CHEMISTRY

Mr. Saunders' Magic Glue

"Gunk" that will stick anything to anything else will hold strips of aluminum alloy together until a pull of more than a ton and a half forces them apart.

By HARLAND MANCHESTER

➤ EVER SINCE man began inventing things, one of his quests has been an all-purpose glue that would bond all kinds of materials in an unbreakable union, a glue stronger than rivets, screws or bolts. He has even dreamed of a glue that would stick together a house, a plane or an automobile body, with fabulous savings in time, trouble and material.

I thought this was just a visionary idea when I walked into the Chrysler Corporation production research laboratory of S. Gordon Saunders in Detroit recently. Saunders, a casual, good-natured man in his forties, said he had some "gunk" to show me.

He produced a can of what looked like ordinary glue, smeared two large pieces of sheet iron with it, and stuck them together. He squeezed them for a few minutes in an electrically-heated clamp. Then a brawny, six-foot mechanic took a cold chisel and a hammer, secured one part of the united chunk in a vise, and tried to knock off the other part. He worked until the sweat ran but made no impression whatever.

Mr. Saunders showed me the overlapping ends of two slender strips of aluminum alloy that had been stuck together with the same glue. The joined strip was placed in a stretching machine used for testing. Mr. Saunders turned a crank, and an indicator moved slowly around a dial, showing the number of pounds of pull applied. The hand passed the 1,000 and the 2,000-pound marks and nothing happened. When the needle reached 3,100—a pull of more than a ton and a half—the two strips grudgingly separated.

This sensational glue is no mere laboratory sideshow. They call it Cycleweld, and during the last year it has gone to work for 50 war production companies, saving man-hours and materials in hundreds of ways. In bombers, fighting planes and gliders the magic glue has reduced the number of rivets by thousands. Cycleweld has been introduced in automobile manufacture. It is being used in making electrical instruments and all manner of small mechanical devices.

This new glue not only unites metal to metal, but will stick metal to wood or to plastics, glass, fiber board, natural rubber and most synthetics—and will quickly and permanently bind any of these materials together in any combination whatever. While it is possible to break the union by means of powerful laboratory testing equipment, no Cycleweld bond has ever yet cracked in regular duty, or has relaxed its hold because of vibration.

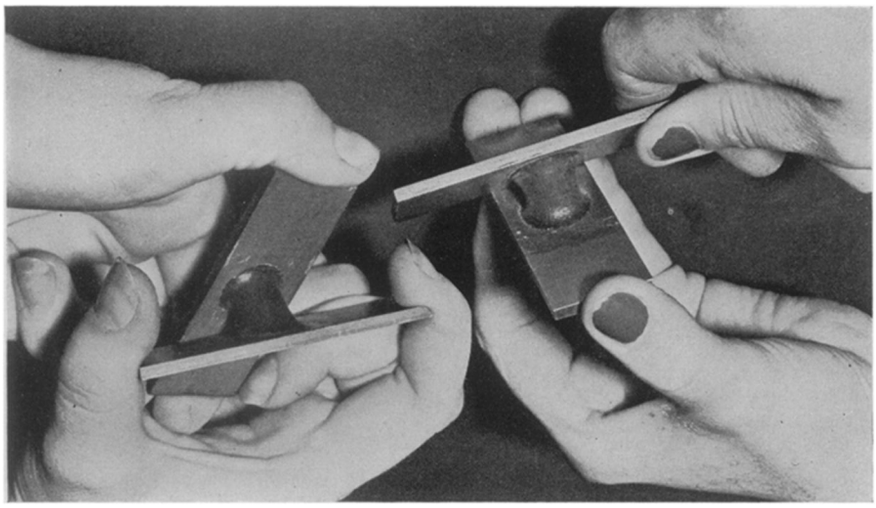
Vibration Resistance

This resistance to vibration has made the glue invaluable in airplane construction. I saw metal wing flaps for P-40 fighter planes being glued together in 18 minutes, saving four man-hours' riveting time. These wing flaps are crisscrossed with interior supports to make them rigid under the terrific strains of combat. Once it took 1,200 rivets to hold the supports in place. Now the super-glue is applied with a spray gun along the strips where the supports are to be placed, and the assembled flap is squeezed together in a heated press, eliminating 900 rivets and cutting the cost by one third. "Look at this aircraft stabilizer," Mr. Saunders said to me. "Only a few months ago 5,500 rivets were used in assembling it. Now we use only 30, and do the rest of the joining by Cyclewelding. The wing is just as strong as the old one, or stronger. This process costs only one-tenth as much as riveting."

Discovered 5 Years Ago

It was only five years ago that Mr. Saunders discovered the formula for Cycleweld. A synthetic resin, it belongs in the same broad group of chemical compounds from which plastic ashtrays, telephone receivers and bomber noses are made, although the exact combination which produced this adhesive is, of course, a secret.

Saunders, a chemical engineer from the University of Kansas, came to the Chrysler Corporation as an expert in paint and synthetic resins. He got started on the work (*Turn to page 172*)



EARLY STEP—In the beginning of his research to find a super-glue, Mr. Saunders discovered that these round "tension buttons" of rubber could be bonded, with his thermosetting plastic, so firmly to pieces of laminated phenolic plastics that the rubber would tear before the bond gave way. The glue gave better results at low temperature, and experiments were continued in this direction.

Do You Know?

Man is the only animal with a jutting chin.

Most snakes are nocturnal and prefer to do their hunting at night.

United States *war expenditures* during 1943 averaged about $241,000,000 a day.

Nearly 99% of the *calcium* and 70% of the phosphorus in the human body are in the bones and teeth.

In 1941, *cheese* made in factories in the United States totaled nearly 1,000,000,000 pounds, about half of which was made in Wisconsin.

A 24-inch pipeline from Texas to the East, now under construction, will deliver approximately 200,000,000 cubic feet of *natural gas* daily by next fall.

Persons 65 years of age and over constituted 4.3% of the *population* of the United States in 1900, and 6.8% in 1940; the under-20 group decreased from 44.3% to 34.5%.

Paints that reflect infra-red rays may be used on houses after the war; they reduce heat absorption in the painted surface, thus keeping the building cooler in sunlight.

Twenty-one new *blast furnaces* have been constructed by the steel industry in the United States since Pearl Harbor; their combined capacity is about 8,000,000 tons annually.

Alaska lies in the same latitude as Sweden, Norway, and Finland; it exceeds in size the combined areas of these three countries which have a combined population of more than 12,000,000 people.

Ground *pork or beef* which is to be frozen for preservation should not be salted, as salt stimulates oxidation resulting in rancidity; sage, pepper, mace, and ginger seem to have an opposite effect.

Vicuna wool is from a hardy gazelle-like little animal, two feet high, which lives in the high Andes in Bolivia and Peru; the vicuna is related to the camel, and its wool is probably the softest of all animal fibers.

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which led to his new adhesive when someone at a conference asked, "What makes paint stick to metal?" It occurred to him that it would take tremendous power to pull off a single square inch of the paint on the surface of an automobile. Why not learn what makes this happen, and use the knowledge in creating a new super-glue?

In the fall of 1942, Cycleweld was demonstrated in Detroit before 200 representatives of the aircraft industry. The plane builders were greatly impressed. Soon they, as well as the Army Air Forces Matériel Command at Wright Field and the Navy Bureau of Aeronautics at Philadelphia, were backing the adaptation of the process to warplanes.

If the magic glue is revolutionizing the metal plane, its future in plywood aircraft is breath-taking. Saunders foresees a Cycleweld-engineered fighter plane, using unprecedented amounts of plywood at about one-third the weight, one-fourth the cost and one-fourth the production time of a comparable all-metal plane.

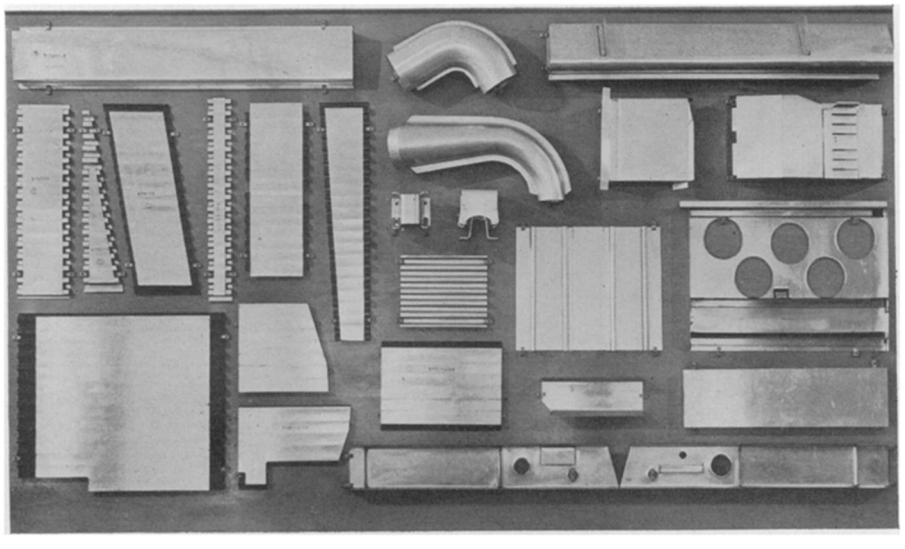
The major handicap of modern plywood is the difficulty of fastening it firmly to other parts. Saunders showed me how Cycleweld solves this problem. Two sheets of plywood simply bolted together were yanked apart in a testing machine with a pull of only 190 pounds, the bolt tearing out a slender piece of the wood. When Cycleweld was used, the strength was increased about 500 per cent.

New horizons in housing are also in sight because of this process which makes possible the joining of all manner of building materials. Already floor panels made by Cyclewelding corrugated steel within thin layers of plywood are being made for use in prefabricated houses. About as thick as ordinary flooring, it is lighter and stronger, and so rigid that only half the normal number of joists are needed.

Another of Saunders' exhibits is a wooden block a foot square made up of multiple layers of plywood. The layers have been sprayed with Cycleweld and bonded by passing heat-producing radio waves through them. Since the layers were placed with the grain of the wood alternating, a beam or support made in this manner has many times the strength of solid wood, and is, in fact, as strong as steel. This is a new entry in the post-war construction race.

Cycleweld's first job after emerging from the laboratory was to bond insulating material to the steel roofs of automobiles, but many other automotive tasks await it. In fact, the new adhesive may change the whole appearance of tomorrow's car, reducing the thickness of corner posts and other supports and bringing about a lighter, stronger, more streamlined body.

At last there may be a transparent plastic top, something technical men



GUNKED—Mr. Saunders' Cycleweld bonds together all these parts for medium bombers. Floor sections used in the bombers are Cyclewelded together in a metal-to-metal bond—one of the ways the new cement saves many man-hours.

have scoffed at as impractical because vibration would break the joints holding the top to its supports. Now the top can be attached by Cyclewelding a thin rubber sandwiched between the plastic and the metal.

That is only a beginning, Saunders says. When you find a gunk that will stick anything to anything else, the sky is the limit.

For much of the technical data in this article the author gratefully acknowledges indebtedness to Lloyd Stouffer, author of "Cycleweld—a New Bonding Process," published by *Modern Plastics*, September, 1943.

Science News Letter, March 11, 1944

CHEMISTRY

Paper Shipping Sacks Receive Specifications

➤ THE FIRST extensive federal specifications for paper shipping sacks have just been issued by the National Bureau of Standards. War uses of paper sacks, now necessarily replacing metal, wood or textile containers, make these of particular importance at the present time.

Specifications include construction details for five types of sacks, and for waterproofing the ends of sewn sacks. They cover four different kinds of kraft paper: shipping sack paper, paper treated for high wet strength, paraffined paper, and asphalted paper. For wet-strength paper a wet tensile strength of about 27.5% of the dry strength is specified.

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Process for Obtaining Magnesium from Sea Water

➤ MAGNESIUM, super-light metal needed alike for airplane construction and illuminating flares, has been obtained in quantity from sea water during the present war. Patent 2,342,666, on a process for doing this, has been granted to S. B. Heath and F. R. Minger of Midland, Mich., and assigned by them to the Dow Chemical Company. Basic steps in the process are the treatment of the sea water first with a lime slurry, then with calcium chloride, to remove undesired compounds (principally sulfates), and introducing carbon dioxide to unite with the magnesium to form magnesium chloride. Since this compound is highly soluble, it remains in solution while the insoluble sulfates are precipitated and filtered out. Then the magnesium chloride is reduced to solid form by evaporation.

Science News Letter, March 11, 1944

CHEMISTRY

Oil-Treated Shoe Soles

➤ SOLES of wartime rationed shoes last longer if treated before attached with special oil preparations, or impregnated with wax. In tests made during the past year by the National Bureau of Standards, an improvement was found of 14% in wear of sole leather of grades available to civilians, and a possible improvement of from 30% to 40% indicated by a few service tests of wax-impregnated soles.

Some thirty commercial mixtures for water-proofing and improving wear were examined at the Bureau, but the service tests on oil-treated soles were confined to two, both of which are made of available materials and may be applied without special equipment. In the service tests a considerable number of cadets were used, the cadets being in a Washington, D. C., high school military unit.