as would not when finished correspond to specification measurements. This method of procedure was carried out without the approval of the superintendent, who claimed that the lasts would finish within the one-sixteenth permissible variation and insisted on carrying on the work to the finished stage, as was his privilege, providing the lasts when finished measured in accordance with specifications. The lasts in question were rushed through the works at a period when the inspector was out and without his knowledge, and having been given a bath in wood alcohol, covered with a shellac filler, and polished, upon the return of the inspector were offered for final approval. Much to his surprise not a single last was sufficiently under standard measurements to warrant its being thrown out, which immediately raised a question in his mind as to what treatment had been given the lasts to produce this effect. After spending some time in investigating the situation it was found that the lasts had been dipped in wood alcohol, the application of which would cause the lasts to swell at least a size within a short period of time. Upon this discovery it was insisted that the lasts in question remain as they were on the racks for a period of at least a week before any further action should be taken as to their rejection or acceptance. This plan met with disapproval on the part of the management, who claimed that the lasts were properly finished, found to be in accordance with specifications, and consequently were ready to ship. They were, however, informed that the lasts would not be accepted until they had been subjected to further tests to ascertain whether or not any treatment to which they had been subjected might possibly prove detrimental to the lasts. As a matter of fact, the lasts remained on the racks for a period of 10 days, at the end of which time they were gone over

carefully and it was ascertained that they had gone back nearly to their original and normal measurement, which was from a quarter to a half a size under the permissible allowance. The alcohol, being a quick absorbent, had penetrated the wood and produced an immediate swelling, while the application of shellac and polishing material sealed the pores, retarding the evaporation, and thus temporarily maintaining the lasts in this semiswollen condition.

THIMBLE BORING.

This operation, while very simple, oftentimes is not properly performed. Thimble holes should never be bored any deeper than to permit the insert of the thimble. Some manufacturers do not place much stress on this point, simply boring holes regardless of depth or of a resultant vacuum at the base of the thimble, thus giving absolutely no support for the thimble to rest on, whereas if the thimble rested firmly on the wood, supported by the heavy E. C. W. bolt running horizontally across its base, it would be practically impossible for any heavy pressure to push it deeper into the last. It has been found and proved that lasts where thimble holes were bored regardless of depth will not stand up under heeling and leveling machine pressure. In fact, after two or three times in use the thimbles are crushed deep into the last, often splitting the heel and rendering perfectly good lasts unfit for further use. It is well to see that this operation is properly done, as it materially affects the life of the lasts.

POLISHING.

Little can be said of this department other than to state that proper application of some good filler should be made to every last. In the past it has been permissible to use either a filler made in liquid form, or what is called a "hard stick" filler, which is applied and burnished in by a wheel. The latter is not considered advisable, an examination of thousands of finished lasts having demonstrated that the polishing operation is of no value without a proper filler, and further that there is no filler that equals liquid white shellac. This should be applied with a brush and not too sparingly, and should be worked well into the grain of the wood in order to prevent extensive shrinkage and swelling. Specification for the 1308 lasts states:

> Lasts to be filled with a high-grade filler or white shellac and then polished and thoroughly waxed with Canauba wax. Lasts must be stained before applying filler.

The finishing and polishing of a majority of the lasts received during the first three months of the manufacture of the 1308 type were not up to the standard. It was suggested at that time that all last manufacturers be required to use white shellac properly applied with a brush, since it was ascertained that Canauba wax was extremely difficult to obtain and it was thought that if white shellac were used it would prove sufficient protection from the elements. There is yet to be found a composition the application of which will render the lasts safe from shrinkage and swelling. However great the care exercised in the storage of lasts, their measurements are bound to vary as a result of the atmospheric changes to which the eastern section of the country is subject.

Chapter XV.

RECEIVING, SHIPPING, AND STORING OF SHOE LASTS.

Early in the game it was discovered that the questions of receiving, shipping, and storing of lasts would afford many complicated problems, demanding quick and accurate solutions. It should be borne in mind that there were in the New England States at one time 21 manufacturers making Army shoes and that there were approximately 750,000 Munson welt lasts and 227,000 Munson metallic lasts to be handled. The production of shoes depended to a large extent upon ideal conditions surrounding the efficiency of the last department, and whenever it became necessary for Washington or for local officials to take up with shoe contractors the matter of facilitated production the contractors invariably referred to the last situation, either claiming that they did not receive lasts at the time they were ready to commence operations or that owing to errors in shipment they did not receive lasts of the style, size, and width required, which in the early days was generally true.

During the manufacture of the early contracts it was customary to ask the shoe manufacturer how many lasts were desired and then to allow him 10 to 20 per cent more then he requested, when as a matter of fact his demands were more liable to be about 40 per cent in excess of his requirements. After a decision had been made as to the allotment of lasts to the shoe manufacturer, it was customary to order the lasts required either directly from last manufacturers as they were completed or from storage. Under normal conditions in accordance with regulations, the distribution division would handle the ordering in and out and the accountability; warehousing, the storage; and transportation, the moving of lasts; but owing to delay in sorting, bagging, and preparation for shipment, errors in assembling styles, sizes, and widths as ordered, and general delay in moving lasts from storage to the transportation companies, it became evident that if any degree of efficiency was to be obtained it would be necessary to install a unified and detailed system.

After a careful survey of the general situation it was decided, first, to delegate all authority relative to the distribution and storage in as far as possible to the Shoe Branch; second, to prepare a system covering the purchase, manufacture, and distribution of shoe lasts; and, third, to establish a central warehouse to be used as a clearing house and storage place for shoe lasts at Brockton, Mass., which is not only the greatest men's shoe center in the world but is within a few miles of Whitman, Rockland, Abington, Bridgewater, South Weymouth, and Stoughton, where shoes and lasts were being manufactured.

One feature of this system was the decision that all lasts should be bagged 36 pairs of a solid size and width to each bag, bins being used

for odd lasts with compartments for lasts of each size and width which were in charge of men who made up a bag as soon as 36 pairs of any size and width were accumulated. The results obtained from the system installed were so satisfactory that at the climax of endeavors there were moved in and out of the warehouse at Brockton over 900,000 pounds of shoe lasts every 30 days, and after employees had been thoroughly trained it was possible in case of an emergency to move lasts in and out at the rate of 3,000 pairs per hour without serious errors as to size and width. This resulted in the minimizing of criticisms from all sources and it is thought that if employees were trained in accordance with this system no difficulty should be experienced in successfully handling any emergency which might arise in connection with last problems.

ROUTINE AT THE BROCKTON WAREHOUSE.

I. Receipts.

Receipts at the Brockton warehouse fall into two general classes—receipts from shoe manufacturers and receipts from last manufacturers. Since the routine in each case differs slightly they will be taken up separately.

A. FROM SHOE MANUFACTURERS.

1. *Records of receipt.*

(*a*) The used lasts which are returned by the shoe manufacturers should, upon receipt, be reported on tally sheets. This is the form prescribed by the Warehousing Section for use in connection with goods of any kind which are received at a warehouse. This tally sheet is made out in triplicate. The receiving checker also records the receipt in his receiving book, giving the information that is called for in it. These tally sheets are sent to department 2, which handles all the records concerning receipts from shoe manufacturers.

2. *Records of inspection.*

(*a*) In this department one of the clerks notes the range of the container numbers in the shipment and prepares a page, or set of pages (like Form 6) upon which is entered information appearing upon the tally sheets. These pages are kept in a book called "Receipts from shoe manufacturers." The original tally sheet is then sent into Boston, one copy is filed, and one is kept with the goods.

(*b*) As the lasts are inspected, the original tags are attached to each inspection report and are sent into the office by the inspection checker to department 2. A clerk here removes the tags, checks them with the inspection reports, and sends them to be filed, and then passes the inspection report to the clerk in charge of the book of receipts from shoe manufacturers. This clerk makes an analysis on Form 2, showing the lasts over, short, and rejected. An analysis must be made out in duplicate for every inspection report that comes in. The original is sent to Boston and the duplicate is kept at the warehouse.

3. *Credit to shoe manufacturers.*

(*a*) When all the bags of a shipment have been inspected and reported upon, the allotted spaces on the pages (Form 6) which have been prepared are filled in and the clerk then makes up a consensus report on the entire shipment. These figures are checked with the incoming shipping report of the shipment. If they correspond, both copies of the shipping report are signed by the person in charge and forwarded to Boston. If they do not correspond, it should be called to the attention of this person who notifies the officer in charge. The analyses, giving the amounts received and accepted on each shipment, form the basis of crediting the shoe manufacturers with the lasts they have returned. The Boston office should also be notified how many bags each shipment from shoe manufacturers consists of, since the manufacturer is charged with the burlap bags and he can not be credited with their return unless the warehouse notifies the Boston office.

4. *Disposition.*

(*a*) The inspection report with the analysis is sent to department 1, where the clerk enters the amount accepted on the proper stock sheet. These papers are

then sent to be filed. These lasts may be put either in permanent storage or may be held for redistribution, but, in any case, proper stock sheet must be credited.

B. FROM LAST MANUFACTURERS.

1. *Records of receipt.*

(*a*) As lasts are received from last manufacturers, the receiving clerk makes out tally sheets (Form 5), just as is the case in every other shipment. Also record of the receipt is entered in the receiver's book.

2. *Records of inspection or checking.*

(*a*) Usually these lasts have already been inspected at the various factories and it is necessary only to check them. However, whether they are to be inspected or checked, the form to be used is Brockton warehouse inspection report (Form 4). The checker removes the original tags after the inspection or checking, attaches them to the tally sheets and the inspection report, and sends them to department 3, which handles all the records of receipts from last manufacturers.

3. *Approval of invoices.*

(*a*) This department checks the tags with the tally receipts and inspection reports to make sure that there are no errors. This is very important, since a great many of the errors discovered have been caused by carelessness in copying the figures from the tags. After the tags have been checked an analysis is made of the checking or inspection report on Form 2. This shows the lasts over, short, rejected, and accepted. This is made out in duplicate, one copy for Boston and the other for file at the warehouse. Any irregularities in the shipment should be called to the attention of the person in charge and noted in the space provided therefor on the analysis sheet. The original tally sheet and the original analysis are then sent to Boston. The duplicates of these two papers then go to another clerk in this same department, who records the information on the analysis sheet in a book called "Receipts from Last Manufacturers."

(*b*) These figures are entered under each manufacturer's name, and from them the invoices are checked up and approved for payment. No invoices should be approved unless they bear the sizes and widths of the lasts invoiced.

4. *Disposition.*

(*a*) The lasts that come in from last manufacturers are in all cases stored so they will be available for redistribution. The place where they are stored is marked on the inspection report and these papers are sent from department 3 to department 1, where the accepted lasts are entered on the proper stock sheet.

II. SHIPMENTS.

A. FROM MAIN WAREHOUSE.

1. *Initial steps.*

(*a*) The initial step in shipping lasts from the warehouse after the authority has been given is to make out a shipping order in duplicate. One copy is for the person in charge, who keeps it as a personal memorandum to be destroyed when the shipment has been completed. The other copy goes to department 1, where the amount of the shipment is deducted from the stock sheet. The clerk here also fills in the information as to whom the shipment was ordered by and the authority therefor. For the purpose of explanation, it should be made clear that the shipment is *authorized* by letter or a telephone call from the Boston depot and is *ordered* by the person in charge of the shipments at the warehouse. This clerk further notes on the order that the amount has been deducted from the stock sheets.

(*b*) The order is then passed to the person in charge of the warehouse, who numbers it. This number is used later on the shipping ticket also.

2. *Selection, etc.*

(*a*) The order then goes to the shipper, who has it selected, bagged, and checked, filling in the names of the persons who do the work. He also makes out duplicate shipping sheets, showing the contents and weight of each bag, and also its United States number, which has been previously assigned by the shipping clerk.

(*b*) When lasts are bagged and ready to ship, the shipper turns the shipping sheets over to the shipping clerk, who checks the figures to see that the totals are correct and amounts packed agree with the amounts ordered. The clerk

then makes a typewritten copy of the onion-skins and mails it to the consignee to be used in checking in a shipment. He also makes out a shipping ticket, one copy of which is retained at the warehouse, one copy of which is sent to the officer in charge of production, and one copy of which is received by the Distribution Division. Space reading "Invoice to" is to be left blank. After the shipping ticket is given a special number in the editors' department, warehouse copy will be sent to the warehouse making the shipment for filing. This ticket is made out after the goods have been delivered to the transporting agent. He also has the bill of lading signed by the agent and fills in the necessary data on it. The shipping order is also turned over to him by the shipper and he fills in whatever information is called for. He can usually note everything on it but the shipping report number.

3. *Completion of shipment.*

(*a*) The complete shipping ticket, order, and the signed bill of lading are handed to the person in charge. The fact is noted that the order has been shipped and the duplicate shipping order destroyed. All the documents then go to department 1, where the figures are again checked. The documents then go to department 4, which handles all of the records in regard to outgoing shipments. The clerk in this department makes out the shipping report and distributes the various copies. One of the warehouse copies of the shipping ticket and the duplicate shipping sheet is then detached and sent to be filed. The original shipping sheet is attached to the rest of the shipping ticket, which goes into the depot, as does the complete bill of lading. The shipping order is filed, together with the other documents concerning the same shipment. This clerk also keeps a record of all outgoing bills of lading.

III. Division of Routine.

In dividing the routine work at the Brockton warehouse it has been considered best to call the clerk, or clerks, handling each phase of the work a department. In some cases where the department consists of more than one clerk the work can not be assigned to a particular person, therefore it is best to assign it simply to the department.

A. DEPARTMENT 1.

(*a*) All stock records are kept here. They show exactly what is on hand at all storage places. All orders must pass through this department in order to be deducted from the proper stock sheet. All stock transfers must come here so that the records may be kept accurately. When lasts are inspected a report must come to this department so that those accepted will be added to the stock sheet.

B. DEPARTMENT 2.

(*a*) This department takes charge of all records pertaining to receipts from shoe manufacturers. Book called "Receipts from Shoe Manufacturers" is kept here and is used in the manner described under "Receipts." The inspection reports of these lasts come here, as do also the incoming shipping reports of lasts returned by shoe manufacturers, so that they may be checked.

(*b*) This department also makes out and sends to Boston an analysis of each inspection report showing the lasts over, short, rejected, and accepted. Anything else that comes under the head of receipts from shoe manufacturers is handled by this department. Incidentally this department keeps record of all incoming bills of lading.

C. DEPARTMENT 3.

(*a*) Receipts from last manufacturers are handled by this department. Incidentally the work of approving invoices from last manufacturers comes under this heading. In addition to the book showing the analysis of each receipt of lasts, this department keeps a register of all bills that pass through it.

D. DEPARTMENT 4.

(*a*) This department handles the clerical end of all outgoing shipments. The shipping ticket is distributed here and the shipping report is made out and distributed also, and record is kept by number and by consignee of every shipping report that goes out. The outgoing bills of lading are also recorded here.

E. DEPARTMENT 5.

(*a*) This department has charge of all time keeping and personnel work. The daily report of absence and tardiness, the employment and discharge slips, the pay rolls, and the other personnel records are made out and kept here.

F. DEPARTMENT 6.

(*a*) This department has charge of filing all documents and issuing of all office supplies.

IV. Miscellaneous.

A. PERSONNEL.

(*a*) Accurate record must be kept of the time each employee enters and leaves the warehouse in the morning, at noon, and in the evening. Absence and tardy reports must be made out and sent into Boston not later than 10 a. m. the following day. It is especially important that pay rolls be made up and sent into Boston on time so that there may be no delay in paying off the employees.

B. BOOKS OF RECORD.

(*a*) So far as possible all records of importance should be kept in permanent books so that they may be available whenever necessary. Among the purposes for which permanent record books should be kept are receipts from shoe manufacturers, receipts from last manufacturers, record of incoming and outgoing bills of lading, record of incoming and outgoing shipping reports, register of all invoices that pass through the warehouse, supplies received at the warehouse, and a record of absences and tardinesses.

C. OFFICE SUPPLIES.

(*a*) A stock of office supplies sufficient to meet the needs of the office for at least two weeks should be kept on hand at all times. In ordering no items should exceed a two weeks' supply.

D. USE OF THE TELEPHONE.

(*a*) The telephone should be used only on official Government business, and all toll calls should be recorded. In calling up Boston as much business as possible should be saved for one call so that they may not be numerous.

Form No. 1.—Shipping Order.

A shipping order contains all the possible information needed about any one shipment. It takes in more than the shipping ticket and is also necessary so that there may be one distinctive form upon which to order the shipments. It has been found confusing to put orders on size sheets, because the size sheets may be used for many different purposes, such as memorandums, records of what has been received, etc. Practice has shown that it is much safer to have one distinctive form such as this for orders. For method of use see "Shipments."

BROCKTON WAREHOUSE.

SHIPPING ORDER.

(FORM 1.)

No. .....

DATE.....

SPEC. No. .....

SHIP TO.....

Ordered by
Authority
Noted on Stock Sheet by
Selected by
Packed by
Checked by

Shipping ticket No.
Actually shipped on
Shipped via
B/L No.
Shipping Report No.
No. of bags

	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	14	15	Total.
A—wide																			
B—wide																			
C—wide																			
D—wide																			
E—wide																			
EE—wide																			

U. S. Bag No.	Weight.	U. S. Bag No.	Weight.	REMARKS. Note lasts which it is impossible to ship.

Form No. 2.—Analysis Sheet.

This is used to record the final results of the checking or inspection of the shipments. Formerly lasts over, short, rejected, and accepted were recorded on separate sheets. All four size sheets were necessary to complete the records of one shipment. By using this analysis sheet all the information of any one shipment is on one piece of paper, even to the invoice number and to the disposition of the rejects and overage and notification of the shortage. For information as to the use of this sheet, see "Receipts."

(Form 2.)

ANALYSIS SHEET.

Invoice No. .....

RECEIVED FROM..... Specification .....

Shipment received.....
Lasts inspected.....
Inspection.....
Rejects.... Shortage.... Overage....
Disposition of rejects.....
Notification of shortage.....
Notification of overage.....

ACCEPTED.

	5	5½	6	6½	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	14	15	Total.
A																				
B																				
C																				
D																				
E																				
EE																				

Form No. 3.—Stock Transfer.

In order to keep the records of the stock accurately it is necessary that every transfer be noted on a stock transfer and sent to clerk No. 1, who keeps the stock records. She transfers the amount on her books and then sends the form to be filed.

(Form 3.)
SHOE LASTS.

BROCKTON WAREHOUSE.

STOCK TRANSFER.

INSPECTED.

UNINSPECTED.

Date ..... Specification .....

From ..... to .....

Transferred by .....

Bag No. Contents.	Bag No. Contents.	Bag No. Contents.	Bag No. Contents.	Bag No. Contents.
				Deducted from
				By—
		Approved by		Posted into

FORM NO. 4.—INSPECTION REPORT.

This report is used in checking or inspecting lasts that come in from last manufacturers. For its use see "Receipts."

(Form 4.)

INSPECTION REPORT.

SPECIAL FORM FOR 1154 LASTS RETURNED BY SHOE MFRS.

CONSIGNOR _____ SPEC. _____

RECEIVED FROM _____ DATE _____

Temporary Disposition.

TAG NO.	TAG CALLS FOR.	ACCEPTED.	REJECTED.	NEW LASTS.	SMALLE LASTS.	SHORT OR OVER.

FORM NO. 5.—TALLY SHEETS.

Form 256A—P. & S.—1-1-19.
Original filed in Receiving Section.

INCOMING.

TALLY SHEET.

SERIAL NO.....
NO. OF SHEETS.....
SHEET NO.....

GOODS RECEIVED AT WAREHOUSE..... DATE.....

RECEIVED FROM..... B/L OR PRO. NO..... CAR NO.....

SHIPPER'S NAME..... CAR SEAL NO..... PURCHASE OR CONTRACT NO....

REMARKS.....

NUMBER AND KIND OF CONTAINERS.... DATE CAR ARRIVED..... DATE CAR RELEASED.....

CHECKER'S SIGNATURE..... UNLOADING BEGUN..... UNLOADING COMPLETED.....

	MATERIAL.....			MATERIAL.....			MATERIAL.....		
	PACKAGE NO.	AMOUNT.	SIZE.	PACKAGE NO.	AMOUNT.	SIZE.	PACKAGE NO.	AMOUNT.	SIZE.
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
TOTAL									

RECEIVED BY	REPORT PREPARED BY	DATE.

INSTRUCTIONS TO TALLY CLERK.

Mark heavy circle on other side of this sheet around numbers of damaged packages and list them below with full information as to condition in which they are received. This is of the utmost importance, as claims will be made on the basis of this information.

PACKAGES RECEIVED IN DAMAGED CONDITION.

Pkg. No.	Weight.	Articles.	Condition of Packages.

Form No. 6.—Special Inspection Report.

This is a special form of the inspection report which is used for lasts, Specification 1154, now being returned by shoe manufacturers. It was designed to classify lasts which have never been used by manufacturers and also lasts manufactured by Bekkenhuis & Smalle, which are now being rejected after use.

SPECIAL INSPECTION REPORT.

(Form 6.)

Name of concern.....

Location.....

Specification.....

Date Rec'd.	Bag No.	Tag Calls For.	Date Insp.	Accepted.	Rejected.	Short.	Over.	Temporary Disposition.	Final Disposition.
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
	12								
	13								
	14								
	15								