SUPPLEMENT: ATLAS MAP OF ITALY

VOL. 120, NO. 5 NOVEMBER, 1961

NATIONAL GEOGRAPHIC

$8.00 A YEAR $1.00 A COPY

THE JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D. C

NATIONAL GEOGRAPHIC Society

16th & M Streets N.W. Washington 6, D. C.

National Geographic Magazine

ORGANIZED IN 1888 "FOR THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

COVER: *Italy swings like a Christmas stocking from the mantel of Europe.*

PAINTED BY WILLIAM PALMSTROM. PHOTO BY JOSEPH E. BARRETT

This beautiful Lady Hamilton is Allure "L", $350. At Hamilton jewelers in the U.S. and Canada. Hamilton Watch Co., Lancaster, Pa.

You shouldn't...and so you do! You go all out. You give her not just a watch but a Hamilton—set in diamonds! It hardly matters that you can't afford it, or that she needs a good watch, or that this one is registered to protect your investment. Logic really has little to do with your choosing such a gift—only love.

HAMILTON

Cadillac supremacy

Wherever highways lead and quality is recognized, Cadillac is known and accepted as motordom's supreme achievement.

GEOGRAPHIC FLAG SURVIVES A YEAR ON THE PHANTOM COAST OF ANTARCTICA

When exploring icebreakers of the U. S. Navy hulled their way to a virgin stretch of Antarctic coast on the Bellingshausen Sea early last year, the commander, Capt. Edwin A. McDonald, planted the flags of the United States and the National Geographic Society. Revising the map, he found that the land known as the "Thurston Peninsula" is really an island.

Returning this year with the U.S.S. *Glacier* (above) and *Staten Island* to continue his explorations, Captain McDonald found the tattered flags still flying, though the two-inch iron flagstaff had been grotesquely bent by savage Antarctic gales.

Such ends-of-the-earth adventures come to life for members of the Society in the pages of their GEOGRAPHIC. Share these exploits of brave men with your friends. Make their memberships much-appreciated Christmas gifts, if you wish, by sending their dues with your nominations.

PLEASE ENTER THESE MEMBERSHIPS IN THE NATIONAL GEOGRAPHIC SOCIETY AS GIFTS FROM ME ▶

1962 MEMBERSHIP $6.50

$6.50 MEMBERSHIP DUES for calendar year 1962 include subscription to NATIONAL GEOGRAPHIC. Allowing for postage differentials, remit $6.50 for United States and Possessions; $7.00 for Canada; $8.00 elsewhere. . . . Life Membership, $150. Allowing for postage differentials, remit in U.S. funds $150 for U.S. and Poss., and Canada; $200 elsewhere. . . . Make remittances payable to and send direct to National Geographic Society.

mail to THE SECRETARY
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON 6, D. C.

MY NAME:

(PLEASE PRINT)

ADDRESS

CITY, ZONE, STATE

NAME (PLEASE PRINT)

ADDRESS

CITY, ZONE, STATE

Send gift card signed

NAME

ADDRESS

CITY, ZONE, STATE

Send gift card signed

(1-61) Total remittance enclosed $

PLAN NOW your European adventure with

Exciting TWA Jetliner Tours at low, low cost!

14 DAYS $499*
ENGLAND • HOLLAND
BELGIUM • FRANCE

You'll see the Crown Jewels in the Tower of London...a diamond-cutting factory in Amsterdam... the unique Wiertz Museum at Brussels ... and the sparkling Left Bank in Paris! There are hundreds of things to see and do overseas...and all in two glorious weeks!

17 DAYS $599*
PORTUGAL • SPAIN
ITALY • FRANCE

You'll hit all the high spots in Lisbon ...Madrid...Rome...Nice...and Paris. See the sights you've dreamed about. Dine in world-famed restaurants. Buy clothes and gifts in the smartest shops of Europe! Send coupon today for all details.

Other TWA Jetliner Tours from 10 days to 51 days

*Prices per person, two people traveling together round trip from New York. Based on 17-day Jet Economy Excursion fares, October through March.

this colorful library of TWA travel ideas!

Write today for TWA Travel Guides

50¢ each $1.00 for 3 $2.50 all 8

A TWA travel book for any nation puts a whole world of facts right in your pocket. There are eight of them, each compiled by TWA travel experts. They tell where you find the most comfortable places to stay ... the finest dining ... and how to get there. Plus hundreds of other tips for holiday fun abroad.

FREE with your order ... the 48-page booklet, "What to Know Before You Go." Fill out coupon... mail today!

FREE! TWA's new booklet, "Vacation Planning Ideas," is your picture window on Europe. Look through it for suggestions on the holiday of your life and how to enjoy it most! How to travel on your own or on a sparkling Jetliner tour. How to do, see and buy more for less money. See your travel agent, call TWA or mail the coupon today!

FREE! Colorful new brochure on Economy Excursion travel to Europe shows you how to spend two carefree weeks overseas and still save money. See your travel agent, call TWA or mail coupon today!

FREE! Basic Travel Wardrobe folder saves you time, trouble and money. Gives complete information—how to dress anywhere abroad in any season. See your travel agent, call TWA or mail coupon today!

TRANS WORLD AIRLINES, DEPT. GEO-61
P.O. Box 1460, Grand Central Station, New York 17, New York

☐ Send Free TWA Vacation Planning Ideas

☐ Send Free Economy Excursion Brochure

☐ Send Free Basic Travel Wardrobe Folder for men and women

☐ 50¢ for one
☐ $1.00 for 3
☐ $2.50 for all 8
☐ Britain
☐ France
☐ Germany
☐ Ireland
☐ Italy
☐ Portugal
☐ Spain
☐ Switzerland

Enclosed is check or money order for Travel Guides indicated.

Name _____
(Please Print)

Address _____

City _____ Zone ____ State ____

My travel agent is

_____

_____

Please allow a reasonable time for delivery

The slide projector with ears! This brand-new Airequipt Superba Sonic cuts the cord that has bound the remote control to the slide projector. It's equipped with electronic "ears" that hear the commands of a unique 4-way *wireless* remote control. Now you can run your slide show from virtually anywhere in the room—not just at the end of a cord. Just press a button on the simple remote control, and you can change slides forward and reverse, and even focus. You can't see it, feel it, or hear it work, but the remarkable new Superba Sonic obeys instantly. Ask your dealer to let you try "the slide projector with ears."...**The Airequipt Superba Sonic Under $220***

*FOUR OTHER AIREQUIPT SUPERBA PROJECTORS TO CHOOSE FROM, PRICES START AT LESS THAN $99.

Jet-Smooth '62 Chevrolet...

Refreshing beauty with a restful ride!

Any more elegance would be extravagance. Here's all the room, refinement and riding comfort you could reasonably want. Rich new interiors tastefully topped by a striking slim-roof silhouette. A new choice of road-relishing V8 power. A road-gentling Jet-smooth ride. You could scarcely expect more at any price. So why pay more?

Time was when elegance cost a pretty penny. But not this time! The '62 Chevrolet has everything you could reasonably want in a car, *including* a reasonable price. Things like a satiny Jet-smooth ride (with Full-Coil suspension). Beauty that stays beautiful (thanks to protective measures such as new steel front fender underskirts that fend off rust). Power all the way up to 409 hp* (6 engines in all to choose from, including standard 6 and V8). A high-capacity heater-defroster that's standard equipment. All this and more—beautifully packaged with Body by Fisher finesse. Sounds like a lot of car? That's what it *is* . . . except in price. Drop in on your Chevrolet dealer and see for yourself. *Optional at extra cost.

Impala Sport Coupe . . . couldn't look more like a convertible unless it were one.

the new Chevy II

dependability never looked so dapper!

Chevy II 200 4-Door Sedan

Here's a totally new line of cars with all the virtues you know you can count on in the Chevrolet family—plus some surprises you've never seen on any car before. Thrifty? Your choice of a frugal 4- or a spunky 6-cylinder engine (in most models). Roomy? Sedans seat six solid citizens, big and baggage. Price? A real pleasant surprise!

It's easy to park, pack and pay for. Easy to service. Easy to maintain. Very easy on gas. Nine models to choose from. And it rides like many a big car, thanks to a new kind of design—Mono-Plate rear springs. Sound good? Go see! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

Alitalia offers 3 Holiday specials with Jet fare and all expenses paid at the finest hotels and restaurants!

$648 For 17 days in Israel, Greece and Mediterranean Islands

Group departures every two weeks

Jet to Italy, then sail from Venice on a luxury cruise to Athens, Rhodes, Cyprus and Israel. There you'll see it all – Haifa, Tel Aviv, Jerusalem and Nazareth.

$594 For 17 days in London, Madrid and the Canary Islands

Groups tours, individuals 5 times weekly

The sights of London and Madrid . . . the sun-soaked beaches of the far-off Canaries. No place like it for golf, deep sea fishing and "free port" gift bargains.

$583 For sunny Southern Italy — Rome, Naples, Capri, Pompeii

Groups weekly, individuals daily

For ten days you'll bask in the warmth of Italy, travel thru villas and vineyards, the Blue Grotto of Capri, the works! Optional extra week at comparably low prices.

YOURS FOR THE ASKING – a fascinating color brochure describing each holiday special in detail. Just check the trips that intrigue you most, fill out the coupon and send it to:

ALITALIA AIRLINES

666 Fifth Avenue, New York 19, N. Y., Dept. G11

All prices are based on round-trip jet excursion fares from New York effective thru March 31 — use Alitalia's "pay later" plan and fly for just 10% down! For further information consult an expert — your Travel Agent.

☐ Israel-Greece ($648) ☐ London, Spain, Canary Islands ($594) ☐ Italian Cities ($583)
☐ Holy Land ($797) ☐ London Theatre Trip ($421)

NAME: _____

ADDRESS: _____ CITY: _____ ZONE: _____ STATE: _____

The Sporty Car in Chevrolet's New World of Worth

CHEVROLET

'62 Corvair

Built for budget-minded people who go for sports car driving

Here, with saucier styling, tasteful new interiors and bigger new brakes, is the latest version of the car that proved itself in the fiercest rally competition going. Read on and get to know this new Corvair better.

You'll like what we changed—and what we didn't change—about this new '62 Corvair. We've spruced up the interiors, sparked up the styling and included a bundle of goodies (a cigaret lighter, front door armrests, dual sunshades, an automatic choke—even a forced-air heater and defroster!) as standard in sedans, coupes and station wagons. You also get bigger, more efficient brakes that team up with Corvair's rear-engine traction to give you just about the surest-footed car that ever latched onto a road.

But here's what we haven't changed. Corvair's quicksilver steering. Its jigsaw agility. Its gutty air-cooled engine. Your dealer's is the place to see it. Chevrolet Division of General Motors, Detroit 2, Mich.

Corvair Monza

This is the one that started the bucket seat brigade—the Monza Club Coupe.

'62 CORVETTE

New go—for the goingest car in America!

Dramatic styling refinements and a smooth new 327-cubic-inch V8 make this the sweetest Corvette yet. See America's only true sports car at your dealer's. He's got just the one to convert you to a wind-in-the-face sports car enthusiast.

At the internationally renowned Schloss Mittersill Sport and Golf Club overlooking Austria's beautiful Salzach Valley

This is the Way to See Europe...and America Too

You can travel First Class on the road at an advantageous price, if you take delivery of a Mercedes-Benz in Europe. Your car will be delivered to you at the factory in Stuttgart or in virtually any principal city in Europe. You will find your Mercedes-Benz a passport to a perfect trip. Wherever you go or stay in Europe, you are received as befits the owner of a Mercedes-Benz, which is the car of people of state and statelliness. Go in the autumn or the winter when far fewer tourists encroach on your privacy. Sightsee or ski but add a Mercedes-Benz to your pleasure. You will find that motoring behind the silver, three-pointed star of Mercedes-Benz is the most distinguished and comfortable way to get to the other end of a road...in Europe or the U.S.A.

Mercedes-Benz Sales, Inc., South Bend, Indiana
(A Subsidiary of Studebaker-Packard Corporation)

NOW! A Special Eyeglass Hearing Aid with power of "conventional" models

The new Zenith Dyna-Range is a special eyeglass hearing aid* that has the power and performance of a conventional model for those who haven't found the help they need in regular eyeglass hearing aids. It delivers remarkable volume and quality of sound reproduction . . . previously available only in conventional type aids.

Zenith makes this possible with its new, improved miniaturized four-transistor circuit and the exclusive "float-mounted" Permaphone.® For added convenience, there's a finger-tip volume control with on-off switch. Temple bars and connectors are adjustable for wearing comfort.

Truly, the new Zenith Dyna-Range offers the ultimate in styling and performance—never before available to persons with a severe hearing loss. For complete information on the Dyna-Range, fill in and mail coupon below. Or see your Zenith dealer. He's listed under Hearing Aids in the "Yellow Pages."

**You purchase lenses and frame, if needed, from your eyeglass specialist.*

ZENITH

"LIVING SOUND"
HEARING AIDS

WRITE FOR FREE INFORMATION TODAY!

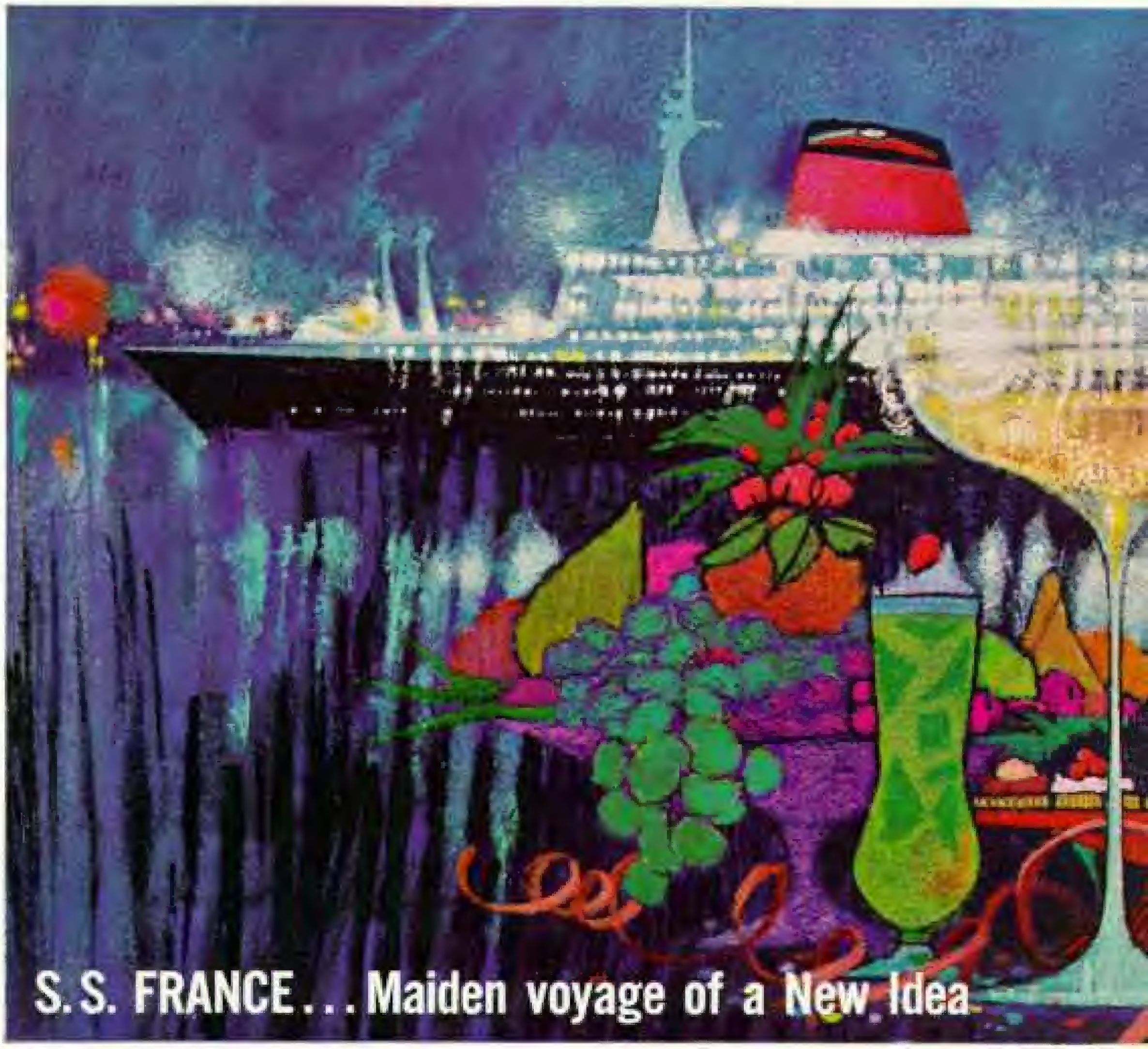
Hearing Aid Division, Zenith Radio Corporation, Dept. 4Y
6501 W. Grand Avenue, Chicago 35, Illinois

Please send me complete information on the new Zenith "Dyna-Range" Hearing Aid.

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

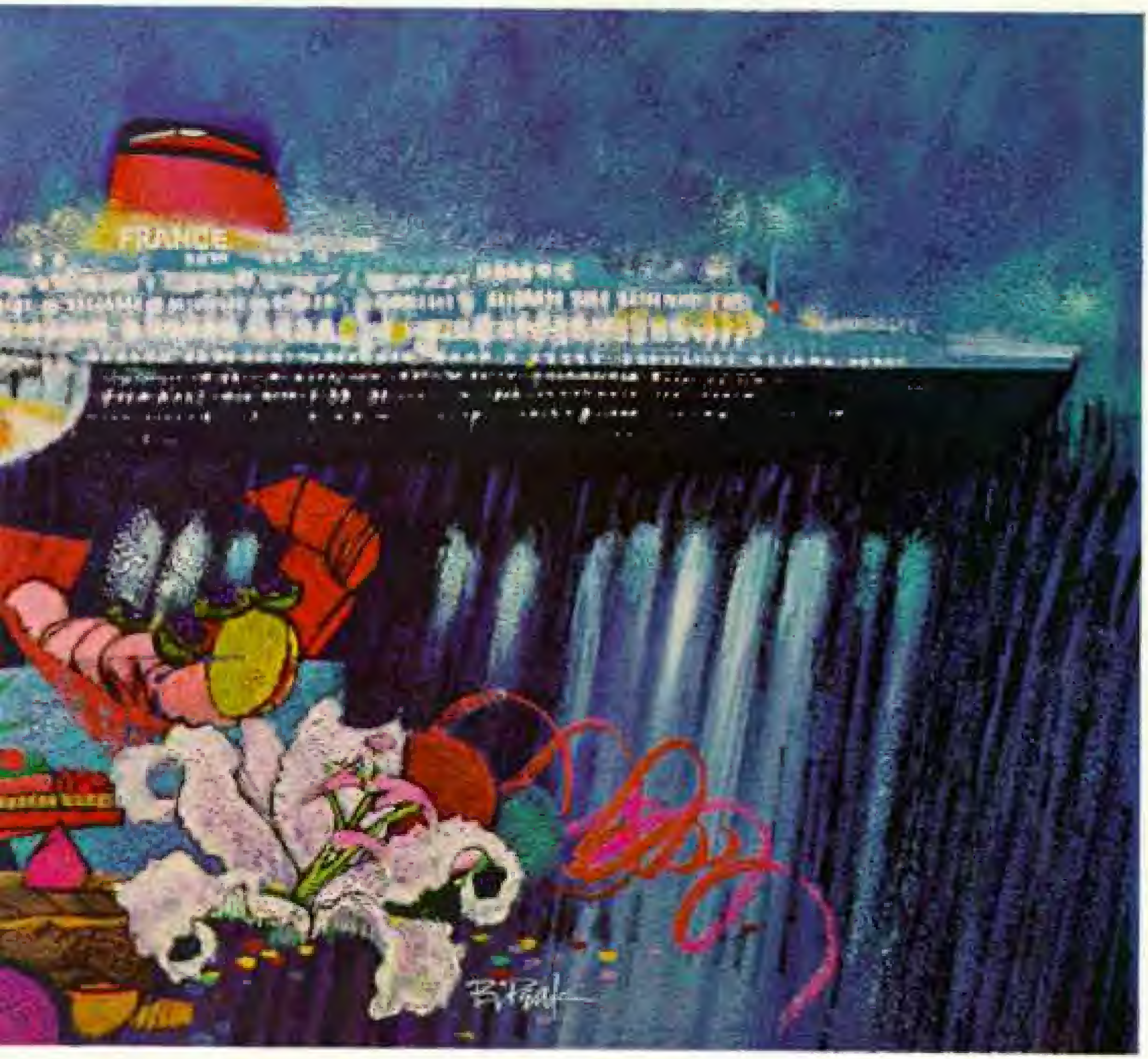


Opening a new world of luxury for all. New grand luxe First Class. New

"AND THIS IS TOURIST?" Yes. The France brings new beauty and comfort to Tourist Class. A telephone in every cabin. A separate closet for each passenger. As comfortable as your own home!

French Line is world-known for its incomparable First Class service and accommodations. Cabins have a telephone, push-button radio, and closed-circuit TV on request.

The Tourist Class Salon, the Cocktail Lounge and Dining Room all reflect the art of the great decorators of France. Novel Recreation Center for children of all ages.



concept of Tourist Class, hundreds of single and double cabins with bath

She arrives FEBRUARY 6 • Her 1035-foot length and her stabilizers make for smooth sailing • World's longest liner carries 600 First Class passengers, 1400 in Tourist Class • 4½-day crossings to England, 5 to France • Tourist promenade deck encircles magnificent Tourist public rooms • Enclosed swimming pool

When the new S.S. France sails proudly past the Statue of Liberty, her deep voice will salute this symbol of the aspirations of two great nations. For truly she is an ambassadress of the people of France to America.

Once aboard, you'll enjoy the fine cuisine for which France is justly famous (table wine compliments of the Line). You'll be charmed by the traditional courtesy of French Line service. You'll *relax*.

With the France, *a new idea in luxury travel suits the seas.* When you see her you will know that *your* ship has come in . . . for your enchanted voyage . . . the bright experience of a lifetime!

BOOK NOW for your voyage on the S.S. France

She makes her first voyage from New York to Europe on **February 13.** Then **March 2** and **15.** Rates from **$417.50** First Class, **$223** Tourist Class.

Save 10% on Thrift-Season Sailings to Europe. Go round trip on French Line. Or one way French Line, one way any steamship or airline.

See your authorized travel agent now!

Ask him for **free** full-color brochures on the France. Or write French Line, 610 Fifth Ave., New York 20, N.Y. PLaza 7-2500.

French Line®

FRANCE-AFLOAT NEW AND TRIUMPHANT

IMPERIAL LE BARON FOUR-DOOR SOUTHAMPTON

A forthright challenge to everyone who plans to buy a luxury car this year

In a few days, you will receive, by mail or telephone, a personal invitation to drive a 1962 Imperial.

Not the usual vague "see your dealer" . . . but a specific challenge to compare your own car with the best Imperial we've ever built.

At your convenience, a dealer in your area will deliver a new 1962 Imperial to you . . . for a thorough comparison-tour that you conduct all by yourself.

We believe anyone who is planning to invest from five thousand to seven thousand dollars in an automobile is entitled to the unembroidered facts right from the car itself.

Naturally, our dealers will gladly *explain* the advantages of torsion-bar suspension . . . *tell* you how the alternator supplies electricity even while the engine idles . . . *quote* engineering data on the superior performance of our new transmission . . . and answer any other question you ask about Imperial.

But you can find out only so much about Imperial by mere *listening*. To give the facts substance and meaning you must *drive* and *compare*.

So, when our invitation arrives, take us up on it. It obligates you not at all. And whether you eventually buy an Imperial or not, you'll never forget that once you drove a car which handled and accelerated and thrilled as a great car is supposed to.

IMPERIAL

AMERICA'S MOST CAREFULLY BUILT CAR

R.S.V.P. *Even though our invitation may somehow miss you, an Imperial comparison-tour may easily be arranged by writing on your letterhead to: General Manager, Imperial Division, 12200 East Jefferson, Detroit, Michigan.*

IMPERIAL — A PRODUCT OF CHRYSLER CORPORATION

REFLECTIONS ON GIVING A CAMERA

When you give a Honeywell Pentax camera—to yourself or to someone else—you soon know the satisfaction of having chosen a truly fine gift, one that is given with pride and used with pleasure.

The Pentax is the single lens reflex which honestly perpetuates the tradition of 35mm cameras, small and light in weight, of precise construction, its operation is smooth and flawless . . . its results superb, even in the hands of the most casual photographer.

Either model of the Pentax is extremely versatile. The Pentax H-3 has a 55mm f/1.8 lens and speeds to 1/1000 sec.; the H-1 has a 55mm f/2.2 lens with speeds to 1/500 sec.

Discuss a Honeywell Pentax with your photographic dealer today. You'll be pleasantly surprised at the modest price, which is no more than $149.50 for the H-1 . . . no more than $199.50 for the H-3. Twelve fine interchangeable lenses and a variety of accessories are available.

Shown with the Pentax above is the Honeywell Futuramic II electronic flash unit. Ask your dealer to show you why it's the world's most convenient way to flash pictures! Write for illustrated brochure to Minneapolis-Honeywell, Heiland Division, 5206 East Evans Ave., Denver 22, Colorado.

Honeywell

H Photo Products

A car a minute—Fiat's Mirafiori plant, Torino

Giant marine diesels—Fiat's Grandi Motori plant

Checking out Fiat G 91 jet fighters for NATO

The Three Provinces of Fiat—*Fiat's famous automobiles are familiar sights in 120 countries. Fiat marine diesels power ships on all the Seven Seas. You will find Fiat trains, trams, trucks, buses and tractors on all the continents. There are nearly 3,000 service stations to assure Fiat owners maximum value wherever they go. Fiat G 91 jets fly for NATO throughout the far-flung areas it protects. Land, sea and air—all are provinces of Fiat. To know Fiat better is to know the world better. Visitors are welcome at Fiat's home at Turin, Italy.*

FIAT

FIAT S.p.A., Turin, Italy • U.S. Representative and FIAT MOTOR COMPANY, INC. • 500 Fifth Avenue, New York

This view was reserved for you months ago

on BOAC's Economy Tours of Europe ...17 days as little as $445

What fun to see the wonders of Europe...yet pay so little for the pleasure! And BOAC's selection of 17-day Economy Tours include everything! Hotels...sightseeing... air and surface transportation... even theatre tickets and entertainment! And everything's reserved for you far in advance. In addition, BOAC makes certain that you really see the by-ways as well as the high-spots in the places you visit. So, it's well worth a visit to your Travel Agent for information about BOAC's many 17-day Economy Excursion Tours, available until March, 1962. Or why not mail coupon below for fascinating booklets.

Tour prices based on 17-day Economy Excursion Fares aboard the jet-prop Britannia from New York. Jet fares only $30 more. Also based on double occupancy in hotels. ***Departures also from Boston, Washington/Baltimore, Detroit, Chicago, Honolulu, Los Angeles, San Francisco, Montreal and Toronto.***

ALL OVER THE WORLD

B·O·A·C

TAKES GOOD CARE OF YOU

BRITISH OVERSEAS AIRWAYS CORPORATION
Dept. BE-48, 530 Fifth Avenue, New York 36

Please send me colorful brochures on Fall and Winter European Tours and "Guide to Europe's Gaiety" folder.
☐ Escorted ☐ Independent

NAME_____

STREET_____

CITY_____ STATE_____

REVOLUTIONARY!

Kodak brings you a new experience in automatic slide-showing pleasure!

New Kodak Carousel Projector has 80-slide revolving tray on top. You change it as easily as a record...you store it like a book! Slides won't "pop" or jam!

Here is a revolutionary forward step in the smooth, automatic, trouble-free showing of your color slides.

This new Kodak Carousel Projector uses a unique round tray. The tray goes on top—as easy to change as a record. It turns like a wheel. It holds 80 slides—a long, relaxed show before it's time to change trays. Every slide is accessible—but they can't spill even if you drop the tray.

You sit comfortably with guests or family. The projector, set for automatic pacing, puts on the whole show for you. Or you can change the pace yourself, hold any slide, fine-tune the focus, back up for a second look—with a handy all-in-one remote control.

Your slides feed gently by gravity—can't stick or jam in mid-show. At a touch on the push-button console, you can select 500-watt or 300-watt power to suit light or dark slides. After the show, each tray goes back into its own indexed case—stores on your library shelf like a book.

See the Carousel Projector at your Kodak dealer's. Take some slides along, and learn why it's the big new step in slide-showing pleasure. The price, less than $140; see your dealer for exact retail price.

Store on bookshelf—each tray in a titled jacket. Slides can't spill.

Place tray on top like a phonograph record. It couldn't be simpler!

Turn on controls at rear. Keyboard is lighted for easy use in the dark.

Focus remotely . . . advance or reverse slides from up to 12 feet away.

Dial automatic change . . . choose 5-, 10- or 20-second intervals, or manual.

Edit any time. You can remove any slide instantly, easily!

Price subject to change without notice.

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

ENJOY WALT DISNEY'S "WONDERFUL WORLD OF COLOR" SUNDAY EVENINGS, NBC-TV

Kodak
TRADEMARK

ss BRASIL in Cape Town, one of the 20 ports you'll visit on this cruise to 3 continents

MOORE-McCORMACK LINES

1962 SEA-SAFARI

63 days to South America, Africa, and the Mediterranean including CARNAVAL IN RIO

NEW ss BRASIL SAILS FROM NEW YORK FEB. 21, 1962 · PORT EVERGLADES FEB. 23, 1962

Come aboard and cruise right out of the Northern Hemisphere to summer below the Equator.

In Rio, it's Carnaval time. The streets are packed with Samba bands and parades. Hotels are jammed with merrymakers. But *your* hotel, here as in every port, is the quiet, air conditioned ss BRASIL.

She's one of America's newest cruise liners, built to cater to world-wide cruise vacationers rather than crowds. All staterooms are outside and individually air conditioned. All first class. Two outdoor pools, four sunlit sports decks. Luscious food. Top-rank entertainers. And an easy informality to life on board that appeals to sophisticated travelers.

So much more to enjoy on shipboard and on shore. Fascinating ports. Interesting inland trips—among them, Brazil's new capital, Brasilia; Africa's big-game preserves, diamond mines, Sphinx and Pyramids. Pompeii, Capri, Rome. Spain's Monastery of Montserrat. Truly, the "Cruise of the Year," priced from $2185, less than $34 a day.

Other Moore-McCormack Cruises to the Caribbean, to South America or the Northlands—6 to 38 days. *See your Travel Agent.*

N. Y., Port Everglades, Barbados, CARNAVAL IN RIO, Santos, Montevideo, Buenos Aires, Tristan da Cunha, Cape Town, Durban, Lourenço Marques, Zanzibar, Mombasa, Aden, Suez, Alexandria, Messina, Naples, Barcelona, Lisbon, N. Y.

M Much More with Moore-McCormack Lines

Two Broadway, New York 4, N. Y. Dept. 624

ONLY THE ODOMETER KNOWS ITS AGE

The miles keep clicking off and still the Lincoln Continental looks and responds almost as it did on the day of delivery. Lasting qualities are to be found everywhere in this incomparable automobile.

Body rustproofing is applied inside and out. Underbody structural members are galvanized. Stainless steel is used lavishly, even for fuel lines. For longer life and smoother working, vital brake parts are chromium plated. The body is finished with four coats of enamel with baked in luster.

*This painstaking care is what makes the Lincoln Continental such a remarkable investment in driving pleasure—your finest investment in tomorrow. No wonder the Lincoln Continental can be warranted for twice as long as any other American car (24 months or 24,000 miles).**

LINCOLN CONTINENTAL

Product of Ford Motor Company Lincoln-Mercury Division

*Ford Motor Company warrants to its dealers, and its dealers, in turn, warrant to their Lincoln Continental customers as follows: That for 24 months or for 24,000 miles, whichever comes first, free replacement, including related labor, will be made by dealers, of any part with a defect in workmanship or materials. Tires are not covered by the warranty; appropriate adjustments will continue to be made by the tire companies. Owners will remain responsible for normal maintenance service and routine replacement of maintenance items such as filters, spark plugs, ignition points and wiper blades.

ADVERTISEMENT

Superscenic Space Travel

by BRUCE HAMBY

Travel Editor, The Denver Post

NEWSPAPERMEN are supposed to be strictly impartial; but, I'll argue from here to the moon that the California Zephyr's route between the Great Lakes and the Golden Gate provides the most breathtaking mountain scenery anywhere!

The mountain country is my home, but I had never *really* seen it, nor appreciated its splendor, until I viewed it from the Vista-Dome. And winter time, I discovered, adds new dimensions of beauty.

Dedicated to the premise that travel always should be enjoyable, the Vista-Dome California Zephyr is a magnificent land cruiser which has put nearly two million people into orbits of travel delight. Its "see-level" trajectory, carefully timed for maximum daylight exposure of favored American spaces, is not paralleled by any other means of travel. This is an "ooh-and-ah" adventure—at least I never heard so many "oohs" and "ahs" from wide-eyed, camera clicking passengers as the other day when I again rode the C Z.

Westbound, the Burlington Railroad eases the train out of Chicago, racing the setting sun to cross the mighty Mississippi by twilight. Roaming through the train, you inspect with mounting pleasure the complete choice of accommodations, spacious lounges, the famous Vista-Domes (five on the C Z with a total of 120 unreserved sightseeing seats) and the superb diner serving *freshly*-prepared meals of your choice. You know that you will not want for anything on this "hotel-on-wheels."

Next morning at Denver, the train passes through an automatic washer—a subtle hint that scenic thrills await on your journey through the Colorado Rockies via the Rio Grande Railroad.

The C Z climbs the east side of the front range, giving you an almost limitless look at the Great Plains, then plunges into the rugged Rockies. At every turn there's a new delight—towering snow-blanketed peaks, pine-covered canyons, and tumbling mountain streams—a panorama of Nature at her unspoiled best! You cross the Continental Divide through the six-mile Moffat Tunnel, then pace the Colorado River for 237 scenic miles to arrive Salt Lake City that evening.

Here the Western Pacific Railroad takes over. Desert country is crossed by starlight (the domes are a haven for stargazing and romancing). By breakfast time the train is washed again, and you're already in another fantasyland, California's Feather River Canyon.

I'm not prepared to state that this Sierra wonderland is more scenic than my own Colorado Rockies, but I assure you it's sensational, distinctive and downright beautiful! Williams Loop . . . tunnels, dams and massive hydroelectric plants . . . color-splashed orchards and picturesque towns—the arrival in Oakland and the fascinating trip across the Bay Bridge into San Francisco come all too soon. Two full days of super-scenic travel leave you relaxed, refreshed and inspired—and hopeful that you captured on film some of the splendors which are now treasured memories.

Many things stand out about this cross-country excursion—the warmth and friendliness of the Zephyrette and crew members . . . the contagious congeniality among passengers . . . the many businessmen on board who so obviously endorsed the benefits of this "no-tension" travel . . . the joy of relaxing and "finding" yourself again—and, most of all, the realization that ours is great, beautiful and majestic country, worthy of the tribute of your travel time at "see-level."

C Z Features—*Superscenic travel at any time of year . . . true economy—low fares and meal prices, budget dinners, snack service, generous baggage privileges . . . family fare plan. True comfort—spaciousness . . . freedom to roam . . . delightful lounges, such as the unique and charming "Cable Car Room." True convenience and dependability . . . seat-at-car service . . . Rail Travel Credit Plan . . . dependable schedules . . . no weather worries, just cozy comfort.*

FREE colorful literature—address California Zephyr, Dept. 612-N, 547 West Jackson Blvd., Chicago 6, Illinois.

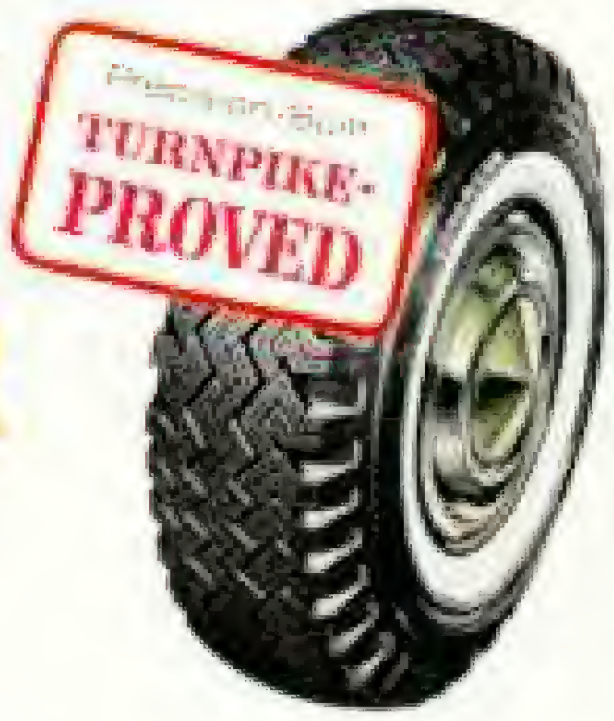
MORE TRACTION WHEN IT SNOWS...

MORE MILEAGE WHEN IT DOESN'T!

1. Traction to bite through snow that's hub-cap deep.
2. Turnpike-proved mileage when the roads are clear.

3-T SUBURBANITE PRICES START AT $15.95

Black, tube-type 6.70 x 15 plus tax and recappable tire



GOODYEAR

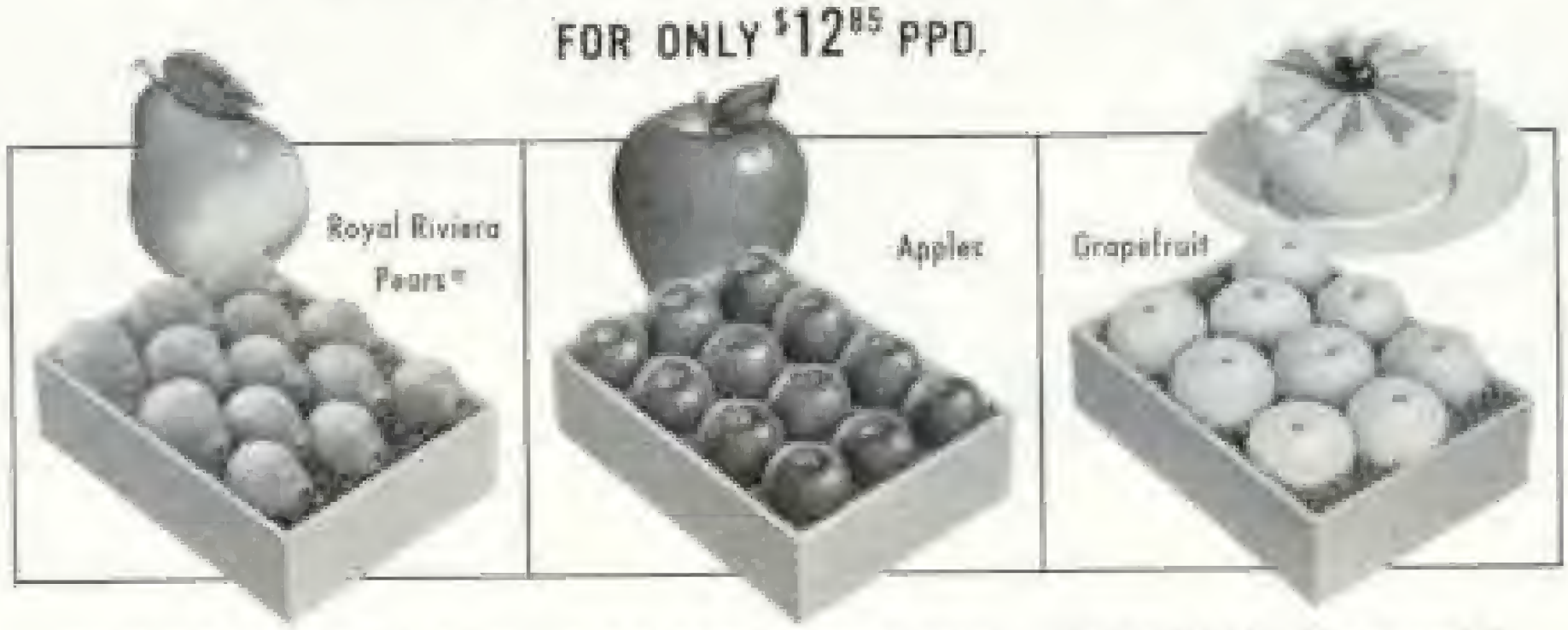
MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND.

Suburbanite, T.M., The Goodyear Tire & Rubber Company, Akron 16, Ohio.

This year you can give the Royal 3 Box

Fruit-of-the-Month Club*

FOR ONLY $12.85 PPD.



CHRISTMAS. Rarest fruit alive today. So juicy you eat 'em with a spoon. We hand-pick only the fattest and finest, and ship them in gay, Christmasy gift boxes (about 10 lbs!) with your greetings.

JANUARY. So big 'n beautiful folks won't believe their eyes. These prize winners come from our secret apple orchards up near Canadian border. Beautifully boxed, shipping wt. about 9 lbs!

FEBRUARY. Harry and I get these proud, pampered beauties from way down where the robins spend the winter. Bigger than harvest moons. We ship in gorgeous gift boxes. About 13 lbs!

ROYAL 3-BOX Fruit-of-the-Month Club

ORDER GIFT NO. 11 PREPAID $12.85

It's the world's most wanted Christmas gift—but only a fortunate few get it, because rare, pluperfect fruits like these are so scarce, not 1 person in 1000 has ever seen or tasted them. Perfect taste gift for friends, relatives everywhere—ideal for fussy folks who "have everything." You'll get thanks for months on end!

12-BOX CLUB: At Christmas, Royal Riviera Pears; Jan., Apples; Feb., Grapefruit; March, Royal Oranges; April, Pineapple; May, Preserves; June, Home-Canned Fruit; July, Nectarines; August, Pears; Sept., Peaches; Oct., Grapes; Nov., Bosc® Pears.
Order Gift No. 20 ppd. $53.95

EASY TO ORDER. Send list of names plus check or M.O. (No charges or C.O.D.). Tell us how to sign greetings.

* © ® 1951 H&D

Harry and David

Box 1330, Medford, Oregon

FULLY GUARANTEED

Stop Climbing Stairs

Modern residence elevator brings one-floor convenience to any multi-story home. Easily, quickly installed without major alterations. Safe, low-cost operation.

Write for literature

Shepard Elevator Co., 5105 Brotherton, Cincinnati 9, Ohio

Florida

you haven't seen the half of it!

BEACHES— Florida has 1,016 miles of them, on Gulf and Ocean. Enjoy them as you want to; Swim, float, ride the rollers, skin-dive . . . water ski. Bask and soak up the sun. Or just watch your toddler wade.

The magic names of Miami Beach, Ft. Lauderdale, Palm Beach and others on Florida's Lower East Coast are the world's most famous vacation spots. Here you set your pace . . . and your budget.

PLAN NOW to enjoy these other experiences, too!

In a horse-drawn surrey, tour St. Augustine—oldest U.S. city. Visit ancient fort, nearby Castillo de San Marcos.

Talk to Indians in a South Florida Seminole village, shop for curios.

Enjoy Florida citrus, ripe from tree, at gift fruit stands. Snap your family picking fruit.

There's so much more to *come back to* in Florida

Governor Farris Bryant

FREE! New "GUIDE TO FLORIDA VACATIONS" tells where to find new Florida vacation thrills. Mail coupon now!

"*EXECUTIVES:* As Florida's governor I invite you to get facts about Florida's advantages for conventions, sales meetings and for plant locations. Write to Florida Development Commission, Box 2106-A, Tallahassee, Florida."

See your Travel Agent

Mr. Wendell Jarrard, Chairman
Florida Development Commission
Box 2106-A, Tallahassee, Florida

Send FREE Florida Vacation Guide book to

Name _____

Address _____

City _____ Zone _____ State _____

for 1962 four new Thunderbirds

Today the car that brings the boldest new ideas to the American road is multiplied four times. For now there are *four* new Thunderbird models . . . paced by a unique expression of total luxury, the limited-edition Sports Roadster.

Sleek as a racing hydroplane, arrogantly individual in its gleaming sweep of deck, this is the most exciting invitation to two-passenger travel ever issued . . . but removal of the tonneau cover reveals the standard Thunderbird rear seat when four must journey. (Particularly pleasant is the fact that the top can be raised with the tonneau cover in place.) There's also a Thunderbird in evening dress, the Landau coupe with leather-grained vinyl top; plus new versions of the four-passenger Hardtop and the swift-lined Convertible.

All four pure Thunderbird, all sparkling with original Thunderbird ideas, from Swing-Away Steering Wheel to "floating" rear view mirror . . . and all crafted to Thunderbird standards of extraordinary quality. See them at your Ford Dealer's.

The padded, leather-grained vinyl top of the Landau coupe expresses the Thunderbird spirit in terms of formal elegance, adds a traditional accent in the landau S-bar.

Thunderbird Sports Roadster—The slip-stream headrests are an integral part of the Sports Roadster's distinctive lift-off tonneau cover. Standard equipment includes full-chrome wire wheels and a passenger assist bar, plus the Swing-Away Steering Wheel found on all Thunderbirds.

Ford

The sleek prow of the Hardtop sheathes the secret of Thunderbird's torrential power—the 300 Special V-8 with four-barrel carburetion.

The Convertible conceals its top, automatically, at the flick of a switch. There's no cloth boot to attach, no bulge to break the flawless sweep of line.

The Restless Years—Nine to Twelve

If you've a son or daughter in the 9 to 12 age group, you've had your moments of joy—and your moments of desperation—coping with your child's perplexing behavior, such as the young boy who delights in teasing an older sister.

Take heart. Knowing why the pre-teener behaves as he does helps you to help him. So, let's consider some typical problems of "the restless years"—and how to handle them.

"Bobby's nose is always in a comic book." Some comics are suitable for children—others that stress cruelty or crime are not. Keep an eye on the types of comics your child reads. Make good books available—about exploration, adventure, mystery—the very things that youngsters seek in comic books. Cultivate his interest in hobbies such as keeping scrapbooks or collecting stamps.

"Johnny always spends his allowance quickly and foolishly." It is well to remember that a youngster learns how to use money only by trial and error.

Teach your child to budget his allowance so it will last and cover the things he wants most. But the final decision as to how to spend money must be his if he is eventually to learn the purpose of an allowance and the value of money.

"Janiv's having trouble at school." The school can't be expected to solve all your child's difficulties. But when understanding teachers *and* parents work together, they can do much to help children get along better in both school and out-of-school life.

Get together with other parents and plan programs that can provide your youngsters with stimulating opportunities and activities.

Metropolitan's new booklet, *Nine to Twelve*, gives a fuller discussion of how to understand the sometimes stormy, but always interesting, pre-teen years. Use the coupon below for your free copy.

Why Ford Motor Company cars are better built. One touch of the toe while backing up and the brakes are adjusted. That's one of the self-servicing features pioneered by Ford Motor Company, and standard on many of our cars. Others include 6,000 miles between oil changes and minor lubrications, major lubrications that last 30,000 miles and life-of-the-car transmission fluid. These are just a few of the steps already taken in Ford Motor Company's determination to free you from car cares. They add up to the fact that Ford-built cars are built to last longer, require less care, and retain their value.

FORD: Falcon, Galaxie, THUNDERBIRD
MERCURY: Comet, Monterey, LINCOLN CONTINENTAL. Products of Ford Motor Company

THE NATIONAL GEOGRAPHIC MAGAZINE

VOL. 120, NO. 5 NOVEMBER, 1961

The second Risorgimento—the new awakening—finds the land of the "Italian look" booming, prosperous, and enjoying life as never before

United Italy Marks Its 100th Year

By NATHANIEL T. KENNEY
National Geographic Senior Staff

MAYOR PARIDE LERRO of Teano stabbed the green turf of the roadside with his toe.

"Despite the grazing cow of the farmer Domenico," he said to me, "this is hallowed ground. Modern Italy was born on this spot."

He paused to shy a rock at the cow.

"Here," he continued, "Garibaldi and King Vittorio Emanuele II of Sardinia agreed to form the first united Italian nation since the Roman Empire collapsed fourteen centuries before. But I think you know of this."

Italy's Future Sealed by a Handshake

It happened that I did. Across the gulf of 100 years, I could picture the dramatic scene:

Victor Emmanuel came to this sun-blessed little town in southern Italy as the undisputed master of North Italy. By diplomacy and force of arms, he had thrown out the Austrians. The people from the Alps to Rome stood united beneath his Savoyard banner of green, white, and red.

Garibaldi held the rest of Italy, the South. With him at Teano, thirty miles north of Naples, was his red-shirted Legion of the Thousand, fresh from the conquest of the dual Bourbon Kingdom of Naples and Sicily.

The two strong men rode to each other. They drew rein side by side but did not dismount. They eyed each other a moment, the swashbuckling commoner and the tough King. In this moment Italy could be two nations or one. Then the King put out his hand. Garibaldi grasped it and said, "I salute the first King of Italy" (painting, page 596).

All Italians salute both of them this year, for it is the official centenary of *Il Risorgimento*—the resurgence or re-emergence—Italy's name for all the battle, political maneuver, and plebiscite that brought her freedom and unity. Risorgimento means to Italians what the American Revolution means to the United States. They are celebrating not the meeting at Teano, which took place in 1860, but the culminating act in the city of Turin, the proclamation of Victor Emmanuel as King by the representatives of Italy's diverse regions.

To see Italy in *festa*, I twice flew the Atlantic in the jets of Alitalia, the airline that carries the Italian flag over most of the world.

Something Ancient Rome Never Saw: a Helicopter View of the Colosseum Showing Outer Walls and Arena

Like the Roman god Janus, Italy wears two faces. One, soft with the patina of age, looks back on a glorious history, the other, shiny new, epitomizes an era of progress. Superhighways lead to awesome monuments of Imperial Rome. Glassy skyscrapers tower over medieval palaces. Power-

ful floodlights illumine centuries-old cathedrals, and loud-speakers blare jazz tunes amid Renaissance treasures. The Colosseum, symbol of the wonder and wealth of ancient Rome, draws a constant stream of modern-day visitors. Dedicated A.D. 80 by Emperor Titus, the amphitheater witnessed 400 years of bloody games, then fell silent. Succeeding generations saw it damaged by earthquake, plundered for stone, and, recently, shaken by motor vibration. To preserve the structure, Rome has restricted traffic and drilled steel bars into weakened walls and columns.

PAINTING BY PIETRO ANNIGONI IN THE PUBLIC PALACE, SIENA, AND BY ENRICO ROB

My photographer friend James P. Blair and I motored in an Italian-made Fiat auto, touring the country from the beaches on the Italian boot toe to the tunnel being driven through Mont Blanc to France, and from the Tyrrhenian Sea to the Adriatic. (See the ten-color Atlas Map, **Italy**, distributed to members with this issue.)

Land of Warmth and Hard Work

Not for the first time—for we both had been here before—we fell in love with Italy, as who doesn't? We found her beautiful and, because our love was obvious, warm and friendly in response.

We found her booming and prosperous, a special pleasure for me who had known her in time of war. We watched her craftsmen, architects, engineers, artists, and fashion designers at work, an inspiration to both of us, for here was the fountainhead of the "Italian look," at its best a modern standard for elegance and good taste.

We did not find the "miracle" some see in the postwar surge of Italy to world eminence. We found, instead, Dr. Ruggero Gastaldi, young manager of the Necchi sewing-machine firm, in his office with his sleeves rolled up and his beautifully tailored suit coat on a hanger. We saw Neapolitan girls, long believed too clumsy for anything but picking oranges and tending babies, skillfully assembling Olivetti typewriters.

The miracle turns out to be hard work, performed by a people whose skills and love of beauty are the legacies of ancient Greece, Rome, Florence, Urbino, Venice.*

Today they are free, these Italians, to fol-

*See "Venice, City of Twilight Splendor," by Joe Alex Morris, NATIONAL GEOGRAPHIC, April, 1961.

ITALIAN MINISTRY EDWARDS, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Handshake Unites Italy at Teano, October, 1860

Crying, "I salute the first King of Italy," Garibaldi (left), liberator of Sicily and Naples, relinquished his conquests to Vittorio Emanuele II, King of Sardinia. Five months later Italy officially became a nation; this year Italians celebrate their centennial.

Mirror in Turin witnessed the nation's growing pains. While dining at this restaurant table, Italy's first Prime Minister, Camillo di Cavour, kept an eye on the reflected balcony of Carignano Palace, where the Deputies met. When an aide waved a handkerchief, as re-enacted here, Cavour hurried to the Chamber to avert a crisis.

Sicilian signorina with classic features leans on a Romanesque column in Monreale cloister near Palermo.

Dark-eyed Roman loves sports cars as her ancestors cherished chariots.

Beauties on a bench enhance the gardens of historic Aquila Castle in central Italy and pointedly ignore mobile admirers.

low their true star in their own inimitable way—free of the last oppression, the Fascism that perished in war; free of the sicknesses that died with the mosquito and the lice of typhus in the magic clouds of DDT; free to buy with their marvelous manufactures the foods and materials their own soil never yielded.

Some call this period in Italy the "second Renaissance," but the test of time is lacking, and no one can predict how much of the new Italian look will survive.

I prefer to call it the "second Risorgimento," the reawakening of a people who only a few decades ago had lost everything except the firm grip of skilled hands on their bootstraps.

Po Waters Piedmont's Rice Crop

Jim and I started our Italian odyssey in Turin, or Torino. For one thing, it is the capital of the Piedmont, where the Risorgimento began.

The Piedmont is energetic, varied, and beautiful. Along its northern border stand the mighty Pennine Alps, pierced by the Great St. Bernard Pass and the Simplon Tunnel to Switzerland. Skiers from many lands come to Courmayeur, in the shadow of Mont Blanc—Monte Bianco in Italian—and there is good skiing, too, in the Maritime Alps on the Piedmont's southwestern border, the one it shares with France.

The Po River crosses the Piedmont, and where it waters the land, the people raise rice, one of Italy's major crops (page 676). They

Face as fresh as her flowers, a vendor offers carnations and gladioli in Ventimiglia

Chic model arrives at Rome's new Fiumicino Airport for a fashion show of jet-age styles

make wine in the Piedmont also; it is the home of Italian vermouth.

We had another reason for starting in Turin. The Fiat industrial empire has headquarters here, and we picked up our car in one of its factories.

Whereas the first Risorgimento was military and political, the second is founded in industry and commerce. Fiat, valued at more than a billion dollars, forms the largest unit in that foundation and makes most of Italy's most important export — automobiles.

But Fiat also makes buses, trolleys, the G.91 fighter plane of the North Atlantic Treaty Organization, steel, household appliances, and myriad other things. It headed the combine that built the Kariba Dam across the Zambezi River in Africa. It is helping punch out the incredible Great St. Bernard and Mont Blanc highway tunnels.

It does business with flair: I am talking now about the soft, modish sweaters Jim and I still wear.

"Signori," said the girl in the main offices, "the weather has turned brisk and you do not wear waistcoats. Fiat does not like to see its friends catch colds."

And she sent out for sweaters and tried them on us until she approved their fit.

"The colors match your suits, your eyes," she mused, studying us. "I make my mark of approval . . . so!" and kissed us both on the cheeks.

We saw the assembly lines at Mirafiori, a suburb of Turin, from which the several


nata Paperino

sizes of Fiat cars come at 2,000 a day, to rush in final test about a track banked like a racecourse. This is like Detroit, with the steel shapes of the conveyers, workmen reaching out with wrenches, and at the end of the production line, the automobiles in movement.

Knowing that the Italian Communist Party, an approximate 24 percent of the voting population, is the largest in Western Europe, I asked a Fiat man how many Communist workers they had. Many, he replied, but he furnished no figures, for he said the company did not inquire about its employees' politics.

Later I came to know several executives in industry well enough to talk politics with them, and one described the Italian Communist for me thus:

"Giovanni or Pasqualino has had too little for too many centuries. Today he has more, and this has given him more appetite. He has a Vespa motor scooter; he wants a small car. This is normal and healthy.

"Now, appetite long stifled becomes a fierce thing. Giovanni looks for a strong remedy, and finds the Communist Party. In Italy it puts on a moderate front. It does not try to sell a foreign ideology, but only assistance in getting the small car.

"Giovanni may join the party, but they always have trouble collecting his dues. My very best Communist friend is also a monarchist, a good Catholic, and sometimes a vigorous anticlerical.

"I say that a man so diverse can only be an Italian. Italians, as you know, love their country, and can be trusted not to betray her."

Rain in the north, discouraging photography, sent us southward. We drove through Asti and Alessandria to the pride of the Italian highway system, the Autostrada del Sole. This "Expressway of the Sun" flings twin ribbons of parkway-separated concrete between Milan and Florence, a 175-mile-long part of a yet-unfinished web that will one day blanket the nation.

The Autostrada resembles its American counterparts, with toll booth and cloverleaf, but goes completely Italian in the architectural shapes of the Pavesi Autogrill, the booming chain of expressway eating places. Gangs of women in shirts of luminous red, the better to be seen by speeding motorists, were planting flowers in the center strip as we rolled on past Piacenza and Parma, ancient towns enjoying new prosperity because they lie near natural gas fields that are now being exploited.

Modena: Two Ferraris a Day

An exit sign read Modena, but to automobile buffs Blair and Kenney it meant "Ferrari." For Modena is the home of the Ferrari car, the one we agreed we would rather own than any other. Even the Fiat people had suggested we see how Italians build an automobile when only quality, and not price or profit, is the prime consideration.

Former race driver Enzo Ferrari's tiny plant turns out only two of these machines a day, selling them with apparent reluctance, as an artist sells a favorite painting. We called by the offices in Modena for Franco Gozzi, our Ferrari host.

"Sorry we can't ride you in a style befitting a Ferrari official," I said, heading our

Defying Gravity, Pisa's Leaning Tower Stands 14 Feet out of Line

Begun in 1174, the bell tower soon developed a tilt as earth sank under one side. Work stopped. A century later a new architect, adding the top four galleries, attempted to rectify the inclination, but with each passing year the tilt increased. Late in the 16th century, Pisans believe, Galileo used the tower to demonstrate that weight has no influence on the speed of falling bodies.

Vendors here offer souvenir balloons to sightseers. Inflated goose at left says in Italian, "You were born a gosling," and then adds, "What can you do about it!"

Camera in hand, an Australian visitor records scenes on her tour of Italy.

smaller-than-compact-size sedan for the factory at near-by Maranello.

"Who can afford a Ferrari?" said Signor Gozzi diplomatically. "Signor Ferrari himself comes to work in a car the size of yours."

From afar we heard the 12-cylinder engines on the test bench, screaming at more than 7,000 revolutions per minute. Most mass-produced engines cannot reach 5,000 without danger of flying apart.

The atmosphere of the Ferrari plant is that of a watchmaking factory. Here the workers are artisans, and well they might be, too, for their forebears hewed the statues of Herculaneum and carved the choir stalls in the Carthusian monastery near Pavia, the celebrated Certosa di Pavia.

A man may spend his entire day on one vital part, grinding, measuring, balancing, until not even the uncanny eye of Enzo Ferrari himself can spot a blemish. There is no assembly line here. The car does not come to the workers; they go to the car.

No Speed Limit on the Autostrada

Only a handful of men, usually racing drivers with engineering training, are considered qualified to road-test a new Ferrari. You do not send a garden-variety motorist out into the countryside with a $15,000 automobile that can do more than three miles a minute.

This I discovered by asking my host a simple question.

"May I drive one?" I inquired.

Rome Flames Again as in Nero's Day; Glaring Floodlamps Light the Forum

Each summer night the Roman Forum revives scenes of the past. Not live actors, but spotlights, recorded voices, and sound effects unfold such

I drove back to Modena—in our sedan. A man stopped me in the hotel lobby.

"I'm George Arents, Jr., and I help distribute the Ferrari in the United States," he said. "It happens I brought my own car over this trip. If you've nothing better to do, let's go drive it."

Mr. Arents is a brave man. He did not ask me for a driver's license or even inquire as to my eyesight. He merely drove the great pulsating coupe out to the Autostrada and turned it over to me.

I should tell you that there are police prowl cars on the Autostrada, but no speed limit. You get tickets for using the wrong lane or letting your cow wander onto the road. For passing a police car going as fast as it can, you get envious huzzas from the policemen.

I put Mr. Arents's Ferrari into low gear and ran inexpertly through the four-forward-speed sequence. Singing along in high, I stole a look at the speedometer. "A hundred and fifty kilometers," I remarked. "Why, that's more than 90 miles an hour."

"Pardon me," said Mr. Arents, relaxed against the pigskin upholstery. "The speedometer is calibrated in miles an hour, not kilometers."

The Ferrari's disk brakes, which in modern sports cars replace the family auto's drum brakes, brought me to a halt before the paralysis of terror set in.

"You drive, please," I managed to say.

Jim and I left the Autostrada again at Bo-

dramas as Caesar's triumphant return from Gaul and Mark Antony's funeral oration. Here, in the burning-of-Rome sequence, lights pick out the triple columns of the Temple of Castor and Pollux, restored Senate Building (center), and Temple of Antoninus and Faustina (right).

PHOTOGRAPHED BY JAMES P. BLAIR © NATIONAL GEOGRAPHIC SOCIETY

logna, where not even the Italian look can conceal the medieval flavor inherent in narrow, arcaded streets. We took rural roads across half the Italian peninsula until we came to the shores of the Tyrrhenian Sea and turned south along the coast road to Rome.

On the way we checked the tower in Pisa (page 600). It is still leaning. The people would not have it otherwise, for who would come to see an ordinary straight tower? I remember in war days how a mischievous group of G. I.'s went to Pisa and pretended they were going to straighten the tower with complicated blocks and tackles attached to powerful trucks. They called off the joke quickly when the Pisans came in tears to see their chief tourist attraction ruined.

South of Leghorn, seat of the Italian naval academy, and across the blue water beyond the beaches lie big Sardinia and tiny Elba, two of Italy's cherished islands. With Sicily and many near-by islets like Pantelleria and the Lipari group, they comprise all the Italian territory off the mainland.

Before World War II, Italy's empire extended to North and East Africa. Many Italians, even ranking government officials, believe the loss of those colonies was a good thing for Italy economically. The offshore lands, however, pay their way. Of the 18,000,000 foreigners who come to Italy each year as tourists, for example, more and more go to these islands. I heard a hotelkeeper on fabled Capri complain that several long-faithful paying guests had deserted him for Elba.

Floodlights Brighten Roman Landmark

Our road to Rome took us by the new Leonardo da Vinci Airport at Fiumicino. Leonardo's heroic statue and the beautiful new buildings stood all but deserted at the time; the planes did not come until the radar and communication systems were completed last January.

We drove into the capital of 51,000,000 Italians, and once of the whole Western World, by way of the Via Claudia. Already in early evening the familiar Colosseum stood stark in the glare of the new floodlights, which needlessly horrify some purists. Flavian emperors floodlighted it, too, perforce with torches; the modern city is only doing the same thing better.

The Roman does not enshrine his past, but lives with it. He blends an ancient wall into his new railroad station. He stages *Aïda*—with real camels—in the Baths of Caracalla. He thrills to the electronic sound-and-light

performances in the Roman Forum (page 602), and converts the home of a Medici on the Via Giulia into an apartment building.*

And so the centuries that lie between old and new in Rome are not readily seen, and this is an ingredient of the Eternal City's fascination for the holidaymakers from all corners of the earth. Time, even when it is important, does not seem so; hours spent watching the horses in the Villa Borghese or the scene from the Spanish Steps sit lightly upon the conscience.

But government offices blaze with lights at midnight. Someone is keeping the wheels of the second Risorgimento turning, and I do mean wheels; traffic, modern symbol of progress, is bedlam in Rome.

Roman traffic somehow lacks malevolence. Bachelor Jim Blair said he thought this was because there are so many motor scooters with pretty girls riding sidesaddle on the tandem seats, feet sticking out into traffic.

"Italians are gallant," Jim said. "No driver would dream of tipping these girls over."

*Harnett T. Kane gives a vivid picture of present-day Rome in "Eternal City With a Modern Air," NATIONAL GEOGRAPHIC, April, 1953.

Newlyweds in Rome scurry toward St. Peter's Basilica for a moment of worship. Boy with a toy gun wonders about a target.

America Weds Italy in a Film Comedy

Come September teams Gina Lollobrigida and Rock Hudson in an argumentative scene shot at Cinema City, outside Rome. Gina is gowned for her wedding to another man; Hudson dissuades her and, at film's end, marries her himself.

Scores of recent American motion pictures wear the imprint of Italy. Rich natural settings, low production costs, and tax advantages lure Hollywood companies.

The Italian look overlook me in the great shops of Rome. Now my wife owns a handbag by Gucci of the Via Condotti, and my daughters sweaters and scarves with which show windows of the Via Barberini are booby-trapped. As for me, I wear a suit by Brioni.

I had dropped by Brioni's in my professional capacity, wanting to see how they put the Italian look into men's styles.

"My head tailor, who would fit you should you happen to order something," remarked Signor Gaetano Savini-Brioni casually, "scored recent notable successes with your Gen. Mark Clark, Signori Henry Fonda and John Wayne of Hollywood, and also our lovely lady of the screen Anna Magnani."

As matters turned out, I was glad I was so well-dressed the day we visited Cinecittà, the motion-picture capital of Italy.

Stars Flock to Roman Hollywood

"Cinema City" stands in the Via Tuscolana on the edge of Rome. When I was there, both a French and an American company were at work on different sets. In one day I saw the English actor Robert Morley, the French star

Bernini's Matchless Colonnades Embrace St. Peter's Square

Chief sight of Vatican City, the Basilica of St. Peter utilized the genius of Italy's finest artist-architects—Bramante, Raphael, and Michelangelo. To provide a setting, Bernini designed a square capable of holding half a million people.

An Egyptian obelisk taken to Rome by the Emperor Caligula spikes the plaza.

Appearing at his window in the Papal Palace, Pope John XXIII blesses pilgrims in the square. His personal coat of arms hangs below the sill. One of the 140 statues of saints and martyrs atop the Bernini colonnades stands at left.

Alain Delon, and the Italian Gino Cervi. The Americans Guy Madison and Ralph Bellamy were stopping at my hotel in Rome.

I watched an artificial lake churned into waves by huge paddle wheels. The water was a beautiful green.

"It's a river today," someone told me. "When we want the sea, we dye the water blue."

I visited a prison set, so realistic I felt claustrophobia until I touched the stained walls and found them made of plastic. I saw many

(Continued on page 611)

Strolling Musicians Enliven a New Roman Night Club

Da Meo Patacca specializes in folk music, country costumes, rustic atmosphere, and food that might have come from a farm kitchen. The establishment, near Rome's Tiber River, occupies a vaulted cellar and the cobblestoned stable yard opposite. Cooks, waiters, and bus boys provide entertainment between culinary chores.

This quartet—with accordion, tambourine, guitar, and opera-trained voices—fills the night with music.

Watermelon on ice wins the approval of a waiter, who pauses for a slice.

Horse-drawn wine kegs lend atmosphere to Da Meo Patacca. One traveler observed that American tourists come for the show, Italians to watch the Americans, and Frenchmen for the food.

"classical" Roman statues and oil paintings that I could scarcely believe were copies of masterpieces. A member of Universal-International's publicity staff found me in the dusty depths of a robbers' cave.

"You are about to realize the dream of every red-blooded American man," she said. "Follow me."

We entered one of the cavernous studio buildings, picked our way through passages cluttered with fat electric cables, and emerged into a floodlighted satin boudoir where there was a gorgeous young woman in a bridal gown.

"Mr. Kenney, I'd like you to meet Miss Gina Lollobrigida," said the publicity girl.

I'm afraid I just gaped and stammered and said nothing witty or charming. However, I can now tell people—and do so at every opportunity—that I spent an afternoon with Miss Lollobrigida. I don't mention, of course, that also present were some fifty cameramen, stagehands, electricians, directors, and Rock Hudson.

The company was making

Rome's Opera House Hails Britain's Radiant Queen

In the Presidential box, Elizabeth II stands beside Italy's chief executive, Giovanni Gronchi, and acknowledges the acclaim of a beribboned and bejeweled audience May 3, 1961. Prince Philip, Duke of Edinburgh, appears, partly hidden, behind the Queen.

Floral streamers adorn red-and-gold boxes for a gala performance of *Falstaff*, an opera written by Italy's Verdi about the character immortalized by England's Shakespeare.

the film *Come September* (page 605). Financial considerations first brought many of the Hollywood people to Italy. Mr. Hudson told me that, in addition, actors reap a bonus of inspiration.

"It's good to feel you are working in the atmosphere that produced *La Strada* and *The Bicycle Thief*, in the country of Rossellini and De Sica," he said. "Also, the Italian stars . . ."

At this point Miss Lollobrigida impishly snipped off the end of Mr. Hudson's cigarette with scissors she had been using as a prop.

". . . are so informal and friendly," Mr. Hudson continued. "Do you have another cigarette on you?"

Reverent Silence Greets a Blessing

Rome has something for everyone, which is the mark of a cultured city. At the opposite end of the spectrum from Cinecittà there is Vatican City, one of the Western World's staunchest spiritual pillars. I am not a Catholic, but I have many times been to mass in St. Peter's.

Jim and I joined a huge throng waiting in St. Peter's Square for the Pope to appear at his window (page 607).

"*Viva il Papa!*" everyone roared when he appeared. "Long live the Pope!"

And then when he blessed the crowd, there was utter silence. I heard only the splash of the square's towering fountains and the rustle of clothing as the massed thousands made the sign of the cross.

Italy divides, as the United States does, into North and South. The industrial North is rich. The South, called the Mezzogiorno, has always been bitterly poor, although things are much better these days because of the government's 15-year plan, being executed through the Cassa per il Mezzogiorno, or Fund for the South.

We Americans know the southern Italian better than we do the Northerner and regard him and his home regions of Sicily and Calabria and Basilicata as "typical" Italy. It was the Southerner who came to our shores in a wave of immigration last century. He built the very streets of our cities, and he gave us some of our best as well as some of our worst citizens, proving once again the diversity of the Italian.

Cassino is in the South, on the N 6 highway from Rome to Naples, and we paused there as we headed for Naples. You will remember the name from World War II communiques. Here the Germans dug in before the Allied advance to the north in the early days of 1944.

They fought with skill and tenacity, holed up in the old stone houses with walls four feet thick, and it took the Allies until May to root them out and clear the Liri Valley roads to Rome.

There was bitter fighting also on the peaks overlooking the town, and the venerable Abbey of Montecassino, a lofty place of peace and learning founded by St. Benedict himself in the sixth century, was reluctantly bombed flat by the Allies.

The building is now restored, largely by the monks. I had seen it before the bombing, I saw the bombing, and I saw the ruins after the Polish soldiers captured the mountain (pages 616-7).

"My memory seems faulty," I told the luncheon waiter in the town. "The abbey does not loom so large above Cassino. Perhaps a mountain looks smaller when there is no one with a gun on top of it."

Town of Cassino Moved Since War

"Aha, I fought in these hills myself, and that is so," said the waiter. "But also Cassino has moved down from where it stood, at the very foot of the mountain. This new Cassino of ours with the modern homes and nice stores and hotels stands a kilometer away, on the plain.

"We do not go any more to the ruins of our old homes. They still contain unexploded bombs and shells."

We took the narrow road up Montecassino to the abbey, a road so steep and winding we had difficulty negotiating the turns. Frequently we stopped and looked down on the old bloody ground. Barbed wire rusted in a tangle of scrub. A stone house still lay in ruins. An artillery emplacement still bore ruts gouged by a pivoting gun carriage.

Allied and German dead still lie here in

Red Plumes Streaming, a Lieutenant of Carabinieri Carries the Italian Flag

One of some 70,000 hand-picked men who police the republic, the cavalryman wears his full-dress uniform, which has changed little since the corps's founding in 1814. Rome's Villa Borghese witnessed the review honoring the King and Queen of Thailand.

Retired from combat, a puppet warrior swings on his strings in a Palermo antique shop. A gentle touch by an admirer in her First Communion dress imparts a bit of animation.

Punch Aims a Blow at a Devil to the Delight of Small Fry

Hand puppets draw a capacity crowd to a park performance at Janiculum, overlooking Rome. Boastful, cowardly Punch (in white) has changed little in character or appearance since he first came on stage in Naples at the beginning of the 17th century. He still harangues his wife and spars with adversaries. Neapolitan puppets, unlike the Sicilian marionette at left, are simple in structure and do unsophisticated slapstick routines.

Impish Third-graders Ponder a Problem

Italian students in public schools wear uniforms through the fifth grade; dark colors conceal ink stains. Pens are used even in the lowest classes. Unable to correct their work, pupils think carefully before writing. These children study at Casanova, north of Naples.

Solemn altar boys, bearing censer and candles, lead a procession near Urbino honoring St. Veronica.

their separate cemeteries. On the highest of the peaks there is the tall monument to the Polish soldiers who burst the blockade of Montecassino at last. I walked to it in the rain and on around the slender shaft until I came to the side where the inscription is written in English.

"For our freedom and yours," it says, "we soldiers of Poland gave our soul to God, our life to the soil of Italy, our hearts to Poland."

"We soldiers of Poland . . ." it says, but it could also read truthfully, "We soldiers of Carthage . . ." or of Greece or Arnby or France or Austria. Many soldiers of many lands gave their lives to the soil of Italy, and on their way to their destinies, left in the fabric of Italian civilization the marks of their cultures—the Greek temples of Paestum, the Renaissance buildings of Urbino, and Africa in the dark eyes of Sicily.

A visiting priest came by with a small camera.

"In the abbey," he told me, "they do not hate those who dropped the bombs. They forgave before the dust had settled, as they forgave the Lombards and the Saracens and the French who also destroyed Montecassino.

"I am not a Benedictine, but I know them for men of unswerving faith. They do not doubt the ultimate triumph of the peace of God, and so can forgive the wayward children of God who break it from time to time.

"Everyone should come here to see and feel and hear as we are doing now. I think they might then have the faith of the Benedictines."

I offered him a lift down the mountain, but he declined with a smile.

"I go the other way, over the hill to the German monument, the one to my own comrades of the sad days."

He walked away in the rain.

Neapolitans Enjoy Magnificent Views

Naples, called Napoli in Italian and Napule in the dialect, is the great city of the South. Like Algiers and Rio and San Francisco and Cape Town and the other most beautiful cities, it starts at the edge of the sea and climbs a curve of hills (page 618).

1944: Skeleton of Montecassino Abbey Straddles a War-torn Hill

For centuries the home of the order founded by St. Benedict about 530, the monastery has been destroyed four times by battle and once by earthquake.

In World War II, Montecassino, with the German Gustav Line entrenched below, commanded an undistructed view of Allied forces advancing north from the Rapido River. From its heights, Nazis directed a devastating fire, pinning the Allies on the outskirts of Cassino for four months. Reluctantly, Allied aircraft bombed the mountain and reduced the abbey to rubble. Courageous Polish troops finally dislodged the Germans and opened the road to Rome.

1961: Battle scars healed, the restored abbey overlooks a cemetery for Polish war dead. Sprays of flowers decorate an altar.

The classic view from Naples embraces Vesuvius, which destroyed Pompeii in the year 79, and across the Gulf of Naples you can see Capri, where visitors go in hydrofoil ferryboats.*

Among the darkly handsome people of the city is the Italian version of Dennis the Menace, the *scugnizzo*—the urchin who clings to the hindmost part of every streetcar, the part where the conductor cannot see him.

The restaurant called La Quercia takes its name from the *vico*, or little street, in which it stands. This small "Street of the Oak Tree" is in the heart of the city, and La Quercia's food is the equal of any in Naples.

As we moved across the room to our table, conversations ceased and the diners all smiled at us. This was understandable, I thought: Anna Prisco was with us, and she is very beautiful.

"I do not wonder that diners neglect the ravioli, even at La Quercia, to smile at Anna," I told Glauco Prisco.

"You begin to talk like a Napulitano," said Glauco. "But I must tell you the smiles are not only for my wife's undoubted beauty.

"The people in here are of Napule, and

*These remarkable craft were described by Dr. Gilbert Grosvenor in "Hydrofoil Ferry 'Flies' the Strait of Messina," NATIONAL GEOGRAPHIC, April, 1957.

Lightning heralds an evening thunderstorm over Naples's sparkling waterfront.

many recognize Anna; they know she is the granddaughter of Ernesto Murolo, a great poet and playwright of the city. Already the musicians have been told that Anna is here.

"Soon the singer will come to our table, and to Anna he will sing her grandfather's songs. The people are aware of this, and they look forward to music they love."

The musicians came, and the singer kissed Anna's hand and placed his voice in her keeping, and also his heart.

"*Prèga, 'Pescatore 'e Pusilleco,*" Anna suggested.

The choice greatly pleased the musicians. Well did they know Pusilleco, which is the Neapolitan name for Posillipo, sun-bathed suburb of Naples only the price of a trolley-bus ticket away. Well did they know the *pescatori*, the gay fishermen, who went out in their boats from its crescent beaches or jigged for octopus at the base of its grottoed cliffs.

The song is life and life is the song, and the two are always together in the streets of old Naples, beneath the drying clothes strung from balcony to balcony when the sun is warm. The Neapolitan sings when he is happy or sad or in love, and that means he sings a great deal.

He sings loudly and usually well and with disregard for where he finds himself or what

Capri-bound boats spin luminous wakes beneath the brooding hulk of Vesuvius

Portofino Harbors Fleets of Pleasure Craft; Medieval Castle Crowns the Cliff at Right

A resort since Roman times, this fishing village on the Italian Riviera caters to millionaires and motion-picture stars, artists and aristocrats. The

Italian Government requires that all new building and exterior alteration be in keeping with Portofino's old-world charm, but quayside apartments and hilltop villas have modern equipment and luxurious furnishings. Olive, pine, and cedar trees clothe the precipitous slopes.

hour it may be. No one turns to stare, for he is only living as one lives in Napule.

South of Naples the Amalfi Drive clings to sheer cliffs above the sea, rimming a peninsula of superb villas (page 625).* Richard Wagner was enchanted by one of them, and in his opera *Parsifal* I can hear the waves shattering on gray rock. Farther yet there is Paestum, with temples the equal of any in all the ancient Greek world.

Virgil's Roses Still Bloom in Paestum

I used to think of Paestum, abandoned in the Middle Ages because of malaria, as a dead end, without living connection to the Italy of today. That was because I had never been there in May or November. Now it was November, and roses bloomed at my feet. They are the very same roses, the *bifericque rosaria Paesti*, of which Virgil wrote 2,000 years ago in the fourth book of Georgics.

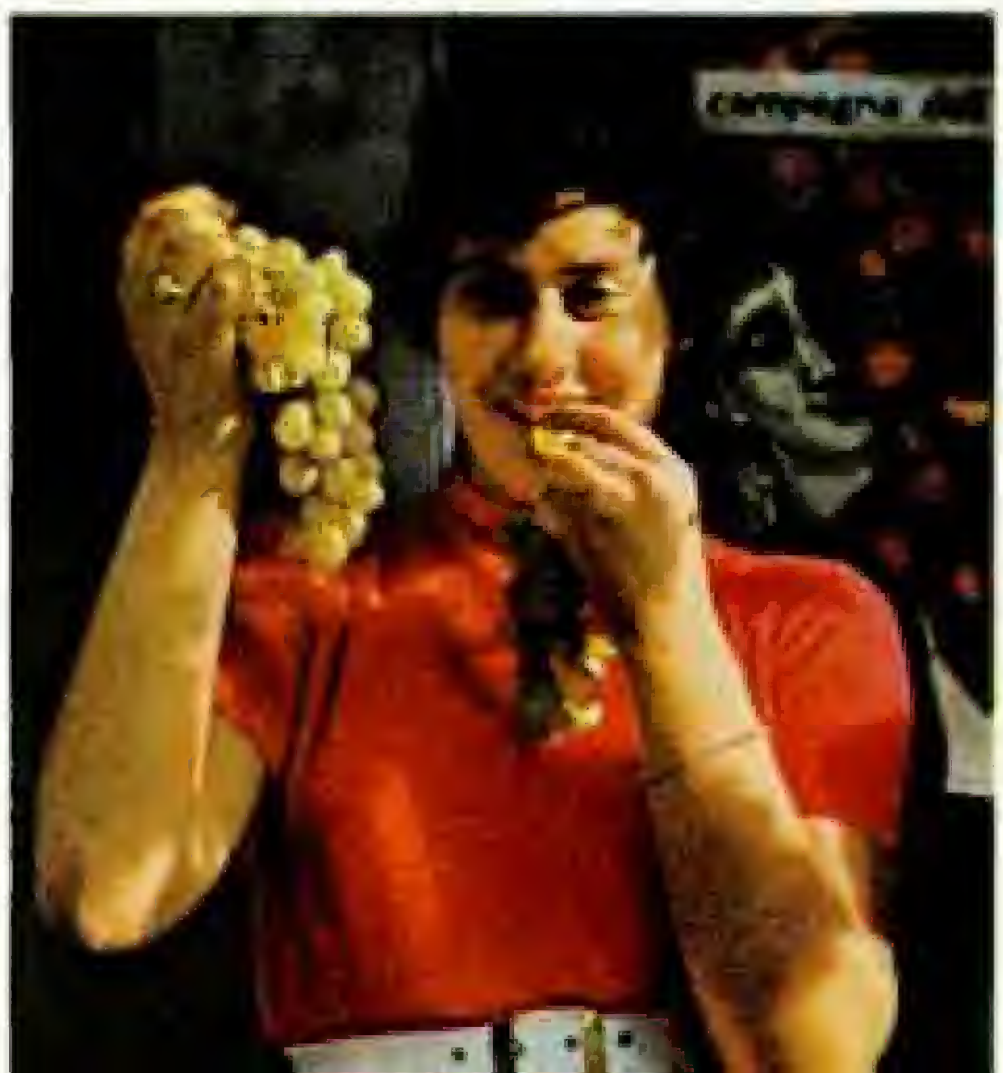
We went southward from Paestum; though it was dead of winter back home in Washington, D. C., the people of the Mezzogiorno were turning the earth for spring planting, and the tiny birds, the *passerotti*, twittered in the blue sky above the fields.

The Italians take a practical view of the birds. They eat them. Even restaurants serve them in season, cooked with the heads on.

Of a sunny Sunday the country roads come alive with motor scooters, most with two hunters armed with scatter-guns. They take to the fields afoot, and anything that flies—even a songbird—is often a target. I saw and heard many birds in Italy, but this unrestricted hunting must take a heavy toll.

We were riding the coastal road beside the Tyrrhenian Sea. It goes to the southernmost point of Italy, past the Strait of Messina. Over this strip of water, above the whirlpool of Charybdis and the rock of Scylla, now arch enormous cables three miles long. They carry electric current generated by Alpine streams to Sicily's new industries and homes. Sicily is a story in itself.†

Glauco Prisco, who is in the Naples office of the government visitors' bureau, had told us that all the South Italian littoral was destined for intensive development as a vacationland. Of the more than 2,080 billion lire ($3,350,000,000) the government will have spent on the Mezzogiorno in the 15 years that



*See "Amalfi, Italy's Divine Coast," by Lady Marden, NATIONAL GEOGRAPHIC, October, 1950.

†Mr. Marden describes Italy's boot-toe island in "Sicily the Three-Cornered," NATIONAL GEOGRAPHIC, January, 1956.

Eager hands reach for full-bodied bunches during the grape harvest at Chiesanuova, a village near Levanto.

Homeward bound to Riomaggiore, a picker balances a basket of grapes on her head. Cloth shades fruit from the sun.

Riomaggiore Crowds a Crevice Above the Sea; Mountainsides Yield Grapes for Its Vintners

In the Cinqueterre, or Five Lands, a stretch of the Italian Riviera northwest of La Spezia, life moves in the rhythm of the Middle Ages. No road links Cinqueterre villages with larger towns; only a sea-hanging path connects them. Serenity and order abide among a people attuned to land and sea.

Dante described this coast as filled with the "most wild and broken fall of rock," but the people have transformed the slopes into a green staircase for grapes. So steep are some of the terraces that men attached to ropes hang from cliffs to cultivate the vines. Success rewards their labor: Cinqueterre grapes produce some of the finest wines in Italy.

Festival-goer tastes a sample of Riomaggiore's grapes.

Sunny citrus accompanies a young merchant to market in Amalfi. Tiered groves high above the Gulf of Salerno grow lemons as large as oranges and almost as sweet.

Amalfi Leaps From Sea to Sky; Villages Clamber Rocky Slopes

Nearing Atrani, a ribbon of roadway overhangs the sea—the spectacular 26-mile Amalfi Drive. Villas and terraced gardens climb cliffs above a scalloped shoreline.

A steamer bound for Naples slips past jetties at the town of Amalfi, haven of ancient mariners.

end with 1965, some 60 billion will have been used to promote tourism. Already the resorts are taking shape beside the azure sea.

One of the little towns on this coast I remember well from war days. Some of us used to visit little Santa Maria near Castellabate for a few days of leave. There was nothing there—only beauty and sunshine, and friendliness and peace in the midst of war.

Jim and I found my little town changed. A wealthy Roman has turned a crumbling castle beside the water into a summer villa. A jukebox blares on the square. The Vespas and the Lambrettas, the motor scooters, are numerous now in Santa Maria.

My town typifies the entire Mezzogiorno: it wants to be modern like the North. The Southerner is tired of being looked upon as his country's yokel. He wants to feel that life is not passing him by.

Movie Company Brings New Hungers

An American movie company with Rory Calhoun had been at work in the area, and that may have accounted for some of the longing for modernity we found.

"They were the modern ones, those movie people," I heard a man say. "We must live as they do. I, for one, will sell my fishing boat. Instead I will have a small, fast red car with no top."

It came as something of a shock to find Eboli, once a symbol of Mezzogiorno poverty and backwardness, yearning for modernity and well on its way toward achieving it.

Eboli is in the hilly country back from the sea. Less than fifty years ago, many of the people hereabouts lived in caves. Prowling wolves killed children weak with malaria. Carlo Levi told of this in *Christ Stopped at Eboli*, published in 1947, the first of the new Italian writing that has so intrigued the world of letters.

Ultramodern Apartments Replace Caves

Levi's narrative spurred the government to take action and build apartments for cave dwellers at Eboli and Matera. Allied bombing of Eboli had already helped, ironically, by destroying many of the caves.

Jim and I saw the apartments and the few remaining caves. The apartments are designed on the principle that the architect Luigi Cosenza had in mind when he created the Olivetti typewriter branch factory at Pozzuoli and the workers' apartments built with it. I can best explain the principle by repeating what Signor Cosenza said the day he showed me the Olivetti establishment.

"Everything was designed for people whose factories for centuries had been the open fields and whose living rooms were the city streets or the village square," he said.

"For these people there must be the feel of being in the open—the glass wall in the factory, the spaces among the apartment buildings for the children to play, and the women to gossip in the sun, and the young lovers to stroll about."

Eboli is the sort of community in which the Southerner feels secure: the snug eating and sleeping places near, the neighbors clustered

Father and son stop farm work near Urbino to speak with the photographer. Although primarily agricultural, Italy must labor hard to feed her people. By draining Pontine and Venetia marshlands, she has added to her farmland. Chemical fertilizers increase the yield on ancient fields, and irrigation makes a second harvest possible in the dry South.

Geyser of olives erupts from a sieve as a grove worker winnows fruit near Palmi. Southern Italians harvest oil olives after they drop from the trees. Women work long hours collecting and cleaning the crop, a major factor in Italy's economy.

Bending to a backstraining task, barelegged girls weed a rice field in Vercelli. Each summer hundreds of women migrate from all parts of Italy to work in rice plots along the Po. In orderly ranks, they wade the flooded lowlands, singing as they go. A staple of their diet is a thick soup made from frogs that live in the ponds.

Farmers Chopping Tilted Fields Ignore the Familiar Splendors of Urbino

Domed Cathedral and the 15th-century ducal palace of Federigo da Montefeltro crown the hilltop city where the painter Raphael was born. Under Federigo, a patron of the arts, Urbino thrived as a center of learning during the Renaissance.

San Marino crossbowmen in Renaissance costumes storm castle ramparts in a mock assault.

closely outside, the loud, comforting radios. No child need fear the wolf here.

Luciano Rocco, a small boy, took us to a cave in which now only his donkey lives. Luciano called it by a dialect name, *a ciuccio*, and then asked me not to tell his teacher.

"I must call him *l'asino*, in Italian," he explained. "The dialect is old-fashioned."

I told him his elders had lived in this cave, had been bitten by mosquitoes, and had died of malaria.

"*Oi*," he scoffed. "Malaria is old-fashioned too. Last week they stuck our arms with needles for polio."

Foreign Land Within Italy's Borders

All the while Italy celebrates her centennial, she guards a secret. She is not united after all. There is a whole foreign nation inside her boundaries!

I commented to this effect to the manager of the Autostello hotel in Lagonegro, where we stopped on our way back north; these touring hotels, run by the Italian Automobile Club, are new features of Italy's roadsides.

"Ah, San Marino!" grinned the manager. "What is there in San Marino that Italy would want?"

"We don't know," I said. "We're on our way to find out."

Here we met the great Apennines that divide Italy into east and west as the Alps cut her off from the rest of Europe to the north.

Mountains and centuries of invaders were responsible for Italy's disunity. They divided the inhabitants, so that there was not even a common language until the 14th century, when the cultured people began using the Tuscan dialect, now Italy's preferred tongue. Even today, the dialect of Naples is not always understood in Pozzuoli, less than 15 miles away, and vice versa.

For the winding roads of the Apennines one needs a stout car, a firm grip on the steering wheel, and a sharp ear for the two-toned horn blasts that announce a truck or a bus coming around the curve.

Several times we turned east and ran to

Fantasy in the clouds, the tiny mountain republic governs itself as an enclave within Italy

the Adriatic coast, also in process of development into a vacationland. In the North—around Rimini, for example—the process is well advanced, and thousands come to these sunny shores in summer by car and bus from Austria and Germany.

In Rimini, with some difficulty, we found the little twisting road to San Marino. Like so many old towns in Italy, the republic stands on top of the steepest mountain that could be found (above).

Il Capitano Wears Red Tights

But as I said, San Marino is not politically Italian at all. She is the last of the Italian city-states, the smallest independent republic in the world, and a living museum of Italy before the Risorgimento. Here one can attend a wedding reception dressed as a captain of Renaissance crossbowmen.

Jim wanted three crossbowmen for pictures of the crenelated fortresses and the 15th-century Tuscan Gothic town palace. Signorina Giuseppina Tamagnini of the visitors' bureau could find only two. It was not tourist season, and the crossbowmen of the summer festivals were mostly back in high school.

"Signor Kenney," said Signorina Tamagnini, "please try on these red tights."

Thus I became a self-conscious *capitano* in the long-demobilized army of Borgo Maggiore, the village at the foot of the mountain. I wore a black singlet with gold buttons and puff shoulders, a cap with a long floppy peak, and those red tights, reasonable facsimiles of which I have seen on the shelves of New Hampshire general stores.

We made our pictures. On my way back to Signorina Tamagnini's office, I stopped by my hotel for a fresh notebook and ran into a wedding reception in complete possession of the first floor. The party welcomed me joyfully, thinking the town fathers had sent me.

I was about to kiss the pretty bride when the hotel proprietor recognized me.

"The *americano* in room 4!" he shouted. "What a *simpatico* gesture he makes! Long live the *Stati Uniti!*"

So instead of getting to kiss the bride, I was asked if I knew numerous Sammarinese and Italians who had emigrated to Brooklyn. You get this all the time in Italy, especially in the South.

Starting out once more, I ran afoul of a busload of off-season vacationers who asked me in pidgin Italian to pose for pictures. I was rewarded in German coins.

I don't really know why San Marino did not join the rest of Italy when it united 100 years ago. The Sammarinese served the cause of unity by sheltering Garibaldi in 1849, when he was in trouble.

But they declined to become Italian, and likely this was because the Sammarinese, never more than 25,000 strong, had been free for 13 centuries and could not break the habit. Italy let it pass.

To get from Rimini to Milan, the leading industrial city of Italy and hence the heart of the second Risorgimento, you may drive through nearly half of the 250-mile-long Po Valley, which makes up the largest single bit of flat and fertile land in all Italy's rugged 116,303 square miles.

Cremona, city of candy, mustard, and violins, lies on the Po, and a sizable detour to the northern valley rim will take you to Verona, home of Romeo and Juliet. Surprisingly, I found the Veronese more interested in talking about the opera in their marvelously preserved Roman amphitheater than about the world's best known love tragedy.

I did find, however, Le Due Torri, a hotel I think I would pick for a honeymoon. Every room is furnished with antiques—heirlooms from the castle of the proprietor, whose noble family dates back centuries. No two rooms are alike; you pick yours at the front desk

Members of a big family picnicking in Monterosso al Mare take refuge from the sun beneath a single beach umbrella. One of the Cinqueterre villages, Monterosso attracts Sunday excursionists from Genoa.

Umbrellas Mushroom on Alassio's Beach

A resort on the Italian Riviera, Alassio draws crowds with a broad curve of fine-grained sand and a mild winter climate.

Girl in a bikini walks behind a curtain of bathing suits and towels hung to dry. Hump-backed Island of Gallinara beckons across the Ligurian Sea.

Sicilian Mosaic Shows the Ancients Had Bikinis

Holding a wheel, this muscular beauty adorns the floor of a Roman emperor's villa near Piazza Armerina, Sicily. She appears with other women in athletic events far more strenuous than sun bathing—discus throwing, foot racing, jumping, ball playing, and gymnastics.

from a panel of colored photographic transparencies, each illuminated by its own light button.

The rates were so low that I asked the proprietor how he expected to recover the large sum of money he has poured into his brand-new establishment.

"I may never get it back," he smiled. "This is my expensive hobby."

Resisting further detours, we went on to Milan, called the New York City of Italy. Here businessmen have abandoned the traditional Italian siesta and at lunchtime jam instead into Gonzales, the new American-style snack bar, for a hamburger and milkshake.

The city's new buildings, including her pioneering skyscrapers, symbolize modern Italy. They are smothering the past; they ring the Piazza del Duomo, overshadowing the rich Milan Cathedral, third largest church in Europe after St. Peter's Basilica in Rome and Spain's Seville Cathedral.

Milan's queen is the breath-taking Pirelli skyscraper near the Central Railway Station, headquarters for the firm that makes Pirelli tires and high-tension electric cables. The graceful building has 31 stories above ground. It tapers at each end, like the bow and stern of a double-ended ship. It depends for strength upon massive central pillars of concrete and steel rather than exterior walls (opposite).

Interior partitions can be moved for variety of office arrangements. It has so many windows that it takes 30 days to wash them all from special little cars scampering up and down the building's exterior on permanent tracks. Subterranean floors hold power plants, communications centers, and elevator machinery.

The best architectural and engineering brains of Italy, including the gifted Gio Ponti and Pier Luigi Nervi, had a hand in the creation of the skyscraper. There is no other building in the world like it.

Leonardo's Masterpiece Saved From Decay

I said that modernity smothers the past in Milan. That is not completely true, of course. Leonardo da Vinci's glorious painting of "The Last Supper," which he did on the walls of the old Santa Maria delle Grazie convent refectory, owes its existence to modern techniques of restoration and dehumidification. The painting, long believed in process of final decay, will last many years yet, though it is faded and mutilated.

I mentioned earlier making two trips to Italy for this article. The second was this year, in the spring, and I went with a small group of American travel writers who were looking over the Alto Adige, South Tirol, where few American travelers ever go.

The invader of old reached the south of Italy by sea, from the warm countries, from Greece and Africa. But here in South Tirol he struck across the Alps, and the blue-eyed Austrian in his rude fur clothing used the Brenner Pass.

He came to stay, this Austrian, so that no place in Italy today is so unlike the usual concept of Italy as

Milan at Twilight Glitters With Brilliance and Prosperity

Sleek new Pirelli Building towers 31 stories above Piazza Duca d'Aosta, commercial center of the industrial city. Designed by Gio Ponti and Pier Luigi Nervi, it is Italy's tallest structure of reinforced concrete.

A blur of traffic swirls up the bustling Via Vittor Pisani (center), which cuts a swath through the financial district.

Milan's Cathedral glows in the Piazza del Duomo. Christmas tree adds tinsel to a sparkling setting.

PHOTOGRAPHED BY JAMES P. BLAIR © NATIONAL GEOGRAPHIC SOCIETY

the bilingual Alto Adige, of which Bolzano is the chief city. This is Germanic-seeming country. Chalets dot the mountain slopes and valleys amid vineyards and orchards. Castles on the gray peaks recall castles on the Rhine.

"*Buona sera*," I said as I passed people on the streets of Bressanone.

But the answer came back in German—"*Grüss Gott*"—"God greet you"—the greeting of Austria.

Banquet With the Habsburg Ghosts

Italy acquired South Tirol from Austria in 1919 under the Treaty of Saint-Germain. A generation later, friction still exists between the Germanic and Italian elements in the Alto Adige. Those who have cultural ties with the Germanic countries seek a greater degree of self-government.

There is a castle in Merano built by the Habsburgs of Austria, who inherited South Tirol when the line of the Bavarian Counts of Tirol petered out in the 14th century. It is a museum these days.

With the other travel writers, I went there one night to a banquet which must have made the Habsburg ghosts hungry indeed, for there had been no food on the banqueting tables of the castle for 400 years. We were the only guests, and the people of Merano gave us a magnificent party.

A mounted honor guard in medieval costume awaited us in the torchlighted palace courtyard. When trumpets blared, the famous

Columbus points the way to new worlds from his pedestal amid the palms of Santa Margherita.

Seated on a throne of hills, modern Genoa exudes the spirit that inspired Petrarch to write: "A city of Kings, the very temple of prosperity, the gate of joy." Arch to the Fallen, a World War I memorial, dominates the Piazza della Vittoria.

Caravels of Columbus sail a grassy sea in this floral painting at Genoa, the explorer's native city.

Corridor of Conquest, Quiet Susa Valley Knew Charlemagne, Caesar, and Possibly Hannibal

For centuries this Alpine trough, cut by the Dora Riparia, echoed the thunder of advancing armies.

Hannibal, invading the Roman Republic through the western Alps, appears to have used a pass within a few miles of this spot in 218 B.C. He led his foot soldiers, horsemen, and terrifying battle elephants across the snows in 15 days.

Two centuries later, Caesar's legions passed through the valley on their way to victory in Gaul. Charlemagne and his knights marched this route in 773 to rescue Rome from the Lombards.

In World War II, Italy mounted an unsuccessful attack against France at Mount Cenis Pass, close by.

Today tourists, not troops, stream through the Frejus Tunnel. Susa Valley promotes peaceful pursuits: farming in summer, skiing in winter.

Members of this family cut and stack wheat on a slope above Ulzio. Language and heritage ally them with France, just over the mountains.

honey-colored mountain horses of Avelengo snorted and reared and struck fire from the cobbles with their hoofs.

The people jammed the square. A man stepped out before us in the torchlight, twirling a great crimson banner around his head until it was a sheet of flame bright as the torches themselves. Liveried pages, young men and women, formed lines and escorted us into the Princes' Castle.

Torchbearers stood at every corner and landing of the narrow stone stairway to the upper floors. More torches, candelabra, and a leaping cooking fire lighted the banquet hall hung with medieval paintings and carved Habsburg coats of arms.

PAINTING BY WALTER BEARDS EDMONDS, NATIONAL ARCHAEOLOGIC STAFF © N.G.S.

Smoke swirled beneath the high Gothic ceiling. Pages constantly moved about, replenishing sputtering torches and stamping out glowing embers. A men's chorus in Tirolean costume sang to us, and there was a lady yodeler, the best in South Tirol.

A most unusual orchestra played. All the men of an Alpine village had come to do us honor, bringing with them strange instruments they or their forebears had made from grape roots, tree limbs, and such unlikely things. But the music was sweet and the leader, a true jester, all but put us into hysterics with his antics.

We ate quail from the Alpine valleys, and huge steaks. In this setting I found myself

Strolling beauties on the shore of Lake Garda recall Byron's words on an Italian woman:
Heart on her lips,
and soul within her eyes,
soft as her clime,
and sunny as her skies.

Toytown Island Floats on Lake Maggiore

Cupped in the Alps, Maggiore specializes in enchanting vistas. Italy shares the lake with Switzerland. Cork-float seines dry along the shore of Isola Bella. Distant Isola dei Pescatori (Fishermen's Island) rises from serene waters.

suddenly thinking it would be proper to toss the bones to the stone floor for the ghosts of the Habsburg dogs. Such medieval surroundings seemed a world away from the humming factories and busy cities I had seen.

Wounded Typewriter Flunks Examination

That exuberantly modern Pirelli skyscraper back in Milan is to me like two other remarkable products of the second Risorgimento—the Olivetti typewriter and the Necchi sewing machine. All three are efficiently functional, all are glamorous, all have the Italian look.

We visited the main Olivetti factory at Ivrea and the Necchi plant at Pavia. The look is the same—airy buildings, vistas of lawn and flowers outside, music piped into workrooms, skillful men and women workers whose bicycles, motor scooters, and small cars fill long rows of sheds. The typewriters and adding machines march round and round the factory on their assembly lines, uniformed like soldiers in gray, ivory, and green.

At Ivrea they took a typewriter out of the parade and wheeled it away on a cart.

"Poor dead soldier," I said in Italian as it passed, bowing my head.

"No," grinned one of the attendants, "he is only wounded. He broke his umlaut on the final test, and for one who must speak German, that is a serious wound."

Necchi, I discovered to my surprise, began as an iron foundry. It still makes castings for Fiat automobiles.

Both firms win frequent awards for product

Hydrofoil Skims Lake Garda as if Flying on Wings

Beginning the run between Peschiera del Garda and Desenzano, the boat rode on its hull until, picking up momentum, it rose clear of the water and flew on two V-shaped foils. By reducing water resistance, the foils enable the boat to attain a speed of 50 miles an hour. Alexander Graham Bell pioneered development of hydrofoil craft early in this century.

Venetian Spectators Crowd Palace Balconies as Antique Gondolas Sweep the Grand Canal

Each September canal-ringed Venice stages its seven-century-old Historical Regatta. *Bucentaur* (right), an 18-oared barge of state filled with cos-

PHOTOGRAPHS BY HENRY GROSE, PHOTO RESEARCHERS © NATIONAL GEOGRAPHIC SOCIETY

tumed officials, Iearis elaborately carved gondolas that once belonged to the republic's merchant princes. After the procession, the gondoliers race. Five centuries ago some 10,000 gondolas plied the canals; today they number fewer than 500. Domes cap Church of Santa Maria della Salute.

Don Lorenzo Monaco's altarpiece, which portrays saints and angels witnessing the crowning of the Virgin, hangs in the Uffizi Palace, Florence. Most of the gallery's priceless art was collected by the Medici family. One of its treasures is "Il Vecchio"—"The Old One"—by Filippino Lippi (right).

design and good taste in advertising. The Museum of Modern Art in New York City exhibits a Necchi sewing machine and an Olivetti typewriter as masterpieces of modern industrial design.

The Italian designer Marcello Nizzoli, who created these machines, belongs to that scintillating world of artist-engineers, artist-architects, and talented craftsmen so largely responsible for the Italian look. This world includes Ponti, Nervi, auto designer Pinin Farina—and I would add my friend and nemesis Brioni the tailor.

I think of them as legitimate descendants of Leonardo da Vinci, who could both paint the Mona Lisa and design locks for the still-useful canal system that passes the Necchi factory at Pavia. Thus Necchi and Olivetti and Alitalia, which hangs abstract paintings in its aircraft and commissions Italy's best decorators to do its exquisite ticket offices, become modern counterparts of the noble families who subsidized the artists and craftsmen of their day and gave the Renaissance its enduring form.

Florentines Enact Their Historic Game Beneath a Copy of Michelangelo's "David"

Part of the Festival of St. John, patron of Florence, the game calls to mind a day in 1530 when the Holy Roman Emperor Charles V laid siege to the city. Refusing to surrender, the people defiantly staged a football match. Playing here by medieval rules, teammates await a chance to kick the ball over the opposition's fence. Priceless tapestries cover the walls of Palazzo Vecchio, onetime home of the Medici.

Nuns and Children at Piazzale Michelangelo Enjoy a Magnificent View of Florence

Medieval tower of the Palazzo Vecchio at center and the Cathedral's dome rise above a sea of tiled

ILLUSTRATIONS BY WILLIAM ALBERT ALLARD © NATIONAL GEOGRAPHIC SOCIETY

roofs. Top-heavy with shops, the 600-year-old Ponte Vecchio spans the River Arno.

The wealthy merchant-aristocrats of Florence, or Firenze, supported the artists while they transformed the Tuscan capital into a cultural center of the Renaissance. Today it stands as one of the noblest museums of Western art.

Paramount among the patrons stood the Medici family. You meet them at every turn of a corner in the lovely city beside the Arno. The magnificent Uffizi and Pitti art galleries once were Medici palaces (page 642). The Ponte Vecchio, where stand the shops of the jewelers and goldsmiths, was built simply as a river crossing for the Medici soldiers (page 646).

To see some of Michelangelo's best sculptures, one visits the tombs of the Medici in their luxurious chapel at the Church of San Lorenzo. Glorious muscled figures—one male, one female—decorate the tomb of Giuliano de' Medici, son of Lorenzo the Magnificent.

Botticelli Painting Comes to Life

Another Giuliano, Lorenzo's brother who was killed in a feud with the rival Pazzi family, once gave me an unusual experience. I was at tea in the Milanese drawing room of Mario Crespi and his wife Fosca; she is the daughter of Giacomo Puccini, composer of *Madame Butterfly* and *La Bohème* and other operas. The Crespis own one of the several Botticelli portraits of Giuliano; another hangs in the National Gallery of Art, Smithsonian Institution, at Washington, D. C.

Among the guests that day was a lady, now an American, born in Florence of an aristocratic family. She stood by Botticelli's Giuliano, and I caught my breath: she might have posed for the portrait! The fine long nose was the same, and also the firm mouth with the unexpected upturn at the corners.

"Gloria is a Medici!" I exclaimed.

"The name is extinct," Fosca Crespi said, "but some Florentine families are related to the Medici."

"Pooh," said Gloria, wandering over. "It is only the long Tuscan face, which makes it difficult for me to wear the new pillbox hats."

It may not be correct to like a painting because it resembles someone you know, but this, I confess, has something to do with my fondness for "Il Vecchio"—"The Old One"—who hangs in the Uffizi Palace in Florence. He is a portrait in fresco by

Filippino Lippi, son of the raffish monk-painter Fra Lippo Lippi of the Medici court, and he is only a nameless old man wearing a wool hat a bit too large, so that it bends his left ear down (page 642).

But he looks like someone everyone knows. Shown the reproduction I brought home, my secretary said he looks like a man who goes to her church.

"The image of a patient of mine," swore an Italian doctor. "Stubborn, wary, not learned perhaps, but wise. Irascible, too, the result of some hardening of the arteries."

To me he looks like a retired colleague at the office, and like a relative of my wife, and even like an Arab friend in Aden. In short, the Old One is universal, an image of all humankind.

Italy is universal, and so are all the Italians, the old land and its peoples of ancient ances-

Fireworks spangle the Florentine night and spray the Arno with reflected glitter

try. In them the greatest human civilizations merged like converging rivers. The waters run together in harmony, but each stream is sensed apart, so that no man can go to Italy and not recognize there something of his own background and himself.

No one therefore can be lonely in Italy. Certainly I read no loneliness in the familiar face of the Old One, who looks like all the rest of us.

during the Festival of St. John

Motor-scooter stowaway joins University of Florence students in a matriculation carnival during which upperclassmen haze freshmen, make speeches, parade, and toot horns (below).

Bemedaled, duck-billed hat identifies a student's college. Yellow is chemistry; red, medicine.

Booming Italy: Portrait of Prosperity

FROM a thousand-foot cleft in the Dolomites, a curved sheet of concrete rises 860 feet above the Vaiont River, a tributary of the Piave. This new dam—the world's tallest—stands as a symbol of modern Italy, where human ingenuity and enterprise are turning the forces of nature into power and progress.

North of Venice, the Vaiont Dam and its lake make their debut on the latest map in the National Geographic's Atlas Series, **Italy,** distributed with this issue to 2,700,000 member-families.*

Italy—now totaling 51,000,000 people—has never known greater change than in the past 10 years. At the end of World War II, more than a third of its productive power lay in ruins. By 1950, aided by Marshall Plan funds, the country was back on its feet and has been reaching for the skies ever since.

With its industrial heart in the northwestern triangle of Milan-Genoa-Turin, today's Italy is one of Europe's technological pacesetters. Output has tripled in only 15 years.

It takes power to stay in the race, and even more power to forge ahead. This up-to-the-minute map reveals a dozen sources of energy. Recently found oil fields at Gela on Sicily supply a new government-built refinery near by. Sardinia's Flumendosa River has been harnessed to provide industrial power for the island. Weird arrangements of pipes and machinery near the Tuscan town of Larderello capture volcanic steam and put it to work. Electric power soon will be dispatched from the nation's first commercial atomic reactor, under construction at Latina, southeast of Rome near Anzio (see inset C).

Italy's seaports are busier than ever. From Genoa, Naples, Leghorn, and other coastal cities, the world's seventh largest merchant marine fleet (6,500,000 tons)—after those of the United States, the United Kingdom, Liberia, Norway, Japan, and Greece—speeds Italian products to all parts of the world.

Yet most of Italy's best customers are close to home. The map shows five of them—Switzerland and parts of West Germany, France, Austria, and Yugoslavia. Last year exports climbed to 2,281 billion lire ($3,650,000,000), a 25 percent increase over 1959.

The map traces in red a network of surfaced roads. Visitors who drive over them can see the Italian boom in action. In 1938, the most prosperous year before the war, only one Italian in 67 owned a car, a motor scooter, or a motorcycle. Today the figure is one in nine.

Double red lines indicate completed portions of a superhighway system known as Autostrada del Sole (Expressway of the Sun), that eventually will crisscross Italy for more than 2,000 miles and may even bridge the Strait of Messina to Sicily. The latest stretch, just completed, crosses the treacherous Apennines to link Bologna with Florence.

Italy's rugged terrain has never discouraged tourists. One world-famed playground spreads along the Italian Riviera—a mountain-walled coast of gay resorts and peaceful fishing villages fringing a 200-mile arch of the Ligurian Sea. Another, the Island of Capri in the Gulf of Naples (see inset B), has attracted pleasure seekers since the days of the Roman Emperors Augustus and Tiberius 2,000 years ago. Last year, Capri entertained 50,000 foreign visitors.

Italy's 116,303 square miles completely surround two sovereign states. Just below the 44th parallel, near the Adriatic Sea, lies tiny San Marino, independent for more than 1,000 years (pages 628-9). The other, smallest of the world's states, covers only 108.7 acres within the city limits of Rome (see inset A). Important out of all proportion to its size and population—a mere 1,000—Vatican City is the spiritual capital of the world's 530,000,000 Roman Catholics.

*Italy, twenty-seventh in the series of uniform-sized maps issued as magazine supplements in the past four years, becomes Plate 37 in the Society's Atlas Series. To bind their maps, a quarter-million members have ordered the convenient Atlas Folio, at $4.95. Single maps of the series, at 50 cents each, or a pocket of the 21 maps issued in 1958-60 at $8.25, may be ordered from the National Geographic Society, Dept. 88, Washington 6, D.C. A combination of the 21 maps and folio is available at $12.50.

◀ **"Monte Cervino!" cry Italians** viewing their half of the Matterhorn and its reflected image in a snow-melt pool. The northern face lies in Switzerland.

Last Moments of the Pompeians

Dramatic new discoveries re-create a city's death by volcanic fury

By AMEDEO MAIURI
Director of Antiquities, Campania Region, Italy

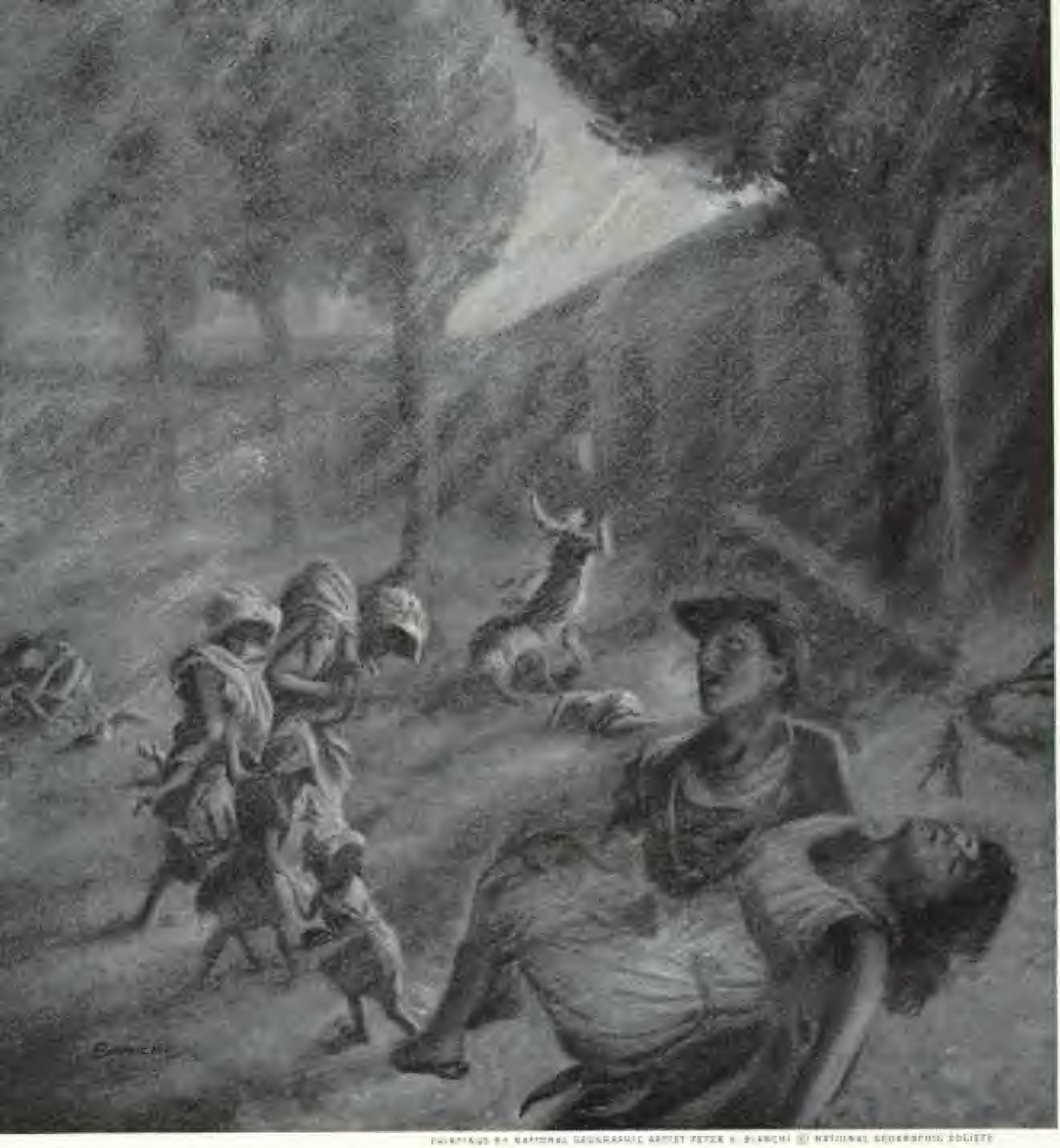
Photographs by LEE E. BATTAGLIA
National Geographic Staff

TO THE TERRIFIED Pompeians on that August day so long ago, it seemed that Vesuvius would destroy the world.

One moment the volcano towered peacefully above the city in the morning light; the next, a thunderclap split the heavens, and a fearful cloud rose from the peak, snuffing out the sun.

An explosion followed, the mountaintop cracked open—and a rain of death began. Great bombs of pumice, forged in the volcano's fiery furnace, thundered down on the doomed city, smashing walls, splintering roofs, and burying the streets. The inhabitants fled shrieking through the midday gloom, snatching up roof tiles and pillows for use as shields against the hail of lapilli—gravel-sized pumice.

Pelted by a deadly hail, panic-stricken Pompeians flee their doomed city as Vesuvius erupts with a sound like a thunderclap. Smoke and pumice belch from the volcano six miles to the north. The date: August 24, A.D. 79. Staff artist Peter V. Bianchi portrays the Roman city at the onset of the cataclysm. Chunks of pumice litter the city. Steppingstones enabled pedestrians to cross the streets dry-shod during downpours. Water-filled standpipe rises above the public fountain at center.



PAINTINGS BY NATIONAL GEOGRAPHIC ARTIST PETER V. BIANCHI © NATIONAL GEOGRAPHIC SOCIETY

Refugees Flee Across the Palaestra, the City's Colonnaded, Open-air Gymnasium

Prudent Pompeians abandoned the city at the mountain's first outburst. Scorching pumice and clouds of ash struck down those who tarried. The distinguished author of this article estimates the disaster's toll at 16,000. Crossing the Palaestra, these desperate fugitives fight for life. Piles of lapilli—small pieces of pumice—climb the colonnade.

To ensure the authenticity of his paintings, National Geographic artist Bianchi visited Pompeii and conferred frequently with the author.

Stabbed by Lightning, a Pall of Ash Blots Out the Sun

Blinded and choking, inhabitants struggle through deepening drifts of ash and lapilli. Death overtakes these victims just short of the Nucerian Gate. The artist has attempted to re-create the last moments of the three families whose forms were found and preserved in plaster only this year (page 654). Pliny the Younger, who witnessed the eruption from Misenum, 18 miles to the west, described the gloom as "the darkness of a sealed room without lights." When the sky cleared three days later, Pompeii lay buried beneath a volcanic mantle some 20 feet in depth.

Many Pompeians—chiefly the wealthy—refused to abandon precious homes and possessions and took shelter, hoping the horror would pass. The decision cost them their lives.

Steadily the tide of rock and ash rose against doors and windows, burying the victims as they huddled in courtyards and cellars. Poisonous volcanic gases seeped in, trapping others in upper stories. Soon the sea of rock and ash crept above the eaves, then above the rooftops. Pompeii lay dying.

Not content with the death of the city, Vesuvius heaped ton after ton of ash on the grave, as though to blot out the very memory of Pompeii. Within three days the city was transformed from a thriving port into a huge burial vault, sealed beneath some twenty feet of rock and ash. Entombed in the vault lay 16,000 Pompeians—80 percent of the city's inhabitants.

The story of Pompeii's tragic death is not a new one, and many may wonder why I retell it here. My answer is that 37 years' service as director of archeological work at the ruins has taught me that the full story of Pompeii is far from told, for new chapters are being written all the time.

The explanation for this is simple. Pom-

peii—unlike many victims of volcanic eruption—was not burned to death; it was smothered. The very pall of rock and ash that took the city's life preserved it more beautifully than the most skilled museum curator could have done. That is why we learn more about Pompeii every day, for in effect we are excavating not a ruin but a marvelously intact museum.

Take the case of the 13 Pompeians we discovered only recently. Theirs is a pathetic story of terror and fortitude.

We can conjecture, as you will see, that they were three families. Perhaps two of the men were tenant farmers and the other probably a merchant. They lived on the south side of Pompeii—the side farthest from Vesuvius—close to the Nucerian Gate, and they undoubtedly were good neighbors, as people often are who live far from the center of town and have need of one another.

At the first sign of danger they presumably banded together, held a hurried conference, and decided to take refuge in the strongest house, there to wait for the hail of stones to end. We can imagine them crouched desperately against the walls as the house shuddered under the bombardment of rock.

Ash-and-rain Mixture Dooms the Tardy

Then a terrible thing happened. As the rain of rock subsided a little, in its place came an even more frightful peril, against which there was no defense—a dense black cloud of ash mixed with condensed steam that filled the eyes and lungs, choking, clinging.

There was no choice then, and the little band fled from the house, the families holding hands in those bonds of kinship and affection that even mortal danger could not dissolve.

It was a flight of the blind, the terror-stricken fugitives floundering through the darkness across the quicksand of ash and gravel that long since had buried gardens, pathways, and even walls. As they fled, they must have called to one another in encouragement, hoping desperately to reach safety together.

But there was no safety. The cloud of moist ash settled upon them, suffocating them and bowing them down (painting, page 653). One by one the voices faded, the fallen bodies becoming formless mounds in the bed of ash. At last there was no trace of the fleeing band, and still the ash continued to fall.

There we found them, almost 1,900 years later, barely 30 yards from their last refuge. But the extraordinary thing is the form in which they were discovered, for here were no mere charred scraps of bone, no scorched bits of clothing to intrigue the archeologist and set his imagination to work.

Even Facial Expressions Preserved

That is why I call Pompeii a museum, for what we have are actual molds of the 13 Pompeians—faithful images of the victims, even down to their hair styles and their very expressions in death (opposite page). Many are outlined in such beautiful detail as to clothes and even possessions they carried that we can guess quite accurately at their occupations and even their state of health.

I should explain that there are two types of human remains at Pompeii, as my account of the tragedy suggests. The one type represents those who, like the wealthy Pompeians, took shelter till the last and whom we find trapped within the walls of their houses as in cruel prisons, huddled in corners or jammed together in doorways in a last-minute but futile attempt to escape.

These victims we find as skeletons, for it was the dry, gravel-like lapilli that killed them and sealed their remains. We find their possessions all intact—their elaborately wrought gold bracelets and earrings, furniture of metal, and the extraordinarily beautiful frescoes, statuary, and mosaics (pages 662–4 and 666–7). But of the human beings themselves there remain only skeletons. In

Plaster Casts Preserve the Forms of the Volcano's Victims Where They Fell

Lethal fumes and throat-clogging ash smothered Pompeians who survived the initial hail of pumice. Rain or condensed steam turned the ash to mud, which hardened around the fallen figures. Disintegration left molds that preserved the victims' final postures. Excavators, pouring plaster into these molds, reconstruct lifelike human forms. These 13 casts attest the fate of refugees who fell near the Nucerian Gate (page 653). The author believes they represent three families. Man in foreground died with a bag slung over his shoulder. Two children lie beyond. Now-peaceful Vesuvius rises in the distance.

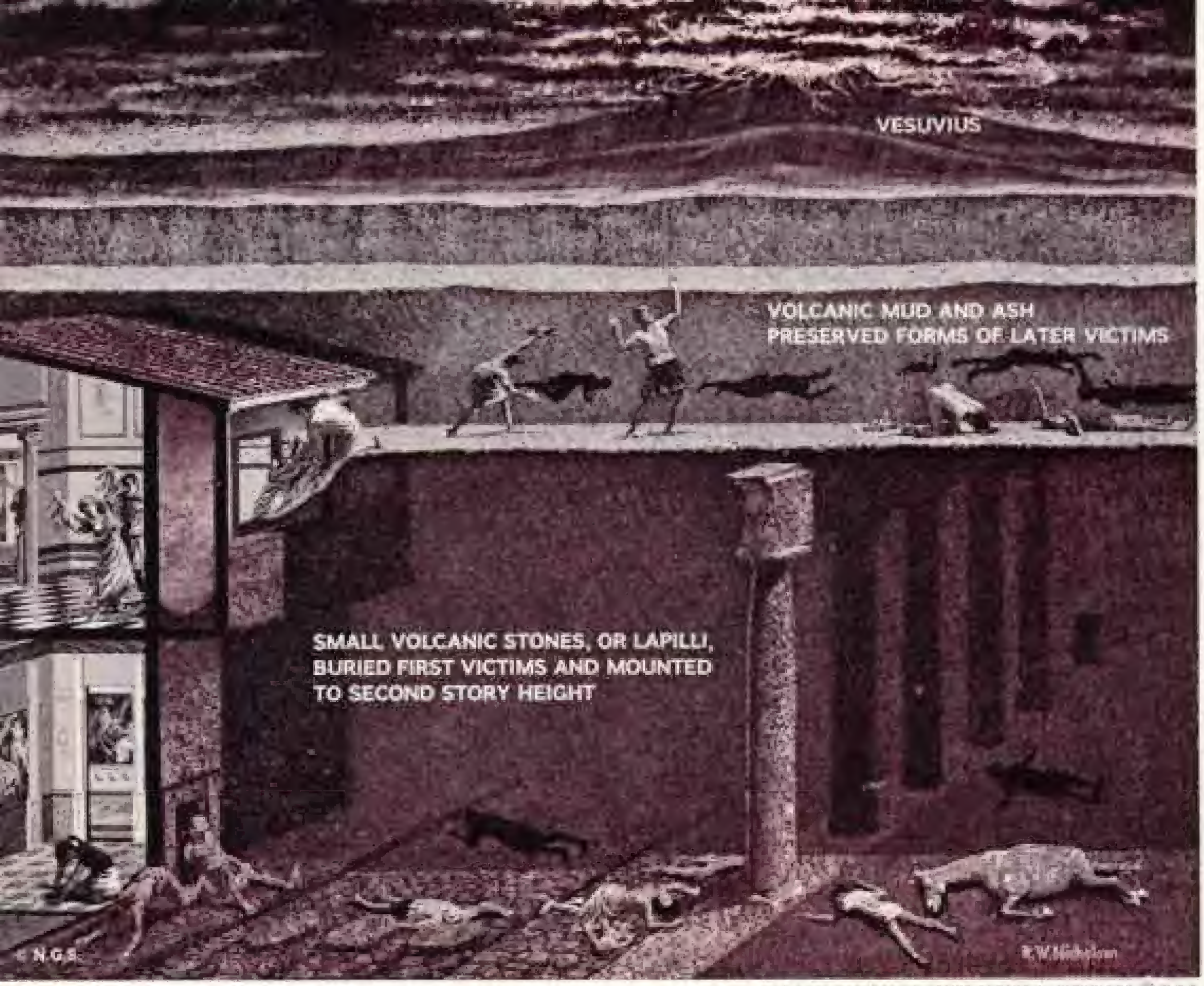
Immortalized in plaster, mother and child met death together (center). These figures appear fully exposed as the fearful family on page 654. Workmen at right prepare to make other casts. To find the hollow sepulchers, diggers cautiously probe the ash with picks. Vittorio Accornero, a noted Italian artist, sketches the scene.

Plaster poured in a mold takes the form of a victim's body. After it hardens, workmen chip away the ash and reveal the cast. Exposed skull survived the centuries.

The author: Amedeo Maiuri has superintended the disinterment of Pompeii and near-by Herculaneum, which Vesuvius buried at the same time, for 37 years. A distinguished archeologist, he continues the systematic, street-by-street excavations instituted by Giuseppe Fiorelli in 1860. Professor Maiuri's goal is to restore each object in the buried cities to the place it occupied at the instant of the eruption.

Stripped of Their Ashen Shrouds, Casts Depict a Mother's Futile Efforts to Save Her Child

Plaster failed to fill the mold at the woman's hand and ankle; patching will correct the defects. Archeologists have poured plaster images of 41 Pompeians. Only skeletons endured where people perished in pumice; ash preserved the outlines of later victims.



National Geographic artist Albert E. Nicholson © N.G.S.

How Pompeii Perished: Cross Section Exposes Layers of Volcanic Fallout

Lapilli quickly buried the city to an average depth of 12 feet. When the accumulation of stones reached second stories, survivors fled across balconies, only to be felled by wet ash and poison gas. As the mud hardened, it preserved their forms, even to details of clothing. Some were naked, having discarded hampering, mud-laden garments.

Struggling upward against oppressive ash, a fleeing merchant died before he could regain his feet. Plaster preserves his death mask, molded by the volcanic mud of 1,900 years ago.

Scattered Casts Lie Where Fugitives Died

After bulldozers scrape off earth and ash, diggers delicately probe for molds of mud that hardened around victims, then fill them with plaster. Here the molds have been removed and the plaster forms revealed.

National Geographic © National Geographic Society

that lowest bed of loose lapilli, water and air penetrated freely in time, and eventually destroyed such perishable materials as wood, textiles, and human tissue.

With the Pompeians buried in the upper layer of ash, the ones who died trying to flee the city, the case is quite different. There the moist ash packed gently about the victims, precisely in the manner of plaster molds, preserving in detail their very features, the musculature of their bodies, even the folds of their garments. It was as if nature wished to reward them for their efforts by memorializing their figures.

Of course the bodies of these Pompeians, too, decomposed in time. But by then the molds had hardened, and the outlines endured through the centuries.

These mold formations were discovered as early as 1860 by one of the first archeologists at Pompeii, Giuseppe Fiorelli. He is credited with developing the process by which we turn the molds—one might call them negatives in clay—into the positives of plaster statuary.

The technique is simple. During excavation in the upper beds, we happen on the mounds that indicate one or more molds. After delicate exploration, we separate the entire mound from the bed and cautiously cut one or more holes through to the mold.

Victims Seem Risen From the Dead

Through these holes we probe and clean the chamber with a surgeon's tool, a long, spoonlike instrument, and then pour in liquid plaster of Paris. In three days' time the plaster has hardened, and we crack away the surrounding ash (pages 656-7).

The results are startling. Suddenly we are faced with human beings out of the dim past at their very moment of death. Some show

an attitude of fierce struggle against their fate; others recline peacefully as though in sleep. It is like a vision of the Last Judgment, when the dead shall be clothed again in flesh at the signal of the angel's trumpet.

Though the mold formations have long been known, we have never found such a large and well-preserved group as our 13 fugitives. That is what makes them so exciting, and why we have studied them with such care. With the casts completed, we can reconstruct the victims' last moments in terrible detail.

When the band at last decided to flee, one of the tenant-farmer families led the way. First came a servant, carrying over his shoulder a bag hastily filled with provisions. We found him where he fell, near the wall of a vegetable garden—a cabbage patch, by the look of the furrows. (We know that cabbages were a Pompeian specialty.) The man was still in a crouched position, suggesting not so much the weight of the sack as the dense darkness and the violent, eruption-born winds through which he struggled.

Next, hand in hand, came the farmer's two little boys of about four and five, who probably only hours earlier had romped in the greenery and sunshine of the garden. Now perhaps, in the inferno and the darkness, they called out pathetically in order not to be left behind. Neither child, we discovered, wore the good-luck amulet commonly hung around the necks of Pompeian children to ward off evil. Near by, we did find a piece of tile and a crude iron utensil, doubtless used by the children as makeshift head guards.

Excavated Ruins Along the Mercurian Way Open a Window on the Past

Killed swiftly at the zenith of its wealth and power, Pompeii lay locked in the earth for generations. As memory of the disaster faded, man forgot the city's location and even its name. Workmen digging an irrigation tunnel penetrated Pompeii's ruins in 1594, but failed to recognize their discovery. Excavation, not begun until 1748, has exposed an ancient city preserved as in a museum.

Viewed from a tower on the north wall, the Mercurian Way terminates at the Arch of Caligula. Roofed buildings shelter frescoes and artifacts.

Polygonal blocks of lava pave the Street of the Forum near the city's heart. Vesuvius looms beyond the Arch of Caligula. Archeologists supplied the place names.

Mural in the Villa of the Mysteries Glorifies Forbidden Bacchic Rites

Vivid paintings embellished the walls of most houses in Pompeii. Entombment protected them from time and weather. Much of man's knowledge of Greek and Roman art stems from discoveries at Pompeii and Herculaneum.

Authorities believe that this painting in Pompeii represents a stage in the initiation rites of a cult outlawed by the Roman Senate. Kneeling initiate in the life-sized panel awaits the whiplash.

Crested helmet in National Museum of Naples came from the gladiators' barracks in Pompeii.

PHOTOGRAPHED BY LEE E. BATTAGLIA, NATIONAL GEOGRAPHIC STAFF

Serpent, hippopotamus, crocodile, and waterfowl enliven a Nile River mosaic from a dining room threshold of the House of the Faun. This relic now rests in the Naples museum.

Injured Aeneas, Virgil's hero, leans on his weeping son, Ascanius; a museum piece from the House of Siricus. Venus, Aeneas's mother, offers healing herbs; a physician attends the wound.

Finally came the children's parents, the farmer supporting his trembling wife. They had fallen with faces to the ground, as if to hide the agony of suffocation. The two boys, on the contrary, had died facing the sky, their expressions peaceful, as if, after a few tears, they had resigned themselves to sleep.

Behind the farmer's family came a young farm couple with their daughter, the father clutching—we deduce by the imprint—a silken cloak or cushion to protect his head. His wife died near by, fallen on her knees, still holding her clothing to her mouth in a desperate effort to filter out the ash.

In the case of the daughter, the stream of plaster failed us. We have only the vague outline of what seems to be a slender, undernourished child.

Last came the merchant's family—two young boys in their teens, followed by their mother and a younger sister. The two boys' limbs were inextricably entwined, suggesting that they had been walking hand in hand and had fallen as one. The mother, her body already weakened by childbirth, trailed behind with her small daughter, whose pain perhaps she was trying to ease in their last moment.

The final figure in that pageant of death was the merchant, to me the most tragic of the group. He was not lying down but still sitting upright with his right arm pressed against a mound of earth and his back bent in a supreme effort to rise, to fight off the black demon that had him by the throat, and to come to the aid of his family. Bent thus, he appeared to us not as the frozen nakedness of a plaster cast, but as a living man of flesh and blood (page 658).

These, then, are the mute witnesses to the agony that was Pompeii, but they are not the only ones. Several years ago we uncovered a number of refugees, also in the southern half of the city. This section, being closest to the sea, became a main escape route. Here I found four molds of fugitives who had somehow survived the crumbling walls, the collapsing roofs, and the tiles hurled like projectiles by the wind, and who had perished at last near the harbor.

The first figure, a man of powerful build, had fought bravely to the end. I found him face down, legs still outspread, reminding me of some stouthearted prize fighter finally overcome by a superhuman opponent.

Two other figures, more beautiful than statuary, proved to be those of a young couple. They had fled together, doubtless hand in hand, until the last moment when some force—perhaps a whirlwind or a flying slab of tile—parted them and they fell, still striving to touch each other.

The last of the four was an aged man—a beggar, if we may judge from his clothing. In flight he may still have been clutching the bits of bread and meat given him by some passing citizen or by some kindhearted street vendor in the Forum. Beggar though he was, the old man wore a pair of handsome hobnailed sandals that would have delighted the proudest fop in the city. Perhaps they came from public charity. Certainly our beggar was the most elegantly shod pauper in all Pompeii!

Poison Gas Still a Danger

Despite all that our human casts tell us of Pompeian life and death, there is drama, too, in the more fragmentary remains. I recall a discovery in 1936 at the house known as the Villa of the Mysteries, whose brilliant murals depict the forbidden rites of Dionysus (page 662). Here lay only skeletons.

In the servants' quarters, in a small cubicle, I found the bones of a house attendant, perhaps a watchman, lying face down on the floor. He had stood his post faithfully to the last, even in his master's absence.

Beneath the covered portico of the villa we found the skeletons of laborers who were at work on the demolition or repair of a cistern when the eruption came. Trapped in the subterranean hole, they died from the same fumes of carbonic acid that prevented

Venus Still Glows After Centuries Beneath Deep Volcanic Deposits

Beautifully preserved paintings in Pompeii proclaim the inhabitants' love of art. Their muralists worked on mortar enriched by alabaster and marble dust. After brushing on the pigment, they polished the surface, coated it with wax, and buffed it with tallow. Such painstaking work gave the panels the luster and durability of enamel.

Painted by an unknown artist, the Roman goddess gave her name to the House of the Marine Venus. Glass skylight protects the masterpiece from rain and direct sun.

Miniature bust of Mercury, Roman god of commerce, helps to balance a scale in the National Museum of Naples. Other weights include a stone surmounted by a bronze goat. A wine jar stands in the background. Diggers found the objects in Pompeii.

Charred loaf of bread, nuts (left), and figs (right) attest the scorching tide that buried Pompeii. Eggs survived the holocaust with shells intact.

Gold jewelry in Naples museum reflects the craftsmanship prized by wealthy Pompeians. Lacking precious gems, goldsmiths lavished skill and delicate chasing on ornaments. Treasure seekers plundered the ruins in the 1700's, but diggers continue to unearth rich discoveries.

Bronze statuette in the Naples museum adorns the handle of a pot that survived the eruption.

Sphinxlike sculpture decorates the base of a bronze table in the museum. Its marble top holds Pompeian artifacts: an oil lamp embellished with a figure of Cupid, a blue chalice embossed in white with a man's face, a 2,000-year-old drinking glass, a glass plate seared by ash, and a silver spoon and egg cup recovered from the House of Menander.

us, 19 centuries later, from exploring without breathing apparatus.

Many Pompeians took refuge in the city's gymnasium, the Palaestra (page 652). Among our discoveries there between 1932 and 1935 were the remains of workmen who had been repairing damage caused by an earthquake 17 years before Pompeii's disaster.

When Vesuvius erupted, the gangs of workmen fled to a great enclosed latrine, where they barred the doors and waited for the danger to pass.

Mule and Owner Die Side by Side

One pitiful member of the crew, the muleteer with his mule, was left behind. Finding himself locked out, he hammered frantically on the gates, and receiving no answer, at last resigned himself to death.

Rolling himself in his blanket like a caterpillar in its cocoon, he lay down against the wall of the building and died, scourged and suffocated by the fiery whirlwind. We found the bones of his mule near by, its neck still encircled by bits of colored glass such as the draymen of Naples use to this day to adorn their animals.

The muleteer's companions outlived him by little. Locked in their fortress, they survived the rain of lapilli, but the ash cloud that followed crept through the windows, and they suffocated.

Even with all these evidences of death, however, Pompeii seems to me at times a living city. When one strolls through the streets past the excavated shops and the houses whose murals shine so brilliantly with the images of life, one half expects to hear a sudden roar from the crowd in the distant amphitheater or the rumble of chariot wheels echoing down a side street.

The sounds never come, of course. There is only the beauty and the bright sky—and Vesuvius, standing calm and lovely above the city as it did on that summer morning nineteen hundred years ago.

Kissed by Clouds, Slumbering Vesuvius Towers Above the Ruins of Pompeii

Continental Europe's only active volcano, Vesuvius has erupted some 70 times in the memory of man. Ash from its latest display, in 1944, damaged Allied aircraft based near by.

Pompeians knew Vesuvius as a docile landmark somewhat lower than its present 4,190 feet, a figure that varies from eruption to eruption. A mountainside observatory records the volcano's moods. Vineyards and orchards climb the slopes, thriving on soil refreshed by mineral-rich ash.

Ruins cover 161 acres. Horseshoe-shaped theaters appear at lower right. Rescued from oblivion, Pompeii suggests a city gutted by bombing. Bombs, in fact, did fall in 1943.

STRAIGHT UP AND STRAIGHT DOWN FROM THE SURFACE OF MAN'S HOME PLANET, THE UNKNOWN STILL LIES ONLY A FEW MILES AWAY. THE TWO ARTICLES THAT FOLLOW TELL OF DRAMATIC VENTURES TO THESE FRONTIERS: BALLOONISTS SOAR HIGHER AND SCIENTISTS DRILL DEEPER INTO THE SEA FLOOR THAN EVER BEFORE

PROJECT STRATO-LAB HIGH 5

We Saw the World From the Edge of Space

By Comdr. MALCOLM D. ROSS, USNR

NEVER IN HISTORY had men enjoyed so magnificent a view of the earth for so long a time.

As our Navy balloon lofted us 21½ miles above the Gulf of Mexico, the southeastern United States spread out before us like a huge relief map. My companion, Lt. Comdr. Victor A. Prather, Jr., and I gazed over half a million square miles of land and water from Texas to Florida.

Our Strato-Lab balloon had carried us higher than any balloonists had gone before —113,740 feet. Now an eerie blue-black sky loomed over us as we floated along the inhospitable fringes of space.

Far beneath us, we spotted U.S.S. *Antietam*, the aircraft carrier that had launched us that morning, May 4, 1961. The enormous ship, more than a sixth of a mile long, appeared so small that we identified her at first only by her wake as she raced after us across the Gulf.

An uncanny feeling gripped us as we peered down at New Orleans and Mobile. The two port cities, 140 miles apart, seemed strangely silent and lifeless. Their proudest buildings had dwindled to tiny specks.

Running through New Orleans, the mighty Mississippi seemed a tiny scratch on the face of the continent. We traced it as far upstream perhaps as Vicksburg. Farther westward, we could barely discern the coast of Texas beneath puffy dots of clouds.

As our gondola slowly rotated, we looked eastward across the Florida peninsula to the Atlantic Ocean and followed the coastline nearly as far north as Savannah, Georgia.

A few men in spacecraft and rocket planes had climbed higher than we, but none had anything to compare with our picture-window view. Others had to glimpse the world through a periscope or miniature window. At the crest of our nine-hour elevator ride, we sat in an open gondola for more than

Ground photographs by WALTER MEAYERS EDWARDS, National Geographic Staff

Tinted by dawn's rosy light, the U. S. Navy's giant Strato-Lab High 5 balloon tugs at its launching platform aboard the carrier U.S.S. *Antietam* in the Gulf of Mexico. Inflation is completed; limp helium tubes dangle from the top of the bag. Soon the craft will start its climb to 113,740 feet—a new record for manned balloons.

two hours with the world displayed before us.

Our aluminum cage offered little protection from the deadly atmospheric conditions around us. We depended entirely on our space suits and clear plastic face plates. Any failure of these would have meant sudden death. We would almost literally have exploded.

What we did not know was that when death would come to one of us, it was not to be from the hazards of space but from the almost forgotten peril of water that lay like a blue counterpane 21½ miles below.

Testing Suits for Space Journeys

Flight surgeon Vic Prather and I had good reason for going on the most difficult and dangerous high-altitude balloon flight ever undertaken. Navy aircraft pilots, flying increasingly high, must know the precise capabilities of their suits. Furthermore, a suit that can protect a man above 99 percent of the earth's atmosphere is a major step toward clothing that can protect a man on rocket trips to the moon, Mars, or Venus. Our flight provided the longest, toughest test of space suits ever made under actual operating conditions.

The Office of Naval Research farsightedly conceived the Strato-Lab program in 1954 and began sending up progressively higher balloon flights. On November 8, 1956, the late Lt. Comdr. M. Lee Lewis and I reached 76,000 feet, higher than balloonists had been before.

Later we soared to 83,700 feet, and other balloonists soon topped that figure. The highest manned balloon altitude mark until now was set by Capt. Joseph W. Kittinger, Jr., of the U. S. Air Force, who parachuted from 102,800 feet on August 16, 1960.*

For our flight, Winzen Research Inc., of Minneapolis, Minnesota, designed a unique gondola—open, but with Venetian blinds to control temperature. The company already had a suitable balloon, the biggest successfully tested to that time. The 10,000,000-cubic-

*NATIONAL GEOGRAPHIC published the pilots' own narratives of these historic flights: "To 76,000 Feet by Strato-Lab Balloon," by Malcolm D. Ross and M. Lee Lewis, February, 1957; and "The Long, Lonely Leap," by Joseph W. Kittinger, Jr., December, 1960. A quarter-century ago, the National Geographic Society and U. S. Army Air Corps sent aloft the famed Explorer stratosphere balloons, reaching 72,395 feet in November, 1935—a record for manned balloons that stood for 21 years.

Venetian Blinds Cool and Warm the Gondola, a Cage Open to the Sky's Deadly Dangers

Comdr. Malcolm D. Ross, sitting before his instrument panel, discusses plans with his copilot, Lt. Comdr. Victor A. Prather, Jr., on the evening before the flight.

Made of aluminum tubing, the gondola offers scant protection against the near-vacuum, radiation, and −94° F. cold that the men will face. Adjustable slats, black on one side, aluminized on the other, will absorb or reflect the sun's heat.

Buttonlike electrodes cemented to the body will broadcast Ross's heartbeat. Other sensors will record brain waves, respiration, and temperature. Collodion and rubber cement hold the electrodes firm. "It took weeks to get that stuff off," says Ross.

Dressing takes hours. Prather puts on the last item, cold-weather clothing specially developed for the flight. Trouser legs and other parts are stuck together in sections so that they may be torn off and jettisoned in an emergency. Plastic face plate permits wide-angle vision.

PHOTOGRAPHED BY WALTER MEAYERS EDWARDS, NATIONAL GEOGRAPHIC STAFF © N. G. S.

foot gasbag swelled to a diameter nearly the length of a football field.

Beneath the balloon, the gondola would hang from a large parachute. If the balloon failed, the 70-foot parachute would open automatically and bring the gondola down. Balloon, parachute, gondola, and the trailing antenna made a craft taller than an 80-story skyscraper. Yet the walls of the polyethylene plastic balloon measured only a thousandth of an inch, a third the thickness of the page on which these words are printed.

Balloonists Are Wired for Science

Our last tests behind us, Vic and I boarded *Antietam* at the Naval Air Station, Pensacola, Florida. Before dawn on May 4 we had physical exams; then technicians from the Naval Medical Research Institute, Bethesda, Maryland, and the Aviation Medical Acceleration Laboratory at Johnsville, Pennsylvania, cemented electrodes to our bodies (page 673). The sensors would pick up electrical impulses transmitting our heartbeat, temperature, brain waves, and respiration, and send the data, via radio, to the ship.

Vic and I donned two sets of underwear each, then wriggled and squirmed into our full-pressure suits, tailored to a skintight fit. Crewmen fastened on our outer cold-weather clothing, and we clambered into the gondola. Dino Mancinelli of the Navy's Air Crew Equipment Laboratory at Philadelphia hooked our suits to the oxygen supply and to the radio. The laboratory had worked with the Bureau of Naval Weapons in Washington to develop the life-support systems.

Partly inflated, the balloon towered majestically overhead, but the launch platform had apparently snagged the thin plastic. Anxiously, I peered through the Venetian blinds on the sides of the gondola, as balloon-maker Otto Winzen carefully patched the holes.

Rollers Like a Clothes Wringer's Pay Out the Inflating Balloon

Blue-coveralled Otto Winzen, whose company made both the bag and the gondola, supervises the operation.

The polyethylene plastic envelope swells under its intake of helium. Soon the men will attach the big parachute from which the gondola will hang. Despite precautions, a parachute shroud caught on a deck cleat, but crewmen yanked it free with a prodigious effort.

All now seemed ready. The balloon, anchored to a cranelike vehicle on the deck, rose to its full height. Men attached the big orange-and-white cargo parachute.

Suddenly a shroud tangled around a deck cleat, and my stomach tensed at the last-minute complication. Several crewmen jumped to help Dick Miles, our parachute rigger, pull it free. There was no more difficulty. Soon only the tie-downs held our gondola to the deck.

"All ready for launch, Mal?" asked Comdr. John W. Sparkman, our technical director.

"All set?" I asked Vic on the intercom.

"Roger," said Vic.

"Ready, Sparky," I said. But I didn't feel as ready as I should have liked. At the start of every flight there comes a moment when a question bursts into my mind: How did I get here? That feeling was with me now.

Crack! The tie-downs were cut. The gondola rocked. We were airborne! The time was 7:08 a.m.; the site, 138 miles southeast of New Orleans (page 678).

"Give us a report," I asked Sparky by radio.

"Everything is in good shape."

In a few minutes we had reached 10,000 feet. We lowered the Venetian blinds all around the gondola and turned the black side out, so that we would absorb energy from the sun and stay warm. When we wanted to cool the gondola, we had only to turn the blinds silver side out.

As we reached 26,000 feet, our eyes fastened on the altimeter. If our suits did not start maintaining artificial pressure on our bodies soon after we passed 27,000 feet, we would be in deep trouble.

We passed 26,500 feet, then 27,000. At last the suits began inflating, pulsating gently, their pressure valves giving off a foghornlike "ah—*oooo*, ah—*oooo*." Slowly, as the valves fluttered open and shut, the surging suits

Knights in Silvery Suits Prepare for an Ordeal on the Edge of Space

Like deep-sea divers, Prather and Ross close their face plates and breathe pure oxygen to drive nitrogen from their blood, lest it cause disabling bends. Batteries for power hang below the open gondola. A fellow officer hands Ross a flight instrument.

sealed us off from the increasingly dangerous low pressure around us.

At 35,000 feet we were also experiencing bitter cold. The temperature had dropped to −40° F., eventually it was to plunge to −94° at 52,000 feet.

We knew that our balloon now was as brittle as a glass Christmas tree ornament. A sharp change in wind speed—a wind shear—could shatter it into confetti. I have seen this happen to unmanned balloons: I shall not forget the sight.

We had entered the region of the jet streams, rivers of air that race through the upper atmosphere. They increased the danger of a wind shear, and they also might carry us irresistibly into storm clouds where lightning would find us a tempting target. Only a year earlier, lightning hit an unmanned balloon just like ours, releasing its gondola.

But with practically clear weather at our launch position, a less dramatic but more in-

Casting a long morning shadow, balloon and parachute float above the carrier. From the flight deck they tower 483 feet.

sidious danger gave us greater concern. Our hot breath made our plastic face plates fog up so that we couldn't see. We could drive off the fog by turning up the heating system in the masks, but too much heat might make them melt, exposing us to death-dealing low pressure.

To warn us when the face plate temperature reached 135°, a red light would flash on. As a precaution, the temperature was also relayed to the ship.

Radio Fails at Tense Moment

Our constant concern about this point had a firm basis. At peak altitude the pressure would be only .09 of a pound per square inch, compared with 14.7 pounds at sea level. Without artificial pressure our blood would boil, our blood vessels and organs rupture.

As we approached 45,000 feet, near the boundary of the stratosphere, I heard a soft hissing, as if my suit were leaking. Almost simultaneously, I noticed a cloud of vapor that seemed to come from beneath me. The vapor trailed out the front of the gondola.

By radio, I reported the mysterious sound and vapor, but because I was strapped in so tightly, I could not bend over enough to spot the source. My search had to be made by awkwardly manipulating a mirror attached to a hand muff.

In the midst of my search, we lost radio contact with our companions on the ship. Nor could we reach the huge monitoring plane that had come from the Pacific Missile Range, Point Mugu, California, for our flight. Frantically, we shifted from primary to secondary ultrahigh frequency, then tried the international emergency channel. No response.

Suddenly I noticed more trouble. Our rate-of-climb indicator showed our ascent had slowed. The pointer dropped inexorably to 750 feet per minute, then 600. The balloon is leaking, I thought. But I didn't say it aloud.

Holding the balloon steady, *Intrepid* matches the wind's speed and direction. Two-foot weather balloons attached to the deck allow the captain to follow a breeze. Shipboard launching minimizes twisting and billowing of the balloon by wind.

A beautiful launch! the carrier radios the balloonists. Four gunlike squibs, firing simultaneously, shear the tie-downs holding the gondola to the deck, and now the envelope leaps skyward past a tiny weather balloon.

Dangling sleevelike line at right holds electric wires attaching gondola to helium valves. Parachute connecting cage and balloon will open automatically in an emergency.

The world drops away. Commander Ross takes a look at the receding deck past the toes of his arctic boots that protrude into the picture.

Sea shines bright to the horizon four hundred miles away; above it blue atmosphere darkens to black space. Ross took this picture near peak altitude, higher than any man has ever held a camera. Fearing the film lever might tear his suit, he made few shots. Other cameras failed.

"What do we do now?" Vic asked quietly.

"Sit right," I replied with all the self-confidence I could muster. "We're in an inversion."

An inversion—the bane of balloonists—is a rapid rise in the temperature of air as one ascends. Normally the air grows colder with increasing altitude to the tropopause. Above the tropopause the temperature remains almost constant or increases slightly.

Just as hot air rises and cold air falls, a balloon gains added lifting power when its helium is warmer than the surrounding air. It loses lifting power when the air is warmer than the helium. Thus, when the balloon enters an inversion layer, or warmer region, its ascent may be slowed or stopped altogether.

Our rate of climb dropped to 500 feet a minute. We were broadcasting "blind," trying to get word of our plight to any near-by ship or airplane that could hear us.

Then, miraculously, the crisis passed. Our ascent steadied, then speeded up. It hit 650 feet per minute, then 750. We had indeed been in a sharp temperature inversion.

Communications came back in as quickly as they had faded. The harsh radio voices of our comrades sounded sweet as lullabies.

The hissing stopped, and the vapor cloud disappeared. I still don't know what caused them—perhaps condensation of oxygen exhaled from my suit.

Hot Face Plate Threatens Disaster

We passed 71,000 feet. Suddenly Commander Sparkman's voice broke in, warning Vic that his face plate was overheating.

Vic responded immediately. With dismay, we saw that the warning light had failed. We thanked our stars for the engineers who had provided a backstop.

When we reached 90,000 feet, we had passed through the coldest part of the atmosphere. Conditions in the gondola were pleasant, and I could resist no longer. I had to see outside. Slowly maneuvering my left arm into position, I hooked the palm of my inflated left glove over one of the spokes of my Venetian blind controls and turned the wheel laboriously to raise the blind.

I caught my breath as I looked out. The scene as we topped 100,000 feet was utterly magnificent. For long moments we drank in the beauty of earth, sky, and sea.

Our horizon lay some 400 miles away. A narrow lower segment of the sky appeared bright and whitish-blue. I recognized it as the troposphere, the layer of the atmosphere closest to earth. Above the troposphere came

Ross and Prather view Texas and the Atlantic coast in a panorama from 21 1/2 miles above sea level—a new record for manned balloons.

9:47 a.m.
113,740 feet
21 1/2 miles
-29° F., .09 p.s.i.

11:17 a.m.
110,000 feet
-33° F.
.11 p.s.i.

Air pressure falls from 14.7 pounds per square inch at sea level to 9/100 of a pound at top of flight. Without space suits, balloonists' blood would boil and death would be almost instantaneous.

9:05 a.m.
95,000 feet
-41° F.
.2 p.s.i.

Balloonists valve helium for 1 1/2 hours in a grim struggle to descend before they exhaust their oxygen.

Crew shuts Venetian blinds to prevent escape of heat and avert freezing of feet.

1:40 p.m.
75,000 feet
-67° F.
.52 p.s.i.

Normal climb resumes, relieving fears. Crew realizes that a temperature inversion caused the delay.

Ross's suit stops hissing.

8:25 a.m.
65,000 feet
-80° F.
.74 p.s.i.

2:50 p.m.
45,000 feet
-76° F.
2.1 p.s.i.

Ross hears a hissing sound, fears a leak in his suit. Rate of climb slows, suggesting a puncture in the balloon. The radio goes dead.

8:10 a.m.
53,000 feet
-94° F.
1.4 p.s.i.

7:59 a.m.
43,000 feet
-73° F.
2.4 p.s.i.

TROPOPAUSE

Descent through temperature inversion accelerates to 1,140 feet a minute; alarmed balloonists jettison ballast, batteries, and finally Venetian blinds and drag rope.

Ross and Prather anxiously await automatic pressurization of their space suits on which their lives will depend at higher altitudes.

7:34 a.m.
26,000 feet
-27° F.
6.6 p.s.i.

3:30 p.m.
15,000 feet
42° F.
8.3 p.s.i.

Drop slows to normal. Crew lights cigarettes and enjoys the view.

Balloon launch from U.S.S. Antietam delayed momentarily as a clear in the deck snags a parachute shroud.

7:08 a.m.
0 feet
74° F.
Air pressure:
14.7 pounds per square inch

Balloon alights 140 miles from take-off point. Ross boards helicopter and flies to U.S.S. Antietam. Prather slips from a helicopter lift and drowns at sea.

Landing:
4:02 p.m.
0 feet
76° F.
14.7 p.s.i.

Research by George W. Beatty, Graphics

Hebrard

another layer, a much richer, deeper, and cleaner blue. Above that, the blue darkened to blue-black in the void of space. In silent awe we contemplated the supernal loveliness of the atmosphere (page 678).

As we slowly rotated, I spotted land ahead: Florida. I could see all the way across the peninsula to the blue Atlantic. Our rotation slowed, and we held the view across Florida for some time. I noted what I believed was Cape Canaveral, though I could not be sure, and then my eyes followed the coastline north.

As we stared in fascination at our "map," the radio crackled:

"Mal, this is Otto. Do you realize you have already broken the record? Congratulations."

Snapping back to reality, I acknowledged the message gratefully. We had indeed reached a point higher than any previous balloonist. But on the intercom, I said to Vic:

"I had forgotten all about the record. Somehow it seems rather insignificant."

Balloon Refuses to Descend

Shortly after we passed 113,000 feet, I decided we should prepare to start down. I was uneasy about difficulties of the descent.

I opened the valves in the balloon to release helium. This process, known as valving, required merely pushing a button controlling the valve motors at the top of the balloon.

But lengthy valving failed to make the balloon descend. Instead, we continued to rise. I wasn't greatly concerned at first, because I knew that the balloon was establishing equilibrium with the surrounding air. Shortly it would begin to sink. But I had to be careful; I must release enough helium to come down from the very cold heights, but not so much that we would fall too fast when the balloon entered the warmer air.

Race Against Waning Oxygen

After more valving, we slowly started downward. Rotation now gave us a panoramic view of Texas, Louisiana, Mississippi, Alabama, Georgia, and Florida. We saw the sand bars and island segments that make up the outer barrier of the Inland Waterway.

New Orleans and Mobile, easily visible, caught my eye. Then I peered eastward, fighting the haze for landmarks. Again I looked up and down the Atlantic coast.

After more than half an hour, despite repeated valving, we were descending at a rate of only about 70 feet per minute. Mentally I plotted our oxygen versus time, and compared this with our descent rate. I saw at once that we could tolerate the situation no longer. I valved steadily for 15 minutes.

As we passed 90,000 feet, our descent rate reached 500 feet per minute; at 60,000, a

Needle-shaped at Sea Level, the Balloon at 21½ Miles Resembles a Giant Onion

Just above the ship, air pressure of 14.7 pounds per square inch squeezes the helium. At maximum altitude, where pressure is only .09 of a pound, the bag bulges to a diameter of 200 feet, only 10 feet short of the length of a football field.

Any rip in the men's pressure suits would have killed them quickly. Ross and Prather spent 8 hours and 54 minutes aloft.

PHOTOGRAPH BY NAVAL WEAPONS LABORATORY, NATIONAL GEOGRAPHIC STAFF

Recorded heartbeat reassures anxious shipboard team when voice-radio contact is lost. Graphs show the balloonists are safe, their suits working well—a good omen for future astronauts in space.

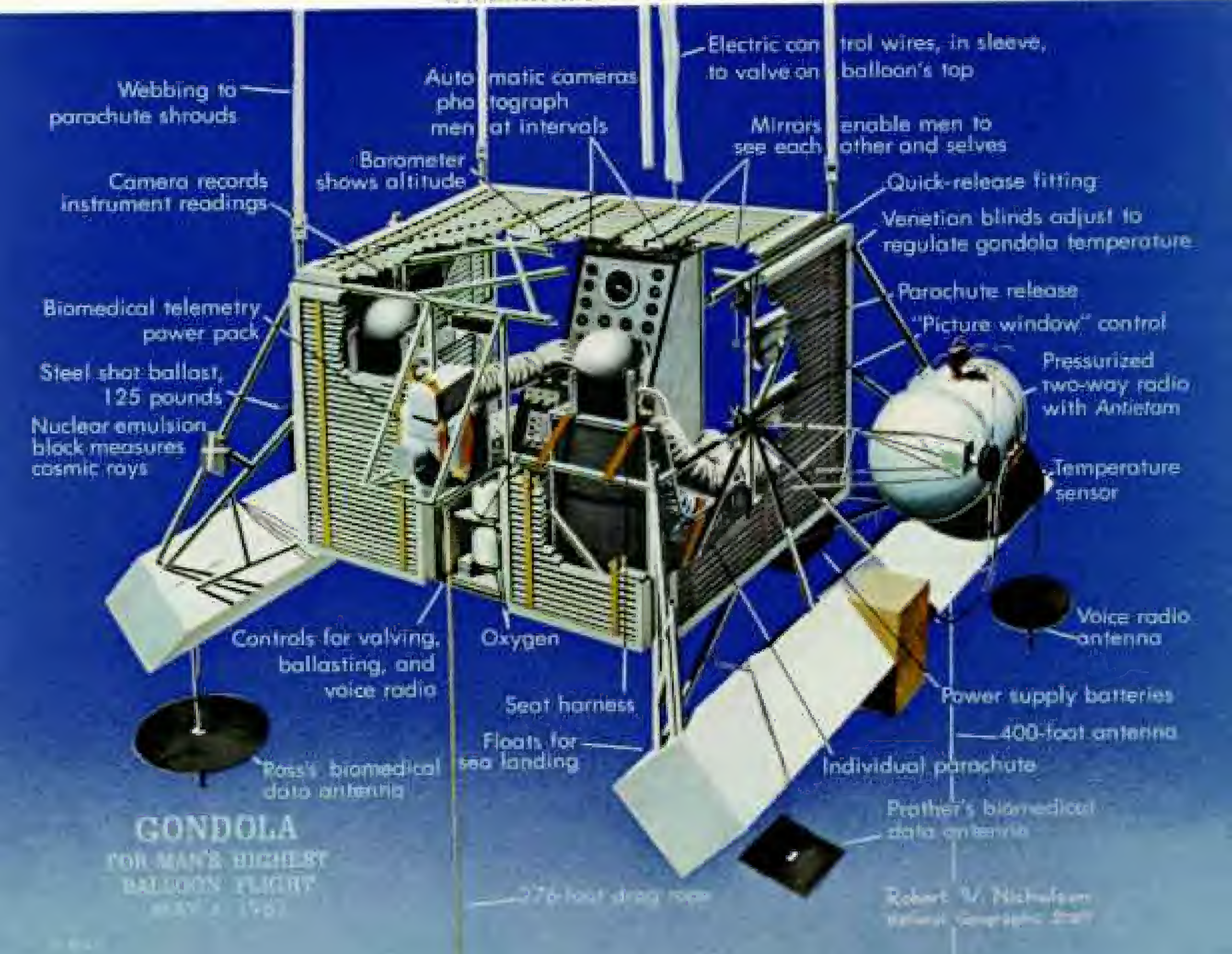
Limp at Take-off, Bag Swells in Space to a Full Moon

Though the balloon drifted 140 miles across the Gulf, it never wandered out of sight, because of its immensity, the clear sky, and the carrier's constant tracking.

Shortly after lift-off the bag bulged gracelessly. But at peak altitude, as seen by a 500-mm. telephoto lens, it looked like a giant soap bubble in the sky (far right).

Raising the blinds of the gondola gave Ross and Prather man's best prolonged look at the world. Most other men on the rim of space have peered through small openings.

Ballast consisted of steel shot as well as jettisonable equipment. Oxygen converted from liquid to gas supplied the breath of life. Floats buoyed the gondola on the sea (page 684).



PHOTOGRAPHS BY EMORY KRISTOF, NATIONAL GEOGRAPHIC STAFF

Sailor shields his eyes against sun, only obstacle to viewing balloon during flight.

check showed we had won the race with oxygen. But now the opposite danger appeared: We were descending too rapidly.

At 47,000 feet we had accelerated to 900 feet per minute. At 28,000 we were hurtling downward at 1,140 feet per minute.

We started jettisoning ballast. First, we released our batteries and 125 pounds of steel shot. Then we began throwing equipment overboard.

At 15,000 feet we pushed open our face plates to breathe air again. It felt wonderful.

Vic heaved a power supply unit overboard, while I dismounted an oxygen converter and tossed it out our picture window.

At 12,800 feet our descent had slowed to 720 feet a minute. A few minutes later it decreased to 560. At 7,000 feet Vic pushed a button that turned the bulk of our radio equipment into just another chunk of ballast. Now we were more or less enjoying the situation. We had even lighted cigarettes.

At 2,500 feet Vic cut off the drag rope, and I began throwing out our Venetian blinds. Suddenly I realized that I still had my cold-weather clothing on. I unzipped the boots and tossed them overboard, following with the rest of the outfit.

Gondola Lands Amid Own Debris

About 150 feet above the water, I got ready to fire the squibs that would release the balloon. A moment later the gondola hit the Gulf, splashing up spray all around us.

I pushed the squib control button. As it fired, Vic yanked a knob to release half of the parachute shroud lines. I reached for a similar knob on my side, but it fouled and the shrouds did not release. The parachute remained blossomed for about a minute, then collapsed into the water.

Vic and I, floating comfortably in the gondola, joked as we awaited pickup. Around us were many of the items we had jettisoned. Landing in our own "mess" was poetic justice.

The parachute worried me. It might reinflate, catch the wind, and pull the gondola over. I decided to cut the shroud lines.

Grabbing a knife, I was hacking away when helicopters from *Antietam*, now only about a mile and a half away, rattled around us (page 684). One chopper lowered a cable with a rescue hook on the bottom. I grabbed the cable and called to Vic to get aboard.

"You go ahead," he said. "I'll come later."

It was no time for an Alphonse-and-Gaston act. "See you later," I said.

"Right, sir."

I stepped onto the rescue hook with my left foot, then added my right. The helicopter lurched forward. I slipped off the hook and slid part way into the water. But I hung onto the cable with my hands. In the water, as the copter started to rise, I wrapped my legs around the cable and was pulled up to safety.

Vic saw my mishap. He had been sitting happily in his seat, secure in the knowledge that we had accomplished all our objectives and, thanks to our suits, had survived prolonged exposure to the deadly stresses on the doorstep of space. The Navy had made a major contribution toward outfitting the men who will walk on the moon.

The Price of Progress: Tragedy

For reasons that still are not clear, a few minutes later Vic slipped into the sea himself as he was trying to board the dangling rescue hook. Despite the courageous efforts of Navy divers, he drowned. It was an unbelievable and tragic ending to a brilliantly successful flight.

Vic lost his life in the most significant moment of his career, but his achievement remains undimmed. Even in dying, he contributed to man's conquest of space. Because of his accident, spacemen are instituting new procedures and modifying equipment to prevent any recurrence.

Back in Washington, President John F. Kennedy personally telephoned Vic's widow to offer his sympathy. Later the President received Mrs. Prather and her little boy and girl at the White House to present the Navy's Distinguished Flying Cross awarded to Vic for "heroism and extraordinary achievement" (opposite).

The Senate of the United States hailed Vic as a "patriotic young American who gave his life while striving to advance the scientific frontiers of our country and add to mankind's fund of knowledge."

Vic's death overwhelmed me. At first, I wanted to forget the balloon and everything connected with it. But later I realized that I could not betray the ideals that Vic had died for. He would have wanted our story told.

Our flight means that mankind can advance with more confidence toward undreamed-of wonders in the universe. The priceless knowledge we gained is Vic's memorial. He earned it with courage and devotion in the perilous emptiness where space begins.

Its parachute collapsed, the gondola rides the sea like a raft. Helicopters hover above. Moments later Prather drowned during rescue operations.

Helmet removed after flight, a weary Ross squints into the sun.

In the White House, Mrs. Victor A. Prather, Jr., shows her children, Marla Lee and Victor III, the Distinguished Flying Cross awarded posthumously to their father for "heroism and extraordinary achievement." Citation held by President Kennedy praised Dr. Prather's ability and devotion.

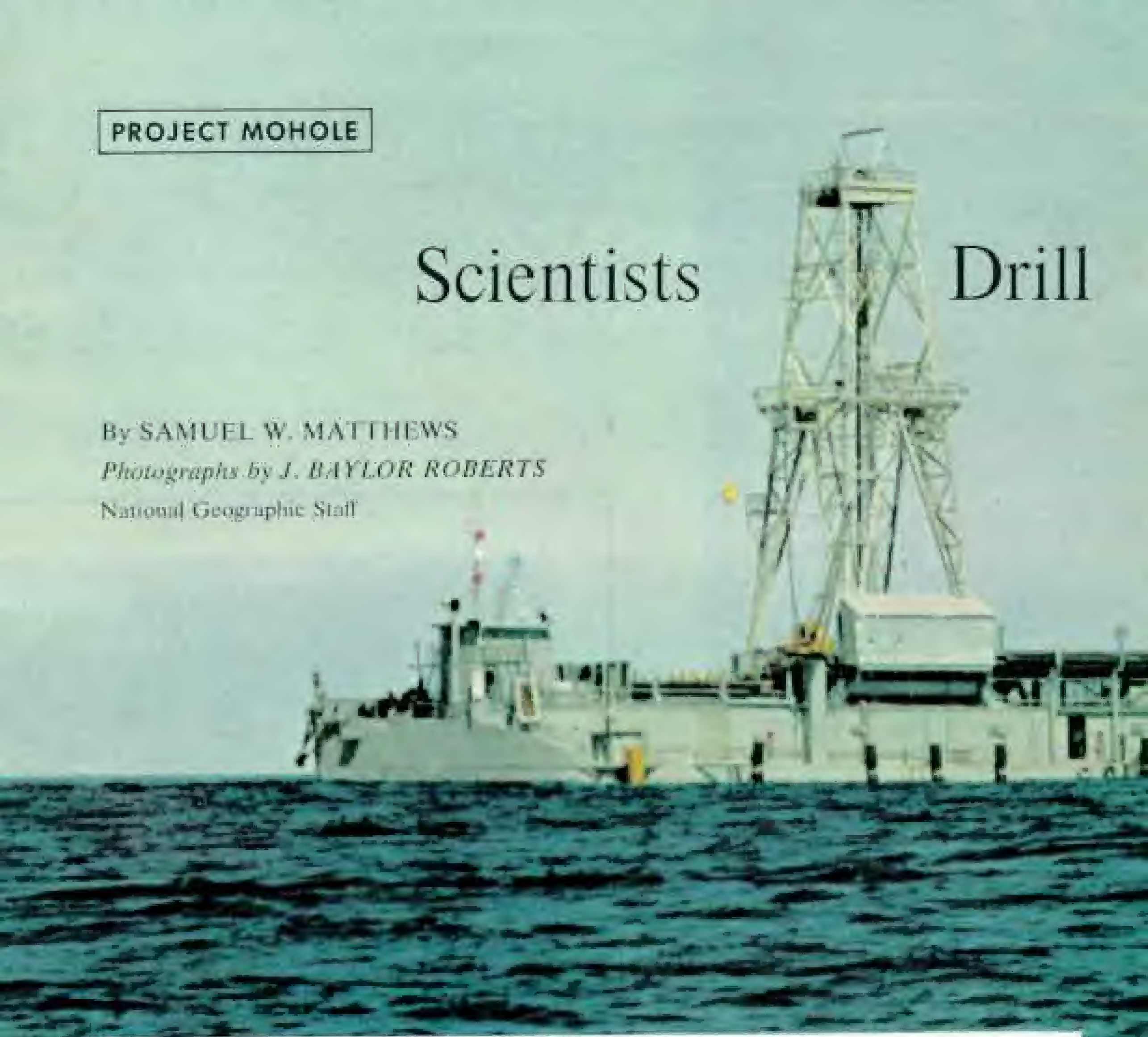
PROJECT MOHOLE

Scientists Drill

By SAMUEL W. MATTHEWS

Photographs by J. BAYLOR ROBERTS

National Geographic Staff



EARLY IN 1961 a strangely assorted crew of scientists and oilmen went to sea to drill a hole into the crust of the earth. They went not to seek oil, but to probe secrets of our planet's heart and past.

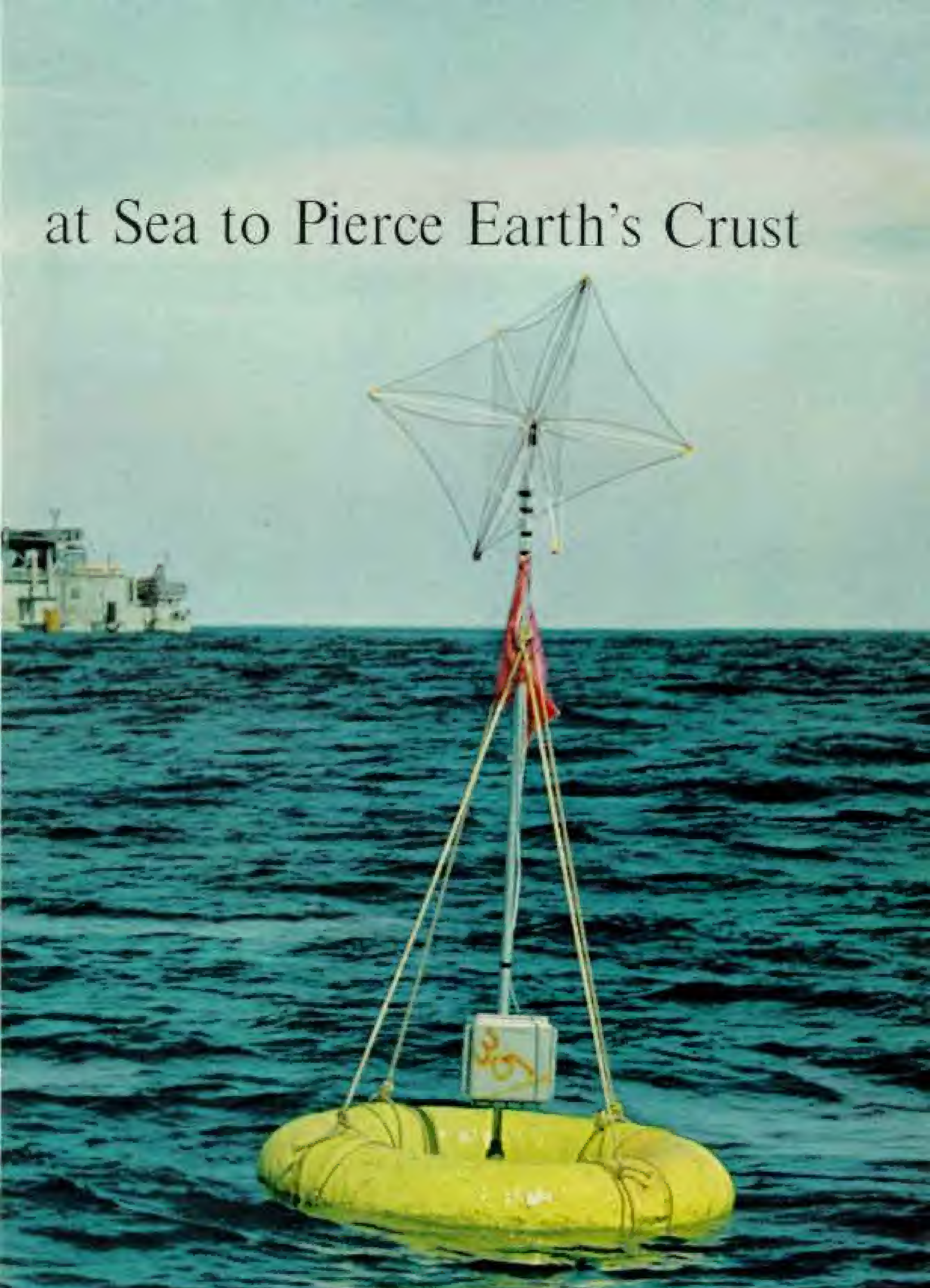
Aboard an outlandish craft lying unanchored on the open Pacific, 20 miles off San Diego, California, I watched these explorers lower a slender steel pipe 3,100 feet to the ocean bottom. There a diamond-studded drill chewed into the sediments of countless ages, boring farther into the deep-sea floor than man had ever done before.

The vessel was *CUSS I*, a high-sided barge sprouting a derrick as tall as a nine-story building (above). With this special seagoing oil rig, the National Academy of Sciences and the National Science Foundation were taking the first steps toward drilling a Mohole—a hole entirely through earth's crust.

A few years hence, if all goes as planned, another ship will drive a nine-inch drill some six miles below the surface of the sea to a boundary within the earth that scientists call the Mohorovičić discontinuity—the "Moho" for short. The Moho marks the division between the crust—3 to 30 miles thick the world around—and the underlying,

Radar reflector moored in 3,100 feet of water helps position a seagoing drill rig probing the Pacific floor off California

at Sea to Pierce Earth's Crust



even harder mantle, a still-mysterious 1,800-mile-deep layer that forms five-sixths of the earth's total volume (right).

Should Project Mohole succeed, it will stand as one of the 20th century's most significant scientific achievements. It will offer geologists their first direct contact with the earth's mantle; it will shed new light upon the history of our planet, perhaps even upon the beginnings of life itself.

Andrija Mohorovičić, a Yugoslav seismologist, first detected the line between crust and mantle in 1909 while studying earthquake waves. Geologists today are reasonably sure the mantle is solid rock. But what type no one knows absolutely, for no one has ever taken a sample. Scientists think it may be a form of dunite or peridotite, igneous rocks similar to stony meteorites from space. But until a drill penetrates the mantle and brings up a piece of it, they can only guess.

When I clambered aboard *CUSS I* in early March, I met the scientists, engineers, and drillers who were setting forth on this historic adventure. They wore safety helmets and hard-toed boots. Their grease-smudged faces sagged from lack of sleep, but their eyes gleamed with excitement as they worked.

"This is the first test of many new ideas and techniques," Mohole director Willard Bascom told me. "What you are seeing is the first deep-sea drilling ever attempted, the first from an unanchored ship."

PAINTING BY E. STEPANOV, BEFORE RESEARCHES START © N. G. S.

Brawny Drillers Use Skill and Steel to Unlock Secrets Below a Restless Sea

Drilling crewmen, called roughnecks, can connect one 60-foot section of pipe to the drill string every 60 seconds. Plunging through thousands of feet of water, the drill bit has now hit bottom.

Here two men disengage a big wrench, called tongs, from the drill pipe. Collarlike "elevators" on yellow rods above them are used to hoist pipe into place. Silver-and-blue kelly imparts rotation to the drill string and conveys mud and water to lubricate the drill bit. Third man steadies the mud hose.

In a moment the kelly will be hauled from its canted sheath into place atop the drill string. Then drilling begins.

Melon-plug diagram shows earth's structure as interpreted from seismic records.

Guide shoe receives the bit that will be driven through sea and earth. Dean McCurdy teeters above the moon pool, the drilling well within the hull of *CUSS I* (next page).

"The bottom of the San Diego Trough lies 3,100 feet under us. If we can drill here—if a few things work—we'll try next in 12,000-foot depths, south of San Diego between the Mexican coast and Guadalupe Island."

Bascom's "few things" included holding the ungainly *CUSS I** within a few hundred feet of a precise position, hour after hour and day after day. Anchor cables could not do this at such great depths. From a free-floating platform drillers had to lower thousands of feet of flexible drill pipe and, without snapping it, drive it through the ancient ooze of the sea bottom into unknown layers of rock.

"Our drill string is no more rigid," Bascom continued, "than a wire one-sixteenth of an inch thick lowered from a twelfth-story office window to the sidewalk. With it we have to bore into rock harder than concrete."

Invisible Signals Guide *CUSS I*

Exploring that incredible ship, I soon discovered how Mohole engineers had solved their first problem. *CUSS I* stayed on station by an unlikely combination of radar, sonar, and outboard motors.

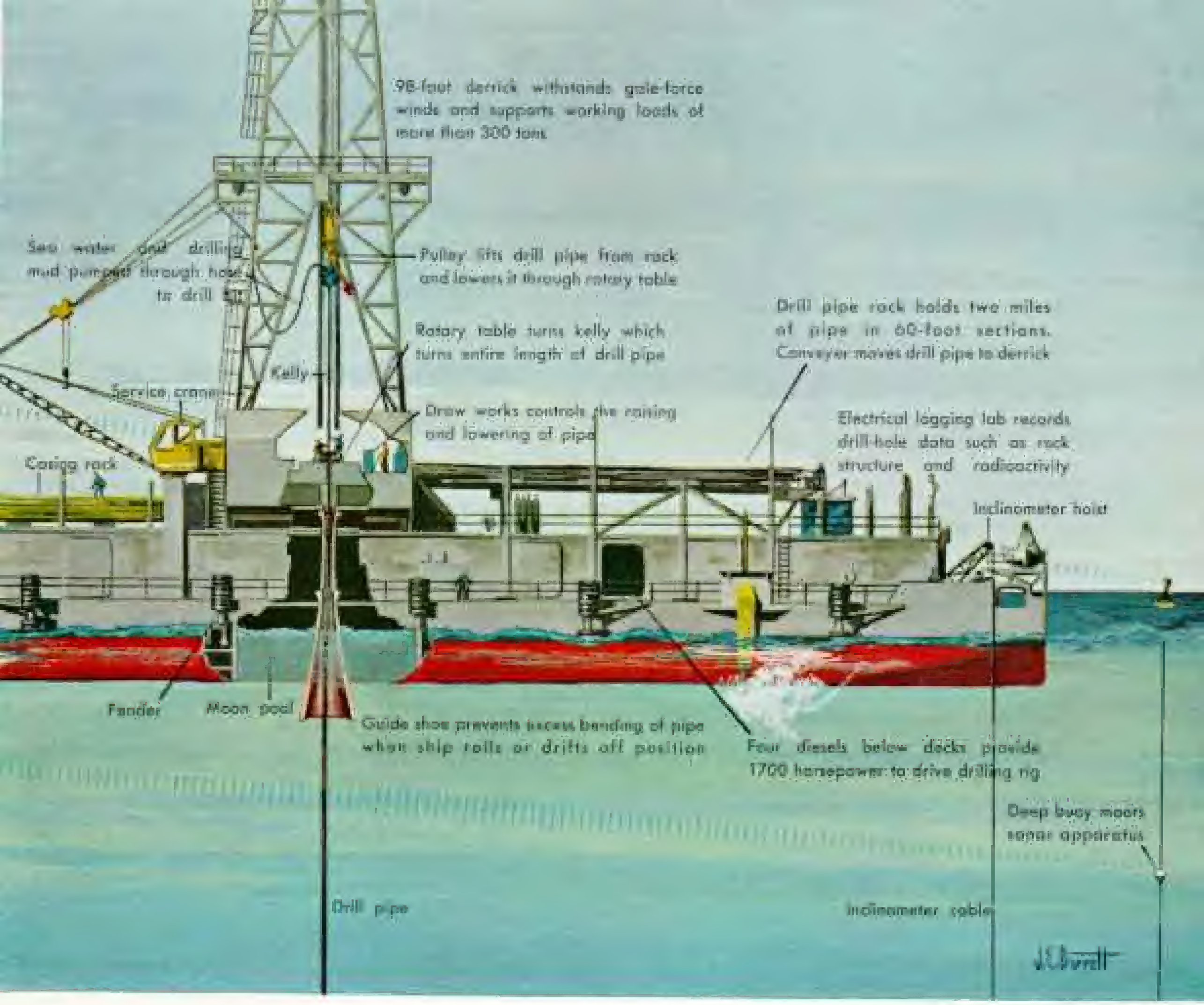
In the pilothouse, a lone man was maneuvering the ship with a small joy stick and control wheel. Sonar echo-ranging signals from beneath the keel bounced off tautly anchored underwater buoys that ringed the ship: the returning "pings" indicated ship-to-buoy distances. Meanwhile, radar pulses tirelessly scanned special reflectors bobbing on surface buoys, giving still another check on position.

The joy stick and wheel controlled four huge diesel outboard motors mounted on *CUSS I*'s flanks. A touch jockeyed the ship to compensate for a shift of position shown by reflection from the buoys (photograph and diagram at right).

Another innovation, a 38-foot guide shoe, jutted into the sea beneath the derrick (upper diagram). Flaring like a trumpet pointed to the deep, this collar encased the drill pipe at a crucial point, cushioning it against any sharp bend—and possible break—should the ship roll severely or drift off position. At the other end a flexible casing cushioned bending where the pipe entered the sea floor.

But, you may ask, why drill the Mohole at sea at all? Haven't oil wells already gone miles deep on solid land?

*CUSS I is named for Continental, Union, Shell, and Superior oil companies, which converted an ex-Navy freight barge to an offshore drill rig. Global Marine Exploration Company of Los Angeles now operates the ship.



Finger-tip Control Steadies *CUSS I* Above Pacific Deeps

Working in four-hour shifts, helmsmen kept the rig within 250 feet of its planned position above the drill hole thousands of feet below.

In the pilothouse, engineer Russell Thornburg peers into the radarscope which shows position of the ship. By moving the joy stick, Ray Garcia controls the speed and direction of all four outboard motors, shifting *CUSS I* forward, backward, or sideways. By turning the wheel, he can make the ship pivot. Switches on the control panel provide auxiliary control systems for motors.

Sun sets over the Pacific as the crew continues its night-and-day probe

Some have gone down almost five miles, Mohole director Bascom confirms. One in west Texas hit 25,340 feet in 1958. But on land the underlying crust averages 21 miles thick —four times as deep as anyone has drilled.

"Reaching the mantle from land," he adds, "can't be done. The weight of 100,000 feet of pipe, plus the heat at the bottom of the hole, is too much for modern methods and metals.

"From an island, the Moho isn't so far—perhaps only 50,000 feet. But nearly all the way would be through hard volcanic basalt, the toughest sort of drilling.

"Under the oceans the crust in places may be only two and a half to three miles thick. Counting the water, the Moho lies some six miles down. Drilling through three miles of rock is somewhat of a problem. But lowering a drill string, our total length of pipe, completely unsupported in great depths of water, is a very large problem indeed."

Now, in the late afternoon sun, we watched as the feat was tried. Above us the derrick stood etched against a pale blue sky. *CUSS I* reverberated to the thunder of heavy engines and the banshee scream of a winch brake against 100,000 pounds of pipe.

On the drilling platform, five men moved in disciplined harmony and rhythm, as graceful as acrobats juggling a 60-foot steel pole. One false move could crush them.

Another length of drill pipe rode a conveyer forward from racks on the stern. Yanked upright within the tower, it dangled from a pulley block taller than a man [opposite]. Gently lowered, it met the previous length of pipe, and a spin locked their threaded ends. Together they dropped away through a hole in the center of the platform. Far below, the business end of the drill string—a diamond-toothed, doughnut-shaped bit (right)—dropped into drilling position on the sea floor.

into the earth's undersea crust

Diamond teeth stud the nine-inch tungsten-carbide drill bit. Grooved watercourses flush chips and mud from the drill face as the 88,000 bit makes 30 to 40 turns a minute.

Guide rails, unknown on land rigs, prevent the yellow traveling block from swaying as the ship rolls. The block supports the entire drill string, which may exceed 100 tons in weight.

Here roughnecks add another length to the string of pipe that plunges through the rotary table. Sixty-foot sections of pipe line the rack behind.

On the drilling platform the ballet of brawny roughnecks went on. The kelly, a gleaming shaft of steel, was lifted, spun onto the top length of pipe, and lowered to fit a hole in the rotary table.

Slowly the table began revolving. At 20 to 40 revolutions a minute—about the speed of a long-playing phonograph—it turned the kelly, and the kelly turned all 3,500 feet of pipe below. At the far end, the diamond drill bit gnawed into the bottom.

Miscellaneous Society Gets a Job

I went off to talk to Gordon Lill, geophysicist and chairman of the AMSOC Committee—the men who conceived and now guide Project Mohole. AMSOC, I knew, stood for American Miscellaneous Society. Why?

"It began back in 1952, as a society for considering ideas that couldn't be sent anywhere else," he answered, straight-faced. "We were somewhat less than formal—no bylaws, no officers, no dues. Any two members who happened to meet, particularly after more serious scientific meetings, made a quorum.

"We did have branches," he grinned. "Eccterology, Phenomenology, Calamitology, Generalogy, and Triviology."

But in 1957, Mr. Lill went on, at the home of Scripps Institution geophysicist Dr. Walter Munk, an idea was discussed that AMSOC members found themselves taking seriously: a proposal to drill to the mantle.

"Geology needed a single, major project that would open new avenues of thought and research in many fields," Mr. Lill recalled. "A hole through the crust, it was agreed, would do that—and more."

A drilling committee was formed on the spot. In addition to Lill, Munk, and Dr. Harry H. Hess of Princeton University, it included such men as Drs. Roger Revelle, director of Scripps; William W. Rubey, Harry S. Ladd, and Joshua I. Tracey of the U. S. Geological Survey; Arthur E. Maxwell of the Office of Naval Research, and Maurice Ewing of Lamont Geological Observatory, Columbia University.

To lend the AMSOC-Mohole Committee proper weight, it was made an official committee of the august National Academy of Sciences. Funds came from the National Science Foundation, a Government agency.

"When word of our plans got out," Mr. Lill said wryly, "AMSOC began hearing from the public. We were warned that we would drain all the water from the oceans, or blow up the world like pricking a balloon. The commonest worry was that the Mohole would release a volcano. We answer all letters, explaining that such dire results are simply not possible.

"Geologists also heard of the project, and the news stirred interest and enthusiasm all over the world. Scientists have dreamed of drilling through the crust for nearly a century. Now someone was going to try it."

As engineering plans progressed, so too grew the range of scientific studies proposed for the Mohole. AMSOC and the National Academy carefully reviewed those that seemed possible and named a scientific party to handle the sea-bottom samples, or cores, that would be brought up.

At various depths in the drilling, a 20-foot-long core barrel would be dropped in the pipe. Like a long, tubular cookie cutter, the corer would trap a continuous cylinder of material from the bottom. Then a cable would bring it back to the surface.

What it carried up would be the pay dirt of Project Mohole. Oceanographers have scarcely penetrated the deep ocean floor, rarely sampling deeper than 60 feet with corers dropped on wire lines from research ships. Every foot deeper the Mohole goes extends man's knowledge by that much.

Suspense Rises With the First Core

A core barrel now had been lowered through the drill pipe. The tempo beneath the drill derrick had changed.

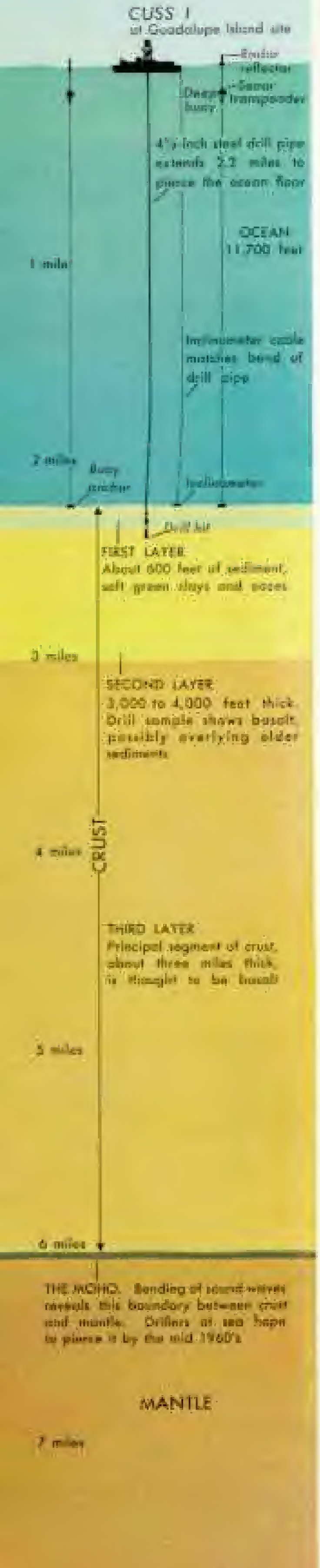
"We wait," said William Riedel, the young, deep-voiced Scripps geologist who headed the scientific party. Every scientist aboard was on deck, watching and waiting.

Suddenly the core barrel appeared, the long silvery tube flashing in the sun. Reverently, the scientists laid it on a wooden catwalk. Slowly, gently, they pushed a solid rod through the tube. It stuck.

Incongruously, they had to use heavy hammers and an electric drill to free the jammed barrel. Finally, a cylinder of gray-green silt and sand and clay slid forth.

Mohole Director, Above the Moon Pool, Scrapes Mud From the Drill String

Early in the operation, a radar range switch was accidentally flipped, and the ship drifted off position, snapping the tip of the drill pipe in the sea floor. Here the salvaged section is raised for a new drill bit. Oceanographic engineer Willard Bascom scoops off a clinging blob of mud to learn the nature of the sea bottom.



CUSS I drills the sea floor for data about the structure and history of the earth. When and if the drill bit passes the Mohorovičić discontinuity ("Moho" for short), it will enter the dense, never-plumbed mantle rock.

On land the Moho lies 18 miles or more deep, but at sea it may rise within a few miles of the floor. By operating in water, a drill rig needs only to sink its bit some six miles to get samples of the mantle.

"We seem," one of the drillers said, "to be collecting the most costly mud on record." But he did not say it very loudly.

Actually, the history of the earth may be read from such layers of sediment, deposited over millions of years in the deep oceans. They contain the record of the slow, ceaseless fall of shells of creatures of ancient seas, of silts and sands brought from the land by streams, surf, winds, or volcanic upheaval.

Changes in climatic conditions may be deduced from tiny marine organisms fossilized in the accumulated sediments. One variety of the shelled life known as foraminifera, for example, builds a special spiral casing. In cold waters the shell twists one way, some paleontologists have observed, and the other way when water temperature rises above a certain point.

Science may gain vital new data on the

age of the oceans and the possible drift of continents across the underlying mantle. Magnetic properties of successive layers may indicate whether the earth's magnetic poles have shifted radically. Flow of heat through the crust, measured during Mohole drilling, may reveal more about suspected movements within the earth. Is our planet cooling, or still gaining heat from inner radioactive fuels? And there is the final goal—the stuff of the mantle itself, mysterious and elusive.

"That Which Is Far Off . . ."

Thus Project Mohole, fairly and ably begun, promises new knowledge of the earth beyond all man's imagination.

Two weeks after the San Diego tests, *CUSS I* drilled successfully in waters nearly four times as deep—11,700 feet down, 2¼ *miles*—near Guadalupe Island to the south. This time it penetrated the mysterious second layer of the crust beneath the softer sediments, bringing up samples of volcanic basalt from 600 feet under the sea floor (below).

Two to three years of study and tests still lie ahead before the Mohole itself is begun. The best site must be chosen. New equipment must be designed for the tricky operation of retracting the entire drill string, changing the diamond bit, and returning it to the same hole. A bigger ship must be found or built to carry the far greater weight of pipe and gear needed for the ultimate attempt.

"We are asked whether a Mohole can be drilled at all," Mr. Bascom said. "With what we learned this year, we know it can be done."

It would seem a direct enough reply to the question from Ecclesiastes (7:24): "That which is far off, and exceeding deep, who can find it out?"

Scientists inspect the first cores. They seek answers to these questions. What is the earth made of? When did life begin in the seas?

Paleontologists have been unable to span the gap between the record of simple Pre-Cambrian life and the relatively complex organisms appearing at the beginning of the Paleozoic era. Records of this gap may lie in rocks deep below the seas.

When the drill, biting 360 feet into the bottom, struck rock formed by volcanic forces, did this basalt indicate that molten material had flowed above deeper sediments? Or had a continental mass drifted across the mantle? Or was this the true floor of the primordial sea? Future tests may tell.

Historic sample from 560 feet under the sea floor in 11,700 feet of water off Guadalupe Island shows a sharp boundary between sedimentary and igneous layers.

Basalt core sample from Guadalupe site, split and polished, belongs to the National Museum, Smithsonian Institution, Washington, D.C. Depth 650 feet below the sea floor.

National Geographic color cameras record a scene of historic pageantry

Queen Elizabeth Opens Parliament

By W. E. ROSCHER
Director of the European Office, National Geographic Society

Photographs by ROBERT B. GOODMAN

GREAT BRITAIN'S THREE ESTATES—Lords Spiritual, Lords Temporal, and Commons—gather once a year in the House of Lords to hear from Her Majesty's lips the policies drawn up by her cabinet.

Heretofore the Fourth Estate, a name for the press attributed to Edmund Burke, has only once been permitted to photograph the ceremony's brilliant pageantry. But in November, 1960, NATIONAL GEOGRAPHIC was granted permission to record the historic occasion in color.

The picture at left and those that follow illustrate highlights and portray some of the personalities taking part. Prominent among them are Great Officers of State: the Lord Great Chamberlain and the Earl Marshal; and Officers of the Royal Household: the Lord Steward, the Master of the Horse, the Mistress of the Robes, a Lady of the Bedchamber, and a Woman of the Bedchamber. Some gain these honors by heredity, others by meritorious service.

Tabards emblazoned in extravagant color identify heraldic attendants bearing romantic titles: Bluemantle Pursuivant, Arundel Herald Extraordinary, and Norroy and Ulster King of Arms. Senior officers of the Household Cavalry attend as Gold Stick in Waiting and Silver Stick in Waiting. The Honourable Corps of Gentlemen-at-Arms wait closely on Her Majesty.

Unwitnessed by the public, this glittering ceremony has taken place with little change for more than six centuries. Today the event serves as a link with the era of the divine right of kings, and each year symbolically renews the subtle bond that unites Sovereign, Lords, and Commons.

Reading the Speech from the Throne to assembled Lords and Commons, Queen Elizabeth II opens the second session of the 42d Parliament of the United Kingdom of Great Britain and Northern Ireland. Hand on the hilt of his sword, Prince Philip, Duke of Edinburgh, occupies the Consort's seat slightly to one side of the great throne designed for Queen Victoria.

Resplendent Cavalrymen Escort the Royal Coach to Westminster

Coldstream Guards, wearing black bearskins, present arms and lower their First State Colour in royal salute as the Queen arrives at Old Palace Yard after a ceremonial drive from Buckingham Palace. Members of the Royal Household follow in four state landaus.

The Queen's Irish State Coach, originally purchased for Queen Victoria from a Dublin coachmaker, is drawn by four of the Windsor Greys. Two outriders and two divisions of white-plumed Life Guards have preceded the coach. Two divisions of red-plumed Royal Horse Guards—the Blues—follow it.

Stained glass in the great window of Westminster Hall memorializes members and servants of Parliament who fell in World War II. The Hall, which dates from 1097, was one of the settings for early Parliaments. It has witnessed many historic moments, including the deposition of Richard II in 1399 and the trial of Charles I by the Roundheads in 1649. An equestrian statue of Richard the Lionheart stands below the window.

Yeomen of the Guard in Tudor Scarlet Line the Royal Path

Walking backward, the Lord Great Chamberlain with his white wand of office and the Earl Marshal of England pay symbolic homage to their monarch as she passes down the Royal Gallery on her way to the House of Lords.

An ancient emblem of authority, the two-handed Sword of State, borne by Field Marshal the Viscount Slim, precedes Prince Philip, while the Cap of Maintenance, carried by the Lord Mills, passes ahead of the Queen. Her Majesty wears her ermine-lined red and gold Parliamentary Robe. Two Pages of Honour bear the 18-foot train. The Mistress of the Robes follows with a Lady and a Woman of the Bedchamber.

Two hours earlier the Yeomen of the Guard, nicknamed Beefeaters in 1669 by the Grand Duke of Tuscany, searched the vaults to forestall any repetition of the Gunpowder Plot of 1605, when Guy Fawkes attempted to blow up King James I and his Parliament.

For centuries the House of Commons has demonstrated its independence of the Crown by refusing to attend Parliament's opening ceremonies until commanded by the Queen's personal messenger, the Gentleman Usher of the Black Rod. When Black Rod approaches the Commons with the royal command, the door slams unceremoniously in his face. This act, laden with significance, shows that not even a representative of the monarch may enter without permission.

Black Rod knocks three times on the closed door. He then gains admission to the chamber and returns to the House of Lords with members of the Commons.

This custom originated in Charles I's attempt to arrest five members of Parliament in 1642.

Archaic Splendor and Modern Dress: a Dazzling Spectacle in the House of Lords

Britain's High Court Judges, in judicial wigs, occupy a woolsack—an enormous hassock—before the Queen's hand-carved throne. The Archbishops of Canterbury and York and other bishops sit at

PHOTOGRAPHED BY ROBERT SISSON © NATIONAL GEOGRAPHIC SOCIETY

the judges' left. Ambassadors take their places behind the bishops. Members of the Royal Family and, behind them, peers, peeresses, and wives of ambassadors sit across the aisle. Privileged guests line the gleaming brass rail of the West Gallery above. Though the Sovereign is above politics, her speech has been drafted by the cabinet to outline the government's legislative program for the year.

In her jeweled State Crown, Elizabeth addresses Lords and Commons. Tradition says the flashing sapphire in the topmost cross came from the ring of Edward the Confessor. Giant Black Prince ruby below it embellished the helmet of Henry V when he defeated the French at Agincourt in 1415. Second Star of Africa, a 316-carat segment of the Cullinan diamond, blazes from the rim.

Distinguished ladies await the speech. Front row, left to right: Duchess of Gloucester, Duchess of Kent (now Princess Marina), Princess Alice, and the wives of two ambassadors. Next row: the Duchesses of Buccleuch, Rutland, and Fife, and the Marchionesses of Cholmondeley and Salisbury.

Peers in their scarlet robes crowd the well of the House of Lords—the Parliament Chamber.

Oregon's Sidewalk on the Sea

Article and photographs
by PAUL A. ZAHL, Ph.D.
National Geographic Senior Staff

Surf-carved crags, dunes that walk, and the teeming life of the tidal zone absorb a naturalist's family on vacation

THE ALARM CLOCK went off at 4:30, and ten minutes later my wife and I stepped out into a cold pea-soup fog. We wore boots, several protective layers of sweaters, and windbreakers. An early dawn outing on the spray-drenched Oregon coast—even in mid-July—can be a chilling experience.

Driving a short distance beyond the village, we parked by the road, crossed a field of wet grass, and descended abruptly onto the beach. By

now darkness and fog were giving way to a soft, misty light, as a glow of pink developed above the mountains to the east. Before us stretched a weird, tide-exposed world of slippery rocks and mirror-topped tidal pools. Beyond that was the surf, thundering in from the vast Pacific.

Here, near the salty little village of Yachats—pronounced Ya-hots—we were beginning a long-planned tour of the fabulous Oregon coast. Our main objective was to study the strange and colorful sea life that abounds here. But this was a vacation, too, and included just about every kind of seashore activity.

For two full months we lingered along U. S. Highway 101, which meanders nearly 400 miles through some of the wildest and most beautiful scenery in North America. Who, with camera in hand, could long resist this shore's sculptured beauty,

Rocky sentinels guard Cannon Beach, Oregon; retreating tide exposes a sandy playground

the turmoil of sand, rock, and surf that lies beyond each headland?

All but 23 miles of the rugged Oregon shore is under public ownership. A chain of coastal parks, historic sites, and scenic overlooks meticulously maintained by the Oregon State Highway Department added to the delights of our summer excursion (map, page 713).

Beachcombing Offers Rich Bounty

We quickly discovered that one of the most exciting diversions here is beachcombing—though not the idyllic desert-island variety. The Oregon shore stroller must enjoy the sting of cold salt spray on his face and the challenge of slippery rocks, gravelly beaches, and steep, crumbling coastal cliffs. But the treasures he finds make all the difficulties worth while.

The beachcomber may hunt for driftwood, sea stars, or fossils of ancient marine life. He may search for the polished beauty of agates, or the globes of colored glass that drift across the ocean from Japan (page 722). Perhaps it is fishing that lures him to the shore, or riding sand dunes in a balloon-tired jalopy, or watching the sea lions and vast colonies of sea birds. We joined enthusiastically in all these activities during our visit.

But this morning, on the dawn-tinted beach at Yachats, we had eyes only for *Anthopleura*, a genus of saucer-sized sea anemones that inhabit Pacific shore waters from Panama to Alaska.

Cautiously groping our way forward over the rubble of slippery rocks, we found ourselves at last on the floor of a deep trench, at whose seaward end, not far ahead, a mighty surf roared. An hour before, this trench had been, and an hour hence would be again, at one with the crashing sea. Only now for a brief period of low tide was it dry. Dry? With each impact of the surf against the outer ramparts, a cloud of biting spray showered over us.

Although wet, wild, and cold, the exposed area teemed with life—life in abeyance, that is. Scores of sea-creature species, millions of individual organisms, surrounded us, each quietly awaiting the inevitable return of mother sea.

In pools along the way we had seen many anemones in "bloom"—bright green flowers whose fringing petals were tentacles. We hadn't collected any of these, however, for we wanted specimens from under ledges where little light penetrates. I was interested in examining these for the microscopic algae that live in the tissues of many anemone species, giving *Anthopleura* its striking emerald hue.

The rock cleft before us seemed the right place, for one of its walls was undercut and shaded as far back as my arm could reach. There, collapsed and with all their tentacles shrunken and stringy, sagged no fewer than 500 *Anthopleura* (opposite).

Crouching on the wet sea floor, I reached under the ledge to pluck one, only to have it contract even farther. My hand slipped and came away wet and slimy. I had to use my pocketknife to dislodge half a dozen for our collecting bucket.

We lingered a few minutes to take photographs, but not without a certain uneasiness at the threat of a sudden break-through by the now-rising tide. We knew how swells seem to follow a safe pattern for a time, then suddenly rush in without notice like an unleashed maelstrom. We were already dripping with spray; so I made no objection when Eda suggested we pack our gear and get out.

Tiny Creatures Feel Anemone's Sting

Back in the cabin, our usually wide-awake children—Eda Kristin, 12, and Paul, 9—were still in bed. We left them there while my wife prepared breakfast and I transferred the anemone specimens to an electrically aerated 10-gallon aquarium I had set up just outside the back door.

That afternoon I found myself conducting an impromptu symposium on marine biology. Participating were Laurette and Asa Irwin,

Dull and Inert at Low Tide, Sea Anemones Bloom When the Water Rises

Surf-loving anemones (*Anthopleura xanthogrammica*) cling with sticky bases to offshore crevices and ledges. At high tide they resemble vivid flowers. When tide ebbs, they draw in their tentacles and suggest masses of overripe fruit.

Accompanied by his daughter, Eda Kristin Zahl, the author pries a specimen from the wall of a tidal pool near Yachats. Transferred to an aquarium, the captives unlock their fleshy houses. Wavy tentacles carry a paralyzing sting for small sea creatures that come within range. A purple sea star (*Pisaster ochraceus*) shares the tank.

Photographs by Paul A. Zahl, National Geographic Staff

Petal-like tentacles encircling puckered mouths distinguish a cluster of anemones collected off Vachats. *Anthopleura elegantissima* feeds when covered by water. Exposed by the tide, it contracts and closes. Fragments of shell and gravel normally cover the trunk. *Anthopleura* multiplies by sexual reproduction or by lengthwise division into two new animals. Spreading colonies form densely crowded beds.

Fronded sea slug browses the bottom of the author's aquarium (above). Sea slugs, or nudibranchs, lack the limestone shells that house most land snails, their kin.

Antlerlike sense organs of red and blue adorn the head of a tawny-fringed sea slug.

Hungry maw of a sea cucumber (*Cucumaria miniata*) gapes red. Clumps of tentacles wreathe the mouth; tube feet stripe the body.

Land and Sea Battle Ceaselessly Along Oregon's Rugged Shore

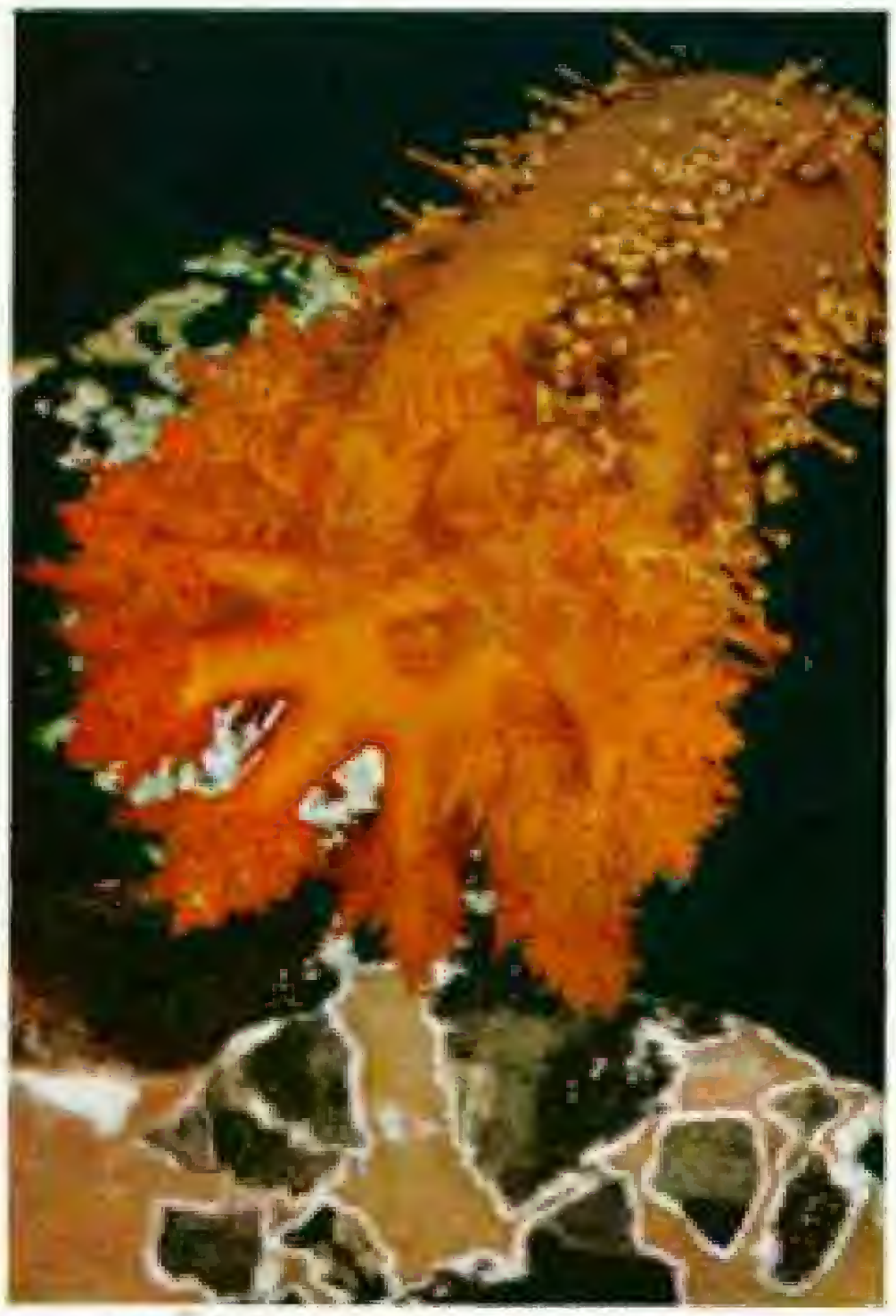
Bold headlands and undercut cliffs attest the violence of the struggle between earth and water. Few good harbors indent the jagged 296-mile coast. Scenic U. S. Highway 101 parallels the shoreline, providing breath-taking panoramas from bluffs and promontories.

from whom we rented these quarters: their children, Kathryn and Ken; my wife; and, of course, the ever-present Eda Kristin and master Paul. Seven heads peered down at the aquarium, in which our anemones now bloomed in full resplendence. A striking transformation from the utterly drab to the utterly exquisite had taken place (page 710). But only my wife and I, having collected the originals, could appreciate the change.

"Do you mean to say those green water flowers are really animals?" asked Ken.

"Do they sting?" wondered teen-aged Kathryn.

"What do they eat?" my daughter Eda wanted to know.



And from Paul, thoughtfully: "Why are they green?"

Lowering my hand into the aquarium, I brushed the tentacles of a bloom fully eight inches across. The green flower quivered but did not contract. The only sensation I felt was a slight stickiness.

These creatures, I said, were coelenterates — members of the same animal phylum as the Portuguese man-of-war. Characteristic of the group is the presence of thousands of microscopic sting cells in the outer skin layer. Sting cells of the Portuguese man-of-war inject a poison dangerous to man, but those of most anemones are harmful only to small marine animals, which comprise the main diet of the flowerlike creatures.

Their green color, I explained, was due to tiny chlorophyll-laden algae living inside the anemone tissues. These specimens, coming from a habitat of low light, were definitely less green than those I had seen in open, sunlit tidal pools. In shade-grown *Anthopleura* the internal algae are evidently less prolific, or produce less chlorophyll, than in those exposed to direct sunlight.*

Simple Intercom Transmits Stimuli

Each of our captives now had its base glued to the floor of the aquarium, but measurements made at hourly intervals would have revealed movement. Most anemones are capable of a slow, slow glide over the surface to which they seem so securely fixed.

*See the author's article, "How the Sun Gives Life to the Sea," National Geographic, February, 1961.

Instead of sense organs, these creatures possess only rudimentary tissues responsive to such stimuli as light, vibration, and touch. They are brainless, but simple intercom systems invisibly crisscross their soft bodies. Having no hard parts, they can shrink or swell enormously, attaining their form and size by varying their water content.

Anemones show no conspicuous external sex differences. Generally the sexes are separate. However, in a few species, single individuals produce both male and female cells, which mature at different times. The male cells, liberated into the water, penetrate other individuals, ensuring cross-fertilization.

In most anemones the fertilized eggs produce free-swimming larvae that eventually attach themselves to rocks or other hard surfaces. Other species reproduce by such means as splitting or growing buds that mature into a new generation of anemones.

The creatures vary from minute to washtub-size, and run a gamut of brilliant coloration. They inhabit all shores of the marine world, as well as the sea floor thousands of feet below the surface.

Some species live less than a year, while others show astounding longevity. Several specimens in an aquarium at the University of Edinburgh, Scotland, survived for more than 80 years.

We kept our pets for more than a week, never ceasing to be struck by their glorious flowering, especially in the morning after a night undisturbed by children or visitors. When we made ready to leave Yachats, I

Rocky remnants of vanished headlands rear above the breakers near Cannon Beach, a resort town. Popularly called sea stacks because of their shape, the islets survive the onslaught of wind and wave.

Haystack Rock, one of the best known, towers 235 feet in the middle distance.

Cannon Beach takes its name from a ship's gun dragged ashore following the wreck of the schooner *Shark* in 1846.

These hikers in Ecola State Park take advantage of a crystal day; haze often shrouds the coast. Ecola derives its name from a Chinook Indian word, *ekoli*, meaning whale. All but 23 miles of Oregon's Pacific shore is public-owned land.

transferred the specimens to a bucket and carried them back to the sea. They were none the worse, as far as I could see, for their week's contact with the human species.

Driving on up the coast, we soon came to another beach where the interest was not only biological, but historical as well.

Beached Whale Made Oregon History

"*Ocian in view!* O! the joy," wrote Capt. William Clark in his notebook on November 7, 1805. After 18 months of slugging it out with hostile prairies, mountains, and wilderness, he and Meriwether Lewis had at last brought their expedition to the Pacific coast, near the mouth of a mighty river known as the Columbia.*

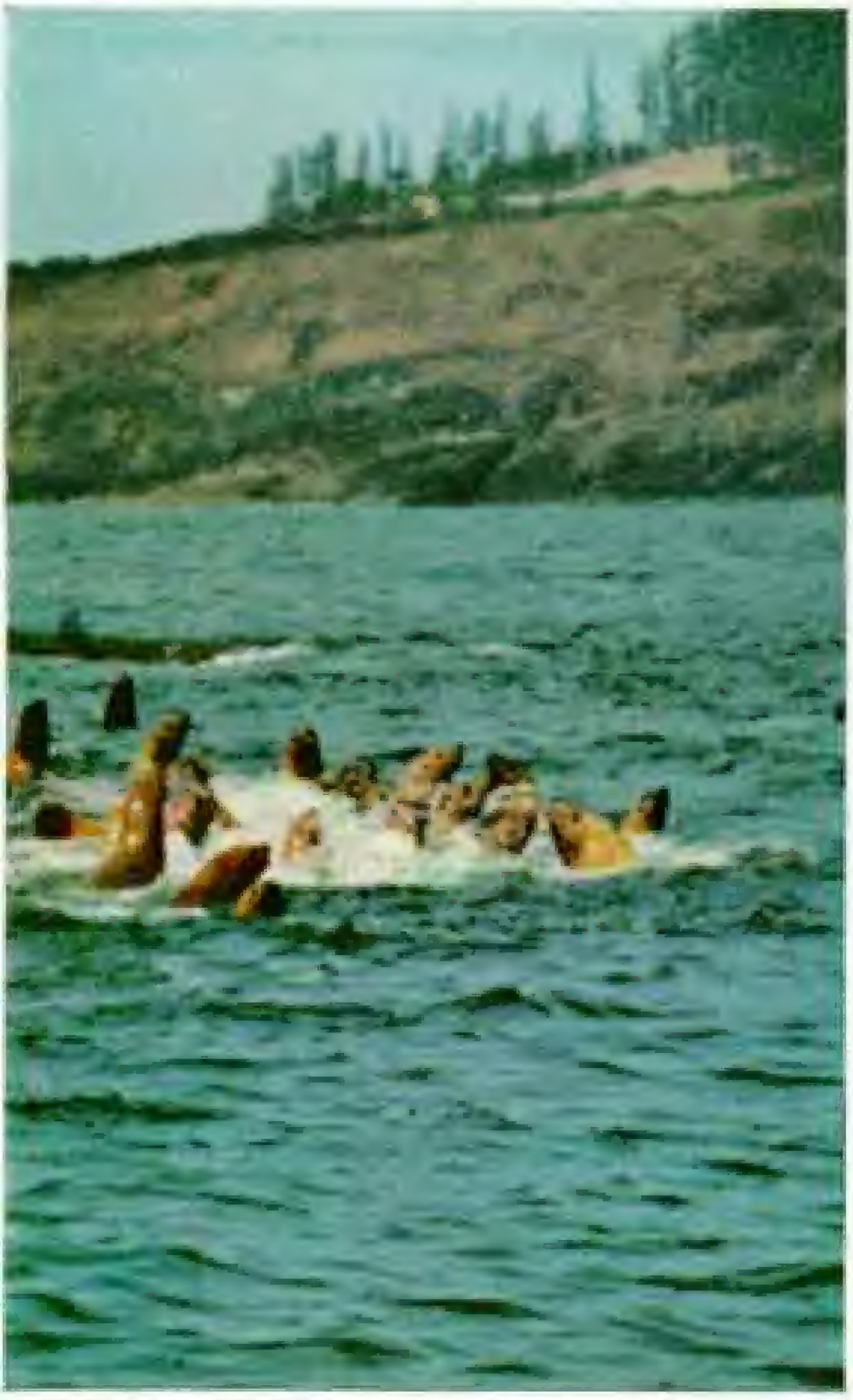
They spent the following winter in what is now Clatsop, the Oregon coast's most northerly county. They collected salt by boiling sea water, and hunted for sorely needed fats. Rumors of a stranded whale lured some of the group 18 miles south of their winter quarters at Fort Clatsop.

There, on a broad beach, they found the whale—its 105-foot carcass, that is—freshly stripped of blubber by Tillamook Indians. The expedition was able to barter for a few gallons of precious whale oil, but complained that the Indians charged an exorbitantly high price. Captain Clark was nevertheless grateful to Providence for ". . having Sent this Monster to be *Swallowed by us* in Sted of *Swallowing of us* as jonah's did."

We visited the whale site, now known as Cannon Beach, on a Sunday afternoon. Easing our car out of a steady stream of surfside traffic, we parked within the shadow of an enormous monolith known as Haystack Rock.

A landmark of the Oregon coast, it thrusts 235 feet above the surf (preceding page). Around its base, now partially exposed at low tide, swarmed scores of holiday biologists, many of them weekenders from Portland, only a 90-minute drive away.

*See "Following the Trail of Lewis and Clark," by Ralph Gray, National Geographic, June, 1953.



Dignified Murres and Playful Sea Lions Find Sanctuary Around Three Arch Rocks

Murres, denizens of northern seas, appear unafraid of man. Downy young hatch from pointed eggs that do not roll easily from rock ledges.

Powerful swimmers and superb fishermen, Steller sea lions dive as deep as 600 feet for food. A grown bull may weigh a ton. Hunters respect his bellowing charge, but say the mere opening of an umbrella may provoke headlong flight.

A national wildlife refuge, Three Arch Rocks provide nesting space on their rugged cliffs for some 300,000 murres, puffins, and cormorants.

I saw children intrigued with the crusty arms of great sea stars, so plentiful here; others searched for clams or filled plastic buckets with shells and beach stones.

After watching awhile, we moved on to Ecola State Park, just a few minutes' drive north. While my wife spread supper on a picnic table, I strolled, camera slung from my neck, to the edge of a high bluff and looked back toward Cannon Beach.

Sea Carves Spectacular Scenery

The view was unbelievably grand. Haystack and a score of lesser pinnacles rose out of the forelying sea and shore; they seemed arranged with almost theatrical forethought. It was hard to imagine that all this was the result of erosion—those imposing rock spires, those evergreen-tufted headlands, those broad crescent beaches.

A mist began to envelop the loftier rocks while I photographed, and changes in light sent sea and shore through a spectrum of deepening blue, green, and gray. Even the bright little wild flowers at my feet seemed suddenly subdued.

A lady artist was hard at work near by. She lamented: "How can I possibly know what to paint? Those shifting colors and light values." She looked through my camera view finder, adding, "Perhaps you'll have better luck on color film."

Weeks later I studied my transparencies to find that these too were lacking in total fidelity. Only the human eye, with all other senses alert, can capture—and then only for an evanescent moment—the reality of so vital a scene.

Picnic over, we drove eight miles to Seaside, the Northwest's version of Atlantic City. A vacation mecca for visitors who like bright lights, Seaside also enshrines the spot where explorers Lewis and Clark boiled sea water to make salt.

Next morning our one-car safari set out southward again, ready for new beachcombing adventures.

Our first stopover, 50 miles down the coast,

Painstaking Fossil Hunter Exposes a Scallop Shell 25 Million Years Old

Chipping sandstone on Moolack Beach, Douglas R. Emlong shows young Paul Zahl how he bared the shell at left. Persistent search has rewarded Mr. Emlong with a remarkable collection of petrified sea-mammal remains. His finds include:

Twin molars of a rare four-legged relative of today's sea cow that dined on clams (right).

Fangs and front teeth of an ancient sea lion.

was at Tillamook, seat of a county that proclaims itself "land of cheese, trees, and ocean breeze." Here our local host, Burford Wilkerson, arranged for Robert C. Twist, of the U. S. Fish and Wildlife Service, and John Gorman, of the Tillamook *Headlight-Herald*, to accompany me on a visit to Three Arch Rocks —one of the world's most populous sea-bird rookeries.

On the boat trip out, we passed a number of small, low-lying rock masses where scores of tawny Steller sea lions sprawled in the sun (page 716). Larger than the California sea lion, this species ranges from Alaska to southern California and is fairly common along the Oregon coast. One colony north of Florence inhabits a great cavern at the surf line, into which visitors may descend for a closer view.

Soon we were in the shadow of three towering pinnacles, each a true arch frilled with white surf (page 717). Gradually my eyes picked out the hordes of sea birds that peppered every nook and cranny.

"Some 300,000 murres nest there," Twist told me.

We edged closer, and indistinct dots became feathery as the brown-and-white birds unfurled seaward in virtual sheets. Innumerable others remained glued to their eggs or stood close to their young.

"Nesting period's about over," Twist volunteered. "Another month and most of them will be gone."

"Just like all the summer tourists!" I exclaimed.

Twist and Gorman laughed. "As a matter of fact, the Oregon coast gets its share of winter tourists, too," Gorman said.

Waves Uncover Long-buried Fossils

Thunderous waves lash the coast during winter storms, eating away at the cliffs, exposing all sorts of long-buried fossils. But the next storm may bury everything again. Knowing where and when to look for these remains of ancient life takes a special kind of beachcomber.

Rockhounds comb the beach at Oceanside, seeking agate-rich gravel beds exposed by storm and tide. A sharp-eyed beachcomber—if he knows what he is looking for—can discover the stones in a bewildering variety of colors and patterns.

Such a one was 18-year-old Douglas Emlong, whom we met at Gleneden Beach, a village some 50 miles south of Tillamook. Douglas wants to be a professional paleontologist, and I have no doubt that if his present enthusiasm continues, he'll make the grade.

Taking us to his home, he proudly showed us one of his most remarkable finds. Sprawled in his front yard, together with scores of other marine fossils, were the remains of an ancient sea mammal.

It was embedded in half a ton of sandstone when he found it, and Douglas had dug it out after many hours of painstaking work, then triumphantly carried it home in a truck. Scientists have identified it as a Miocene sea lion 25 million years old.

I asked Douglas to take us beachcombing for fossils. We drove down the coast highway several miles, then set off on foot toward some high cliffs along the beach. Stopping at the base of a great sandstone escarpment, Douglas pointed to a spot about 15 feet above our heads.

"See that line?" he asked. I nodded, recognizing an eight-inch stratum ribboning across the massively eroded cliff face.

"Now run your eye along it," he directed.

I did, and suddenly discerned what the casual beach stroller perhaps would not have seen. Chalk-white shells by the hundreds protruded from this ancient layer of sedimentary rock.

The hard parts of such organisms, geologists tell us, accumulated on the sea floor over centuries of time. Slowly they were covered by layers of mud and fine sand, which eventually solidified. Inland volcanic activity added ash and lava. Thousands of years of earth contortion, uplift, and erosion followed, producing what specialists regard as a geologically complex coast.

Gleaming Pebbles From Gum-ball Machines

Shrieks of delight came from my daughter Eda. She had discovered a heap of loose rock teeming with bivalve, snail, and tube-worm fossils. They were so abundant that we could have filled a bushel basket. Needless to say, the children and their mother were already at work to this end.

A far more popular form of beachcombing centers on carnelian, sagenite, and a score of other agate varieties for which the Oregon coast is famous. Every shore town has its agate shop or shops. Often they have rotating drums of beach stones outside the door for all to see.

Rough, vaguely translucent beach-gathered

Burnished trophies, tumbled for weeks with abrasives and water in a rotating drum, reward the pebble hunter's patience. Translucence and colored patterns identify agates. Shaped into spheres, they become prized "aggies" for marble shooters.

Photographed by Paul A. Zahl, National Geographic staff © N.G.S.

pebbles are put into such tumbling devices: first with water and grinding abrasive, later with a polishing rouge compound. Driven by an electric motor, the tumbler rotates slowly and continuously for several weeks. Then the stones are removed and washed, ready now for the cutter or the souvenir market (preceding page).

I watched one day while a rockhound switched off the motor and poured his tumbler's contents onto a coarse-mesh wire screen. The hundreds of olive-sized agates and other beach stones were just a heap of muddy lumps. But a minute later, after being rinsed clean, they looked like Aladdin's treasure trove. Each agate was now a glass-smooth gem. So popular and plentiful is this stone that many a seaside soda fountain or restaurant has a gum-ball dispenser loaded not with chewing gum but with handsome agate mementos of the Oregon coast.

Agates Formed Over Millions of Years

Eons ago, these coastal agates were formed in cavities made by gas bubbles caught and suspended in masses of solidifying lava. As ages passed, silica-bearing waters percolated through the rock, depositing concentric layers of silica in the bubble cavities. Metallic salts in the solution account for the varied color bands and strange patterns. Finally, erosion broke away the surrounding matrix, and the agates were eventually deposited on the beach.

At Depoe Bay we met Mr. Linton Cosby, who has made a career of collecting agates and selling them at his local rock shop. When he learned that I represented the National Geographic Society, of which he is a member, Mr. Cosby showed us some real collector's items—polished stones whose brooding depths reflected miniature worlds of exquisite design and color. Within one fist-sized piece of silicified wood I could make out tubular structures, once the borings of ancient shipworms.

In addition to agates, Mr. Cosby's shop featured another product—hollow glass balls, varying from plum to basketball size (below). Used by Japanese fishermen as floats for their nets, these buoyant balls sometimes escape and are carried across the Pacific by ocean currents. Eventually many of them are washed ashore. Collectors tell of finding dozens in a single day. So popular are they as home decorations that many local shops offer them for sale to visitors.

Continuing southward, we stopped briefly at Cape Foulweather—so called by Capt. James Cook when he saw it in 1778—for another distinctive view of the coast. At Seal Rock we went clamming; at Cape Perpetua we had a picnic. Pages could be written about each of these, and all the other fascinating points we saw along Highway 101: Heceta Head, Devil's Elbow, Sea Lion Point, Florence, Umpqua.

Pools Teem With Life at Low Tide

We stopped for a longer visit at the fishing village of Charleston, where the University of Oregon maintains an Institute of Marine Biology. Early one morning I accompanied Professor B. H. McConnaughey and his invertebrate zoology class on a field trip to explore the tide-exposed base of precipitous sandstone cliffs in Sunset Bay State Park.

Here, at low tide, every hollow and depression was a pool of trapped water. Some were choked with rockweed, surf grass, or kelp. Others held masses of sea urchins, anemones, mussels, and other marine creatures.

"Here at the edge of the sea, the mortality rate is very high," Dr. McConnaughey told his students. "Specimens that live where

Blue Globes Crossed the Wide Pacific, Propelled by Wind and Currents

Japanese fishermen use the glass spheres to buoy their nets. Some floats break free, drift across the Pacific, and wash ashore. Beachcombers collect the balls for ornaments. Paul and Erla Kristin admire this collection in a meadow carpeted with agoseris, a flower related to the dandelion.

Haze drops a veil over Mack Arch, a double-peaked monolith sculptured by wind and wave, which juts 231 feet above the sea. Boats easily pass through the 100-foot arch, and sometimes in stormy weather anchor in the lee of the islet.

Coastal Oregon owes its summer fogs to winds from the west that soak up heat and moisture over the Pacific. Nearing land, the damp air blows across a cooling zone of chilly inshore water. As the air cools, it reaches its dew point and turns to fog, which drifts toward the coast.

Knobby tentacles and trumpet-shaped umbrella characterize a stalked jellyfish. Shown five times life-size, *Haliclystus* hangs upside down from a blade of surf grass.

Bubblelike jellyfish suggest plastic balloons in a nighttime sky. Tentacles fringe the bottoms of the bells. *Polyorchis* swims by flexing the sides of its transparent dome. The Zahls dipped up these specimens (twice life-size) at wharfside in Charleston.

Sea palms thrive in surf, their flexible stalks withstand the shock of breakers. Mrs. Zahl found this clump of *Postelsia palmaeformis* on an exposed rock at low tide off Yachats.

water is trapped at low tide have the best chance to survive."

He went on to explain that plants and animals living in an environment of alternate submersion and exposure must have the power to resist sun and wind drying.

Thus, during low water, anemones contract into ugly slime-covered lumps, such as we had seen at Yachats. Bivalves draw in their soft tissues and snap shut. Worms retreat into casements, and some mollusks hide behind trap doors. Crabs and many other invertebrates take refuge amid seaweed, or vanish into sand or moist crevices. Sea stars and sea urchins have armorlike coverings which help prevent the rapid escape of internal moisture. Exposed limpets, snails, and chitons simply cling tightly to rocks, thus protecting themselves from desiccation.

But there are limits. Should these living things be exposed much longer than from one tide to another, deterioration and even death could sweep across this world of betwixt and between.

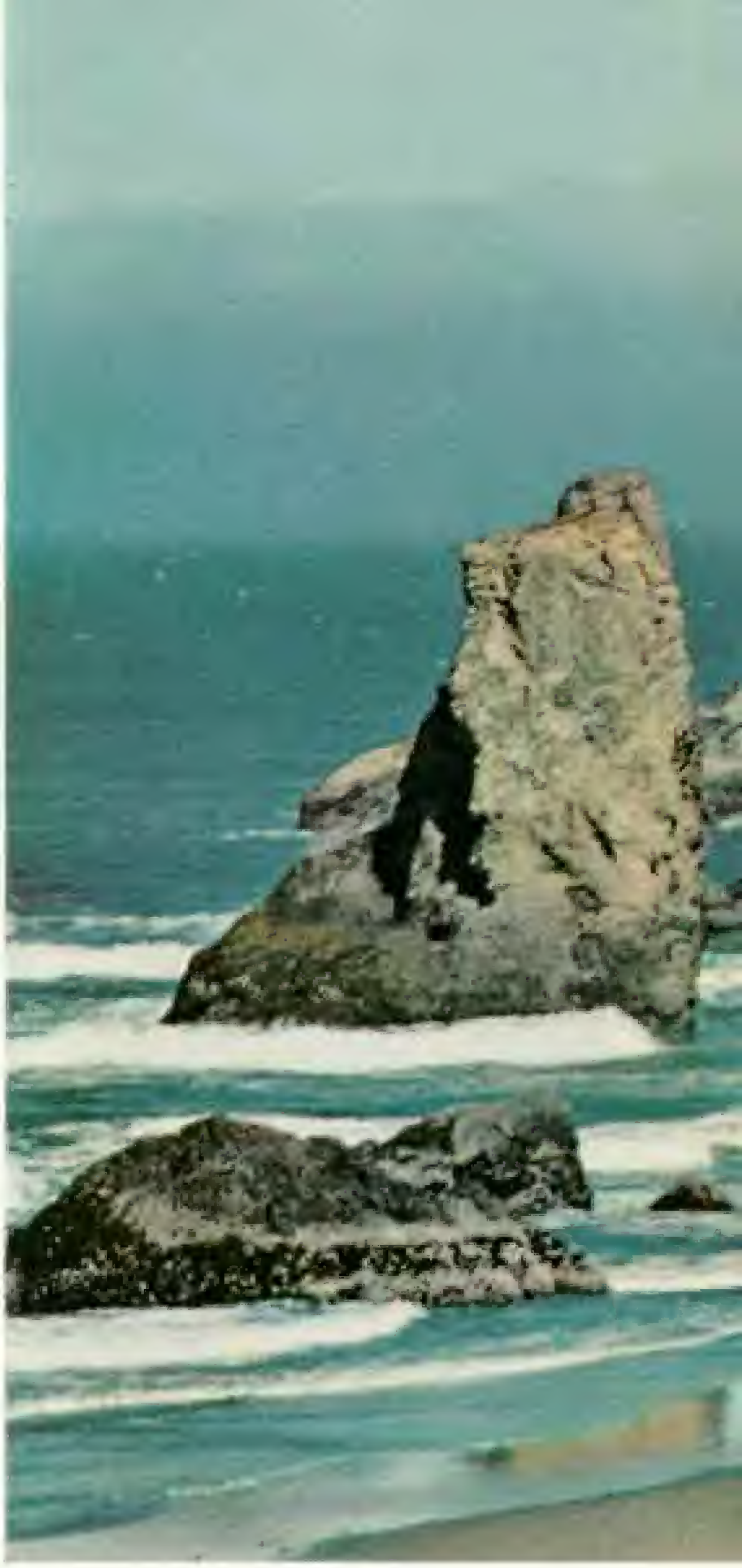
Sea Plants Bend to Surf's Whiplash

Several days later my wife and I explored Cape Arago, two miles south of Sunset Bay. On this excursion we noted that, in addition to defense against exposure, dwellers of the intertidal zone must possess incredible resistance to physical shock.

On a ledge less than a dozen yards from where we stood grew a petite forest of upright sea plants, *Postelsia palmaeformis*, each a moplike clump of drooping leathery fronds supported by a smooth yellowish-brown trunk about 16 inches high (page 724). Clutching "roots," known to the marine botanist as holdfasts, anchored them firmly to the rock. I climbed down to collect one of the closer plants, but pull and jerk as I might, I could not dislodge it.

I quickly scrambled back to a higher perch where Eda stood, for an enormous swell was forming not far out. When it struck and exploded, every member of the tiny forest yielded freely to the rush of water, bending and tossing like a palm in a tropical hurricane. When the breaker's force was spent and its water had foamed back into the sea, the little palms were again erect, unbroken and unharmed. Elasticity, in this instance, is the secret of survival against the whiplash of the surf's fury.

Other organisms resist by virtue of their hard, tough character. Take those mussels tightly wedged in beds all around us. This



Surf-sculptured rocks suggest monoliths

species, *Mytilus californianus*, anchors itself with strong tufts of hairlike filaments called byssus threads. It requires more than ordinary strength to wrench a mussel free by hand. These common bivalves are sedentary, although they can shift position by loosening the threads on one side and extending new ones on the other.

Mussels exposed at low tide keep their valves tightly closed. But when submerged, they gape, enabling the animal inside to strain nutrient plankton from the sea water. Both Pacific and Atlantic mussels are regarded as tasty delicacies, but as with mushrooms, it is wise to eat only those of whose history and purity one is sure. At certain times of the year outbreaks of poisonous plankton may occur.

raised by prehistoric man at Stonehenge. Offshore fog hugs the sea near Bandon

Toxic chemicals in the plankton then tend to accumulate in mussel tissues, rendering them dangerous to man.

While I pried off several specimens for closer inspection, my wife braved the cold water of neighboring pools in search of sea slugs. This did not surprise me, for ever since Eda's first encounter with these fantastically colored shell-less mollusks on Hawaiian reefs, she has stoutly maintained that they are the sea's most fascinating treasures.*

"Look at this beauty!" she called enthusiastically. "It beats even agates for color!"

Peering into her collecting bucket, I saw a shimmering purple creature with a forest of tawny-colored fingerlike projections fringing its back (page 712).

As my family and I wandered in this thunderous, wind-swept world of spray and salt, we saw other marine species too numerous to examine individually. But when we came to a tidal pool carpeted with what looked like gorgeously purple pincushions, I called a momentary halt.

Sea Urchins Bore Holes in Stone

Here was a whole colony of sea urchins, of a species I could not pass over, if for no other reason than the intriguing length of its name, *Strongylocentrotus purpuratus*.

Each urchin sat in a form-fitting cavity, or pothole, which its hundreds of sharp spines

*See "Unsung Beauties of Hawaii's Coral Reefs," by Paul A. Zahl, NATIONAL GEOGRAPHIC, October, 1959.

—probably scraping in a rotary fashion—had excavated from solid rock (below). The spines no doubt wear down during the process, but they constantly repair themselves by growth, whereas the rock does not.

The advantage of the pocket was obvious when I tried to remove the occupant from one. The sea urchin instantly pressed the tips of its spines against the inner cavity walls, tightening its position so that removal was practically impossible.

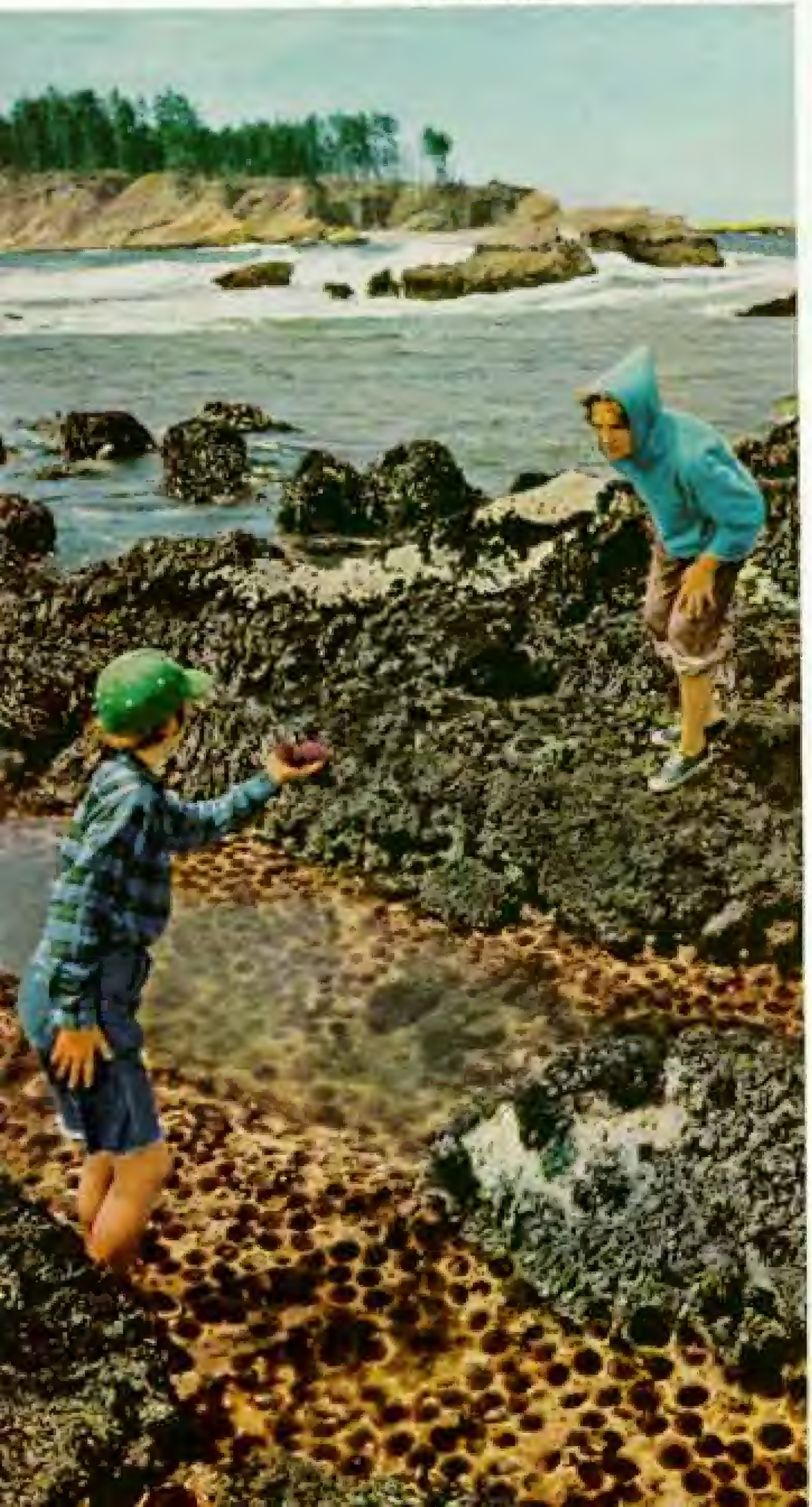
When there is little surf disturbance, some urchins come out of their pockets to feed on algae and organic debris. Others, larger than the openings of their crypts, were self-imposed prisoners and had to rely on food washed in by the surf.

"Dune Scooters" Ride Sand Hills

A few days later I stood on the hump of a huge sand dune at Hauser, 11 miles north of Coos Bay. I really crouched rather than stood, for the wind that had battered me all the way up was even stronger here.

A sheet of fine sand, blowing off the windward side of the dune crest and accumulating on the other, was pushing the entire dune ever so slowly in the leeward direction. As far as I could see, hundreds of these great ripple-surfaced hills were "walking" along slowly in just this way.

With one hand on my hat, and the other fumbling to adjust a camera, I waited. There they came at last, my wife and the two children, seated in the bright-orange jalopy of Norman Hanson, a young Ore-



Each Prickly Sea Urchin Sits in Its Own Pothole

Successive generations of purple sea urchins have created homes for themselves by patiently boring into surf-washed rocks. When disturbed, they wedge themselves into their burrows. Spines of *Strongylocentrotus purpuratus* can cause infection if broken off beneath the skin. Eda Kristin Zahl found this colony in a tidal pool near Sunset Bay. She holds specimens of the living pincushions for her mother's inspection.

Feather boa kelp (*Egregia menziesii*) grows to a length of 24 feet. Paul and his sister plucked this frond from the sea off Yachats.

gonian who takes tourists on thrill rides across the extraordinary world of piled-up sand.

The three passengers held on for dear life as Norman gunned the balloon-tired vehicle up to the crest's edge, then, amid shrieks of delight and terror, zoomed over the top (next page). I held my breath as the "dune scooter" swooped down, then sped up the steep slope of another dune, and disappeared.

Scores of coastal residents indulge in this sport, which they call "dune-busting." They revamp old cars with hang-on seats and oversized, low-pressure tires. Then away they go!

These sand dunes, part of an incredible Sahara-like belt, extend 50 miles or more along the mid-Oregon coast from Coos Bay to north of Florence. They originated with the uplift of the continental shelf, ages ago. Surf continuously pulverized the sandstone shelf as it rose, and onshore winds did the rest.

Feeling like a Foreign Legionnaire, I spent a full ten minutes beating the sand out of my hair and clothes while I waited for my family to return. Their dune scooting adventure was the fulfillment of a long-standing promise to the children. Back in the car at last, we made ready for the next item on the day's agenda: smelt fishing south of Coos Bay.

The home of Lee and Lena Weltzheimer perches like an eyrie high above the boundless Pacific. We stopped there for travel directions. But when Mr. Weltzheimer led us to the seaward edge of his property and pointed down over a sheer drop-off, we lost all thought of leaving. There, waist-deep in the surf, stood groups of people with big dipnets in their hands. After one look, our children ran down a path to join in the sport.

Smelt Fishermen Challenge Surf

It was exciting to watch these smelt fishermen, perhaps 50 local Oregonians, challenging each incoming breaker with the downsweep of their powerful nets (next page). If the smelt happened to be running, the nets would emerge sagging with a silvery catch of perfect frying-pan size.

"Sometimes when a run is due," said Mr. Weltzheimer, "gulls begin to gather, and a few hair seals start bobbing up and down in the swells. If the sea isn't rough, I can see the schools maneuvering for the move-in—dark blotches just under the surface. Must be tens of thousands in each school."

Crowding the foamy crest of each incoming breaker, female smelt swim beachward, ready to deposit their load of pinhead-sized eggs. Just as the breaker spends itself, two or

BY EXTACHROME BY PAUL A. ZAHL, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Handful of surf smelt may be fried, broiled, or baked. Firm-fleshed *Hypomesus pretiosus* ranges from northern California to northwestern Alaska.

Dippers scoop glistening fish from foaming surf south of Coos Bay. When running, masses of smelt ride the surf into the shallows to release their eggs.

Dune scooter swoops down a slope near Hauser with a roller-coaster effect. Shifting sand stretches 50 miles along the shore north of Coos Bay. Trees slow but fail to halt the dunes' relentless advance.

Ebb tide exposes sea stars encrusting a ledge off Harris Beach State Park. Cut a starfish in half, Dr. Zahl explains to the boys, and two will grow. Sea stars cling to surf-swept rocks by suckers at the ends of hundreds of tube feet; a lever may be needed to pry one loose. Along this stretch, high tide reaches seven feet above the low-water mark.

more males squeeze alongside each female, pressing her between them. This action either forces out the ready roe, or stimulates its expulsion. The male fish simultaneously release milt.

In a second or two it is all over, and the prospective parents are washed back to the sea or, if stranded, catch the next wave. The eggs—10,000 to 20,000 from each female—settle into wet sand and gravel. About two weeks later the tiny smelt hatch and are washed seaward by another tide.

"When the smelt are really running, you can fill a bucket in no time at all," said Mr. Weltzheimer. "My sister-in-law has caught more than 85 in a single dip; I can claim only about 60."

I saw a roller break over the heads of two staunch fishermen; they scrambled ashore, thoroughly doused. "Couldn't that be dangerous," I asked, "especially when there's an undertow?"

"They take chances," my host replied, "but in all the years we've lived here, there hasn't been a single serious accident."

Some fishermen had nets with special pockets where successive catches accumulated; others with ordinary nets had to heave each dip's catch back onto the beach, where a wife or child picked it up. Our children, I noticed, got the idea quickly. Now they too were scurrying about, retrieving for new friends.

"Want to borrow my net?" suggested Mr. Weltzheimer. "You might have some luck down there." But before he could tempt me further, his wife asked us to stay for supper. A feast of smelt was all ready.

We stayed, relishing every savory morsel of the tender baked fish. After supper my wife asked for Mrs. Weltzheimer's recipe,

which included olive oil, vinegar, spices, and garlic. I asked where she thought she was going to find fresh Pacific smelt back home in the District of Columbia.

"Any fish would taste good in that sauce!" she replied confidently.

Tube Feet and Pincers Protect Sea Stars

By late August we were on the last lap. Driving southward from Coos Bay, we stopped briefly at Bandon, where an immense offshore rock displays the perfect profile of a woman; at Port Orford, most westerly incorporated city on the Oregon coast; at Gold Beach, where the jaws of the Rogue River offer superb chinook and steelhead fishing; and, finally, at Brookings, only five miles from the California border.

There, amid the majestically sculptured shore rocks of Harris Beach State Park, we photographed a marine denizen so commonplace that we had practically ignored it all summer. It was *Pisaster ochraceus*, a crusty, usually five-pointed, dinner-plate-sized sea star, whose colors range from brown through purple, orange, and yellow (below).

As I adjusted the camera, my wife tried to pick up a handsome yellow specimen for closer inspection. Just as I had done with the sea palms, she pulled and strained, but nothing gave. Only when she inserted the blunt edge of a knife under first one ray and then another, did the creature loosen its grip. Many of its little underside tube feet broke away, with their terminal suction pads still clinging to the rock. This, however, was no serious loss. Sea stars quickly grow replacements.

Indeed, it is the remarkable adhesive power of those tube feet that enables sea stars to flourish on surf-pummeled rock ledges. Near by, I saw an orange sea star humped high on a mussel bed under shallow water. I knew that its scores of tiny feet, exerting a slow, powerful pull, would eventually force apart

Sea stars spangle a tidal pool off Cape Arago. Gluttons for mollusks, starfish also consume barnacles, dead fish, and sea anemones. To open a bivalve, they wrap around the shell and pull with their tube feet until the victim's shell-closing muscle tires. Five-rayed *Pisaster ochraceus* attains a span of 14 inches and has several color phases, among them orange (center), brown (right), and purple (page 710). Many-rayed sea star at top attains two feet in diameter and may shed an arm or two even if handled gingerly. Ten-armed, two-toned sun star at left comes from offshore waters.

Rusty hulk of the *Peter Iredale* haunts Fort Stevens State Park. A gale drove the British windjammer aground in 1906. Dr. Zahl and his children collect barnacles from the derelict's mast. To survive exposure when the tide wanes, barnacles trap water inside their limy plates. A Japanese submarine shelled the park in 1942.

the mussel's valves so that the star could banquet on the flesh within.

Most sea stars are equally well equipped for defense, especially against such squatters as barnacles and borers. At certain seasons billions of the spawn of these species crowd the surf, competing for a surface on which to settle. But covering the rough upper side of each sea star are thousands of tiny stalks, each tipped with a nearly microscopic set of pincers. Any young barnacle, mussel, or unwary borer seeking to attach itself there is summarily pinched to death.

Youngsters Brighten a Surf-side Picture

Three boys in blue jeans came over to see what we were doing.

"Hi," I greeted them. "How would you fellows like to join these starfish for a NATIONAL GEOGRAPHIC picture?"

There were eager nods, and the boys piled in close to a cluster of specimens and froze into tintype poses. "When will the picture come out?" one whispered.

"Never," I replied, "unless you loosen up and look interested. Just suppose you'd never seen a starfish before."

That did it. My wife, who had backed away, got the picture (page 732).

"You boys on vacation?" I chatted.

"Yep," replied the spokesman, "we're staying for a whole week. It sure is keen out here on the beach."

I nodded in complete agreement, although "keen" didn't begin to describe this or any other part of the Oregon coast. But what words could? I looked around me, at the breath-taking panorama of rocks and sand and sea. The only way to know the Oregon coast, I thought, is to go there.

Notice of change of address of your NATIONAL GEOGRAPHIC *should be received in the offices of the National Geographic Society by the first of the month to affect the following month's issue. For instance, if you desire the address changed for your January number, the Society should be notified of your new address not later than December first. Please give BOTH your OLD and NEW addresses, including postal-zone number.*

sail away
to Europe
on
Cunard's

VACATION ISLAND

This fall and winter the special delights of a Cunard Vacation Island crossing are yours at much lower rates! New low Excursion Fare from November 1, 1961 through February 28, 1962 saves 25% on every Cunard round-trip . . . permits 21 full days in uncrowded Europe. Think of it! Sail round-trip in the stabilizer-equipped superliners Queen Elizabeth and Queen Mary for as little as $627* in First Class . . . $388* in Cabin Class . . . and under $300* in Tourist Class. All the pleasures of Cunard hospitality—international cuisine, impeccable British service, fun afloat—just as they are in any season. Before or after Excursion Fare dates, and for extended stays in Europe, you can still enjoy the substantial savings of Cunard Thrift Season. Discover for yourself . . . there's no bigger bargain on the Atlantic than a Cunard crossing!

*Minimum extra round-trip to England, to France slightly higher.

Cruise vacations, too: Caronia to the South Pacific and Far East, Jan. 27, 1962, to Mediterranean, May 1, 1962 . . . Mauretania Winter Sunshine Cruises to the West Indies, Dec. to Apr., or 18-day Mediterranean Cruise, Feb. 3, 1962.

Cunard by air: Round-trip Cunard Eagle Airways fares New York-Bermuda $95 Tourist, Miami-Nassau $33 Tourist; Miami-London $500 Economy. Consult your travel agent.

CUNARD LINE
CUNARD EAGLE AIRWAYS
Main office in U. S.
25 Broadway, N. Y.

Getting there is half the fun . . . GO

CUNARD

QUEEN ELIZABETH · QUEEN MARY
MAURETANIA · CARONIA · SYLVANIA
CARINTHIA · IVERNIA · SAXONIA

See Italy first

ANY SEASON IS HOLIDAY SEASON IN ITALY

Great mountains with lots of snow for winter sports . . . sunny beaches and sparkling lakes for summer relaxation . . . natural and man-made beauty everywhere . . . picturesque villages and magnificent cities . . . art collections unique in the world . . . fashionable shops with exquisite products of the local handicrafts . . . superb cuisine and delicious wines . . . a gay social life, cultural events, folklore . . . it's all there!

SEE YOUR TRAVEL AGENT NOW!

ITALIAN STATE TOURIST OFFICE—E.N.I.T.
Palazzo d'Italia, 626 Fifth Avenue, New York 20, N.Y.
333 North Michigan Avenue, Chicago
International Trade Mart, New Orleans
St. Francis Hotel, San Francisco

AIR-INDIA
Maharajah Holiday in Spain!

Two days each in London and Paris, plus 11 sun-drenched days in Spain—all for just $559 including air fare. Tours Leave Every Friday From New York Through March 11. Send coupon now for full details . . . or see your travel agent.

Air-India, 410 Park Avenue, New York 22, New York
Send me full information about Air-India's exclusive Maharajah Holiday Tour of Spain, por favor.

NAME_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

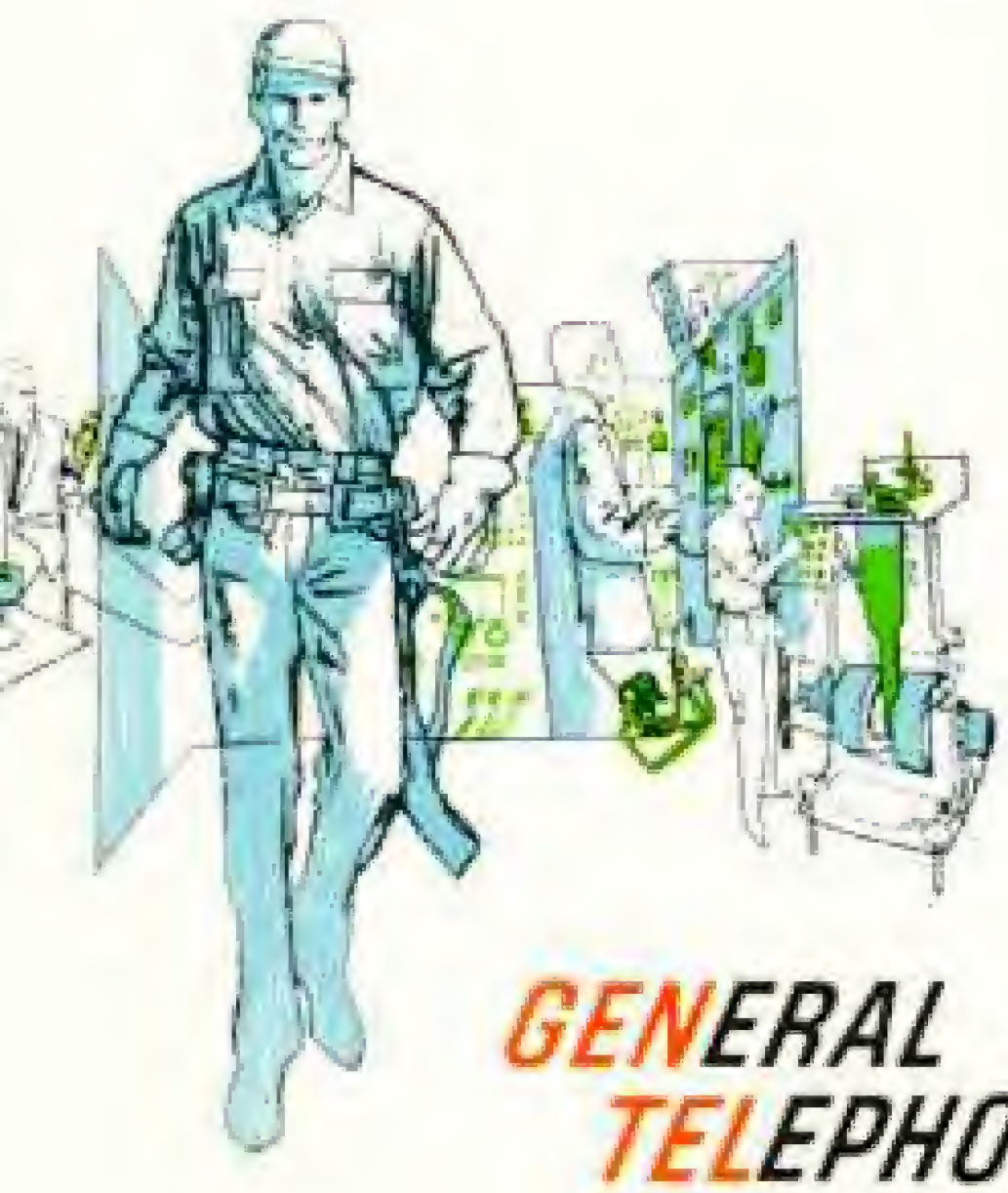
SEPT. 58

Christmas is 16 Golden Days at Boca Raton

Yuletide takes on a golden glow from December 17th through New Year's. Whether you come for golf with Sam Snead, our mile-long ocean beach and cabana club, the Holiday festivities or simply relaxing in a setting of tropical splendor, come to Boca for Christmas. Write R.G. Leggett or call your Travel Agent.

An Arvida Hotel, a subsidiary of Arvida Corporation
National Representative: ROBERT F. WARNER, INC.
New York • Chicago • Washington • Boston • Toronto

Charting our own course



Over the years Gen Tel has become a large and important part of the nation's vast communications network.

In fact, Gen Tel is today the largest of the many independent telephone companies that supply a substantial share of America's great and growing communications needs.

By striving for strength through self-reliance, Gen Tel has become a fully integrated communications system—with separate operating, manufacturing and research facilities.

Although we chart our own course in providing modern communications in 31 states, we contribute to the economic growth of the entire nation by drawing on hundreds of businesses, large and small, for many of our needs.

We at General Telephone & Electronics will continue to build on the principle that self-reliance is the nation's strength, as it is our strength. By charting new courses, we intend to forward our progress and that of America through more and better communications for home, business and national defense.

General Telephone & Electronics Corporation, 730 Third Ave., N.Y. 17.

GENERAL TELEPHONE & ELECTRONICS

Don't buy any organ until you try this one...

built by C. G. Conn, Ltd.
the world's largest manufacturer
of band instruments...
since 1875

Come see and hear the noticeable difference in a Conn. Bring this ad to your Conn dealer now for *free* "Instant Music" lesson...Conn's easy, color-coded method that will have you playing in *minutes!* Seven superb models, from $995. For address of your closest Conn dealer write: Conn Organ Corp., Dept. NG-1, Elkhart, Indiana.

CONN ORGAN

Loafing or playing BERMUDA is the place to go

FREE

Write for new four-colour booklet, "BERMUDA". Mail this coupon today.

"BERMUDA", Dept. N-111
620 Fifth Avenue, New York 20, N. Y.
Please send the Bermuda Vacation Kit to:

NAME _____

STREET _____

CITY _____ STATE _____

20 x 50

AMAZING OFFER!

$29.95

Denied Now Glasses? Tremendous power. Brings all objects 20 times closer. Coast-directed. Achromatic. With 50 MM front lens (2" across) assures greater illumination and sharp crisp images at all distances. Weighs 27 oz. 5" high. Instant focus adjustment. Streamlined design and new, lighter feel amongst all usual features make these jump powered glasses easy to hold, easy to use. Hand-rubbed finish case.

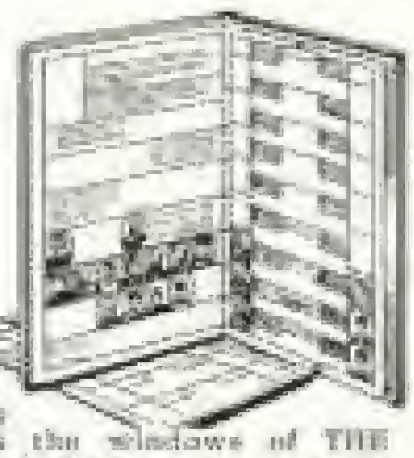
30-DAY-NO-RISK-TRIAL If not satisfied return for full refund. Made in Japan. Leather case and straps included. Add 18% Fed. tax plus $1.00 postage and handling. C.O.D.'s require $5.00 deposit.

UNITED BINOCULAR CO., Dept. N-999
9963 S. Western, Chicago 20, Illinois *Dealers Wanted*

The LIFETIME CHRISTMAS GIFT

"The RECORD OF MY ANCESTRY"

BAILEY'S Photo Record with the Famous CUT-OUT Windows



The expert's way of preserving your family records. Endorsed by leading genealogists everywhere. Your family history is seen at a glance through the windows of THE RECORD OF MY ANCESTRY. For beginners or experts — compact, complete, easy to use. Full instructions with each book. In use over FIFTY YEARS, in its SIXTH EDITION.

WRITE FOR FREE ILLUSTRATED BROCHURE

ORDER NOW: 120 pages 10 X 14 inches. Bound in beautiful FABRIKOID $15.00, Cloth Binding $12.00, Genuine Leather Binding $20.00. Ppd. C.O.D.'s accepted.

FREDERIC S. BAILEY, Publisher
Dept. G-1 BOX 254 Quincy, Massachusetts

Sold by — Brentano's, N.Y. — Marshall Field, Chicago — J. L. Hudson, Detroit — Goodspeed's, Boston.

LIBERTY MUTUAL

the company that stands by you

If only he hadn't gambled on worn-out tires—

POOR JUDGMENT BY A CARELESS "IF-ONLY" DRIVER can force you to the wall: car smashed, yourself and others hurt, facing litigation and court appearance. Here's how Liberty takes over policyholders' troubles. ■ Liberty's 24-hour claims service goes to work if your car needs repair or replacement, pays the wrecker, garage and paint shop. Liberty takes care of you and your passengers: Medical Expense coverage pays for emergency-ward treatment and hospital care. Liberty has the manpower to locate witnesses and dig out evidence to defend your case in court. If there's an attachment on your car, we pay the premiums on bonds to release it. If civil suit is brought against you, we pay court costs, legal fees and judgments up to the limit of your policy. You start all this simply by calling any Liberty Mutual office and asking for help. ■ We are a policyholders' company, owned by policyholders and run by policyholder directors. We have insured careful drivers at low cost for over 40 years. Why don't you switch to Liberty ... when your present insurance expires?

LIBERTY MUTUAL INSURANCE COMPANY • LIBERTY MUTUAL FIRE INSURANCE COMPANY • HOME OFFICE: BOSTON

Get the jump on Spring! Call **DAVEY**

...to take the pressure off your Spring gardening

What a help it would be if you could do some of next Spring's gardening *now!* You can! It's so easy to lessen the Spring rush of feeding and planting and pruning shrubs and trees.

A call to Davey now will unburden you of much of your concern for tree care in the Spring. Did you know that trees go on feeding until the ground is frozen? That's why a Davey tree expert can give your trees their deep-root Spring feeding now. You'll be sure your trees will have every chance of reaching their fullest vitality for a beautiful Spring awakening and lush summer showing.

Let trained Davey men prune away broken or dead limbs now, too. There'll be no unsightly bare branches to mar your trees' first burst of Spring beauty. And there's still time for experienced Davey men, using the most modern techniques, to brace or cable weak forks and heavy limbs, before winter storms split and deform your trees—perhaps beyond repair.

Look up DAVEY TREE SERVICE in your phone book or write:

DAVEY TREE EXPERT CO.

Kent 11, Ohio

MARTIN L. DAVEY, JR.
President

THE OLDEST AND LARGEST TREE SAVING SERVICE IN THE WORLD

DAVEY TREE EXPERT CO.

Balda®

DEPENDABLE Travel Companion

Highest rating for camera or travel mate is DEPENDABILITY! The **automatic 35mm Super BALDAMATIC** I—with electric eye coupled rangefinder, luminous-frame viewfinder—was designed by famed West German craftsmen for **uncanny dependability... perfect pictures! Just sight 'n shoot!** (or switch to manual setting). Famous Compur shutter—speeds up to 1/500 sec.—45mm f/2.8 Color-Baldanar lens. Only **$109.50** — at fine camera stores.

KLING PHOTO CORPORATION
257 PARK AVENUE SOUTH, NEW YORK 10, NEW YORK

LUNDSTROM SPACEMASTER

SOLID-DESIGN, ADJUSTABLE-SHELF BOOKCASE ONLY $53.50 COMPLETE

3 shelves adjustable every ½ inch, overall size 33¾ inches wide x 41 inches high.

Here at last is a solid-design bookcase with beauty and utility. The Lundstrom Spacemaster is unusually flexible . . . with shelves adjustable in half-inch intervals. Accommodates hard-to-fit books. Extra shelves available. Finished in rich mahogany or walnut satin lacquer. With sliding glass doors $10.50. Lundstrom bookcases sold direct since 1899 — guaranteed to satisfy, save you the middleman's profit.

Color Icon Ads at write for free catalog No. 1161 showing complete line, factory prices.

C. J. LUNDSTROM MFG. CO.
Little Falls, N.Y. Since 1899
New York Showroom: 482 Fourth Avenue, 10th floor

Fort Lauderdale

for the fun of it!

■ For sights, delights and the widest choice of things to see and do, it's Fort Lauderdale for the fun of it! Before visiting this city you'll want our new colorful 16-page brochure. It's yours for the asking. Filled with facts and spectacular photos to help you plan your trip and get the most out of it.

FREE Send for brochure now. Just mail the coupon.

City Information Dept. • Room 1161-G3
P. O. Box 1161, Fort Lauderdale, Florida

Please send the new brochure to:

Name_____

Address_____

City_____ Zone____ State_____

Bright bouquets cost only pennies in Peru, just one sample of the bargain shopping you'll find from Panama to the Argentine

Delightful dances enliven your trip wherever you wander in uncrowded Argentina

Expect a record catch wherever you toss a hook in the beautiful Chile-Argentine lake country

Panagra slashes Jet fares to South America

Dramatic cuts in Panagra jet fares make the world's friendliest continent one of the biggest travel bargains ever. No jet surcharge—no time limit. New Jet Economy fares good all year long.

And what wonderful things to do with the savings Panagra tucks in your pocket! Treasure-hunt for silver in timeless Indian markets. Fall in love with gilded, sculptured cathedrals. Catch your breath watching a breakneck game called *pato* in Buenos Aires. Cruise on hidden lakes that mirror the mighty grandeur of the Andes.

Panagra expands jet service

Panagra now flies 6 jets a week to Buenos Aires, 5 to Santiago, Chile and daily jets to Lima, Peru . . . all at new, low fares. No change of plane over the routes of National, Pan Am and Panagra. Call your Travel Agent or Pan Am. Sales Agent for Panagra.

For your copy of a 130-page book "How to Get the Most Out of Your Trip to South America," send 25¢ to Don Wilson, Room 4432, Chrysler Building, New York 17, N. Y.

PANAGRA

WORLD'S FRIENDLIEST AIRLINE

Diamonds will recall your finest memories

This is a time for diamonds. Your anniversary deserves the only gift that keeps the shared meaning of the past and present shining into the future. This year, let a diamond gift make memorable that special anniversary, or important birthday, a debut, the birth of a child, or any significant event.

A trusted jeweler can help you choose a lovely diamond gift from stock—a pin, earrings, a dinner ring or bracelet. Or, he can design a one-of-a-kind original. Whether you spend $100, $500, or more, diamonds give your gift significance, enduring value.

A gift she'll treasure beyond all others

IF YOU CHANGE YOUR ADDRESS

Notice should reach the NATIONAL GEOGRAPHIC by the first of the month to affect the following month's magazine. For instance, if you desire the address changed for your June number, the Society should receive notice of your new address not later than May first.

The National Geographic Society, Washington 6, D.C.

OLD ADDRESS:

NAME (please print)

STREET AND NUMBER

CITY ZONE STATE

NEW ADDRESS:

STREET AND NUMBER

CITY ZONE STATE

Brand new '61-'62 edition of the travel guide that was read by over 15,000,000 persons last spring!

Full color pages on Europe's pleasures by TV star Mitch Miller and Edward Streeter author of "Father of the Bride"

How to see Europe on $5 a Day

"Open House", Europe's latest attraction

Planes with a sky high personality

The ABC of stretching your travel dollar, including extra cities at no extra fare

Tips on packing, customs, currency and other travel helps

How to rent or buy a car in Europe

Why do thousands of readers (except Egbert!) crave this temptatious brochure?

It's heady stuff, that's why. In fact, it's too powerful for dreamy souls like Egbert who don't dare face the travel urge of even a picture postcard from Europe.

This SAS "Treasure Chest"... free!... features articles by famous personalities. It's filled with fascinating pictures. It describes "Open House" in Europe during fall and winter, plus SAS fare reductions of up to $136 for 17 day jet economy excursions, transatlantic or transpolar. It sets up tours to everywhere for every season of the year. It adds ideas on seeing Europe for $5 a day. And all this temptation is yours at your SAS travel agent or with the coupon on the right!... Why, Egbert. You, too?

SAS G-111

SCANDINAVIAN AIRLINES SYSTEM
638 Fifth Avenue, New York 20, N. Y.

I SURRENDER! Send me your FREE alluring "Treasure Chest of World Travel."

Name_____

Address_____

City_____ State_____

My SAS Travel Agent is_____

What do you want in a slide projector ?

Fully automatic controls ?.. pictures that always stay in focus ?.. remote control forward and reverse ?.. instant pop-up slide editing ?.. zoom lens ?.. brighness control ?.. pre-view panel ?.. illuminated central control panel ?.. ability to show all slides — 35mm, Bantam, Super *and* 2¼ x 2¼ — automatically in the same tray? Prices start at under $80. Most dealers offer you all these important things for a lifetime of enchanted evenings **plus — from now until Dec. 25 — enough non-spill 40-slide trays for 520 slides at no extra cost with**

BAUSCH & LOMB
BALOMATIC

THE FUN WAY TO TRAVEL

Want to explore exciting new places? Or maybe you'd prefer the fun of a warm sunny beach or relaxing beside some inviting stream. Or perhaps you know a road somewhere you'd like to follow to the end. It's all the same with an Airstream Land Yacht . . . good beds, bathroom, hot and cold water, refrigeration, heat and light independent of outside sources wherever you go. Road voyaging with an Airstream means real travel independence — no time-tables, tickets, packing. It's the exciting, better way to travel here in North America or anywhere in the world.

write for free booklet "World At Your Doorstep"

AIRSTREAM INC
10 CHURCH STREET, JACKSON CENTER, OHIO
12504 S. FIRESTONE, SANTA FE SPRINGS 10, CALIF.

ELECTRO-WARMTH

(The original on-the-mattress bed warmer.)

You will love the pleasing sensation of complete relaxation as the soft radiant warmth soothes the nerves and induces deep restful sleep. The gentle rising warmth improves circulation, guards against colds and cramps, and drives out the cold and dampness from your bed. Use the top cover of your choice. Temperature control handle at the head of your bed. ELECTRO-WARMTH has 4 times more warming element than any other bed warmer appliance, sleep as clean as your mattress, covered with your bed spd. One year repair & Year warranty. Factory or user service. Send for additional information or

ORDER DIRECT from
THE ELECTRO-WARMTH CO.
4115 -B- Aspen St. Washington 11, D. C.

Double or Single Bed
$24.95
Postpaid

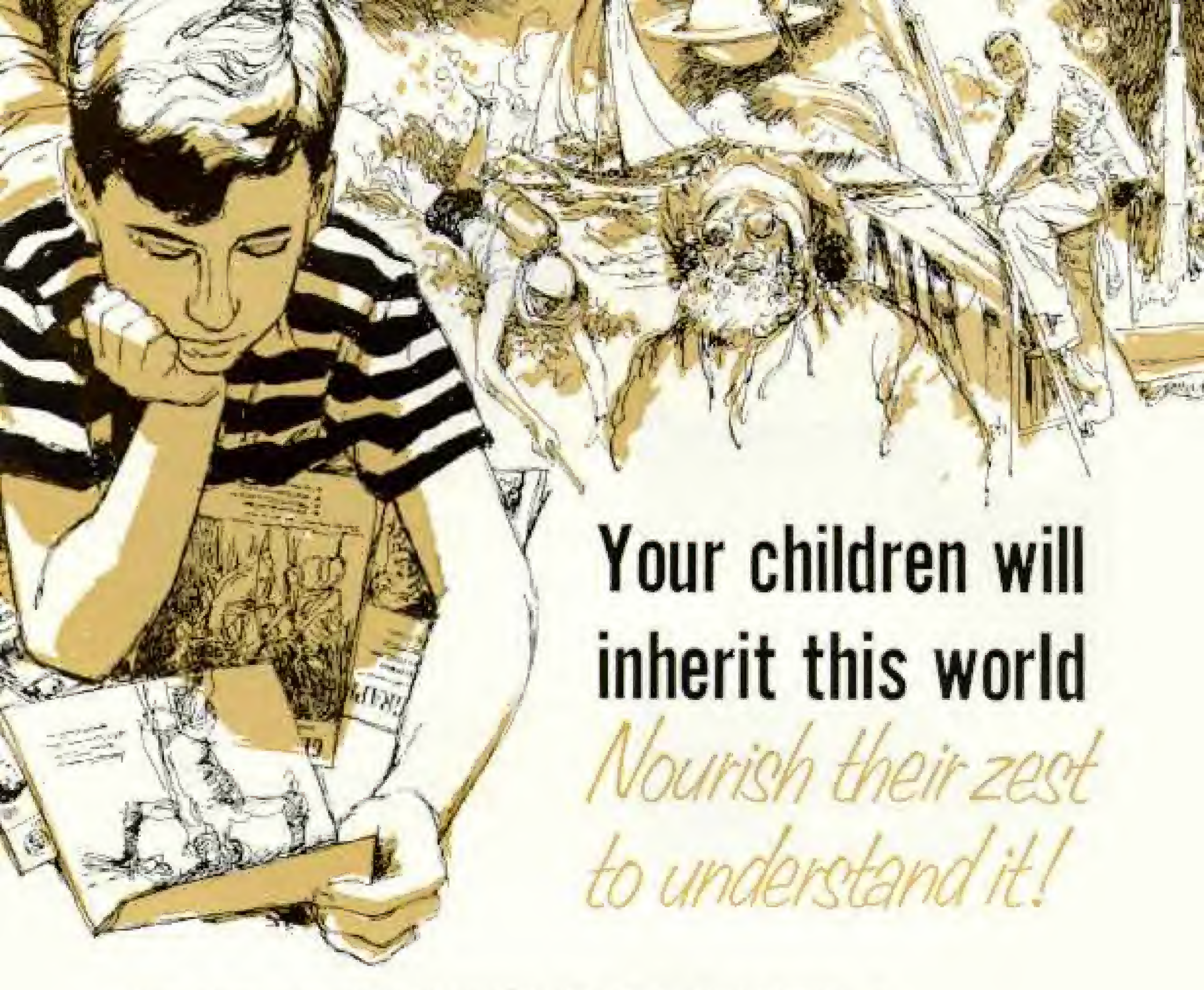
Family Arms

The Cost of Arms of your forbears is probably among 100,000 family blazons from which we produce accurate Heraldic Wall Shields for home decor in full colour and high relief. Size 13" x 10"

$20 POSTPAID

Checks are returned with information and official book if the Arms cannot be traced

YORK INSIGNIA LTD., YORK ENGLAND



Your children will inherit this world

Nourish their zest to understand it!

Give them the GEOGRAPHIC SCHOOL BULLETIN—a wholesome, exciting publication of their own—to help them learn how people live, work, and play in other lands.

Admired by teachers and students alike, the award-winning BULLETIN becomes even more stimulating as new features are added. Lively picture stories on nature, science, history, peoples, and places fill its pages. They are keyed to the child's level to capture the imagination even of pupils in the elementary grades.

As an educational contribution, the National Geographic Society produces the BULLETIN through its School Service Division and makes it available at far below actual cost. It is issued weekly during the school term.

Give your children a one-year subscription—or take advantage of the economical three-year rate. The first issue for this school year will go into the mail soon.

☐ 1 Year $2

30 issues
Canada, $2.25
Elsewhere, $2.50

☐ 3 Years $5

90 issues
U.S. only

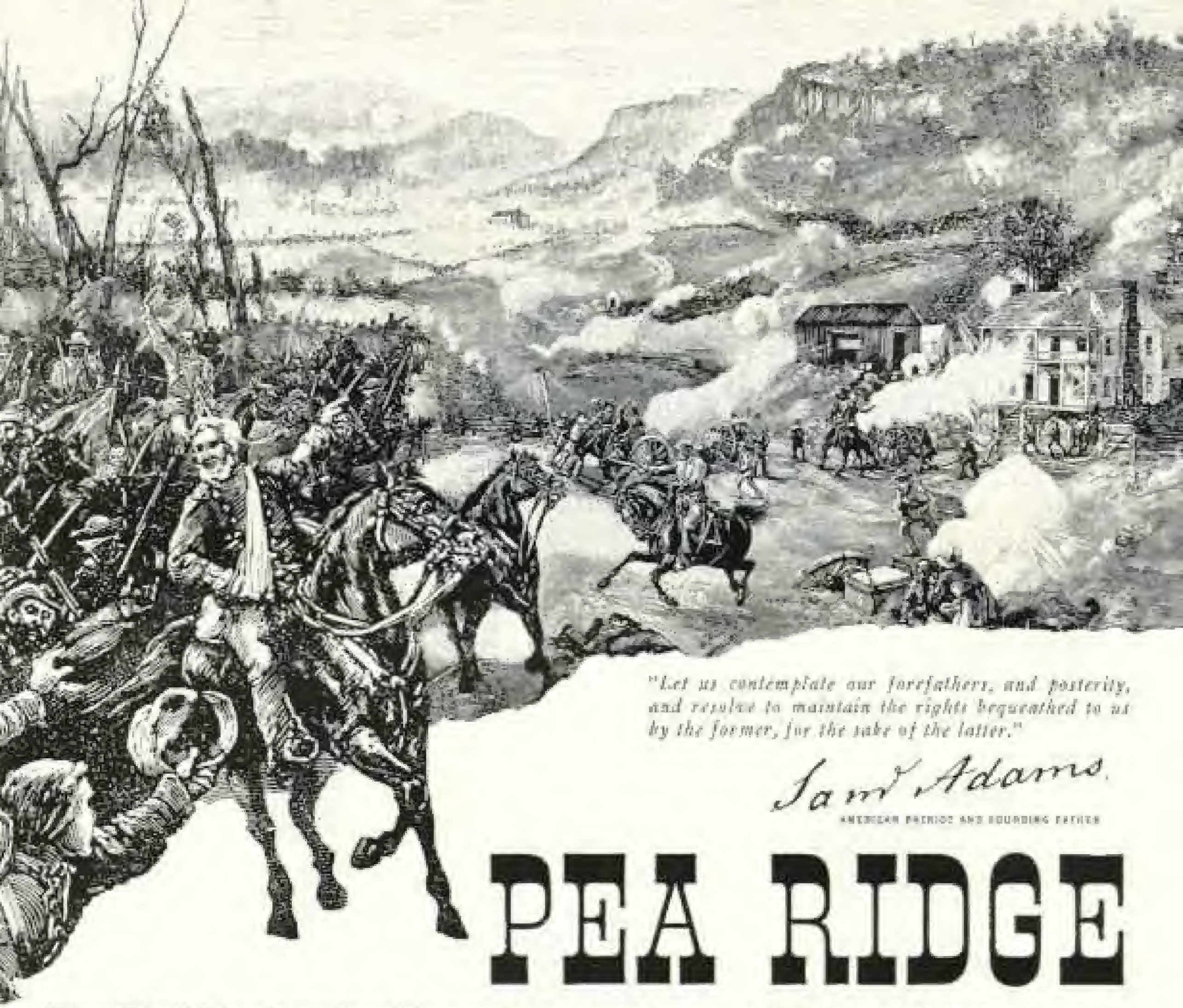
NATIONAL GEOGRAPHIC SOCIETY
Department 111, Washington 6, D. C.

Enclosed find $..... for ..... subscription(s).
Send *Geographic School Bulletin* to:

NAME

STREET

CITY, ZONE, STATE



"Let us contemplate our forefathers, and posterity, and resolve to maintain the rights bequeathed to us by the former, for the sake of the latter."

Sam'l Adams.

AMERICAN PATRIOT AND FOUNDING FATHER

PEA RIDGE

The Civil War battle with cowboys, Indians and "Wild Bill" Hickok, too

The Ozarks, beginning in Arkansas and running northeasterly into Missouri, are a wonderful blend of scenery, history, and mountain folklore. You'll find all three on Pea Ridge Battlefield. The scenery is unequalled in any National Military Park. The history? *Here a Federal victory saved Missouri for the Union.* And the folklore tells of "Wild Bill" Hickok, Wild West cowboys and Indians, and tales of valor you won't believe until a Park historian shows you where it all happened.

"Wild Bill" fought at Pea Ridge as a Union scout, shooting from the hip. Choctaw, Chickasaw, Seminole, Creek and Cherokee Indians went on the warpath for the South, their warwhoops matching the rebel yells of Texas cowboys enlisted as cavalry men.

In the little clearing just below the "covered wagon" in our illustration, twenty-two devil-may-care Confederate horsemen charged an entire regiment of infantry, captured their flag, and chased them into the woods. Along Little Sugar Creek, you can walk in the original trenches, after one hundred years still as deeply etched in our land as the battle is fixed in our history.

Pea Ridge Battlefield in Arkansas is being restored by our National Park Service. You'll enjoy being there on next May 7 when it will be formally dedicated. The pomp and ceremony you'll see would perhaps seem needless "toofaraw" to the rawboned frontiersmen who fought here. *But today's Americans will understand, and be grateful for this timely reminder of our heroic past.* And, as old Sam Adams hoped, they will more firmly resolve to maintain our American heritage in this world of angry dissension.

FREE CIVIL WAR MAP. Ask your Sinclair Dealer about Sinclair's Civil War Centennial Map. Shows battle lines of 29 great engagements, colorful illustrations of Civil War battles, uniforms and guns. You'll treasure it as a collector's item!

FREE TOUR INFORMATION. Let Sinclair help plan your trip to Pea Ridge, or other Civil War battlefields during the Centennial. Write: Tour Bureau, Sinclair Oil Building, 600 Fifth Avenue, New York 20, N. Y.

Sinclair A Great Name in Oil

PUBLISHED IN COOPERATION WITH THE CIVIL WAR CENTENNIAL COMMISSION, ESTABLISHED BY ACT OF CONGRESS TO INCREASE AWARENESS OF OUR HISTORICAL HERITAGE – THE MEN AND EVENTS WHICH SHAPED OUR NATION'S GROWTH.

This was the first telephone booth

it was "invented" in 1877. Alexander Graham Bell and Thomas A. Watson had to shout into the primitive telephone on intercity tests. This annoyed their Boston landlady.

Then Watson had an idea. One night he rolled some blankets into a loose tunnel, and crawled in with his telephone. It was dark, it was hot, but it worked. While Watson bellowed, the landlady slept serenely!

but today's serve you better by far, wherever you are!

THE AIRLIGHT BOOTH

Watson's woolly cave has grown into this modern glass-and-aluminum booth, used indoors or out. At night, it's a reassuring lighthouse along city streets and major highways. When you see it, you know that service and protection are at hand.

THE WALK-UP PHONE

As busy Americans make more and more calls, the Bell System makes service even more convenient. This newest public phone, called the Walk-Up, saves lots of time and steps. You'll find it as convenient as the corner mail box.

THE DRIVE-UP PHONE

Like the drive-in movie and drive-in bank, the Drive-Up Phone is a natural for a nation on wheels. Forgot something? Late for a date? Need room reservations miles ahead? Just pull off the road and call — as you would on your own phone.

BELL TELEPHONE SYSTEM

Pan Am offers more Jets to more

Pacific Paradises than any other airline

Nobody covers the Pacific like Pan Am! From California, fly Pan Am's exclusive Great Circle route to the Orient; or from Los Angeles, San Francisco, Seattle and Portland, Jet Clippers® will speed you to Hawaii, Manila, Saigon, Singapore, Djakarta, Hong Kong, Bangkok and Tokyo. And only Pan Am offers Jet service from all 4 West Coast gateways to Fiji and Australia. Stop over wherever you wish.

PAN AM

From the moment you choose Pan Am you enjoy a feeling of confidence—for Pan Am is the World's Most Experienced Airline. And the Priceless Extra of Pan Am's experience is reflected in everything that Pan Am does. It's a great experience to fly *with* experience. For reservations, call your Travel Agent or any of Pan Am's 69 offices in the U.S. and Canada.

®Trade Mark, Reg. U.S. Pat. Off.

WORLD'S MOST EXPERIENCED AIRLINE—FIRST ON THE PACIFIC . . . FIRST ON THE ATLANTIC . . . FIRST IN LATIN AMERICA . . . FIRST ROUND THE WORLD

For smooth, easy writing...there's no substitute for a true fountain pen

THE POINT'S THE REASON! This Sheaffer point is precision-ground for effortless, personal writing in the style you prefer—from extra fine to extra broad. And 14k gold has a knack of adjusting to your way of writing.

A THOUGHTFUL GIFT. Remember birthdays, anniversaries and all gift occasions with a handsome pen and pencil. Choose from Sheaffer's wide selection.

From $5. Illustrated: Sheaffer's Imperial IV Pen, $12.50; set, $17.50

SHEAFFER'S