

NORTON ABRASIVES



How to Sharpen

BEHR-MANNING, TROY, N.Y., U.S.A.
(DIVISION OF NORTON COMPANY)

NORTON ABRASIVES

How to Sharpen

A Book for the Mechanic,
Farmer, Home Craftsman
and Student

Twenty-second Revised Edition
1942

*"What a curse be a dull tool; what
a prideful comfort a sharp one."*

ANON.

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change without notice.

BEHR-MANNING, TROY, N.Y., U.S.A.
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Why put up with dull tools or knives? From these pages make up your mind just which inexpensive item will give you the greatest comfort and satisfaction; then go to your dealer and order *by name* the exact stone wanted. If he hasn't it in stock he will be very pleased to get it for you.

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1942

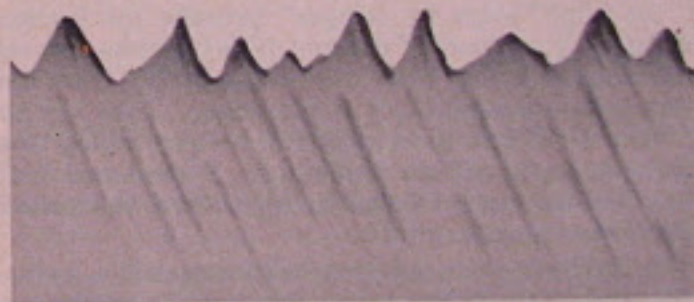


The Purpose

Even before we discuss what oilstones are; how they are made; their use and care, we must appreciate that they are merely a means to a highly desirable end — *the achievement of a perfect cutting edge.*

What the Edge Is:

A perfectly sharpened edge, under a powerful microscope, resembles a picture of a mountain range with its hills and valleys. Such an edge is like saw teeth, but not nearly so uniform. These mountains or teeth are actually what make an edge cut. Without them a tool loses its cutting efficiency and is dull.



Microscopic Section of Sharp Edge Highly Magnified to Show "Mountains and Valleys"

The topmost grades of tool or knife steels, properly tempered and ground, possess a high degree of flexibility, a property which extends into the saw-like teeth of the edge. Being flexible, they bend back and forth under pressure of operation and gradually break away. When they are completely gone, the edge has lost its keenness and is ready for oilstoning.

The Oilstone's Job

The primary functions of oilstoning are to restore the microscopic mountains and valleys to a cutting edge which through use has become dull, yet is not ready for grinding and to remove wheel marks from freshly ground tools. In both cases, the cutting teeth of the edge are made keener and smoother—the tool works easier and produces better finished work.

Oilstoning can be repeated time after time until the bevel becomes so short or thick that the tool works with difficulty and only by the use of so much force that the bevel, or even the tool, may be fractured and made useless! Before this stage arrives the original bevel should be restored on a grinding wheel.

Too Much Heat

An edge "loses its temper" because the friction created by pressure of the tool on the grinding wheel develops sufficient heat to draw the carbon from the tiny invisible steel teeth of the edge. They are no longer steel but have reverted to iron which has little strength and no flexibility. A steel tool that has lost its temper is no better than a sharpened clam shell or piece of tin.

In oilstoning extremely delicate edges it is sometimes possible to create enough heat to produce a harmful effect; therefore, it is always better to err on the side of light pressure and plenty of lubricant. No matter what statements may be made by manufacturers, an edge should never be ground on a dry grinding wheel or oilstoned on a dry stone.

Avoid Heat in Grinding

Excessive heat in grinding is caused by too high a wheel speed; using too much pressure; grinding dry, or by a combination of all three.

The grinding wheel should be operated at as low a speed as feasible and the tool should be held lightly against the wheel, keeping it constantly in motion from side to side. Let the wheel do the cutting—do not force it.

Always use some form of liquid coolant to relieve friction. In the absence of better equipment have a pan of cool water handy. Dip the tool into it frequently, keeping the tool or wheel or both constantly wet.

The Wire Edge

A freshly ground tool may come from the grinder with a "wire" or feather edge which may persist, through oilstoning. This has nothing to do with the teeth in the edge previously discussed. A wire edge can be seen and felt. It is removed by laying the tool flat on the face of the stone and gently rubbing it off. The cutting edge should then be returned to oilstoning position and given a few light strokes.

Advantages of Perfectly Sharpened Edges

A carelessly ground tool, the edge of which is "burned," will not stand up to its work. It dulls quickly and must be ground frequently. On the other hand, a carefully ground and oilstoned edge maintains its keenness for a long time. Moreover, its cutting action can be restored repeatedly *without grinding* if stoned at the first sign of dullness.

Besides saving time, a correctly finished edge does better and faster work, reduces labor to a minimum and saves valuable tool material wasted by frequent trips to the grinder.



How to Select a Stone

What Sharpening Means

It is not merely the friction between the stone and the steel that brings the latter down to an edge. Sharpening means *cutting*.



Magnified View of Sharpening Stone Crystals

Every sharpening stone is a mass of minute crystals—sharp little cutting points, each harder than steel.

The coarseness or fineness of these crystals, their hardness and their brittleness or toughness are the things which make one stone better than another for a specific purpose.

You would not think of sharpening a razor on a scythestone. The scythestone and the razor hone mark two extremes. Between them lie the various stones used in shops, homes and on the farm.

The first thing to consider is the purpose for which the stone is to be used—whether a fast-cutting stone will be more useful than a slower-cutting stone that gives a finer edge.

Cutting edges are classed in three groups—coarse, medium and fine. The ideal edge for a carving knife is a “coarse” edge. To take the time to set a finer edge would be a needless waste of time.

Coarse-Edged Tools

Practically all of the tools in the coarse-edged group are *knives*. One of the reasons why these do not require a fine edge is the fact that knives are always used with a diagonal, or a sawlike motion. This adds to the cutting efficiency, and at the same time the slight coarseness of edge, in its turn, adds to the sawlike effect, again making the cutting easier. These tools include carpet knives, carving knives, bread knives, paring knives and kitchen, household and farm knives of all kinds, including scythes and sickles, but *not* including *tools*.

Medium-Edged Tools

Medium-edged tools require more smoothness than a coarse edge affords, yet do not need extreme fineness. Such are the tools used by most mechanics—more particularly the broad bevel-edged tools, like chisels, planes and draw knives.

The logical inference would be that to secure a medium edge one should use a stone of medium grit. This is not entirely correct. The more satisfactory way is to use a *coarse* stone for rapidly cutting the edge down, and then to finish on a *fine* stone to whatever degree of fineness is desired. For this reason, a *Combination Stone*, which unites a coarse stone and a fine stone, is usually more useful than a medium stone.

Fine-Edged Tools

The tools and instruments in this group are used for highly specialized purposes, notably by the

surgeon and the dentist and also by the scientist in preparing specimens for the microscope. Such edges when quite dull are usually brought down to comparative sharpness on a fine-grit stone, such as Norton India but the finishing touches are given on an Arkansas stone.



Natural and Artificial Stones

Explanation of Difference

Natural stones include those which are taken directly from the earth and, without undergoing any change of structure, are fashioned into convenient shapes for mechanical purposes. Artificial stones consist of certain basic materials which in the course of manufacture undergo some chemical change whereby an entirely new material is created, after which it is crushed, graded and molded into proper shapes and baked under intense heat in kilns or ovens.

Electric Furnace Abrasive

By scientists, the production of Artificial stones is regarded as a triumph of the first order. It means the making by man of rock crystals which are harder than anything in Nature except the pure diamond. The titanic magnitude of the operation may be partly understood when it is said that these crystals require for their making a temperature running at times as high as 4000 to 5000 degrees of heat—a temperature made possible only by the use of great electric furnaces.

There are now two important types of Artificial oilstones on the market; one is known chemically as Aluminum Oxide and the other as Silicon Carbide. The best known form of Aluminum Oxide

is Norton Alundum abrasive which is a reproduction of the natural mineral Corundum; which, in turn is closely related to the Ruby and Sapphire. When made into oilstones this artificial electric furnace material is known as Norton India.



Norton Alundum Furnace in Action

Advantages of India Oilstones

One of the chief advantages of Norton India is the remarkable *uniformity* which it is possible to impart to the coarseness or fineness of the crystals. Since the degree of coarseness is one of the prime considerations in choosing a stone, it becomes a matter of real importance to be able to *control* this, and thus to secure a perfect stone with coarse, medium or fine grit.

A second advantage is the consistent hardness and texture throughout the stone, due to the scientific "bonding" together of the crystals. This enables the user of a Norton India stone to buy a new stone of the same grit with the assurance that it will be a duplicate.

HOW TO SHARPEN

Alundum crystals, from which Norton India is made, are so extremely *tough* that, in addition to their fast-cutting quality, they withstand the hardest service.

There is no steel too hard for them to sharpen quickly, nor hard enough to cause them to groove or wear down unevenly if properly used.

Being made in three grits—coarse, medium and fine—there is no ordinary class of sharpening of which they cannot take excellent care.

It is this unique combination of *toughness* with extreme *hardness*—this *fast-cutting* quality coupled with the ability to *hold its shape*—that makes Norton India the most useful sharpening stone known.

This is why, in the great machine shops, Norton India gives such satisfactory service. This is why carpenters, wood-workers and other mechanics favor it and why we recommend it for use by experts.

Another attractive feature of Norton India Oil Stones is that they are oil-filled by a process which gives them *remarkable freedom from glazing*. This avoids the necessity of soaking new oilstones in oil and makes them ready for use with only a slight application.

Crystolon Oil-Saturated

For those jobs where speed of cut with light pressure is desirable—such as experienced in home workshops—the line of Norton Abrasives includes a full assortment of bench stones and slips of Crystolon (silicon carbide) abrasive.

Oil impregnated at the factory, Crystolon oilstones are ready for immediate use as received or, if preferred, with only slight additional application of oil for still easier and smoother cutting. Because of this oil saturation, Crystolon oilstones offer at all times a well lubricated and free cutting surface.

HOW TO SHARPEN

Natural Stones

There are some Natural stones that hold their places as firmly as ever. One of these is that famous stone known to every user of extremely keen tools—Arkansas.

Hard Arkansas

No other stone, Natural or Artificial, approaches this for its particular purpose, which is to sharpen tools requiring the very finest edges, such as are used by surgeons, engravers, wood and ivory carvers, dentists and others. It has a finer grit than any other oilstone and imparts the smoothest edge.

Soft Arkansas

This stone is more porous than the Hard, and a little coarser, hence does not impart so fine an edge. It cuts faster and is better for some work.

Washita

Washita stones have always been favored in carpenter, woodworking and cabinet making shops. While slower cutting than Artificial stones they will always be popular due to the fact that they give a smooth, long-lasting edge. There are two grades, "Lily White" being the best selection.

Other Norton Stones

Among other Norton Natural stones are the Queer Creek, Hindostan and Sandstone. These stones are used for certain specific sharpening operations. The Queer Creek gives the desired edge on the knives used by the native workers on the rubber plantations of the world. It is also the right grit for hackers used in the turpentine forests of the South. Hindostan is popular in the packing house industry, while Sandstone is used where a rough, coarse edge is desirable.



How to Sharpen

One rule that has very wide application in using cutting tools is to sharpen against the edge.

With two exceptions, all kinds of sharpening (both on grinders and oilstones) are performed with the edge of the tool working *against* the stone. The exceptions are: (1) when sharpening on leather, as with a razor strop; (2) when the tool itself is held still while the whetstone or oilstone is moved to do the sharpening—as in sharpening a scythe or sickle with a whetstone or in sharpening the inside of a gouge or other concave edge with an oilstone slip. The reason for sharpening against the edge is that this results in less "wire edge."

Broadly speaking there are only two ways of sharpening tools or knives:

1. By means of a grinding wheel, as in the old-fashioned grindstone or the more modern tool grinder.

2. By rubbing or whetting the tool on some one of the many shapes and styles of oilstones, hones or whetstones.

There is no type of hand tool for which you will not find in the Norton Abrasive line a sharpening stone that is adapted to give you best results. Let us discuss first the reasons for sharpening on grinding wheels.

Grinding wheels have two enormous advantages: First, they cut steel fast; second, they give the tool a *concave*

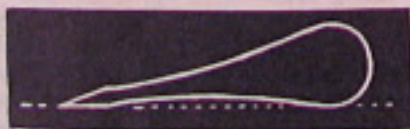


Fig. 1

or hollow ground bevel. This does not mean, however, that grinding wheels can take the place of sharpening stones, the use of which is explained further on.

Now about bevels: Look at the illustrations. The dotted line represents the flat surface of an oilstone or a hone. Fig. 1 shows a cross section of a hollow ground razor. Properly, all hand tools and knives must be sharpened on this same "Hollow Ground" principle to do their best work. It is hard to see this in a knife, but easy to see it in any tool with a broad bevel, such as a chisel or draw-knife.



Fig. 2

Fig. 2 is exaggerated a little to show how exactly like the razor is the *correctly* ground bevel of a chisel—both are *concave*. This *concavity* comes from the curve of the grinding wheel.

Fig. 3 shows an *incorrectly* ground chisel. The bevel is *straight* instead of *concave*. This is caused by not holding the tool in *one unchanging position* on the grinding wheel.

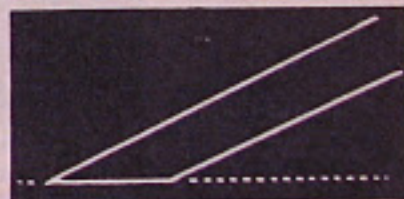


Fig. 3

One object of the *concavity* is that it makes a *thinner* shaped wedge, hence enters wood, etc., more easily than does the straight bevel.

Another object is that this hollow ground bevel will last much longer than will a bevel like that shown in Fig. 3. Here is the reason for

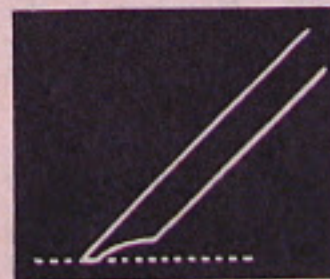


Fig. 4

this: Fig. 4 and Fig. 5 show the hollow ground chisel and the straight ground chisel after they

have been sharpened several times on the oilstone.

Note that the hollow ground chisel (Fig. 4) is still concave. It will not go to the grinder for some time. But the other (Fig. 5) is now convex—it works hard and slow. It should go to the grinder right away. It needs grinding much *oftener* than the chisel in Fig. 4.

The same thing is true in all other tools—even in butcher and carving knives. The *properly* ground tool will cut better and need less frequent sharpening.



Fig. 5



The Use of Stones

Grinders give the correct *bevel*, but it takes the *flat* surface of an oilstone or hone to put on the finishing touches of a keen, lasting *edge*.

Many people lay a blade on an oilstone and proceed to sharpen it by a *circular* or *rotary* movement. With a pocket knife or other short blade, this will put on an edge in time. But straight strokes sharpen more quickly. Moreover, in the case of chisel-like tools this rotary motion constantly changes the angle at which the tool is held and prevents the edge from being true.

Chisel-like Tools

By far the greater number of the cutting tools in common use are of the chisel type. These instructions, therefore, apply with slight variation to chisels, plane-irons and all tools of this general pattern.

A tool of this type shows its dullness in the form of a thin white, or bright, line along the edge. Until the bevel-edge has become so obtuse as to

need grinding (as explained before), this dullness is properly removed on the oilstone. The test of sharpness is the disappearance of the thin bright line.



Fig. 6

First see that the oilstone lies perfectly level to insure a true edge. Apply a few drops of oil to the stone and grasp the tool as shown in the illustrations, Figs. 6 and 7.

Note that there is no side-wise turn in the right wrist. Any twisted or turned position in

this wrist is sure to give a certain amount of rolling or twist to the tool, thus impairing a true sharpening angle. Swing the right arm from the shoulder bending it only at the elbow and holding the wrist rigid. Place the edge at an oblique angle across the face of the stone, as shown by the dotted lines, and rub backward and forward, bearing down with both hands.

If the bevel has been recently ground, hold the hands low to make the oilstone bevel correspond with the grinding bevel. With each sharpening it is necessary to hold the hands a trifle higher until, finally, the oilstone bevel becomes too obtuse, when the tool must again go to the grinder. In rubbing over the stone move the hands *horizontally* — parallel with the stone — instead of giving them a dipping or scooping motion, as this latter tends to round the edge of

the tool and to make the stone hollow out. For the same reason, it is important to use, as much as possible, the entire face of the stone, rubbing the tool over the entire length and occasionally turning the stone end for end.

When, after wiping the tool clean, you find the thin line of dullness has entirely gone, turn the tool over, keeping it PERFECTLY FLAT on the stone, and with one or two light, sidewise strokes remove any burr or wire edge.

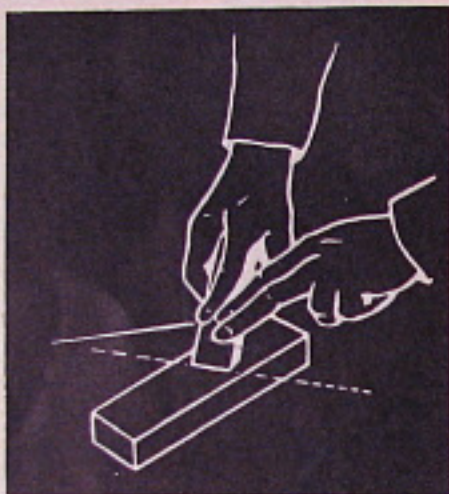


Fig. 7

The bevel angle on a chisel or gouge varies according to whether the tool is to be used regularly on hard or soft wood. A long, acute angle does not afford as much strength as does a more obtuse one. Hence, men who work in hard woods use tools that would seem to workers in soft woods to have a rather blunt bevel.

The bevel on a framing or mortising chisel must be more obtuse than that on a paring or "firmer," chisel for the reason that in the latter there is not so much need for strength.

Curved Edges on Plane Irons

To avoid leaving marks of the plane on the wood, the plane iron should be ground to fit the tool in which it is used. (See Fig. 8.) For a single-iron

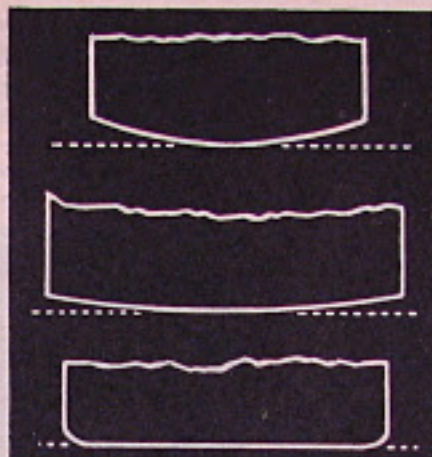


Fig. 8

Sharpening a Draw Knife

Place the tool, bevel uppermost, with one handle flat on the bench and the other projecting over the edge, so that you can grasp it firmly in the left hand. With the oilstone in the right hand, run it over the bevel, back and forth in an end-to-end direction, as in this way it is more easy to steady the stone and hold it true to the proper angle.

Gouges and Irregular Edges

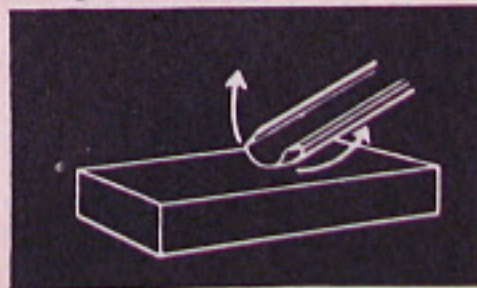


Fig. 9

ing motion from side to side as it passes back and forth over the stone. (See Fig. 9.) The same is true in grinding. Hold the length of the gouge, not

jack-plane the edge should be rounded; for ordinary jack-planes, slightly rounded and for smoothing, panel or trying planes, straight except with a slight turning up of the corners. On all other planes, the edge is entirely straight.

For good work, the bevel on a gouge must follow the curve of the tool. For this reason, it is necessary to give the gouge a rock-

parallel with the face of the wheel, but at right angles so that the bevel is ground sidewise and rock the entire surface of the bevel back and forth on the face of the wheel. In Fig. 10, "A" shows the result of good, accurate sharpening, while "B" indicates the irregular bevel-angle caused by attempting to sharpen a gouge without enough of the rocking movement.

To take off the wire edge from the inside, hold the gouge firmly against the bench and gently rub with a round-edge oilstone "slip." Be very careful to hold this flat against the inside of the groove to avoid turning the edge of the tool.

Gouges and other irregular shaped tools with the bevel inside are likewise sharpened by holding them firmly against the bench while an oilstone "slip" of the right shape is rubbed against the bevel.

The two previous paragraphs explain why it is desirable to have several slips of different shapes and sizes.

How to Sharpen Knives

As stated, knives are like the chisel type of tools in that they cut better if sharpened so as to retain the wedge form. The wedge-like angle, however, is not the main bevel extending from the back of the blade down to the edge. If it were, the whole blade would have to be held flat on the grinder wheel and this would soon grind the blade down to such thinness as to rob it of rigidity and strength. The wedge-like angle, or cutting bevel, extends back from the edge only a very short distance—rarely more than an eighth of an inch even on a large knife. Often this bevel can hardly be seen.

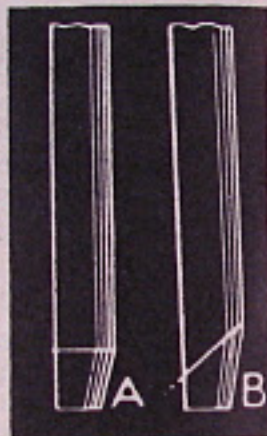


Fig. 10

This means that, on the grinder as well as on a Knife Sharpener, or an oilstone, the blade is applied with its back tilted up to get the *bevel edge* flat on the stone.

Practically all mechanics' knives with straight edges are sharpened on a flat oilstone, many of the thinner blades never being put on a grinder at all.

For sharpening ordinary knives, such as used in and around the home, the best device is a household knife sharpener. Because it sharpens so quickly we suggest the Norton Kantbreak Knife Sharpener.

It requires no skill and hardly any practice to get perfect results with this. Fig. 11 shows how to use it.

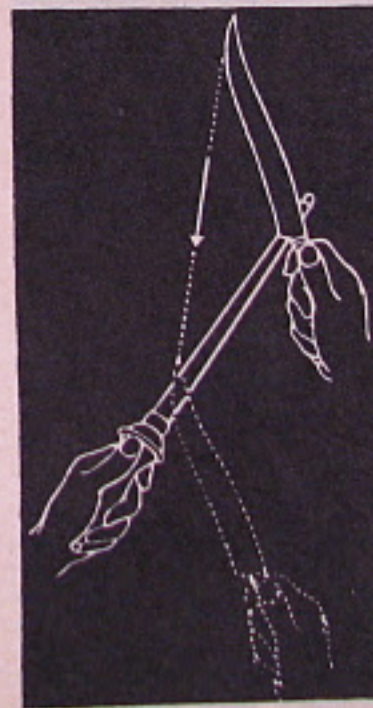


Fig. 11

Holding it in the left hand with the point upward, the handle protects the hand so that one may swiftly sweep the blade downward, first on one side, then on the other, with the edge foremost. Hold the blade against the stone with the back of the blade slightly lifted to give the right angle on the bevel. Always start each stroke at the "heel" of the blade and, sweeping down diagonally, cover the entire length of the edge from heel to point in each stroke. Do not use much pressure.

No one but a butcher should depend on a "steel"—and even he is forced to use it almost constantly to make it effective. A "steel" is only useful to add the last touch of keenness to a knife already extremely sharp.

To Sharpen Stainless Steel Cutlery

An effective method for sharpening household knives with highly polished blades, without scratching or marring the finish, is to use one of the Crystolon knife sharpeners described on page 39. The operation is simple. Hold the knife in the left hand and with the right hand, apply the sharpener to the cutting bevel using little file-like motions a-



Fig. 12

long the entire length of the blade, first on one side and then on the other. Tilt the sharpener slightly, not only to give the correct bevel but also to clear the fine finish of the blade without touching.

To Sharpen Scissors

Scissors can be touched up on almost any good quality stone with a flat surface. All that is necessary is to apply the blade so that the bevel lies accurately upon the face of the stone with the blade crossing the stone at right angles. Then draw the blade smartly across the stone from heel to point. Do not run the blade back and forth—start each stroke at the heel of the blade.

Pocket Knives

These should be sharpened preferably on a medium or fine oilstone, or better yet, on a Pocket Knife Sharpener such as is referred to on page 31.

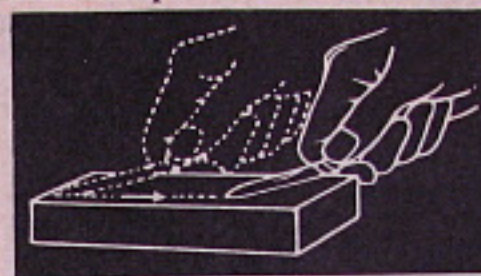


Fig. 13

Apply the blade of a pocket knife to the stone with its back slightly tilted. Hold it obliquely across the face of the stone, and smartly rub straight back and forth. (See Fig. 13.) Then reverse to the other side of the blade and repeat. With a *fine* oilstone, if the blade is sharpened thoroughly, there will be no perceptible wire edge—none at all, if it is finished on a Norton Arkansas. If it is necessary to remove all trace of burr, this may be done by stropping the blade on the coarse side of a razor strop.

Many leading teachers of manual training recommend the Sloyd pattern knife for young pupils. This knife has a pronounced bevel extending midway to the back of the blade and is best sharpened by laying this bevel flat on the stone. To sharpen all the way back to the "heel" on both sides of the stone, it is recommended to sharpen one side of the blade first with the right hand, and then applying the blade to the left side of the stone using the left hand.

Scythes and Long Blades

With blades like the scythe, sickle and others that are too large to be moved over the whetstone or oilstone, the blade is held firmly in the left hand and stroked along the edge with the stone—first on one side, then on the other, and always toward the point of the blade.

Augers and Gimlets

Augers and auger-bits are often sharpened with a file. But to get a smooth edge, it is necessary to use, at least for finishing, an oilstone "slip." The two parts that get dull are the "nicker" or scoring nib, A, and the cutting lip, B, in Fig. 14. The scoring nib is sharpened only from the inside. Otherwise it would become smaller than the body of the bit.

The cutting lip should be sharpened from the lower side, care being taken to preserve the original angle.

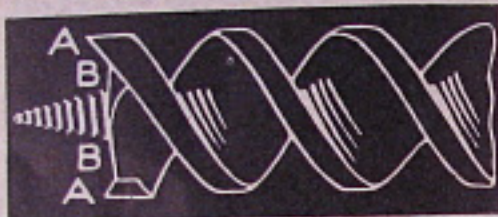


Fig. 14

Norton India stone No. 10 is especially shaped to get at the angles of an auger.

To restore a gimlet, fix a piece of oak about $1\frac{1}{4}$ inches thick in the vise and make a hole $\frac{3}{4}$ inch deep in its top with the gimlet to be sharpened. Fill the hole with flour abrasive, adding a few drops of oil and then reinsert the gimlet and bore down into the wood until the point shows through. Repeat for a few minutes, adding fresh abrasive and oil. Then repeat the process, using this time a piece of soft pine and abrasive without the oil.

Lawn Mowers

The Utility File described on page 39 is an excellent lawn mower sharpener. First, invert the mower. Then grasp the blade near the end with one hand and with the Utility File in the other hand, run it over the bevel back and forth, in an end-to-end direction, being careful to follow the bevel already established. Most blades require but little touching up.

To Hone a Razor

Hold the razor *perfectly flat* on the hone. The thick back takes care of the bevel. Lay the razor diagonally on the hone and draw it against the edge across the full length of the hone, using light pressure.

Reverse the razor at each stroke, rolling it on the back, and repeat the stroke in the opposite direction. (See Fig. 15.)

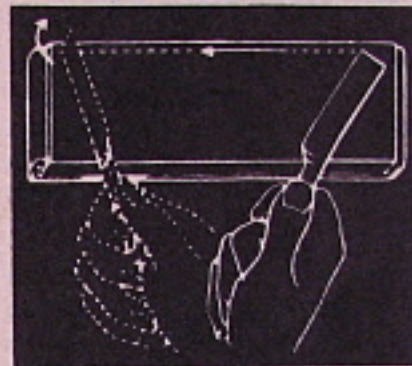


Fig. 15

Unless the razor is quite dull a few strokes will make it ready for the strop. Do not use the hone too freely. Beyond a certain point, the edge loses its velvety keenness. This is called "over-honing" and may be safely avoided by observing the rule "Use the hone less and the strop more."

Using the Strop

Hold the blade perfectly flat on the strop and hold the strop as *taut* and *straight* as possible to prevent rounding the bevel. Draw the razor diagonally from heel to point along the length of the strop, and away from the edge instead of against it. Then roll the razor on its back to reverse it and repeat the stroke in the opposite direction. Be sure the entire length of the razor's edge is covered during each stroke.



Oilstones in the Machine Shop

The oilstoning of metal cutting tools is of greater importance than ever in these days of extremely high speed cutting tools. It serves two distinct purposes. First, it means much longer life between trips to the grinding wheel; and, second, it produces a smoother finish.

One great difficulty of high speed steel is the tendency of the surface to crater just back of the cutting edge. This cratering is caused by excessive frictional load. The friction can be materially reduced by oilstoning such surfaces as are subject to cratering, and thereby prolonging the life of the cutting edge. This is a distinct advantage on lathe tools, milling cutters, twist drills, reamers and threading tools like taps and die chasers.

Oilstoning is a very profitable operation on opening die chasers on turret lathes, both hand and automatic. Also, it requires only a short oilstoning operation to remove the slight burr which occurs in grinding thread tools, and this means that a much smoother thread can be cut.

Norton India Oilstones are used almost universally in the large machine shops of the world. An oilstone that wears out quickly, or one that grooves easily, has no place in modern industry. It is by reason of supreme quality that Norton India is so widely used in shops where the most modern practice prevails.



How to Care for Oilstones

To obtain full value from an oilstone the following rules should be observed:

A stone should be kept clean and moist at all times. To let it remain dry or expose it to the air for long periods tends to harden it.

After using, the dirty oil should be wiped off the stone. Use a clean rag or cotton waste.

When not in use a stone, with a few drops of clean, fresh oil left on it, should be kept in a box with closed cover.

Use the entire face of the stone to prevent uneven wear and hollowing out in the middle.

Oil should always be used on oilstones to prevent glazing caused by particles of steel being forced into the stone; also, as a coolant to avoid heat created by friction.

Do not use heavy oils or greases which fill the pores of the stone and slow its cutting action. Because of its non-gumming and non-drying qualities Pike Oil is excellent. In case of emergency—no Pike Oil available—kerosene may be used.

If a stone becomes glazed or gummed up, a good cleaning with gasoline or ammonia will often restore its cutting qualities. If not, use a piece of abrasive paper or cloth.

Norton India and Crystolon oilstones are pre-saturated with oil at the factory, requiring only slight further application at time of use. As the natural oilstones, Arkansas and Washita, are not oil-filled an over-night soaking of new stones in oil is beneficial.

HOW TO SHARPEN



India Bench Stones

Read "Advantages of India Oilstone", Page 9.

Numbers			Size	Each
Fine	Medium	Coarse		
FB24	MB24	CB24	4 x 1 x 1/2"	\$0.55
FB 6	MB 6	CB 6	6 x 2 x 1"	1.15
FB 7	MB 7	CB 7	7 x 2 x 1"	1.25
FB 8	MB 8	CB 8	8 x 2 x 1"	1.50

India Combination

A Coarse and Fine grit India, vitrified (not glued) together, giving the distinct advantage of two stones in one.



Numbers	Size	Each
IB134	4 x 1 3/4 x 3/8"	\$0.85
IB 6	6 x 2 x 1"	1.25
IB 7	7 x 2 x 1"	1.50
IB 8	8 x 2 x 1"	1.75

India Round Edge Slips

Widely used for putting an oilstoned finish on tools and knives with curved cutting edges.



Numbers			Size	Each
Fine	Medium	Coarse		
FS24	MS24	CS24	4 1/2 x 1 3/4 x 1/2 x 1/8"	\$0.65
FS34	MS34	CS34	4 1/2 x 1 3/4 x 3/8 x 1/8"	0.65
FS44	MS44	CS44	4 1/2 x 1 3/4 x 1/2 x 1/8"	0.65

HOW TO SHARPEN

Crystolon Bench Stones

Read "Crystolon, Oil-Saturated". Page 10.



Numbers			Size	Each
Fine	Medium	Coarse		
FJB24	MJB24	CJB24	4 x 1 x 1/2"	\$0.55
FJB 6	MJB 6	CJB 6	6 x 2 x 1"	1.15
FJB 7	MJB 7	CJB 7	7 x 2 x 1"	1.25
FJB 8	MJB 8	CJB 8	8 x 2 x 1"	1.50



Crystolon Combination

Coarse side restores dull edges rapidly. Fine side produces a finished edge.

Numbers	Size	Each
JB134	4 x 1 3/4 x 3/8"	\$0.85
JB 6	6 x 2 x 1"	1.25
JB 7	7 x 2 x 1"	1.50
JB 8	8 x 2 x 1"	1.75

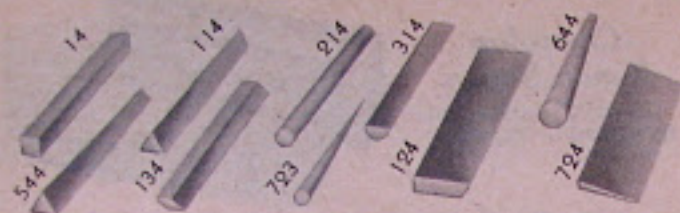
Crystolon Round Edge Slips

For tools with curved cutting edges.



Numbers			Size	Each
Fine	Medium	Coarse		
FJS24	MJS24	CJS24	4 1/2 x 1 3/4 x 1/2 x 1/8"	\$0.65
FJS34	MJS34	CJS34	4 1/2 x 1 3/4 x 3/8 x 1/8"	0.65
FJS44	MJS44	CJS44	4 1/2 x 1 3/4 x 1/2 x 1/8"	0.65

HOW TO SHARPEN

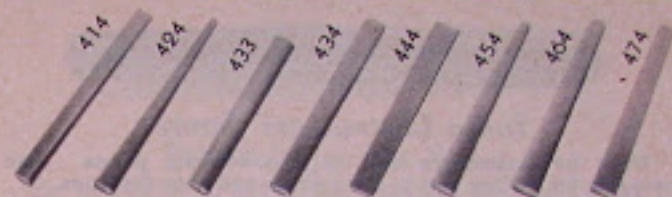


India Files

Made in many different shapes and sizes for various classes of work like stoning dies, cleaning and polishing moulds, lapping or reaming round or square holes, in fact, a thousand and one jobs that come up daily in every class of industry.

Numbers			Size	Shape	Each
Fine	Medium	Coarse			
FF 14	MF 14	CF 14	4 x 1/4"	Square	\$0.40
FF 24	MF 24	CF 24	4 x 1/8"	"	0.45
FF 34	MF 34	CF 34	4 x 3/8"	"	0.45
FF 44	MF 44	CF 44	4 x 1/2"	"	0.45
FF114	MF114	CF114	4 x 1/4"	Triangle	0.50
FF124	MF124	CF124	4 x 1/8"	"	0.55
FF134	MF134	CF134	4 x 3/8"	"	0.55
FF144	MF144	CF144	4 x 1/2"	"	0.55
FF214	MF214	CF214	4 x 1/4"	Round	0.60
FF224	MF224	CF224	4 x 1/8"	"	0.65
FF234	MF234	CF234	4 x 3/8"	"	0.65
FF244	MF244	CF244	4 x 1/2"	"	0.65
FF314	MF314	CF314	4 x 1/4"	Half Round	0.50
FF324	MF324	CF324	4 x 1/8"	"	0.55
FF334	MF334	CF334	4 x 3/8"	"	0.55
FF344	MF344	CF344	4 x 1/2"	"	0.55
FF644	MF644	CF644	4x1/2x1/4"	Taper Round	0.75
FF544	MF544	CF544	4x1/2x1/4"	Taper Tri.	0.75
FT134	MT134	CT134	4x1/2x1/4"	Diamond	0.90
FF723	MF723	CF723	3x1/8" Base	Point	0.90
FF724	MF724	CF724	4x1x1/4" Back	Knife Blade	0.70
FT124	MT124	CT124	4x1x1/4"	Reamer	0.55
FT125	MT125	CT125	5x1x1/4"	Reamer	0.55

HOW TO SHARPEN



India Silversmiths' Stones

Originally designed for the many different shapes and sizes of dies in the silversmith industry, these stones are now used in a great variety of general mould and die work.

Numbers			Size	Each
Fine	Medium	Coarse		
FF414	MF414	CF414	4x1/2x1/2x1/2"	\$0.75
FF424	MF424	CF424	4x1/2x1/2x1/2"	0.75
FF433	MF433	CF433	3x1/2x1/2x1/2"	0.75
FF434	MF434	CF434	4x1/2x1/2x1/2"	0.75
FF444	MF444	CF444	4x1/2x1/2x1/2"	0.75
FF454	MF454	CF454	4x1/2x1/2x1/2"	0.75
FF464	MF464	CF464	4x1/2x1/2x1/2"	0.75
FF474	MF474	CF474	4x1/2x1/2x1/2"	0.75



India Carving Tool Slips

Special shapes designed for producing an oilstoned finish on various shaped knives and tools used by carvers of wood and ivory. If used in connection with Arkansas Carving Tool Slips almost any desired edge may be obtained.

Numbers	Size	Each
MS12	2 1/4 x 3/4 x 1/4"	\$0.50
MS22	2 1/4 x 3/4 x 1/4"	0.50
MS32	2 1/4 x 3/4 x 1/4"	0.50
MS42	2 1/4 x 3/4 x 1/4"	0.50

Arkansas Carving Tool Slips

Numbers	Size	Each
AS12	2 1/4 x 3/4 x 1/4"	\$0.50
AS22	2 1/4 x 3/4 x 1/4"	0.50
AS32	2 1/4 x 3/4 x 1/4"	0.50
AS42	2 1/4 x 3/4 x 1/4"	0.50

HOW TO SHARPEN



India Lastmakers' Stone

Used by lastmakers and in woodworking plants. Also valuable for cutting dies in glove shops and shoe factories.

Numbers			Size	Each
Fine	Medium	Coarse		
FT48	MT48	CT48	8 x 3/8 x 5/8"	\$1.00



India Special Gouge Slip

Excellent for oilstoning inside or outside curved surfaces. Used extensively in shoe and glove shops and woodturning factories. Made in Special Fine grit only.

No.	Size	Each
FS76	6 x 2 x 1 x 1/2 x 3/8"	\$1.50



India Engravers' Pencil

A Medium and Fine India file mounted in wooden case or pencil. Used by engravers and for marking metals.

No. IT17 Price \$0.65 each



India Skiving Knife Stone

Created to remove burr from knives used in Amazeen skiving machines, but found useful for many operations.

No. MT34 Size 4 x 1 x 1/4" Price \$0.65 each

HOW TO SHARPEN



India Auger Bit Stone

The varying bevel and surface angles of this shape make it of outstanding value to every builder of metal models as well as to the general tool and die maker. Also far superior to the metal file for sharpening auger bits.

Numbers			Size	Each
Fine	Medium	Coarse		
FT10	MT10	CT10	4" long	\$0.65



Crystolon Pocket Stone

Puts a keen edge on pocket and pen knives, ink scratchers, scissors and small tools. Every man who takes pride in owning a sharp pocket knife and every woman who enjoys smooth, easy-cutting scissors should have one of these stones. Made in Fine grit.

No. JP13 Size 3 x 1/4 x 3/8" Price \$0.20 each



Lily White Pocket Stone

For those who want to obtain an extra smooth, fine edge on pocket knives and small tools, this stone made from the best grade of natural Washita will be found very desirable. It produces a keen, finished edge.

No. LP13 Size 3 1/4 x 3/8 x 1/4" Price \$0.15 each



Arkansas Bench

Pen Knife Piece



Arkansas Mounted

Round Edge Slip



Lily White Washita Bench



Natural Oilstones

Arkansas is the one stone which is fine enough to remove the last trace of burr from cutting edges. Hard Arkansas is used by surgeons, engravers, wood and ivory carvers, dentists and all users of fine edged tools. Soft Arkansas is preferred by pattern makers and workers in hard wood. Lily White Washita produces a keen, long-lasting edge on carpenters' tools. A few of the best selling sizes of the above stones are given below.

Bench Stones

Size About	6 x 2"	7 x 2"	8 x 2"
HARD each	HB6 \$6.00	HB7 \$7.00	HB8 \$8.00
SOFT each	SB6 3.00	SB7 3.50	SB8 4.00
LILY WHITE ea.	LB6 1.40	LB7 1.50	LB8 1.80

Mounted Stones

Stone Size About	6 x 2"	7 x 2"	8 x 2"
HARD each	HM6 \$5.25	HM7 \$6.00	HM8 \$7.00
SOFT each	SM6 2.60	SM7 3.00	SM8 3.50
LILY WHITE ea.	LM6 1.50	LM7 1.80	LM8 2.10

Round Edge Slips

Length About	3 x 1 3/4"-2"	4 x 1 3/4"-2"	5 x 1 3/4"-2"
HARD each	HS3 \$1.00	HS4 \$1.50	HS5 \$2.00
SOFT each	SS3 .50	SS4 .75	SS5 1.00
LILY WHITE ea.	LS3 .30	LS4 .40	LS5 .50

Pen Knife Pieces

Length About	3"	4"	5"
HARD each	HB13 \$0.75	HB14 \$1.00	HB15 \$1.25
SOFT each	SB13 .40	SB14 .50	SB15 .65
LILY WHITE ea.	LB13 .20	LB14 .25	LB15 .30



Three Stone Model



Multi-Oilstone Oil



Two Stone Model



Multi-Oilstones

A complete Sharpening Service for meat markets, hotels, carpenter and cabinet shops, cutlery and instrument makers and every sharpening need in the home. Ideal for Home Craftsmen.

Exceptional features are: stone in use is elevated, preventing cuts and grazed knuckles—other stones resting in a bath of oil; grit changes made instantly; stones are self-leveling and may be reversed if worn; impossible to draw temper of knives and tools. Heavy non-skid base insures rigidity. Enameled case is finely finished. Working parts heavily nicked.

Three-Stone Model No. IM313*

Three genuine Norton Oilstones vitrified and factory saturated with oil. Coarse, medium and fine grits. Large size $11\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ ". One quart oil supplied. Price \$16.00 each.

Two-Stone Model No. IM211*

Two stones, coarse and fine grits, $11\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{2}$ ". One 24 oz. can of oil supplied. Price \$12.00 each.

Multi-Oilstone Oil

Perfectly pure, fully meeting U. S. Pharmacopoeia specifications. Especially necessary where knives and tools come in contact with food products. Prevents glazing by floating particles of steel removed from edge when honing.

No. XB12 Quart can \$1.00 each.

*Prices on models equipped wholly or in part with Arkansas or Washita stones quoted on request.



Sportsman Stone



Crystolon Axe Stone



Queer Creek Axe Stone



Pike Oil



Outdoor Sharpening Helps

Sportsman Stone No. WIP 13

Tools for sport are doubly valuable if kept in condition. The Sportsman Stone is a practical addition to every man's outdoor kit. It is almost indispensable for sharpening camp and hunting knives, axes or hatchets, fishhooks and gaffs. Has two grits, coarse and fine, in leather case.

Price 50c each

Crystolon Axe Stone No. JT3

The expert woodchopper finds this electric furnace product (silicon carbide) of exceptional merit. Its coarse surface reduces dulled and nicked edges rapidly and its fine surface produces a keenness that is a delight to the user. It is also a handy stone for summer camps and fishing or hunting expeditions.

Price 60c each

Queer Creek Axe Stone No. KT33

A natural stone of single grit. Its fine texture produces a beautiful edge on knives and tools making it a convenient all around stone for the home, farm or camp. Used with oil or water, it is excellent for carpenters' tools.

Price 25c each.

Pike Oil No. XB1

Superior for use on oilstones and also valuable for cleaning and lubricating bicycles, firearms, reels and skates. A good household oil.

Price 25c each.



No. 273T

No. 273A

No. 273H



Kantbreak



Crystolon Utility File



General Purpose



Ezy Edge Razor Hone



For the Home and Farm

Crystolon Knife Sharpener No. 273

Takes away women's dread of sharpening. Enables them to keep all home knives constantly sharp, from the finest finished stainless steel cutlery to the ordinary every day paring knife. A few filing strokes along the edge only, with the sharpener slightly tilted, does the trick easily and quickly. Three choices in shape: Hexagonal; Arrowhead or Triangular. Choice of six colors in handles to harmonize with kitchen equipment.

Price 35c each.

Kantbreak Knife Sharpener No. KPT 2

Superior to a steel for sharpening carving knives. Strengthened by steel rod running its entire length.

Price 50c each.

Crystolon Utility File No. JD2

Unusually handy around the farm and home. Mower section knives sharpened without removing from the machine. Spades, sod cutters, hoes and the like made sharp quickly. A beautifully balanced 5" flaming red handle attached to a 9" shaft of Crystolon (silicon carbide) electric furnace material.

Price \$1.00 each.

General Purpose Stone No. JT911

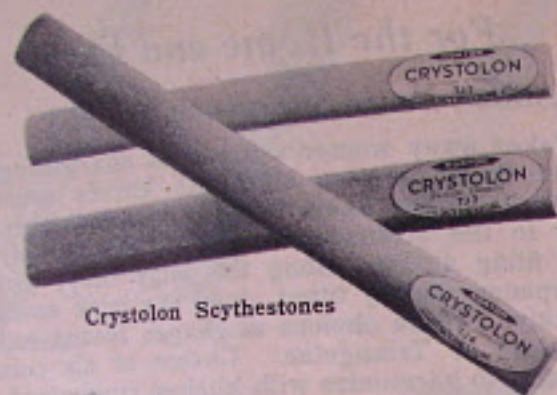
Excellent sharpener for household knives and garden tools.

Price 30c each.

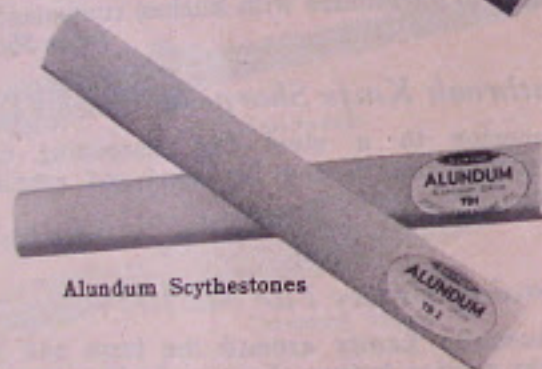
Ezy Edge Razor Hone No. VR2

Popular with professional and private users for many years.

Price 50c each.



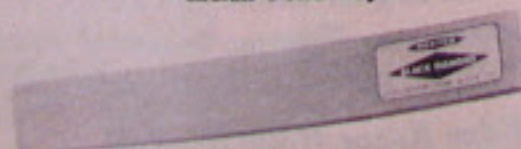
Crystolon Scythestones



Alundum Scythestones



Indian Pond Scythestone



Black Diamond Scythestone



Norton Scythestones

Scythestones are used primarily to keep scythes in keen cutting condition, but they also make excellent sharpeners for many knives and tools around the home, farm and garden.

No. TJ2 — Norton CRYSTOLON

Rapid cutting stones (silicon carbide) which produce keen edges with little effort. Designed for those who prefer a light stone. Round oval in shape. Size $10 \times 1 \times \frac{5}{8}$ ". Price \$0.25 each.

No. TJ3

Same as TJ2 except heavier and rectangular in shape with rounded edges. Size $10 \times 1\frac{1}{4} \times \frac{3}{4}$ ". Price \$0.30 each.

No. TJ4

Same as above except longer, more suitable for heavy work. Oval in shape. Size $12 \times 1\frac{1}{4} \times \frac{3}{4}$ ". Price \$0.35 each.

No. TD1 — Norton ALUNDUM

An Aluminum Oxide Product, famous for its long wear and fast cutting. Same size and shape as TJ3 above. Price \$0.25 each.

No. TD2

Same as TD1 except made in the popular flat oval shape. Size $10 \times 1\frac{3}{8} \times \frac{1}{2}$ ". Price \$0.20 each.

No. TL4 Black Diamond

A fine natural New England grit, giving a long-lasting edge suitable for tough, wiry grass. Size about $10 \times 1\frac{1}{4} \times \frac{1}{2}$ ". Price \$0.25 each.

No. TL2 Indian Pond

This brand has been famous for more than a century. Produces a medium coarse edge. Size about $10 \times 1\frac{1}{4} \times \frac{1}{2}$ ". Price \$0.20 each.

HOW TO SHARPEN

India Oilstone Wheels

For all kinds of small lathes used for fine grinding and sharpening, such as dentists, jewelers and others use in their regular work. Made in coarse, medium or fine grits. These wheels are not carried in stock, but are made up special on receipt of order. From five to six weeks required for delivery.

THICKNESS OF WHEEL IN INCHES

Diameter Inches	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{2}$	2
1	\$.90	\$1.10	\$1.25	\$1.45	\$1.80	\$2.15
$1\frac{1}{2}$	1.10	1.45	1.60	1.80	2.15	2.50
2	1.25	1.80	2.15	2.50	2.90	3.25
$2\frac{1}{2}$	1.45	2.15	2.50	2.90	3.25	3.80
3	1.80	2.50	3.05	3.60	4.05	4.50
$3\frac{1}{2}$	2.15	2.90	3.60	4.30	4.95	5.40
4	2.50	3.25	3.95	4.70	5.40	6.10
$4\frac{1}{2}$	2.90	3.60	4.30	5.05	5.75	6.65
5	3.25	3.95	4.70	5.40	6.10	7.00
6	3.80	4.50	5.20	5.75	8.30	10.60
7		5.85	7.20	8.55	10.35	13.65
8		7.00	8.10	10.10	12.60	16.20
9		8.30	9.60	12.15	16.00	21.60
10		9.90	11.25	13.95	18.70	25.20
12		12.60	15.30	19.80	27.00	31.80



Wheels between above diameters or thicknesses take price of next larger size.

Special shaped faces or special grits subject to special prices, quoted on application.

India Wheels not subject to return or cancellation.

Arkansas Wheels

Where the very finest edges or a beautiful oilstone finish are required Arkansas Wheels are a necessity. Full information on such wheels will be supplied on request.

HOW TO SHARPEN

General Purpose Grinding Wheels



These Norton Alundum Wheels are uniform in quality, long wearing and true running. They cut cool, fast and free and are not affected by oil or water. Will give superior service in the home workshop, the carpenter shop, the repair garage, the machine shop and on the farm. There is a choice of three grits: Fine, Medium, or Coarse. The Medium grit is an excellent all around wheel suitable for a great variety of grinding operations.

The following wheels represent the most commonly used sizes. Your dealer can supply sizes not listed.

List Prices Each

THICKNESS IN INCHES

Diameter Inches	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$
3	\$1.05	\$1.10	\$1.20	\$1.30	\$1.60
$3\frac{1}{2}$	1.60	1.70	1.80	2.00	2.30
4	1.75	1.90	2.05	2.35	2.70
$4\frac{1}{2}$	2.05	2.20	2.40	2.80	3.20
5	2.50	2.70	2.90	3.30	3.80
6	3.00	3.25	3.50	4.00	4.60
7	3.60	3.95	4.30	4.90	5.70
8	4.30	4.70	5.15	6.00	7.00

How to Order

Go to your dealer and give him the diameter, thickness and size of arbor hole desired. State the kind of material to be ground. If he hasn't the grade you need, he will order it for you. It will be well to insist on a wheel bearing the "Norton Abrasives" trade mark. It will insure complete satisfaction.

Garnet Papers and Cloths



Standard for wood-working in the large industrial plants for many years. They are coated with real garnet ore from the famous mines of the Adirondack region of New York State and have entirely superseded the old-fashioned "sandpaper" in actual industrial use.

Behr-Manning Garnet Products include Paper in sheets for hand sanding, Finishing Paper, extra-flexible, in sheets for fine cabinet work, and both Paper and Cloth in rolls for belts and drum covers for machine use.

*Lightning Metalite Cloth

In sheets 9" x 11"



This abrasive cloth, is *ELECTRO COATED. The grains are compelled to stand pointed end up, at even distances from their neighbors, by the electrostatic field of 46,000 volts. The added cutting speed and sharpness, combined with easier working qualities, make it a favorite for metal sanding.

Handy Rolls



Provide clean-cut, straight edged strips, $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{2}$ " and 2" wide from which one may tear off exactly the length required.

Speed-wet Waterproof Paper

The accepted standard for fine water sanding throughout the automotive and metal furniture industries.

Its coating of silicon carbide grain is particularly sharp and fast cutting, but has a "velvety" feel that indicates the preparation of a smooth, scratchless surface.



Flint Paper

The most commonly known form of abrasive paper. It is not so tough as other minerals used for woodworking but for removing old paint from furniture and interior trim where the gummy coatings clog the surface of the sheet without exhaustive wear, Flint Paper, because of its low price, may be indicated.

It should never be looked upon as a production tool.



Emery Cloth

The standard smoothing and polishing cloth for metal.

The natural mineral, Emery is not nearly so sharp or tough as the electric furnace mineral on our *Lightning Metalite Cloth*. For actual removal of metal, *Lightning Metalite Cloth* is the proper material.



Behr-Manning Corporation have been manufacturers of Quality Abrasives Papers and Cloths since 1872. The factories and executive offices in Troy, N. Y., as pictured below, occupy about eight acres of land and comprise fifteen acres of floor space.



This includes Testing and Research Laboratories constantly guarding and improving the quality of out-put and a Service Department anxious to co-operate in solving any sanding problem.

It is not good economics to worry along with Flint Paper and Emery Cloth when *Garnet Paper* and *Aluminum Oxide (Lightning Metalite)* Cloth have completely superseded them in commercial use. Likewise, for fine lacquer finishes on metal, water-sanding with *Speed-wet Waterproof Paper* is the fastest, best and most economical.

In order to insure the finest quality Abrasive Papers and Cloths, we suggest your ordering and insisting on the following brands:

- Behr-Manning Garnet Paper and Cloths for woodworking.
- Behr-Manning "*Lightning Metalite*" Cloth for metal working.
- Behr-Manning "*Speed-wet*" (Waterproof) for water sanding.

The Sandpaper with



"BARNEY" the Bear

An attractive booklet entitled
"SANDPAPER—ITS HOW AND WHY"
 is FREE for the asking.

BEHR-MANNING . TROY, N. Y.

BEHR-MANNING - TROY, N.

Quality Abrasive Papers and Cloths
Since 1872



Sales Representatives in the United States for

NORTON ABRASIVES

- India Oilstones
- Crystolon Oilstones
- Hard Arkansas Oilstones
- Washita Oilstones
- Abrasive Specialties



Stocks are carried in branches in the following cities:

BOSTON	INDIANAPOLIS
BUFFALO	LOS ANGELES
CHICAGO	NEW YORK
CINCINNATI	PHILADELPHIA
CLEVELAND	ST. LOUIS
DETROIT	SAN FRANCISCO
GRAND RAPIDS	TACOMA
HIGH POINT	TROY

and by good Distributors in important trading areas.

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