

Scotch® Transparent Tape
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A National Historic Chemical Landmark



AMERICAN CHEMICAL SOCIETY
SCIENCE THAT MATTERS

Scotch® Tape

Scotch® Tape: An innovation that stuck

It's been used for everything from wrapping gifts to protecting blimps. It is so commonplace (try to find a home, school or office without it) that it is easy to take for granted. Yet Scotch® Transparent Tape is an astounding product with an extraordinary history marked with audacity, serendipity, and "stick-to-itiveness."

For a time in its early development, the very idea of transparent tape seemed ludicrous as each day stacks of spoiled cellophane piled up several feet high on a laboratory floor. Yet driven by what was to become a corporate credo — "Thou shalt not kill a new product idea" — Minnesota Mining and Manufacturing (3M) engineers persisted and ultimately triumphed, creating what was to become one of the most ubiquitous and successful products ever developed.



Today, 3M makes more than 900 varieties of Scotch Brand tapes. Each year, 3M sells enough Scotch tape to circle the Earth 165 times. But producing the first roll wasn't just a challenge, it was something of a marvel considering that it was the brainchild of a banjo-playing,

Cover images: A customer uses an early Scotch® tape dispenser; Dick Drew (third from right), with fellow 3M employees in 1925 — the year he invented masking tape, the forerunner of Scotch® Transparent Tape; modern Scotch® Brand tape dispensers.

engineering school dropout who had a limited background in chemistry and who had no idea what he was getting into when he told a client he could solve his problem.

The problem, Richard G. Drew, a 23-year-old 3M research assistant, saw was a big one. And his ingenious solution — masking tape — would revolutionize 3M and set the stage for eventual development of Scotch Transparent Tape.

Who was that 'Masked' Man? The emergence of Richard Drew

By the early 1920s, two-toned cars were the rage, and that created a major headache for the automotive industry. To craft this duo-tone look, one portion of the car had to be masked off while the other was painted. The problem was nobody knew how to do this well. So automakers and auto body shops improvised. They glued old newspapers to the body and windows with library pastes, homemade glues or surgical adhesive tape. This helped create a sharp demarcation between the two colors. But the adhesives stuck so firmly that trying to remove them often ruined the paint job.

At the time, 3M primarily manufactured sandpaper and other abrasives. One of Dick Drew's jobs was taking samples of waterproof sandpaper (another 3M invention) to nearby auto body shops for testing. One morning in 1923 he walked into one of these shops and overheard "choicest profanity I'd ever known." Yet another paint job was botched and the worker who'd done it was furious. Drew had seen this occur on many other visits, but this time he spoke up. He could, he said, produce a tape that would end the painter's torment.

It was a brash pledge since, as one historian noted, "(Drew) could back this promise with neither experience nor know-how. He didn't even know exactly what was needed, but he had the optimism of youth." It also helped that he received the backing of his

superiors at 3M, who were looking for ways to diversify the company. Still, Drew hardly seemed like an innovator.

Growing up in St. Paul, Minn., Drew spent much of his time playing banjo in local dance bands. Using this talent, he earned enough to pay for engineering classes at the University of Minnesota. But the demands of playing in bands at night and taking classes during the day proved too much. He dropped out of school after eighteen months and took a correspondence course in machine design. In 1921, he was hired by 3M and all too soon he was trying to figure out how to deliver on his impulsive promise to that auto painter.

Using the adhesive used in 3M's waterproof sandpaper as a starting point, Drew spent two years experimenting with vegetable oils, various resins, chicle, linseed, and glue glycerin. Eventually he developed a formula containing a good grade of cabinetmaker's glue, which was kept sticky with the addition of glycerin. For a backing, he settled on treated crepe paper. The product he created — Scotch® Brand Masking Tape — adhered strongly yet stripped off easily without mucking up paint. It was the first of what was to become a sprawling family of Scotch Brand tapes. But it was Drew's second Scotch Brand innovation — still known as "the famous one" — that would really set the world abuzz.

Tale of THE TAPE

Serendipity fascinated Dick Drew. It is, he said, "the gift of finding something valuable in something not even sought out." And that was never truer than for transparent cellophane tape, a product Drew designed for one purpose but ended up being used in ways that no one at 3M could have imagined.

Drew's serendipitous quest began in 1929, four years after the introduction of Scotch Brand Masking Tape. Flaxlinum Company, a St. Paul insulation firm, contracted to insulate

several hundred railroad refrigerator cars, but there was a complication. The insulated batts needed to be wrapped and sealed with something moisture-proof so they could be used in the refrigerated cars. The company thought Scotch Brand Masking Tape would work. It didn't. Drew, now technical director of 3M's Product Fabrication Laboratory, plunged in. He and his team worked diligently, but after numerous attempts came up empty handed. Nothing, it seemed, was sufficiently watertight.

In the meantime, DuPont had developed cellophane, a moisture-proof packaging material. Another 3M employee, who was considering ways to package Scotch Masking Tape in this new material, showed a sample to Drew, who immediately saw its potential to solve his latest challenge.

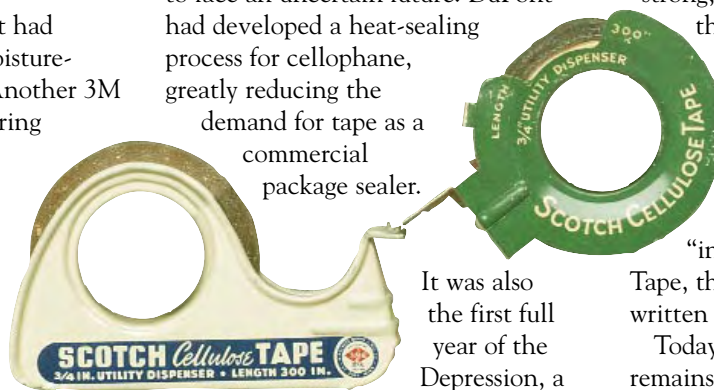
Tests showed cellophane would work as a backing for pressure-sensitive tape. Elated, Drew conducted more experiments, convinced he had found the solution to Flaxlinum's dilemma. By then, however, Flaxlinum was no longer interested. But many other industries were. In particular, bakers, meat packers, grocers, and confectioners who had adopted cellophane food wrap were clamoring for a moisture-proof and attractive way to seal their new packaging.

So Drew and his assistants pressed on. It took them almost a year to produce a marketable product, including what some would recall as "the longest and most discouraging months in 3M's history." The cellophane curled near heat and split as it was being coated by machine. It often broke or tore before a full roll was coated. The adhesive wouldn't adhere evenly. The dark amber adhesive spoiled the look of the colorless, transparent cellophane.

Gradually, Drew's team overcame these difficulties. They designed machinery that prevented splits and breaks. Instead of standard masking

tape adhesive, they developed a new, nearly colorless one — made from oils, resins, and rubber — which helped keep the cellophane transparent. They found that using a primer helped the adhesive hold evenly along the backing.

On September 8, 1930, 3M sent its first roll of cellophane tape to a prospective client, who enthusiastically endorsed it. Still, the product — originally called Scotch® Brand Cellulose Tape and later renamed Scotch Transparent Tape — appeared to face an uncertain future. DuPont had developed a heat-sealing process for cellophane, greatly reducing the demand for tape as a commercial package sealer.



It was also the first full year of the Depression, a seemingly bad time to introduce a new product. But Scotch Brand Cellulose Tape would soon prove that even in the worst of times opportunities for success abound.

The 'new seal' binds a nation

In an era when thrift wasn't just a virtue, but a necessity, Scotch Brand Cellulose Tape virtually sold itself. Almost daily, new ideas sprang up for using the tape to make old things do. It was used to mend book pages, sheet music, window curtains, and even small rips in clothing. Bankers used it to repair paper currency. Secretaries found it perfect for patching broken fingernails. Farmers discovered they could use it to seal cracked eggs. Housewives used it to cap canned milk, remove lint from clothing, secure bait on mousetraps, and repair cracked ceiling plaster. Goodyear used the tape to cover the inner ribs and beams of its dirigibles, creating an anti-corrosive shield.

As a result, 3M prospered and was one of the few companies in the world that didn't layoff employees during the

Depression. In the years ahead, 3M would continue responding to consumer demand, developing numerous specialized tapes for household and industrial use. During World War II, almost all of 3M's tape production was diverted to the war effort. The company developed more than 100 types of tape to solve war production problems, such as sealing and labeling parts.

Rubber shortages during the war prompted 3M to switch to synthetic acrylate adhesives. Although not as strong, acrylate adhesives retained their clarity and actually aged better than rubber-based adhesives, which turned yellow and brittle over time. Later, acrylate adhesives would be mated with an acetate backing to create "invisible" Scotch® Magic™ Tape, the first tape that could be written on with pencil, pen or marker.

Today, Scotch Transparent Tape remains a mainstay of 3M's highly diversified, multibillion dollar global enterprise. It's estimated that transparent tapes are used in more than 90 percent of American homes.

The tape that Dick Drew conceived so many years ago has been to the moon (as insulation on a lunar lander), been featured on *Saturday Night Live*, and been immortalized in fine art. But Drew, who died in 1980 at age 81, never gave up trying to find something better. As a result of his tinkering, which was continued by those who followed in his footsteps, 3M developed a number of breakthrough adhesive products including 3M™ Micropore™ Surgical Tape, Scotch® Pop-Up Tape Strips, and Post-it® Notes. Yet despite his many successes, which led to his 2007 induction into the National Inventors Hall of Fame, Drew never forgot how a bit of sandpaper changed his life.

"Would there have been any masking or cellophane tape if it hadn't been for earlier 3M research on adhesive binders for (waterproof) abrasive paper?" He once asked rhetorically. "Probably not."

National Historic Chemical Landmark

The American Chemical Society designated the development of Scotch® Transparent Tape by 3M as a National Historic Chemical Landmark in a ceremony in St. Paul, Minnesota, on September, 19, 2007. The plaque commemorating the discovery reads:

In 1925 Richard Drew invented Scotch® Masking Tape, which marked 3M's entry into tape manufacturing. Five years later Drew invented Scotch® Cellulose Tape, later renamed Scotch® Transparent Tape, the first waterproof, clear adhesive tape. Introduced during the Great Depression, Scotch Transparent Tape quickly filled the need of Americans to prolong the life of items they could not afford to replace. These inventions have grown to a family of more than 900 pressure-sensitive tapes used by professionals and consumers in office, medical, electrical, construction, and many other applications.

About the National Historic Chemical Landmarks Program

The American Chemical Society, the world's largest scientific society with more than 160,000 members, has designated landmarks in the history of chemistry for more than a decade. The process begins at the local level. Members identify milestones in their cities or regions, document their importance, and nominate them for landmark designation. An international committee of chemists, chemical engineers, museum curators, and historians evaluates each nomination. For more information, please call the Office of Communications at 202-872-6274 or 800-227-5558, e-mail us at nhclp@acs.org, or visit our web site: www.chemistry.org/landmarks.

A nonprofit organization, the American Chemical Society publishes scientific journals and databases, convenes major research conferences, and provides educational, science policy, and career programs in chemistry. Its main offices are in Washington, DC, and Columbus, Ohio.

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Written by Doug Dollemore

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American Chemical Society
Office of Communications
National Historic Chemical Landmarks Program
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