

Pipes of Plastic

Plastic pipes, light in weight, low in cost, strong and durable are expected to replace most of the metal plumbing before long in newly built homes in many states

By Ruby Yoshioka

► TOYS, textiles, kitchenware and now plumbing. Plastics have surrounded us and even entered into the very heart of the household.

Whether we like it or not, plastics have taken over. There is almost no area plastics have not penetrated and it is becoming a plastic world.

Among everyday uses, plastic pipes are of special interest. They cover a broad area of our lives and have had a strong impact in many industries from household plumbing to oil well drilling.

Although in most uses they have now become routine, such as water sprinkling systems and oil transmission, plastic pipes have not yet been completely accepted for plumbing.

Just as did fabrics woven of man-made fibers, now such an essential part of our textile industry, pipes made of man-made materials must overcome resistance for nation-wide acceptance. So far, these pipes have been accepted in some areas in all 50 states, and statewide codes have been established in about half of them.

Customers Need Convincing

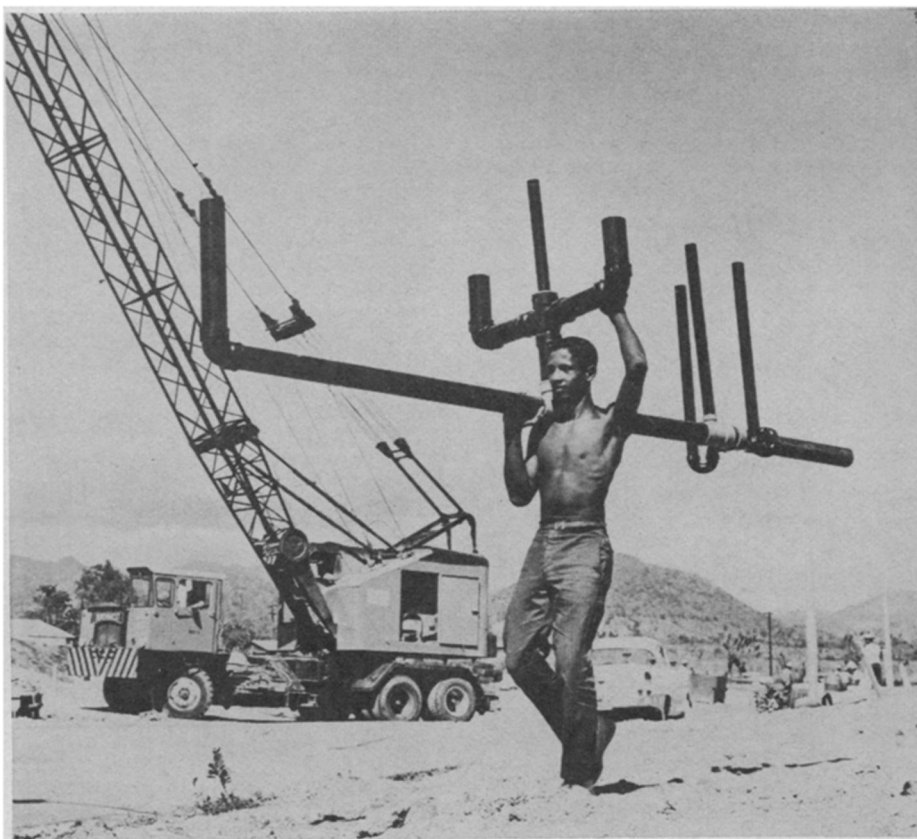
People worry about whether plastics will hold up as well as iron or copper, the natural products. Will they last for 50 years or more? There is no proof yet, because the industry is still too young. Tests indicate that they will, but customers must be convinced.

The phenomenal growth of the plastic pipe industry is shown by its rapid rise in annual production from \$10 million in 1955 to \$75 million in 1963. With broadening uses and new market potentials the market may reach as high as \$350 million by 1972.

Until recently most of the plastic piping was for water lines outside buildings, irrigation installations and industrial uses.

Now the big drive is for plastic plumbing in every household.

In order to place pipes in homes, new building codes had to be formulated and standards established. Congressional hearings and conferences had to be held to overcome the resistance and skepticism of builders and others involved. Finally, a special committee of industry representatives, water works officials and specialists from the field of plumbing and sanitation developed a Model Plumbing Code. New commercial standards for plastic pipes



Celanese

PLASTIC 'TREE'—A plumber's helper carries a plastic plumbing "tree" during construction of a low-cost housing unit in Ponce, Puerto Rico. The tree, weighing only about 50 pounds, would weigh more than 240 pounds if made of cast iron. Made by Celanese Plastics Company, the lightweight ABS plastic substantially reduced plumbing costs and construction time.

have also been set by the U.S. Department of Commerce.

Since its first appearance plastic pipe has had to prove its worth. It had to show that it could do what metal pipes do and also that it had some qualities that metal pipes did not have. Otherwise there would be no reason for changing from the long established use of cast iron, wrought iron, and copper to a new unknown material.

Plastic pipes for homes, at present, are usually used for bringing water to the home and for drain waste and vent (DWV).

Plastics used in piping are those known as thermoplastics, a class of polymers that soften when heated and

become rigid again when cooled without any chemical change.

There are now three main thermoplastics that are used for plastic pipes—polyethylene (PE), polyvinyl chloride (PVC) and acrylonitrile-butadiene-styrene (ABS).

There are certain common characteristics that make them suitable for pipes.

The surface of thermoplastics is smooth—no rough surfaces, no sharp edges. Thus, things do not get caught and clog the drains—they go sailing through. Since there is less friction, drainage is faster and pipes of smaller diameter can be used.

Plastics, being polymers, consist of long chains of thousands of simple

molecules, called monomers, linked together. The chains, like tiny threads of various lengths, line up randomly along the tubes, enabling linear molecules to be pushed and bent without breaking, thus giving flexibility to the pipes.

Plastic pipes are therefore more resistant to impact than metal ones and adjust better to shifts in the house or ground.

Polyethylene, the most flexible of the three can be bent to fit the need as it is being installed.

The plastic can also be made more rigid for particular purposes by increasing the length of the chains or by cross-linking—that is, by connecting the long chains together by branching—like rungs in a ladder. The single chains thus joined are no longer free to slip and slide at will, and make the material more rigid.

Plastics do not conduct heat as readily as metals, as one can see by touching a piece of metal and a piece of plastic. The metal will feel colder since it carries the heat of the body away more quickly. In the same way, hot greases flowing down the drain do not chill as rapidly in plastic pipes as in metal ones, with the result that there is less clogging.

Thermoplastics Rust-Free

Thermoplastics are inert. That is, they do not react with other chemicals. They will not rust by combining with the oxygen in the air or soil, and will not corrode by combining with the liquid flowing through the pipes.

Being nonconductors of electricity, they do not ionize or go into solution when exposed to most household chemicals, salts and acids. Thus they do not suffer electrolytic corrosion as metals do.

Another important factor in their favor is lower cost, an asset for low-cost housing in the United States as well as developing countries. Plastic piping reduced the expense of plumbing by as much as 38% in a new 1,000 unit low-cost housing project in Ponce, Puerto Rico.

It is also only about one-fifth the weight of cast iron pipe, and is thus easy to handle. In the above project completion rate was stepped up by some 59% and a plastic piping "tree" weighed only 50 pounds compared to the average weight of 240 pounds for cast iron soil pipe of the same size. Of the three plastics, PE, PVC and ABS, polyethylene is the most widely used. The pipe, colored black with carbon black, can be coiled for transportation. Until recently, PE dominated the industry accounting for 65% to 75% of all plastic pipes made.

Because of its excellent impact resistance at below-freezing temperatures in addition to its other properties, it is useful in low-pressure, low-temperature cold water service, such as in drainage and irrigation.

The pipes are made of the same material as the transparent polyethy-

lene bags that are soft and flexible, but the molecular chains in the pipes are longer. Polyethylene comes in various grades of strength, the toughest and best having around 750,000 monomers in a chain. The longer the chains, the harder and less flexible the PE.

PVC and ABS are used for drain, waste and vent. Of the two, PVC is more popular at present but ABS is coming to the fore and just recently was granted approval for use in permanent residences.

A polymer of vinyl chloride, PVC has all the favorable properties of thermoplastics. It is a petrochemical high in strength and chemical and weather resistance. It displays perhaps the best all-around properties of the thermoplastics. Since it does not support combustion, it should be in great demand for household plumbing and is now used in some U.S. Navy ships for that reason.

PVC, first introduced into the piping industry in 1952, is now manufactured by about 40 companies in the United States.

Rigid ABS is increasing in importance and is one of the most important plastics used for DMV purposes.

Recent tests have shown that pipes made of this plastic are stronger than those made of copper or iron. Although ABS weighs only one-ninth as much as service-weight cast iron, it is much stronger and retains its impact resistance even when temperatures dip below zero, thus avoiding damage in cold weather installations.

The ABS pipe, being resilient, rebounds from heavy blows, while cast iron breaks into fragments and copper tubing buckles under impact.

ABS pipe is used in 98% of the mobile homes built in the United States.

However, there is one drawback in plastic piping—thermoplasticity.

The temperature range of polyethylene is from 160 degrees F. down to -60 degrees F. If the water is too hot the pipe will become soft. Therefore, it is suitable only for cold water systems.

Housewives, naturally, are opposed to having two types of fixtures, hot water with bright chromium and cold water of black plastic. However, plastic manufacturers are working to design a plastic that will transmit liquids at temperatures higher than that of boiling water (212 degrees F.). Test installations of such piping have been made, but are not yet commercially available.

So the versatile plastic may eventually win and homes may one day be equipped with decorative fixtures

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Current U.S. Patents

➤ A GLEAMING fluorescent light that shows where teeth have not been properly brushed is the idea behind a patent granted by the U.S. Patent Office.

The toothbrush and dye-containing toothpaste to accomplish this earned patent 3,261,978 for Dr. Henry Brenman of Philadelphia, Pa.

The teeth are brushed in approved manner as usual. The difference is that any spots inadvertently missed or not entirely clean are coated with the invisible dye contained in the toothpaste. When ultraviolet light illuminates the teeth, the dye fluoresces, giving a bright picture of any unclean surfaces.

The ultraviolet light is built into the toothbrush, which has a white light source and a filter that removes all the radiation except that with a wavelength of 3650 Angstroms. Two nontoxic dyes that fluoresce at this wavelength are fluorescein and erythrosine, both of which have been approved by the U.S. Food and Drug Administration.

After a first brushing, it is necessary to brush again only those teeth or areas that show signs of fluorescing in order to complete the cleaning operation.

The toothbrush and toothpaste should be available commercially within a year, Dr. Brenman said.

Rigid-Rotor Helicopter

A light, less expensive method by which the rotating blades of a rigid-rotor helicopter are maintained in an essentially fixed position, instead of flapping a bit as they otherwise would, earned patent 3,261,407.

Irven H. Culver, who won the 1966 Dr. Alexander Klemens award of the American Helicopter Society for the rigid-rotor system, assigned rights to Lockheed Aircraft Corporation, Burbank, Calif. Co-inventors are Thomas F. Hanson and Lance G. Look, also at Lockheed.

In the rigid-rotor system developed by Lockheed, the helicopter blades are attached rigidly to the hub instead of being hinged. The patent covers the virtually instantaneous method by which the changes in both chord angle and flap angle are detected, measured and compensated for by a gyroscope.

Since the signals relaying the measured changes are combined before being fed into the gyro, the gyro can now

be made much smaller and more simply—some 140 pounds worth. Pilots who have flown the 4,700-pound Lockheed Model 286 report that it is easier to fly it than to drive a car.

Other Interesting Patents

The use of optical fibers to illuminate the lungs and other organs that can be reached for examination by tube from outside the body earned patents 3,261,349, 350 and 351. Dr. Frederick J. Wallace of New York assigned rights to American Cystoscope Makers, Inc., Pelham Manor, N.Y. The optical-fiber instruments can be sterilized without difficulty and can be shaped as necessary for the body part being examined.

Nobelist Giulio Natta, with Piero Pino and Giorgio Mazzanti, all of Milan, Italy, were awarded another patent for their process for polymerizing into plastics compounds that originally consisted of atactic macromolecules. Rights were assigned to Montecatini Societa Generale per l'Industria Mineraria e Chimica, a company for which Dr. Natta is a consultant.

A sound range and bearing recorder for locating submarines underwater was awarded two patents, 3,262,091 and 3,262,092. Although patent application was made in 1951, the sonar device was actually in use during World War II. Both the application and issuance of the patent were delayed because the existence of the recording device was classified for security reasons. The inventor, J. R. Richards of Cheverly, Md., assigned rights to the Government through the Secretary of the Navy.

Do You Know?

Canada's first electronic *computer* for use in air traffic control will be installed in Newfoundland by mid-1967.

During the Middle Ages, English children were required to honor their mothers by visiting them once a year and bringing a "mothering cake."

Castor oil is used in the manufacture of all-purpose greases, hydraulic fluid, artificial leather, printing ink, soap and cosmetics.

Pipes of Plastic

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molded to suit the homeowner's fancy and to match the color of the kitchen walls or bathroom tile. With the present copper shortage, plastic pipes will become even more important.

Even the pipes in drab laboratories may burst out in cheerful colors to liven the traditionally somber walls.

Plastic pipes in all areas are being continually improved and new ones are being introduced. Most prominent among these is polypropylene, expected to account for about 20 million pounds by 1968. Polydivinyl chloride, a relative of polyvinyl chloride, also may become important. It has potential as a high-temperature plastic.

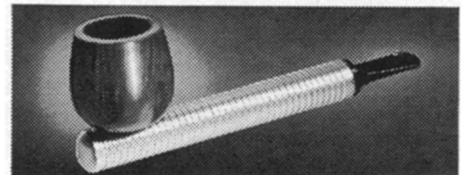
Of course, plastic is not better than metal in all aspects. But it is the combination of weight, smoothness, low cost, inertness and noncorrosiveness that have been responsible for the progress of plastic pipe.

Now that the battle for recognition is almost over, the next question is which polymer will come out on top? What new properties can be instilled in a plastic to give better performance?

Only time will tell, but one fact is certain—plastic pipes are here to stay and a new era of plumbing is at hand.

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