ruit. The owner sold the apples as curiosities, and frequently individual specimens brought large prices. It was exceedingly interesting to examine the crop, as one apple differed widely from another, and there was difficulty in finding two precisely alike. A few were found in which almost exactly one half was sweet and the opposite sour, but a majority were made up differently. Sections, one quarter or one sixteenth, more or less, would be sweet or sour, and the remainder would be of the opposite kind. The line of demarcation on the skin was distinctly defined, the sour portion having a reddish color, while the sweet was of a pale green. There was no mistaking the flavor; the sour portion was very sour, and the sweet very sweet. On the same tree apples grew which were uniform in kind, some being entirely sweet and others entirely sour.

This pomological freak was brought about by a careful process of budding, two buds of different varieties being divided, and one half of each joined together, so as to adhere and grow in that condition. As none of this fruit has been seen of late years, we conclude that the tree has perished.—*Boston Journal of Chemistry.*

We can corroborate the foregoing, having ourselves seen them growing, and tasted apples that were sweet on one half and sour on the other. This was several years ago. The tree which produced this curious fruit was upon the premises of the Rev. Dr. Ely, of Monson, Hampden county, Mass.

PRACTICAL MECHANISM.

NUMBER XIII.

BY JOSHUA ROSE.

PISTON RINGS.

The tension referred to in our last (see page 293) is, in all probability, caused by the unequal cooling of the ring after it is cast.

Iron and brass molders generally extract castings from the mold as soon as they are cool enough to permit of being removed, and then sprinkle the sand with water, to cool and save it as much as possible. The consequence is that the part of the casting exposed to the air cools more rapidly than the part covered or partly covered by the sand, which creates a tension of the skin or outside of the casting. The same effect is produced, and to a greater extent, if water is sprinkled on one part of a casting and not on the other, or even on one part more than on another.

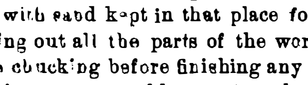
It has already been stated that brasses contract a little, sideways, in the process of boring, and that work of cast metal alters its form from the skin of the metal being removed; this alteration of form, in both cases, arises in the case of a piston ring from the release of the tension.

It sometimes occurs that a piece of work that is finished true in all its parts may unexpectedly require a cut to be taken off an unfinished part (to allow clearance or for other cause), and that the removal of the rough skin throws the work out of true in its various parts, as, for instance: a saddle of a lathe being scraped to fit the lathe bed, and its slides finely scraped to a surface plate; or the rest itself being fitted and adjusted to the cross slide of the saddle. If, when the nut and screw of the cross slide are placed in position, the nut is discovered to bind against the groove (of the saddle) along which it moves (the nut being too thin to permit of any more being taken off it) there is no alternative but to plane the groove in the saddle deeper, which operation will cause the saddle to warp, destroying its fit upon the lathe bed, and the trueness of the Vs of the cross slide, and that to such an extent as to sometimes require them to be refitted.

The evil effects of this tension may be reduced to a minimum by taking the castings from the sand and placing them in a heap in some convenient part of the foundery, and covering them with sand kept in that place for the purpose: and by roughing out all the parts of the work which are to be cut at one chucking before finishing any one part.

Piston rings are turned larger than the bore of the cylinder which they are intended to fit, and, as before stated, sprung into the cylinder. The amount to which they are turned larger depends upon the form of split intended to be given to the ring; if it be a straight one, cut at an angle to the face of the ring, which is the form commonly employed, the diameter of the ring may be made in the proportion of one quarter inch per foot larger than the bore of the cylinder, sufficient being cut out of the ring, on one side of the split, to permit the ring to spring in to the diameter of the cylinder, when the ring may be placed in the cylinder and filed to fit, taking care to keep the ring true in the cylinder while revolving it to mark it. But if the ring is intended to be of the form here illustrated, the ring must be made of a larger proportionate diameter, the proportion depending upon how much the ends of the ring are intended to lap each other, the lap being from *a* to B, in Fig. X.

Fig. X.

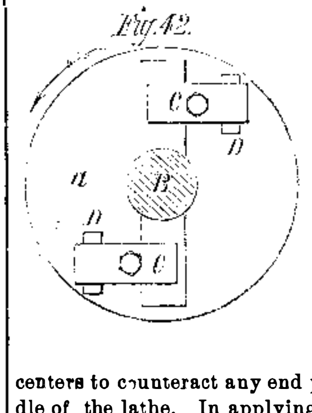


There is more work entailed in giving a piston ring this form of split, but it is undoubtedly superior to the plain one. Another plan to give spring to a piston ring is to turn it to the same diameter as the bore of the cylinder, and then to pene it all round on the inside face (that is, the bore), the result being that, when the ring is sawn in two (which is all that is necessary in this case), it will spring open and be of a larger diameter. When, however, it is placed in the cylinder, it will require to be sprung together again to the diameter to which it was turned (the split being open to the width of the split cut by the saw), so that it will not require much, if any, filing to fit it to the cylinder.

LATHE WORK.

When bolts and plates are employed to hold rough work, care must be taken to place the plates over those parts of the work which touch against the chuck or face plate against which the work is bolted; or the pressure of the plates on the work will spring it, and when it is taken out of the lathe (or other machine) it will spring back to its original position, and the part that has been cut will be no longer true, causing in many cases a great deal of unnecessary vise work. If it is not practicable to so place the plates, then those parts of the work which stand off from the face plate or chuck should be kept from springing by having wedges driven between them and the plate, which is of great importance in light work.

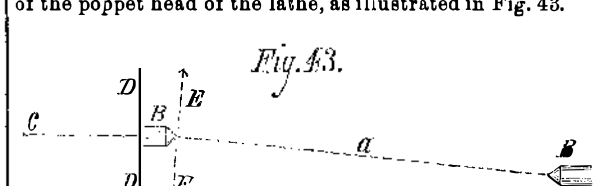
The plates (or clamps) should be so placed that the ends gripping the work travel in advance, the bolts being kept as close to the work as possible and the packing at the other end of the plates, as shown in Fig. 42. *a a* represents the chuck plate, B is the work, C C are the plates, and D D are the packing pieces.



Heavy cast iron work requiring much turning to be done to it between the centers should have wrought iron plugs screwed on the ends, and the centers put into the wrought iron; because centers, if of cast iron, cut, and soon run out of truth. Before boring or turning work that is chucked, if there is sufficient room, put a rod of iron between the centers to counteract any end play there may be in the spindle of the lathe. In applying a steady rest, be careful not to put an unequal strain on the work by screwing any of the jaws tighter than the others, or it will spring the work out of the straight line, in which case the cut taken by the tool will not be parallel. When there is sufficient room, use a boring bar with a small tool in it for boring holes; for the extra strength of the boring bar enables the tool to take a heavy cut, which a boring tool having a slight body would not do, in consequence of the springing.

If work chucked in a lathe is much heavier on one side than on the other, bolt a weight on the chuck (near the light side of the work) sufficiently heavy to counterbalance it, otherwise the centrifugal force generated by the revolutions of the heavy side of the work will cause it to revolve eccentrically, and to be in consequence turned untrue.

In turning a cone on anything which is held between the centers of the lathe, the dog or clamp used to drive the work must be so placed as to be able to move to accommodate the varying angle of the center line of the work to the center line of the poppet head of the lathe, as illustrated in Fig. 43.



The dotted line, *a*, represents the center line of the work; B B are the lathe centers. C is the center line of the poppet head of the lathe, D D is the chuck plate E is the position of the center line of the dog or driving clamp at one side of the lathe center, and F is its position when the lathe has made one half of a revolution; from which it will be perceived that the tail stock of the lathe, being moved out of the center line of the headstock of the lathe, the end of the dog or clamp which is driving the work advances toward and recedes from the chuck plate at every revolution, and liberty must therefore be given it to move in that manner.

In boring brasses for journals, place a piece of sheet tin in the joint of the brasses, and bore them the thickness of the tin too large, which will make them fit well on the crown when the tin is taken out; for brasses bored with the joints close together always bind on the sides, and will not fit down on the crown without being filed.

The same end may be attained by boring the brasses a trifle too large, so that filing a little off the faces of the joint will let them together and down on the crown; but the above described plan is the best.

The amount of shrinkage to be allowed for contraction, on holes in cast iron of two or less inches bore, should be so little that, the outside callipers being gaged to touch the shaft very lightly and the inside callipers or gage to touch the hole only sufficiently to feel the touch, you can just see plainly between the two when they are placed or gaged together.

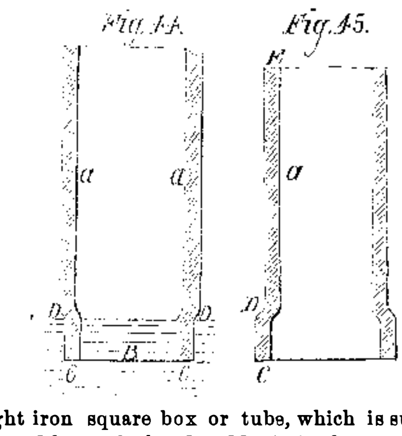
For larger sized bores, proportionately increased allowance should be made, so that a hole of 12 inches diameter will have less than $\frac{1}{64}$ of an inch of shrinkage. Wrought iron may be given a little more shrinkage, and steel one half less in the case of the 12 inch hole.

EXPANSION AND CONTRACTION.

Much labor and expense may often be saved by employing the principles of expansion and contraction to refit work For instance, suppose a bolt has worn loose: the bolt may be hardened by the common prussiate of potash process, which will cause it to increase in size, both in length and diameter. The hole may be also hardened in the same way which will decrease its diameter; and if the decrease is more than necessary, the hole may be ground or "lapped" out by means of a lap A lap is a mandril used to grind holes which are not quite true, are a trifle too small, or have been hardened and cannot therefore be cut by a tool A lap may be simply a piece of rod copper, or an iron mandril with tin or lead cast around it. The diameter of a lap should be turned to be an easy fit at both ends in the hole and a trifle larger in the middle, so that the hole which it is intended to grind will fit tightly on the middle of the mandril, the latter being about three times the length of the former.

The operation is to place the lap through the hole which it is to grind and then between the centers of the lathe; then, while the lathe is running at a high speed, supply the lap with oil and grain emery, moving the work back and forth along the lap until it will pass easily from end to end, when the lathe may be stopped and the lap indented with a cold chisel, and supplied with oil and emery, and the grinding operation proceeded with as before. The work should be held upright and on each side of the lathe alternately, so that its weight shall not cause the grinding to be excessive on one side of the hole. Only about $\frac{1}{64}$ of an inch of shrinkage can be obtained on a hole and bolt by hardening, which, however, is highly advantageous when it is sufficient, because both the hole and the bolt will wear longer for being hardened.

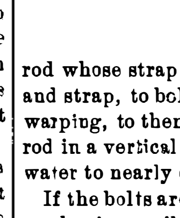
For closing long holes, boxes, etc., the water process may be employed, as represented in Fig. 44. *a a* is the section of



a wrought iron square box or tube, which is supposed to be made red hot and placed suddenly in the water, B, from its end, C, to the point, D; the result is that the metal in the water, from C to D, contracts or shrinks in diameter, and compresses the hot metal immediately above the water line, as the small cone at D denotes. If then the box or tube is slowly immersed in the water, its form, when cold, will be as described in Fig. 45, that part from C to D maintaining its original size, and the remainder being smaller.

It must then be rebeated and suddenly immersed from the end, E, nearly to D, until it is cold, and then slowly lowered in the water, as before, which will contract the part from D to C, making the entire length parallel but smaller, both in diameter and bore, than before it was thus operated upon.

Small holes to be reduced in bore by this process should be filled with fire clay, and the faces nearly or wholly covered with the same substance, so that the water will first cool the circumference, as shown in Fig. 46 *a* represents the hole, B the circumference of the washer supposed to be operated on, and the dotted line, C, the fire clay filling the hole and nearly covering the face; so that the part not covered will cool first, and, in contracting, force inwards the metal round the hole, which is prevented from cooling so quickly by the clay and therefore gives way to the compressing force of the outside and cooler metal.



This principle may be made use of for numerous purposes, as for reducing diameters of the tyres of wheels, reducing the size of wrought iron bands, or for closing-in connecting rod straps to refit them to the block end, the mode of operation for which is, in the case of a rod whose strap is held by bolts running through the block and strap, to bolt the strap on the rod to prevent it from warping, to then heat the back of the strap, and (holding the rod in a vertical position) submerge the back of the strap in water to nearly one half its thickness.

If the bolts are not worn in the holes, or if the strap is one having a gib and key, they may be merely put into their places without placing the strap on the rod. Even a plain piece of iron shrinks by being heated and plunged into water, but only to a slight degree, and the operation cannot be successfully repeated. Eccentric rods which require to be shortened, say $\frac{1}{64}$ of an inch, may be operated on in this manner, in which case care must be taken to immerse them evenly so as not to warp them.

Prizes for Essays.

The Academy of Arts, Science and Belles Lettres of Caen, France, offers a prize of eight hundred dollars for an essay on the subject of the functions of leaves in the vegetation of plants. A dissertation on the present state of science on this question, including the results of personal experiment, showing new facts tending to confirm or modify the doubtful points in theories now admitted, is required. The papers must be submitted before January 1, 1876.

Another prize, of one hundred dollars, is offered by the Academy of Sciences of Rouen, for a treatise on the advantages to be obtained by the conservation and improvement of cider by the employment of the processes of heating now applied to wines. The award will be made during the coming year.

Tests for Oils.

The testing of oils, in a simple mode, has always been a desideratum. Miss Kate Crane, in the *American Journal of Pharmacy*, gives an account of a series of experiments instituted by her, which tend to show that much reliance can be placed on the cohesion figures produced by dropping oils on the surface of clean water. In her experiments, a single drop of oil was allowed to fall from a burette held at a distance of four inches from the surface of a dish of clean water. The time required for the production of certain figures was carefully noted, as it appears that several oils will produce very similar figures ultimately, if sufficient time be given. Oil of turpentine spreads out instantly and begins intestine motions, and lastly forms a beautiful lacework. Oil of cinnamon forms a figure not more than half the size of the above. In a few seconds, small portions are detached and separate into distinct drops. Oil of nutmeg forms a large figure instantly, the edge showing a beaded line. Poppy seed oil spreads instantly to a large figure, retaining an unbroken form for a few seconds; then holes appear round the edge, and soon the whole surface is broken up with curved lines. Cod liver oil spreads into a large film; a little way from the edge small holes appear, and in a minute or two the surface is studded with them. These gradually enlarge, assume irregular shapes, and become separated by branching lines. As these oils give different figures, and behave differently when mixed with one another or with lard oil, this method may be of very great use in the preliminary testing of suspected oils.

A NEW DETACHABLE HORSESHOE.

The improved horseshoe represented in the annexed illustration is so constructed that it may be put on or removed from the hoof without requiring the labor of the blacksmith. When constructed of malleable iron, its cost need not be over half that of the ordinary shoe, while it is much more durable, there being no wearing out of the rim, if that portion be constructed, as it easily may be, of steel. The inventor suggests that the device is especially adapted for use in the army, and that it might be made in various sizes, and thus issued, nothing further than a rasp, in the hands of a cavalry soldier or artilleryman, being needed to fit the shoe to the horse's hoof.

The invention, as shown in section, in Fig. 3 of our engraving, is made in two parts, A and B, fastened together by dovetails, C, at the heel, and a screw, D, at the toe. The lower part has toe and heel calks, and the foot of the horse rests upon its upper side. The portion, B, forms a metallic rim around the hoof, covering the edge of the same, so that

Fig. 1

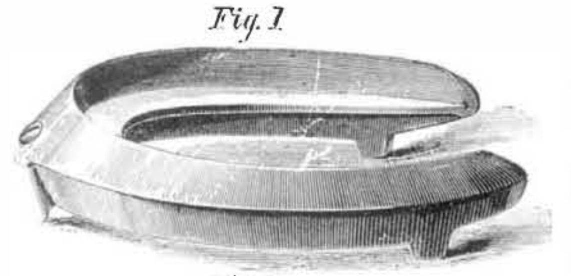


Fig. 2

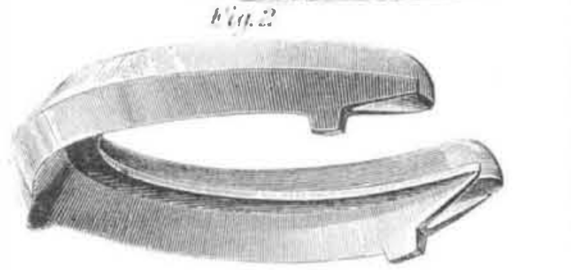


Fig. 3

when the parts are screwed together by screw, D, the shoe is firmly held. By placing a cloth or rubber cushion beneath the foot, the fit of the shoe may be tightened, and of course, by loosening the screw, the shoe may be easily removed.

Exterior views of the device, from above and from underneath, are given in Figs. 1 and 2. By its use, the horse's feet are left in their natural state, only requiring to be rasped off occasionally as the hoof grows. The shoes may be removed when the animal is turned out to pasture or when in the stall.

The inventor states that the entire shoe, ready for use, can be made for from twenty to thirty cents, and that, even if it be provided with a fancy polished rim of brass or other metal, its cost will not be so great as that of the common shoe.

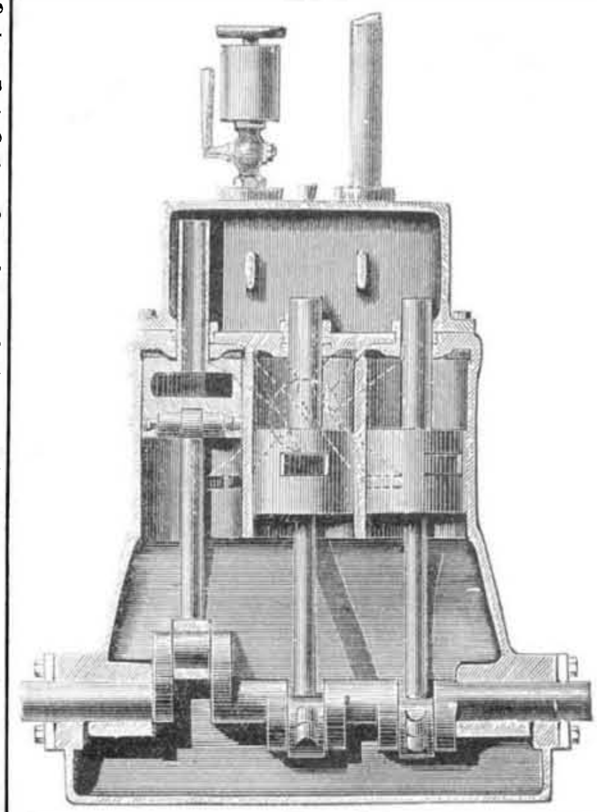
Patented through the Scientific American Patent Agency, August 25, 1874. For further particulars address the inventor, Mr. Luther W. Griswold, Marshalltown, Marshall county, Iowa.

A VALUABLE GIFT.—The Cincinnati *Gazette* states that Thomas H. Yeatman, Esq., has presented to the Young Men's Christian Association Free Library, of that city, a complete set of the volumes of the SCIENTIFIC AMERICAN. They comprise thirty bound volumes, and extend from 1859 to 1874 This is a rare and valuable gift.

WILLANS' THREE-CYLINDER ENGINE.

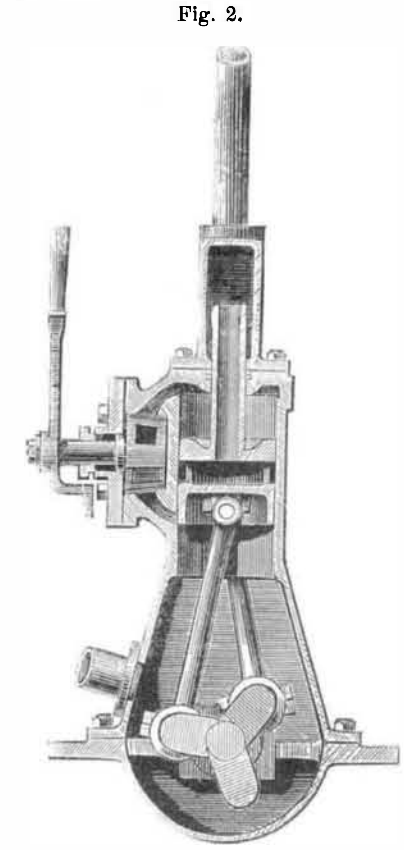
We illustrate herewith an ingenious and very neat arrangement of three cylinder engine, designed by Mr. P. W. Willans, of Greenwich, England, which is now in use for driving a fan, etc., at the works of Messrs. John Penn & Co., of

Fig. 1.



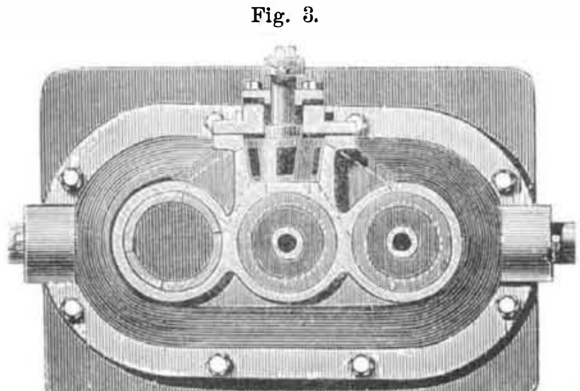
Greenwich, an establishment with which Mr. Willans is connected. In the engine in question three cylinders are used, and each cylinder is single-acting, receiving its steam upon the upper side only of the piston. The connecting rods are attached directly to the pistons, and actuate a three-throw crank shaft.

Fig. 2.



Each piston serves as a steam valve and controls the supply of steam to one or the other of two remaining cylinders. There is a steam chamber in each piston and a port in its side (see Figs. 1 and 2). Steam is supplied from the boiler by means of a hollow rod passing through the top of the

Fig. 3.



cylinder into a steam chest. When the piston has reached about three fourths of its downward stroke, the steam port in it overlaps a port formed in the side of its cylinder, and steam then passes to the top of another of the cylinders; when, on the other hand, the piston has reached about one half its return stroke, it uncovers the port in the side of its cylinder and allows the steam to escape, from the cylinder into which it was previously admitted, into a casing round the crank shaft, from which the exhaust steam is taken either to a condenser or to the air, as the case may be.

In an engine which is required to run only one way round, the port in the side of each cylinder passes direct to the top of one of the other cylinders; but where it is desired to reverse the engine, as in the one illustrated, the ports to the top of each cylinder and those to the sides of each cylinder meet in a three-way cock (see Fig. 2); and this cock, by connecting the port in the side of any one cylinder with that to the top of either one or other of the other cylinders, reverses the engine. It will be seen that the wear upon the connecting rods and crank shaft bearings is always in one direction, namely, downwards, so that no moderate amount of wear affects the working of the engine, and the whole machine is perfectly noiseless. The tubes through the tops of the cylinders, besides forming guides for the pistons, allow a great number of revolutions to be made without any loss of power in stopping and setting in motion again, the amount of dead weight in motion being small; and the pressure upon the three tubes keeps them in equilibrium, but still maintains a constant pressure upon all the bearings. All the lubrication is done through a steam lubricator on the steam chest (Fig. 1), and whatever oil is wasted in the cylinder passes down to the bottom of the casing, and lubricates the lower ends of the connecting rods as they pass round. The upper ends of the connecting rods receive their lubrication direct from the steam chamber in the piston by way of small holes drilled through the bottom of the chamber. As the stroke of the engine is so large in proportion to the width of the steam ports, the latter are opened and closed very quickly, and there is little or no back pressure in the cylinders. By some slight modifications the engine may be made compound, and the crank shaft may, if necessary, be kept outside. A plan of the arrangement is shown in Fig. 3. When there is a casing round the axle, the feed water may be heated by being pumped through pipes passing through that casing.

We have examined the engine at work at Messrs. Penn's (says *Engineering*, to which we are indebted for the engravings), and have found it work with admirable steadiness at very high speeds. Some indicator diagrams have also been taken from this engine, showing a very good distribution of the steam. The whole arrangement is, as will be seen, very simple and compact, and there appears to be a wide field for the application of such an engine.

IMPROVED CORK-SOLED BOOTS.

Represented in the annexed engraving is a novel plan for making boots and shoes with cork soles, which, judging from some completed articles which the inventor has submit-

Fig. 1

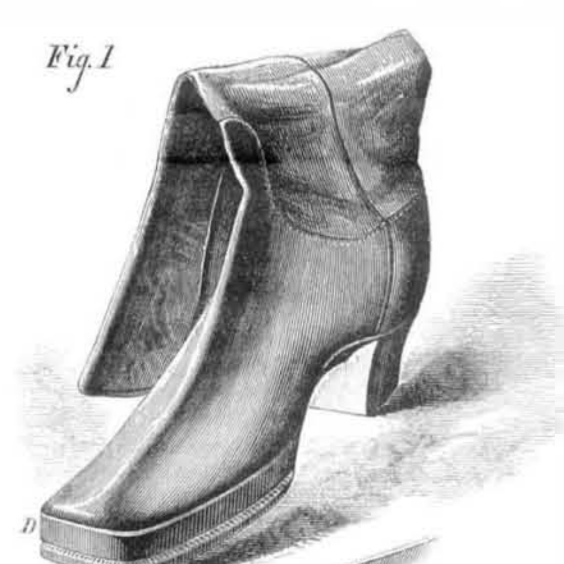
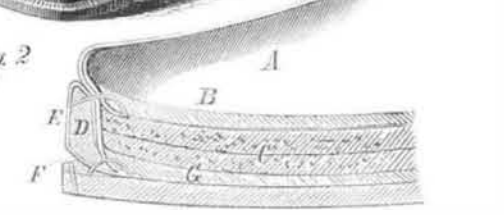


Fig. 2



ted to us, is an invention both valuable and timely. A very thick but very light sole is provided, which effectually keeps out the cold and wet of winter, and in summer shields the foot from the excessive heat of the sun-baked pavements. The device is as easily repaired as the common sole, and its use in bad or rainy weather would obviate the wearing of overshoes, to most persons a disagreeable necessity

In Fig. 1 a view of the finished boot is given, from which it will be seen that there is no detraction from the neat appearance of the covering. In Fig. 2, a sectional view of the sole shows the mode of attachment of the various portions of the same. The upper, A, is attached to the inner insole, B, by a seam. C is the cork, which is made in two layers, superposed, this construction preventing dampness passing through, however thin the material itself may be. Around the edges of the cork is placed a band of sole leather, D, covered with fine calfskin, E. This cover and the upper edge of the band are sewn in with the upper to the inner insole. By a second seam the upper, the lower edge of band, D, the cover, E, and the welt, F, are attached to the middle sole, G. The upper is taken up in both seams, giving great strength and firmness to the sole. The outer or main sole is secured to the welt by a third seam in the ordinary manner.

Patented through the Scientific American Patent Agency, June 16, 1874, by Mr. E. A. Brooks, of 1,196 Broadway, New York city, who may be addressed for further particulars.