

# Popular Science

January  
1929  
25 cents

SM

MONTHLY *Founded 1872*

*Wilbur and Orville Wright  
Inventors of the Airplane*



*The true and inside story of the  
FATHERS OF FLIGHT • never before  
published • begins in this issue*

# How You Can Test Antifreeze



"Paste this in your hat," Gus suggested. "A glycerin solution that floats this particular hydrometer at 1,080 will keep Jack Frost out of your radiator down to ten degrees."

## Gus, Turning the Model Garage into a Laboratory, Works Out Easy Formula for Radiator Solutions

By

MARTIN BUNN

of glycerin and water. What's the matter with that way of finding out what you want to know?"

"But will the results be sufficiently accurate?" Dexter objected doubtfully.

"Why not?" countered Gus. "You could wear out a couple of pencils figuring it closer than the paper on the wall, and even then you wouldn't be dead sure. These cheap hydrometers are no great shucks for accuracy. Your figures might be all right and a bum hydrometer would throw you way off. But if you make up the actual mixtures and float a hydrometer in 'em—any old hydrometer—you can keep that hydrometer just for testing your radiator solution, can't you?"

"You've proved your case," admitted Dexter.

"THESE storage battery hydrometers," Gus continued, "don't read much below 1,075, so you won't be able to tell anything about very weak solutions of glycerin and water. Let's start with one part glycerin to two parts water. That's a thirty-three percent solution."

"Reads about 1,080," said Dexter, bending over to get his eye on a level with the top of the solution in the test tube.

"Paste that in your hat," Gus suggested. "A glycerin solution that floats this particular hydrometer at 1,080 will keep Jack Frost out of your radiator down to about ten degrees."

"But we occasionally have colder weather than that in this latitude," Dexter objected.

"Sometimes," agreed Gus. "Let's see how it reads in a forty percent solution. That won't freeze down to zero. And if we add one third of a part more glycerin to what we've got in the test tube already we'll have mighty close to a forty percent solution."

DEXTER did a bit of figuring while Gus was stirring in the added glycerin and found that the auto mechanic was right.

"There you are," said Gus, as he jiggled the test tube to make the hydrometer float without sticking to the glass walls. "Just 1.100 on the scale. Nice easy figures to remember. Keep the solution at 1.100 if you want zero protection."

"Excellent!" Dexter exclaimed. "Now I have merely

(Continued on page 154)

"SOME people," grumbled Gus Wilson, "sure do waste a lot of time finding out what they want to know."

The veteran auto mechanic disgustedly shoved the telephone away from him.

Joe Clark, his partner, who had called him into the office of the Model Garage to answer the phone, grinned sympathetically. "What did that bozo want?" he inquired. "If I'd known he only wanted to ask a bunch of fool questions, I wouldn't have bothered you."

"Funny you didn't recognize him," replied Gus. "That was old Dexter, the bird who's always spouting theoretical stuff about calories, thermo-something-or-other, and the rest of it. He'd rather mess around for hours with a pencil trying to figure out something than to ask someone who knows."

"Then what's he pestering you for?" Joe asked. "Why don't he figure it out if he's such a shark at it?"

"He didn't ask any questions," grunted Gus. "He says he's coming here to get me to help him on some of his blasted calculations. I didn't get what he was driving at except it had something to do with specific gravity. I just told him to come ahead and I guess he's on his way now."

A FEW minutes later Dexter drove up and insisted on bringing his car inside instead of parking it in front of the garage. It was below freezing outside, he explained, and he was afraid the radiator might freeze.

"I am sorry to bother you, Mr. Wilson," he said, as he reached into his car and dragged out several thick and musty looking scientific books. "It is just a relatively simple problem in specific gravity. That is, it should be simple enough, but

there are several confusing factors that complicate matters."

"What are you trying to do, figure out what makes ice float?" smiled Gus.

"No," replied the other. "You recommended that I use glycerin in the radiator this winter and I took your advice. The results have been excellent until day before yesterday, and then I unfortunately forgot to open the radiator shutter until the motor became so overheated it began to boil, and I am afraid that a large part of the solution squirted out the overflow pipe with the steam. Now I don't know what actually is left in the radiator. I looked up the specific gravity of glycerin and found it was 1,265 degrees at ordinary temperatures. It occurred to me to calculate the specific gravity of the mixture I was using and then by test see what I actually had. But these books show that it is rather complicated."

"BUMPED right into a tough one, didn't you?" said Gus. "Seems to me I remember reading some place that 'a solution is a uniform mixture that doesn't follow the law of definite proportions.' That floored you, eh?"

"That's it precisely," said Dexter, "and now I am unable to find a formula to fit the case. Perhaps you can help me?"

"Sure," Gus replied. "Chuck those blame books back in the car. We won't need 'em. Hey, Bill!" he called to the youngster who was sweeping the other side of the garage. "Chase yourself down to the drug store and buy me a couple of ounces of glycerin and a test tube. Make it snappy!"

"Now," Gus explained when Bill returned a few minutes later, "all we've got to do is to take the hydrometer float out of this storage battery hydrometer and see how it floats in different mixtures

# \$25 Extra Each Week for YOU—Easy

Make BIG MONEY—Spare-Time or Full-Time—with Hawaiian Guitar

Be the life of every party—be paid big for your spare-time hours! Dances, parties, orchestras—all pay REAL CASH for the sweet melodious music of the Hawaiian guitar. YOU can make \$25 a week and up extra; or \$60 to \$100 a week full-time pay!

No Musical Knowledge Needed; Learn Quick! Right at Home in 1 to 3 Months

My easy method explains everything. No hard practice, no tiresome "scales" to learn. You play real tunes from the very first! And in only 1 to 3 short months you can actually be playing for pay. I'll prove it to you without cost; get my FREE Book below!



**PROOF**

"I had learned only a few chords when I was asked to play at a dance. Received sixteen dollars (\$16) for one night's playing."  
—E. A. Prutzman, Lehigh, Pa.  
"Only quarter way through 6 week course and already playing 3 evenings a week, spare-time, for \$10."  
—J. Krulwich, Kitchener, Ont., Can.  
"Have made almost \$200 with my Hawaiian Guitar in spare-time."  
—John B. McMartin, Cadet, Mo.



This Genuine HAWAIIAN Guitar Comes with 1st Lesson

**PHONOGRAPH RECORDS and Complete Outfit at No Extra Cost**

You also receive clear, correct, fool-proof Demonstration Phonograph Records of every selection in the course. And NOT ONE CENT OF EXTRA COST to you!

**FREE BOOK Shows You How**

Shows how I train you at home, quickly to play Hawaiian Guitar; how you risk absolutely nothing to learn; how I send you everything you need. Clip the coupon and send it today. NOW!



**MAIL NOW!**

A. F. Bloch, President, Hawaiian Studios, 560 9 of New York Academy of Music, 200 Fifth Avenue, New York City.

Without obligation, send me FREE Book "How to Learn Hawaiian Guitar," with facts on how I can make BIG MONEY, spare-time or full-time.

Name \_\_\_\_\_  
Address \_\_\_\_\_

## ADDING MACHINE VEST POCKET SIZE

ADDS, SUBTRACTS, MULTIPLIES, DIVIDES

Does work of a \$200 machine. Guaranteed 5 years. NOT A TOY. Made of steel and indestructible. Million dollar capacity. Fits in pocket. Will not make mistakes. So simple child can operate it. Everybody should carry one for figuring.

**FREE TRIAL** SEND NO MONEY

Just name and address. We will ship Calculator immediately. On delivery pay postman \$2.50 (plus few cents postage) 10c additional for Handsome Leatherette Case. (If outside U. S. send cash.) If not satisfied after 10-day trial you get your money back. THOUSANDS OF SATISFIED USERS. This is lowest priced practical calculator made. "Why pay more for inferior imitations?" Order from this ad.

**\$2.50** TOTAL COST

Mail Coupon Today

**BABY CALCULATOR SALES CO., (MANUFACTURERS)**

Dept. 61, P. O. Box 1118, CHICAGO, ILL., U. S. A.  
[ ] I am enclosing \$2.50—send adding machine prepaid.  
[ ] Send adding machine C. O. D. \$2.50 plus postage.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_

**AGENTS** Write for big commission and exclusive territory proposition.

## Battles with Polar Ice

(Continued from page 27)

north, east, and west of you." And the ship fettered with chains of ice! Another radio flash! But not from Babushkin. It was the *Krassin* sending word that it had gotten through to the north coast of Spitzbergen and soon would enter the ice.

The next day everything around the ship suddenly cracked and roared! What was the matter? The ice fields surrounding the boat, as far as the eye could reach, were moving in different directions.

Ice-anchors and hawsers were dislodged. Huge masses of ice climbed over the *Malygin*, broke to pieces, plunged into the water, and emerged again. Now open water appeared around the boat, and as suddenly disappeared. Within the ship, cross beams bent and cabin doors warped. Filler and paint flew off the walls in chunks. The ice-breaker was like a house in an earthquake.

**A**BOUT noon the wind scattered the fog, and Hope Island was sighted only five miles away from the ship!

Now the moving ice carried the boat straight against the island—a new danger.

The engines raced madly, full speed ahead! At first, the ice refused to yield. For half an hour, the ship failed to advance a single yard. Then the frozen wall began to separate slowly! Plowing on desperately, the *Malygin* pushed through. Water spouted in geysers from beneath the screw, and whirlpools seethed all around. Floes several yards long and wide were quickly pulled in and rose to the surface, broken to bits. The blades of the screw struck the ice cakes with continual crashes.

Still, no word from the aviators. In the afternoon of the fourth day, the ship was hemmed in again. Whole mountains of ice piled up against the sides. That night, a brisk wind rose from the north and drove the ship slowly toward a group of icebergs. They faced the *Malygin* like stolid marble monsters. There seemed no chance to avoid them. Again a terrific ice jam made the engines useless.

The crew was on deck. Not a word was spoken. With mingled fear and awe they watched the magnificent sight before them.

**B**UT the field ice which slowly propelled the *Malygin* happily passed between the icebergs! The fearful danger passed. At last the *Malygin* came to a full stop four miles from the granite island that had threatened it with destruction. There it lay, ice-locked again, for two more days. And still no word from the flyers!

At last, in the dawn of July fourth, while most of the crew were asleep and only the captain and helmsman were on the bridge, a small black spot appeared in the distant sky. It was the plane! Babushkin and his men had suffered untold hardships. For days they had scarcely slept nor eaten, and several times had escaped death by a narrow margin.

These experiences convinced the leaders of the expedition that the *Malygin's* route should be changed. The ship was headed southward to open water and then east, where less ice was expected. Many another hard battle with fog and floes was fought, until finally word came from the *Krassin* by radio that the *Italia's* men had been rescued.

The superb achievement of the *Krassin*, and later the thrilling story of the *Malygin's* adventures, have brought the ice-breaker a measure of public renown. The fact that boats of this type, during the last half century, have virtually built up a new technique of the sea is still, however, little recognized.

For thirty-nine years, the great wooden ice-breaker, the *Bear*, of the U. S. Coast Guard, was Uncle Sam's policeman as well as the only physician, the only hospital, and the only base of food supply north of Nome,

Alaska. Some two years ago the veteran ice fighter was succeeded by the modern steel cutter, *Northland*.

Canada, too, uses ice-breakers on the Great Lakes and in the Gulf of St. Lawrence, where four of the ships are on the job each winter. The *Mikua*, which clears the way for shipping in the St. Lawrence, is one of the largest ice-breakers afloat.

Not only in purpose, but also in design, the ice-breaker is different from every other type of craft afloat. It must be both heavy and powerful. Capable of speed sufficient to give it the necessary momentum to break the ice by the sheer force of its blows, it must at the same time be strong enough to inflict, and not suffer, damage by the collision. It must be able to crack ice into pieces weighing a few score tons apiece! And at the same time, it must be capable of sliding on the ice.

The majority of ice-breakers are equipped with large water tanks fore and aft, and in the center. These may be filled or emptied at the rate of several hundred tons an hour, so that the weight can be greatly increased to smash the ice, or to roll the ship in such a manner that it can smash itself free. The ships are provided with steel plating of armor thickness, which sometimes is even doubled fore and aft along the water line and to the bottom of the keel in the fore body, where the ice impact is heaviest.

Today, ice-breakers capable of crushing their way through ice from five to thirty feet thick go to the rescue of ships in distress in all parts of the world. They save human life and costly craft, and are an invaluable aid in increasing humanity's knowledge and wealth.

## How to Test Antifreeze

(Continued from page 84)

to insert the hydrometer in the radiator at any time to determine the strength of the solution."

"Not any time," answered Gus. "You forget that a hot solution is expanded and the hydrometer will sink down below where it ought to float. That reading is only good at about sixty degrees."

"Would that reading also apply to that new antifreeze, ethylene glycol?" Dexter asked.

"I should say not!" replied Gus emphatically. "It's good only for a mixture of glycerin and water. Ethylene glycol is just as good as glycerin as an antifreeze, but the pure stuff reads only 1,120, so you'll have to use a hydrometer that reads lower than the storage battery hydrometer to test it when it's thinned with water. Plain water reads 1,000 on the hydrometer scale, you know."

"And if it's alcohol you're trying to test, you'll have to have a hydrometer that reads even below that, because alcohol is lighter than water."

"If glycerin and ethylene glycol do not evaporate as does alcohol, I suppose there's no necessity for testing quite frequently as is the case if you are using alcohol," Dexter observed.

"Depends a lot on how hot your motor runs," Gus explained. "If you don't go spraying the road with expensive cooling solution through a leak, or by boiling it over as you did, and the motor doesn't run so hot that it evaporates a lot of water, you can just squirt in the radiator once in a while to make sure that the solution is still there."

"Either glycerin or ethylene glycol will last almost forever if you don't lose 'em through leaks. There's no reason in the world why you shouldn't use the same solution winter after winter, adding a little antifreeze each year to make up for leaks if the hydrometer tells you it's needed."

A definite program for getting ahead financially will be found on page four of this issue.