

# POPULAR SCIENCE

SEPTEMBER

15 CENTS

20 CENTS IN CANADA



FOUNDED MONTHLY 1872

NOW  
**15¢**

20 CENTS IN CANADA



SEE PAGE 47

NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS  
HOME WORKSHOP PLANS AND HINTS • 350 PICTURES



By  
MARTIN  
BUNN

WITH Gus Wilson perched on a front fender, Tim Barret drove his car up the steep grade of Bluff Hill. As the car gained speed, the veteran mechanic crouched closer to the open hood and the driver poked his head out of the window like an alert locomotive engineer.

"There it is. Hear it?" Barret shouted over the drone as the motor started skipping.

Gus nodded and reached into his overalls pocket for a screw driver. Listening intently, he short-circuited each of the six spark plugs that studded the motor block. With the exception of the last plug, the miss grew more pronounced each time the contact was made.

"O. K. I think I've got it," the gray-haired garageman shouted, jerking his thumb toward the spark plugs. "Pull over when you get a chance and we'll have a look."

"Funny thing about this car," Barret complained while Gus rummaged in his portable tool kit for a spark plug wrench. "She'll run fine for five or six days in a row. Then all of a sudden, she'll develop that miss every time she takes a hill. What gets me is that it disappears as quickly as it comes."

"Sort of takes a vacation now and then," suggested Gus with a grin. "Been acting that way long?"

"Not particularly," replied Barret. "Noticed it first about three weeks ago when I was down at the beach on my vacation. She acted that way for days at a time down there, but since I've been home, I haven't noticed it so much."

As Barret talked, Gus touched the base of each spark plug, wetting his finger tip as a housewife does when testing a hot iron. Finally, he slipped the head of the socket wrench over the last plug in line and with a steady tug loosened its threads.

"How about dirt in the carburetor?" the owner suggested. "That'll make a motor miss, won't it?"

In his casual preoccupied way, Gus lifted the spark plug from its hole in the cylinder head and rubbed a knowing thumb across the tip of the insulator. Then, after a careful inspection, he screwed it back into place.



# Tales that Spark Plugs Tell

"Unless I miss my guess, it's the ignition wiring," he said finally. "As long as I've got an extra set here in my tool kit, we might as well stick them in and see what happens. While we're here, we can try it out on this same hill."

A half hour later a second trip up Bluff Hill proved that Gus was right. The new ignition wiring completely eliminated the miss. In fact, the whole car seemed peppier and more powerful.

"That sure turned the trick," agreed Barret as the two men started their trip back to the Model Garage. "But I still don't see how bum ignition wiring could make a car run the way this one did. Why didn't all the cylinders miss, and how come the trouble only showed up now and then?"

"Sort of a combination of circumstances," explained Gus. "In the first place, only one piece of that ignition wiring was bad. For some reason or other, it was resting smack on the motor and the heat just naturally rotted the insulation.

"When it was dry, it held up, but when there was a lot of moisture in the air, the water saturated the spongy spots and made a short circuit to the motor head. Naturally, the juice was shunted away from the spark gap and the motor missed.

"Down at the beach it was probably

Gus Wilson short-circuited the spark plugs with a screw driver. "I think I've got it," he told the driver. "Pull over when you get a good chance and we will have a look"

damp, especially at night when the fog rolled in, so the short circuit was there most of the time. When you came back here where it's drier, she only acted up when it was muggy and rainy. Chances are, that heavy rain yesterday is what made it miss today."

"What gave you the hunch it was the wiring?" put in Barret, interested.

"The usual symptoms," replied Gus.

"Symptoms?" repeated the man. "Why, all you did was look at one of the spark plugs. What sort of symptoms can you see by looking at those greasy things?"

"You wouldn't think a doctor could tell much by feeling a patient's pulse or looking at his tongue, but he can," pointed out Gus. "When I found out which cylinder was missing, my first hunch was a fouled spark plug. When I saw that it was fairly clean and just a bit wet, I decided that something else was keeping the

juice from reaching the gap. The distributor was O. K., so my next guess was the wiring."

"Simple when you know how, isn't it?" said Barret, admiringly. "No wonder every one in the county knows Gus Wilson."

"Ever want to be a detective when you were a kid?" asked Gus, trying to ignore the compliment. "Well, finding out what ails a car isn't much different. First you've got to find the clues and spark plugs are good witnesses. They'll tell you about plenty of car troubles."

"I've never been able to see much difference in spark plugs," insisted Barret. "They all look alike."

"Not by a jug full," corrected Gus. "Every motor leaves its telltale marks on a plug that's been in use any length of time. Why shouldn't it, the spark-plug ends being right down there in the business end of the motor? They come in contact with everything that makes the car run—air, gasoline, oil, and electricity.

"Lots of people wonder why the gap terminals on their spark plugs wear down so fast. Generally it's an indication that the carburetor mixture is too lean. If the tips of the insulators are straw colored at the same time, it's a cinch that a lean mixture is causing (Continued on page 118)



# NEW OPPORTUNITY IN ACCOUNTING

—and how you can take advantage of it

Never before, has there been as great an opportunity as now faces the accounting profession. Depression has taught executives the vital urgency of knowing all the facts about their business. Then our new governmental policy forces the keeping of better and more complete records in every office and plant. It is not a matter of choice—it is necessity. Authorities tell us the demand for competent accountants will probably soon exceed the supply. This spells real opportunity—for those already in accounting, and for capable men who will start immediately. The man who is wise will investigate promptly—he will write for free booklet and full information.



**LA SALLE EXTENSION UNIVERSITY**  
The Institution That Has Trained Over 1,200 C. P. A.'s  
Dept. 983-H CHICAGO

## Clean Air—Temperature and Humidity Control

# Air Conditioning

Increasing demand for heating and ventilating engineers, builders, and salesmen trained in air conditioning offices, stores, theatres, homes, factories, coaches, etc.

Real opportunity to get in on ground floor of this fast-growing industry and grow up with it. Thorough home-study, training in 6 to 12 months. Send TODAY for Free Bulletin. No obligation.

**American School, Dept. AC646 Drexel at 58th, Chicago**

## EARN \$40 a MONTH at HOME!

Yes, you can easily earn up to \$8 an hour at home stringing tennis rackets! No experience needed. LEARN HOW TO EARN in a few minutes. I've already helped many fellows make \$20 to \$40 and MORE per month. Each job pays 200% PROFIT. Think of it! Go into partnership with Dad or a friend... your home is your office! Grab this great opportunity, plan now to make \$100 to \$200 cash this season. QUICK—write for FREE details to W. BICKEL, 809 W. Madison, Dept. 13-66, CHICAGO, ILLINOIS.

Set of Finest Silk Strings, 11-lb. re-stringing guide, with easy directions. All Prepaid **95c**

## Inventions Wanted

Patented or Unpatented

Our manufacturer-clients want better inventions to meet competition. What have you?

**Chartered Institute of American Inventors**  
587 Barrister Building Washington, D. C.  
"World's Largest Organization of Inventors"

## Chemistry Supplies

Write for FREE information or send 15c in stamps to cover cost and get valuable catalogue.

**KEAMKIT CHEMICAL CORP.**  
135-A JOHNSON ST. BROOKLYN, N. Y.

Combination of 1 test tube holder, 1 test tube rack, 7 test tubes, 1 test tube cleaner, 1 atom, 1 valuable catalogue. Cannot be duplicated elsewhere for less than \$2. NOW postpaid complete—for only \$1.

**\$2 SPECIAL**

Always mention **POPULAR SCIENCE** MONTHLY when answering advertisements in this magazine.

## INVENTORS PATENT YOUR IDEAS

Your Patent Application Must be filed for Examination by the Examining Corps in the U. S. Patent Office. Choosing your Patent Attorney is an important matter. Why not select a Registered Patent Attorney having had personal experience in the Examining Corps of the U. S. Patent Office. MAIL COUPON TODAY FOR FREE PATENT BOOK and RECORD OF INVENTION form.

**HOW TO PATENT**

## MILLER & MILLER

REGISTERED PATENT ATTORNEYS  
FORMERLY IN EXAMINING CORPS U. S. PATENT OFFICE

1638 Woolworth Bldg., Dept. C, New York  
205 MILLER BUILDING WASHINGTON, D. C.

Please send me your Free Book, "How to Obtain a Patent," and your "Record of Invention Form."

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

# FEATS OF MAGIC FOR THE HOME CHEMIST

(Continued from page 61)

flame. When the material is heated, it is then touched with a drop of cobalt nitrate and again heated. If the mass becomes blue (Thenard's blue), the presence of aluminum is indicated. On the other hand, if a green color (Rinman's green) results, zinc or one of its compounds is present.

Free nickel or cobalt can be produced in small quantities in the home laboratory by simply heating a mixture of cobalt or nickel compounds and sodium carbonate (soda ash) on a charcoal or asbestos block. Prepare small quantities of the metals in this way and place them in a test tube. Then hold a strong horseshoe magnet near the sides of the tube and you will be surprised to find that the powders retrieved from the fused mass in each case will be attracted. Strange as it may seem, both cobalt and nickel are magnetic.

IT IS this magnetic property of cobalt that makes possible the manufacture of cobalt steel alloy, a metal displaying a higher magnetic strength than any other steel. The great magnetic properties of cobalt steel are illustrated graphically by the floating magnet shown in the photograph. The device, arranged by the Westinghouse Electric Company, consists of a metal ring that floats mysteriously in the air above an innocent-looking composition base. The secret lies in the use of cobalt steel. A permanent magnet of cobalt steel is cleverly hidden in the base while the floating ring itself is made of the same metal. The combination of the repelling forces of like poles holds the floating ring away from the base, suspending it in the air. No other steel exhibits such strong magnetic qualities.

Metallic cobalt also can be obtained by immersing a bright strip of magnesium metal in a solution of cobalt nitrate. The cobalt will be precipitated on the strip in the form of a greenish powder which, when washed and dried, appears black. In testing, you will find that a magnet also will attract this prepared form of cobalt. Similarly, by adding zinc dust to a nickel-chloride solution, free metallic nickel will be formed. It, too, will display strong magnetic properties.

Although there is nothing startling in the statement that iron is magnetic, many amateur chemists will be surprised to learn that iron hydroxide also will exhibit magnetic qualities. This interesting compound can be prepared in the home laboratory by adding a half teaspoonful of ordinary hydrogen-peroxide solution (3%) to a somewhat dilute solution of ferrous ammonium sulphate. Several drops of strong sodium-hydroxide solution then should be added and the iron hydroxide will be precipitated in the form of a light brown powder. Finally, shake the tube and rest it close to the poles of a permanent magnet. When the iron hydroxide precipitates and settles, a quantity of it will tend to adhere to the glass nearest the magnet.

FEW chemicals have a more high-faluting name than the cobalt compound known as cobalt hydromercurithiocyanate. Although the chemical has no practical uses, the colors disclosed make its production an interesting experiment for the home chemist.

To prepare the chemical, add a solution of ammonium, sodium, or potassium sulphocyanide (thiocyanate) to a solution of mercuric chlor. and place it in a tall container such as an olive bottle. Then add a solution of pinkish cobalt nitrate. In a short time, a flaky blue precipitate will fall gently through the liquid, slowly settling to the bottom. This precipitate, resembling a blue snowfall, will be the cobalt hydromercurithiocyanate, which when washed and filtered, can be preserved.

# TALES SPARK PLUGS TELL ABOUT MOTORS

(Continued from page 68)

the trouble you are having in the engine. "On the other hand, spark plugs in another car may show an accumulation of dry soot down near the points. Generally that means a mixture that's too rich. You can check it by holding your hand in front of the exhaust after the motor has been running awhile. If it smells strongly of gasoline, it bears out the spark-plug symptom."

"I've always thought that a badly carbonized spark plug meant only one thing," said Barret. "And that's a worn piston and rings."

"ONLY when it's oily," said Gus. "If the plug is dry, the heavy crust of black carbon may be caused by any one of a number of different things. Bum timing, a broken connection, a low battery, poor breaker points, and leaky valves all can contribute to the carbon on a plug. If the rings are bad and oil is being pumped into the cylinder, the plugs are bound to be fairly wet and gummy."

"Generally, leaky pistons and rings will give themselves away by fouling the plugs almost as fast as you can clean them. If one or two cylinders particularly act that way, it's a safe bet they're pumping oil."

"I had a funny thing happen to me about a year ago," interrupted Barret. "Took my plugs out one day to clean them and adjust the points and found that the tips on two of the insulators were cracked. What do you suppose caused that? The motor seemed to run fine when I put in new plugs."

Gus grinned. "Chances are you caused that trouble yourself. Good plugs seldom crack inside a motor unless it overheats. You probably made the mistake of bending the electrode that's embedded in the porcelain instead of the one that's joined to the metal shell. Naturally, you're going to crack the insulator if you put any pressure on it. Once it's cracked, it's only a question of time until carbon finds its way in and short-circuits the plug."

"There's more to these spark plugs than I imagined," said Barret as he stopped the car in front of the Model Garage. "Except for cleaning my plugs every so often and replacing them now and then, I've never bothered much."

"Well, at least you've been doing the important things," agreed Gus, smiling. "That's more than most folks do. They'd rather save pennies on spark plugs and ignition wiring and waste dollars on gas."

## TESTS SHOW BACTERIA SURVIVE INDEFINITELY

NEW evidence that bacteria can survive for illimitable periods has been furnished in tests made by Dr. Charles B. Lipman, professor of plant physiology of the University of California, of soil taken from 800 to 1400-year-old pre-Aztec and pre-Inca pyramids. Three years ago Dr. Lipman discovered living bacteria in the interior of anthracite coal and last year he reported finding bacteria in meteorites (P.S.M., April '33, p. 42). His discoveries have led Dr. Lipman to conclude that bacteria can survive in a state of suspended animation for millions of years.

## ALTITUDE FLYERS NEED CARBON DIOXIDE SUPPLY

AVIATORS flying at high altitudes should take along a supply of carbon dioxide as well as a tank of oxygen, recent investigations at Hamburg, Germany, have shown. Many of the ill effects of high altitudes are now overcome by the use of oxygen but the recent tests have shown that other effects are due to a lack of carbon dioxide in the blood.