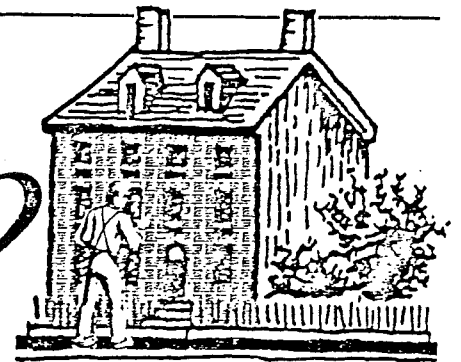


REPOINTING MASONRY

WHY REPOINT?

BY
SUSAN M.
TINDALL



When I was young and foolish and wildly naive, I listened to my father's advice. "Never buy a wooden house!" said he. "It will always need maintenance. You'll spend your summers painting and spackling instead of going to the shore." Like generations before him, my father firmly believed in the value of buying a brick home. He was right about the brick house not needing to be painted, but he was wrong about it not needing maintenance. Shortly after buying my first house, I discovered it needed to be repointed.

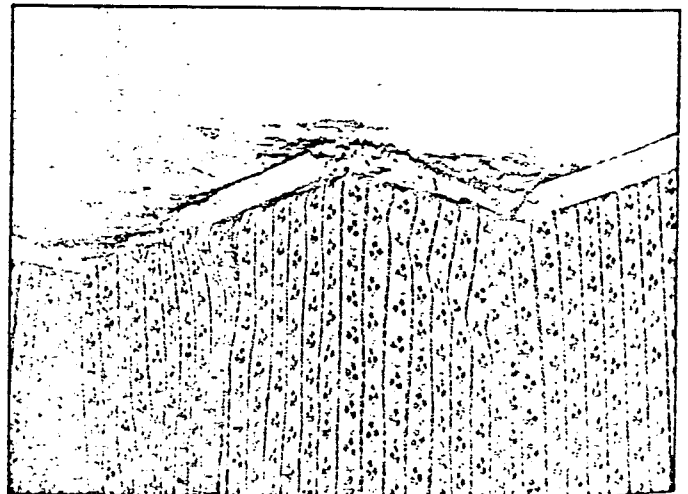
Repointing is the process of repairing deteriorated mortar joints in brick or stone walls. Your joints are deteriorated and need repointing if they exhibit: mortar eroded back more than 1/4" from the face of the masonry; cracks (hairline size and larger) running vertically or horizontally through the mortar; mortar bonds broken or pulled away from the masonry; or joints from which the mortar has literally fallen out, most often horizontal joints (sometimes a few vertical joints were deliberately left open to permit water to "weep" out of the wall).

Failure to keep mortar joints in good repair permits water to penetrate the masonry, which can result in severe damage to both the interior and exterior of a building. This damage is often the first-noted evidence that repointing is required.

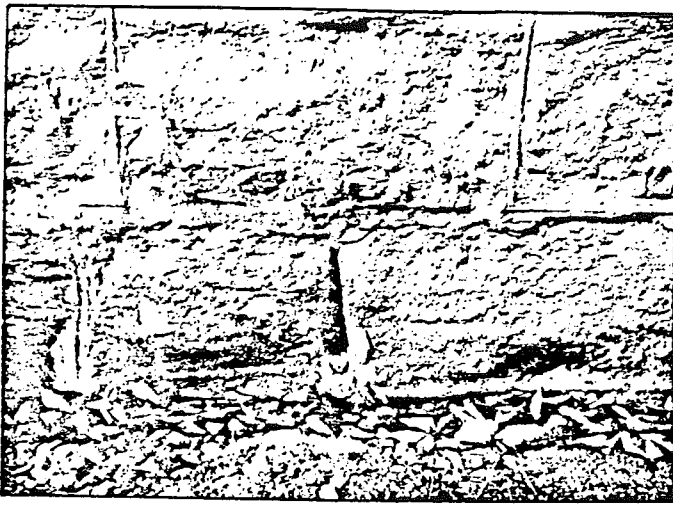
Typical exterior damage includes open joints, efflorescence (a white "bloom" of salt crystals), spall-

ing, and loosened masonry units. In severe cases, enough water penetrates into the wall to corrode inset metal elements, such as shelf angles above windows. The metal then exfoliates, separating into its multiple layers and expanding up to ten times larger in cross-section. This expansion causes the masonry around the metal element to "jack" and torque out of place, eventually breaking free from the building.

Even mortar joints that don't appear badly deteriorated may permit large volumes of water to enter the wall, which can trigger interior damage such as failing plaster and stained wallpaper. Such damage is not



Here's an example of what can happen if you fail to keep your chimney properly maintained - ruined plaster.



Open joints in the foundation admit water to the basement. The damage this causes is seen in the photo at right.



This is how the other side of the wall pictured at left looks. Paint is peeling, and efflorescence is spreading.

always limited to exterior walls -- monitor for water damage, too, in rooms and attics through which a chimney stack passes. Large open joints in the foundation can contribute to efflorescence in the basement and, in severe cases, basement flooding. Openings may also permit entry to foraging mice and insects.

There are five major reasons for mortar joint failures:

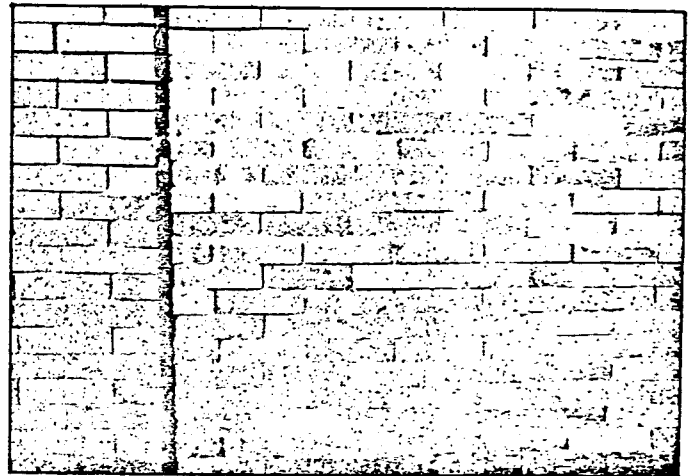
- **Weathering action:** Weathering is inevitable. Masonry mortar, particularly that used in older walls, is purposely soft to allow the wall to flex with expansion and contraction caused by temperature changes. Wind, rain, and pollution eat away at this soft mortar. On highly exposed areas, mortar joints can weather away to a depth of several inches. Only regular repointing maintenance can prevent severe erosion.

- **Settling:** Both mortar and masonry can crack due to uneven settling of a building's foundation.

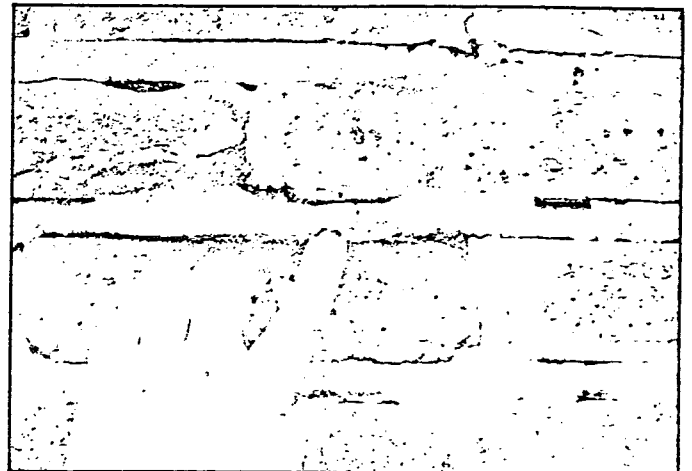
- **Temperature cycle:** Moisture entering at a bad mortar joint may freeze and expand, causing a section of the joint and perhaps a portion of the surrounding masonry to pop off. This is called spalling. The seasonal cycle of hot and cold, too, causes masonry and mortar to expand and contract, often at different ratios. This eventually breaks the masonry's bond to the mortar.

- **Poor original design and materials:** The ability of a mortar joint to shed water and preclude penetration is largely the result of its profile. Concave joints provide superior protection from water entry; raked joints, popular because their top-to-bottom inward slant makes for dramatic shadows, are susceptible to premature failure. If the original mortar was too hard, it will have shrunk excessively, resulting in numerous hairline cracks. If it was too soft, it will have yielded quickly to weathering action.

- **Lack of exterior maintenance:** Water sitting in a joint or flowing across it speeds joint erosion. Poor-



Weathering action has taken its toll on this wall. Someone has randomly "repointed" the deepest joints.



Differential expansion and contraction rates have this portland-rich mortar popping out -- and damaging the bricks in the process.

ly functioning gutters, downspouts, or flashings contribute to excessive mortar failure. This deterioration is logarithmic in nature. Ignoring a problem speeds up the rate of deterioration.



The process is easy. You won't need the combined experience of these two seasoned contractors to do your own repointing.

Can the homeowner do his own repointing? The process itself is not that difficult. It essentially entails four stages: preparing the area to be pointed (including removing old mortar); mixing new mortar to match old; filling the joints; and tooling the joint to the appropriate profile and finish.

Foundations and inconspicuous areas can easily be successfully repointed by the average homeowner. (My soon-to-be-five-year-old had great fun assisting me in pointing up a portion of my foundation.)

Repointing old masonry, though, can be a tedious, exacting chore. A professional pointer experienced in

old masonry should probably be employed in any of the following areas or conditions:

- Chimneys need repointing.
- Window lintels must be rebuilt.
- Masonry is loose or missing.
- Work must be done from scaffolds or extension ladders.
- The original mortar joints were "beaded," that is, tooled with a raised, round-profiled joint that projects out from the wall.

Ideally, you should choose a local, established contractor whose previous work you have inspected. The contractor should be willing to make a commitment to you in a formal, written proposal, which should detail the scope of the work to be done, the time necessary to complete the project, the responsibilities of the owner (you), terms of payment, and a not-to-be-exceeded price that covers all materials, fees, and labor costs. A certificate of insurance, current and carrying at least one million dollars in liability coverage, should attach to the proposal.

The contractor should provide you with both his federal identification and state registration numbers. A call to the Better Business Bureau or the Secretary of State's office should reveal any complaints or investigations pending against the contractor or his identification numbers.

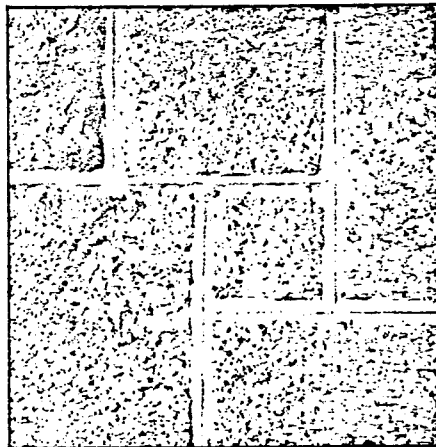
After the contract has been signed, any change-orders or messages should be put into writing, initialed, and carbon-copied to avoid misunderstanding.

TUCK POINTING: WHAT'S IN A NAME?

"Tuck pointing," "repointing," and "pointing" are each terms used to describe the replacement of old mortar with new mortar. "Pointing" and "repointing" are interchangeable terms. "Tuck pointing," however, is more precisely used to describe a specific type of repointing that gives the appearance of a thinner joint. Usually, a background mortar that approximates the color of the masonry fills the joint, and a mortar of contrasting color is shaped into a thin line that protrudes from the surface of the background mortar. It can be done with just one color, too.

True tuck pointing originated in England in the early 18th century to provide the more expensive appearance of narrow joints among the era's commonly rough-shaped, irregular bricks. In the early 19th century, the technique was moderately popular for middle-class brick dwellings, particularly around London.

In America, tuck pointing was rarely practiced, although the historical record shows that such work was done in New York, Chicago, Boston, Philadelphia,



Albany, Buffalo, Toronto. Other examples can be found in Oregon, Wyoming, Ohio, Indiana, Ontario, and Quebec. The historical archives of tuck pointing, however, are quite sketchy, and we must assume that many buildings that once boasted the work have seen it weather away.

True tuck-pointing is difficult to perform and expensive to contract out. Even the most skilled contemporary mason

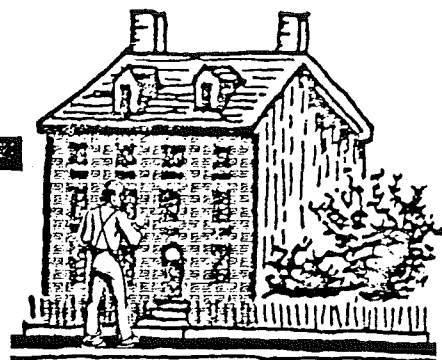
rarely has experience in it. Its use to improve the appearance of irregular brick is of questionable aesthetic necessity. It is attractive in stone work (as with the granite pictured.)

Use of the term "tuck pointing" for "repointing" in the United States seems to have begun in Chicago in the last quarter of the 19th century, among masons either ignorant or confused about the term's true meaning, or eager to adopt the term for its attendant cachet of higher-quality repointing work.

To avoid confusion, OHJ urges its readers to limit the use of "tuck pointing" to its especial use. While we're at it, why re-pointing? Why not just "pointing"? Ah, but that's a different windmill at which to tilt.

— Historical data abstracted from August 30, 1985, draft "Will the Real Tuck Pointing Please Stand Up?" presented at the 1985 annual conference of the Association for Preservation Technology in San Francisco, by Michael Shellenbarger, University of Oregon.

HOW TO REPOINT



BY GREGORY S. WOROCH

Repointing is perhaps the most common procedure necessary in restoring and preserving old masonry structures. When done correctly, repointing will keep your old house weathertight while maintaining the historical accuracy of your brickwork. The effects of misguided repointing, however, can be costly or impossible to correct, and may cause irreparable damage both to the building's appearance and to its physical structure. Armed with a bag of redi-mix, a case of beer, and just enough know-how to get into serious trouble, a do-it-yourself repointer can inflict more damage in one weekend than mother nature had in the last 100 years.

Yet be not discouraged! Let me share with you some of my secrets of just how to do this procedure correctly, avoid expensive mistakes, and end up with a finished product you can be proud of.

Pointing, repointing, and pressure grouting all mean the same thing (see box): that is, replacing old, deteriorated, or missing mortar with new mortar. Frederick Herman's article (*June 1979 OHJ*) would be a fine place to begin boning up on the nature of the task at hand, just to get a feel for what you're up against. If you are still under the impression that tuck pointing is something done only between consenting adults, you should definitely go back and read this article.

Okay, let's assume you've assessed the condition of your brickwork and you've determined that repointing is in order. Close inspection of the masonry surface probably revealed that the mortar has receded in varying degrees, ranging from little to no weathering under the soffits and overhangs to perhaps a quarter of an inch erosion (or more!) where the exposed brickwork takes the brunt of the weather. Old mortar joints are constantly in a state of recession; water is the chief culprit, although wind, pollution, and seasonal and diurnal temperature changes add to the erosion.

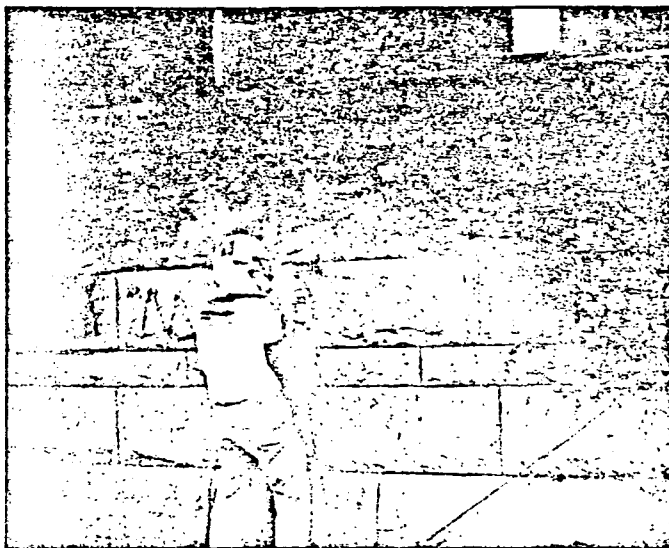
Perhaps some sections have suffered accelerated damage because of leaking gutters or downspouts. If damaged gutters or leaking soffits are allowing excess

water to run across your masonry, fix them before repointing.

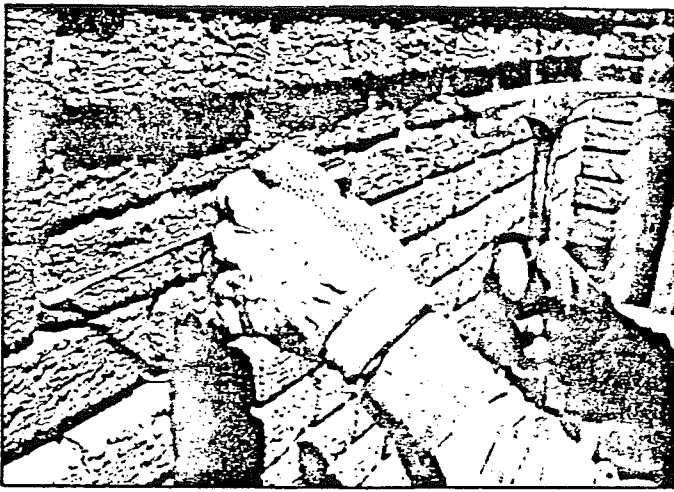
REMOVE THE OLD MORTAR

A decision you should make early on -- before removing any mortar -- is whether you will have your building chemically cleaned. Cleaning will alter the color of your mortar by removing decades of dirt and grime. Cleaning is best done before removing the old mortar, to deter the chemical cleaner from penetrating the soft sides of newly exposed bricks.

The first step in achieving a professional-quality repointing job is careful surface preparation: that is, clearing the old mortar out to make room for the new. I estimate that forty to fifty percent of the total time spent on a repointing job is consumed by this task. I sympathize with those who abhor such tedious, thankless chores, but please, don't skimp here. Poor preparation leads to poor adhesion of the mortar to the masonry. The whole job may count for naught in a year or less. A good job, adequately prepared, should last twenty years or more. Diligence in the prep phase will vastly improve the outcome of your work.



Power grinding the joints of this stone wall is grueling work. It requires steady hands and a lot of muscle.



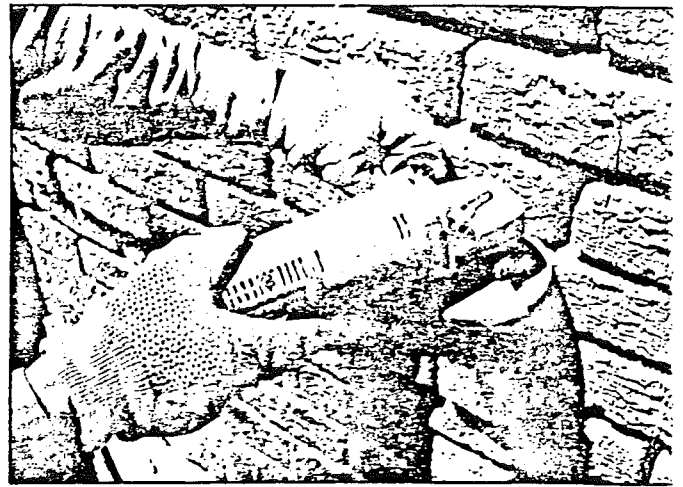
Knocking the old mortar out manually is your best bet. It's time consuming, but you're less likely to damage the brick.

With a small mason's chisel (no wider than half the width of the joint) or a cheap, expendable screwdriver and a hammer, take the mortar back to a depth of about 3/4" from the brickface. A 1/2" depth is usually sufficient if the mortar joint is only 1/4" wide or less. Some experts advocate raking back a depth of about two and a half times the width of the joint. Remove all obviously deteriorated mortar.

Take your time and be especially careful not to chip or damage the surrounding bricks. Pieces of brick do sometimes fall off; if they're large enough they can simply be glued back with any good ceramic glue. Pulverized brick mixed with glue can also be used to fill small holes left by lead anchors, nails, etc.

It's not unusual to find that you are not the first person to repoint sections of your house. Your predecessors' distinctive styles and materials are often quite noticeable; sometimes that old mortar proves stubborn. If you're finding it hard going, stop here and scrutinize your work. Is the stuff you're trying to remove hard as nails? Are you taking off chunks of the surrounding bricks along with the mortar? Does it appear, then, that earlier repointing was executed solely with portland cement? If so, this is the time to weigh a major decision; perhaps you should consider laying aside your hammer and chisel to reach for a power grinder.

Many historical architects and restoration purists decry the use of machinery to remove mortar; but my experience is that, if done carefully, mortar joints of one-half inch or larger can be raked out with little risk using power grinders. If you're adept with power tools and are of sound mind and steady nerve, a tuck-point grinder with a 4 x 1/4-inch abrasive blade will do the chisel's job considerably faster, eliminating many hours of vexatious, and sometimes destructive, hand work. Don't use an electric saw with a masonry blade--they're much too awkward to handle accurately.



If you use a power grinder, use it on horizontal joints only. You're sure to damage the brick if you try it on the vertical ones.

I usually rake just the bed joints (horizontal) with the grinder, then go over them thoroughly with my screwdriver to clean right up to the edges of the brick. I chisel the head joints (vertical) by hand to minimize the risk of nicking the brick.

Working with a grinder takes lots of concentration one mental lapse can lead to unsightly gouges in the bricks. Again, mortar joints of over one-half inch are the narrowest that I would recommend using a grinder on, especially for a beginner. (When he's on a roll, however, my partner Bill can rake 1/8" wide joints by machine with indescribable dexterity.)

Don't let my detailed description of power grinders overshadow the value of hand work, however. Nine times out of ten the old hammer and screwdriver method will work just great, and generally leads to fewer accidents.

If you are unsure whether certain portions of mortar are deteriorated or not, go ahead and clean them out. Repointing a long joint is easier than filling in small spots, and makes for a neater, more uniform appearance than new mortar interspersed with old (regardless of how closely you match the mortar).

REMOVE LOOSE BRICKS & GRIT

If some bricks need to be taken out and replaced, now is the time. You can safely remove sections of six to eight bricks without jeopardizing the structure. I use a Sawzall (reciprocating saw) with a six-inch, carbide-impregnated blade. It zips right through soft old mortar. Harder mortar may have to hand-chiseled.

Finally, clean the joints of all dust and dirt. The joint may be vacuumed, blown clean with compressed air, or flushed with water. If the joints to be pointed had weathered severely, there will probably be a crust of carbon or dirt clinging to the masonry. Mortar won't adhere to this. It may be necessary to scrub the joint with stiff brushes and a detergent (not soap, which leaves behind a residue).

This extensive preparation stage may have taught you something: You'd rather call a professional and go bowling instead. Don't despair if you get cold feet at this point; you can still hire someone to formulate your repointing mortar and press it in. If you're still game, though, press on!

MATCH OLD MORTAR'S CONSISTENCY

To produce the most pleasing results, your repointing mixture should match as closely as possible the appearance of the original mortar. Generally speaking, the texture and, to a certain degree, the color of the mortar is determined by the type of sand or aggregate used in the mortar mixture. To isolate the aggregate for identification and duplication, take a small amount of the old mortar and crush it in your fingers (if you can), then place it in a glass of water. (Old, high-lime mortar will crumble easily and dissolve in water. Modern portland cement will break, not crumble, and will not dissolve in water.) Use muriatic acid instead of water, if you have some. Examine closely the pieces of sand or shell that settle out.

Old mortar materials -- even sand granules of a certain size -- may not be readily available today. Go to a sand and gravel yard with your sample and see what they have. Talk with some old-time masons: What do they remember of local materials and methods? A little detective work here will give you a big jump on achieving accuracy with your final formula. If precisely matching your sample proves unfeasible, get as close as possible.

Now that you've gathered the proper type of sand or aggregate, you're ready to start putting it together into a mixture compatible with the old bricks and their original mortar. The basic ingredients involved are type I or type II grey or white portland cement, hydrated lime, and your sand. Don't confuse portland cement with masonry cement -- the latter comes premixed with lime. If you live out West or in the Northeast,

hydrated lime is sold at just about any building supply house. In certain parts of the east, though, lime is scarce. If you have trouble acquiring materials, call United States Gypsum -- they'll give you the nearest location where you can buy their products. Lime usually comes in fifty-pound bags, portland cement in ninety-four pound bags: Get one of each.

I start concocting my mortar with a base mixture of portland and lime. Because you're going to experiment to achieve the proper color and consistency, you may want to limit the amount of material you begin with. If I'm matching a weathered-looking mortar joint that hasn't been chemically cleaned, I use grey portland. If the building has been chemically cleaned and its mortar is stark white, I use white portland.

Contrary to many formulas, I use as much as six parts lime by volume to one part portland. You may go to a five-to-one mix if you need something a little greyer or harder. I've rarely used stronger than a four-to-one mix on a pre-1920 house because it sets up too hard. A small wheelbarrow makes a handy mixing bin; use a garden hoe or square-ended shovel to mingle the ingredients. The lime/portland mix should resemble grey cake flour at this point: light and fluffy.

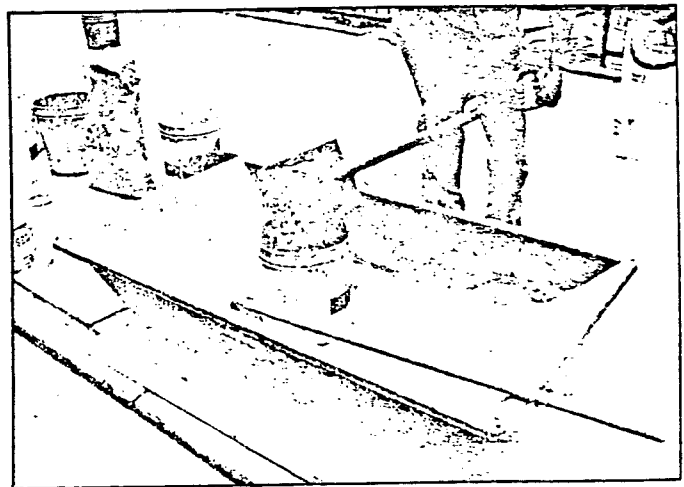
This mix is now ready to have the aggregate added. If you can see lots of exposed sand on the surface of the original mortar, start by mixing two parts of sand with one part of the cementitious material. If the original mortar's sand seems to be pretty well hidden within the matrix, start with a ratio of two parts sand to one and one-half parts portland-and-lime mixture (4:3). Mix it all up -- still dry. Remember, though, these are not hard-and-fast proportions. They can be altered to fit your particular situation. Experimentation is the only way to get it just right.

MATCH OLD MORTAR'S COLOR

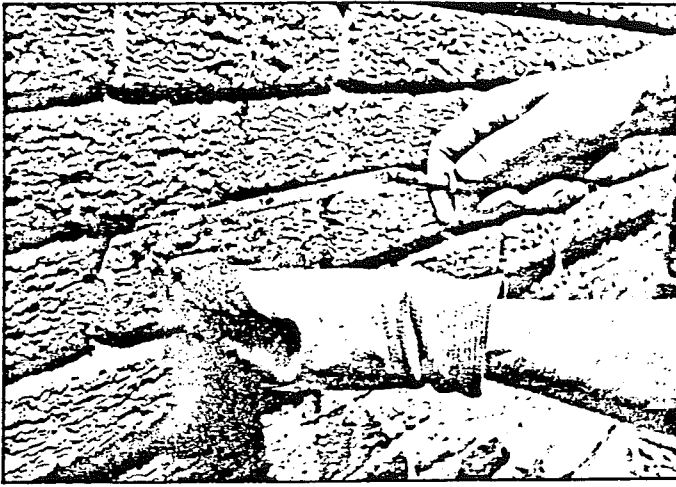
Now look again at the existing mortar. What color is it? Is it off-white, grey, beige, red, black? Some-



The joints between these stones have been chipped out to a depth of three inches, and are ready to receive the new mortar.



Finding the right aggregate is the only tough part in preparing the new mortar. Actually mixing it takes only minutes.

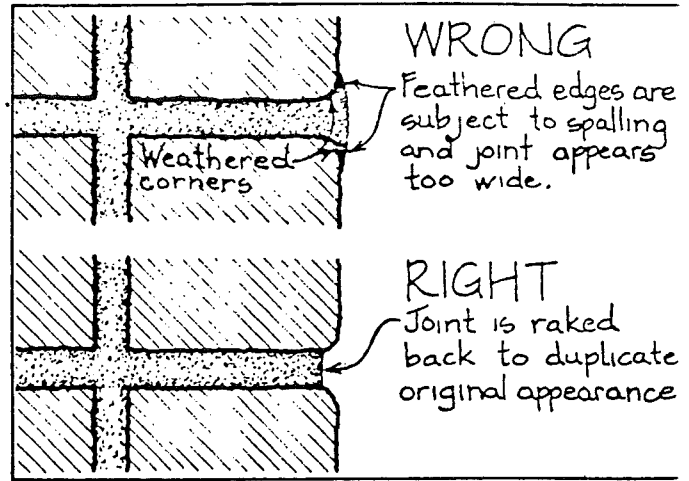


Pressing the new mortar into place. Press firmly to fill the joint completely without creating voids or air pockets.

times sun and weather will bleach portions of a wall, so a single wall may boast half a dozen different shades of mortar. If this is the case, match the color that predominates in the most noticeable areas. Because the colors of lime and cement are white and grey, a mixture of just these two materials can vary in hue from pure white to dark grey. You can also alter your mortar's overall color by increasing the proportion of sand to cementitious material, thereby emphasizing the color of the aggregate.

I'm going out on a limb now by recommending the use of color additives in your new mortar mix. Other enlightened sources have declared that there is no way to match colors exactly; to a certain extent that may be true. Yet over the years, my company has specialized in compounding mortar formulas that in the majority of cases are indistinguishable from the original, even after fifteen years. Perhaps some time in the next century some persnickety soul will be able to spot the difference; in the meantime, no one will be the wiser if you mix your colors right. Here's the secret: Take a garden hose and soak a portion of the old brickwork. Notice how the color of the wetted mortar gets darker. Your new mixture, when you add water to it, should be the same color as that section that you hosed down. Such a mortar mix will dry to exactly the same color as the old mortar.

To match an off-white mortar, I may use about one-eighth to one-quarter cup of dark buff dye to five gallons of dry mix (sand and cement and lime). You may have to intermix some cement colors to match your particular mortar; sometimes I will use a walnut brown in combination with black and red to match complex burgundies. Off-white and beige mortars are probably the easiest to match; black too is quite simple. Reds and burgundies can be troublesome. Add your dye to the mixture dry and stir the compound thoroughly; that way the final color blend will come out more uniform. Limit your dye to less than ten percent of



Regardless of the shape of the joint, the mortar should be recessed from the brick to prevent spalling.

the volume of your cement (you'll probably require far less than that).

When you're ready to add water to your final mixture, add only enough to make it damp. You should be able to shape it into a firm ball, but it should not be all gooshy. At this somewhat dry consistency the mortar mixture will be much easier to pack into the wall and it will not be as likely to smear onto adjacent bricks. With the mixture in a wheelbarrow, use your garden hoe in short, chopping strokes to get the mixture evenly damp.

Some experts advise pre-hydrating your mortar. That is: Stir the mix up with very little water, let it rest for one or two hours, then bring it up to proper consistency with a bit more water. Personally, I've found my simplified approach works fine.

Now, press a little of your mortar into the wall next to the original. Does it look like the original that you had wetted down? Great! If it doesn't, you may add or subtract minor amounts of ingredients to your mix. More likely, you should throw out your first, trial batch and start again. Keep a record of your proportions so when you get it right you can duplicate the result.

PRESS IN NEW MORTAR

Once your mix passes the eyeball-on-the-wall test, you're ready to fill the joints. To ensure a good bond, wet the cleaned joints with water before applying the mortar. If you're working inside, a spray bottle plant-mister works great. Allow any puddled water to soak into the wall; the joints should not be visibly wet.

Grab up a ball of mortar in one hand (wear rubber gloves) while wielding a trowel in the other. The trowel should be just slightly narrower than your joint (sometimes called a caulking trowel). Begin by packing the mortar, using the narrow trowel, into the deepest voids. Then fill the back of the entire joint

with a 1/4" layer of mortar. Press the mortar mix into the joints firmly and, in a succession of 1/4" deep layers dried to thumb-print hardness, bring your work up to the same depth as the original. Use long, smooth strokes, and do the vertical joints before the horizontal ones.

Some people load some of the mortar onto a mason's hawk -- a flat square plate with perpendicular handle -- or onto the bottom side of a regular mason's trowel, and push the mortar off the hawk or trowel into the joint with their caulking trowel.

A tool sometimes marketed as a "tuck-pointing trowel," shaped like a small-scale mason's trowel, is not, despite its name, much good here; don't waste your money.

When your mortar is almost flush with the wall, tool it to match the original surface profile or to mimic the surviving pointing work. If in doubt about your tooling profile, a smooth, slightly concave surface is a standard shape, and has excellent water-shedding capabilities. Don't overfill the joint so that it overlaps onto the brick, though -- the joint will appear too wide, and the bricks may spall.


Let your repointing job set up for half an hour or so, then brush it with a wet whitewash brush to feather in the edges to the original. If you need to match a particular style of tooling, do it soon after you put in the mortar; retool if necessary after you brush with water.

MATCH OLD MORTAR'S TEXTURE

Getting that slightly weathered look can be accomplished with a fine mist from a garden hose. Another texturing technique, called stippling, is performed with the end of a whisk broom or whitewash brush. If you're working on a particularly hot day, you may need to mist your surface periodically to keep your work from drying out too fast. Don't be afraid to experiment here; if you don't like what you've done you can always wash it out with the hose and start again.

Replacement bricks can be laid as you're pointing, using the same mortar mixture. Simply spread a bed of mortar onto the bricks below and point the replacements into place. You will, of course, use replacement bricks that match the old as closely as possible in appearance and characteristics. Remember, old bricks are generally much softer, and more elastic, than new ones. An unyielding patch of new bricks in an old wall will lead to mortar cracking and brick spalling.

Let your work dry for a minimum of a week, then come back with a mild solution of muriatic acid (one part acid to five parts water) or an organic brick cleaner. With a stiff nylon brush, remove any mortar smudges or film that you left on the masonry. Be sure to thoroughly flood the wall with water when you're finished to remove any traces of acid.

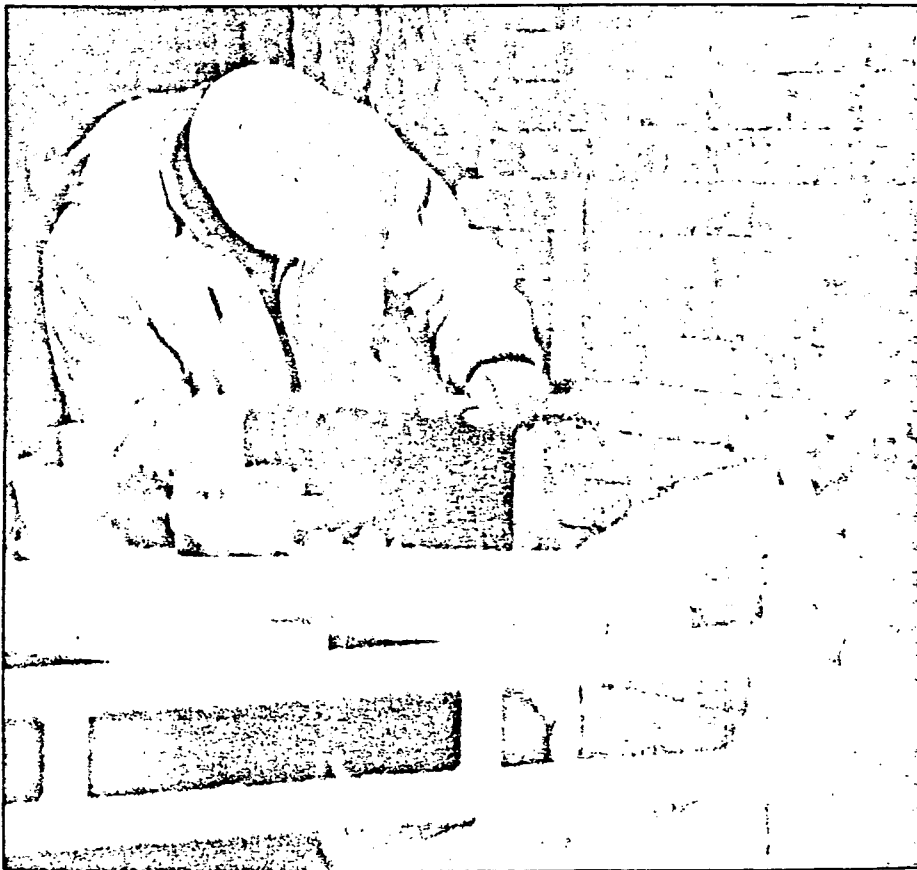
If you worked carefully, following my suggestions, your repointed walls should keep you and your family snug until well into the next century. 

VERY NARROW MORTAR JOINTS: A CHALLENGE

Very thin joints (sometimes called butter joints) present special problems. What's the secret? No magic answer: Just assume the job will take longer and cost more in labor.

Power grinders are out of the question here. The old mortar must be chiseled out by hand. Even then, you must work with extreme care; the bricks are easy to damage. In the photo, each mason holds a cold chisel perpendicular to the joint, then strikes the chisel to break the bond between the mortar and masonry. The crumbled mortar is raked out with an old screwdriver. This method lessens the likelihood of chipping off corners of the brick.

A narrow caulking trowel is helpful to regROUT. New mortar in buttered joints should be recessed, and tooled with a narrow jointer (either beaded or concave).



GUIDE TO MORTAR MIXES

This table gives an indication of the proportion of various mortar ingredients based on the role and location of the masonry as well as the strength of the stone or brick. The letters O, N and S correspond to the equivalent ASTM standards. Type M (very hard) mortars, which are not indicated here, are made with very little lime and are too hard for use with old masonry.

Use	Strength of the Masonry			Mortar Mix		
	Low (marble, weak limestone or sandstone, common brick)	Average (hard limestone or sandstone, facing brick)	High (granite, paving or vitrified brick)	(parts of each ingredient by volume)		
				Portland Cement	Lime	Sand
Interior and Party Walls						
Sheltered Exterior Walls				1	4	11-15
Normally Exposed Exterior Walls				1	2½	8-10
Highly Exposed Exterior Walls				1	1¼	7-9
Paving				1	1½	4-5

Very soft

1 4 11-15

Soft (type O)

1 2½ 8-10

Medium (type N)

1 1¼ 7-9

Hard (type S)

1 1½ 4-5