TECHNOLOGY

Nails Now Hold Tighter

Research produces nails with 470% more "holdability" than old style smooth-shanked nails. These nails with threaded shanks make a house frame four to six times stronger. Testing centers try out new designs.

By HORACE LOFTIN

► THE CIVILIZED world is held together, in a very real sense, by nails. For the countless number of jobs nails perform, over 1,000 nails of different head, point, shank, size, material and strength have been designed and are in use.

With all their variations, the one essential likeness is their ability to hold and hold tightly.

Holding power of nails is largely a matter of frictional resistance or wedge action of nail shanks to the material into which they are driven. So nail manufacturers are constantly experimenting and designing to find new nails that resist withdrawal better and longer. Once a new nail is created, it must be rigorously tested to find how well it works.

The Wood Research Laboratory, housed in a hugh stone building on the campus of the Virginia Polytechnic Institute, Blacksburg, Va., is just one of the testing centers, but an important one. For here is the center of research on nails with threaded shanks.

The director of the laboratory, Dr. E. George Stern, standing among his giant-sized instruments, explained how they exert direct or lateral pulls and pushes of measured strength on nailed structures, to test the holding power of different nails. There are also chambers to simulate tropical or Arctic conditions or to speed up the aging of wood, to test the reaction of nails in wood to varying climate and time.

"Here are four kinds of nail shanks," Dr. Stern said, holding four very different looking nails in his hand. "The one you are most familiar with is the plain-shanked nail, the common nail with the smooth-surfaced shank. But these others may be quite strange to you."

One of them had a series of parallel threads running down the shank at 60-degree angles, looking like the threads of a screw. "When you drive this 'helical-threaded' nail in wood," he said, "it turns just like a screw does. The thread shoulders force the wood fibers aside and form grooves in the wood. This compresses the wood around the shank, making increased frictional resistance. And that adds up to increased holding power."

The threads of the next nail formed a series of closed rings down the shank. This "annular-threaded" shank works on a somewhat different principle from the helical thread, Dr. Stern explained. When the annular threads bite into a piece of wood, the wood fibers are forced between them and act as wedges to prevent the nail from moving backwards.

The last nail seemed a hybrid between the annular- and helical-threaded nails. While its shank contained a series of parallel spiralling threads like the helical-threaded nail, the angles they made were so sharp—about 15 degrees—that the nail seemed almost to have annular threads. And, Dr. Stern said, this is exactly the reasoning behind the design. This nail exhibits both increased frictional resistance of the helical thread and wedging effect of the annular thread.

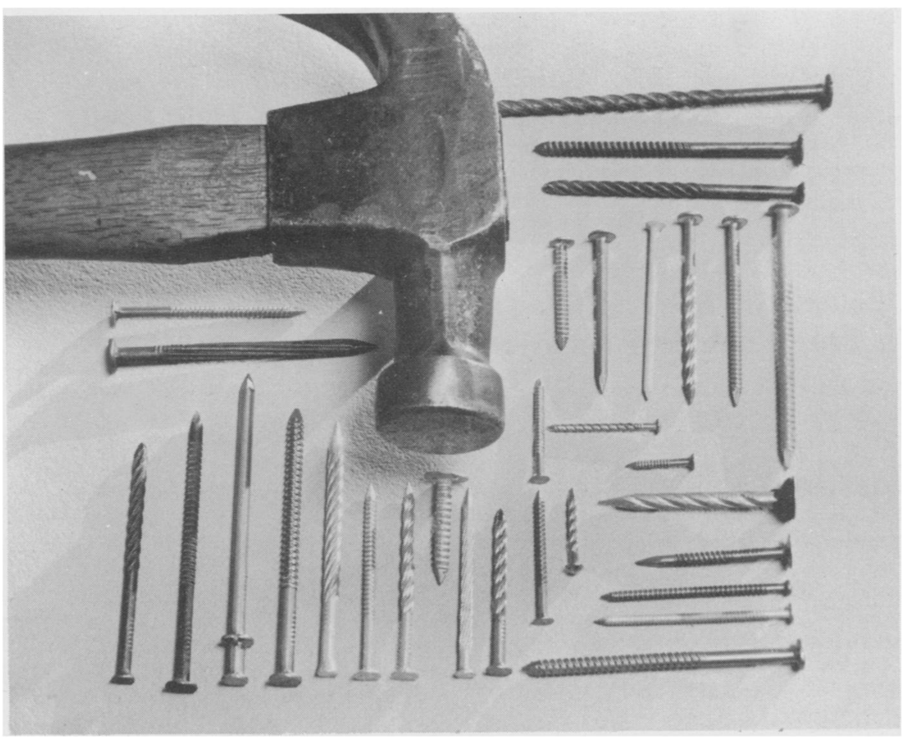
Experiments at the Wood Research Laboratory show that it takes about 15% more work to drive a threaded nail into a piece of wood than it does a plain-shanked nail. But for that 15% more work, you get 70% more resistance to withdrawal from a piece of partially air-dry pine. After five months seasoning of the wood, threaded nails give an average of 470% more holding power than smooth-shanked nails.

"Now, about costs," Dr. Stern said. "Suppose you were planning to build a 50-x-24-foot, five-room house with attached garage, costing in all about $10,000. The construction would require about 560 pounds of nails—about $67 worth of plain-shanked nails, or six-tenths of one percent of the entire costs.

"If you substitute threaded-shank nails completely for the job, their cost would be about $106, or about one percent of the total expense.

"Then threaded nails cost more? Not when you consider that using them in the unsheathed frame of the building alone would give you a framework four to six times stronger than the same structure built with plain-shanked nails."

"Here is another nail that may interest you," Dr. Stern said, holding up a plain-shanked nail equipped with a double head. There was about ¼ inch between the upper and lower heads.



BETTER HOLDING NAILS—The right nail for the job is the goal of nail designers. Shape of head, shank, point, material and size all vary according to the nail's function. The threaded-shank nails shown in the photo hold harder the longer they stay in the wood.

"If the advantage of threaded nails is that they are hard to withdraw, then the advantage of smooth-shanked nails is that they are easier to withdraw. So, when you erect temporary structures like scaffolds, you would use plain-shanked nails, because they would come out easily when the job is done.

"To make the job easier still, why not design the nail with an extra head, so that you can get the hammer claw under it without scarring the wood? And thus you have the nail with a duplex head."

It is this kind of designing with an eye to function that makes today's nails more serviceable and convenient, longer lasting on the job and harder holding.

Reaching into a large glass bowl resting on his desk and filled with hundreds of different nails, Dr. Stern fished around a few moments and pulled out two very dissimilar fence staples. One was the common U-shaped staple, its smooth shanks of equal length.

The second staple had one shank twice the length of the other, and this longer shank was ringed with annular threads.

"Now, suppose you are putting up a wire fence with this old style staple," Dr. Stern said. "You will have to place the wire inside the U, hold both the wire and staple with one hand, while you try to hammer with the other.

"But if you use the L-shaped staple, you can run right down the line of fence posts, driving in the points of the longer shanks. Then you can lay the fence wire into the still open L's of the staples in a single operation. An easy blow of the hammer drives the rest of the staple in."

The annular threads of the longer shank are for additional holding power, Dr. Stern explained. The U-shaped, smooth shanked staple, while it holds firmly when first put into a post, begins to lose its resistance to withdrawal with the passing of time and may soon pull out. The L-shaped staple with a threaded shank, however, actually increases in holding power the longer it is in place.

Tests at the Wood Research Laboratory have demonstrated that there is as much as 70% increased resistance to withdrawal of threaded nails a year after they are driven into test woods.

The threaded shanks, the duplex head, the L-shaped staple—all these variations were designed to fill specific jobs better than the nails before them did. There are a thousand other nails of different style head, point, shank, material, size—or combination of these. Each was made the way it is for a purpose.

When you have a job that calls for nails, it will pay to figure out what kind of fastener would do the job best. You can be sure there is a "best" nail available for the job.

Science Service has prepared a kit containing a variety of nails of new design. A booklet accompanying the nails describes experiments that can be done to demonstrate the astonishing "holdability" of threaded nails. Besides the basic kinds of threaded nail shafts, the kit includes examples of different points, heads, metals and sizes of nails, and experiments to reveal the functions of these different nail characteristics.

These kits are available at 75 cents each from Science Service, 1719 N St., N.W., Washington 6, D. C. Ask for the Nail kit.

PUBLIC SAFETY

Protect from Drowning

► NEARLY TWO-THIRDS of all drownings occur between May and September, so now is the time to think about preventing these accidents to yourself or family.

Start with the baby. There has been a "shocking" increase in baby drownings during a child's first year of "ambulation," or getting around, Dr. Harry F. Dietrich of the University of California School of Medicine at Los Angeles declares. In a report to G P, published by the American Academy of General Practice, he says it is wrong to teach an infant that he is unsinkable and to be absolutely unafraid of water. Teach the baby respect for water, not fear of it.

In answer to the old question, "When should a child learn to swim?", the doctor points out that he should learn sometime before the likelihood of unexpectedly finding himself in water over his depth.

In the education of older groups, he lists several lessons which must be taught and learned in the interest of safety.

(1) Learn to stay afloat in water.

(2) Learn to shed clothes while in the water to regain maximal swimming ability.

(3) Be impressed with the fact that many things can rob a person of his ability to swim (blow on the head, successive inhalations of water, cramp in the stomach or legs, severe allergic reaction, or extremely cold water and fear.)

There are special lessons to learn too. In various environmental situations a person must learn about currents, tides, undertow, rocks and coral. Dr. Dietrich also warns that a person must be impressed with the danger of being around or in water with a nonswimmer or a swimmer of lesser ability. That would forestall the tragedy of the capable swimmer being drowned by or with the poor swimmer.

Elderly people need protection too. They should be encouraged to wear life jackets or have them immediately at hand.

PHYSICS

Atomic Heart Found 15% Smaller Than Thought

► THE HEART of the atom, called the nucleus, which is basic to all matter, is smaller than previously thought to be by 15%.

Beams of mesons, recently discovered subatomic particles, were created in Columbia University's 385,000,000-electron-volt synchrocyclotron "atom smasher." These were used to measure indirectly, through X-ray emission and computations, the size of the atomic heart.

The nuclear radius is a few tenths of a trillionth of an inch. It is smaller for lighter elements and larger for heavier ones, with the size varying with the total number of protons and neutrons in the nucleus. Only about 1/10,000th the linear dimensions of the atom as a whole is occupied by the nucleus.

The experiments with the Nevis cyclotron have been in progress for two years by Val Fitch, graduate student, under the direction of Prof. James Rainwater.

High-energy X-rays were proved to be given off when the mu mesons enter the orbits of an atom and travel to its nucleus. A different and characteristic energy is associated with each element.

Another kind of particle, called the pi meson, is believed responsible for binding the nucleus together and for the energy released in nuclear fission as in the atom bomb. The pi meson in its decay produces the mu meson, used in the experiments. The mass, spin and magnetic moment of the mu meson were measured independently by the two Columbia physicists.

Both old and new size determinations of the atomic nucleus can be reconciled by altering the accepted mental picture of what is inside the atom. Instead of a solid nucleus of uniform density and sharply-defined edges, the nucleus may have a dense center and gradually become fuzzy at the edges.