EXPLORING THE OCEAN DEEPS
What to Do Until the Firemen Come
OUR MISSILE-FIRING SUBMARINES
how to be a hero...

on a budget!

Think what a hit you’ll make with a fishing rig like this! Fishermen who love their families pick Evinrude’s 40 hp Big Twin as the smart big power economy buy of the year. Power enough to take the family along for fishing, picnicking, camping and plenty of power to ski your own kids and your neighbor’s, too. Nothing can match it near its price!

Frankly, Big Twin is as fine a performer in every respect as Evinrude’s luxury Lark II, except for electric starting and automatic choke. And Big Twin starts easier by hand than other motors of lesser hp. It has the same magnificent Lark II engine under the hood — with advanced thermostat temperature control. It’s the most efficient, smoothest-running, longest-lasting engine money can buy. It’ll give you the same silk-smooth trolling, crisp response, and commanding power as the Lark II.

Feature for feature... dollar for dollar... nothing can match Big Twin’s genuine value! Be a hero to your family... see how little it costs to own, at your Evinrude dealer today!

A Div. of Outboard Marine Corp.
In Canada: Peterborough, Ont.

EVINRUDE
FIRST IN OUTBOARDS

40hp BIG TWIN

Big power economy buy of the year!

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Send me catalog of 1960 Evinrude Motors with details of today’s most advanced features.

Name.................................................................
Address............................................................
City..................................................Zone...State
CORVAIR'S A NEW SMOOTHIE

Behind Corvair's array of engineering innovations (literally behind) lies its engine: America's first and only rear-mounted air-cooled aluminum "pancake" six. The spec sheet reads like this: 140 cubic inches of displacement, bore 3.375 inches, stroke 2.60 inches, maximum horsepower 80 @ 4400 r.p.m., maximum torque 125 ft.-lb. @ 2400 r.p.m. (Hitch these figures to a car weighing only 2,375 pounds at the curb and you've got yourself a peppery package, if we do say so.)

Anyway, of the four adjectives, we particularly like "pancake." Translated, it means that this is a horizontally opposed six, instead of the conventional in-line type. If you cut the engine crosswise, it would look like the picture.

There are three pairs of cylinders, of course, each working in unison. When one piston is at the top of its stroke, so is its mate. So? Well, Barney Navarro, who's engineering editor of Motor Life magazine and should know about these things, writes "opposed engines (of Corvair's design) are inherently balanced." In other words, each pair of pistons, rods and crank throws balance each other, and there's no need for counterweights. Because this type of engine is inherently balanced, it's inherently smoother than an in-line six. And after all, ultra-smoothness is just what you're after.

As you might suspect, there's precious little of the commonplace in a Corvair engine. Yet there's nothing so radical that it hasn't been proved time and again for reliability. About the only question left now is whether we can build enough of these cuties to fill the demand. One thing you ought to do for sure is to try one out. After that, you'll probably be badgering us to build you one. This is a problem we're happy to have.... Chevrolet Division of General Motors, Detroit 2, Michigan.

That rear engine is just one of the engineering marvels in this new Corvair. Others include the silken smoothness of independent suspension at all 4 wheels... a practically flat floor, front and rear... briskly competent handling... and the ingenious unit combining the engine, transmission and rear axles. Be prepared to spend some time with these wonders when you check out the revolutionary Corvair at your dealer's.

FEBRUARY 1960
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Next Month...

HAVE YOU EVER wanted to ride a turbojet-powered runabout? . . . cruise the Florida Keys? . . . watch the bottom of your boat in action? . . . see a kalamaro? . . . learn more about flotation? (It could save your life) . . . take a 10-minute course in maritime law for small boats? . . . improve your boat trailering technique? PM's editors take you along and show you how in the big Annual Boating Section—28 pages of our best on boating for 1960

POPULAR MECHANICS
Exclusive Copper-Glass Seal Stays Gas-Tight Under 1400 Pounds Pressure

AC Fire-Ring Spark Plugs are your best buy in spark plugs for many reasons—but a big one is AC's exclusive Conductaseal that bonds the terminal screw and center electrode to the aluminum oxide insulator. This seal protects against leakage far better than ordinary seals. Leakage alters the spark plug heat range, which can damage the spark plug and, in turn, the engine. Conductaseal is a product of AC research. It is made of finely ground copper and glass, inserted into the center of the insulator and formed under terrific heat and pressure into an unyielding bond. It is tested under 1400 p.s.i. to give you trouble-free spark plug operation and long life.

The pictures on this page give graphic proof of Conductaseal superiority. Remember them the next time you buy spark plugs. For highest quality and greatest reliability, ask for AC Fire-Ring Spark Plugs.

AC SPARK PLUG & THE ELECTRONICS DIVISION OF GENERAL MOTORS

AC PRESENTS THE ART CARNEY SHOW, NBC-TV, FEB. 5

Skin-diver demonstrates how AC Conductaseal stays gas-tight under 1400 p.s.i., while ordinary spark plug leaks.

This X-ray check makes certain that the Conductaseal has bonded properly. It's one of 116 AC reliability tests.

Every AC Spark Plug features the exclusive Hot Tip that heats faster, cools faster to stay clean longer.

They must be the best!

AC Fire-Ring Spark Plugs
ASK THE EXPERTS!

Men who work on America's top construction jobs work with America's top saws—built by Black & Decker!

That same tough dependability, prized on big construction jobs, makes a Black & Decker Saw your best choice—whether you use it on the job or around your home.

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scraping on driveways?
Load-Levelers® put an end to this common annoyance by increasing road clearance of even heavily loaded cars.

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Over the Editor's Desk

A FAMILIAR NAME is missing from this issue. Wayne Whittaker, managing editor of Popular Mechanics for the last year and a member of the editorial staff since 1942, died recently after a long illness.

His name is well known to our readers as the author of many articles. When PM inaugurated its annual Home Section in the October issue of 1953 Mr. Whittaker was placed in charge of this popular feature and his writings and his ideas have sparked this every year since. He traveled widely each year in search of the best-designed homes in America and the architects who designed them, and thus became one of the nation's experts in knowledge of what Americans want in homes and home improvements. Prior to his editing the Home Section he had supervised Popular Mechanics' wide coverage of the automotive field.

Popular as a writer and as a man, his legion of friends throughout the country will mourn with us his passing.

LOOKING for a pen pal overseas?

Often we are asked to publish letters from readers who would like to correspond with someone abroad. This we cannot do.

Instead we refer you, if you are so interested, to the International Friendship League, Inc., 40 Mt. Vernon St., Beacon Hill, Boston 8, Mass. The League, a member of President Eisenhower's People-to-People Program, in cooperation with American embassies throughout the world, is promoting the idea of exchanging information between adults or youths and pen pals in 139 free countries and territories. Just send a stamped, self-addressed envelope to the League at the above address and ask for its brochure and application blanks. The League has thousands of letters from people abroad who would like to correspond with Americans.

To the Editor:

Enclosed is a photograph of the Karlson sound chamber that you submitted plans for in the July 1958 issue of Popular Mechanics.

When I started construction, we needed some record storage also, so this was built onto the right side of the chamber with the whole unit having a design that was similar to the Hoffman console hi-fi that we already had. A good quality coaxial speaker was used with excellent results. It (Continued to page 10)

POPULAR MECHANICS
IF you’re that person, here’s something that will interest you.

Not a magic formula—not a get-rich-quick scheme—but something more substantial, more practical.

Of course, you need something more than just the desire to be an accountant. You’ve got to pay the price—be willing to study earnestly, thoroughly.

Still, wouldn’t it be worth your while to sacrifice some of your leisure in favor of interesting home study—over a comparatively brief period? Always provided that the rewards were good—a salary of $3,000 to $10,000 and up?

An accountant’s duties are interesting, varied and of real worth to his employers. He has standing!

Do you feel that such things aren’t for you? Well, don’t be too sure. Very possibly they can be!

Why not, like so many before you, investigate LaSalle’s modern Problem Method of training for an Accounting position?

Just suppose you were permitted to work in an accounting firm under the personal supervision of an expert accountant. Suppose, with his aid, you studied accounting principles and solved problems day by day—easy ones at first—then more difficult ones. If you could do this—and could turn to him for advice as the problems became complex—soon you’d master them all.

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ACCOUNATING
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Six years on the same job with never an accident...
And then one morning...

2. A cave-in put me six feet under for six long minutes
Quick! Get him out of there!

3. In the hospital, I had plenty of time to think
Six years I've been buried alive in that same old job, Jane!

4. I'd passed over dozens of I.C.S. ads in Popular Mechanics. But I saw this one in a new light
I.C.S. Success plan...
256 courses to choose from... This could be the answer... Won't hurt to find out

FREE!

I.C.S. Career Kit
Send coupon now... get all three books

International Correspondence Schools
Box 21953B, Scranton 15, Pa.
"How to Succeed" A 32-page gold mine of ideas CAREER CATALOG
Opportunities in the
Sample Lesson (Math)

"Then a few days later...
Mr. Walsh called me in...

""How it was going to go...
I'm keeping you on salary.
You'll have to go out for six months.

"Then everything came apart...
I'm not going to build a house.

"And thanks to I.C.S. it's a
social occasion that
"I'm ready now.
Mr. Walsh.

"They gave me some
simple assignments,
and I sure
learn about
luckies?"

"One month later...
You back on your feet?
I'm going to see
while before you're back in the
desk for you in the office,
when you're ready.

"How it was going to go...
I'm keeping you on salary.
You'll have to go out for six months.

"Then everything came apart...
I'm not going to build a house.

"And thanks to I.C.S. it's a
social occasion that
"I'm ready now.
Mr. Walsh.

"They gave me some
simple assignments,
and I sure
learn about
luckies?"
Hey SKINNY!

...YER RIBS ARE SHOWING!

I Can Make YOU a New Man, Too
In Only 15 Minutes a Day!

Don't let your friends ask you, "When did you get so big?"

I was ashamed to strip for sports. Girls made fun of me. They called me "Skinny Slim." But now I'm big and strong.

I published a book called "Dynamic Tension." It's just one of my many books. I've sold over 10 million copies of my books.

Sometimes you just can't do it yourself. I'll help you.

To the Editor:

Enclosed you will find a photo of a horse made from rubber tires, located in Brainerd, Minn., in an area of interest to the tourist. The photo clearly shows how the tires were cut and arranged to bring about the effect. To add realism a two-wheeled cart is hitched to it.

Elmer Vandrey, Fairmont, Minn.

(Continued from page 6)
Make More Money Soon Fixing Electric Appliances

Learn at Home in Spare Time

Earn more money. Enjoy doing important, interesting work. Learn Electrical Appliances Servicing. This is a field of increasing opportunity. Today every wired home has many electrical appliances and millions and millions of new appliances are made and sold each year. Find out more about this great, growing field. Find out how NRI can train you, at home and in spare time to be an Appliance Service Technician. See how you can start soon to make extra money servicing appliances.

Add to Your Income Soon After Enrollment Opportunities Increasing for Service Technicians

NRI Training is practical, thorough. You get easy-to-understand lessons, and NRI supplies parts to build professional type Multi-Use Tester. Use it to get practical experience. Soon, you can add to your income by servicing appliances. Build a profitable sideline for your spare time—qualify for a good job—develop a business and be your own boss. As an Appliance Service Technician, your opportunities are broad—your services wanted, gladly paid for, highly regarded in your community.

Appliances are necessary to comfortable, convenient living. Owners pay well to keep them in repair. The field is amazingly big. In addition to major appliances such as electric ranges, air conditioners, refrigerators, there are over 40,000,000 electric iron, 5,000,000 electric blankets, 15,000,000 coffee makers, plus many millions of vacuum cleaners, fans, toasters, mixers, etc.

Learn and Earn With Tester Diploma When You Finish

Locate appliance troubles easily with Portable Appliance Tester you build. Use it to learn and do actual electric appliance repair jobs. For only $3.00 with enrollment and $6 per month, get training including Tester—a small price to pay for increased earnings. Mail coupon for Sample Lesson and Book—your first step toward more interesting work, bigger earnings. NATIONAL RADIO INSTITUTE, Dept. ABO, Washington 16, D. C.

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Name: ____________________________ Age: __________

Address: __________________________

City: ____________________________ Zone: ______ State: __________

ACCREDITED MEMBER NATIONAL HOME STUDY COUNCIL
To the Editor:

Bob Arrol, pharmacist at the central Illinois town of Arcola, started this coffee bar in his drugstore back in 1940 with six cups. Today he has 162 cups in the stalls, and has a waiting list. To join the club now, the prospective member must first drink five gallons of coffee. When some member dies, Arrol removes the cup and reassigns the space. To a member moving away, he gives the cup as a memento.

Grover Brinkman, Okawville, Ill.

Shocking Meal for Squirrels

If it irritates you to watch squirrels dining on the expensive seed you bought to feed songbirds, here's one solution: a feeder that administers a mild electric shock to the squirrel. It's built on the see-saw principle. The perch is counterbalanced and a squirrel weighing over eight ounces causes a microswitch to make contact and give the interloper a harmless but effective jolt.

(Continued to page 14)
Your big opportunity to walk into Something Good!

Wouldn't you be happier with a job that not only is secure and highly paid, but also offers a splendid opportunity to go in business? The fast-growing refrigerator and air conditioning industry meets this requirement. It can use 20,000 newly-trained mechanics every year. It needs you. Refrigeration is so widely used in the home, in industry, and in transportation, that opportunities exist almost everywhere. You may become established right in your own community. For complete information on how to get into this lucrative field, fill out and mail coupon.

Enjoy the prestige of a service engineer
Few colleges offer courses in air conditioning. Therefore, industry chooses its service engineers from the ranks of well-trained technicians. What a wonderful way to gain professional status—and greater income—without benefit of a college degree!

CTI has the practical way to train you for success in Refrigeration — Air Conditioning
As in anything else, there are short-cuts to getting ahead. In the refrigeration field, the short-cut is CTI Home Training. There is no other training like it. Only CTI home study is practical. Only CTI sends all parts and tools to build the condensing unit illustrated at right. You run many experiments—go through the trouble-shooting and repair techniques you'll encounter on the job.

How CTI students earn money as they train
Many students, after a few lessons, earn extra cash by installing and fixing refrigeration and air conditioning units. Some work evenings and weekends for local dealers; others establish service routes which include restaurants, motels, meat markets, supermarkets, etc. This is possible because CTI training is practical—equips the student to do field work. CTI training pays its way—start you in business while you're still a student! Others have done it. You can too!

PROOF! Read these letters from CTI men

"I'm in the refrigeration business for myself now. I earn nearly double what I used to. During my training, I made enough to pay my tuition."—Alfred Heim, Ky.

"I've started a business and it's a success."—Otto Degner, Canada..."I am in business for myself. I am building a nice trade doing service work."—Paulin Waters, Tex.

"I applied for a job to install air conditioners in autos and got it."—Richard Vinet, La.

"Your refrigeration training helped me get repair jobs after only twelve of your lessons."—Frank Green, W. Va.

Expect the best—and get it!
Your career is in safe hands when you rely on CTI for a technical education. This progressive institute, which specializes in home study, was the first to offer kits to build a condenser. CTI lessons are kept up-to-date, well illustrated, understandable. You get better and more lucrative training through CTI. Mail coupon and see for yourself!

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Name__________________________Age__________________________
Address__________________________City________Zone______State____

FEBRUARY 1960

13
To the Editor:

For more than 20 years I have been a constant reader of your publication. I am enclosing a photograph of the entrance to my house in this city in which I have used as decoration two wheels from an old English coach.

Major Alvaro Roldan S.,
Chief of Public Relations and Sales,
Hotel Tequendama,
Bogota, Colombia

To the Editor:

With typical teen-age skepticism, Roger M. Woodbury, Jr., of Natick, Mass., decided to prove to himself that the sun's rays could be captured to cook a meal, heat a house, burn through steel, etc., as he had read so much about it in past issues of Popular Mechanics. After polishing up the reflector bowl of a discarded bathroom heater, he replaced the heater coil with a wire spit. Next he loaded the spit with a frankfurter and aimed the bowl toward the sun. In 15 minutes the hotdog was sizzling with a mouth-watering aroma, ready to coat with mustard and pop into his mouth.

Roger M. Woodbury,
Natick, Mass.
MAKE MORE MONEY IN TELEVISION
RADIO-ELECTRONICS

TOP PAY... UNLIMITED OPPORTUNITIES
LIFETIME SECURITY CAN BE YOURS!

You are needed in the Television, Radio, and Electronics industry! Trained technicians are in growing demand at excellent pay—in ALL PHASES, including Servicing, Manufacturing, Broadcasting and Communications, Automation, Radar...Government Missile Projects.

NATIONAL SCHOOLS SHOP-METHOD HOME TRAINING, with newly added lessons and equipment, trains you in your spare time at home, for these unlimited opportunities, including many technical jobs leading to supervisory positions.

YOU LEARN BY BUILDING EQUIPMENT WITH KITS AND PARTS WE SEND YOU. Your National Schools course includes thorough Practical training—YOU LEARN BY DOING! We send you complete standard equipment of professional quality for building various experimental and test units. You advance step by step, perform more than 100 experiments, and you build a complete TV set from the ground up, that is yours to keep! A big, new TV picture tube is included at no extra charge.

EARN AS YOU LEARN. We'll show you how to make extra money right from the start. Many of our students pay for their course—and more—while studying. So can you!

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If you wish to take your training in our Resident School at Los Angeles, the world's TV capital, start now in our big modern shops, labs and Radio-TV Studios. Here you work with latest Electronic equipment—professionally installed—most modern facilities offered by any school. Expert, friendly instructors. Personal attention. Graduate Employment Service. Help in finding home near school—and part time jobs while you learn. Check box in coupon for full information.

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City

State

Age

Check if interested ONLY in Resident School training at Los Angeles

Veterans Give date of Discharge

NATIONAL SCHOOLS
Los Angeles 37, Calif.
Do You Know This Old-Timer?

This old-timer was the “trophy” given to Eddie Collins of the Philadelphia Athletics when he was selected as the Most Valuable Player in the American League in 1914. The car, built on a 132-inch wheelbase, had a starter-generator combination that made stalling theoretically impossible. When the engine stopped, the starter automatically would start it. The engine was a six-cylinder T-head and its exhaust manifold was finished in heavy baked enamel. Can you find the driver? He’s Harry R. Johnson of Baltimore, Ohio, in a 1915 pose, and he’s where he should be—behind the steering wheel. If you can’t name the car, turn to page 242.

95% PROFITS
YEAR ’ROUND

Be your own boss. Operate a SIMPLEX lawn mower sharpening service in your community. One compact machine grinds all mowers, sharpens cutlery. Low investment, 95% profit. Pays for itself in average month.

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Dept. PM-2, Plymouth, Ohio

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THE CHANCE TO "BE BOSS" OF YOUR OWN $10,000 A YEAR SHOE BUSINESS

Sell friends Work, Dress, Casual Shoes and Boots in spare time. No investment, no overhead, no stock to carry. Simple 2-finger demonstration of patented AIR CUSHION comfort makes shoe selling a snap! Actual shoe samples supplied.

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Show America's greatest shoe values for men, women and children. Over 180 styles. Sizes 4 to 18, widths AAAA to EEEE. Sell full time if you wish, or spare time if now employed and have a "second" income! Advance commissions to $5.00 a pair, plus big Bonus and "Vacation Checks." Get your own shoes as "extras" at no cost!

SNOw MIRAcLE VALue $8.95 AND $9.95
MEn'S DRESS SHOES!
The most sensational group of under $10 footwear folks have seen in 20 years! Our own new "jet age" equipment makes such values possible.

SEND FOR NEW SELLING OUTFIT!
Write NOW if you want the security and big steady income of a business of your own. You can't lose—so act today!

CHARLES CHESTER SHOE CO.
Dept. B-03, Brockton 64, Mass.

MAIL COUPON RIGHT THIS MINUTE!

Sidelights from the PENTAGON

By William R. Kreh

The Navy has laid aside a project it had been toying with for three years—training pigeons to steer guided missiles. It worked like this: The missile would be equipped with a cameralike device in its nose. It would pick up a picture of the target which would be shown on a screen inside the missile. A pigeon, a wire cemented to its back, would be trained to peck at the image every time it moved from the center of the glass. The pecking would make contact with the gridded glass and relay a correction to the steering mechanism. The idea worked in the laboratory, but the project has been put on the shelf since the emergence of more practical electronic guidance systems.

Speaking of birds, the Navy's still trying to outsmart the "Gooney Birds" of Midway Island. Last year there were more than 500 bird collisions with Navy planes, causing $156,000 worth of damage. The Navy has tried to smoke the birds away, steal their eggs, scare them with weird noises. Now the Seabees are building false airstrips to lure the 420,000 nesting albatrosses on the island away from the real airstrips. If this doesn't work, the Navy's going to clear away some of the dunes that flank the airstrips to eliminate air currents on which the birds soar.

The Army, along with private industry, has developed a new combat-surveillance radar which can spot and tell the difference between a walking man and a woman at from 5000 to 10,000 yards. The radar uses principles of the Doppler effect system, which has to do with the change in lengths of sound waves as an object moves in relationship to a fixed point. The radar can distinguish whether equipment, troops, or men or women are moving. The set is housed in a shelter which can be carried by helicopter, truck or a small two-wheel trailer. The Army will soon have 99 sets in use and industry is studying possible applications of the device.
Now! Work Over
300 PRACTICAL PROJECTS with these PARTS AT HOME!

to help You learn ELECTRONICS
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FEBRUARY 1960
Would You Like to Make $1,000.00 a Month?

That’s what Stanley Hyman has made selling the amazing new PRESTO Fire Extinguisher.

All over the United States, more and more men and women report large profits from introducing the new Presto Fire Extinguisher. And no wonder: 11,000 people died in fires last year! Over half were women and children! Civilian defense authorities have said that in the event of atomic attack regular fires in your home will be fighting large fires and that the people must be equipped to take care instantly of the little fire that might so easily become a big one. So an eager public has been waiting for a handier new kind of fire extinguisher—one without the drawbacks of large, bulky, expensive models. Now it’s here.

Over 3 Million Prestos Already Sold!

Presto salesman H. J. Kerr reported making $50 a day, William F. Wydall—$150 a week. Peter Zucara, a beginner—$100 in one week. And this report from Stanley Hyman: “I have been selling the Presto Fire Extinguisher for well over a year and have found it to be the fastest money-maker and quickest-selling item ever produced. If a man demonstrates it intelligently, sales follow automatically. I have made an excellent living with the Presto Fire Extinguisher, having made more than $1,000 in a month. Presto is a natural.”

How You Can Make Good Money Too

You can make good money in this way too! Just start introducing this new kind of fire extinguisher to civil defense workers, owners of homes, farms, cars, boats, filling stations, stores, factories, offices, in your locality and to stores for resale.

The Presto is so light—so small—so handy—even a child can put out a blaze with it. So inexpensive ($4.95) anyone can afford it. Yet its contents (a new wonder chemical developed during the war) have been rated 1.5 to 6 times as effective as other extinguishing agents on an equal weight basis.

Nationally Advertised

And what sales advantages for you—as compared with large, bulky extinguishers that cost 4 times as much and are 8 times as heavy! Presto is easier to use. No more swinging the heavy barrel around in a circle. No more trying to reach the back of a room. No more delay. Even with just a twist of the knob...and flames disappear as fast as 2 seconds.

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FEBRUARY 1960
Harley-Davidson 1960 Line Features Lightweight Cycle

Harley-Davidson's 1960 line includes a new lightweight motorcycle, the Super-10, powered by a 10-cubic-inch engine, and an automatic transmission on its Topper motor scooter. The two-cycle engine on the Super-10, rated in excess of six horsepower, has a new intake and exhaust port designed for quick acceleration. The cycle is equipped with a waterproof ignition system and an alternating-current generator. The Super-10 features a three-speed transmission with constant-mesh gears. Each wheel has five-inch internal expanding brakes. The automatic transmission on the Topper scooter requires no shifting or clutching. Driving the rear wheel in the standard motorcycle manner is a roller chain that runs over a sprocket on the secondary sheave of the transmission and the sprocket at the rear wheel. The overall drive ratio varies from 18:1 in low to 6:1. The Topper also is powered by the 10-cubic-inch, two-cycle engine and delivers up to 100 miles per gallon. In the dual suspension system, the front wheel is suspended on a leading-link swinging arm. Rear suspension is by a pivoted rear fork, controlled by two adjustable extension springs. Among other features of the Topper is a parking brake lock located on the hand lever. Other vehicles in the line are Duo-Glides, Sportsters and Servi-Cars.

Harley-Davidson Motor Co., Milwaukee 1, Wisconsin

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Air-Control System
Could Track All Planes

Every airplane flying above the United States could be tracked—and thus warned of an impending mid-air collision or crash—by a new system devised by engineers of Lockheed Aircraft Corporation. It calls for installations in aircraft and on the ground. Each airplane would carry a small five-pound radio transmitter that would automatically and continuously send out, in all directions, coded pulses of altitude, identity and location information. On the ground, four receivers located in sectors which would be roughly 70 by 100-mile rectangles would pick up the signals and transmit them by microwave relay to a control center for that sector. The data—part of which is developed as the result of the receivers being located at widely separated points in the sectors—would be interpreted and then automatically and electronically displayed (radar displays similar information on screens).

Lockheed engineers say their system is comprehensive and fast. The controller can track more than 1000 aircraft in his sector, including those too small to be shown on radar screens today. Reports on position are obtained 10 times a second, and on altitude and identity 35 times a minute. A supersonic transport flying 3000 miles an hour, for example, would be positioned every 500 feet. Every aircraft equipped with a transmitter could be tracked at altitudes from 1200 to 100,000 feet. The system could also be used for intensive coverage down to almost zero altitudes on approaches to an air terminal. Transmitters would cost about $200 each for private planes, $500 for commercial and military aircraft. The system’s developers say about 250 sectors would be enough to cover all major U.S. airways and that 700 would cover 48 states and provide high density coverage around major air terminals.

Launching Platforms to Moon
May Be Built by Robots

Launching platforms for moon and planet expeditions may be built by robot men with television eyes and remote-controlled hands. Dr. Fred L. Whipple, of the Smithsonian Institution, says that such a robot would copy the motions of an operator. Its fingers would have feedback pressure so that the operator could feel objects being touched. Men in space suits will find it too dangerous to build the space platforms, according to Whipple.
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FEBRUARY 1960
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Key-Chain Flashlight Weighs Less Than An Ounce

Weighing less than one ounce, a tiny flashlight that requires recharging once a month can be carried with you on a key chain. A small battery inside the flashlight is recharged by placing the light in an accompanying recharge box overnight. Shaped like a globe, the flashlight has an on-off switch that is connected to a chain and key ring.

"Hot" Waste Baked Into Bricks

Dangerous radioactive contamination around nuclear waste-disposal sites can be prevented by baking the "hot" residues into glasslike bricks. Scientists in the United States, Canada and Russia have reported good progress in perfecting the waste-disposal process.

Typical of the findings are those of Dr. James R. Oliver, chemistry professor at Southwestern Louisiana Institute. He said that he had mixed simulated reactor wastes containing cesium-137 and strontium-85 with sodium silicate or aluminosilicate powder and fused the mixtures into bricks. Samples containing nine percent or less of waste fused with aluminosilicate were unleachable even with water at 190 degrees F. The process in which the dried, neutralized waste was mixed with powdered aluminosilicate and fused yielded the least leachable sample in the shortest time and at the lowest temperature. Mixing a neutralized solution of aluminum-containing waste with sodium silicate solution, then drying and fusing the mixture gave the easiest process to handle, but produced fused samples with slight surface activity which would have to be washed before storage.

Dr. Oliver said that the process still requires some long-term studies, though one sample containing 14.2 percent waste showed no leaching even after being subjected to water at room temperature for three months.
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FEBRUARY 1960
Incandescent Lamp Passes Through Needle

Small enough to pass through the eye of a darning needle, a new incandescent lamp has a filament less than one-tenth the diameter of a human hair, yet glows brightly enough to be seen in a well-lighted room. The body length of the microminiature Sylvania lamp is .125 inch; its diameter .040 inch. More being produced in quantity, the lamp is expected to find application in transistorized circuits in missiles, computers and electronic systems. Requiring low current and voltage, it can be operated directly from the output of a transistor.

Insects Build Resistance To Modern Insecticides

Insects appear to be winning the battle to keep them in check, despite the $500 million spent each year on their control. Resistance to insecticides is now virtually nationwide and only two states, Montana and Wyoming, are free of insecticide-resistant insects, according to Fairfield Chemical Division of Food Machinery and Chemical Corporation. Some chemicals introduced as recently as three years ago are already less effective in many parts of the country, the firm reports. Resistance can take many forms. Some are: slow rate of absorption which prevents the insect from getting a lethal dose of insecticide; enzymatic changes that render the insecticide harmless; storage of the insecticide in non-sensitive parts of the insect’s body; or avoidance of the insecticide by change of normal habitat by the insects.
LIKE many another young American, Edward Walls was doing all right, in a moderate way, when the uranium bug bit him a couple of years ago. And thereby hangs a mighty interesting tale.

Ed was a barber and hairdresser by trade. He operated a small shop in a Colorado city—and in his shop he heard glowing reports of overnight fortunes being made in uranium, the wonder-metal of the Atomic Age. "If others can get rich fast in the uranium game, so can I," he thought. The more he pondered, the more alluring the Big Idea—uranium—seemed.

So he sold his little shop, packed up his belongings and, with his young family in tow, struck out for Utah—the new Golconda! Or, so he imagined it to be.

A few months later, his disillusionment was complete. He hadn't made his quick million. He hadn't even made an impressive start. Despite his hard work at a precarious job with a firm engaged in uranium reduction, the cold fact was that he was broke—and likely to stay broke.

Refused to Stay Beaten

But Ed Walls isn't the type of man who "chickens out" of life's problems. Discouragement had him down, but he was far from out!

His thoughts kept turning to an old friend of his, back in Colorado, who had bought a Rug Deterger machine some time before from the Von Schrader Manufacturing Company, 210 "R" PL., Racine, Wisconsin, long-established maker of high-quality rug-cleaning machines and equipment. This friend had grown tired of working for somebody else, and had set himself up—with no previous experience and with only a small financial stake—as an independent businessman.

"And," mused Ed, "he is doing all right for himself. He is no smarter than I am. Why can't I do the same thing? All over town there are homes with rugs just itching to be cleaned!"

So enthused did he become over this idea that he telephoned the company to arrange for the purchase of a machine and supplies, and to discuss ways and means of making the most of his opportunities for money-making in the rug-cleaning business.

Small Loan Aids Fresh Start

Once his mind was made up Walls' next job was to borrow the small amount of money he needed to get started. "I found out that it's tough to borrow even a little dough when you're broke," he said. But, somehow, he did get the money and, with it, the machine.

"Believe it or not," Ed says, enthusiastically, "two weeks after I got my equipment and started using it, I was able to pay back the money I had borrowed—interest and all! And I was really amazed how easy it was to get work to do. One satisfied customer would tell a friend, and that friend would tell another friend. You'd think every rug in town needed cleaning—and that wouldn't be far wrong."

Ed has grossed as much as $548 in a single week since he started his own business. Some months he takes in up to $1400. Needless to say, the Walls family isn't going hungry these days.

Plans Larger Success

At latest report, Ed Walls is setting up a training program for young men in his town. He plans to add new machines to his equipment as fast as he can train these young men to operate them and represent him throughout the area.

"A year or two from now," he says, "I hope to have a real success story to tell. Things are better for me than they have ever been. My dreams of making a fast million in uranium never materialized—and actually I'm glad, for they forced me back to earth, where I can deal with real people and give them a real service that I'm proud of. And I'm happier that way, in addition to making a very, very good living out of my very own business."

Clubs, Banks, Hotels and Institutions of various kinds are regularly serviced by Mr. Walls.

Mr. Walls is shown here cleaning the carpets in the home of one of his many wealthy customers.
Exhaust Heat of Rocket Becomes Electric Power

Direct conversion of the heat of a rocket exhaust into electric power to run the vehicle's steering controls is the job of a new electronic generator which has no moving parts. The device, a developmental RCA tube of the type known as a thermionic generator, has already produced up to 270 watts of power directly from a high-temperature heat source—a Thielkol solid-fuel rocket motor. This is an output of nearly 80 watts per pound of its 3½-pound total weight. The generator could power the steering mechanism of the rocket as well as the guidance, telemetering and related electronic equipment throughout the operating life of the rocket motor.

The present experimental RCA tube has the form of a hollow cylinder that slips like a sleeve over the rocket-flame tube through which the burning fuel passes. A cathode is formed by the inner wall of the hollow cylinder, while a second electrode is formed by the outer wall. Between the walls is a narrow space filled with cesium vapor. When the cathode wall is heated, electrons "boil" out of the cathode material into the space between the walls. The cesium vapor becomes ionized upon contact with the hot cathode, and encourages the easy flow of electrons to the outer wall. The electric power that is generated is fed to the rocket steering apparatus by cables attached to the cathode and second electrode.

Irradiated Bones Preserved for Grafts

Radiation-sterilized bone from deceased persons is now being preserved in the first atomic age bone bank in western United States. The bone is kept in a freezer at the University of California at Los Angeles until needed to help repair the bones of the living.

Only relatively small pieces of bone are taken. Specimens are quick-frozen and air-expressed in dry ice to the Massachusetts Institute of Technology where they're irradiated under a three-million-volt Van de Graaf cathode-ray generator. This process sterilizes bone pieces without damaging their ability to function as grafts. Next, the bones are returned to UCLA and stored at subfreezing temperatures for a maximum of six months. Grafts of preserved bone promote union in fractures that have not healed, fill cavities in bones from which cysts and tumors have been removed, bridge and fuse weak joints and support the bones of children who have been born with deformities.
New PROFIT-PROVEN* Home-Business!

"I make $400.00 a week!"

MAKE BIG MONEY, TOO—printing without a printing press! Learn the secrets of this new MIRACLE PRINTING METHOD... build a Big-Pay Business, SPARE or FULL-TIME, right in your own home. Never before has there been an uncluttered golden opportunity to turn pennies into dollars in profit!—to build a successful, prosperous future easily, quickly, and enjoyably—AT HOME.

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SCREEN PRINTING IS FUN... EASY! If you like to work with your hands and make beautiful things, you'll find Home Business that provides greater enjoyment, relaxation, and PROFIT! You'll enjoy every moment... creating beautiful printed materials that may sell for BIG MONEY!

NO EXPERIENCE OR COSTLY EQUIPMENT NEEDED! Home Business offers you such BIG PROFITS for so little time, money, or training! You don't need art ability, expensive equipment, or previous experience! You start home with little or NO INVESTMENT... yet you can print—almost immediately—on PAPER, GLASS, LEATHER, CLOTH—ANYTHING! With a little work, even the vibrant new FLUORESCENT "Glitz Colors" that are in such big demand in advertising circles! It's amazing—but true.

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Plastic Container
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Time-consuming searches for business cards can be ended with a desktop file that alphabetically arranges as many as 500 cards. Cards slip into slots in the circular plastic holder and can be filed either by name or service rendered. When the card is needed, a selector knob is turned to the proper letter. A pull on the knob lifts the cards for easy access.

Carbon Dioxide Recovers More Oil

Carbon dioxide and carbonated water are superior tools in the secondary recovery of oil, according to L. W. Holm of the Pure Oil Company. An experimental investigation on oil-recovery efficiency of carbon dioxide has demonstrated this fact, he says. The use of relatively small quantities of carbon dioxide followed by carbonated water at pressures above 900 pounds per square inch resulted in oil recoveries that were from 50 to 150 percent greater than those obtained by conventional methods of operation.

Chromite Catalysts
May Reduce Smog

Smog components have been reduced by using chromite catalysts at the Franklin Institute Laboratories. Nitrogen oxides, one of two main components of smog produced by automobile exhaust, have been reduced by more than 90 percent by countering the oxides with chromites and carbon monoxide. Under certain conditions, hydrocarbons, the second smog component, have been reduced by the same chromites. One present drawback to using the method to fight smog, says the Institute, is whether chromites can withstand lead poisoning in the exhaust, which would reduce their effectiveness.

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HERE'S A READY-MADE FUTURE FOR YOU

MILLIONS OF HOMES IN U.S. HAVE 6-12 SMALL APPLIANCES
8 MILLIONS MORE SOLD EVERY YEAR - MILLIONS NEED REPAIR NOW
WITH THE NEED INCREASING DAILY!

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"Make $15.00 Saturdays and
more. Am only able to operate
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a mechanically minded man

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FEBRUARY 1960
First Terrain Map of Moon
To Help Select Landing Sites

Depicting 60 percent of the lunar surface, the first terrain map of the moon will be used to select eventual landing sites. The current map study by the United States Geological Survey describes such surface features as slopes, texture and the likelihood of underground openings and caverns. The map is to be completed by October, 1960. The first Russian photos of the other side of the moon lacked sufficient detail to be useful in the mapping project.

Helicopter Speedometer
Uses Sound Plus Radar

Pilots of helicopters now may learn how fast they are moving, even when their aircraft is hovering or moving at slow speeds. Turbulence from rotor blades—which sometimes throws air-speed indicators into error—does not affect a new system developed by Midwest Research Institute. The new system uses an acoustic wave projected from the helicopter and an electromagnetic wave (radar) which is also sent out and bounced off the sound wave. The frequency of the electromagnetic energy returned from the collision is interpreted by an instrument system to give the pilot an instantaneous reading of his air speed.

Leak Detector for Electronic Gear

Extremely small leaks in vacuum tubes, transistors and missile devices can be detected with a redesigned mass spectrometer leak detector. The detector has a filament that can be replaced in five minutes, compared to 30 minutes to an hour for previous models. Developed by International General Electric, the detector locates microscopic leaks through which less than one cubic inch of air would pass in 5000 years. Leaks are located by applying helium tracer gas to one side while the detector draws a sample of air from the other. If helium is present in the gas drawn out, an alarm is given.

Orange Blossom Perfume?
That’s a House You Smell!

If your house has the odor of citrus fruit the next time it’s painted, don’t be surprised. The Florida Citrus Mutual, in a unique paint-making experiment, is using citrus peel oil in place of conventional paint thinners. Twenty-five bushels of fruit make a gallon of peel oil and one gallon of peel oil makes $1\frac{1}{2}$ gallons of paint. Mutual made up 150 gallons of the paint as an experiment. The paint smells like citrus blossoms only until it dries, which takes 24 hours. After that it's odorless.
THE OPPORTUNITY TO MAKE YOUR OWN SECURITY!

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With the increasing number of construction projects under way throughout the country—highways, dams, airports, bridges, factories; the need for trained men is also increasing and will continue to increase as newly planned projects get underway.

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TRAIN NOW to fill the demand for qualified heavy equipment operators . . . specialize in the construction field.

LEARN to operate the heavies: tractors, scrapers, graders, carryalls, bulldozers. Learn field maintenance on modern equipment.

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Sample Case packed with 1000 sample-
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Becomes wearing our suits and shirt
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experience is needed. SATISFACTION GUARANTEED.
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Make Big Money! With our easily operated, highly efficient wall washer, Charles Stelle took in $217 in first ten days. E. L. Goss took in more than $10,000 in one year. G. H. Jones wrote, "I made a net profit of $1200 on one job." And no wonder — this machine washes walls 6 times faster and better than by hand and with no mess — no drop cloths needed.

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One device is a microwave diode switch capable of switching 700 million bits of information a second. It uses hollow pipes as conductors instead of conventional wires.

Another device is a microwave amplifier tube which can perform logic operations at the rate of one billion times a second. It employs a radio wave traveling down an electron beam to cause one microwave signal to control another microwave signal.

Isaacs predicts the earliest use of these devices will be in systems simpler than computers. "An immediate possibility," he says, "is development of a communications system in which a message, say of 30 words, such as a telegram, could be transmitted in a millionth of a second. This kind of system could transmit the message on a single radar impulse." He says they also could be used to reduce large amounts of data to more easily handled amounts in nuclear physics experiments where billions of events occur in a small space of time. The system would count and correlate these events.

Raw Rubber Mill Extrudes End Products

Hoses, tire treads and other rubber products can be formed continuously by an automatic machine that tears up raw rubber, blends it with chemicals and fillers and forces it through a slot. A simple machine capable of mixing a wide variety of rubber compositions on a continuous basis, the Rotomill is believed to be the first practical device for doing this type of job. The machine is a tapered, corrugated rotor that revolves inside a tapered, smooth shell. A short extruder screw and a "die" can be at the output end. These permit simultaneous mixing and extruding. Feeding of the rubber and the many additional ingredients that go into modern elastic compositions can be done automatically. The rotor mixes them and the screw forcibly extrudes the product through the die, which shapes the desired end product.

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If you want to have your own business — to start a business on your own — here's your big opportunity.

High speed, low cost General block machine produces up to 1,000 concrete blocks a day. Sell all you make to builders, supply houses, and others for homes, factories, buildings, garages. Cash in on the building boom! You can make profits at 100% to 150% — up to $75 a day! General block machine equipped with 1/2 hp. electric motor — or can be supplied with gasoline engine — works anywhere, in little space, indoors or out. Operates from ordinary house light socket. Simple, foolproof 2 step operation — in every child can do it. Makes superior 3 core blocks any size from 4" to 12". Also makes chimney, wall, corner and other types. Blocks meet all building code anywhere in the country. Materials — sand, water, cement, available anywhere. Simple illustrated operating instructions and mixing formulas for cement and sand blocks supplied with each machine. Write for free folder with full information. Free illustrated book gives floor plans for 3 sensational concrete block bungalows. Tells how to lay blocks, lay out building lines, mix concrete, build steps, porch and concrete floor all at great savings. Written by experts. Can save many times the cost of the machine! Get it now! No strings attached. Send 1.00.

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These men are getting practical training in NEW Shop-Labs of

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Motors—Generators—Switchboards—Controls—Modern Appliances—Automatic Electronic Control Units

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Glass Motors Power Rockets

Vanguard III’s third stage was made of glass fibers bound with a plastic substance. The 50-pound glass rocket motor burned 10 seconds longer than previous stages and went into orbit with the 50-pound payload, according to the National Aeronautics and Space Administration (NASA). A similar glass rocket motor will form the third stage of the NASA’s Thor-Delta rocket.

Phone Line Thwarts “Bugging”

Foil “petticoats” around a telephone line will stop eavesdropping by persons using either induction-type or direct line-tap equipment. The foil sheets are connected to a highly sensitive relay which is activated when the electric current changes in the cable as little as two one-millionths of an ampere. The cable sounds an alarm to tip off the users that someone is tampering with the wire, and a noise generator “talks” into the cable, making such an unfilterable howl that it is impossible to listen in with induction equipment.

Wall of Trees to Hush Jets

People living near Dulles International Airport at Chantilly, Va., in a few years should not be bothered by the roar of jet engines. A barrier of trees was left standing around the airport when the site was excavated in 1958. This spring the Federal Aviation Agency will have 175,000 seedlings planted and hopes eventually to have a muffling ring of trees 1000 feet deep surrounding the 9800-acre airport.
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February 1960
49
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MS-147

FEBRUARY 1960 51
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FEBRUARY 1960

59
Atomic Waste Creates Problem

Disposing of radioactive wastes may become a great obstacle to the whole nuclear power program of the United States, warns Francis R. Bruce of the Oak Ridge National Laboratory. Bruce estimates that by 1970 the U. S. nuclear power industry will have produced 7,300,000 gallons of radioactive solution containing about three billion curies of radioactivity. By the year 2000, these figures will have risen to 300 million gallons of liquid with 60 billion curies of radioactivity. Mr. Bruce also calculates that in the year 2000, only 12 percent of all fission products obtained in atomic power stations will have found a practical or scientific application, while 88 percent will have gone into the waste disposal system.

Earth’s Interior Is Cooler Than Formerly Believed

Temperatures inside the earth are probably somewhat lower than they were believed to be a few years ago, according to a University of California geologist. Dr. John Verhoogen reports that present observations indicate the bottom of the earth’s crust to be about 900 degrees F., and the outer boundary of the core to be approximately 3600 degrees.
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Guided missiles may be used to carry such items as thousands of pounds of medical supplies on mercy flights to any spot in the world within the next 10 years, says Robert P. Haviland, satellite engineer for the General Electric Company. He says improved guidance systems will enable a reentry vehicle to "ride-in" on radio beams sent out by commercial or airport radio transmitters and land at a predetermined point. Problems connected with guiding military missile weapons will not apply to mercy missiles, for the people at the receiving end will be making every effort to provide a loud and clear signal to bring the vehicle in. Haviland says supply rockets will be used primarily in emergencies, where economy and efficiency are relatively unimportant.

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FEBRUARY 1960
Why Don’t You Invent It?

By Paul Brock

You must have heard this phrase scores of times:

“Why on earth don’t they think up some gadget that will...?” The plaintive question is completed in a hundred different ways.

It is uttered usually at times when the inefficiency of some trivial article becomes particularly annoying.

“Why don’t they...?” It’s always the same cry. Well why don’t you think up a gadget before they do? Good ideas bring high prices in any market, and we all get bright ideas at one time or another. The trouble is that we seldom recognize ideas when they come along. We fail to give them a second thought and the germ of what could be a fortune-making idea dies.

Many years ago an Irishman named O’Sullivan was working at a bench in a factory. The vibration from the machines upset his stomach, so he brought a rubber mat to work. He found that by standing on it the shaking was eliminated.

Two days later the mat disappeared, removed by some light-fingered gentleman who approved of O’Sullivan’s idea. So the Irishman bought himself another mat, which also disappeared. Finally, O’Sullivan bought a third mat, but this time he cut out two pieces of rubber and nailed them to the heels of his boots.

The idea worked, and the unpleasant effects of the vibration virtually were banished. O’Sullivan had the good sense to realize the value of his inspiration, and so it was that rubber heels came on the market and netted a fortune for their inventor.

Simple ideas like O’Sullivan’s are within the scope of all of us, but so often we just have our gripe and leave it at that. A good idea is marketable, even if you haven’t the money to launch a commercial venture of your own.

It is foolish to be stopped because you are not an electronics specialist or a nuclear scientist, for frequently the expert is blinded by his own knowledge. His point of view is so cramped by technicalities that he would never dream of experimenting along novel lines. The outsider, unhampered by technical knowledge, can make a success of an idea that the expert would reject as impractical.

Elias Howe, son of an American farmer, conceived the idea that resulted in the lockstitch sewing machine. Nobody thought of

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tells how we'll put the atom to work peacefully in digging harbors and generating power from underground explosions
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POPULAR MECHANICS
Future Space Vehicles May Sport “Bumpers”

Future space vehicles may have bumpers for protection against meteors. Dr. Fred L. Whipple of the Smithsonian Institution suggests placing a “skin” layer one-tenth the thickness of the original metal a few centimeters from the “outside skin” of the space craft. Striking the outer skin, the meteor would explode there and only gas vapor would strike the heart of the craft. The vapor would not cause punctures, according to Dr. Whipple.

Electrical Current “Sews” Wound

Bleeding wounds that are difficult to seal off can be “sewn” closed by a small direct electrical current. Three surgeons from the State University of New York tested the technique on blood vessels, spleen and liver incisions on animals. Currents from 2 to 100 milliamperes were used on hemorrhaging tissues, effectively controlling the bleeding.

Gas-Charged Steam Kills Soil Organisms

Steam, charged with gas at a temperature of 140 degrees F., can be used to kill plant-disease organisms in the soil. The new treatment, developed by Dr. Kenneth F. Baker of the University of California, does not destroy harmless organisms. Previous methods, involving 212-degree temperatures, killed all organisms, rendering the soil sterile.

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POPULAR MECHANICS
Two Easily Melted Elements Make High-Temperature Parts

Gallium and phosphorus—two chemical elements whose outstanding quality is that they melt at low temperatures—have been fused into a highly heat-resistant material which the Army Signal Corps says may be ideal for the electronic parts of missile nose cones. The nose cones are subject to blast-furnace temperatures when returning from outer space.

Resembling yellow ground glass, the material, gallium phosphide, will withstand temperatures up to 1500 degrees F. From it, the Signal Corps has built an electronic diode—a transistorlike version of the radio tube diode that detects radio signals—which has withstood temperatures seven times higher than silicon and germanium, previously used in electronic diodes.

“The material may also be used in building solar-cell power plants for space stations,” says Brig. Gen. J. C. Monahan, Chief of the Corps’ Research and Development Division. “As a rugged core of tiny electrical devices, it may be used in making electronic parts for missiles, satellites and space probes of the future.”

Gallium, a rare silvery metal that costs about $1500 a pound in pure form, will melt when held in the hand; phosphorus, used in matches, melts in summer sunlight.

Doses of Sulfate Counteract Strontium

Poisonous strontium in radioactive fallout from atomic bombs can be counteracted by doses of sulfates, if man responds as dogs do in experiments at Johns Hopkins Medical School. Research reported by Drs. MacKenzie Walser, John W. Payne and Ann A. Browder shows that sulfates cause animals injected with strontium to excrete 5 to 20 times as much radioactive strontium as they normally would. The sulfate infusions might be used therapeutically in the case of a laboratory accident or massive amounts of strontium in radioactive ash such as befell Japanese fishermen a few years ago, but they would not be useful in the gradual piling up of strontium in bones in normal fallout.

QUOTE:

“In my judgment the missile, because of the need for a dependable but still mobile base of operation, and the large space vehicle, because of its requirement for a powerful engine, and for a source of enduring power for transmission of data to earth, will find in the atom a solution for their now forbidding problems.”

—JOHN A. McCONE, Chairman
Atomic Energy Commission
Floor and wax wisdom

Hats stored and protected in hanging closet shelf

Unit controls for home-movie projection

Western book ends for den or library

Spray adjustment won’t work when shower is blocked

Home plumbing repairs

Miscellaneous

Shut-off switch for power mower made from wooden block and cord

Photo speedlight charger powers battery toys

Bell-and-pocket hints for wandering pencils

Heavy asphalt building paper cut without grab on binding

Lightweight ice-fishing shelter

Photography

Knitting needle keeps tongs out of photo developer

Refinishing camera parts to original black finish

Copy-camera mount

Solving Home Problems

Sputtering of candles eliminated

Curtain knobs

Skeleton keys

Prevent floor mops from falling

Air your clothes

Upright piano kept from sliding on floor

Cutting tile

Loose needles and pins easy to locate

Empty milk cartons make handy frozen-food containers

Shopping for Tools

Hand-operated shear

Spherical caster

Tree-planting machine

Electrically driven chain saw

Angle indicator

Locking pliers

Machine-tool clamping set

Composite plastic screw

Integral metal form

Hollow-ground blade

Sander-polisher

Stone-cutting saw

Penetrate concrete

Magnifying viewer

Flame-cutting

WorkshopHints

Small parts storage cabinet

Clothespin used to start screws in hard-to-reach places

String helps mount heating coil

Storage jars hang on L-hooks

Socket-head screws driven with nail clipper

Oil burner chamber relieved

Small stock clamped on holder can’t spin when drilled

Use paste wax on rubbing job

Wooden block resets snap ring

Double-decker nail tray

Cutting accurate miters

Battery clip improves extension cord

Sitting with a sharp chisel makes clean cut in hardboard

Dowel held for end-drilling with improvised v-block

Dowel joints

Restore chuck-jaw faces with cylindrical lap

Precut disk-cement tube for convenient application

Drill regrind for wood working

Extension on siphon hose guide table for ease of feeding

Counterbalanced safety sticks

Increase capacity of your lathe with these chuck-jaw extensions

NOTICE—It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts to help them make wise decisions in their work. However, the magazine cannot be held responsible for the accuracy of the information presented, and readers are encouraged to verify any information before relying on it.

POPULAR MECHANICS
Unbreakable Canteen

For the outdoor sportsman or worker, an unbreakable plastic canteen maintains the temperature of hot or cold liquids for six or more hours. The canteen holds a full gallon, and will not corrode or cause water to have taste or odor. A water-repellent fabric cover has a pocket for paper cups.

Will Man Create Life?

Man may be able to create living cells in a test tube within the next 1000 years, according to an authority on evolution, Dr. Hans Gaffron of the University of Chicago. He says the Darwin theory that living things evolved from less complex ancestors also supposes that there must have been a first primitive living cell or group of cells, and that laboratory experiments have indicated how lifeless compounds on earth evolved into those living cells. Dr. Gaffron estimates it took three billion years to make this change in nature and predicts that within 1000 years scientists may duplicate its four major stages in the laboratory. Those stages that occurred in nature were:

1. A layer of water vapor-methane-hydrogen-ammonia covering the earth provided for the accumulation of important organic compounds.
2. Oxygen began to replace hydrogen in the earth's atmosphere.
3. Organisms capable of living in an oxygenless atmosphere gave way to cells deriving their energy from visible light.
4. Green plants which produce oxygen became dominant.

Big Ones won't get away
WITH FISH-SAVING LEVEL-WIND AND MICRO-DRAG

"This one didn't," says Marlux DeJong. "My push-button outfit stopped him cold on Campbell lake in Michigan."

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FEBRUARY 1960
making an eye in the point of a needle. It was all wrong, unnatural and absurd. But it worked.

Ideas do not usually arrive ready-made and cut to fit. The mind must be alert and prepared to fasten upon the inspiration of the moment.

In the days when a woman was proud if she could sit on her combed-out hair, a husband sat watching his wife at work with a fresh packet of hairpins. His curiosity was aroused because she had to put a little kink into each prong before inserting the pin.

Idly he asked why.

"To keep the things from slipping out," he was told.

The husband immediately came up with the idea of a hairpin with kinks in it, and some time later he marketed a hairpin with three or four kinks in each prong. Result: a fortune, yet one could hardly say that he was an inventive genius.

There are three steps in obtaining ideas and making them profitable: observation, appreciation and commercialization. Observation is easy. We see inefficiency many times a day—paper clips that tear paper, buttons that have been sewn on a dozen times and still come off, mirrors that get covered with steam so that a man has to hold his breath while shaving.

It is in the matter of appreciation, of learning from our observation, that most of us come to a full stop. We seldom think about such matters long enough to understand the problem involved.

Edison once declared:

"You have only to state a problem accurately and you have, in general, stated the solution."

Let's take the safety pin as an example. This little item made a huge fortune for the man who put it on the market. The inventor was faced with the problem of finding a pin that was safe. To make a safe pin the point had to be covered in a sheath. Obviously, the sheath could not be a separate item, and it was essential that it maintain its position over the point.

So the inventor attached the sheath to the other end of the point, and bent that end around until it reached the point. One extra coil at the bend provided the necessary resilience to hold the sheath in place.

A first-class idea, if developed the right way, can prove more profitable than complicated invention. The farmer who invented barbed wire became a millionaire in no time at all.

An idea doesn't even need to be inventive in order to be salable. In the days before safety matches were invented, matchboxes had a strip of sandpaper fixed on either side of them. A man, about to throw away an empty box, noticed that one striking side was as good as new. He made inquiries regarding the cost of sandpaper in the match trade, and then decided to sell his idea.

When he managed to get an interview with a top executive, he said his idea would save the firm some quarter of a million dollars a year. But he would sell it only if guaranteed $15,000 a year for life.

It simply had not occurred to company experts to put sandpaper on only one side of each matchbox. The idea was adopted and the author received his salary.

The third step in making money from ideas is through commercialization. Here you must be wary. It is foolish to indulge in wildcat schemes that may involve financial loss. If you cannot afford to promote your own idea, then sell it outright on a royalty basis.

When you have an invention, procure a patent and avoid the grim experience of seeing somebody else reap a fortune from your idea. An invention patent gives the inventor the privilege, for a limited time, to exclude others from making, using or selling his article. However, he cannot have patent rights if his idea is merely an improvement on some unexpired patent.

Patents are not granted for methods of doing business or for claims contrary to natural law. Hundreds of applications have been received for a perpetual motion machine, but until a working model is presented that actually fulfills the claim, no patent will be issued.

But it is the inspiration that is of primary importance. Hundreds of ideas must have been lost for want of a few minutes' thought.

So the next time you hear somebody say, "Why on earth don't they think up a gadget...?" just turn the matter over in your own mind. There could be a fortune in it for you.

---

**Noiseless Air Conditioner For Nuclear Subs**

All new nuclear submarines will be equipped with noiseless air-conditioning equipment which uses liquid lithium bromide to absorb heat and cool the air. The atomic sub Thresher, now under construction, will be the first craft to have the new air conditioner. The unit, which has a 140-ton capacity, will be used along with conventional cooling equipment. A 170-ton-capacity unit will also be installed in the Ethan Allen class of fleet ballistic-missile atomic subs.
Things really jump when you start with a Delco Dry Charge battery. It's got reliable power plus stamina. You need both—for today's high compression cars, loaded with accessories, demand an awful lot from a battery. In fact, the electrical load has tripled in the past 10 years! That's why you're wise to replace with Delco DC-12, the battery that's designed for modern car requirements. More new cars come factory equipped with this power-packed Delco. It's a dry charge battery, too—your assurance of

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POPULAR MECHANICS
The information in this article may save your home — or your life.

What to Do Until The Firemen Come

By Paul W. Kearney

At about 11 o'clock one night last June, a man in California discovered a small fire burning in a closet of the bedroom where his five children were sleeping. While his wife routed the kids, he rushed outside for the garden hose. Pulling it through the window, he knocked down the blaze, put the children back to bed and closed the door.

Several hours later the house began to feel so warm that the father got up to investigate. Opening the door to the children's room, he was driven back by a blast of flame. He

Call the firemen as soon as a blaze is discovered
—then try to put it out while they're on the way
Many shapes and sizes of CO₂ extinguishers are available; carbon dioxide is good for fighting blazing fat and electrical fires. Homes with municipal water supply can be protected by a special fire-hose station.

could neither enter the room nor get near the window on the outside. By the time firemen were summoned, all five children had been cremated in the ruins.

This tragic episode is an eloquent demonstration of an age-old fact familiar to trained firefighters: putting out a fire is only half the job; keeping it out is the important second phase. Under the trade name, “overhaul,” this dreary chore takes more time and labor than extinguishing the flames in the first place.

While it is not the intent of this article to make firefighters out of civilians in one installment, some elementary advice about self defense for the householder seems warranted by our morbid record of over 1500 dwelling fires a day in this country. The action of that California father was perfect so far as it went, but he lost five children and a home because it wasn’t far enough.

His initial mistake was in failing to call the fire department first — or having his wife do it while he worked on the outbreak. This is the most universal error in “do-it-yourself” firefighting. No matter how much you know, you’re a sucker not to call for reinforcements just in case you’ve bitten off more than you can chew. Firemen don’t mind a dry run nearly as much as one where it’s too late to do anything.

Wire-connected sensory and alarm panel in bedroom gives fire warning audible through house. Installation of detector unit is done with screws. Wire leading to central panel (left) is stapled into place.
The Californian's second mistake was in quitting too soon. True, he used the best "extinguisher" there is for that type of fire—a garden hose. Official manuals recommend water above everything else for this so-called Class A outbreak in ordinary combustibles—the typical dwelling fire. Usually in abundant supply, water cools the burning fuel—brings its temperature below the ignition point—and quenches the fuel by seeping below the surface if you give it a chance. This man didn't give it a chance.

By way of contrast, a New Jersey insurance man came down for an early Sunday breakfast to find the overstuffed divan in his living room smoking furiously. Evidently one of the previous night's cigarette butts had fallen on the upholstery and burrowed in. He knew that if he ripped open the upholstery, he would stimulate the fire by admitting more oxygen. Yet if he threw water on it, used the garden hose, or even resorted to a chemical extinguisher, he would not get the required quenching effect because most of the water or chemical would bounce off instead of penetrating the smoldering mass.

So he did a smart thing. Hustling outside for a water can, he sprinkled the water slowly over the smoking area so it could soak in. As the water penetrated, he opened up the cushion and kept sprinkling. When he felt that he had caught up with the fire, he threw the remains of the offending cushion out in the yard.

This last is exactly what the ill-fated father should have done. Everything in that closet should have been "overhauled"—pulled out and examined. Every charred piece should have been opened and doused, then heaved outside. There would have been no "rekindle," the sin of firemanship.

Insurance companies have always advised calling the firemen, period, rather than calling the firemen first. "Insurance can replace your house but not your life," is their irrefutable logic. Yet there are probably few insurance men who themselves won't tangle with an outbreak in their own homes if they think they have a chance to...
Individual pressurized horns can be mounted anywhere in the house. Heat sets off loud blast of horn to stop it. And since this is the most human reaction in the world, some basic facts can help minimize the calculated risk.

The first secret of safe and effective home fire fighting is *early discovery*. You can line your halls with hose and put an extinguisher under every pillow. But if you're going to snore blissfully while a young outbreak is taking possession of the premises, you and the firemen are both licked.

There are a dozen or more inexpensive automatic fire alarms on the market which may—or may not—be better than nothing. But at least three unit-type automatic detectors, bearing the coveted Underwriters' Laboratories label, give reasonable assurance that you won't be caught napping. Some require no electrical connections, but are actuated by Freon gas which blows a loud, shrill horn when the temperature of the surrounding air reaches a hostile level. For about $100 you can have such an automatic watchman in your basement, upstairs hall, and attic — providing top-heavy odds that you'll discover your fire in ample time to do something effective without undue risk. Yet the sad fact is that the typical housewife would rather spend the money on a cedar-lined clothes closet to fight moths — which have never yet killed a child!

Given a reasonably prompt discovery, even a garden hose on a going blaze requires some technique. As indicated by the watering-can incident, it is important that the water soak into the fuel. In his effort to deliver the most water in the shortest time, the average householder usually adjusts the nozzle to give a straight, solid stream. But because of the force of this stream at close range, about 80 percent of the water splashes off the burning fuel and accomplishes nothing.

It is more effective to adjust the nozzle for a *coarse* spray, which will do two things to compensate for its shorter range: (1) It substantially reduces the run-off or splash, and (2) provides a "broken stream" of thousands of individual drops, exposing more water *surface* to the heat, hence, absorbing more heat.

This is a crude approximation of the advantages firemen obtain with fog nozzles — that sprinkler on a large scale. It kills more fire with less water.

Since most residential fires involve ordinary combustibles (even though many originate as grease or electrical fires), and since water is the best extinguishing agent for such Class A outbreaks, the smart householder will have enough hose and connections to reach any room in the house with a substantial stream of water. This means he should have an upstairs line and connection for an upstairs fire.

Two factors operate against this ideal. First, any given length of hose may be somewhere else when needed. Second, outside hose connections are shut off in the
New dry chemical extinguishers resemble anything from shotguns to bombs. This one, for gasoline, grease, oil and electrical fires, resembles a globular bomb with a pistol grip and trigger. The shell is disposable.

Winter. Since storing garden hose inside is awkward, the perfect solution is a fire-hose station for homes. Such units, now on the market, use ¾-inch linen hose, compactly stored in a steel wall cabinet and permanently attached to the regular house water supply. The fire line is equipped with a nondetachable nozzle which can be adjusted to the desired spray for close work, or to a solid stream for a longer range of 25 to 30 feet if necessary. Prices range from about $35 for a 30-foot length to around $52.50 for 75 feet.

While ideal for homes served by a municipal water supply, the country resident who pumps his own water should back up this protection with hand extinguishers. A fire of electrical origin may knock out the pump; wind or sleet storms often paralyze the public power supply. In either case, he is left with an unloaded gun.

Unfortunately, the choice of the "right" extinguisher for the home has been made complicated by the manufacturers of approved extinguishers who must cater to industrial needs—and far too simple by the high-pressure gyps with their

Pushing a button on this compact unit causes a dry chemical to be discharged onto a blaze, attacking the fire with a smothering action. The gauge on the side indicates the amount of pressure and quantity of chemical in the container.

(Continued on page 278)
Tire Has Replaceable Treads

Three separate tread bands that can be interchanged or replaced quickly without tools are featured on a revolutionary tire introduced by Pirelli of Milan, Italy. The treads fit over the tire casing, and as the tire is inflated, pressure secures them firmly. When one tread band is worn, it can either be interchanged to equalize wear or it can be replaced by a new band without the need of buying a new tire. Two types of bands, one for fine weather driving and the other for winter roads, can be alternated as the weather warrants. And the winter treads (above) can be supplemented with steel ice spikes, eliminating the need for chains. Each casing normally outlasts two sets of tread bands.

Adult View for Kiddies

It's no longer necessary for your child to become restless on trips because he can't see out of the front car window. A new portable seat brings the child up where he can see from both the front and rear seats. Weighing only four pounds, the seat is equipped with a safety belt and torsion bars to hold it in position. A cotton-backed vinyl cover makes it comfortable and easy to clean.

Underwater Metal Detector

Skin-diving prospectors or treasure hunters will find many uses for a new underwater metal detector developed by a California manufacturer. Fully transistorized, the detector locates iron, steel, brass, aluminum, copper, gold, and silver in fresh or salt water and through mud, sand, rock, concrete, wood, or other non-conductive materials. The detector can be carried ahead of the diver, who can swim, watch the dial, and make tuning adjustments without taking his hands from the grips. The clear-plastic disc is non-conductive and strong enough to stand rough handling or pressures down to a depth of 100 feet.

[Asahi, Tokyo newspaper, is reproducing its daily edition 600 miles away by transmitting full pages on facsimile machines.]
AN EYE ON SPACE

By Dr. Dan Q. Posin

PROFESSOR OF PHYSICS, DE PAUL UNIVERSITY
SCIENTIFIC CONSULTANT AND ADVISOR, COLUMBIA BROADCASTING SYSTEM

THE FLYING SAUCER stories refuse to stay down. Month after month, sightings are reported. And you may be sure that's the way it will always be.

Many people have seen hair-raising sights in the sky. I must admit that I am one of these. It happened at the university in Panama City, Panama. On a bright Earth-day at about 5 p.m., I stepped outside into the courtyard and suddenly noticed an object in the sky. It was round, silvery and silent. Then it was gone, lost on the horizon. I knew something about meteors and weather balloons. It did not seem to be either. This was more than 20 years ago, but the experience has stayed with me.

Are there flying saucers? The Earthlings wonder. "Have we been visited by beings from other worlds?" they ask. Could such mechanisms exist somewhere in the universe, swift, silent, streaming mechanisms, spanning great oceans of vacuum between planets, spanning vast oceans of vacuum between solar systems, guided by intelligent beings, daring, wondrous?

Actually, I do believe such mechanisms and such beings may exist!

The concern with flying saucers got started on the planet Earth in June, 1947, when an airplane pilot reported seeing nine dazzling saucer-shaped objects buzzing around Mount Rainier. After that a rash of saucer reports broke out over the entire country.

Not all reports could be laughed off easily by skeptical Earthlings. On Aug. 25, 1951, three professors at the Texas Technological College saw several groups of lights dash silently across the sky. One evening in 1949 in Las Cruces, N. M., Clyde Tommabugh, the Earth-man who discovered the planet Pluto, saw a "strange" solid "ship" whip across the sky. It appeared oval and "seemed to trail off at the rear into a shapeless luminescence." The object glowed a blue-green, and about six "windows" were visible at the front as well as at the side.

As saucer reports multiplied, they grew less reliable. One man reported finding the wreckage of a flying object with dead midgets about. Another told of conversing with visitors from outer space. A third claimed to have films of saucers.

What are flying saucers? Opinions among Earthlings vary. Aime Michel, an amateur scientist, believes some are from outer space. Dr. Donald Menzel, eminent astronomer, believes that all "objects" seen are reflections of lights, balloons, missiles or atmospheric effects. The flying saucers, many Earthlings believe, are not all missiles, atmospheric disturbances or meteors. But some are merely meteors. "And these, of course, are really out of this world," the Earthlings say. "They may even bring some tiny visitors with them—spores, slumbering bacteria—but no little green men."

Can flying saucers even be built? Yes. In fact, they are being built right now by the little men of earth. To travel in outer space, they have made huge rockets, and are designing space ships, space sailboats and gigantic cosmic butterflies to flit between planets.

Have any genuine saucers come to us from outer space? The answer our foremost scientists give is: "Probably not. But they can come and they might come—any day!"

(\(^{(\text{Dr. Posin is author of a new Popular Mechanics Press book, Out of This World.)}}\)
Remotely-Controlled Helicopter Fires Torpedo

Whirring up from decks of U.S. Navy destroyers, remotely-controlled helicopters called DSN-1 Drones can dart off to lairs of enemy submarines and release torpedoes which automatically seek out and destroy underwater targets. This combination of DSN-1 and destroyer forms the Navy's DASH (Destroyer Anti-Submarine Helicopter) weapon system. The helicopter's blades rotate in opposite directions.

"Hot Air" Engine

Scottish clergyman Robert Stirling invented the air engine in 1816, but it was soon dropped as inefficient. Now, in the laboratories of Allison Division of General Motors, engineers have used the same principle to build a reliable power source for space research vehicles. The Stirling-cycle engine works by driving a piston with the expansion and contraction of a gas when heated and cooled. The mechanics are much like a steam engine, with the expanded gas shunted out of the cylinder after the power stroke, then cooled and returned to be used again. Heat from any source can be used, and the closed-cycle engine can work in airless space, so its uses in satellites are obvious. It should run for two years unattended. At left, Allison research men H. H. Dice and T. F. Nagey inspect scale model of satellite using the engine.
Camp Cruiser
Built on Truck

Camping trailers and truck conversions didn't suit the needs of C. F. Johnson of Seattle, Wash., so he had an aluminum body built over a Willys Jeep four-wheel-drive truck chassis. The 18-foot rig has 11 1/2 feet of living space with butane stove and refrigerator-freezer, a full galley, and laminated plastic surfaces throughout for easy maintenance. Tanks in front carry a supply of water and 50 gallons of gas, with a spigot to draw off gas for the outboard motor. The motor rides upright in its own compartment. Up front, there's a bed for an eight-foot boat with a winch for loading and a power winch for pulling out of mudholes. There's even a special built-in riding shelf for the dog.

FEBRUARY 1960
THOUGH the little town of New Smyrna Beach, Fla., is far more famous for beaches and tourists than for cowhands, it's the birthplace of the equestrian world's newest and most unusual sport—palmetto polo.

And in the short space of seven years, this unique game has spread from the little Atlantic coastal community to the ranges of Texas, New Mexico, Colorado and Oklahoma, to California and the Pacific Northwest, and even aroused interest of the sedate horsemen of England.

Starting as a strictly local sport, it's developed regional and national interest, and since 1953 annual national championship competitions have been held, first in the sport's Florida birthplace, later in Texas, where the American Association of Sheriffs' Posse and riding clubs eagerly adopted the game, and in 1959 in Colorado Springs, Colo.

To a first-time viewer, palmetto polo can be a confusing sport, but obviously one that demands top-flight horsemanship, and the players are experts or they don't last in this game. It's fun for both the contestants and the spectators, and each club always has its own rootin' section, either perched on the field's fence—corral style—or lounging in western saddles. It's a horseman's game, first, last and always.

Basically the game was developed to enable riding clubs to have team rather than individual competitions, and to provide sport for horsemen who aren't in the "polo string" financial category. And today, it's just that—poor man's polo.

Its kinship to society polo is scant. Any group of riders can play at a minimum expense. The essentials are a field 40 by 80 yards, an inflatable rubber ball, and some polo sticks—which originally were carved from the stems of palmetto fronds, giving the game its Florida name. Today, however, the polo sticks have gone from the happy-go-lucky palmetto frond to the manufactured stage, but the game's name hangs on.

Where in regular polo the players speed the length and breadth of the field, in the palmetto sport each is limited to his particular zone, placing the emphasis upon quick starting, dextrous pivoting and complete coordination between horse and rider. The game consists of four 15-minute chukkers, and it'll tire any horse and rider just as much as the regulation game.

The playing field is divided into five...
zones—the middle one, 20 yards in depth, the others 15 yards deep. Not much room for long runs; a slow starter won’t make the grade as a palmetto polo pony. The players must maneuver to hit the ball without riding or reaching over their respective boundary lines.

Each team has five players. Occupying the largest zone is the center. The middle forward plays in the first 15-yard zone adjoining the center zone, opposed by the defensive middle guard, and nearest the goal is the forward, opposed by the defensive goalie. Each player maneuvers offensively and defensively as the situation requires.

Unlike regular polo, player and mount are substituted as a unit, and no rider may have more than one mount unless his horse is injured. This enables the one-horse owner to compete on equal terms with a horseman with a string of ponies.

Thoroughbreds are rare in palmetto polo, although when properly trained they can perform as well as other horses. Most of the mounts are quarter horses, noted for their speed over short distances and

Early referees worked on foot, but the job proved both tiring and dangerous. Now they ride, with a pickup net to retrieve the ball without dismounting.

Close action at a zone line—two riders chase the ball while a third waits across the line in his zone, ready to move in if the ball comes his way.
Game begins with a center charge as opposing centers race for the ball. Fast-starting horses pay off here.

Fast starting and stopping. This requirement makes the game suited to hard-riding cowboys whose horses wheel and pivot all day under normal working conditions.

The original field developed by the New Smyrna Beach Riding Club was slightly smaller than today's, measuring 25 yards wide and 60 yards long. But as the sport grew, the playing field expanded to the (Continued to page 262)

Jack Sapp demonstrates the old method of making palmetto polo sticks while Ed Eslinger watches. At right they compare the old and new sticks. Both are polo players and members of the New Smyrna Beach Riding Club.
Assembly Line Packs Herring

Thousands of herring an hour flow along the assembly line of cutting machines and canners aboard the Lamut, a packing ship built at Osaka, Japan for the Ship Import Corporation of the Soviet Union. The 4982-ton vessel is equipped with modern devices usually found only in shore-bound plants for the automatic processing of up to 120 tons of herring a day. One device shakes piles of herring from a table onto a conveyor belt in a neat row.

Aluminum Pipe Welded Quickly

Aluminum pipe can be welded automatically while passing through a new machine designed and developed by Aluminum Company of America. The high-speed unit completes a weld on four-inch pipe in 11 seconds, and it can weld pipes with diameters up to 11 inches. To insure complete filling of welds, the torch can be set to move automatically back and forth across the joint, and it can be raised for servicing.
LIKE THE BIG-car feel? Detroit thinks you do and builds cars accordingly.

As a result, even the new small compacts feel bigger than they are. To the people who tell the engineers what kind of a car you want (the product planners), this is an important selling advantage.

These planners, the town scyvers of Detroit, are convinced that to be successful a car must feel big—the bigger the better, in the good old American way.

Yet the revolution (the Big Turn that American Motors brags about) was started by small, nimble, frisky and certainly not-big-feeling imported cars. What made the public buy them? Certainly not any big-car feel.

It's more obvious daily that the new compacts don't compete with volume imports as much as with Rambler and Lark. Obviously, the Big Three chose not to fight the world champions in this round, but settled for the American champs. Maybe the next round will be for the world title?

As of now, however, it appears that the nimble, alert imports will continue to sell over here. Once pillimated by the aliveness of a good small car, an owner may hesitate to go back to the more stodgy big-car feel that Detroit worships. (Not to mention, of course, the $500 price differential and actual 30 miles to the gallon.)

Incidentally, the car to watch at American Motors is the American, not the bigger Rambler. It is leading the industry into the 100-inch-wheelbase field. Right now, it is heavier and bulkier than it should be (after all it is about 10 years old) and its engine is less efficient that it should be (it's even older), but things will change—soon.

Reports are that the overhead-valve six may become available in the American early this spring. There may even be a new American body in 1961, certainly by 1962. Here is the car that AM will use to call the “Even Bigger Turn” into the small-car field.

Like the rooster that thought its crowing brought up the sun, AM seems to be thinking that it brought the small cars into the world. There's no doubt, though, that AM is (and will continue to be) standing there crowing when the “sun” does come up.

The Big Three are all working on cars of under 100-inch wheelbases. Of course, none will admit it. It's the old “The public will never settle for anything less” routine.

Perhaps these upcoming smaller cars will be nimbler, more alert, more small-car-feeling than the present compacts. And surely more economical. But the product planners once again may get in the engineers' way and so the little cars will feel and look big.

Before these small cars come out, however, there will be a rash of bigger compacts. Cars like the Comet, from Lincoln-Mercury, will be brought out to satisfy the dealers' demands. Actually, the Comet was rushed out earlier than planned as a result of tremendous dealer pressure for something to compete with the new compacts. Lincoln-Mercury dealers suddenly discovered that their Ford brothers had all the gravy: The Falcon, Ford and T-Bird.

Consequently, the Comet is expected to come out different from the original plan and different from what it may shortly become. Engineering time ran out. As a result it may share the same engine as the Falcon without the expected increase in displacement. Original plans were to lengthen the stroke by a half inch for more power, but that will have to wait a year now. More time is also required to get a three-speed automatic transmission ready for production, something both the Falcon and the Comet could use.

The industry is pleased with how quickly you have accepted the facts of life about compact cars. It knew that wasn't going to give you what you expected and it was worried. But you have apparently adjusted to reality fast. The myths are dispelled.

First, there was initial price. Somehow you expected the compacts to sell for about $1500. It took a few weeks for the $2000-and-up shock to wear off. Second, there was the size and comfort. You expected small cars and they were not so small. You expected bumpy, austere cars and they were comfortable, more luxurious than you anticipated (this was a pleasant surprise). Third, (this will take longer but you'll get used to it) you expected more miles per gallon than these compacts give. The hoped-for 30 miles per gallon over-all was a dream. These cars are not miracle-makers—they get only the same amount of work out of a gallon of gas as a bigger car. Being a little lighter, a little smaller, they go a little farther on a given amount of gas. But they won't go twice as far, or three times as far, as some people seem to have expected. Such are the facts of life.
They’re Rolling Steel From Powder

By Sheldon A. Mix

In the long history of steelmaking, blast furnaces have been as necessary to a steel mill as a desk is to an executive’s office. Yet a process has now been developed that can make strip steel without the help of the 100-foot-high furnaces. It also bypasses other conventional steelmaking operations such as coke ovens, open hearths and blooming mills.

Developed in the research laboratories of Republic Steel Corporation, Independence, Ohio, the new process rolls out steel directly from powdered iron ore. While considerably more research needs to be done on the process, and Republic estimates that commercial production will not be realized for five or six years, the nation’s steel industry is keenly interested in Republic’s steel-from-powder experiment because it has already proved that it can produce a quality steel.

These are the steps in the new process: The iron ore is first put through a machine which removes the impurities by magnetically drawing off the iron. Then a powerful ball mill grinds the ore into powder, which is cleaned with hot hydrogen. The purification of the powder is vitally important, because with as little as one-half of one percent impurities, the strip steel produced from the powder would tear or crack.

In the next step, the highly purified metallic iron powder is funneled between four rolls that press it into a semi-solid strip. The strip passes through a furnace, where it is heated at 2200 degrees F. so it can be rolled, then slides through a series of three hot-strip rolling stands, where it is squeezed between rollers. (Most existing hot-strip mills have 12 stands.) Each of the stands has two working rolls. The stands reduce the product to full density and the desired thickness. The strip is at 75 percent density when it enters the first stand.

The hot-rolled steel emerges from the final stand and is coiled. Then the steel is
pickled, cold-rolled and annealed in the conventional ways before being re-coiled or cut into sheets.

To test the steel made from the new process, Republic has made stampings of it in a die-forming machine—one of the severest tests possible. The result was that the new strip steel completely resisted tearing and cracking.

Now that Republic has solved the mechanical problem of rolling the iron ore powder into strip steel, the company is concentrating on long-range plans including a pilot-plant operation and an evaluation of the cost of making commercial quantities of steel by the new process. One matter under consideration is the iron ore powder: It has to be abundant, pure and inexpensive. In price, it will have to compete with the ingot.

In simplifying steel production by making iron without melting, the new process would reduce labor and equipment costs. Republic estimates that a plant designed to house the direct-reduction process would cost only 40 to 50 percent as much as plants used today in the conventional melting process. Part of that saving might come from elimination of the familiar blast furnace, which costs about $75,000,000 to build and uses enough bricks in its lining to erect 80 five-room brick houses.

OLD: HOT STRIP ROLLING MILL

DIRECTION OF STEEL

NEW: HOT STRIP ROLLING MILL

DIRECTION OF STEEL
NEW: POWDER STRIP ROLLING MILL

TRAVEL THROUGH CONTINUOUS HOT MILL

TRAVEL THROUGH PICKLER

FEBRUARY 1960
Army's Flying Platform Is Jeep of the Air

Combining characteristics of a Jeep and a helicopter, an "aerial platform" has been developed by Curtiss-Wright Corporation for the U. S. Army Transportation Research and Engineering Command. The vehicle is 17 feet long and 16 feet wide. Exhaust from the 425-horsepower gas-tur-

bine engine, which powers four two-bladed propellers, is directed backward to give a large part of the thrust required to propel the vehicle. The platform's small size, low silhouette and flat cargo deck may make it suitable for transport and reconnaissance, and for use as a transporter and ground-firing platform for a recoilless rifle, rockets or other weapons. The power plant requires no warmup, making immediate takeoff possible. The pilot controls direction of flight by simply moving a conventional pilot's stick, a collective pitch lever and foot pedals. Although actual speed of the VTOL aerial platform is restricted information, it has been demonstrated at 20 miles per hour and is expected to go considerably faster.

Tiny Radio Fits on Ear

Wearing a tiny transistor radio on her ear, this pretty resident of Frankfurt, Germany, tunes in on a local radio program. She's holding another miniature receiver in her hand. Powered by a tiny battery that keeps it running for 150 hours, the "ear" radio can pick up stations within 15 miles without an antenna. The radio can be converted to other frequencies and could be utilized by patrolling policemen to pick up police broadcasts.

Lichen plants can survive either in the steaming tropics or on Antarctic mountains where they are frozen nearly all year.

POPULAR MECHANICS
Trailer Train Dumps to Either Side While Moving

Dumping to either side, a giant trailer train, made up of a truck and one or more trailers, dumps clear of the roadway in 30 seconds while it keeps moving. Multiple trailers with 15 and 25-ton capacities for highway and off-highway use can double and triple the normal load hauled. The number of trailers is limited only by the steepness of the grade. From inside his cab, the driver can tilt each trailer to a 55-degree dumping angle to clear sticky loads. Developed by Differential Company, the highway trains are powered by 255-horsepower V8 gas engines. The larger off-highway trains are powered by diesel engines of 300 and 385 horsepower.

Electric Motor in Camera

No larger than a nickel, a battery-powered electric motor winds film, cocks the shutter and allows sequence or single exposures on a new 35-mm camera made by Graflex, Inc. The camera features complete interchangeability of bayonet-mounted lenses. Billed as the first self-contained electric-motor-driven camera, it is the same size as a regular 35. The motor is in the film uptake spool.
IN MID-NOVEMBER, two scientists sank 18,600 feet into the Pacific near Guam to peer into a never-before-seen world of perpetual darkness where strange creatures exist in an “atmosphere” that presses with a force of more than four tons on every square inch.

Their descent into the ocean was far deeper than man had ever gone before—and by the time you read this, they may have set another world record of almost twice the depth of that November mark.

The scientists are Dr. Andreas B. Rechnitzer, Navy Electronics Laboratory oceanographer, and Jacques Piccard, who helped his famed father, Auguste, develop the craft in which the record was made.

The vessel that carried the explorers under water is an awkward blimp-like craft, the bathyscaphe, Trieste. And, despite the world-record performance, the Trieste is only beginning its work, for there are many more journeys planned into “inner space” as oceanographers seek to learn about the deep sea. The scientists will also test equipment and lay the groundwork for more specialized or advanced types of deep-submergent craft.

The bathyscaphe is one of only two of its kind in the world—both built by famed Swiss physicist Auguste Piccard. The craft was delivered to the U.S. Navy Electronics Laboratory in 1958. It made a number of preliminary dives and was partly rebuilt before the descent to 18,600 feet.

Among the gains to be made by prowling around where pressures are measured by tons rather than by pounds is further contribution to the vast knowledge about deep scattering layers and thermoclines which frequently are used by submarines to avoid detection by surface craft. Scientists, too, can see for themselves the fantastic creatures of hitherto inaccessible depths and examine visually the geology of the bottom.

This craft that can carry human cargo miles below the ocean’s surface is, in reality, an undersea analogue of another of Professor Piccard’s inventions—the early stratospheric balloon. The bathyscaphe operates free of any surface connections, just as the balloon does. A float full of gasoline provides buoyancy, and disposable ballast gives control of ascent and descent. The scientists ride below the float in a gondola—a 14-ton ball of steel that protects them from the crushing water outside. It is capable of withstand the greatest pressures to be encountered in the sea with an adequate safety factor.

The main structure of the bathyscaphe is a partitioned steel float, approximately 60 feet long and 11 feet wide. The float holds 26,000 gallons of gasoline in its 11 compart-
Probing with powerful lamps in the inky blackness thousands of feet below the surface, the bathyscaphe can roam about a mile horizontally. Its two passengers ride in the gondola suspended below the hull, entering it through a tube that leads down from the structure topside labeled "Trieste." The hull, when lifted from the water, clearly shows the stripes that define the 11 gasoline-filled flotation compartments inside.
Depths to which various submersibles have gone and some characteristics of oceans are illustrated in this chart. Thermoclines and the deep scattering layer vary in depth; those shown are only symbolic of the phenomena. Though the Triest set a record November 14, 1959, it's expected to go much deeper.

The two occupants enter the cabin through a tube about 25 inches in diameter. The tube leads from atop the float to the interior of the gondola. Once the two are aboard, the tube is filled with water to maintain internal pressure; they exit by pumping out the water or blowing it clear with compressed air. Inside the 6½-foot gondola, the occupants are protected by its 6-inch-thick shell and kept comfortable by an air-conditioning system that supplies breathable air for 48 hours.

Windows in the cabin offer a direct view of the ocean floor under the light of mercury-vapor lamps.

The bathyscaph, which barely floats when loaded with gasoline and ballast, descends by the operators' careful control of
water and ballast. Sea water fills two water-ballast tanks, and, as the craft sinks, automatically enters the hull through an opening in its underside, compressing the buoyant gasoline and equalizing the pressure inside and out. The craft’s rate of descent—60 feet per minute—is controlled by the release of a portion of the 13 tons of iron pellets which are carried in fore and aft containers. Variation in the rate of descent is encountered as the gasoline, which is 30 percent lighter than water, loses a little of its buoyancy because it is compressed by increasing water pressure and cooled by lower temperatures.

At the bottom, the vessel is held down by the remaining ballast; balance is so fine that a thin wire suspended beneath the vessel will cushion the final few yards of descent as the weight of the wire is taken up by the sea floor.

Moving about under the power of its own battery-driven motors, the Trieste has a horizontal range of about one mile.

Designing equipment to work in seawater at great pressures is a difficult and time-consuming task for oceanographers. But despite the difficulties, the Trieste carries specially designed equipment, such as an electronic sound velocity meter that measures...
Vinyl Molds Produce Inexpensive Stone

Mass-produced duplications of hand-carved stone work now can be made at low cost from molds of vinyl plastisol. After the stone work pattern is designed, an aluminum master mold is cast and the plastisol poured into it to jell. When the plastisol cools, it is stripped from the mold, forming a durable vinyl mold. Concrete is then poured into this mold for mass-production work. The cost is considerably less than wood molds and the vinyl is flexible, making it easy to manipulate.

80-Foot Light Poles Made of Concrete

Towering 80 feet over a Tacoma, Wash., baseball park are 10 lighting standards made of pre-stressed concrete, the first poles of this size made with that material. The poles are anchored on their concrete bases by welding the reinforcing rods at the base; all wiring is located inside the hollow poles. The 10 poles support a total of 144 floodlamps of 1500 watts each.

Reactor May Power Space Generator

Electric power for future space vehicles may be provided by a high temperature nuclear reactor that weighs only 220 pounds and generates three kilowatts of power, according to John A. McCone, chairman of the Atomic Energy Commission, who recently reported that a prototype of the reactor has been test operated.
Transistor Radio-Phonograph

Seven-inch (45 r.p.m.) records may be played on a portable, German-made radio-phonograph that also picks up short-wave broadcasts. Four flashlight batteries power the radio, four others spin up to 1000 records against a needle that is shielded inside the unit.

Surgical Stapler

Inserting vitallium staples in the human body as a substitute for hand suturing is the job of this Russian-made surgical stapler. It can even stitch sections of the heart.

Revolving Hotel

Guests in the eight rooms on the top floor of the Kan Ichi Hotel, Atami, Japan, have a panoramic view of mountains and Pacific Ocean coastline. The floor, riding on a track, rotates in a complete circle once each hour. It is turned by a 7.5 horsepower motor operating a chain-drive.

Rod Rest for Angler

Fishermen never seem to have enough hands, but a new neck-slung rod rest holds the most delicate rod and reel securely while you change lures or carry tackle.
FASTEST
BOAT
IN THE
WORLD?

By Les Staudacher
As told to Dick Kirkpatrick
PM photos by Tom Stimson

I THINK she's the fastest. I designed her and built her and was driving last November 23 when the water-speed meter went up over 260 miles per hour on a test run. The current world's water speed record is 260.35.

We were testing the Tempo Alcoa that day, getting her ready for an attempt on that record, when we were put out of action by a strange collection of the things that can

EDITOR'S NOTE . . .
The gentleman at left builds church pews. In his spare time he builds fast boats. And drives them. He's Les Staudacher, owner of Kawkawlin Wood Products Company of Kawkawlin, Mich., and he has earned a reputation as the nation's finest builder of unlimited-class hydroplanes. He has built 34; one of them, Jack Regas' Hawaii Kai III, holds the world's speed record for propeller-driven boats at 194 miles an hour. And you've probably heard of the others, even if you don't follow boat racing . . . Tempo, Miss Pepsi, Miss Thriftway, Maverick, Gale, Shanty, My Sweetie—and now Tempo Alcoa.

In 1958, Staudacher-built boats swept the first five places in Gold Cup Competition for unlimited hydroplanes. His boats have won the other big awards, too—The Silver Cup, the President's Cup, the Governor's Cup, the Harmsworth Trophy and the national powerboat championship.

In 1955, Les built Tempo VII for orchestra leader and hydro racer Guy Lombardo. Tempo VII cleaned up that year, winning the national championship. And that's where Guy comes in. Now the two are partners and co-owners of a new boat—maybe the fastest thing on water. Les tells about it in this exclusive article.
Tempo Alcoa, on high speed test run, streaks across Nevada's Pyramid Lake at around 250 miles an hour. Boat and engine combination is thought to be capable of over 400 miles per hour; safe up to around 320 happen at over 200 miles an hour on the water. But we'll get another chance sometime this year, and we'll break the record.

Let's begin at the beginning. Ten years ago the world's water speed record was held by the late Sir Malcolm Campbell, the great British speed merchant, at 141.74 miles an hour. In June, 1950, the late Stanley S. Sayres brought the record to the United States when his Slo-Mo-Shun IV was clocked at 160.323 on Lake Washington near Seattle. Two years later he raised his own mark to 178.497, the last world's water speed mark to be set by a propeller-driven boat.

In September, 1952, Englishmen John R. Cobb, holder of the world's land speed record, drove his jet speedboat Crusader at Loch Ness in Scotland at 206.80 through one official measured mile, but on the

Moving away from the pits, the jet boat crouches low in the water and idles along at 10 to 15 miles an hour. The hull stays "wet" up to 90, then leaps up onto its three riding points and gains speed very fast.
Staudacher buzzes the pits on his final speed run at a "leisurely" 180 miles an hour. This was the last photograph taken before the now-famous flight over Pelican Point; the boat had tested at over 260 miles an hour and was ready for an official speed run. The engine cowling was not used during the speed trials.

Special truck and trailer carries Tempo Alcoa, spare engine and parts for highway travel.

The same run Crusader disintegrated and Cobb was killed. Since only one timed run was made, the record could not be certified as an official one.

After the death of Malcolm Campbell in 1948, his son Donald had sworn to hold the water speed record for England. In July, 1955, his jet hydroplane Bluebird was clocked at 202.32 on Ullswater Lake, England, to win the record for Campbell and England. He became the first man to drive a boat at more than 200 miles an hour and live.

Every year since then, Donald Campbell has raised his record, and has remained unchallenged in the jet field. In 1956 he set the single-run record at 286, though a slow second run cut that year's record to 225.36. (For an official record run, the boat must pass once in each direction.

Crane eases Tempo Alcoa into Pyramid Lake for test runs. Note the clean underwater lines; at high speed the boat rides on the after ends of the sponsons and the small skag just forward of the rudder.

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After flight across promontory, boat stopped at the water's edge after traveling 100 feet in the air and another 60 across the sand. Staudacher emerged unhurt, said "She runs much better on water." At right, left to right, W. S. McChesney of Alcoa, Guy Lombardo, and Staudacher discuss model

through a measured mile course within one hour. The speeds are averaged for the time.) By 1959 he had raised the record to 260.35, a mark which still stands.

Determined to stay ahead in the speed race, Campbell is planning to shoot for 300 miles an hour in 1960, but has interrupted his boat work to try for a land speed record with a jet-powered car also named Bluebird and thought to be capable of 400 miles an hour. Campbell says he'll retire when he holds both records; five years ago he could have done it. But now Guy Lombardo and I are after his world water speed mark.

During the New York Boat Show early in 1959, Guy talked speedboats with some of Alcoa's boating experts, and they decided they'd like to try an aluminum hydroplane. I had built an experimental prototype of a jet boat in 1958, mostly to test design ideas and powerplants. Guy

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Staudacher, in racing gear, inspects the hydraulic booster controls that operate the rudder. Booster is necessary to turn the rudder even at fairly low speeds; it's never used above about 90 miles an hour

FEBRUARY 1960
**Push-Pull Train Has Extra Cabs**

Going into service on Chicago and North Western Railway's suburban lines is a new train that, for ease of operation to and from the Chicago terminal, will have its diesel engine located permanently at one end of its double-decked coaches. Thus the engine will always push the train into the terminal and pull it out. When the engine is pushing, the engineer will control the train from a cab in the leading coach. It and several other coaches have full controls — air brakes, headlights, bells, rail sanders for braking and automatic signal and stopping devices. The train will never have to be switched around; the engineer will merely walk from coach cab to engine cab to run the train back to the suburbs. Having controls in other coaches allows some coaches to be removed, while still retaining a coach with a cab at the end opposite the engine.

**Electric Dial Switch Locks Cars and Power Tools**

Dialed like a combination lock, an electric locking switch lets you lock any electrically or pneumatically operated mechanism, from a motor vehicle to an elevator. A pair of lead wires coming from the hand-size switch connect into any a.c. or d.c. locking circuit. To open, four numbers are dialed, each closing the contact points on four plastic gears. Installed on a car, the switch lets you lock doors, windows, hood and ignition by pressing a button on the dashboard. It can easily be installed on power tools, burglar alarms or doors of buildings, too.
Youngsters Must Earn Long Slide
To get a long slide, a youngster must earn it by climbing hand over hand along the angled upper edge of a new playground slide. Once he reaches the highest point, he’s rewarded with a 12-foot slide. The stainless steel slide is 16 feet across, and is edged with 1 1/2-inch tubular steel. The entire structure is supported by sturdy steel posts.

Flash Unit Is Rechargeable
There’s never need for battery replacement in a new electronic flash unit; it has a sealed-in nickel-cadmium battery and charger that recharges from ordinary household current. Each charge yields 50 flashes of 1/2000-second duration. It has a light-color guide of 52 and recycling time of nine seconds. Monitorized relay transistor circuits give a constant light output and uniform edge-to-edge coverage. The self-contained unit weighs less than two pounds.

Mouthpiece Flashlight
Designed by a fisherman for fishermen, but also of use to mechanics, electricians, TV repairmen, or anyone who must work with his hands in the dark, a lightweight plastic flashlight features a built-in mouthpiece. It hangs from a neck cord when not in use, easy to reach and switch on when needed. The light, directed away from the eyes, doesn’t leave the user blinded afterwards.

FEBRUARY 1960
THIS MAKES THE TORPEDO CHILD’S PLAY

POLARIS MISSILE GAS-LAUNCHED FROM BENEATH SURFACE POOPS UP AND TAKES OFF ABOVE THE WAVES

ENGINE SPACES

MISSILE HATCHES

REACTOR ROOM

LAUNCHING TUBES FOR 16 POLARIS MISSILES

PERISCOPE ROOM

MISSILE CONTROL CENTER

62-TON STABILIZING GYROSCOPE

BATTERY ROOMS

TORPEDO ROOM

DIVING PLANES

BRIDGE

SAIL
The first missile-carrying sub soon will put to sea. And, to perfect the technique of firing the Polaris from beneath the surface, a strange ship already is spitting A-missiles into the sky

By Richard F. Dempewolf

WITHIN THE next few months, one of the most formidable vessels ever to sail the seas—the atom-powered and atom-armed submarine George Washington—will glide out the channel from Port Canaveral, Florida, and dive beneath the waves. The 380-foot monster, shaped like a slim blimp, is the first in a planned force of some 50 Fleet Ballistic Missile submarines. Five more now building are scheduled to join the Navy during the next two years. All will be fighting arms of a new U.S. Navy defense strategy. All will have lethal fists cocked and ready to explode with knockout power from depths of oceans throughout the world.

Marching down the broad back of the George Washington (SSBN 598), are eight pairs of hatches, like two rows of giant steel blisters about five feet in diameter. Beneath them, in an arrangement reminiscent of an old-fashioned candle mold, are nested 16 vertical steel tubes that rise from the ship’s rounded bottom. Each tube contains a nuclear-tipped Polaris missile. The 30-foot, solid-fueled two-stage navy rocket can hurl a thermonuclear warhead 1500 miles, and the navy’s rocket experts hint that later models will do even better.

But the neatest trick in this wedding of nuclear sub and nuclear missile is that even while the ship ghosts along under the surface, it can fire its destructive birds. At his control panel deep in the forward part of the hull, the fire-control officer presses a button. High-powered pumps force compressed gas into the tubes. When a certain pressure is reached, there’s an ear-splitting crack, and, topside, a firing tube lid flies open. The missile, driven upward by the tremendous pressure of the hammering gas beneath it, pops from the tube like a cork from an agitated champagne bottle. Blasting upward through the sea’s surface, under its own momentum, it leaps vertically into the air to a height several times its length. Near the peak of its free climb, a timing device touches off the first stage rocket engine with a mighty roar, and the great missile soars off toward outer space.

Fifty cameras and TV monitors, such as the two above, record each missile launching on the Observation Island. They are controlled by a technician below decks who views a screen and moves a lever.
on a preset course. A built-in inertial guidance system that senses the slightest deviation from course feeds any such data to a computer that promptly calculates course corrections and triggers a device that changes the burning pattern in the rocket engine, deflecting the missile back to proper trajectory. At the end of powered flight, the nuclear nose cone separates from the rocket and soars ballistically to its target at a top speed of about 12,000 m.p.h.

When you know that virtually every major city in the Soviet Union lies within 1500 miles of open sea; and that those 16 warheads in the George Washington alone pack more destructive wallop than all the U.S. bombs dropped during the whole of World War II, you begin to appreciate the strength and agility of this counter punching weapon.

Admiral William F. Raborn, Jr., director of the Polaris program, points out that a fleet of FBM nuclear subs, poised and ready, are able to prowl for months at a time, hide beneath Arctic ice, move tens of thousands of miles without thought of refueling. No one except the Pentagon's highest brass will know where they are. Even an enemy's sonar would tell him little about the kind of target he was facing; every "ping" in the sea might be another missile sub. Should an enemy power be foolish enough to launch an atomic war, says the admiral, this fleet alone, when fully deployed, will insure instant and incredible retaliation. The rapid firing rate possible with Polaris will allow the submarine to launch its entire cargo in a remarkably short space of time. The hypersonic speed of the missiles will deliver total destruction to target cities more than 1000 miles away in a matter of minutes. Once developed to its maximum, Polaris' range will enable it to reach almost any point on earth from positions at sea.

When an FBM submarine has shot its last missile, it is far from defenseless. Up forward, rides a battery of Mark 37 anti-sub homing torpedoes that can be fired when the ship is submerged or surfaced, and will seek out targets by themselves.

High-speed cameras shooting four pictures a second made picture of live Polaris missile emerging from tube. In actual operation, it would fire rockets and take off for target. The cloud was caused by compressed air.
What's more, with its capability of stealth, maneuverability and high speed underwater endurance, the FBM sub will make a tricky target. The *George Washington* was rushed to completion by inserting a missile section in the middle of a 260-foot "teardrop" Skipjack Class atomic sub hull. While the stretched out version probably won’t come up to Skipjack’s rumored 40 knots underwater, it’s no slouch. "She still goes fast and deep," according to her designer. "She has clean lines."

*Officers at launching operations station below decks controls firing sequence after an involved countdown*

FBM sub 608, now on the ways, will be heavier, larger and faster than the first five — "enabling it to take fullest advantage of the many millions of cubic miles of ocean which still offer the greatest hiding place on the face of the globe," according to Raborn. "Polaris," he says, "has just one mission. That is to help prevent the need for its use from ever occurring. It is a weapon in our arsenal of deterrents to aggression."

Since the new missile subs are crammed with the navy’s latest top secret devices and systems, it will be a long time before anyone but their own highly trained crews will ride one. Recently, however, a gray and massive navy surface ship, the USS *Observation Island*, has been operating quietly out of Port Canaveral. Known as an "EAG" (for Experimental Auxiliary, General) the ship is a converted military cargo transport — 563 feet long and 76 feet abeam. From the broad sweep of her flat stern weather deck, to her high antenna-studded bow, she is a complete, floating Polaris missile “complex”—the sea-going test bed for all components of the complicated firing and guidance systems that soon will be installed in the FBM subs.

Some 265 officers and men under a square-jawed navy captain, Leslie M. Slack, operate this portable missile base, and a more concentrated crew of technical wizards probably never sailed the main to-gether. "It’s about the only ship in the navy where chief petty officers swab decks and polish brass," says Commander Kenneth
Wallace, the weapons officer. "Since every man is an expert, an unusual percentage of the crew consists of chiefs. There just aren't enough lower rates to handle all the housekeeping chores alone."

Tip-off to the Observation Island's unusual mission is her flat launching deck with its two great domed hatches covering the launch tubes. These thick-walled steel wells plunge vertically through the lower decks—just as they will on a submarine. Hatches in each tube's wall, at various deck levels, allow for check-off of the missile. Even slugs must have umbilical cords leading out to instrumentation at all of the ship's centers, for complete missile simulation.

Thirty-foot Polaris nestles deep in launching tube. Submarines will each carry 16 such live missiles on the port side of the deck. Polaris missiles rest in giant racks—looking for all the world like the big propane bottles in your local fuel supply yard. Most early "shoots" at sea from this test pad involved concrete-weighted dummy missiles, or "slugs," which lack the typical Polaris "bottle-neck" nose cone. These are the only kind you're likely to see lying in the open on deck. Hoisted by cranes, each is lowered into a yawning tube, which it fits like a piston in a cylinder, and the dome-shaped cover is swung shut and dogged down. Small wooden blocks, or "shoes," fastened to the outer wall of the missile at intervals, prevent the rocket shell from scoring the walls of the tube when launched.

Firing a slug, or a live missile, from one of these vertical gun barrels is done, actually, by blowing it out with a gigantic puff of compressed air let in at the base of the tube. You hear a whoosh of rushing air as the missile rises from the tube and climbs majestically about 100 feet into the air. "The dense cloud of 'smoke' you see billowing from the tube, is actually a cloud of ice crystals, formed from the water vapor in the compressed air," says Lt. Comdr. Ernest J. King, the ship's operations officer.

The virtue of having a 15-ton slug fall in the water, instead of dropping back and plunging through several layers of deck on the ship, is achieved in two ways on the Observation Island. The launchers can be tilted to shoot its monsters at a gentle angle that carries them over the side, or the ship takes on ballast and heels over far enough to "throw" the slug seaward. "We ran one

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Tilted Racks Double Parking Lot Capacity

Offering a solution to overcrowded parking lots, a new system doubles the capacity of lots and garages while making them virtually accident-free. Cars, resting on racks, are tilted under each other at 30-degree angles, thus allowing two cars to park in nearly the same amount of space normally used by one car. The units can be installed in any size parking area. As shown in the three photos at the right, the motorist drives his car onto a rack parallel to an empty parking space. The attendant then takes over. He turns off the engine, gets out and switches on a 110-volt electric motor. This activates a hydraulic jack that tilts the car to a 30-degree position. After it is tilted, the attendant then manually shoves the rack with the car on it into position beneath another car. The entire operation is completed in 40 seconds. When the motorist returns to claim his car, the attendant pulls the rack from the storage slot into the access lane, lowers the ramp, backs the car off and the motorist is on his way. Accidents are greatly reduced, since no car can come into accidental contact with another, once it is on the rack and out of the access lane. Called the Auto-Pack system, it was developed after two years of study.

Russian mining engineers say they have a method that allows them to sink shafts 10 feet in diameter at the rate of about three feet every four minutes, or 10 times faster than by conventional methods; liquid explosives are piped through an opening in a big drill bit and then detonated.

Gloves Give Swimmers "Webbed" Hands

Webbed hands can add greatly to a swimmer's speed and power, but most types of swimming gloves interfere with the use of the hands. A new rubber "Swim Mitt" has full finger webs, but is made of a soft material that doesn't interfere with manual dexterity any more than a pair of household rubber gloves. They'll be sold in six sizes, including models for youngsters.

FEBRUARY 1960
**Smudge Pots Help Meteorologists**

Smoke trails help meteorologists study the intensity and direction of low-level temperature inversions at Lockheed's Georgia Nuclear Laboratory. Spotting these climatic nuisances 24 hours in advance enables meteorologists to determine the advisability of operating the main reactor. Such studies help predict weather variables affecting a variety of industries and military programs.

**Gyro Steadies Binoculars or Camera**

For use with most hand cameras, binoculars and optical instruments, a battery-operated gyro stabilizer steadies hand movements, providing crisp, sharp pictures even from moving vehicles. Two gyro motors perform the function of a tripod, holding the camera on a given axis. For use with cameras weighing 10 pounds or less, the stabilizer is effective in an auto, boat or plane.

**Kit Molds Plastic Night Crawlers**

Fishermen can mold their own plastic night crawlers with a kit consisting of a bottle of liquid plastic and three molds. The plastic lures are oven-cured, then fitted with hooks.
Point on Scaler Holds Fish

Pinning his fish to the cleaning board with one end of a new fish scaler, a fisherman scales it with the other end. The tool can also be used as a fishing rod holder or an ice pick.

Snap-On Letters Make Lighted Sign

Translucent plastic letters that snap over a standard fluorescent tube make an attractive, inexpensive sign. Color and letter plates are interchangeable so that messages can be composed with variety.

Clown Dispenses Oxygen

Oxygen equipment in the guise of a clown eases the fears of youngsters who are frightened by therapy devices. Each breath through the candy-striped hose causes the clown’s left eye (a pressure gauge) to roll. The red nose is an emergency button which starts artificial respiration if breathing stops. The device is manufactured by the National Cylinder Gas Division of Chemetron Corporation.

Tokyo Policemen Wired for Sound

Eighty select Tokyo policemen are constantly in touch with police headquarters as they patrol crowded streets of the city carrying miniature portable radio receivers. Each receiver has nine transistors and weighs only 23 ounces. The radio unit is carried in a black leather case at the policeman’s side while the antenna is concealed inside the leather strap over his right shoulder.

FEBRUARY 1960
Giant snow roller weighs five tons empty, compacts snow in first step to allow other vehicles to operate. Snow planer, below, levels the rolled surface. Sawdust toppings varied from one to three inches in tests.

Pulvi-Mixer, below, grinds sawdust into the top six inches of snow. The surface is allowed to set for about 40 hours before testing. Test pad successfully bears a load of 200 vehicular tons at one time.
Packing Down Squaw Valley’s Snow

By C. Robert Lee

As if there weren’t enough problems involved in holding the 1960 Winter Olympics in California’s remote Squaw Valley, Olympic committee men are faced with the prospect of parking 12,000 cars, trucks and buses in the middle of winter in the 6000-foot valley, where temperatures leap from zero to 50 degrees and they measure snowfall in feet instead of inches. The possibility of having 40,000 people stranded in the half-mile by three-mile valley by a snowstorm or sudden thaw would keep even Squaw Valley’s promoters awake nights. Navy engineers, however, came up with an idea from their arctic experience that may save the day—and $700,000 for the State of California. They plan to pack the snow on the valley floor, then roll down a thick layer of sawdust to insulate it from traffic and the sun’s warmth. A 200-square-yard test pad has proved a success, so plans are going ahead for a 130-acre parking lot, which authorities say has a 90-percent chance of working.

FEBRUARY 1960
The Weird and Wonderful

MODEL YEARS, tail fins and all that are in a world apart from Rowland Emett who invents and builds mechanical things that should have appeared during the reign of Queen Victoria.

Even such a modern concept as his sputnik launcher (as yet unrecognized by the world's scientific groups) has the appearance of a fairly orderly 19th century junk heap. The fact that its secrets have not yet been copied by any major power is a good indication of the degree of sophistication Emett has achieved.

His airplane, too, stands in a class by itself, and some may marvel that it stands at all. But everyone knows that an aircraft—at best—is a fragile thing on the ground, and they await the day it conquers its element. Others fear that someone will try.

Rowland Emett, whose fertile brain and affection for Edwardian and Victorian ages have fostered a whole new brand of technology, is a pleasant-faced man with fair hair and dreamy blue eyes. He
World of Rowland Emett

Oswald, close-mouthed hero of the Ideal Home machine, sits with his creator for an informal portrait. Is this Emett's idea of a television set? At any rate, it'd be a conversation piece in the parlor.

Youthful appearing at 50, Emett looks like any artist seated at his drawing board—but the pictures on the board look like nothing ever seen before. He first gained fame for drawings...
As much at home with tools as with drawing pencil, Emett takes his turn at the forge.

Few people realize how close the tolerance is for placing a brass bed knob under a hipbath. It takes careful sighting.

Well-equipped forge includes an artificial chicken, springs, bells and curtain rods.

Emett divides his time between his pleasant home in Sussex, England, a blacksmith's forge in the neighboring village of Streat, and strange little curio shops and forgotten junk heaps in weed-covered yards of tumbledown warehouses and factories.

It's a red letter day, indeed, for Emett when he runs across a sack of ornate Victorian bed knobs or some other such treasure. Ordinarily, the items he seeks in shops haven't been moving at too brisk a pace since the turn of the century, and it some-

(Continued to page 256)

Emett believes he shouldn't get lost in the past; here he's about to orbit a modern satellite.
Emett adds a new dimension to farm and home living. Among the countless features of the agricultural machine are an egg inducer, a mangelwurzel-digger which scrubs and polishes and a carrot fuddler. Oswald, whom Emett calls "bone idle," appears below in the Ideal Home. Oswald likes everything done for him. Even flowers and grass of the garden are whisked to him through a pipe, held under his nose and then whisked back.
Babies Can Breathe Through This Pillow

Infants who sleep on pillows are no longer in danger of suffocation with this perforated head support that allows a child to breathe when he's lying face down. The pillow, a British invention, is covered with washable wide-meshed material that allows free passage of air. Wood supports hold it at a comfortable angle.

Form Simplifies Concrete Pouring

Adjustable to fit between joists or beams for pouring concrete floors or ceilings, a new steel form is easy to install and remove, makes a smooth bottom surface on the slab, and is strong enough to form a safe working surface during the pour.

Nail Holder Is Finger Saver

Swollen fingers needn't be the trademark of home carpenters. Here's a six-armed nail holder that keeps hands well out of the range of a swinging hammer. Each arm of the rubber device has a different size slot to take care of a great range of nail sizes.
Model Steam Engine
Operates Threshing Machine

Some kinds of work remain in a person's blood forever. This old saying certainly applies to E. J. Earles, of Milwaukee, Wis. After 10 years of spare-time work, he has completed an exact model of a 1916 steam engine he ran as a youth in North Dakota. The steam engine actually operates a scale-model threshing machine (middle right) that Earles also built. Earles made all of the tiny gears and the casting, based on a scale of one inch to one foot. The engine runs on 75 pounds of steam generated through the use of bottled gas or charcoal as fuel.

Lightweight Beryllium—
Latest Metal for Industry

Beryllium, a lightweight metal that could cut the weight of a transport airplane in half if used instead of aluminum, is expected to see extensive use in industry within two years. Northrop Corporation's Norair Division reveals that beryllium metal bars costing $100 a pound, have been extruded into U-shapes after early failures. Aircraft channels have not been built yet, but will eventually be made. Cost of the metal would be reduced drastically if it were to be used freely in the aircraft industry.

Huge Plastic Balloon
Will Become Satellite

One hundred feet in diameter, a satellite developed by the National Aeronautics and Space Administration, can be folded into a metal container 30 inches in diameter and sent aloft at the head of a rocket booster to be inflated in space. It is made of micro-thin plastic and coated on the outside with a film of aluminum. Although it takes 40,000 pounds of air to inflate the sphere on the ground, only a few pounds of gas will inflate it in space. To keep it inflated, despite possible meteorite punctures of the skin, the sphere will carry crystals of a solid that, like dry ice, change to gas. The sphere is proposed as a reflector for radio and radar signals, for around-the-world communication and for signals bounced from the moon in lunar probe experiments.
Thin Hi-Fi Speaker Forms “Sound Wall”

Effectively reproducing high-pitched sounds, a large, thin loudspeaker provides a veritable wall of sound. The entire front membrane oscillates to provide the tone. German-made, the unique speaker sells for $150.

Spinning Disks Wind Electric Cable

Four-layer cables containing 84 No. 16-gauge wires, plus core, can be spun out of a new cable-winding machine at the rate of 15 feet per minute. The machine, developed by Boeing Airplane Company, consists of four aluminum disks mounted on varying sizes of steel tubing and driven in opposite directions by chains and sprockets. The disks carry a number of wire spools which retain their position during the spinning, and spiral each layer of the cable in a different direction from the layer below. The cable is taped automatically.

Airborne Nurses Train in Water

English nurses who accompany sick and injured men home from far-flung naval and air bases are being trained to keep their helpless charges from drowning, should their air ambulance go down at sea. They study at the Royal Air Force Aeromedical Training Center in England, practicing putting on life vests in the water, righting overturned life rafts and other rescue procedures.

(Ninety million meteors bright enough to be seen under good viewing conditions enter the earth's atmosphere each day.

POPULAR MECHANICS
Armor-Like Visors to Regulate Flow of Dutch River

Dutch dam-builders, well experienced in regulating waterways, are employing an engineering technique never before used in the construction of a dam. Visors, resembling those that slipped down over faces of ancient knights, will rotate around an axle in a half circle to control the watercourse of the Lek River near Hagestein, Holland. The traditional turn-doors or lift-doors are eliminated in this project. The slides, which are 174 feet wide, are raised or lowered on their axles.

Besides being considerably less expensive than other dam-building principles, the slides need no lift-towers since they are guided by the axle. Each visor slide weighs about 200 tons. Turn or lift-doors are tons heavier, and greater electric output is required to operate them. Present plans indicate that by 1968, the Lek will have three new sluiceways.

FEBRUARY 1960
Cars That Live in Glass Houses...

Needing a shelter for his sports car, P. J. Amico of Flushing, N. Y., bought himself a prefabricated greenhouse and set it up beside his garage. The glass walls give plenty of light for working on the car during the day, and at night it's protected from the elements. It took him only a weekend to complete the project.

Ten-Ton Tractor Pulls Huge Plow

Two and a half tons of plow—an eight-bottom “pickup” model—is integral equipment on the new John Deere 10-ton tractor for large-acreage farms. Powered by a 218-horsepower two-cycle diesel engine, the giant tractor is the biggest to make use of integral equipment. Front and rear wheel units are mounted separately allowing operation over almost any terrain. Power brakes and steering make driving easy.
School's Circular Library Stands on Stilts

Standing on 10-foot stilts inside a semicircle of classrooms, the library of Arcadia High School in Phoenix, Ariz., forms the focal point of the entire structure. It is the same distance from all the classrooms. Architect Mel Ensign designed the vertical louvers in the classrooms to allow each room to have individual sunlight control.

Tackboard Is Covered With Vinyl

Laminating vinyl wall covering with quarter-inch sheet cork, a California manufacturer has developed a tackboard material that's easy to maintain, yet is as easy to use as cork board. Called Vinylcork Tackboard, it is available in 12 colors; is non-fading and glare-free; and tends to close over old tack holes to prevent damage from heavy use. In schools and museums it can be used as a full wall covering for displays.
Museums Are for Doing Things

Children's museums pick up where school leaves off

By Charles V. Mathis

A MUSEUM is as individual as a thumbprint. It may specialize in art or science or natural history; it may have its own ideas of public service and its own techniques of exhibition. But most museums do much the same job—they display specimens, carry on research programs and ask of the visitor only that he use his eyes.

Within the museum world, however, there is one entirely different breed. It is called the children's museum, and there are now nearly a hundred of them, sprinkled happily across the nation.

These new museums are completely dedicated to and guided by the needs of children. They are places not only to see things, but to do things, and combine museum, workshop, zoo, school and community center. The young visitors can even help build simple exhibits, such as displays of Indian folk art or models of the planetary system.

The youngsters play with live animals of types not usually classified as household pets. They join clubs for science and nature study, participate in pet and puppet shows, and attend organized classes which may range from ceramics and carpentry to taxidermy and telescope making.

The concept of the children's museum is not much older than the twentieth century. The first was the Brooklyn Children's Museum in New York City, founded in 1899. Today there are 92, with the largest numbers in California, New York, Massachusetts, Connecticut and North Carolina.

Most children's museums work closely with the public school system. Their self-appointed task is to bring to life what the children are learning in class. To do so, they send periodic bulletins to the local schools listing current exhibits and coming attractions.

The special flavor that distinguishes children's museums is satisfying the child's yen to get his hands dirty; the flavor of participation. The junior museum program is dynamic, not static, and provides a community with a popular cultural center for young and old. The children who flock in tens of thousands through the doors of the
junior museums learn to think of our native flora and fauna as living things to be cherished. This leads to a genuine desire to protect and conserve our invaluable natural resources.

The junior museum program is built on the belief that curiosity is the beginning of wisdom: that a child’s natural curiosity and love of living things should be encouraged and cultivated in order that his life may be enriched by greater knowledge of the world he lives in.

A child may read about the stars in school, but he can’t see them; at a zoo he sees animals, but he can’t touch them. But in the planetaria maintained by many junior museums, he sees the heavens close and bright, and his face shows awe.

Or a deodorized skunk takes a complacent stroll across the floor and the child strokes its bushy tail and squirms with de-
light. In a museum science workshop, he welds together a challenge—a model of the solar system or a satellite. The preschooler discovers textures—sand or clay—and his fingers transmit their contentment to his face.

A children's museum is a breezy sort of school, where boys and girls may come and go as they like, eat and chew when they please, study just what strikes their fancy and even bring their pet turtles along for company.

They respond to everything—to sounds, to smells, sights, touch—to skunks and stars and all the majestic mysteries which lie between in the wide, wonderful world of the child. And behind every response lies a new little nugget of learning.

Recently the space and satellite activity has given new impetus to the junior museum field. If larger numbers of our youngsters are to become interested in science, the country cannot wait until high school and college and then hope they will select a scientific career.

Scientific thinking must begin with children in the elementary grades. That is the proper time to start a trend which can and should greatly increase the number of young people entering high school and college with a genuine interest and dedication in the field of science.

Junior museums can serve as the science center for a community and through their progressive programs capture the imagination and enthusiasm of even the smallest children. Science is no longer the misunderstood and sometimes, boring oddity with which children occasionally make contact. Through colorful exhibits, especially the popular "touch me" action displays, games and demonstrations, science can be popu-
Sacramento's museum animals are out where the kids can see them—this is Podgey, the popular porcupine.

larized and accepted as part of youngsters' daily lives.

The guiding light behind the junior museum idea is John Ripley Forbes, who for 29 years has worked to repay his debt of gratitude to one of America's great scientists. In doing so, he has built a coast to coast chain of free children's museums and has revolutionized museum practice. Now no hamlet is too small and no slum is too dense to echo a child's happy squeals as he holds a live opossum or sits entranced by nature or science movies.

All this started when Johnny Forbes, then a 14-year-old Boy Scout, went on a hike through the woods near Stamford, Connecticut. He discovered a frog that had just swallowed a firefly. The insect glowed through the membranes of the frog's stomach. John took the spectacular exhibit to his neighbor, Dr. William T. Hornaday, director of the New York Zoological Park and world-famous naturalist. As one scientist to another, the boy and the elderly zoologist exchanged their views. The gentleness and keen interest of the distinguished man inspired the boy to make natural history his career. A year later Forbes opened a museum in his father's attic and invited his new friend to inspect it. Dr. Hornaday spent an hour examining the exhibits; when he came downstairs, he said, "Mrs. Forbes, I came to see a boy's collection, but I have seen a scientific museum. Your son is a born curator."

Forbes has since worked diligently to help establish the national chain of junior museums in paying off his debt to Dr. William Hornaday.

The junior museums pick up where school leaves off. For school is a necessity, dealing in textbooks. The museum is a luxury, dealing in objects. Each is important to the other, as important as the knowledge of arithmetic is to a dedicated junior astronomer.

But if the youngster treats his telescope somewhat more tenderly than his multiplication tables, he can hardly be blamed. For a child's favorite world is composed of objects, not ideas; and it is the sole and gratifying job of a children's museum to hand him the world on his happiest terms.

Douglas Aircraft's early "Bumper Woc" rocket is another popular exhibit in the Charlotte Museum.

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"Hound Dog" Hangs Under Wing Of Huge Air Force Bomber

Suspended under the wing between the inboard engines and the fuselage of this giant Air Force B-52G are two GAM-77 "Hound Dog" missiles. The air-to-ground missiles are manufactured by North American Aviation.
BONELESS FISH!

By Hurley L. Campbell

FISHERMEN'S wives and kids often dislike helping Dad eat his catch because of the inconvenience of eating around the small bones. But you can have boneless fillets if you'll follow these step-by-step instructions next time you clean your fish. It takes only a little more time, and you'll end up with nothing but edible meat. All it takes is a bit of practice and a sharp knife with a flexible blade—and, of course, a fish . . .

1. Start with a forward-slanting cut from behind the pectoral fin and gill cover, working down to (but not through) the backbone

2. Cut along the dorsal fin down to the rib cage, but don't cut the ribs. Extend the cut back along the length of the fin, then clear through the body behind the ribs

3. Slide the blade back along the tail bones with a slight sawing motion to within a half inch of the tail. Stop here, leaving a "hinge"

4. Discard the knife momentarily and use the finger tips to peel the flesh away from the rib cage; it pulls away easily, but be careful not to bruise the flesh. When that's done, the fillet will be freed except for the belly skin and the skin "hinge" left at the tail in step 3

5. Cut along the center of the belly to join the cuts made in steps 1 and 3. This frees the fillet at the forward end, leaving the bones and viscera with the head. (There is no need to scale or draw the fish first.)

6. Flip the fillet over and insert the knife blade where the skin was left attached at the tail. Work the knife along, pressing down against the skin with a slight sawing motion until the fillet is freed. The only bones left in the skinned fillet are the small tip bones from the ribs

7. Easiest way to cut out the rib tips is to remove a quarter-inch strip of meat from the inside of the fillet. The finished fillets can be cooked whole or cut into bite-sized chunks which are quicker and easier to cook.
WHAT'S NEW FOR

ELECTRONIC CHLORINATOR, using ordinary household bleach, treats up to 75,000 gallons of water a day for home, farm or commercial use. Normally located between pump and water-storage tank, the unit is cased in cast aluminum finished in white and gold. Chlorination rate is adjusted by finger-tip control and proper strength is determined by simple test.
Clayton Mark & Co., 1906 Dempster St., Evanston, Ill.

PUFF IRON that clamps onto the back side of an ironing board and is ideal for ironing ruffles and puffed sleeves can also be used for sealing cellophane packages, such as those put in freezers. It has a special heating unit in the head that adjusts automatically to correct temperature for all fabrics. The fittings are chromium plated for longer wear.
Yin-Max Co., 631-85th Ave., Oakland 11, Calif.

KNIFE SHARPENER provides a separation between blade and holding hand for safety. It has self-adjusting, revolving grinding wheels inside a slotted aluminum tube. The mechanism, completely enclosed, sharpens knife evenly, end-to-end. Seven inches long, it fits in drawer and has hole for hanging.

CUTTER-SERVER makes neat work of handling such foods as cake, pie, meat-loaf and pizza. One stainless steel blade resembling a pancake turner is slid under food; knife cuts as handles are squeezed.
Kitchen-Qulp, Inc., Waterloo, Ind.
ELECTRONIC AIR CLEANER weighing just under 50 pounds can be moved from room to room. Its patented ionizer is claimed to remove 85 to 90 percent of all smoke, pollen, dust and airborne dirt in a room. To clean, cell plates are flushed with water.  
Electro-Air Cleaner Co., Inc., Olive & Spaul Strees, McKees Rocks, Penn.

METAL BASKET fits on rotisserie spit and through its tumbling action evenly cooks, and uniformly browns, food items too small to be barbecued on the spit itself. It is self-basting, and the manufacturer recommends it for cut-up chicken, ribs, chopped wiener. Available in a number of sizes, the basket can be cleaned by rinsing in detergent and water.  
Howitt Brothers Mfg. Co., 2207 Cleveland, National City, Calif.

BABY-FOOD WARMER, electrically operated, heats food in seven to ten minutes, keeps it warm for half an hour. Each of three compartments holds a jar of food.  
International General Electric, New York, N. Y.

HAIR DRYER is ready for use when door of case is raised. Cap and tube are stored in the unit, which has a permanent Fiberglas filter. There are no electric wires in the cap itself. The compact dryer has settings for four air temperatures, including cool.  
Sunbeam Co., 3400 Roosevelt Bl., Chicago, Ill.

PORTABLE RADIO CONTROL for electronic garage door openers is a nine-ounce transmitter that operates for more than a year from a single battery. It can be geared to a receiver to operate with any one of 25 signal combinations, and requires no wires.  
Bus for Sightseers
Recalls Yesteryear
When a horse-drawn bus became too small and too slow, a West German sightseeing company demanded a bus for their visitors that resembled the old one. That's what they got, only it's not horse-drawn. It's equipped with a 48-horsepower Austin engine. If you saw it from the back, you'd believe it was the former bus, since it even has the entrance in the rear. The unique vehicle has adequate room for 35 passengers.

Model Village
Made of Bricks
Thousands of tiny concrete bricks, formed in the trays of matchboxes, have been assembled to make a model village in Shawford, England. L. R. Abrahams and his wife spent 10 years building the village now displayed in their front garden. It contains shops, factories, roads, bridges, a church, a movie house, a railway station and a model train. Like all builders, the Abrahams are making plans for expanding their project: They also display a container where their many visitors may drop matchboxes.

Valuable Seeds
Stored in Vault
To make sure the United States will continue to have vigorous strains of corn, cotton, wheat, rice and other plants, the Department of Agriculture has opened a National Seed Storage Laboratory at Colorado State University. Some 300,000 quarts of seeds—the best types remaining from 60 years of plant exploration as well as possible breeding stocks—will be stored in nine vault-like rooms that automatically are maintained at proper temperature and humidity levels for the various types. Seeds from wild plants and primitive varieties also will be kept, and all seeds will be available, free of charge, to scientists in this country and its possessions.

POPULAR MECHANICS
Underwater television cameras watch as lobsters enter a wooden trap on the ocean floor. Below right, a diver prepares to carry an aluminum trap to the bottom. TV studies show lobsters prefer wooden traps.

TV Spies on Lobsters

TELEVISION CAMERAS that spy on ocean-bottom lobster colonies are solving a dilemma that recently has puzzled the lobster industry. While providing closeup views of lobster feeding habits, the cameras can tell lobstermen whether old-fashioned wooden traps or new metal ones are more attractive to lobsters. Light metal traps outlast wooden ones by 12 years, but lobsters prefer the old ones in certain weather. The television cameras show that, when water is cold, lobsters shun metal traps and fight for the same type of bait in wooden traps.

Pictures of lobsters' activities are recorded by movie cameras. Right, each television camera is installed in a water-tight bell, then lowered...
Kids Shift Weight to Operate "Space Trainer"

Kids can rock, spin, or roll as fast or slow as they want simply by shifting their weight inside a new toy. The lightweight wheel and frame can be set up indoors or out, and the wheel can be used with the frame or taken out and rolled along the ground alone.

"Plastic" School

Economy, flexibility and strength are the leading features of a "plastic" school designed by the Department of Architecture at M.I.T. Built of 16-foot-square "tree" units and load-bearing plastic sandwich panels, the school can be expanded, altered to fit new requirements, or even taken apart, moved to a new site and quickly reassembled. The panels have plastic outer skins bonded to a plastic-foam core.
Giant Blower Seeds Embankments

Modified to spray a mixture of wood pulp, fertilizer and grass seed, a big commercial sprayer enables a two-man crew to plant grass on new embankments at a rate of over six acres per day. Developed by International Paper Co., the sprayer applies the mixture in a sweeping motion as the truck moves along the bank. It throws 150 gallons of seeding mixture a minute to a range of about 125 feet. The mixture dries quickly to form a coating much like papier-mache, which protects the seed and raw earth from erosion.

One Man Operates Gold Dredge

Fifteen yards of sand and gravel per hour can be pumped through a one-man, home-built gold dredge. Mounted on pontoons, the dredge is propelled by an auto engine.
Rear Axle Assembly Guides Long Trailers

Extra-long trailers, such as used by telephone companies and pipeline contractors, can be equipped with an assembly that automatically steers the trailer's dual wheels. Mechanically operated, the unit keeps the trailer in its lane on sharp turns and increases tire life up to 50 percent.

Typical 1960 passenger cars have 27 lights, five more than the average home uses for general lighting.

Mobile Theater Fills Small Van

One busy traveling salesman has set up an office and movie studio, all inside a small imported Goliath bus wagon. He is Fred E. Magel, of Erie, Pa., who sells film for United Film Service, Inc. To provide himself with proper facilities for showing movies as he travels, he has equipped the inside of his van with a mobile screening room that has a 30-inch-square screen, 35-mm. and 16-mm. projectors, an editing machine and 1000 feet of film. There's also a traveling office, complete with typewriter. Magel has added a dash of comfort by providing wall-to-wall carpeting.
This Is a Camera Accessory!

It's not standard equipment, but this giant 1000-mm. lens is available with the 35-mm., single-lens reflex camera (right) made by the Asahi Optical Company of Japan. The camera's U.S. distributors say it is the lightest, smallest in its field.

No Confusion Here When Crews "Scramble"

Alert crews of the Strategic Air Command won't be confused when they're told to "scramble" at Griffiss Air Force Base. Metal tubes from the sides of their readiness building guide them straight to vehicles that will speed them to their aircraft. The building houses 75 men on round-the-clock duty.
In late March and early April—when snow is still on the ground, but mostly in patches that are quickly making way for spring—it’s an American custom, dating from the Indians, to go maple sugaring. As might be expected, there are great differences between the methods the Indians used and the methods used today to turn the clear, watery sap of the maple tree into sweet syrup or crunchy, brown sugar.

When Indians slashed a sugar maple and collected the flowing sap in birch bark containers, they dumped the contents into a hollowed-out log. Rocks heated in a nearby fire were dumped sizzling into the sap. The air would steam with water evaporating from the sap and the sticky, brown fluid left over was America’s first maple syrup. Even in those days, children got to lick the log for the candy-like residue left behind after the syrup had been scooped out and stored—a great treat after a long winter in the north woods.

Today, from Minnesota east to Maine, sugar camp operators such as Ned Finnell of Hayward, Wisconsin, are using modern methods and materials to do basically the same job the Indians did. Because it takes 40 gallons of raw sap to produce one gallon of high-grade

When syrup is boiled from sap, a thermostat opens valve to let it flow from tank
maple syrup, it is important that they employ the automation and quality control modern science and invention can bring to bear on production problems.

Finnell (lower left) uses plastic bags, plastic tubing, and a battery-operated draw-off and so needs the help of only two men to process 32,000 gallons of sap. Many producers using modern equipment operate alone for lower overhead. Once the sap starts running, the processing is swift and easy. The plastic tubing is tapped into trees, and as many as 60 of the tubes are connected to spew their collection into 300-gallon tanks, which, in turn, are carried to an evaporator house, where the sap is heated in huge evaporator pans. It is drawn off through a valve that opens automatically, when it reaches the correct density.

Using modern methods, Finnel and his two helpers get 800 gallons of syrup from his bush of 12,000 maple trees.

** Modern operator Ned Finnell also uses plastic bags for collecting. They let in the sun's sterilizing, ultraviolet rays.
Farm Tractors
Drafted by Army

Reversing the old idea of beating their swords into plowshares, a Norwegian infantry battalion is turning farm tractors into tools of war. Shown during recent maneuvers in southern Norway, the halftrack-equipped farm machines are being used in place of trucks to haul equipment over rough terrain. The light, hard-pulling tractors proved superior to trucks for many prime-moving jobs.

Wire-Mesh Panels
Display Paintings

Paintings on display at the Wuppertal, West Germany, Museum are stored for protection while being readily available for viewing. The paintings are mounted on wire-mesh screen panels that can be pulled out easily for inspection by visitors to the museum. The panels also hold more paintings than normally could be placed on the walls of the museum. Paintings are easily attached to the screens, and just as readily detached.

Antenna to Catch Signals
Bounced off Satellites

With a huge horn-shaped antenna, Bell Telephone engineers hope to learn if signals can be bounced off man-made satellites and sent to all corners of the earth. The 50-foot antenna now under construction (a model was built first) will receive radio energy from specific directions, enabling it to pick up signals reflected from the moon or man-made satellites. Its first test will be to catch a signal bounced off moon from an earth station 2500 miles away.
THE MANAGER of a Las Vegas, Nevada gambling casino sat at the control board of the closed-circuit TV system, flipping switches to operate 10 cameras which were set in ceiling ports and focused on the gaming tables. On the television screen before him, pictures of people tossing dice and betting on the spin of the roulette wheel flickered and changed. Suddenly, he hunched forward. He spotted trouble. The screen pictured a crap table, where one player was stealthily palming another's $100 chip.

The alert manager quickly snapped on his intercom. “Joe,” he told a casino detective, “go to table four. White sports shirt just swiped a chip from plaid shirt at his right.”

The thief, picked up a minute later, could hardly argue he was innocent. He had been caught in the act by one of the electronic devices that are as common, and as welcome, as tourists in Las Vegas today.

Las Vegas not only relies on electronics to give the suckers (last year, they dropped about $40 million on its gaming tables) an even break. The casino owners use electronics to guard their vaults, protect patrons from cheaters, give glamorous effects to the glittering stage shows, and keep tabs on dealers, a few of whom might be tempted to larceny were it not for the ever-watchful electronic eyes.

“In the old days, we trusted to luck and to the odds,” says a casino manager.

Television cameras are focused on blackjack tables to catch dealers or players in the act of cheating.
"Nowadays, we put as much faith, sometimes more, in electronics to keep things straight, the odds right." In honest play, the odds heavily favor the house, but let dishonesty from any source plague a casino, and it's usually the house that pays. Electronics helps keep play honest and is used to nab the dishonest dealer (who can flip a winning card to a confederate) as well as the quick-handed cheater who drops a chip on a winning roulette number after the wheel has stopped spinning.

Electronics is used most spectacularly to actuate the gaudiest electric signs in all America that lure the lucky and luckless into the casinos. Cam-actuated brass fingers, tipped with silver alloy, make and break circuits which flick thousands of bulbs on and off every ¾ second on one sign that advertises the Mint, a downtown gambling palace. All told, 11,000 winking bulbs and 13,600 feet of fluorescent tubing comprise the $125,000 sign which was judged the nation's best in 1958.

Electronics has even turned credit manager in many of the plush hotels. Transistorized robots shuffle through credit references approving—or turning down—personal checks offered by luckless bettors.

Electronics at the Hotel Tropicana is put dramatically to work in the lake-size swimming pool. A submergence speaker (with a response up to 10,000 cycles per second), driven by a 30-watt amplifier, booms music to underwater swimmers. Above water, the music is inaudible.

At the Desert Inn Hotel, a musician nightly plays an electronic console, which also sprays water. Called "Dancing Waters," the electronic aqua-spectacle orchestrates 4000 jets of water which plume into the air in time with the music. Pushbutton-controlled magnetic contacts feed high voltage to 19 pumps which, with less than a second's delay, send water 50 feet skyward.

But it is as a silent, ever-present policeman that electronics fills the biggest role in Las Vegas. In one casino, where rows of 400 slot machines cough up nickels, dimes and silver dollars, three
long-play tape recorders (located in the attic) keep track of every jackpot—both to double-check the honesty of cashiers and to ride herd on the generosity of each machine. If a machine pays out too much too often, expert mechanics quickly curb its generosity.

"The system works in this way," explains the casino manager. "Every time a jackpot is hit, a complex circuit lights up the machine, telling the player exactly how much he won. In our operation, the coins don't come tumbling out of the machine. When you hit a jackpot, a buzzer rings, the machine spells out what you've won in lights, its number is flashed on a big board, the cashier announces 'Machine number eight, a $10 jackpot,' and somebody brings you your winnings.

"The girl's voice, announcing the jackpot, is automatically recorded on tape. Once a day we put on earphones and run through the tapes, figuring what every machine paid out. This keeps the cashiers honest and the machines profitable."

The manager is also proud of an electronic microfilm machine that photographs every Keno card before the game's begun. "First, though," he explains, "another electronic machine stamps each card with
Casino managers in Las Vegas monitor their gaming rooms' activities without leaving their desks. Closed-circuit television screen will picture scenes, taken by 10 cameras, at flick of buttons on desk panel.

Electronic circuit on slot machine lights Mint sign for jackpot, signals cashier, flashes win on board.

a serial number and time-clocks its purchase. Then all the cards are fed to the microfilmer—as many as 500 cards a minute. We film some 20,000 cards a day. Once filmed, a card's tamperproof. There's no chance that a losing card can be turned into a winning one with the flick of the eraser.

The same casino—which each month grosses nearly $1,000,000 from slot machines, crap tables and roulette wheels—is also installing elaborate electronic cops to guard the take from slot machines. Vaults beneath each row of slot machines are being rigged with electronic timers. Electronic locks will seal them against pilfering. They'll open only for a 15-minute period every 24 hours when guards trundle the heavyweight loot to the casino's big vault.

"In this place alone," says the manager, "if you count the $100,000 sign that beckons customers, we've got maybe a quarter-million-dollar investment in electronic devices. Most are calculated to keep patrons and dealers honest."

To maintain honesty in another gambling palace, three detectives peer through one-way mirrors installed in the ceiling, watching every gaming table and slot machine. When they spot a cheater, they flick a switch, turning on remotely-controlled movie cameras. The cameras, their...
wide-angle lenses focused at table level, not only film cheaters in the act, but
time-clock the cheating. When the cheater
is apprehended, his name and often, his
picture are added to the Las Vegas
rogue's gallery, a list which circulates the
casinos.

"Once a guy's on our list," says a detect-
tive, "he finds his welcome limited here."

While electronics produces intense, dra-
matic scenes with cheaters—in its role as
policeman—it also is responsible for the
success of some of Las Vegas' more light-
hearted dramatic scenes. It is the unseen
producer behind such spectacular stage
shows as those given at the Hotel Star-
dust's huge supper theater. Packed into
the theater's control booth are $250,000
worth of audio, lighting and special-effects
consoles.

"These consoles," says chief projectionist
Gordon L. Hayes, "coordinate 36 micro-
phones, raise and lower the stage's six big
hydraulic-electric elevators (two weigh
15 tons each), and mix super hi-fi."

Packed along one wall are two five-
channel selective program repeaters whose
endless tapes are recorded with dialogue,
sound effects and music. Pushbutton-con-
trolled from the main audio console, tapes are "cued" automatically when a spot
of aluminum paint on the tape actuates a
selenium photocell.

Typically, one console—its 166-switch
keyboard is more complex than a cathe-
dral organ's—mixes audio through 18, 40-
watt stereo speakers. A locomotive's
whistle, or a full-throated C note, can be
swept from one side of the vast theater to
the other, giving an exciting sound effect.

Special effects are mixed—and micro-
phone pickups blended—in a room-size
reverberation chamber (38 feet long, 12
feet high and 16 feet wide) that has Fib-
erglass walls. As a result technicians can
make the Stardust's 18-piece orchestra
sound like 40 musicians at work. What's
more, the reverberation chamber can pan
sound, or a performer's voice, entirely
around the listeners.

Just as electrically complex is the
theater's mechanics. One bank of console
switches raises and lowers hidden micro-
phones and actuates motor-driven mike
doors (high in the ceiling) which slide
shut to conceal microphone ports.

A vacationing electronics engineer was
so caught up in the gambling capital's
maze of equipment that he scarcely found
time to place a bet.

"You can't shove a nickel into a slot
machine without tripping an electronic
circuit," he said. "You can't toss the dice,
without some electronic gadget, concealed
in the ceiling, drawing a bead on you."

He had discovered that Las Vegas al-
ways bets to win—and that electronic de-
vices are its blue chips.

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TV Records Passing Train

Speeding through an outlying station at 60 miles an hour, this freight train is "sitting" for a portrait. A television camera mounted on the truck at left records the train's passing, and the picture is relayed by coaxial cable or microwave relays to its destination. The yardmaster, with a picture of the car numbers and their sequence in the train, can plan accordingly to keep each car heading for its destination and to make up new trains from the arriving cars.

Catamaran Rig Aids Fishermen

Using native canoes, small outboard motors, old bicycle wheels and angle iron, a British fisheries officer at Lake Victoria in Africa has helped native fishermen speed up their work by 96 percent. Combining two canoes to make a catamaran, Maurice Atkinson added net reels across the hulls. The new boat, with two five-horsepower motors, can lay 1200 feet of net in five minutes and retrieve the same net in half an hour. The job takes half a day from an ordinary canoe.

(about 42 billion steel "tin" cans are produced annually in the U.S.)
Tractor on Screws Slithers Across Mud Flats

Land reclaimers working along Germany's North Sea coast are faced at low tide with mud that's too thin for land vehicles and too thick for boats. Their answer is a prime mover that slithers easily through the mud on rotating screws.

Transmitter in Nightstick Triggers Alarm

Night watchmen armed with an English-made nightstick are equipped to sound alarms, call the police, and defend themselves at the same time; a transistorized transmitter in the stick sets off the alarm system when a button on the handle is pressed. A similar unit is built into the handle of a watchman's flashlight.
**Variable-Pitch Truck Fan**

Switching pitch like the blades on an aircraft propeller, an automatically operated truck fan saves as much as $100 a month fuel costs. Cooling water from the engine operates a thermostatic control which increases or decreases the blade pitch, depending upon engine temperature. On high speed, level operation, the fan runs flat, thereby reducing engine load and fuel consumption.

**Hair Drier for Pampered Pup**

Every canine lassie may soon enjoy all of the comforts of the beauty parlor. A new hair drier can be hung on any cage after the dog is washed. It sends an even flow of air, adjustable from warm to hot, that soothes as it dries. Males like it, too!

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Partial view of a well-stocked demonstration room for evaluation of high-fidelity loud speaker systems

PERSONALIZED STEREO FIDELITY—PART II

Selecting Your Speaker System

By Lothar Stern

FROM 10 TO 250! No, it's not the frequency response specification of a low-frequency woofer—it's the approximate price range of "hi-fi" speakers shown in the catalog of a leading distributor.

Going a bit farther in the same catalog, you'll find complete speaker systems (speakers mounted in appropriate enclosures) ranging from less than 50 to almost 1000 dollars, and just to make matters worse (or better) there are literally dozens of speakers in every price category.

Read the catalog copy carefully. Compare the information given for speakers in the various price ranges. You'll find low-priced units that "outperform speakers costing up to three times as much," medium-priced ones that are "guaranteed to outperform all others—regardless of price," and virtually every speaker has "smooth, flat response over the audible range."

Fantastic? Yes—but that's the situation which makes the selection of this vital part one of the toughest hurdles in the assembly of your custom-built music system.

In choosing all other components you have plenty of valid data to guide your selection; but this fails when applied to loudspeakers. Specifications are usually meaningless since few manufacturers use the same standards and test setups. Recommendations of friends, even those of experts, should be used only as a possible starting point. The fact is that no two speakers of different design sound alike, and what sounds best to one expert may be only a poor second or third choice in the opinion of another. In selecting a speaker, your own ears are the final authority.

To select the best possible speaker within your budget, a listening-comparison test is advisable and, fortunately, there are hi-fi demonstration centers in most cities where such comparisons can be made. But even
before you begin the actual comparison you should have a pretty good idea of what you want. To make tentative selections from catalogs and advertisements, here are some of the things you'll have to consider:

**PRICE VS. PERFORMANCE.** That old adage “You get what you pay for” may not hold true for everything, but it does apply to speakers—particularly in the low and medium price ranges. While you might find it hard to choose between two speakers costing 150 and 200 dollars, respectively, the difference between a 20-dollar unit and one costing 50 dollars is usually unmistakable.

How much should you spend for your speaker? The answer to this depends on the total amount you expect to invest for a basic hi-fi system. If you start with a modestly priced monophonic system—say between 150 and 250 dollars—about one third of this should be allocated for the speaker system. For more expensive systems, or for stereo, the percentage allotted for the speaker should be higher. One reason for this is that the price range is much greater for speakers than for any other single component. Another is the fact that a stereo speaker system can cost up to twice as much as a monophonic one while the price difference between other stereo and monophonic components is often negligible.

**SPEAKERS AND ENCLOSURES.** No speaker can give high-fidelity sound unless it is housed in a properly designed enclosure. To prove this to yourself you need only remove the cabinet from an inexpensive table radio and notice the deterioration of the resulting sound quality. And if this is true even in the cheapest of music reproducer, it is accentuated in a hi-fi instrument. The speaker enclosure, therefore, plays an important part in the reproduction of high-fidelity sound.

Acoustically designed enclosures are available in a wide variety of styles and types. They go under such exotic names as infinite baffles, bass reflex, folded horns, and perhaps a dozen more. Carefully built, all are capable of excellent sound reproduction, yet a given speaker may sound far better in one particular enclosure design than in any other. To be absolutely certain that you're getting the best possible speaker system, you'd have to listen to every speaker in every type of enclosure, and that's a job that would take the better part of a lifetime. But this monumental task can be reduced to the vanishing point if we make one permissible assumption.

Virtually every speaker manufacturer makes not only a number of speakers, but also some complete systems. The latter contain the same speakers which are sold separately. The assumption we'll make is that the manufacturer, in selecting a particular enclosure, has picked the design which shows up the characteristics of his speakers to the best advantage. This being true, it is merely necessary to compare the systems in your predetermined price range and select the one that sounds best.

**STYLING.** There was a time, not too long ago, when physical size was a good yardstick of speaker performance. “The larger the better” was the slogan, and no audiophile would have dared boast about his speaker system unless it was of mammoth proportions.

But times have changed. Today, manufacturers have designed special speakers which give outstanding performance in small, bookshelf-type enclosures—systems which operate as well as their giant-sized counterparts. Size, therefore, is no longer a limiting factor.

**BUILD YOUR OWN AND SAVE.** You can't build a loudspeaker, but you can make your own speaker enclosure at substantial savings. A number of manufacturers now supply their enclosures in kit form at savings of 30 percent or more.

Enclosure kits are relatively easy to build. They are supplied with precisely cut panels, mitered and predrilled for simplified assembly. In many cases, a screwdriver is the only required tool and, usually, an evening or two is all that's needed for the actual assembly.

You can save even more if you have facilities for building your enclosure from scratch. Despite the great care involved in the design of a good enclosure, its eventual construction is relatively simple. If you already own a good hi-fi speaker, or if you have selected one on the strength of a listening-comparison test, the manufacturer usually can supply plans for a recommended cabinet.

But what if there are no facilities for a listening test in your area? In this event you may never have the satisfaction of knowing that your actual selection represents the best possible choice. But the point is a moot one since, in the absence of a comparison standard, your ears quickly adapt themselves to the resulting sound and any good system will be satisfactory.

The only suggestions we can make are: Select from a catalog the most expensive speaker system (two for stereo) your budget permits; or, duplicate a system with which you are familiar; or—build one of the units described on the following pages.

The systems to be described differ from one another both in design and application. They are not represented as being the very best of anything. They are neither the cheapest, nor the most expensive. They do, however, provide excellent sound, and they merit your serious consideration.
THE MARQUIS is a carefully designed enclosure which gives a good account of itself with any high-quality 12 or 15-in. speaker or with multiple-speaker installations. Commercially assembled you can buy it for $60 or $70 (depending on the type of finish); in kit form it's available for about $35. Or you can build it from ¾-in.-thick veneer plywood of your choice in accordance with the exploded-view diagram on the following page. Construction is quite simple, and satisfactory performance is assured if all pieces are properly cut so that a rigid, airtight cabinet results.

The Marquis is billed as a rear-loaded, folded horn enclosure designed for along-the-wall placement. While simple in appearance, the operating theory of the enclosure is quite involved. In essence, the enclosure is so constructed that the sound wave generated by the front of the speaker cone radiates directly into the listening area. The rear wave, however, is loaded by a folded horn, part of which is built into the cabinet itself with the remainder being furnished by the wall directly behind the enclosure. At low bass frequencies, where the horn becomes effective, most of the audible sound is produced by the rear wave which, by virtue of its tighter coupling to the surrounding air, offers much greater efficiency for bass frequencies than could be obtained with equivalent flat baffles or bass-reflex enclosures.

SPEAKER CONSIDERATIONS. Considering the fact that a loudspeaker must duplicate the sounds of strings, reeds and percussions without actually containing any of these in its makeup, it is truly amazing that we have any sort of fidelity at all. It is all the more astounding that some speaker systems can mimic not only the individual instruments, but an entire orchestra, so faithfully that even the experts, at times, are unable to tell whether they are listening to the real thing or a reproduction. Small wonder, then, that the speakers are perhaps the most critical components of a hi-fi system.

Probably the greatest stumbling block in the way of an ultimate-fidelity speaker system is M-O-N-E-Y—that is, the lack of it.
CONSTRUCTION HINTS

Solid, air-tight construction, except for specially prepared openings, is prerequisite in any high quality enclosure. All parts, except back, should be joined with a good wood glue. Glue rubber stripping to all inside edges which contact back cover when the latter is screwed in place. Screws may be used to hold parts together while glue is setting where screws do not show from the outside.

Dimensions of baffle-board cutouts depend on sizes of speakers employed. Countersink speaker-mounting holes so that screw heads do not interfere with application of grille cloth to front of baffle board. Anticipate eventual addition of tweeter and squawk by making the necessary cutouts and mounting holes, and covering any unused cutouts with wood blocks before grille cloth is installed.

Inside surfaces of top and both sides should be covered with 1-in.-thick acoustic insulating material, as shown.

Cover front surface of baffle board with black stain to prevent accentuated outline of speaker cutouts from showing through grille cloth.

Height of enclosure may be made to correspond with that of the equipment cabinet described last month by proper choice of dimensions for furniture glides.

Wiring details for speakers and crossover networks are supplied with building-block kits discussed below.

Often, this limitation brings up the question, "Should I buy two good but low-priced speakers for stereo, or should I start with a superior monophonic system?" That's largely a matter of opinion. My own is that you'll get more listening pleasure from a low-cost stereo system—providing you select the speakers with an eye towards eventual improvement.

Going on this premise, a good initial choice for the Marquis enclosure is the Electro-Voice SP12B dual-cone, all-range speaker. Available from most hi-fi distributors at about $35, this popular 12" unit reaches way down into the bass register.

For monophonic operation or in pairs, for stereo, the Marquis-SP12B combination gives excellent results at low cost.

If you want even greater fidelity, you can improve this initial system by adding the Electro-Voice DD1 building-block kit (cost—$36). The kit includes a T35B tweeter with the necessary crossover network and wiring harness, and extends the high-frequency response of the system close to the very limits of human hearing. The crossover network divides the electrical signals from the amplifier into two parts, sending the low frequencies to the large speaker and the highs to the tweeter. A level control permits precise balancing of the two portions of the audio spectrum for smooth response over the entire range.

Still another improvement is possible. A second building-block kit (type BB3—$84) further splits the audio spectrum so that it is divided between three separate speakers for optimum efficiency and flexibility. Whether or not the cost of this final addition is justified by improved sound quality is something only your own ears can tell you. Certainly you are now in an area governed by the law of diminishing returns—a region where any improvement in quality can be achieved only at a relatively high cost. But that is the nature of high-fidelity.

SPEAKER PLACEMENT. No matter what speakers you use in the Marquis, the system must be tuned to the room for optimum results. The tuning, however, is quite simple, involving merely the moving of the enclosure a few inches out from the wall so that the latter can function effectively as a portion of the folded horn.

POPULAR MECHANICS
THE JENSEN GALAXY II

ESPECIALLY DESIGNED for stereo, the Galaxy II system offers a measure of performance which, a few short years ago, could have been achieved only by a much larger and more expensive set of components. As a space-saving, money-saving stereo system it joins several units by other manufacturers in a compromise design which is rapidly setting a new trend in the stereo industry. The compromise is in the way that stereo is reproduced—not in the resulting sound.

The illusion of stereo depends upon two slightly different audio signals, each independently reproduced through individual speakers. Ideally, this requires two separate full-range speaker systems which can play havoc with your pocketbook. But continued audio research has confirmed the fact that very low sound frequencies, though vitally important for the reproduction of high-fidelity sound, contribute virtually nothing to the directional effect of stereo. It is possible, therefore, to combine the bass frequencies of the two stereo channels, and reproduce them through a single low-frequency speaker, without affecting the apparent orchestral spread. This saves not only the cost of one “woofer” (low-frequency reproducer) but also the space required for its installation.

The Galaxy II system consists of a center bass unit, a crossover network and two “satellites,” each containing a mid-range “squawker” and a high-frequency “tweeter.” The frequency spectrum of each stereo channel, therefore, is divided between three speakers each designed to provide optimum performance over its specified range.

Housed in a tube-vented reflex enclosure, Jensen calls it BASS-SUPERFLEX, an 8-

(Continued to page 244)
TRICKY TRINKET CHEST

By Walter E. Burton

NOT ONLY does this small chest provide compact storage for jewelry, writing supplies and sewing materials, but the unique arrangement of drawers lends an element of mystery. Out of what appears to be 16 drawers, only four are real, one on each side as indicated in the photo above. While the chest illustrated consists of two units or tiers of drawers, additional ones can be added easily since each unit is of identical construction. Drawer units can be added even after the chest is completed and placed in use, providing the top is attached with nails only, omitting the glue until you are sure no more units are to be added. The drawers in each unit extend the entire depth of the chest. In the chest shown, tiers are combined so that the drawers of one unit slide at right angles to the other. If desired, drawers may be positioned so that all the operable ones open on the same side, or they can be arranged to open from two opposite sides.

The parts of the chest may be cut from white pine and walnut as suggested in the drawing on the next page, or any other combination of cabinet woods may be used. To cut costs, veneer stock can be used for all parts but the top and corner posts. Drawer bottoms are ¾-in. hardboard. All joints are glued and nailed. The handle shown was formed from a 6-in. length of brass tubing, although a suitable cabinet door or window pull may be used in its place.

Posts and inlay piece on sides having fake drawers are glued in place before chest parts are assembled.

Side piece and end piece are glued and nailed to border of solid walnut glued to edges of pine bottom.
Except to someone who is familiar with a trinket chest such as this, it is difficult to determine which of the four drawers on each side is the real one.
Photo Speedlight Charger Powers Battery Toys

A photographic speedlight charger can be used as a d.c. power supply for battery-operated toys. Chargers producing up to 6 volts at fractional amperage can be connected directly. Larger-capacity chargers, connected in series with a 25-ohm rheostat, as illustrated, will reduce the voltage and serve as a speed control. A DPDT toggle switch permits forward, reverse and stop control. Mount the rheostat and switch in a box for quick hook-up when needed.

M. C. Anderson, Arlington, Va.

Storage Jars Hang On L-Hooks

Here is a new twist for storing light hardware and small parts. Fasten a lug bolt to a jar cover with two small nuts. Screw an L-hook into the wall and the jar is easily hung. Try it. You will find it easier to pull the jar off the hook than to unscrew it from a cover, which has been fastened to the bottom of a shelf. Larger parts can be stored in cardboard "cabinets" of the type from which typewriter ribbon is sold. These cabinets usually have three drawers mounted vertically and are fine for storing radio tubes and electronic parts.

A. P. Zanelli, Tampa, Fla.

String Helps Mount Heating Coil

You can determine the length of new heating coil you need by threading a piece of string through the path of the old coil. Then remove the string from the assembly and stretch the new coil until it is one to three inches shorter than the string. This will give the coil the proper tension when mounted. Starting from the center of the assembly, thread the coil in. Tighten the terminal screws and complete the reassembly.

Robert A. Brown, Shelbyville, Tenn.
Fireplace Set Has Aluminum Handles

The sleek, distinctive and expensive look of stainless-steel fireplace accessories can be matched at low cost by making your own out of aluminum. This fireplace stand was made by bending a 6-ft.-length of 3/8-in. aluminum rod around a steel post to the desired curve. The shovel is an ordinary coal shovel. Cut the handle off and attach the shovel end to a piece of aluminum bar stock measuring 1 x 1 1/4 x 12 in. From the same stock cut a piece about 6 in. long and bend it in a vise to form the V-shaped blade for the poker. Make the broom in the same way, by sawing the handle off a wallpaper brush. Attach the brush to an aluminum handle with an angle cut from 1 1/2 x 3/4-in. stock. Approximately 1 1/2 in. from the top of each handle drill a hole about 1/2 in. in diameter by which the finished tools may be hung. Given an occasional light coat of plastic spray, the accessories will remain bright and decorative.

Edward L. Fisher, Milwaukee, Wis.

Hints on Repair and Care of Masonry Around the Home

If you have brick surfaces in and around your home, here are a few tips to help you keep them looking bright and in good repair. Red fireplace brick, for instance, will in time become white and chalky in appearance. To restore the bricks to their original color, rub them occasionally with a mixture of olive oil and vinegar and wipe them with a dry cloth. Those same indoor bricks will be protected against stains if they are given a coat of thinned shellac. New brick surfaces and ceramic tile walls that have been finished with white finishing cement will lose that new look if the cement is allowed to yellow. To keep the cement spotlessly white, rub it with an old toothbrush dipped in ammonia. If you wish to do a quick repair job or to make a fairly small object of concrete without the use of forms, try this: Make a rich mixture of concrete, using just enough water to wet all the material. Dampen the area to be covered and set the concrete in place. Shape it as desired and in two hours it can be troweled smooth.

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CASTING PLASTER

By Howell M. Burke

SPECIAL-OCCASION gifts must be simple, useful and decorator styled. These requirements immediately suggest a lamp, planter or perhaps ash trays, all designed and handcrafted with just a touch of flair. The lamp bases and planters pictured below and on the opposite page are selected examples of what you can do with the simplest equipment, most of which you may already have at hand.

All the items pictured are plaster castings, made with what is known to the trade as molding plaster. The lamp base below is made with plaster, a detergent container and a large toy balloon. The essential three steps in the casting procedure are shown in the details at the left. First, cut the bottom out of the detergent can and unscrew the cap. Then attach the balloon to the neck of the can, using a length of fine wire, or better still, a pipe cleaner, which can be twisted tightly, yet is easily loosened quickly. Fill the balloon with water, then empty into a container. The amount of water contained in the balloon will give a measure of the amount of plaster you will need to mix.

With everything in readiness at the kitchen sink or laundry tubs, including a length of ½-in. threaded fixture pipe, mix the plaster in a large shallow pan with a pouring lip. For best results the mix should be about the consistency of heavy cream so that it will pour easily. At this point it will facilitate the procedure if you have
GIFTS

Use care when working casting out of plastic mold. Plaster should be fully hardened before removal.

Above, planters of various sizes make useful gifts. Below, mixed plaster should be poured into mold without delay. Right, after casting has been removed from mold, smooth by rubbing on coarse sandpaper

someone to help you. Molding plaster sets quickly and once mixed to a uniform consistency without any lumps, it must be used immediately. Squeeze the balloon lightly with one hand to force out the air it may contain and have your helper pour about one third of the plaster into the can. Without delay, blow lightly into the can as in the center detail on the opposite page. This will force the plaster into the balloon. Repeat this procedure as rapidly as possible until the balloon is full.

Now remove the filled balloon from the detergent can and place it on a flat surface. Allow the casting to spread somewhat so that it takes the bulbous form pictured. The bottom will flatten and for this reason it's important to hold the cast in the perpendicular position. Next, working quickly, open the balloon carefully and insert the threaded pipe, one end of which has been plugged with a dowel, into the neck of the cast and push down to the bottom. Make sure that the pipe stands perpendicular to the surface on which the cast is placed. Now, working lightly with the tips of the

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fingers, form the neck of the cast around the threaded pipe, shaping to a true curve and uniform diameter.

As soon as the pouring is finished, have your helper wash the utensils and the sink or laundry tubs thoroughly. Do not permit even a small quantity of mixed plaster to enter the drain from the sink or tubs, as a residue may be left to harden in the trap, even though the drain is flushed with a quantity of water.

When the plaster cast has set, tear off the balloon and force the dowel plug out of the threaded pipe. Form a groove in the plaster casting from the outer edge of the flat bottom to the threaded pipe, using a round file. This groove permits the lamp cord to be led out at the side of the base. To finish up the job, wire a socket, slip a brass spacing neck over the threaded pipe, fit a harp and the socket, add a shade of your choice and there you are. By sizing the plaster casting you can decorate it with colored cutouts, or paint it in any color and pattern that suits your fancy. Cement ¼-in. felt to the bottom of the base.

Using various types of plastic containers, bread tins, even a cardboard box which originally contained grass seed, you can make the lamp and planters pictured on page 183 and also the lamp base at the left. In making these the procedure differs somewhat from that used in making the balloon lamp base. You use a somewhat heavier and thicker plaster mix and press it onto the sides of the container with your hand, building up, by successive stages where necessary, until you have a thickness of ¾ in. or more. Wait until the plaster has hardened, then tear off the container and smooth the top edges of the casting with a file or by inverting and rubbing on a sheet of coarse sandpaper as in one of the illustrations.

An attractive planter can be made by using two bread tins, one small and one large one. Pour a creamy mix of plaster in the
larger and then press the smaller tin inside the larger one until the plaster is forced up to the top edge. Center the smaller tin and hold in position until the plaster sets. Then carefully remove the smaller tin and work the casting out of the larger one. Using the same procedure you can make round planters by using a child’s plastic sand pail and a plastic juice container. Mix and pour the plaster in the large container as before and place the smaller one inside, pressing it down until the plaster is forced to the top of the pail. Hold in place until the plaster sets, then remove the juice container and pail and smooth the edges of the casting. Finally, note the base of the lamp in the upper right-hand photo on page 183. This is made by using two separate containers of the type used to store leftovers in the refrigerator. Two separate castings are made and when the plaster has hardened a hole is centered through both to take the threaded pipe. Smooth the meeting faces of the two parts, then join tightly by running seating rings and nuts on the threaded pipe. By using containers of different sizes you get the attractive offset base pictured.

**Socket-Head Screws Driven With Nail Clipper**

In an emergency, such as an automobile breakdown, if a socket-head screwdriver is needed and there is not one at hand, try using the blade of a fingernail clipper instead. The blade is usually about the right size to fit one of the slots of the screw.

**Refinishing Camera Parts To Original Black Finish**

After a period of long, hard service brass parts on a camera will lose their black oxidized finish. To restore the finish add copper sulphate, ½ tsp., to water, 4 oz., and allow it to dissolve. Add sodium carbonate, or washing soda gradually until the precipitate stops forming. A small amount of household ammonia will dissolve the precipitate and turn the solution a deep blue. Now clean the parts to be oxidized and dip them in the solution for about one minute. Wash them with clean water and dry them. The brass should turn black in a few minutes.

**Floor and Wax Wisdom**

The hard work involved in caring for tile or linoleum floors is eliminated by a wise choice and use of cleaning and polishing products. According to the Johnson’s Wax Company, there are two basic types of floor wax—polishing and liquid self-polishing. The self-polishing type is best applied with a fleece applicator, as shown above. It dries to a hard shiny finish and requires no buffing. Polishing wax, which comes in liquid and paste form, requires buffing but affords longer lasting protection and a higher luster. In applying liquid polishing wax a cloth mop is preferable to a sponge mop as the cloth releases the wax more evenly for a smoother, glossier coat. Most liquid polishing waxes clean as they are applied requiring no preparatory scrubbing. A solvent in the liquid loosens the soil which is then picked up by the cloth. However, this solvent has a softening effect on plastic and asphalt floor tile. Any good self-polishing wax is preferable on these surfaces. For linoleum which has become old and porous, two thin and even coats are recommended with at least four hours of drying time allowed between coats.

**New Lease on Life For Rubber Suction Cups**

With much use and exposure to sun and weather, the inner surfaces of rubber suction cups, such as are used on auto-top carriers, may lose their smoothness, become checked and dry and refuse to stick. Their restoration is a simple process. Rub the inner surfaces with fine sandpaper and then brush on a thin coating of plastic rubber, available in any hardware store. Allow the cups to dry over night before attempting to use them. This treatment will give the suction cups a new, live-rubber finish.
5 SHOP SHORT CUTS

When sawing plastic or hardwood, a jigsaw blade will cut with less friction, and therefore remain sharp longer, if it is lubricated with candle or beeswax. Unlike oil, the wax will not soil the work.

Mitered edges of craft work can be protected from nicks while awaiting assembly by covering them with masking tape creased down the center. Tape is peeled off just prior to assembly.

One C-clamp often may be made to serve as two clamps by using short lengths of steel angle under both jaws of the clamp. These steel "pads" will distribute the clamping pressure over a greater area.

Tool stops at the ends of a lathe tool rest will prevent the chisel from accidentally sliding off the end and gouging the work. Stops can be formed by upsetting the metal, or with solder.

Round bottles of varying diameters make perfect ready-made sanding blocks for smoothing contours and concave molding. Abrasive paper is wrapped around bottle and held with adhesive tape.

OIL BURNER CHAMBER RELINED WITH "CERAMIC" FELT

Damaged Ceramic linings in oil-burning home furnaces can now be relined with "ceramic felt" at a fraction of the cost involved when the customary firebrick-relining job is made, according to Socony Mobil Laboratories. Reason for the smaller cost is a drastic reduction in installation time; ½ hr. for ceramic felt and about 6 hrs. for removal and replacement of a brick lining. The latter must be installed by a competent repairman, but a felt lining can be installed by the homeowner at a considerable saving.

Originally developed for insulating aviation jet engines, the new material is made of alumina and silica fibers bonded together to form a flexible blanket-like substance. Manufacturers of two of these products now on the market report that as a combustion-chamber lining, it weighs much less than a brick lining, permits the furnace to develop maximum temperature faster and reduces noise.

Ceramic felt may be purchased in mat form, or as a kit that consists of a stainless steel outer liner and enough felt material for most any installation. The outer liner helps to keep the felt in place and provides a rigid backing. Mat thickness of ½ in. and a density of 10 to 12 lb. is recommended. The material may be installed in any damaged brick, precast or steel combustion chamber that has enough strength to serve as a retainer for the new...
liner. It should not be used when the bricks in an existing chamber are oil-soaked due to a misfire, in which case a new brick lining is needed.

The usual repair procedure is to first remove the access plate of the furnace and obtain the following measurements: diameter of the chamber, chamber height, distance of blast tube from chamber floor and diameter of blast tube. Then place the mat on a flat surface, outline the liner to be cut from the above dimensions, and cut it to fit as shown in the drawing below left. To find the liner length, multiply the diameter of the chamber by 3.14 and add 6 in. for overlap at the ends. Allow 1/2-in. clearance around the blast tube, and locate the hole for the latter about 6 in. from one end so that the lap occurs close to the tube. Use a pair of heavy scissors or a knife to cut the felt. Installation of the liner is easy. Simply roll it up as in the illustration above and place it in the chamber so that the end with the hole can be slipped over the blast tube. Then push the liner into position against the old chamber wall as shown below and the furnace is ready to go again. 

FEBRUARY 1960
Reels in Electric-Fence Wire
With Auto Starting Motor

The hard work involved in winding up electric-fence wire is entirely eliminated with this simple device. An automobile starting motor is used to drive a shaft by means of a V-belt. The shaft is mounted between two water-pump bearings, and the original spool is fitted on one end. By using a reduction pulley, the shaft turns at about ⅛ the speed of the motor, furnishing enough power to reel the wire in at a safe handling speed. Mounted on the front of a truck on an A-frame, the device reels ½ mi. of wire in a few minutes.

Heavy Asphalt Building Paper
Cut Without Grab or Binding

Small difficulties in routine jobs can slow progress considerably. For example, it is hard to make a clean cut in asphalt or other heavy building paper because the edge of the paper will often pull and gather in front of the knife blade. The job can be simplified if the roll is placed face down, as illustrated, and the cut is started about 2 in. in from the edge. With a sharp linoleum knife, cut across the paper and then cut the remaining 2-in. margin.

Daniel Bousha, Jackson, Mich.

Belt-and-Pocket Hints
For Wandering Pencils

A rubber band looped several times around your belt makes a convenient pencil holder. The pencil will always be in reach and won't be broken when you bend over, as it often is when carried in a trousers pocket. If you carry several clip-on pens and pencils, a shirt breast pocket is a good place to keep them. However, they may be hard to clip on and remove from a shirt made of heavy material. In this case, fold a piece of celluloid over the edge of the pocket. This saves much tugging and prevents frayed pocket edges.

R. Hanscom, Elmhurst, Ill.

Hats Stored and Protected
In Hanging Closet Shelf

A convenient place in which to store hats is made by cutting away the top and one end of a cardboard box and tacking it to the underside of a closet shelf, as illustrated. In cutting away the top, leave a strip about 2 in. wide on each side. The strips are then bent outward and the tacks inserted through them. If desired, a box of greater length may be used. Cut away one side instead of an end and attach the box in the same manner. This will allow you to store several hats safe from crushing or soiling.

G. E. Hendrickson, Argyle, Wis.
THIS LIGHT-CONTROL UNIT places complete control of the floor lamp or other room lights at the home-movie or slide projectionist's finger tips, making it unnecessary to grope in the dark for the light switch. The unit consists of two 61 Amphenol female receptacles (with removable mounting plates), a toggle switch and a 61 Amphenol male plug, all mounted in a small metal box. The male plug, leading to the current source, is wired directly to the projector receptacle. This in turn is wired to the lamp receptacle with the “hot” wire running through the switch as illustrated. If desired, a tape recorder or phonograph may be used with the projector. In this case, an additional female receptacle is wired directly to the male plug and to one of the light leads, as shown in the illustration at the right. The additional receptacle is also “hot” and current is controlled at the phonograph.
Solving HOME PROBLEMS

1. THE SPUTTERING OF CANDLES can be disturbing during candlelight dinners or on other occasions where a hushed atmosphere is desired. To avoid this annoyance, first dip the candles in a can of thinned shellac. The candles will burn quietly and evenly all through the dinner or ceremony.

2. WOODEN KNOBS on doors and drawers often persist in coming loose no matter how many times you tighten them. The problem is permanently solved by tightening the mounting screw and then driving a wire brad into the knob from inside the drawer or door. On hardwood knobs, a dab of glue will do.

3. SKELETON KEYS often are left in the door purposely for the sake of convenience and are just as often lost. To keep them from falling out or to prevent children from taking them, place a strip of adhesive tape across the vertical slot of the keyhole, or tie them to the doorknob with a string.

4. FLOOR MOPS that are stored in corners or between a wall and an appliance, have a way of falling into inaccessible places. Prevent this by taping a shoehorn to the handle so that it hooks over the edge of the bucket. This keeps the mop standing upright while it is in storage or when it is in use.

5. CLOTHES HUNG OUT TO AIR are often carried down the clothes line before a good stiff breeze and may fall off and become soiled. No need to repeat the experience. They can be made to stay put with the use of a common fruit-jar rubber. Double the rubber over the clothes line and slip the hanger through the fold. No breeze can move them now.

6. UPRIGHT PIANOS and spinets that see hard and frequent use will invariably creep along the surface of a polished floor. To keep them the recommended distance from the wall, screw two wooden door stops of the required length to the baseboard so that they strike the piano in back at each end.

7. DON'T SURROUND YOURSELF with a pile of chewed-up ceramic tile. Cutting the tile to fit around fixtures and into corners need not be exasperating nor expensive. Use an ordinary glass cutter to score the glazed surface. Then crack the tile by placing it on a drill bit and applying pressure evenly.

POPULAR MECHANICS
LIGHTWEIGHT AND COMPACT, this portable ice-fishing shelter can be set up in a matter of minutes and offers maximum protection against wind and weather. The upright sections of the frame are 1-in. aluminum tubing, 72 in. high. The cross members are 3/4-in. aluminum tubing, 48 in. long. The ends of the cross members are closed with wooden plugs into which are inserted 3/16-in. machine screws. Two 1/4 x 1/2-in. slots which receive the screw heads are cut in one end of the uprights. The canvas is a piece of water-repellent khaki drill measuring 75 x 156 in. A 1 1/2-in. seam is sewn along the top and 2-in. seams along the tent wall as indicated in the diagram. The roof is a triangular section of canvas measuring 50 in. on each side, one side being stitched to the back tent wall. A grommet and rope placed opposite this sewn edge will allow you to secure the roof tightly. To set the tent up, measure off and mark three points on the ice at the proper intervals and drill holes here 2 in. deep. Slip the canvas over the uprights and place the uprights in the holes. Now install the cross members and pull the roof down. The 5-in. overlap at the bottom can be pulled in and weighted down to keep the wind out.

Anchored to the ice, and set facing prevailing winds, the tent offers sturdy and comfortable shelter for one or two-man fishing expeditions. Ventilation is through top joint openings.
LAST MONTH we explained how to plank the fore and after decks, trim the cabin "cockpit" and erect the cabin itself. This included the framing of the after deck and companionway hatches, as well as covering the cabin roof and hatch covers with glass fiber.

The plywood coaming around the forward deck is added next. In studying Fig. 30 you will see that the coaming appears to be a continuation of the cabin sides in that it is of the same thickness, maintains the same 5 deg. inward rake and is located in line. Across the front, the coaming slants inward 70 deg. Beveled cleats screwed and glued to the deck planking provide a base for gluing and screwing the coaming. A rabbeted molding trims and stiffens the upper edges of the coaming and a strip of 1-in. half-round molding, which extends the length of the cabin, is used to cover the rabbet joint. A knee brace adds rigidity to
8. EVER LOOK FOR A NEEDLE in a haystack? How about at the bottom of a sewing basket? Those loose needles and pins are hard to find and they can prove dangerous. A simple way to store them is to stuff a small wad of cotton into a thread spool. Be sure to pack the cotton loosely so that little pressure is needed to insert or remove the needles and pins.

9. IN AN EMERGENCY, a frozen-food container is yours for the making if you have an empty milk carton handy. Remove the staples from the carton and cut away a band ¾ in. wide from the top. Fold the top closed so that the triangular flap ends fold down along the sides. The edges of the top will now join snugly against one another and the cut-away band can be used to secure the container closed. Its size and shape make it ideal for freezer storage.
Western Book Ends for Den or Library

YOU WILL FIND this eye-catching set of book ends for the western section of your library appropriate for the living room or den. The back is cut from 1/2-in. walnut and measures 5 x 4 1/2 in. Trim and chamfer the edges and drill the bottom end with three 3/16-in. holes. The base is 3/4-in. walnut and measures 4 1/2 x 5 in. It is trimmed and chamfered like the back. Along its back edge cut out a section measuring 1/2 in. wide and 3/8 in. deep. Set the remaining strip with 3/16-in. dowels. Dowel and glue the two sections together and allow to dry. Cut the figures from 3/16-in. birch and mount and glue them into 1/4-in. slots cut into the base and back. Now finish the book ends with clear varnish and wax.
the coaming across the bow. This is placed on the centerline of the hull and screwed securely into the deck king plank. Drain holes are necessary at the base of the coaming to permit water awash to drain from the deck. These are formed through both the cleats and the coaming at the deck line. A couple of such holes on each side will be adequate. Rub rails at the sheer are made of oak and are glued and screwed in place so they project ¾ in. above the covering boards. Drain notches, called scuppers, are made in the rails about 4 ft. apart. These can be formed after the rails are in place, making them about 3 in. wide and chiseling them even with the top surface of the covering boards. The rub rail across the bow is built up in the manner shown in the section view A-A, Fig. 30. Consisting of three separate pieces which extend to the outside faces of the sheer rub rails, the top piece, called a toe rail, is shaped according to Fig. 29. Although it is cut from 1½-in.-thick stock, it is easily sprung to the curved deck with clamps. Bed it in bedding compound.

Below, water for drinking and washing is stored in tank housed in padded seat perched atop cabin roof.
and anchor it securely with flat-headed wood screws placed 6 to 8 in. apart. The edges of the toe rail should be rounded and sanded smooth. Finally, a flat molding, beveled on the bottom, is applied at the base of the coaming and along the cabin sides. Half-round molding is used to conceal the plys of the wood at the front corners of the cabin and also at the front corners of the coaming.

Two stowage seats fitted with loose cushions are added to the forward deck, but you should first waterproof the deck by laying glass-fiber cloth in a wet coat of polyester resin, followed by a second coat, as was done in the case of the cabin roof. Fig. 32 shows clearly how the seats are framed, both being alike, with lift-out panels being provided to give access to space below for stowing fenders and mooring lines. The cushions are tailored to fit from foam rubber and plastic fabric and are kept in place by mahogany trim pieces.

The combination seat and freshwater tank, which mounts on the cabin roof, can be made now. Built like a box, it is framed around a custom-made metal tank in the manner shown in Fig. 31. Three cross members cut to conform to the roof curvature, support the tank ½ in. off the roof so that water will drain under it. Actual fastening of the tank to the roof is done later. The seat cushions are standard life-preserver cushions. The tank, of course, is fitted with a filler tube and cap located under a hole covered by a swing plate.
The twin forward berths make use of the space under the deck for leg room and the plan and sectional profile views in Part I show their arrangement. Cross beams fastened to frames 1 and 2 support the part of the berth that extends under the deck and you will see in Fig. 33 that the beam at frame 2 is placed 10 1/2 in. from the top of the bottom frame member. The beam at frame 1 is placed at a point which will make the berth level (parallel) with the water line. A batten, set in notches in the beams, supports the berth plywood at the center.
Additional support at frame 2 is provided by a plywood gusset which is notched to fit over the floor battens and screwed to the after faces of both the berth beam and the bottom frame member. Fitting this gusset in place will require the removal of a section of the temporary floor. But after it is installed and cleats are applied to the gusset to support the floor, the latter can be permanently fastened to the battens. Fig. 33 also shows a support cleat across the top of the plywood gusset. This supports one end of a separate berth board which is used to provide sleeping accommodations for another person. The board is merely a panel of plywood that bridges the area between the twin berths after the ladder is removed. The board stores back under the forward deck.

Each berth extends aft to frame 3 and is framed in the manner shown in Fig. 34. A lift-out panel provides access to the space under each berth and rests in a rabbet formed around the openings with cleats. Side walls are formed by nailing 4-in. strips of 3⁄4-in. plywood to the frame side members and to the stiffeners at the bow. These strips terminate at frame 3 and are spaced 1⁄2 in. apart. Loose cushions of foam rubber and plastic fabric are tailored to fit the berths. Here, again, trim strips of mahogany are added along the edges to retain the cushions. Small blocks are screwed and glued at the ends of the trim strips to support the removable berth board.

Twin storage lockers stand at the ends of the berths, Fig. 37. While identical in overall size, the portside locker is fitted with drawers for storing dishware, whereas the starboard locker houses the drum and tiller cables for the steering wheel. Details of the two lockers are given in Figs. 35 and 36. Both lockers also have lip-type cabinet doors of mahogany, and plastic covered tops. The starboard locker has an optional access opening in the forward side which makes it more convenient to reach and service the tiller cables if and when necessary. Both lockers are custom fitted right against the side planking and the cabin sides and are notched to fit over the coaming members. Doubler blocks are used to backup the plywood for attaching the cable pulleys and the steering wheel hub in the
manner shown in Fig. 38. The latter is centered and mounted about 4 in. down from the top of the locker. Regular nylon pulleys are purchased for the tiller cables, and to save wear, metal sleeves are pressed in the cable holes previously made in the hull frames.

Before the bench-table-bed unit is framed in place, a ¼-in. plywood wall must be applied between the starboard locker and frame 6. This is fitted between the floor and the clamp members and screwed to the side members of the hull frames. Openings should be provided at strategic places in the wall to permit the cables to be reached in an emergency. Such openings would be closed with lift-out panels held with a couple of screws.

The table-and-bed unit detailed in Figs. 39 and 41 contains storage space galore. To convert the unit to a full-size bed, the table is unhooked and lowered to fill the gap between the twin benches. Supporting cleats let the table top rest flush with the benches and a separate tailored cushion brings the center section up level with the others. When the table is used for dining, the extra fill-in cushion is stored up under the forward deck along with bedding. The unit, which also provides a seat for the helmsman, is built amidships right in place.

(Continued to page 242)
Knitting Needle Keeps Tongs Out of Photo Developer

When developing photo prints, tongs for handling the wet prints usually are placed with the handle resting on the tray edge where frequently they slide into the solution. To prevent this, so that the fingers don’t become contaminated with developer chemicals, one photo hobbyist secured a 3-in. length of plastic knitting needle to each of his tongs as shown in the photo at left. A short rubber band looped over the handle of the tongs and the ends of the length of needle holds it in place.

Ken Patterson, Sask., Canada

Small Parts Storage Cabinet

Here is an excellent storage cabinet for screws, bolts, washers and other small parts used around the shop. Made of 1-in. white pine and fitted with plywood doors, the unique feature of the cabinet is the use of aluminum trays or pans in which frozen dinners are sold. The tray lips slide in 1/4-in.-wide by 1/4-in.-deep grooves cut in the cabinet walls and partition. The grooves are spaced to provide 1/2 in. clearance between trays.

B. Pedersen, Lake Charles, La.

Clothespin Used to Start Screws In Hard-to-Reach Places

When starting a screw in a place that cannot be reached with the fingers, one home craftsman grips it with a spring-type clothespin to which a screwdriver is taped as in the photo at left. After the screw has been started, the clothespin is removed and the screw is driven in the usual manner.

Harry Miller, Sarasota, Fla.

Shutoff Switch for Power Mower Made From Wooden Block and Cord

For safety a gasoline engine-powered lawn mower should have a shutoff switch within convenient reach of the operator. Such a switch can easily be rigged by attaching a length of cord to a small wooden block and inserting it between the shutoff blade and spark plug as shown in the photo at left. First it is necessary to bend the blade so that it contacts the plug when the block is removed. The other end of the cord is tied to the mower handle where it can be reached quickly in an emergency. Other engine-driven equipment can be equipped with the same type of switch.

H. Hanscom, Elmhurst, Ill.

POPULAR MECHANICS
FOR TRUMPET PLAYERS
PAST AND PRESENT

By Robert Gannon

THAT OLD beat up trumpet long stored away with musical memories of high-school days, can be put into first-class shape again for your teen-age son. Spend a few hours taking out dents, cleaning, oiling and polishing it and very likely you will have the old horn in like-new condition again. About all it will cost is a few dollars for replacement springs and washers.

Begin the repair job by disassembling the trumpet so that you can give it a thorough cleaning and note what parts are defective. The most common wind-instrument ailment is sticking parts. Slides corrode in place, the mouthpiece won't come loose and valves become sluggish.

When removing the parts that slide into one another, keep in mind that you are working with metal that is fairly soft and thin. Use force with caution. First saturate the joint with penetrating oil, allowing at least one hour for it to dissolve gummy residue formed between the telescoped surfaces, before trying to separate the parts. Then, in the case of a stuck mouthpiece, hold the instrument as shown in the photo below and tap the receiver with a rawhide or wooden mallet, working around it once or twice. If this fails to loosen the part, hold the receiver against a softwood block and strike it slightly harder than before. As a last resort, wrap the mouthpiece in several layers of cloth and clamp it in a vise. Then tap the receiver while pulling on the trumpet.

A good way to loosen a valve slide is to apply penetrating oil to the joint, loop a rope through the
Crook and then clamp the ends in a vise, so that the part can be jerked free as in the drawing on page 201. If it fails to come loose, apply heat to the telescoped portion and try again, being careful not to melt the solder on attached parts.

When disassembling the three valves, you may find that the top and bottom caps can’t be budged by hand. Don’t use a pair of pliers to remove them, but follow the penetrating-oil mallet-tapping routine described. A piston that is stuck in its lowest position, making it impossible to get a good grip on it, can be removed by unscrewing the button from the stem and connecting a bolt or nut to it, depending upon the construction of the stem. If the piston cannot be removed by hand, apply oil from both sides and tap the stem, driving the piston out of the casing.

After the instrument has been disassembled, soak all the metal parts for two hours in a strong solution of water and detergent. Then work a soapy cloth through the tubular parts, rinse all parts with clean water and dry them with a chamois. Wrap cloth around a pencil or toothpick to clean small slots and orifices. When reassembling the valves, coat the pistons with a grade of oil recommended by the manufacturer and be sure to install them in the right casings. If the pistons still stick after cleaning and oiling them, the following should be done. Coat the pistons with a thin film of Lava soap, lathered and applied with a shaving brush. Then work each one into its respective casing until the action feels smooth. Add a few drops of water as needed to keep the soap fluid. Clean, rinse and oil the pistons again before reassembling. Valve
springs and worn leather or felt valve washers should be replaced. New ones can be purchased at most large musical-instrument stores. The portions of parts that are fitted together when reassembled, also should be coated lightly with oil. The cork washer on the water key must close tight against the nipple on the tuning slide. If the cork is worn, dig it out and replace it with a new one, using shellac for cement. When doing this, hold a dime between the nipple and cork and press down on the key to seat the cork properly.

Although most dents are not likely to be deep enough to affect the tone quality of a trumpet, they do detract from its appearance. To remove a dent in a tube that is straight from the open end to the dent, a tapered metal rod is used as indicated in the drawing, page 202, left center. The rod should be of solid stock ½ in. less in diameter than the tube. After grinding the rod to a blunt, tapered point, it is inserted in the tube and tapped through the dent area gently, being careful not to tear or batter the metal.

If the dent is in a crook of a tuning or valve slide, you will have to use a ball bearing and a driver to straighten it as shown in the drawing. The driver, cut from the unthreaded portion of a bolt, is of a length and diameter that will just pass the curved section of the tube. The edges are ground round to avoid scratching the tube. The ball used should be of a size that will permit it to lodge between the dented and undented walls of the tube when dropped into the open end. After the ball has been lodged in place, the driver is dropped into the tube and it is swung in an arc so as to cause the driver to strike the ball. The ball and driver are greased with petroleum jelly to reduce abrasion and prevent them from becoming stuck unintentionally. For deep dents it may be necessary to use several sizes of balls, starting with one that is slightly larger than the passage at the dent and changing to larger ones as the dent is worked out.

A bent mouthpiece can be straightened without much difficulty. Simply block it up in a vise to apply leverage at the desired places as shown in the photo at the bottom of page 202. Use softwood blocks for this purpose to avoid marring the metal. Softwood also forms easily to the contours of the mouthpiece when pressure is applied, providing a better grip.

A first-class trumpet restoration also includes a polishing job. This should be done with a 6-in. buffing wheel turning at 3500 to 4000 rpm. Red or black rouge may be used for a buffing compound. Buffing, of course, cannot remove scratches.

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Small Stock Clamped on Holder Can’t Spin When Drilled

To avoid the danger of having thin stock spin suddenly when the drill bit breaks through it, one safety-minded home craftsman uses a paddle-shaped holder to which the stock is clamped as shown above. The clamping feature is provided by four bolts with washers and wing nuts fitted in slots cut diagonally in the holder. These permit stock of various sizes to be clamped quickly in place. Plywood ¼ in. thick is ideal for this purpose but other thicknesses may be used as well.

M. Robert Beasley, Jackson, Mich.

Spray Adjustment Won’t Work When Shower Head Is Blocked

When the head of a shower pours forth a thick stream of water regardless of how the spray is regulated, it is quite likely that the holes are stopped up. To correct this, remove the head and scour the inside surface with steel wool. This will dislodge the hardened material from all but a few holes. To clean the latter and remove remaining particles from the other holes, thread a darning needle having a maximum diameter slightly less than the holes and pass it through each one. The needle does a good job of removing loosened material when threaded with coarse yarn or string.
WHEN YOUR KITCHEN SINK gets stopped up, or the toilet threatens to flood the bathroom floor, what do you do? These and other plumbing breakdowns require prompt attention, immediate in some cases, if water damage and a hazard to health are to be avoided. Since it is not always possible to obtain the services of a plumber right away, especially on weekends, every householder should know how to go about correcting common plumbing failures. Or, at the very least, know how to make emergency repairs.

When a sink drainage line is allowed to become blocked with debris, the quickest relief usually is obtained by clearing the line mechanically with a drain-trap auger, Fig. 1, detail A. This should be 15 to 20 ft. long and have a crank similar to the one shown. The usual procedure for cleaning an obstruction is to remove the trap below the sink and work the auger down the drain pipe as in Fig. 3. A good technique to use when forcing the flexible part through a tightly clogged pipe, is to make short thrusts, pulling it outward an equal distance each time. The crank permits rotating the auger to help pass turns in the line and to “drill” through troublesome obstructions.

If the obstruction cannot be reached from the sink location, the auger is inserted through entry points at various locations in the line as indicated in Fig. 1. At each of these entry points there is a cleanout fitting, detail B, from which the plug must
be removed so that the auger can be inserted. Such plugs often rust tight, requiring a large pipe wrench to start them. When replacing a plug, clean the threads and apply cup grease to prevent rust seizure.

When a toilet trap becomes clogged, water in the bowl may overflow to the floor. If this happens, the flow can be stopped as follows: Quickly remove the tank lid and press down the tank ball, which seats in the drain opening at the bottom as indicated in Fig. 2. Then let the tank fill again.

A closet auger, Fig. 6, detail C, is used to clear such obstructions. Paper obstructions usually can be shredded by an auger. When you think that the material has been broken up, flush the toilet but be on guard to stop the tank discharge again if necessary. Sometimes solid obstructions become wedged so tightly that the bowl must be removed to dislodge them, involving the services of a plumber. A basement toilet may also overflow due to backflow from the sewer.
Pinpointing Stoppages

Often you can save time on a cleanout job by pinpointing a stoppage and then reaching it through the closest entry point. For example, if a dishwasher doesn't drain and water from the sink backs into it, the stoppage lies beyond the sink. Similarly, if water draining from a lavatory causes water in a toilet bowl to rise, there is an unrestricted passage between the two, and the obstruction lies farther away. If the discharge from all taps in the house causes water to rise from the lowest drain, it is evident that the house drain or house sewer is obstructed beyond this point.

The most common cause of stoppage in a house sewer (the line from the house to the city sewer or to a septic tank), is invasion of tree roots that sometimes get through cracks in pipe joints. Such obstructions can be drilled out as a temporary relief measure. This is done with a power auger fitted with a root cutter, such as are used by plumbers, Fig. 5. A flat spring-steel sewer rod fitted with one of the root cutter attachments shown in Fig. 4, often is effective. The roller ball is used for moving debris through the sewer.

Backflow from sewers often occurs during heavy rainstorms when sewers become overloaded. A temporary measure to stop or retard backflow through a basement floor drain, or toilet, is shown in Fig. 6 and detail D. The best permanent remedy is to install a backflow valve as indicated in Fig. 7, installed so it can be serviced later.

Water-Heater Leaks

A steady stream of water coming from a water heater drain cock, or safety valve also constitutes a plumbing emergency. Likewise, water dripping from the bottom of the heater, which usually indicates a defective tank, needs immediate attention. In all such cases the first thing to do is to turn off the heat source and cold-water supply at the heater, then drain the tank.

The safety valve usually is located at the top of the tank on the hot-water line where it is shown being removed in Fig. 8. There are two common types of valves, combination pressure-and-temperature, and pres-
sure alone. The former type has a fusible plug that melts when subjected to excessive water temperature, opening the valve to relieve pressure. Only the plug need be replaced. The pressure type simply opens a valve when tank pressure exceeds the safe limit. The valve itself may develop a slight leak as a result of solid particles getting on the seat, preventing it from closing completely. This can be remedied by removing the valve and cleaning the seat. After restoring the valve to operation, check the operation of the thermostat, which turns the heat source on and off as necessary to maintain the desired water temperature. If it is overheating, try a lower setting. If the water temperature again becomes excessive, the thermostat must be checked by a service man. Never use a water heater without a safety valve. When not regulated, it can develop enough power to blow itself through the roof! A leaky drain cock may simply be in need of a new washer.

Water pipes seldom develop leaks, except when subjected to unusual strain. Fractures from strain usually occur at the threaded ends where the wall thickness has been reduced. Constant vibration from excessive water hammer may cause a leak. Pipes also may burst from freezing. To make a temporary repair for a leaking pipe, first close the main valve near the meter. Then allow the remaining water to drain from the system. Saw off the defective portion of pipe and install a length of hose as shown in Fig. 9, detail E. A permanent repair can be made later.

Water and drainage lines that freeze shut can be cleared by several different methods, if they are accessible. Cloths may be wrapped around the frozen section and constantly soaked with hot water. An electric iron placed in contact with the pipe can be used for thawing a short section of frozen pipe. A more direct approach, involves disconnecting the pipe from the line at one end and pouring hot water into it as shown in detail F. On a water line, thawing should be done from the faucet side of a frozen pipe, after the faucet has been opened to relieve pressure and permit the water to run when the ice melts.

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**EMERGENCY REPAIR OF WATER-SUPPLY LINE**

- Burst portion of water pipe
- Damaged section removed
- Auto hose removed
- Clamps

**FROZEN SECTION**

- Boiling water
- Small pipe or tubing

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NEEDING A rather heavy anvil for many of his repair jobs, a farmer made the one shown from a short length of railroad rail and a few other odds and ends. A tapered piece of shafting welded on one end of the rail serves as a horn. For a base, the anvil is welded to one end of a length of pipe that is welded to a car brake drum at the other end. The drum provides a sturdy base and permits the anvil to be rolled easily from job to job.

FARM SHOP IDEAS

EMPTY OIL CANS on which the tops have been opened halfway and crimped on the inside, provide convenient storage for bolts and nails. Cans are placed in partitioned crates as in the photo A at far left.

SEVERAL LENGTHS of square pipe welded on end to a flat-steel base, photo B, make a rack for “filig” welding rods according to type and size. Saves trips too, when repairing machinery away from shop.

FOR EASY handling of long work on a table saw, make the rest shown in the photo far left. A setscrew on the upper, telescoping pipe section permits raising the roller and locking it at the height desired.

TO AVOID finger bruises from glancing hammer blows when nailing sheet-metal roofing, use a prick punch to make pilot holes. A handle welded to the punch as shown at left, further protects the fingers.
Double-Decker Nail Tray

WHEN LOOKING FOR a particular size nail or screw, you won't have to dig through a mixed assortment of light hardware if you use this double-decker nail tray. With two levels and seven sections, the tray offers a convenient means of sorting different kinds of nails, screws, nuts, bolts etc. The top tray is the smaller of the two, measuring 3 x 9 x 12 in. The sides and partitions are of 3/4-in. pine and are secured with small nails and wood screws. The bottom may be cut from the same weight stock or a lighter 1/4-in. stock may be used. The bottom tray measures 5 x 6 x 12 in. and its parts are similarly secured. Two 3 1/2 x 12-in. uprights are screwed to the trays. A 3/4 x 13 1/2-in. dowel connects the uprights and serves as a handle. Designed for easy storage the tray does not sacrifice carrying capacity. Sand and finish all parts with stain or light varnish.

Sam Fenn, Skokie, Ill.

Nail trays like this one can be made for storing small radio and electronic parts. Vary the sizes and shapes of the tray partitions to accommodate the different parts.

Wooden Block Resets Snap Ring

To replace a snap ring, bore a shallow hole in one end of a piece of wood. Its diameter should be slightly smaller than that of the ring. Place it over the ring and give the wood a sharp rap with a hammer.

Use Paste Wax on Rubbing Job

Don't ruin a piece of work in the last stages. Heat generated in rubbing a shellac or lacquer finish with steel wool can ruin the finish. You can avoid this by using paste wax as a lubricant.
LIQUID RUBBER
Jack of All Trades

By Walter E. Burton

NEW ON THE MARKET is a type of rubber-surfacing and repair compound that permits the home craftsman to apply a rubber coating of the desired thickness on most any object, a process that could formerly be done only in a factory. Whether it's a tear in a rubber girdle or a punctured tire that needs repairing, a coat or two of this wonderful fluid will extend the useful life of the damaged item. While the preparations of different brands vary somewhat, their application procedures and long list of uses, some of which are pictured in this story, are quite similar.

Primary uses of liquid rubber compounds are to stop corrosion, waterproof fibrous materials, provide a non-skid, resilient surface on boat decks and floors and mend almost anything. One brand, Pro-Chem, is available in 1 pt. to 5-gal.-size containers in black, gray and aluminum. The product may be applied from the container with brush or roller, or it may be thinned for spraying. Small items, such as tool handles that are to be given a more comfortable gripping surface, or insulated for electrical use, may be dipped directly into the can.

Another brand comes in tubes from which the material is applied directly to the repair area, or it may be squeezed into a container and mixed with water to the consistency desired for a particular application. The number and variety of uses for this product, called Flex-O-Fix, is about the same as for Pro-Chem, except that the small-size container of the former precludes

Coat of liquid rubber brushed on floor mat fills small cracks and cuts, giving it like-new appearance
Wooden planter is made watertight by brushing three coats of liquid rubber on inside surfaces. Corners of large boxes should be reinforced, using screening strips laminated between first and second coats.

Right, camera-lens board having numerous scratches on inner face is coated with black liquid rubber to prevent reflections from shiny exposed metal.

Below right, liquid rubber brushed on worn areas of rubberized canvas gloves prevents them from leaking.

Below, dip-coating handles of chain pliers with liquid rubber produces a more comfortable grip, prevents corrosion and insulates them electrically.
using it for anything but small jobs. Because of the many uses for this versatile repair and surfacing material, other brands may be available by the time this is read.

**Application Procedures**

As with the application of any coating material or cement, the surfaces to receive liquid rubber must be free of dirt, oils and loose material. Otherwise it will be impossible to obtain a good bond. Sand smooth surfaces, such as rubber, leather, plastic and metal, using coarse-grit sandpaper. Be especially thorough about these first two steps. Regardless of what is used to apply the compound, flow it on in one direction. Do not scrub it on. Since newly cured liquid rubber tends to adhere to smooth surfaces if pressed hard against them, dust the rubber with talcum powder to prevent this.

When filling holes and cracks, taper the edges of the rubber fill to a thin edge before it sets. Holes in material where there is access to both sides, such as a car tire, should be filled from both sides of the casing to form a dumb-bell shaped patch.

When repairing a large hole, such as the rusted-out spot on the downspout shown in one of the photos, it is necessary to provide a patch of some sort to bridge the gap. In this case a piece of window screening was used. First the repair area is cleaned and given a coat of liquid rubber. When the surface becomes tacky, the screen patch is pressed into it and a second and third coat is applied, allowing about 1 hr. drying time between coats. For repair of holes in other materials, cut a patch from tape, gauze, canvas or other material as best suits the repair situation. Where extra strength is required and it is possible to reach both sides of the repair area, apply a patch on

Broken cloth hinge on sheet-film holder is repaired by laminating cloth strip between multiple coats of liquid rubber applied on holder and strip. Latter is pressed in place on the second, tacky coat, following which two additional coats are applied

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Hole in canvas shop apron is repaired by coating cloth patch and area around hole with rubber compound, then pressing them together. For good bond, patch and repair area should be water-dampened first.

Bead of liquid rubber applied along cut edge of rug prevents fiber "fallout," serves as neat binding.

Chipped spots on enameled photo-darkroom tray are coated with rubber compound to prevent rust damage.
each side. Follow the same procedure and overlap the hole by about one-half its
diameter. With all liquid-rubber products it is important to remove unwanted ma-
terial before it sets. Brushes should be cleaned immediately after using. Use sol-
vents recommended by the manufacturer.

When using liquid rubber to skid-proof a boat deck or any other surface, the follow-
ing 2-coat application procedure is recommended by one of the manufacturers: Flow
on the compound after preparing the surface to be coated. Next sprinkle foundry
grit or fine, dry sand evenly over the first coat while it is still wet. When the latter is
dry, brush off loose grit and add a top coat to seal in the imbedded grit.

Make Rubberized Items

With liquid rubber you can convert objects for other than their designed use, or
even make new ones. Canvas work gloves and aprons can be changed to rubberized
ones simply by brushing on a coat or two of one of these products. Processing trays
to accommodate extra-large prints can be made by coating cardboard cartons of the
desired dimensions. To replace broken parts that are unrepairable, new ones can
be fabricated from corrugated cardboard and other materials assembled and coated
as shown in the photo and drawing at the bottom of this page. Play pools for children
and flower ponds are made by applying two coats of liquid rubber to a frame or form
shaped as desired. Above ground the form must be a rigid enclosure. Below the ground
surface no lateral support is necessary so that fabric, construction paper or any other
flexible material may be used as a liner after excavating to the desired shape. Or,
for a waterproof, rubber-coated work area in a darkroom, greenhouse, studio, or work
shop, clean the surface to be set aside for this purpose and apply liquid rubber. ***

Floating lid for film-processing tank is made from corrugated cardboard disk covered with four coats of
liquid rubber, after edges are taped. Cork handle is laminated in place during application of last three coats

Three coats of liquid rubber on vase bottom prevent it from marring table. Rubber must cure completely
before placing item in use. Porous vases can be made watertight by coating insides with liquid rubber

Hook portion of wire clothes hanger dipped in rubber compound prevents it from scratching wardrobe rod
Overlapped Molding Strips
Insure Accurate Miter Cut

Accurate miters can be cut in light molding by overlapping the molding strips. Cut the stock ½ in. longer than the measurements require. Overlap the strips at right angles and fasten each of them down with a tack. Saw through both strips as indicated in the illustration and secure the joints with brads or glue. Cut in this manner, the miters will fit perfectly, regardless of the angle of the cut.

After sanding a piece of wood, the remaining sawdust can be used to make a good patching paste for filling holes and cracks in wood. Mix the sawdust with a little white resin glue. If the sawdust used is from a neutral-colored wood, such as pine, the patched area can be stained or varnished to match any other kind of wood.

Cords Kept From Underfoot
With Large Battery Clips

With a large battery clip the excess length of an extension cord is held out of the way by doubling part of the cord back upon itself. Attached to the wall or ceiling, several of these clips will lead and position a cord where it is needed. One or more clips can be set to travel the length of a brass or steel rod set overhead above the workbench. The cords from hand power tools and trouble lights are then easily moved where needed and will never be underfoot.

Scoring With a Sharp Chisel
Makes Clean Cut in Hardboard

For a sharp clean cut in a piece of tempered hardboard, score both sides with the edge of a sharp chisel. Repeat the scoring process several times on each side, place the scored line along the edge of the workbench and apply pressure. The result is a faster, cleaner separation than can be had using a saw.

Small cracks in concrete walks and steps should be repaired quickly to prevent them from spreading. Sweep the crack, wet it down and brush in a flowing mixture of portland cement and water. For a medium-sized crack, undercut the edges and fill it with a mixture of sand, cement and water. For large breaks, add gravel to the mixture.
COPY-CAMERA MOUNT

ONE IMPORTANT REQUIREMENT for photographic copy work is a firm camera support. You can convert a drill press into a copying stand by adding this easily built attachment. For vertical copying, subject-to-camera distance is adjusted by sliding the table up and down the column. Finer adjustments within a range of 7 in. are made with a handwheel and screw arrangement. The mount is cut from 3/4-in. plywood, the base fitting into horizontal grooves cut into the sides and secured with glue blocks and wood screws. The adjustable camera platform, detail A, operates by means of a 3/8 x 15-in. threaded rod running vertically through two cross braces. These are secured horizontally to the front top and bottom of the mount. The rod is turned by means of a hand wheel and screws through a 3/8-in. hex nut soldered to an angle iron fitted to the bottom brace. The brass guides on either side of the platform move in 1/4 x 3/4-in. grooves cut into the sides of the mount, and the camera is secured to the platform with a bolt screwed into the camera's tripod attachment. Any play in the platform is taken up by the four metal guides which are adjusted for a good sliding fit.

Howard R. Clark, Springdale, Ark.
Trouble Shooting

THE TOUGH ONES

By Ben Davis

Occasionally a repair job will come to the troubleshooter as the result of a previous do-it-yourself repair job. An example was a '57 Ford that was driven into the shop with the complaint of no oil pressure and no generator charging. This might have been an ordinary case of several malfunctions but for the fact that the trouble occurred only at night. Right then and there I decided that the trouble must be in the electrical system, a supposition which turned out only half-right.

The red tell-tale lights that fold of generator or engine-lubrication troubles went out normally as the motor was speeded up—until the light-switch was pulled out. Then the two lights glowed. Despite this, checking by a meter proved the generating system and oil pressure were O.K.

Now, suspicion swung to the wiring. Maybe some of the bulb sockets had been placed in the wrong dash panel openings. Certainly it wasn't too difficult to switch two lamps, like an instrument light and a generator tell-tale. Yet, checking the wiring colors proved everything proper in this respect. At about this time it was learned that the owner had taken out the speedometer for repair. Evidently, then, something had been altered in the earlier repair job. And so it was. The shielding around the speedometer had been misplaced. Therefore, when the lights were turned on, the reflection of the instrument lamps through the speedometer housing holes made it appear that the oil pressure and generator lights were also lit. Setting the shielding properly stopped the trouble.
Unusual Locations Where Trouble May Occur

Rambler Hood Latch
If you haven’t already experienced trouble with the hood latch on the ’59 Rambler failing to release, be prepared, for it may do so. Push in on the latch post through the grille. It is best to use a blunt tool, such as a screwdriver. After opening the hood, the latch plate should be adjusted by means of the two \( \frac{3}{8} \)-in. (wrench size) screws. Generally the latch needs to be moved back.

Plymouth Driveshaft
More than one driveshaft has already been replaced on the ’57 Plymouth due to its snapping and tearing away from the weld near the rear universal joint. This is especially true of the V8 car with automatic transmission. Whenever you have one of these cars on the lift, why not inspect the joint for signs of a fracture? You may save a customer an embarrassing experience. Failure of the joint will mean a new propeller shaft.

Chrysler Handbrake
If the handbrake on a ’58 Chrysler pulls all the way back but does not hold the car, even after adjustment has been made, check the firmness of the brake-lever support. The lever bracket is welded to the firewall on the driver’s side and sometimes breaks loose. The photo shows a similar arrangement on the ’57 model where the cable passes through the cowl. Reinforce the weld joint with a bolt and nut.

Air Filter Lock Washer
Under the air filter supporting stud of many ’56 and ’57 Ford V8s there should be a lock washer. However, over tightening of the filter nut on this stud may result in the stud screwing out of the base with the result that the washer may drop into the carburetor unnoticed. This, of course could result in expensive engine damage. You should check this washer carefully, or even remove it.

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NOT MANY HOME SHOPS and small woodworking shops are equipped with a single surfacer, or thickness planer, for finishing rough-sawed lumber or reducing finished stock to a required thickness. Where only an occasional piece requires finish planing from the rough, or when a few small pieces of stock must be reduced to a given thickness, the outlay for a small surfacer is hardly justified.

Lacking a conventional thickness planer, you still can turn out good surfacing and thickness planing jobs with accessories available for use on a drill press or circular saw. Even a small jointer can be made to serve when drill-press and table saw accessories are not at hand. A planer head, Figs. 1, 2 and 4 is perhaps the most commonly used for both rough planing and surfacing stock to thickness. A molding cutter head fitted with square-edged cutters and mounted on the saw arbor also is an efficient tool for planing rough stock and reducing stock to thickness. The setup is shown in Figs. 12, 13 and 14.

The planer head: Although the planer head, Figs. 1 and 2, can work in a speed range from 3000 to 9000 r.p.m., it generally does its best work at a speed of about 5000 r.p.m. The vertically-mounted knives are positioned in the head to combine a shearing and scraping action and cut exceptionally smooth and clean when they are sharp. Knives should be honed with a hand stone about every 20 minutes of actual cutting time and should be reground.

POPULAR MECHANICS
An auxiliary table is necessary to assure adequate support for large pieces of work when using a planer head on the drill press. Note construction of the pivoted fence to permit quick, easy adjustment after three or four honings. A simple setup for grinding can be made with an angle vise, Fig. 3. When using a planer head an auxiliary table made of plywood, Figs. 2, 4 and 5, is needed to provide a solid support for average-size work. If the work is warped or rough sawing is irregular, it may require nailing to a base block having a flat surface, Fig. 4. Actual cutting is simply a matter of pushing the work under the cutterhead, feeding from left to right as in Figs. 2 and 4. Down pressure needed to keep the work flat on the table may be obtained with a weight as in Fig. 2. Each pass of the work will surface a strip 2 to 2½ in. wide and work up to 12 in. or more in width can be handled by making successive cuts. If you use a planer head on the drill press, Fig. 2, make sure the chuck is tight on the taper.

Above, set rear jointer table so that knives move test block about ½ in., no more. Below, adjust the front table for depth of cut with piece of thin sheet metal, about .025 in. thick.

When surface on a jointer it's always best and safest to use a pusher. Either type detailed enables you to hold the stock firmly and at the same time feed uniformly throughout length of cut. Metal weights can be used.
spindle so that it won’t loosen when side pressure is applied. Some chucks permit attachment to the spindle with a machine screw as in Fig. 1.

The jointer: A 6-in. jointer will surface a board 6 in. wide in one pass, and work up to 12 in. wide can be surfaced by making two passes of the stock. Unless you make careful adjustments of the jointer you may not get good results. The rear table should be slightly lower than the cutting circle of the knives, just enough so that the knives, when turned by hand, will move a test block forward not more than 1/8 in., as shown in Fig. 6. The depth of cut on a full 6-in. board should not be more than 1/32 in. and preferably a little less. Use a piece of sheet metal about .025 in. thick to set the depth of cut as in Fig. 7. Jointer knives hold a keen edge for about 1 hr. of actual cutting time. They should be honed regularly and systematically, and should be reground after four or five honeings. Applying the right amount of pressure to hold a uniform depth of cut when surfacing on a jointer requires some practice. Use of a pusher, Figs. 8 and 9, or holddowns and an auxiliary fence, Figs. 10 and 11, make the job a lot easier and safer. The operator should stand alongside the machine where he can use his body weight to best advantage, Fig. 9. Down pressure is applied mainly with the left hand, the right hand being used for feeding the material. The pressure should be over the front table at the start of the cut. The hand then moves over the cutterhead and becomes stationary over the forward part of the rear table. Unless you are experienced in this, you’ll do better using a pusher and you’ll also feel safer. The pusher should be ample in all dimensions as in Fig. 8.
The type having dowel handles can be loaded with one or two metal weights to steady the work and lessen the amount of hand pressure required. The feed should be very slow, and, of course, should be continuous. If you have to shift your pressure hand, stop feeding as even the slightest amount of feed without down pressure will cause you to lose the "bite" and the cut will tend to taper off.

Both manufactured and shopmade hold-down devices in a wide variety of styles can be used on a jointer to eliminate the need of hand pressure. One simple setup is made as shown in Figs. 10 and 11, using either the wooden spring hold-down or the flat-steel spring. With the springs supplying the needed down pressure, all you have to do is maintain a uniform rate of feed, running the last few inches safely by using a push stick in the manner shown in Fig. 11.

**Molding head:** Successive cuts with straight knives fitted in the circular saw molding head will quickly surface a rough piece of lumber. Most work will be sufficiently flat so that it will ride without rocking, but uncut strips must be left along the edges to provide runners, Fig. 13. If the work is warped it should be leveled on a flat surface and runner strips nailed in place as in Figs. 13 and 14. Cuts to 3/16 in. deep can be taken. The maximum width of work which can be handled depends on the size of the main saw table. Open-type extensions do not provide adequate support. In running adjacent cuts by this method, the ripping fence is moved after each pass. You'll do better work if you adjust the fence so that the cuts overlap about 3/16 in.

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**Dowels Held for End-Drilling By Improvised V-Block**

Did you ever try to drill an accurate hole in the end of a short length of dowel in the drill press? It's a neat trick if you can do it without having the dowel tilt sidewise or spin and burn your fingers unexpectedly. Here's a way to eliminate all the chances of trouble: Square a block of hardwood of a length slightly less than that of the dowel. Then cut two sections from an old V-belt and tack these to one face of the block as in the detail. Space the pieces so that they support the dowel as in the top view.

Clamp them in place and nail to the block, making sure that the two are in line. Then make the setup as pictured, clamping the dowel lightly in place with a C-clamp. Just make sure that the block bears squarely on the table.

G. E. Hendrickson, Argyle, Wis.
ONLY A FEW of the many forms of the dovetail joint are considered practical for cutting by modern machining methods. Originally, all types were designed, laid out and cut by hand. You will find nearly all types in old work. On old chests the rails were often joined to the side or end panels by means of a single lap dovetail, Fig. 8. Tops of early chests were sometimes joined to the side panels by multiple dovetails, Fig. 2. The old type corner dovetail in which the pins, or tails, are relatively wide, Fig. 10, was quite commonly used in corner-joining wide stock for blanket chests and deep drawers. Sometimes the beveled dovetail joint, Figs. 11 and 12, will be noted in old dough trays, also cutlery trays. Other variations such as the dovetail key, Fig. 9, blind miter dovetail, Fig. 3, and the dovetail dado, Fig. 7, will be found. The blind miter dovetail is rather difficult to cut as the full miter cut cannot be made at the outset on either of the joining pieces. The miters are formed when cutting the sockets and pins. Such a joint was used only in the most painstaking work. The multiple dovetail joint, Fig. 2, the lap dovetail, Fig. 4 and the box joint, a related form, Fig. 6, are commonly used in modern joinery. The single exposed dovetail is sometimes found in modern work as an ornamental feature. Figs. 13 to 18 inclusive show hand methods of laying out and cutting sockets and pins. In present-day joinery sockets and pins are made a uniform size, unless, of course, older types of work are being duplicated.
Extension on Rip-Fence Guide Clears Table for Cross Cuts

When frequent removal of the ripping fence is necessary to clear the saw table for cross cuts on long, narrow stock, an extension welded onto the front fence guide will save time by permitting the fence to tilt downward out of the way. On table saws having round fence guides, an 8-in. length of steel tubing welded to the guide will permit you to slide the fence out far enough to allow the rear end to drop down as pictured at the left.

Wayne Judy, International Falls, Minn.

An open-end wrench can be used to turn a small pipe. Insert a wood screw between the work and the lower jaw of the wrench. The threads will provide the grip necessary to turn the pipe.

Drill Reground for Wood Working

A twist drill can be reground to drill a clean, true hole in wood. Just grind the point of the drill square across and re-sharpen the two cutting lips with a relief angle of about 30 deg. back of the cutting edge. Do not grind the flat lips all the way to the center. Leave a sharp pointed spur at the center to act as a pilot.

H. J. Gerber, Stillwater, Okla.

Precut Disk-Cement Tube For Convenient Application

Application of sanding-disk cement is made easier and more convenient if you cut the tube into sections about 1/8 or 1/4 in. in thickness. The sections are always ready for use and the cardboard is easily peeled off with a knife. In addition, you will have no uncovered adhesive lying about.

Restore Chuck-Jaw Faces With Cylindrical Lap

To restore the gripping faces of a universal lathe chuck, insert a cylindrical lap through the chuck. Hold the lap down with a lathe dog and smear it with coarse-grit lapping compound. Rotating the chuck jaws around the lap will restore the faces to trueness.—H. J. Gerber, Stillwater, Okla.
Counterbalanced Safety Sticks

SOME YEARS AGO I made a safety survey of high-school Industrial Art Shops and found that jointers caused many more accidents than other machines. I also found that nearly every shop had a push stick, but it was not in use when an accident occurred. This indicated that lack of use of the stick resulted in the accidents. To assure that a safety stick would be close at hand at all times, which should help prevent accidents, I designed the unit shown here.

A unit consists of two lengths of tubing, one to telescope inside the other. A collar was used on the upper tube to form a stop for adjusting the height of the unit. Inside the tube assembly a chain and counterweight were suspended as indicated. Push sticks of the desired type were attached to the upper end of the chain. In this way, the stick could be pulled down for use and would return to the top of the tube when released. A unit was placed beside each machine with which a push stick should be used.

Another way of accomplishing practically the same results is if the machines remain in the same place, is to run the chain or small rope over pulleys attached to the ceiling above. Then use a counterweight of the right size to pull up the stick when it is released. To keep the counterweights out of the way, it may be necessary to locate pulleys to let the counterweights lower near a wall so that they will not interfere with working space.

Wayne Judy, International Falls, Minn.
Maintaining and Repairing
THE CORVAIR CAR HEATER

By John Krill

With its new air-cooled engine, the Corvair car has left water-cooling systems behind, and with them the conventional hot-water heaters familiar to motorists for the past decade or more. Instead, the Corvair uses a highly efficient gas-fired heater which delivers heat to the interior of the car almost instantly. But, like any other piece of gas-fired equipment, it must have a means of mixing air and fuel and an ignition unit to fire the mixture. It is therefore more complex than its hot-water counterparts and may require more attention.

The schematic detail above shows the parts of the heater system and the photograph on the following page shows it mounted on the car. Essentially, this unit is a miniature form of the oil-burning hot-air furnaces used to heat homes. But instead of oil, this one burns gasoline. As in the home unit, fuel is sprayed into a burner cup in the form of a fine mist. Here it mixes with air from the combustion blower. The spark plug immediately fires the mixture and the resulting flame heats the heat-exchanger walls. Air pulled in by the ventilating air blower is then warmed in the heat exchanger and blown inside the car through the air distributor. Hot combustion gases escape through a slot located in the top of the inner cylinder of the exchanger and are forced through the outside wrap before being discharged through the exhaust tube thus transferring some of their heat to the ventilating air stream.

Up to this point, though the heater has been operating, the thermostatic switch remains closed until the warmed air heats it to a temperature of predetermined setting. Then it opens and shuts off the ignition and the flow of fuel. However, both the combustion blower and the ventilating blower continue to operate. As soon as the air temperature drops in the air distributor, the thermostatic switch closes, the solenoid switch opens to admit fuel, the plug fires, and combustion begins again. This off-again on-again process is so swift and quiet that variations in temperature inside the car are kept to a minimum and are not noticeable to driver or riders. In extremely cold weather and at high driving speeds, the heater may burn continuously. When the fan switch or the car ignition is turned off, heat in the exchanger will activate a purge switch. This turns on the combustion blow-
er for a short time so that the combustion chamber is cleared of fuel fumes. When the temperature of the exchanger drops, the purge switch cools, and the blower automatically stops.

Once acquainted with the general construction and operating principles of the heater, it should not be difficult for you to spot the cause and cure of malfunctions which may occur. Following are a few of the parts and some of the more common ailments which may require attention.

**If the heater fails to start**, check for a blown fuse. Located under the left side of the car instrument panel, this 15-amp fuse protects the entire heater system. In case the combustion blower does not run, check for broken wiring, motor failure, or a defective purge switch. There is also a separate ground lead attached to the heater motor which should be grounded tightly to the car body. If it is loose, the motor will run only at a reduced speed, if at all. Normal speed is 3000 r.p.m., at 12 volts.

If the preceding investigations reveal nothing, the heater's overheat switch may bear looking into. Mounted on top of the heater case, it is connected in series with the solenoid coil. Its bimetal blade opens the circuit to the coil if the air temperature

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The spark plug's ground electrode must be given the proper ground if the plug is to fire with an adequate arc. A poorly grounded plug will allow a heavy deposit of carbon to form on the electrodes.

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**FEBRUARY 1960**
Proper setting of the breaker points in the heater ignition unit averages between .015 and .021 in. This switch turns the heater off if the thermostat fails to do so and it may get stuck.

Backfiring or "popping" in the combustion chamber is a sure sign that there is something wrong with the ignition system. Check for burned or pitted breaker points or a weak coil. The points should be set at .015 to .021 in. If the trouble does not seem to be electrical, the solenoid fuel valve may be stuck to its seat, in which case it should be cleaned, or replaced.

Notice that the heater spark plug is made with a single electrode. Its ground ele-

trode is welded to the fuel-mixer cup. It is most important that the welded ground electrode be correctly positioned or heavy carbon deposits will build up and foul the plug. Once the plug is cleaned, check its arc before reinstalling it. Gapped at .085 in. and properly grounded, a good plug will test with a steady, bluish arc.

If the heater fails to ignite but the combustion blower runs normally, check to see that the fan control lever is at High or Low position. Serious malfunctions are usually due to a defective thermostat or to the accumulation of carbon deposits in the combustion chamber. If this is not the cause, the hose connecting the blower to the combustion chamber may be loose, or there may be a leak in the fuel line where it connects to the heater. Since the heater is wholly dependent on the engine's fuel pump for its fuel pressure, a defective fuel pump will have an adverse effect on the operation and efficiency of the heater.

Burned gasoline odor is usually due to a loose burner clamp or a loose exhaust gasket. The gasket should be tightly seated between the flange of the heater case and the heat exchanger. In case of a clogged fuel system you will find that the fuel nozzle has a built-in screen which cannot be removed or replaced. If either should give you trouble, replace the entire nozzle unit.

If the combustion blower starts and then stops, something may be wrong with the purge switch. If no current is evident from the black terminal, replace the switch. But, lack of current from the blue and red terminals will require a complete check of the heater circuit. Erratic operation of the combustion blower is almost always the fault of the purge switch. When properly running, this switch will run the blower for up to two minutes after the ignition or the heater switch is turned off.

If no warm air is delivered, yet the rest of the heater seems to be working properly, check the air blower by turning on the fan and ignition switches. Air should be forced from the outlet. If it is not, check for a blown fuse, loose wiring, bad switch or a defective motor.

If the heat output is low, the thermostat unit may not be functioning correctly or a fuel line may be defective, or the engine fuel pump may not be delivering enough pressure. If the heater blows smoke, the air blower hose may be pinched or leaking, or the combustion blower may be running too slow. If not, check the purge switch again.
Increase Capacity
Of Your Lathe With These
CHUCK-JAW EXTENSIONS

By C. W. Woodson

WHAT TO DO when that rush job comes into the shop and the largest chuck in the place won't quite take it? One solution is to use a set of chuck-jaw extensions. Or, if the work is irregular in shape, you generally can utilize the chuck as a base on which to set up a strap-clamping arrangement something like that suggested in the detail above. In some cases one pair of chuck jaws can be removed and one pair and a clamp like that shown, or one similar in assembly, can be utilized to hold those outsized jobs. When the job has been set up it must be carefully checked for running balance and for clearance over the lathe carriage before starting the lathe and before machining. Jaw extensions A and B are designed to be slipped onto the standard jaws of a three or four-jaw chuck and can be bandsawed or milled to the general shapes indicated. They should fit the jaws snugly so that they will stay in place. Extension C has a squared opening to fit over the top projection of the jaw and is held in place with a screw as in detail D. In some instances drilling and tapping the chuck jaws may not be desirable or permissible. In this case the extension can be milled with a step, or offset, which locks over the jaw step.

FEBRUARY 1960
1. HAND-OPERATED SHEAR has a capacity of 16-ga. mild steel and takes a sheet 36 in. wide. Inclined ram combines eccentric-leverage action which greatly increases mechanical advantage and reduces shearing pressure. One-piece bed is a ribbed casting for maximum rigidity. Steel ram, housings resist deflection.

O’Neil-Irwin Mfg. Co., 770 Eighth Ave., Lake City, Minn.

2. SPHERICAL CASTER has wheel of non-marking, stain-resistant rubber. Wheel is 2 in. in diameter and is mounted in a wooden yoke which forms a guard for wheel and an offset mounting for stem which swivels on ball bearings. Caster is for office and home furniture and is available in brass and nickel plated finish.

Faultless Caster Corp., Evansville, Ind.

3. TREE-TYING MACHINE is widely used by orchardists to tie fruit-laden tree limbs so that they are self-supporting and do not require props to prevent breakage. Unit consists of a tying mechanism attached to an aluminum rod, or pole, which comes in lengths up to 25 ft. Unit is designed for one-man operation.

A.S.K. Corp., 2200 4th St., Berkeley, Calif.

4. ELECTRICALLY DRIVEN CHAIN SAW weighs only 17½ lb., making it easy and safe to maneuver in dense undergrowth and treetops. Unit has 16-in. reach and a chain speed of over 2000 ft. per min. Motor delivers full 2 hp. at the chain, operates on 115-volt a.c. or d.c. or from portable generator.

Milwaukee Electric Tool Corp., West Side St., Milwaukee 8, Wis.

5. ANGLE INDICATOR combines with spirit level. Place on inclined surface and read angle on semicircular scale which houses a bubble traveling in a curved path. Use it for leveling picture frames, shelves, posts or tape it to a straightedge and use for leveling concrete forms. Use lower bubble for leveling.

Stegeman Specialty Mfg. Co., 18 E. Sixth St., Newport, Ky.

POPULAR MECHANICS
6. LOCKING PLIERS have cam-actuated jaws and pistol grip with lever-type trigger which gives delicate control when placing and holding small parts. Jaws are long and narrow to reach into hard-to-get-at places. Although designed primarily for electronics servicemen, pliers are useful to modelmakers.

[Handi-Man Tools, Inc., Div. of X-Acto Inc., 48 Van Dam St., Long Island City 1, N.Y.]

7. MACHINE-TOOL CLAMPING SET has a clamping range of \( \frac{9}{16} \) to 11 in. Set includes U-clamps in two adjustable ranges, also extensions and a gooseneck adapter. Both the bolt and the heel-block assemblies are adjustable. The U-clamps can be used individually and with the extensions or gooseneck adapter.

[Hi-Lo Products Co., S817 Lymon Ave., Detroit 38, Mich.]

8. COMPOSITE PLASTIC SCREW with metal core has the insulating properties of plastic combined with the strength of metal. Use of screws of this type often permits elimination of costly parts from electrical assemblies. The screw consists of a serrated metal core carried in a threaded plastic body, or sleeve.

[Austin Screw Products Co., 4873 W. Armitage Ave., Chicago 30, Ill.]

9. INTEGRAL METAL FORM speeds stair building. Form is nailed to wooden stringers and treads to complete a stair from basement to first floor, from first to second floor. Adaptable for use in building either open or closed-riser stairs. Provides 8-in. rise, 9-in. run.

[The Bilo Co., 37 Water St., New Haven 5, Conn.]

10. HOLLOW-GROUND BLADE is specially toothed for cutting plywood without splintering. The teeth are chromeplated to stay sharp. High backs of individual teeth reduce vibration which results in a rough-cut, splintered lower edge on stock. Available in standard sizes.

[H. K. Porter Co., Inc., Dayton 4, Ohio, Philadelphia 30, Pa.]

FEBRUARY 1960
11. SANDER-POLISHER has two speeds, 2400 r.p.m. for fast, smooth sanding and 750 r.p.m. for high-grade polishing of finished surfaces. Unit also can be supplied with an accessory ½-in. drill chuck converting it into a high-low-speed drill for metal and wood. Changes in speeds are made by removing and inserting the driving head, or spindle, in either of two recesses in the gear housing. Unit is supplied as kit Sears, Roebuck & Co., 925 S. Roman Ave., Chicago 7, Ill.

12. STONE-CUTTING SAW is powered by a 2-hp. totally enclosed motor, will make cuts up to 6 ft. long on material 3 in. thick. Uses 14-in. diamond blade or a 14-in. abrasive disk, depending on type of material to be cut. Rugged, precision built track carries rolling motor mount. Blade is entirely housed, except at cutting point, by a rigid guard. Fitted with water-feed control for wet cutting with abrasive


13. PENCIL-TYPE CONCRETE VIBRATOR has a vibrating head only 1½ in. in diameter to get into narrow forms and also to work between closely spaced reinforcement. Head is driven by flexible shaft and is powered by 1-hp. universal motor which operates on either a.c. or d.c., 115 volt. Unit weighs only 23½ lb. with 6-ft. shaft. Both 6 and 12-ft. shafts are available. Unit operates at 10,000 r.p.m. in low-slump concrete

Monarch Vibrator Co., 168 Stanley Ave., Dayton, Ohio

14. MAGNIFYING VIEWER features a multi-lens achromatic optical system for true-color inspection or assembly of tiny parts. Lens is 5 in. in diameter and provides 2X magnification. Can be used for long periods for binocular viewing without eye fatigue. Field of view is 14 in. in diameter and is lighted by 22-watt fluorescent lamp. Unit tilts, swings side to side and can be adjusted for most convenient height

Edmund Optical Co., Inc., Peapack, N.J.

15. FLAME-CUTTING duplicate parts of any ordinary length, width, or thickness is accomplished with this automatically controlled flame-cutting machine. Intricate parts are produced in duplicate simply by feeding pencil drawings of the part into a photoelectric tracing system. Width of kerf made by cutting jets is automatically compensated for, which results in duplicated parts that have exceptional uniformity

The Linde Co., Div. of Union Carbide Corp., 30 E. 42nd St., New York 17, N.Y.
Low-Priced Dodge Dart Features Revolutionary New Engine

New Economy Slant "6" Uses Exclusive Semi-Ram Intake Manifold!

Packing surprising performance with the kind of gas mileage usually found only in much smaller cars, this new Economy Slant "6" represents a major breakthrough in engine design. The 225 cu. in. block is angled 30° to the side to allow for special free-breathing intake and exhaust manifolds. High-turbulence wedge-shaped combustion chamber and carefully selected 8.5 to 1 compression ratio deliver 145 h.p. at 4000 r.p.m., using regular gas. Special high-efficiency camshaft puts top torque right down in useful driving ranges. Output: 215 lb.-ft. at 2800 r.p.m. Uses new velvet-smooth Free-Flight Power engine mounting.

Special slant-block makes room for this new semi-ram intake manifold. Exclusive Equi-flow design provides more efficient, evenly balanced distribution of fuel to all cylinders.

Big, overhead valves mean better breathing, better distribution of fuel mixture inside cylinders. More even burning means extra power and mileage from every gallon of gas.

Special TorqueFlite Six is the first automatic transmission designed specifically to match the power-torque curve of a six-cylinder engine. (Optional at extra cost.)
New Ideas in Photography

Now a Movie Projector as Small as This Page

—yet it shows beautiful movies a yard wide

Here's the latest word in compactness for 8mm home movies. The Brownie 8 Movie Projector stands only 9" by 6½" (this page size) by 6", and weighs only 5½ pounds.

But don't let its small size fool you. It performs big in every way.

At just 12 feet from your screen, this projector shows movies three feet across. The secret is a new-type lamp with its own non-tarnishing, electronically prefocused reflector to assure maximum brilliance.

Loading is simple because there are no sprockets. You can actually thread the film while the projector is running. The projector accepts big 200-foot reels for full 15-minute shows. And it is blower-cooled.

It's worth a trip to your dealer to see the Brownie 8 Movie Projector in action. The price: only $44.50, or as little as $4.50 down.

Lens Automatically "Squints" in Sun, Opens in Shade Like Human Eye

Now Kodak has built an automatic 35mm camera that works much like your eye. It sees light and sets its own lens opening.

The "brain" in the Kodak Automatic 35 Camera is a photoelectric meter. Light reflected from your subject moves a control needle which determines the lens opening. The result: correctly exposed pictures time after time!

Change shutter speed, and an automatic switch adjusts the meter and lens response. If light is too dim even for the f/2.8 lens, an automatic signal tells you to use flash. You don't even thread film — just drop it in!

Try for yourself all the swift, easy operating features of this camera . . . the single-stroke film advance . . . the click-stop "zone" focusing. Only $84.50, or $8.50 down.
Spots on Sun Filmed for Clues
To Radio Disturbances on Earth

Film—in a giant 35mm tele-camera—is bringing astronomers new facts about how happenings on the sun affect us here on earth.

Sunspots cause interference in long-range radio communications. They are being studied through thousands of 35mm photographs of the surface of the sun—taken by a telescope-TV camera system. Kodak films designed for astronomical and professional movie work are being used.

To get the pictures, the radio-controlled photographic equipment was carried by balloon to an altitude of 80,000 feet. This eliminated the shimmer and poor visibility caused by the earth’s atmosphere. As a result, the pictures are far more detailed than any ever obtained by even the most powerful ground telescopes.

And the most searching pictures were taken on Eastman Background-X Film, a close relative of the famous fine-grain Kodak Panatomic-X Film used by amateur and professional photographers.

Versatile Slide Projector Lets You
Use Any of 3 Changer Systems

Mount and store your slides any way you want . . . choose any of three kinds of slide changers. This Kodak 300 Projector lets you build your color-slide collection without restrictions.

And it gives you great performance. The efficient lamp and condenser show both 35mm and super-slides brilliantly. The four-inch lens permits big-screen images even in small rooms.

A quiet, turbine-type blower pulls cool air in over your slides and around the lamp. Carrying handle is on the projector, not the cover, for extra safety. Cover snaps on—no extra carrying case to buy.

With Readymatic Changer and 4-inch lens, Kodak 300 Projector, $64.50; Kodak 500 Projector with extra margin of brightness, $74.50. Look at both before you choose.

Prices are list, include Federal Tax, and are subject to change without notice.

EASTMAN KODAK COMPANY, Rochester 4, N.Y.
SEE KODAK’S "THE ED SULLIVAN SHOW" AND "OOZIE AND HARRIET."

FEBRUARY 1960
REACH FOR THE
RED END
MADE ONLY BY
LUFKIN

Only the best wood rules merit this seal

If a carpenter catches you measuring something, he'll think you're a fellow professional (if you're using a Lufkin RED END rule).

This Lufkin X46, for example. It looks quality, with its natural finish and crisp, black graduations; or the 6" brass extension that makes inside measuring so simple. It even speaks with authority . . . a decisive "snap" from gleaming joints and strike plates.

The X46 is only one of four Red Ends you'll find on the Lufkin Turnover Target—where you can select the exact rule that suits your needs. Reach for one at your hardware store.

always look for the
LUFKIN "TARGET"
where your hardware man displays his finest measuring tools.

FEBRUARY 1960
Shower Doors for Under $35

with Reynolds
DO-IT-YOURSELF ALUMINUM

Make your own attractive aluminum and glass shower doors. Pay under $35 for materials. Same high quality doors that cost $70 to $80 (installed) in most retail outlets. Easy to make in hours with ordinary woodworking tools.

Write for free plans, how-to literature and check-list of over 40 fascinating Reynolds Do-It-Yourself Aluminum Projects.

Look for the Reynolds DIYA display rack at most hardware and building supply stores.

Reynolds Metals Co., Richmond 18, Va.
Please send Reynolds Do-It-Yourself Aluminum How-To kit with FREE shower door plans.

Name
Address
City Zone State

Decorating Problem
Q—My home has 10-ft. ceilings in all downstairs rooms. The windows are tall and the sashes are narrow and curved at the top. The rooms are not large and the smaller rooms seem like a box, the same dimension in all directions. I’ve thought of installing a wainscot of horizontal boards or panels and covering the windows with half shutters instead of full-length shutters or drapes. Above the wainscot the walls would be covered with figured wallpaper. What is your opinion?—F.H., Wis.

A—Basically, you have the right idea. The refinements in the decorative scheme you have outlined would have to be determined by someone, possibly yourself, who could study the problem firsthand and outline a complete procedure. This we could not do at such long range. Of course, if we can visualize the problem correctly from your brief description, we’d be rather doubtful about using figured wallpaper above the wainscoting. It could be that some types of patterned wallpaper would work out satisfactorily, but it would seem that use of such a paper on all four walls of a room would tend to “bring the walls in,” or possibly give a kind of two-dimensional effect which might be objectionable in some rooms. Also, we’d be inclined to favor drapes with wide valances rather than half-length shutters, especially in a rectangular room with tall windows at one end. Also, we would recommend favor painted walls above the wainscoting, at least as a trial in working out the final scheme. You can always paper over the paint, if paper seems more desirable. Much depends on the color used in the rooms. As a rule the lighter pastel shades work out better than the heavier colors on walls in rooms having high ceilings. If the exposed woodwork is in a dark natural wood, it usually is best to lighten it by refinishing or painting. By painting woodwork in the wall color, or only a few shades darker, the room generally can be made to appear larger. Sometimes use of a darker color on the ceiling will have the effect of lowering it.

Slab Floor
Q—This spring or summer I plan to build a summer home with a slab floor. The soil at the location is very sandy, but I’m told that there is a layer of heavy clay about 4 ft. below the surface. The slab will be about 20 x 28 ft. and there will be a separate footing for a fireplace at one end. I have been advised not to pour a slab floor but to support the structure on a conventional foundation with footings on the clay. What do you advise?—L.A., Minn.

A—You can use slab-floor construction by supporting the slab on piers which extend down to the clay. Or you can pour foundation walls with footings on the clay, as you have been advised. However, this assumes that the clay is entirely stable. It’s best to find out beforehand by taking borings, or samples, to determine the kind of clay and the thickness of the layer, or deposit. These samples should be taken by your contractor and evaluated before deciding whether to pour a slab floor or to erect the structure on four foot wall footings. Ordinarily such a procedure is not necessary but your letter implies that there has been some question about the stability of the top soils at the building site and that is the reason the procedure has been recommended.
SPECTACULAR FOR '60
The BOLD
and the Beautiful

New
HARLEY-DAVIDSON
DUO-GLIDE

We've put this "show" on the road—the world's finest motorcycle made better than ever by the world's finest craftsmen.

Spectacular styling with gleaming new headlight nacelle of aluminum alloy. Flowing back from the nacelle, new twin-flare tank paneling adds dash to the famous Duo-Glide look. Spectacular new performance is the result of a host of new mechanical improvements... quieter engine, longer bearing life and faster starts.

Your Harley-Davidson dealer is previewing the new Duo-Glide now. He will show you the many other new features that make the Duo-Glide for '60 the greatest "road show" ever. Or mail the coupon for free, colorful folder.

Harley-Davidson
MOTOR CO.
MILWAUKEE 1, WISCONSIN
Perfect Mating of Man and Machine.

HARLEY-DAVIDSON MOTOR CO.
DEPT. P., MILWAUKEE 1, WISCONSIN

Please send me new folder on the Duo-Glide for '60

Name_________________________________________Age________

Address__________________________________________
Angular drilling for the splayed legs on a coffee table is no problem with this tool because the angle of right or left tilt can be set by a calibrated scale and locked into position. Resetting head to vertical position is simplified by setting of the automatic stop into a milled groove.

Inlay routing in the center of a 30” x 40” project is possible because there is 16¾” capacity between the column and the router bit. Use of the fastest of the four speeds available makes this a smooth operation. Controls are conveniently grouped “up front” for safe, positive action.

Spindle drilling on an extra long hand rail does not require a special fixture or jig because the head tilts. Big ¾” x 23¾” x 15¾” table gives adequate support while remaining parallel to the base. Laminated wood work surface is mounted to a fully machined 8½” x 9” cast iron table.
New radial drill press

makes
"impossible" drilling easy

DELTA 32" RADIAL DRILL—basic machine complete with 1/2" capacity geared chuck, belt and motor pulley.
Weight 65 lbs—only $89.50 (slightly higher in the West).

Here's just what you'd expect from Delta—a brand new radial drill—specifically designed to handle drilling jobs you can't do on a conventional drill press. There is almost no limit to the flexibility this tool puts at your fingertips—and you'll really appreciate the big capacity. The head swivels 360° around the column, tilts more than 90° left and right, travels almost a foot forward and back—yet the work always remains parallel with the base. You can drill to the center of a 32" circle, rout, sand, mortise, do dozens of operations at your choice of four speeds (700, 1250, 2400, 4700 r.p.m.) on a wide variety of materials.

You can count on this tool to extend your skill, broaden your range of projects. And because you know tools, you know you can count on the precision, ruggedness and safety that Delta's 31 years of experience build into tools used throughout industry and in home workshops.

Consider the many ways you can do more jobs better, quicker and easier with the newest Delta tool—you'll want to see the Radial Drill in action! Visit your Delta Dealer (he's listed under "TOOLS" in the Yellow Pages) or your leading Department, Hardware or Building Supply Store. Do it soon!

See the world's most complete line of home workshop power tools and accessories—pictured and described in this colorful, FREE Homecraft catalog. Write to: Rockwell Manufacturing Company, Delta Power Tool Division, 502B N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Guelph, Ontario.
You can...

PICK UP A HUMAN HAIR
with these
precision-machined points

Specially Designed

CHANNELLOCK

No. 738 Long-reach
Round-Nose Plier

A precision gripping tool for precision work... the CHANNELLOCK No. 738 Round-Nose Plier. Gives you a long slim, firm grip in tight places you can’t reach with other pliers. Hundreds of uses on electrical, radio, TV, Hi-Fi and all other types of electronic work. Comfortable, blue-plastic grips. Top quality, polished forged steel. Ask your tool supplier for a CHANNELLOCK No. 738 Round-Nose Plier. If he’s out of them, ask him to order one for you.

PM Houseboat
(Continued from page 199)

and extends from frame 4 to frame 6. In studying Fig. 39, you will see that it consists of a framework screwed to the floor and wall, after which it is covered with ¼-in. plywood. Lip-front drawers, 20 in. deep, are fitted in each bench to ride on regular drawer runners, and hinged access lids installed in each bench top make full use of the storage area under the benches. As with the other cushions, 3/8-in. mahogany retaining strips keep them in place. Only the after bench is fitted with a back cushion. The latter, incidentally, rests against a plywood bulkhead which is later erected and butted against the bench.

The table part of the unit is detailed in Fig. 41. Table fasteners, consisting of L-brackets fitted with thumb screws, are used to anchor the table and its hinged leg. A cleat fastened to the cabin side at the top of the coaming member, provides a screwing surface for the fastener hardware for the table top, where, as in the case of the leg, they are screwed directly to the raised floor between the benches. The leg is hinged to a drawer compartment attached to the underside of the table top. Note that a heel lock on the underside of the drawer keeps the latter from working out. To open the drawer, wide notches in the drawer sides permit it to be lifted up and over the rail. The top surface of the table is covered with plastic laminate.

Fig. 40 shows how the two companionway ladders are made. Special locking hardware screwed to the ladder rails and to the coaming members, allows the ladders to be unhooked and removed. This is necessary in the case of the forward ladder when the berth board is used to increase sleeping facilities. The ladder treads are fitted with rubber step plates.

(Continued next month)

Do You Know This Old-Timer?
(answer to quiz, page 16)

1914 Chalmers

CHAMPION DEARMENT TOOL COMPANY
Meadville 1, Pennsylvania
THESE ARE SOME OF THE NUTS AND BOLTS AND SCREWS THAT WERE NOT PUT INTO THE BODY AND FRAME OF THE 1960 PLYMOUTH.

They just can’t loosen and rattle because they’re not there. The Solid 1960 Plymouth’s new Dura-Quiet Unibody is welded around 5400 times.

Ordinary unit body construction isn’t particularly new. But this kind is!

Chrysler Corporation pioneered unit building in 1934 and turned out the first welded-unit American passenger cars. Later, the method was adapted by other manufacturers. But there were problems, in the way of noise and vibration, and chance of rust and corrosion.

Chrysler engineers kept the idea under study. To it, they applied the biggest digital electronic computer program in the auto business. They used methods developed in the building of space missiles. They built an “electronic highway” to simulate all kinds of road conditions.

The outcome is a new kind of car body—quieter, tighter, more solid than any you have known. With more room inside. Doors and windows that fit tightly. And a noticeably steadier ride, combined with easier, brisker handling.

Unibody Plymouth is made to stay quiet and solid for an unusually long time. Corrosion is licked for years to come by the greatest protective treatment ever given an American car. This Plymouth is, we believe, the best-built, best-performing car in the low-price class. Try it!

SOLID PLYMOUTH 1960
A Chrysler-engineered product, built a new solid way to give you solid satisfaction.
in. dual voice-coil woofer handles the bass tones from both stereo channels, up to 1000 cycles. Frequencies from 350 to about 14,000 cycles from each stereo-amplifier channel are handled separately by the left and right satellites. As a result of the overlap in the 350 to 1000-cycle region, the bass speaker provides a degree of center-channel fill which greatly increases stereo flexibility. Even with the satellites separated by as much as 20 feet, there is little evidence of "the hole in the middle" or the "ping-pong effect" so often associated with widely spaced conventional speakers.

The Galaxy II is not inexpensive. Commercially assembled and ready to play, it costs $170, though you can shave this price by about one-third by buying the KTG-2 speaker kit (price, $92.50) and building the cabinets yourself. The kit is supplied with all speakers, plus the necessary electrical parts and hard-to-make items of hardware, for duplicating the factory-made unit. The only extras you need are the lumber, grille cloth, acoustical padding, and the time required for building the housings. And, due to the small size of even the center cabinet, construction as shown in the diagrams is relatively simple.

The electrical crossover network supplied with the Jensen kit is essentially prewired. The only wiring left for the builder are four leads from the network to the two voice coils of the woofer, and a couple of small parts and wires in each of the satellites. But there is one optional addition which may, in some cases, improve the performance of the system. This addition consists of a separate level control for each of the two satellites.

Although the speaker complement of the Galaxy II is well matched, some listeners may find the resultant sound a bit too "brilliant" for their personal taste—particularly in a very "live" listening area. Tone controls could be used to compensate for this effect, but only at the expense of some of the higher frequencies. The addition of the level controls would permit individual adjustment of the satellite outputs for the most pleasing balance under virtually any condition.

(The wiring diagram supplied with the Jensen speaker kit clearly shows all the necessary connections, but does not provide for the addition of level controls. Anyone building this kit who wishes to make these optional additions can obtain a revised dia-

(Continued from page 177)

(Continued to page 246)
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Selecting Your Speaker System
(Continued from page 244)
gram by sending a stamped, self-addressed envelope to the Popular Mechanics Radio Dept.)

The woofer of the Galaxy II may be installed in a compartment of the equipment cabinet described in last month's article without changing the external appearance of the cabinet itself. In this application, holes for the speaker and vent tube are made in the bottom of the cabinet so that these units face the floor. The openings should be covered with grille cloth for protective purposes.

Rigidity is the keynote for any well-constructed speaker enclosure. If the speaker is mounted in the equipment cabinet, the original compartment drop-door must be permanently fastened to the front of the cabinet, backed up by ¾-in. wood cleats. Similar cleats should be glued and screwed to all inside corners of the enclosure.

The original ¾-in. plywood back no longer serves as the back panel of the speaker enclosure. For the rear of this compartment, a ¾-in. plywood back should be used. The back should be cut to fit snugly inside the compartment and screwed to carefully installed wood cleats in a manner similar to that shown for the BASS-SUPERFLEX enclosure on page 177.

To compensate for the difference in volume between this compartment and the separate enclosure, the vent tube supplied with the Galaxy kit must be shortened. Jensen engineers have calculated that best results will be achieved with a tube length of 2½ inches.

Mounting of the speaker in the same cabinet with the record player and other electronic components is recommended only where space problems prevent the use of a separate enclosure. Vibrations, even in a well-built speaker enclosure, could adversely affect the performance of other components in the same cabinet at very high volume levels. Should this occur, some extra care in shock-mounting the record player and preamplifier will usually correct the difficulty.

Summary
There's no such thing as an absolute criterion for true high fidelity. Loud-speakers, even the very best of them, can have entirely different "voices," and only a listening-comparison test can tell you which one is best for you. But price is usually a fair indication of speaker quality and, if a listening test is impractical, a generous portion of your total hi-fi budget should be apportioned to the speaker system.

The enclosure is an integral part of any

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speaker system. Unless you have facilities for comparing a given speaker in a number of different enclosure designs, you'd be wise in following the speaker manufacturer's suggestions in buying or building a suitable speaker cabinet.

Size is no longer a good indication of quality, but a small enclosure requires special, high-compliance speakers capable of large, linear cone excursions, and the enclosure design may be quite critical. Don't try to place a conventional speaker in a miniature enclosure and expect good bass response.

If your budget is limited, remember that the performance of many systems can be improved with add-on components. Select an enclosure which will permit eventual mounting of additional speakers and pick your original speaker on the basis of good low-frequency response rather than extended highs. It'll make a good deal of difference in the long run.

Finally, whatever speaker system you buy, try it out in various locations in your listening room. Often the placement of a speaker against a different wall, or in a corner, can make the difference between just good sound and superb high fidelity.

Next Month: How to Select Your Stereo Amplifier.
This Makes the Torpedo Child's Play

(Continued from page 132)

experimental shot like that right beside a dock," Comdr. Wallace recalls. "A local reporter heard the launching explosion, turned and saw the ship listing, and clouds of 'smoke' pouring from the hole in the deck. So he promptly turned in an alarm and told the yard we had exploded and were sinking. There was great confusion around here for a while."

What would happen if a live missile malfunctioned or did accidentally fire in the tube? It would probably just launch itself, even with the lid dogged down, King points out. "The tube hatch covers are of soft iron that will blow out at 25 pounds pressure," he reveals. "So the missile can be 'dumped' right through them if anything goes wrong."

Fifty Cameras

In some ways, the maze of systems for testing and evaluating this tricky missile, are more complex on the Observation Island than they will be on the A-sub. For one thing, her decks are studded with grotesque mounts for more than 50 cameras that take still and motion pictures of every instant of every launch. One 16 mm. movie camera shoots 1600 frames per second to pin down the velocity of the slug as it leaves the tube! Batteries of TV cameras are remotely controlled from below at the instrumentation operations station, by technicians who point them this way or that by means of joy-sticks adjacent to monitor screens. "Those TV cameras have embarrassed people," says Wallace. "Several times, before a shoot, we've caught sailors sleeping on the launching deck. You can even read the numbers on their shirts."

Down in the spaces below decks, more than 70 seven-foot-high racks of electronic and electro-mechanical equipment perform in seconds the staggering number of calculations necessary to launch one Polaris.

One of the big problems facing an FBM submarine skipper will be to know, with pinpoint precision, exactly where he is before he can fire one of his birds with any hope of accuracy.

The systems that do this job would curl your hair. A Sperry navigational device called SINS (Ship Inertial Navigation System), involving an array of gyroscopes and accelerometers, records every movement of the ship as it slips through the water. This information pours into an electronic brain, called a navigational data computer (NAVDAC), where the assem-

(Continued to page 250)
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bled data hums through batteries of electronic tubes. Out comes position references. These are fed continuously to a bank of 16 electronic brains known as the “Gee-ballistic Computer.” This monster digests the position facts. Then data about the location, altitude and other specifics of certain special targets like a Russian missile base, or airfield, is fed into the computer’s maw. Instantly, the brain makes a comparison of the relative positions of the FBM submarine and the target—and out comes the precise firing information which is automatically preset in the missile’s guidance package. All in a matter of seconds!

As the missile-launcher moves through the sea during countdown, constant course corrections must be fed to the navigating brains. A device called a Joglog, streamed aft of the ship, provides reading on ocean cross currents. Another log provides the speed through the water.

A launching from the big missile ship begins at dockside, where huge traveling cranes load the shooting cargo. Dummy missiles swing skyward, and are eased into the launching tubes. The weighted slugs have a domed nosepiece entrapping just enough air to keep the great cylinders afloat so that skin divers can retrieve them after the shoot. By reversing the cap and making the nose concave—like the bottom of a wine bottle—the slug becomes sinkable.

**Missiles Are Packaged**

Live missiles come packaged in massive steel cylinders with self-contained cranes. Positioned vertically atop the launch tube, the towering container lowers the rocket down through itself and into the tube by means of steel cables and pulleys—like an elevator descending through a shaft.

Below decks, throughout the ship, checkouts are in full swing as the ship heads seaward. A pair of huge underwater fins hinge outward from recesses in the hull, to counteract rolling motion in much the same way that ailerons keep an airplane on an even keel.

Trying to aim a 1500-mile missile from a moving platform requires tricks, and the Observation Island has several. “The ship’s inclinometer (which measures degree of roll) is ‘educated,’” King explains, “It’s tied in with the fire control mechanism and won’t allow the launching gear to operate until the ship has assumed precise firing attitude in the water.”

Missile submarines will use similar tricks. But instead of anti-roll fins, which only work when a vessel is under way, they’ll be steadied on the surface by king-

size Sperry gyroscopes. Deep under the submarine’s “sail,” the 62-ton devices, with massive rotors resembling steel doors for bank vaults, will spin the stability of an island into the sub whether it is moving or sitting dead in the water. Such giant gyros, capable of diminishing a 40-degree roll to two degrees by means of their muscular torque, had a brief heyday on a few luxury yachts and one big liner right after World War I. Their comeback on the A-sub will be their first appearance in about 30 years.

As firing time approaches, the missile ship hums with activity. In a confusion of lights, dials and switches in the Instrumentation Operations Station below decks, the instrumentation officer scans a display console providing constant read-outs on all navigational data for firing. Across the way at the launching complex, the launch officer watches another bank of dials and lights that will give him the word to start firing sequence. The telemetry officer reads his radar and radio equipment for tracking the big rocket from the instant it moves upward in the tube. Enlisted men stand at the joystick controls for the TV cameras on deck, panning this way and that, while the picture is checked by other men at slave screens scattered around the room. Other complexes for weapons control, missile calibration, missile observation, weapons navigation and launching operations make last minute circuit checks in an aura of tense excitement. Up on the bridge, in the pilot house, Captain Slack stands at a bridge console containing rows of buttons and lights that will permit him to destroy the missile in flight, if necessary, or to hold the countdown at any point.

**Launching Spectacular**

Man with the best view of the proceedings is the ship’s executive officer, Comdr. James O. House. With him is a range safety man from Canaveral. Standing in the Range Safety Observation Station, they look down on the launching deck through slotted windows of three-inch shockproof glass. Similar ports in the roof provide a skyward view. The walls of the shack are of three-inch plate steel, and a trap door leads down to lower decks in case the men have to leave in a hurry. At T-minus-zero, the tremendous crack of the air valve rings through the ship. Fifty cameras automatically begin to record the surging missile as it lifts ponderously from the tube and hurtles skyward in a billowing veil of icy mist. A live Polaris, kicked to an altitude of about 100 feet by the mighty air gun, lights off with a spectac-
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ular roar, engulfing the launching deck and tube in a Niagara of white flame. Within moments, it is lost in the sky—a pinpoint of light on a 1500-mile ride.

The reverberating BANG! of one of those launch valves letting go is an impressive thing, "Below decks," says Comdr. Wallace, "it sounds something like being in a submarine that's sustained a close hit by a depth charge. Once when we were setting up for a firing at Norfolk, an underwater demolition team on a research job near the ship set off a charge without warning. The crack below decks sent everyone racing for the hatches in a mad scramble to get out. Everyone was sure that the launch tube plumbing had let go under the strain and blown up the ship."

A blast of that air, even through an empty tube, can create a colossal wind. Wallace enjoys recalling the first dry run, or "air shot" at Norfolk, when the launching gear was being tested right after work crews had finished the last of their work in the base of the big guns. "Everything worked fine," he says. "We blew a regular volcano of welding rods, coke bottles and Dixie cups all over the shipyard."

Though primarily built as a testing vehicle for the Polaris submarines, the Observation Island has worked out so well as a missile launcher that we may wind up with surface Polaris ships of a somewhat different type. "The launch tubes," Joe King points out, "could be hung on the quarters of aircraft carriers, for instance. Such a carrier task force could launch their missiles to soften a target, then send in their planes to mop up."

Meanwhile, the Observation Island carries the distinction of being probably the most uniquely armed ship in the Navy. "Our weapons department's first-line armament is a 1500-mile nuclear warhead Polaris," Wallace points out, "—backed up by a secondary battery of .45 automatic pistols. That's all."

85-Foot Radio-Telescope Will Listen to Sun

When the sun flares up from now on, shooting out bursts of mysterious radio noises, scientists at the University of Michigan can tune in on them with a huge radio-telescope. The 85-foot-long electronic ear, designed to study the sun's radio emissions, has a 155-ton parabolic antenna that can track the sun from sunrise to sunset, as well as pick up radio noise coming from galaxies millions of miles away.
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ures the varying speeds of sound through the water; depth-sensing devices such as the vibrotron with its resonating tungsten wire chronicling telltale pressures, and a remote-controlled solenoid-actuated plankton collector (designed and built by Dr. Rechnitzer) set to sample the minute sea plants and animals which hover in the water like a living cloud.

At intervals during a typical descent, a scientist triggers a solenoid which trips one of a dozen water-sampling Nansen bottles. Simultaneously, a thermometer records the temperature of the sea-water sample. Overhead, an electronic flash winks, turning a cone-shape area of the depths into daylight as a camera records the contents of the water. Periodically, the velocity meter determines the speed of sound through the water—a velocity which varies with temperature, density and depth. Another button actuates the sampler which obtains a sample of animal and plant life. Another automatic instrument riding outside the bathyscaph’s sphere clocks currents, recording their speed and direction. Another measures sea pressure.

Automated by electronics, this deep-sea research vehicle gathers and compiles data that will yield a profile of information about currents, pressures, temperatures and sea life in a more complete manner than ever before.

Will Map Deep Scattering Layer

One of the important phenomena the Trieste will be mapping is the great blanket of animal life—dubbed the deep scattering layer—which spans the world’s oceans. Other ocean oddities are the great masses of varying-temperature water, called thermoclines, which are stacked atop one another.

“Analysis of sonic probings and vertical profiles of such phenomena has revealed odd current flows and extended distribution of animal life,” says the wiry Dr. Rechnitzer, 34, who heads up the Navy’s “Project Bathyscaph.”

“All have been around as long as the oceans themselves,” he continues. “Now for the first time—and with an assist from the bathyscaph—we intend to expand our knowledge about these and other features of the deep sea. The deep ocean has long fascinated man and discussion about its contents has yielded tales that have not been refuted for lack of accurate observa-

tion. For years, animal distribution in the deep sea has confused sonar and fooled fathometers, registering shallow ‘false bottoms’ in areas where the ocean was known to be hundreds (and sometimes thousands) of feet deeper.”

Only last year Rear Admiral John S. Thach, who commands the Navy’s sub-hunting Atlantic Task Force ALFA, dispatched a frantic S-O-S to the American electronics industry.

“The black boxes are not good enough,” complained Admiral Thach, referring to sub-hunting electronic gear.

Sonar, he said, is often bothered and bewildered by “deep-lying inconsistencies”—thermoclines. Sub-searching sound waves, ricocheting from fathoms-deep layers of varying temperature water, are bent, reflected and distorted. Maverick temperature changes can cut sonar’s range from a hefty 25 miles to a handful of yards. Safe and unsounded are subs that cannily hide beneath a protective thermocline.

Adding to the problem of future detection of deep craft are the animals which oftentimes form a 200-foot-thick cloudlike scattering layer. The layer’s depth is not fixed: it rises like a living elevator from its daytime depths of perhaps 1000 to 1500 feet to just a few feet below the surface at nightfall. Confusing to sonar and its harrassed operators are a myriad of deep-sea noises—the hoots of whales, the snapping of shrimp and whistling cries of porpoise.

But Dr. Rechnitzer, the project’s scientific chief who’s a lieutenant commander in the Naval reserve and a marine biologist (he earned his doctorate at famed Scripps Institution of Oceanography), pigeonholes as “beyond the bounds of military security” any speculation on application of the Trieste’s findings to use of modern nuclear submarines.

Assembly of Top Scientists

Lieutenant Don Walsh, the bathyscaph’s skipper, says, “We’ve assembled some of the world’s leading oceanographic experts ... including Auguste Piccard and his son, Jacques.”

The deep-diving assignment of the bathyscaph is closely watched by oceanographers, for not until the bathyscaph, which physically drops researchers to the depths, was a really detailed study of midwater and ocean floor research possible.

“Certainly,” agrees Dr. Rechnitzer, “you can drop plankton nets from the surface—and dredge up a fair sample of the scattering layer’s minute sea life. You can track the deep scattering layer with echo sound-
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GENERAL MOTORS

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times takes digging in back rooms to locate the things that delight him.

Rowland Emett is as famed today for the crazy machines and contrivances he puts together from collected oddities as he is for his cartoons of equally crazy railway trains which burst upon the delighted readers of the British humor magazine Punch in 1942. You don't have to be a railroad enthusiast to enjoy Emett's trains, although to share some of his affection for the Edwardian and Victorian ages and the myriad small branch railway lines in the backwaters of Britain helps more than somewhat.

Settled at the drawing board in an armchair at his home in Ditchling, Sussex, Emett creates his big-funneled, flower-bedecked, rickety engines pulling incredibly narrow, uncomfortable-looking carriages across a spidery landscape and peopled by bewildered ladies and moustached gentlemen dressed in an outrageous parody of the fashions of the 19th and early 20th centuries.

And in the smoky, noisy blacksmith's forge, Emett and his carefully chosen staff bring to life his drawings of trains and fantastic apparatus—the latter adorned with anything from a Victorian hibath to an up-to-the-minute plastic salad shaker.

Among the many cobwebby contributions Emett has made to the modern world are the Oyster and Far Tottering Railway; Nellie, the gallant little steam engine and heroine of his book, "Nellie Goes to America"; the Hush-A-Bye Bed and the Higsmuddle Rotatory Niggler and Fidgeter.

It was back in 1942 that he became a regular contributor to Punch after a series of drawings he submitted impressed the editor. Hunting for new subjects, Emett came up with his idea of an Edwardian train. To his amazement, he received shoals of letters begging him to draw more of the same type.

"From then on, it was trains, trains and still more trains," he said. "I was kept pretty busy. But I didn't go to quiet places for thought and inspiration. I got my ideas in a noisy London cafe. (These days I fancy the almost equally noisy sea end of Brighton Pier.) When I started on the trains I didn't want to get typed, but people seemed so interested that I just had to keep going on the same lines—if you see what I mean. When they built my Far Tottering and Oyster Creek Railway for
Tom McCahill Reports on:

The Killer—Carbon Monoxide

Any grammar school kid with an IQ of 2 knows that a typical automobile engine produces poisonous carbon monoxide fumes. This deadly gas is odorless and invisible and packs enough wallop to kill the entire population of Rhode Island on a tankful of fuel—if conditions are just right.

Yet few people worry about carbon monoxide dangers, figuring it’s out the rear stack, which makes it a problem for the daisies, not them. Even an audibly leaky muffler doesn’t excite the average driver too much because you rarely hear of a guy dying from leaking exhaust fumes. However, carbon monoxide can cause you to kill yourself. In the end you’re just as dead either way.

The F.B.I. felt strongly enough about it to make an extensive search some years ago into the part carbon monoxide played in many unexplained accidents. They found that truck drivers on long hauls frequently fell asleep and went off the road—probably from drowsiness caused by carbon monoxide from a muffler or manifold leak.

Carbon monoxide can make you kill yourself by slowing up your reaction time to a point where stepping on the brake to avoid running over Aunt Nell, becomes a major chore.

To ignore a faulty exhaust system is like playing catch with a bottle of nitroglycerine. My advice is to check your muffler and exhaust system regularly—and if you find any signs of corrosion or leakage, have the faulty part replaced right away. AP mufflers and pipes are the endurance champs in their field, because they have thicker, coated steel. AP is the world’s largest manufacturer of replacement mufflers and pipes with over 100,000 dealers. Look for the red and white AP “Free Muffler Check” sign at stations everywhere. They sell mink coat mufflers and pipes at muskrat prices.
the Festival of Britain, the interest was greater than ever.

"When I went to America for six months I realized there were wide possibilities. After leaving Punch I designed a crazy aeroplane for an oil company and followed it with an agricultural machine which was a skit on all agricultural machines, which went down surprisingly well with the farmers."

After all these came the Hush-A-Bye Bed, the Ideal Home, and finally Emettland, his latest and most ambitious creation.

The Hush-A-Bye Bed quite reasonably floats delicately among the topmost branches of a small synthetic tree. It has provision for early morning tea at all times of the day and a built-in dawn chorus of warblers in lieu of an alarm clock. If you can accept all this, then you'll understand the logic of the bed's having a pair of dog-powered, ostrich-feathered lateral oars.

The Ideal Home—Emett calls it a boon for the “bone idle”—was the first machine to be built in Emett's own home. He agreed to try to make it himself because of the prohibitive manufacturing costs. It took shape in his drawing room in seven months, and because it was 23 feet long, nine feet high and eight feet broad, the fact that it did only minor damage to the room when taken out was considered remarkable—as well as being a lucky omen.

The machine was intended only for three exhibitions, but when it had served its purpose Emett had the idea of offering it for display in large stores. Today, like the other machines, it is traveling Britain, and—again like the others—it never fails to be in perfect working order.

Emettland, by far the largest of his creations, defies description. There are over 50 characters, ranging from the usual bewildered Edwardians waiting on the usual fantastic station for the usual fantastic train (which fails to stop there), to the gentleman in bathing trunks who dives into a small pool every few seconds and the personnel hanging for dear life on a rope dangling from an airplane which constantly circles the moth sanctuary at the summit of the landscape. This machine, too, was built in Emett's home and is the result of over six months' work in which Emett's right-hand man Arthur Depree kept activity at fever pitch, sometimes working around the clock to get the machine completed on time.

Emett hopes that soon he'll be off to Australia with his machines. "But I'm not going to churn things out one after the other," he said. "I'm afraid the public will (Continued to page 260)"
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get tired of me if I overdo things. And I want time for humorous drawings and illustrations. It will be a year at least before I start another machine, although I have orders galore from various concerns all over the world and I have formed a company, Fluffy Mechanisms Ltd., to exploit the models.

"Anyway, making a machine is a major operation. The difficulties of finding things like hipbaths and gramophone horns these days you just can't imagine."

British royalty are great Emett fans. Prince Philip recently bought the original of a drawing which showed a balloon with a basket crammed in a narrow liftshaft of a Victorian mansion. The hostess was saying to a caller, "We hesitated a long time before putting in a lift. Fortunately, it's period." Soon afterwards there was news that Philip was complaining about the "antiquated" lifts at Buckingham Palace and asking for modern ones to be installed.

"I wonder," mused the genius of Fluffy Mechanisms, Ltd., "if there's any connection..."

Stills Use Solar Energy To Convert Sea Water

Conversion of sea water to fresh water by means of solar distillation is taking place on a research site at Port Orange, Fla. Three stills, each with black-bottomed basins and transparent covers, are expected to produce 500 gallons of fresh water a day. Vapor, produced during distillation from sea water in the bottom of the basins, condenses on the inside of the transparent covers and runs down to channels at the edges of the basins where it is collected. Principle objectives of the solar method are reduction of equipment cost and greater efficiency.

POPULAR MECHANICS
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In the March issue
a PM editor writes
of his experiences in

"Offshore
Cruising by
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The Ridge Tool Company - Elyria, Ohio, U.S.A.
Palmetto Polo

(Continued from page 108)

present size, which allows maximum speed and action.

The original ball was small—six inches in diameter—but the inventive players soon found it had the annoying habit of sticking in the turf holes made by their pivoting mounts. The present 12-inch ball overcomes this difficulty, and at the same time makes the shots trickier because it twists erratically when hit offcenter.

Points are scored by driving the ball through 20-foot-wide goals at each end of the field. A goal made from the goal zone counts one point. Goals made from the second zone, if unaided by a player in the goal zone, count two points, and a successful, unaided, hefty belt from the middle zone counts three. Penalty shots count one point.

When the game was invented, neutral zones flanked the playing field but the players soon discovered time was wasted returning the ball from out-of-bounds. Now the standard field has wood or wire fence boundaries on the long sides, and the experts bank the ball off the boundary walls in a variety of trick shots. There’s a short out-of-bounds zone behind the goals.

Referees Now Mounted

The game has two mounted referees to keep it moving. The first contests were supervised by referees on foot, but this required officials with unlimited stamina and sprinting ability, and with a marked shortage of officials who could outrun quarter horses, the result was that the referees were mounted.

But while this saved the officials it created a new problem—retrieving the ball in the event of a foul or a shot out of bounds. Dismounting to pick up the ball wasted time, so the inventors devised the long-handled pickup “net” which is now standard equipment.

The original palmetto-frond sticks were found to be useless after drying and losing weight, so the modern manufactured, rubber-headed stick was developed. No metal or weighting is permitted; maximum size is four inches long, three inches wide and two inches thick, mounted on a cane or rattan handle 48 to 54 inches long.

It’s a hell-for-leather game from the moment of the center charge. The referee places the ball in the middle of the center zone on a white stripe, and the two centers send their horses charging at the ball from boxes ten yards away, sticks swinging. The quickest starter gets in the first lick, driv-
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ing the ball towards his scoring goal. Sometimes it's a tie, with the ball spurtng off into the center zone for more scrambling and hitting.

From then on the ball shuttles back and forth, in and out of zones, with riders tearing after it full tilt, swinging mightily and pulling their mounts into tight turns to take another swing or to avoid fouling. It's amazing how they manage to ride full speed, yet check their mounts just before going over the foul line.

Few Accidents

Accidents among these expert horsemen are few, although collisions are frequent as they rush each other for the ball, and a loose cinch or some other equipment flaw can spill the best rider. And once he's down, he's in trouble.

Palmetto polo has come a long way from the days when you would cut another stick in a few minutes, but it remains—now on a national scale—poor man's polo, one of the most unusual sports of the equestrian world.

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YOU NEED NOT INHALE TO ENJOY THEM
ers and come up with a gross idea of bottom topography. You can—and researchers do—collect sea water samples from great depths. But to coordinate all this, together with visual observation, photographs and accurate measurements, you need more than surface craft. You need a deep-water research platform like the bathyscaphe.”

Questions yet to be answered are, for example: How continuous is the deep scattering layer (abbreviated D.S.L. by researchers)? Surface research shows the phenomenon to exist in all world oceans, including the strategic Arctic and Antarctic. Soundings have indicated more than one layer in places at different depths.

Moreover, when ocean waters warm, the sea life which most experts believe compose the layers seems to multiply. Its living composition may account for the layer’s depth variations in clear water (off Bermuda, down to 2100 feet) and in murky water (as off California’s coast where the layer has been recorded at shallower depths, between 900 and 1300 feet). Since light penetrates far deeper in clear tropical waters, it may nurture the layer’s creatures at these greater depths.

Layer Changes Depth

Harder to explain is the layer’s behavior. As long ago as 1945, oceanographers located the D.S.L. off California at 900 feet. During the day, it remained at that depth, but suddenly, when darkness fell, the layer mysteriously began to rise at a rate of 6 to 18 feet a minute. In less than three hours, it reached the surface.

Nor is the layer’s thickness consistent. It has been recorded as 300 feet thick at times. And at other times and other places, a third that thick.

One clue to the size and kind of sea life which makes up the D.S.L. comes from nettings. Dredged from the depths have been mollusks, shrimp, sea worms and crustaceans such as copepods. Working on the theory that the layer’s creatures must approximate in size the wavelengths they affect, one Woods Hole Oceanographic Institute scientist declared that few, if any, of the critters could be longer than 12 inches.

Another interesting sea phenomenon which the Trieste may explore is that of deep sound channels—watery sea “tunnels” through which sound travels fantastic distances at five times the speed it travels through the air.

Dr. Rechnitzer, writing in a scientific journal, recently defined sound channels as “layers in the water, set apart by spe-
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FEBRUARY 1960 267
cial conditions of temperature, salinity and pressure, which trap sound...and transmit it considerable distances...sometimes even thousands of miles."

Some sound-transmission channels are transitory. Others seem permanently rooted—and fixed—in the depths.

A mere four pounds of dynamite could be heard from Pearl Harbor to San Diego when detonated at a depth of about 900 feet, the Pacific “tunnel” region of greatest transmitting efficiency. In the Atlantic, the best transmittal zone lies about twice as deep—down around 1800 feet.

There’s another depth problem that the Trieste can explore; the varying speed of sound through water of different temperature, density and pressure.

“Temperature,” explains Kenneth V. Mackenzie, who heads the Navy Electronics Laboratory’s Underwater Sound Propagation section, “causes probably the greatest range errors in electronic gear.” The error can be upwards of one-half percent, he points out.

These are a few of the many strange characteristics of the sea which will be explored and analyzed as the Trieste roams about in the black depths of “inner space” with its many instruments and recording devices gathering in the ocean’s secrets.

Not only will scientists have records and samples of strange underwater phenomena, but they’ll also have firsthand observations of sea creatures which have never before been observed in their environment.

---

**Ring of Hydrogen Around Milky Way**

One of the latest additions to our Milky Way galaxy is an expanding ring of hydrogen gas whose source is unknown, reports Dr. J. H. Oort of the Leiden Observatory. The ring of gas is moving outward from the disk-shaped galaxy in large quantities; in fact, the quantities of gas are so large that, at the rate the gas is moving, it would be exhausted in 10 million to 15 million years if it were not being constantly replenished. The source of the hydrogen gas is one of the current puzzles facing radio astronomers. One possible solution suggested by Dr. Oort is the corona of gas that surrounds the Milky Way. However, astronomers then face the problem of where this coronal gas comes from. Another contribution to knowledge of our galaxy is the discovery, reported by Dr. Oort, of a flat central disk of hydrogen gas some 3000 light-years in diameter that is rotating in a swirl close to the center of the Milky Way.
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Fastest Boat in the World?
(Continued from page 125)

and I talked with the Alcoa people in Pittsburgh in the spring of 1959, and from there the project snowballed into Tempo Alcoa.

Once under way, the job went fast. We knew that the boat would have to be metal—no wood or wood fastening could stand the strains of traveling 300 miles an hour over water—and we knew that it would take 300-plus to beat Campbell. Alcoa provided the materials to my specifications; ½-inch sheet aluminum for the skin; aluminum channels for the framework; tapered sheet (⅞ to ⅛ inch) for the sponsons, to give maximum strength at the rear but minimum weight at the front.

We named the boat Tempo (for Guy's boats) and Alcoa (for that company). Her racing number is J-13; J for jet hydroplane, 13 for Guy's lucky boat number. She took 2½ months to build in my shop in Kawkawlin, and we launched her into Saginaw Bay on Lake Erie on August 27, 1959.

Tempo Alcoa is 31½ feet long and 11½ feet across the beam, and weighs 5800 pounds dry. The power plant is a surplus Allison J-55 turbojet engine, the same as that in the Air Force F-84 jet, which develops 5600 pounds of thrust at 8000 revolutions per minute. The tanks hold 165 gallons of kerosene jet fuel, enough for about 20 minutes of high speed operation.

During construction, Guy met the Air Force's "Blue Angels" precision flying team and told them about the boat. They urged him to build in an aircraft ejection seat, and recommended that we confer with the engineering department of North American Aviation in Columbus, Ohio.

After some discussion, we decided not to use the ejection seat—if something goes wrong in a boat at over 200 miles an hour, there's no time or opportunity to hit a panic button anyway. But while we were working with North American, we met Dr. Robert Leidlaw, chief of dynamics, who suggested that we let him wind-tunnel a model of the boat. We built a model, which he tested at airspeeds up to 320. He made us all very happy when he reported that he could suggest no design improvements, and that Tempo Alcoa should be stable at least up to 320. We believe that this design and power combination could go as fast as 400 or 500 miles an hour, but almost nothing is known about boat performance above 200, and stability over that speed is a tremendous problem. (At 300 miles an hour; water is as hard as a plank, and at that speed you need 3000 pounds of thrust per square inch of hull going through the water. That's 1½ tons of thrust to shove a quarter along.)

Greatly encouraged by the wind-tunnel tests, we launched the boat and started power tests on Saginaw Bay, learning as we went along.

We use a heavy starting battery to crank up the big jet engine, setting the throttle at about 20 percent until she "lights up." At 1000 revolutions per minute the engine is on its own and we unplug the batteries and run on the 24-volt battery aboard. Idling, she eases out onto the test course at 10 to 15 miles per hour with more than half the hull in the water. In position on the end of the course, I run the engine up to 3000 revolutions per minute, then throw the high speed switch that feeds the engine its full quota of fuel.

She accelerates to about 90 with the hull still "wet"—mostly in the water. At about 90, with two-thirds throttle, she comes up out of the water very fast, and within a second she's doing over 100, up on three points and accelerating fast. During that second I have to get her aimed at a target, for there's no steering over 100 miles an hour. To move the rudder would spin or flip the boat, so if I'm off course I have to ease her back into the water and start all over again.

Breaking the suction on the bottom of the hull and getting the boat up onto its three points is the trickiest part of driving her—and the most dangerous. That engine has enough thrust to shove the boat at 500 miles an hour, but must be pushed to full power at 90 to get her out of the water. The boat and its resistance are balanced on that tremendous thrust until she breaks loose and comes up; on one run it took a two-mile, full-power run to do it. If anything should happen to throw the boat off balance during that time, she would spin like a Fourth of July pinwheel. The spin would break the resisting suction, so she'd whip faster and faster, like a missile out of control. I don't want to try that ride. Strangely, on rough water like Saginaw Bay, she bounces up nicely, but on smooth water the suction gives me a lot of trouble.

Once she's on her feet and aimed straight I can let her run; acceleration from 100 to 200 only takes six or seven seconds. At 100, the sound of the jet engine begins to drop away, and at 150 there is no engine noise at all—just the whistle of the wind over the cock pit and the banging of the water on the sponsons. She runs smooth and steady as a rock on the test runs, and I took her up to about 225,

(Continued to page 272)
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winning the big battle by simply traveling that fast and staying alive.

Driving at that speed is much like driving a very fast car down a railroad roadbed—over the ties. In choppy water she jumps up and down from six to ten inches, hard and fast, and pulls up to 9 G's on the bounces. For that reason we had to put in a foot throttle—I couldn't have reached or operated a hand throttle under those conditions. The wheel, above 100, is just something to hang onto; all I'm concerned with is keeping the throttle setting steady and going as fast as possible.

During the tests we added the bow plane between the sponsons; it adds lift to help get the boat out of the water, but adds none when she's up on a plane. Aerodynamic lift is something we don't want, which accounts for the blunt nose. The hull is much shorter than the sponsons to avoid air leverage, which could flip the boat up and over at high speed. We designed the boat for about 1900 pounds of lift at 300 miles an hour. That's all we want or need.

Surprisingly, it's almost as hard to stop the jet as it is to start. In the first place, even with the throttle chopped it can take up to 2½ miles to slow down—more than it takes for a freight train—and she doesn't settle back into the water until she's down to 80 or 90. As she begins to settle, we go through the same critical transition period that we do in coming up onto a plane, only without the overpower problem. She must come down perfectly flat, or a sponson could hook the water and spin or flip the boat. About all I can do is watch the direction she's heading; if she begins to veer, I know she's low on that side and can steer accordingly. It's a very touchy period, and takes fast steering reactions. As we learn more about design and performance at high speed, I hope we can stretch those critical planning and settling periods and make control easier.

The water surface makes a big difference in speed. In dead calm the boat is fast, but if we hit a patch of water ruffled a bit by the wind I can feel her accelerate without a throttle change, then slow down again when we're back on smooth water. Water that's ruffled just enough to produce that effect but not enough to bounce the boat is called "fast" water by boat racers.

It was a combination of those three characteristics of high speed boats—slow deceleration, inability to steer at speed, and the "fast" water effect—that caused the accident at Pyramid Lake and kept us (Continued to page 274)
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I Built a Full-Time Business in six weeks says Jack Philip Paynton, Saskatchewan

MY JOHN DEERE BACKHOE was first bought for working after hours and on holidays. Within four to six weeks I had enough work lined up that I quit my job and am now working full time with the unit. With a lot of farms now being equipped with water systems and sewers, I believe I'll always have plenty of work. I would recommend this unit to anyone who wants to be independent and be his own boss.

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from setting a new world speed record.

Choosing the spot for a speed run is a tricky business. Any fresh water will do if there's room for a straight run of about eight miles, but the surface and wind conditions must be just right—not too much wind, not too smooth, and not too rough. And the weather should be as consistent and predictable as possible. Some lakes are much better than others—favorites are Loch Ness in Scotland, Lake Coniston and Lake Ullswater in England, Lake Mead and Lake Washington (near Seattle) in this country; but they all have drawbacks.

Bill Stead of Reno, an official of the American Power Boat Association and one of the great names in speedboat racing, suggested trying Pyramid Lake, near Reno. It has high banks, good weather, 15-mile straightaways, a good shoreline, a lot of open country around it, and it's good water for high-speed boating. The only trouble with Pyramid is that it's inside the Pyramid Lake Indian Reservation, so permission had to be obtained from the local Piute Indians.

Fortunately for us, Bill Harrah, owner and operator of Harrah's Club in Reno and a friend of Guy's, stepped into that point and handled all the local arrangements. He appeared before the council of chiefs and got permission to use the lake for 30 days, then went on to take over the entire local operation, doing a tremendous job and smoothing the way for our whole project.

On November 14, we loaded the Tempo Alcoa on a special aluminum trailer (equipped with jacks to tilt her to within highway width restrictions) and left Kaw-kawlin in two trucks and a pickup truck with three mechanics, a truck driver, a load of accessory gear and two J-35 engines. When we pulled into Reno, we showed the boat to the local population, then started the final test runs.

On the 22nd, during a test run, I came back down from 200 through a patch of rough water. Bouncing around in the cockpit at about 140, I couldn't control the throttle with the delicate touch that's necessary to control the decelerating engine. My foot bounced on the throttle and fed great gobs of raw fuel into the engine, which was white-hot after the run. The extra fuel burned out the turbine blades and tailpipe one in seconds, and as I looked back I could see chunks of steel coming out the tailpipe like popcorn. That was all for that engine. We put in the spare and made plans for more trials on the 22nd.

The engine tested all right, so on the

(Continued to page 276)
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FEBRUARY 1960
23rd we started trials again. That afternoon I fired up the jet normally and moved slowly out onto the lake, accelerating slowly and making a long run toward the south end of our course. I slowed, turned, and made a high-speed pass, then turned around and ran to the south end. The water speed indicator went up over 260 and everything worked beautifully. As I turned in toward the pits, satisfied that we were ready to try an official run, I spotted a photographer on the shore and remembered that I'd promised one close run for pictures. I opened her up and passed the pits about 200 yards offshore. The water was smooth but we ran easily up over 180 before I cut the throttle. We were headed toward a low, rocky promontory called Pelican Point. On earlier runs, all over 200 miles an hour, the jet had stopped in less than a mile on the smooth water, but a sudden breeze kicked the surface in front of me into "fast" water. Even with the power off, the boat took off so fast that the rudder was useless—it was like skidding on glare ice. I tried to make a shallow turn, but it was soon obvious that we were going to hit the point, and turning the boat wouldn't stop its forward motion. If we hit sideways we'd really break up, so I straightened her out and hit the beach headon at about 150 miles an hour.

I expected a sudden stop—but the next thing I knew the boat was airborne and I was feeling mighty relieved. They tell me I missed a rock outcropping by 18 inches, shot up over a 12-foot bank, then flew 100 feet at an altitude of about 20 feet. We landed on sand, slid another 60 feet, and stopped on the other side of the point with the starboard sponson hanging over the water. Another 30 feet and we'd have made it back into the lake.

As soon as I'd convinced myself that I'd survived the flight I climbed out and walked back to the high point to wave to the crew that I was all right. They were pouring toward the point in cars, boats, and on foot, expecting to see a crumpled boat and a driver to match. As it was, the only injury sustained was when Guy fell among the rocks and cut his leg as he rushed to the scene.

Tempo Alcoa lived through the flight pretty well, too. The major damage was to the starboard sponson and around the jet tailpipe, which was beyond repair. The rest of the boat surpassed our expectations and came through with fairly minor damage. The aluminum was tougher than even we thought. Repair on the spot was out of the question, though, so we loaded up and drove back to Michigan. When we've finished the repairs the jet goes on a tour of the boat shows—New York, Chicago, Dal-

las and Oakland—and then we'll go back and try again. We'll break the record if I can keep her on the water.

A lot of great guys helped out on the Tempo Alcoa project—Dr. Robert Laidlaw at North American Aviation's Columbus Division; Jay Sharp of Alcoa; George Maxwell of the Mobil Oil Company; Bill Stead and Bill Harrah and his staff in Reno. And my own crew of boatbuilders in Kawakwil—Don Morin, Jack Chosay, and Lawrence Fouches — took my life in their hands and built the boat. I was never in any danger; they're the finest group of speedboat craftsmen in the business. When we set a new record, a lot of the credit will have to go to them.

There's a big future for jet power in speedboat racing, even on the closed-course races like the Gold Cup. In the first place, the stocks of big Rolls-Royce and Allison piston engines are being used up fast and they've been out of production since aircraft went to jets. (I have three Allisons in my shop and they may be the only ones left in the country; I'd sure like to hear of any that are still around and available.)

Jets are cheaper and simpler to run, too, and even require fewer mechanics. What's more, they don't need gear boxes, shafts or propellers, and those three things fail as often as the engine in racing.

But there are disadvantages. The jet loses thrust if you slow down for a corner, and doesn't accelerate as fast as the prop jobs. We're trying to figure out a way to slow them down without cutting the engine speed, and to find a way to steer by deflecting the jet blast. The heat from the tailpipe is dissipated so soon that it won't be a problem to other boats, but the jet blast digs a three foot hole for about 20 feet behind the boat, which is even tougher on the other drivers than the "rooster tails" they're throwing now. But I think we'll all be using them before too long.

What about Campbell? The water-speed record is a big thing with England, a national endeavor involving support running into hundreds of thousands of dollars. (Guy and I plan to keep Tempo Alcoa a private thing between us and Alcoa.) If we break that record, Campbell will try to get it back, and he could do it, though we think we've got the best boat—at least for now.

I hope to start work on another jet boat soon—a twin-jet job with smaller engines placed well forward on sponsons and the driver seated aft. With the power forward and the increased beam, we should get a faster, safer, more stable boat that's easier to drive, and it should go over 400 miles an hour. I sure want to try it.
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QUALITY MACHINE TOOLS SINCE 1911
What to Do
Until the Firemen Come

(Continued from page 101)

inadequate appliances and phony demonstrations. So, here are some practical suggestions:

1. DON'T buy any extinguisher which does not bear a UL label, no matter what the man says.

2. Base your choice on rated fire killing power, not price.

3. Rely on your hose line for the common Class A fire in ordinary combustibles—but don't forget the watering can.

4. Back this up with dry chemical extinguishers which are excellent for Class B outbreaks in grease, oil or flammable liquids and are by no means useless on Class A fires if you remember about the overhaul.

5. Forget about electrical fires; the home doesn't have high-voltage electrical equipment. If a domestic appliance or even a TV set takes off, it either blows a fuse or you pull the plug. Then it is no longer an electrical fire.

All the other types of approved extinguishers are effective in the job they're designed to do. But why burden your wife with a "first aid appliance" that is too heavy to transport, unwieldy to handle, or so tricky to operate that she'll have to study the manual first? It's the housewife who's most likely to need the extinguisher. The dry chemical type is simple, foolproof, nontoxic, a nonconductor, lightweight and kills far more fire per pound (or per dollar) than any other type. This makes it a "best buy" for the home—and all leading manufacturers make them.

A promising new fire-fighting chemical was recently approved by the Army for its use—and engineers say it is also safe for the home. It's a brominated chemical which carries the tongue-twisting name, monobromotrifluoromethane—though you may prefer the shorter term, Freon-13B1. The material is excellent for electrical and flammable-liquid blazes.

The thing to remember about all hand extinguishers except those employing plain water is that they are most effective on surface fires where their smothering action is at its best. They can't achieve the penetration of water on ordinary combustibles. But they can do wonders on flash fires in lightweight materials which are so common in the home and so frequently the springboard from which the fatal fire takes off. Once you've seen a small handgun black out a blazing, dried-out Christmas tree, you get the point.

(Continued to page 280)
domestic fires are as awe inspiring as this. One valid exception to this rule of thumb is an automatic sprinkler type extinguisher which has a definite place in any home using an oil-burning furnace or a pump motor which runs frequently. This device, which carries UL approval, is a metal container suspended on a hook from the ceiling and containing carbon tetrachloride and ammonium hydroxide. The latter not only renders the former nontoxic, but it also generates the discharge pressure when the release of a fusible link allows the two to mix. A typical sprinkler distributor spreads the discharge in an umbrella-shaped spray over considerable floor area.

This is hardly fire fighting, but it is compelling the fire to commit suicide by having its own heat turn on the extinguisher! This device, listing at around $29.50, must not be confused with the cheap glass balls or bombs employing straight carbon tet. which are not approved by any recognized inspection agency.

In any "do-it-yourself" project, how you use your tools is as important as what tools you use. Home fire fighting is no exception. Whether you have a hose line or a chemical extinguisher, the cardinal principles are:

1. Always aim the stream at the base of the flames.

2. Keep the stream moving from side to side across the fire.

3. Don't throw the stream at the smoke, but at the burning fuel which is causing the smoke.

Water absorbs the maximum heat at the instant it is converted into steam—which is the way it cools a fire—and the best place for this conversion is at the seat of the fire. Carried upward by convection, the steam also exerts a certain smothering effect. Similarly, a chemical agent releases an inert gas which smothers the flame by excluding oxygen, and you want this gas to be carried upward in the rising column of heat. So always aim at the base of the flames.

The volume of this gas, incidentally, is many, many times greater than the volume of chemical from which it came. Consequently, the approved hand extinguisher, correctly used, will kill far more fire than the uninitiated layman would believe possible.

In a combat with fire, flame is the least of your worries. Being an amateur, you're going to get out if the blaze gets painfully hot—as you should. But if it isn't punishing, you're going to face a far more stealthy adversary: smoke. Smoke contains toxic

(Continued to page 282)

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EASY TERMS ¼ DOWN

combustion gases, some of which are more lethal than carbon monoxide, which is always present. And smoke has killed many more victims than live flame.

Unfortunately, the color or shade of the smoke is not a reliable clue to its toxicity, but there is one cue you'd better follow. If the smoke is thick, dark and "lazy" (slow moving), you'd better get out without delay. Not only is it loaded with lethal gases, but its sluggishness implies a dangerous depletion of oxygen. Never forget that a going fire can survive in an oxygen concentration which won't support life, and this is a condition common to the pent-up cellar or attic outbreaks which are best left for trained men to handle.

About three-quarters of all dwelling fire victims die upstairs from downstairs fires. This is because heat rises. In the home it floods up the open stairwell to the topmost hall—where the bedrooms usually are—then mushrooms under increasing pressure as more superheated air (at 1600 to 1800 degrees Fahrenheit) pours up from the blaze below. One gulp of this withering air is as lethal as a rifle bullet, and escape through it is almost always impossible.

One Brooklynite, aroused at 3 a.m. by the strong odor of smoke, jumooed out of bed, grabbed the hall door knob, then dropped it because it was too hot to hold. Undaunted, he wrapped a towel around his hand, opened the door and was felled in his tracks. Firemen found him sprawled dead across the sill without a burn on him.

What got him? Superheated air and combustion gases flooding up the stairwell. The hot doorknob was a sure danger signal that the hallway was deadly—if only he'd known it.

The basic rule is NEVER OPEN A HOT DOOR. First, put your hand on the panel above your head. If the wood is hot, don't open the door; it's too late. Instead, go to a window and holier for help. Or get out by some secondary exit, such as a porch roof, a back stairway or any other course which does not bring you into the main hall.

If the door is not hot when you feel it, open it carefully. Brace your hip against it; put one hand over the crack between the door and jamb higher than your head; open the door an inch. If there's any pressure against it, slam it shut. If the incoming air on your hand is hot, slam the door shut, for you'll never make the stairway.

Drill every family member in this procedure. Figure out a secondary means of egress for each individual which avoids the upper hall and the main stairway—or any

(Continued to page 284)
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other stairway that might be flushed with heat.

It is smart to have a ladder outside the house so the first one to get clear can raise it to bedroom windows. The modern lightweight aluminum types are excellent.

It is smarter yet to equip sleeping rooms which have no secondary exit with an ingenious escape ladder now available. Fastened to baseboard or under the window sill, this ladder stows in a box on the floor and is always available for emergencies.

All this suggests another basic rule: always bottle up the blaze, if possible. If you can shut a hall or bedroom door and keep the heat from flooding through the house, you've at least put a curb on the extension of the fire by convection — its fastest means of advance. In Jersey City recently four people died on the third floor of an apartment because those who discovered the blaze on the first floor fled in panic and left the door to the hall open.

If your home is situated where a fire department response is fairly prompt, there isn't much for you to do beyond the elementary first-aid operations if you've had the wit to call the firemen first. But if you are in a more isolated location, there are other things to worry about. Two very common types of fire which often break out in concealed spaces are those started by overheated or defective flues in chimneys and those originating in defective wiring. Both require opening up the wall or ceiling with an axe or hatchet so that you can get water or chemicals into the hidden void. And while this is a large order for the untrained layman, he'll have to do it if help isn't readily available. (See the diagram on page 100 for an idea of how fire spreads through hollow spaces — and how to guard against it.)

If you succeed in dousing the fire this way, then the aforementioned task of overhaul becomes vital. This involves following the natural upward course of the heat all through that part of the house, feeling walls and looking for paint blisters or drooping wall paper in all the rooms directly above the outbreak. Such signs mean you must open up that wall and get water in there, else the blaze you thought was out will be coming through the roof presently. The presence of cobweb in such a void is good evidence that no dangerous heat has passed that point.

The same procedure should be followed when any substantial volume of fire has burned inside a room close to the hollow wall. Heat can go through a crack which a cockroach couldn't negotiate, and this vertical spread through concealed voids is (Continued to page 286)
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the bane of the fireman's existence. You've often heard how they "wantonly chop up" a place, doing more damage than the fire did. This foolish gripe stems from ignorance of the fact that they are making certain that a second fire, worse than the first, doesn't break out later.

In modern living, the Class B fire is assuming increasing importance. This ranges all the way from grease in the oven to oil drippings or gasoline spills around the car or power mower in the attached garage. The dry chemical extinguisher will be a stalwart ally here if handled properly; water will just make matters worse by spreading the flame. Sweep the surface of the burning material from side to side, being very wary of the treacherous re-flash from some overlooked hot spot, especially metal. If the fire is on the floor, start at the point nearest to you and mop it up thoroughly as you advance. Don't overlook the italics, for the sudden flashback has trapped many an unsuspecting man in an ankle-deep pool of unburned vapor.

All of this counsel is based on the assumption that you or someone will get an early start on your fire. Fortunately, this is the case in a remarkable number of home blazes. Professional firemen take care of one-third of their alarms with hand extinguishers and handle most of the rest with a small "jump line."

With an early warning, there is a good chance that you can do likewise. But you'll need something more than a flyswatter with which to work — and a little more know-how that the ill-fated father in California had!

Body’s Electrical Energy Is Clue to Emotions

One of these days scientists may be telling you what job is best for you or what your state of mind will be the week after next — all according to the electricity in your body. Three Yale scientists, Drs. H. S. Burr, F. S. C. Northrop and Henry Margenau, have found that basic electrical energy ebbs and flows in all living things, producing predictable changes in human personality and behavior. Tests on more than 500 humans over a period of 11 years, the scientists said, suggest that the performance of soldiers or astronauts under severe stress could be gauged in advance by study of their changing force field patterns. The emotional state of the individual is inseparably related to the ups and downs of the voltage of his electrical field, Dr. Burr said, and each human’s field varies with a measurable rhythm.
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