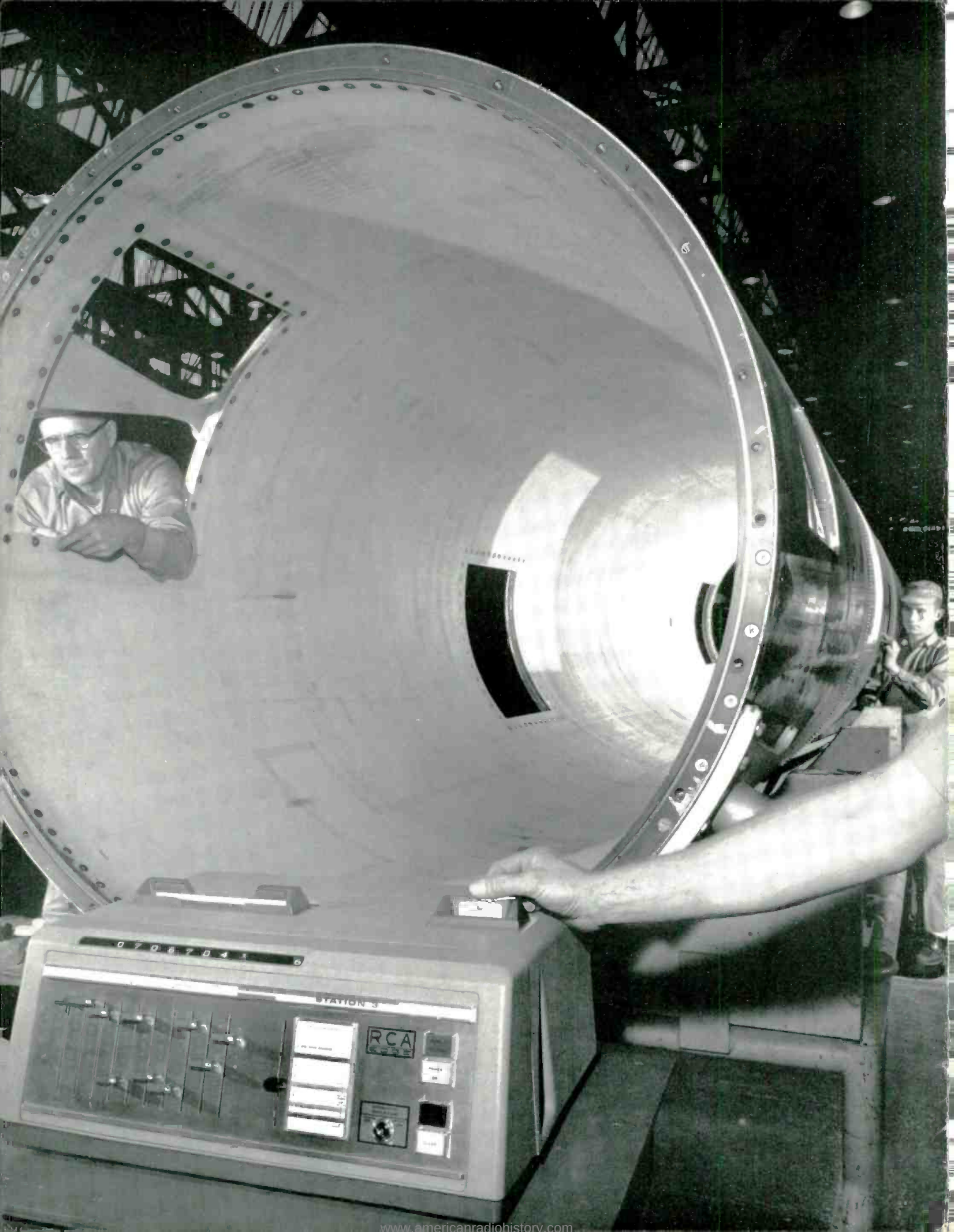
RCA

WINTER
1961/62

electronic age

NEW TOOLS FOR TREND-SPOTTERS

By Luther H. Hodges, Secretary of Commerce



RCA electronic age

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COVER: *A technician produces a kaleidoscopic pattern of color with a demagnetizing coil in a final test on a new RCA color television tube at the company's plant in Lancaster, Pennsylvania. For a comprehensive report on where color television stands now, see article on page 2.*

In this issue . . .

RCA's Electronic Data Gathering Equipment (EDGE) in missile production area at Lockheed, is part of an electronic "factory nerve system" which expedites flow of information within the plant.

RADIO CORPORATION OF AMERICA
30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

DAVID SARNOFF, *Chairman of the Board*, ELMER W. ENGSTROM, *President*,
FRANK M. FOLSOM, *Chairman, Executive Committee*,
JOHN Q. CANNON, *Secretary*, ERNEST B. GORIN, *Treasurer*

THE UPSURGE

IN THREE PRE-CHRISTMAS WEEKS, COLOR TV SALES DOUBLED A YEAR AGO—HERE'S THE EXCIT-

by **JULES KOSLOW**

IN PHILADELPHIA, the president of a TV distributing agency observed: "A number of our accounts have greatly increased their color orders. Several in the smaller eastern Pennsylvania cities are already ordering more color than black-and-white."

In Hartford, Connecticut, the sales manager of a distributing firm noted: "We have orders totaling tens of thousands of dollars for color TV. We're in a state of suspended animation wondering when we're going to get enough sets to fill these orders."

In Los Angeles, a leading television dealer said: "The people out our way are extremely enthusiastic about color TV. Our biggest problem now is getting color TV merchandise."

Mitch Miller "sings along" on color TV

N COLOR TV

FROM THE CORRESPONDING PERIOD
ING STORY BEHIND THIS THRUST

These three comments give evidence of the tremendous surge in color TV, resulting in too few sets to meet the demand. Though the groundswell of color TV has been building up for many months and though knowledgeable stalwarts in the industry have been predicting an imminent color TV thrust, they were unprepared for its explosive force.

"You might say we were caught with our sets down," one distributor wryly observed.

Just how big is the color TV surge? The Radio Corporation of America, which produces the picture tube that is the heart of every color TV receiver on the market today, reported that in order to meet the 250 per cent greater industry-wide demand for picture tubes anticipated in 1962 over 1961, it has authorized a $1.5 million expansion of its internal facilities at its tube plant in Lancaster, Pennsylvania. It also reported that factory shipments of RCA color TV receivers in November surpassed black-and-white in dollar volume for the first time since the introduction of color more than seven years ago.

Significantly, most other color TV manufacturers also are reporting wide acceptance of their lines.

"Since we weren't able to foresee accurately the unforeseeable – the extent of the blast-off in color TV – we've been doing everything humanly possible to ease the shortage of sets," said D. L. Mills, Vice President and General Manager, RCA Victor Home Instruments Division. "We're in full color production at our TV plant in Bloomington, Indiana, but you can only go so fast without sacrificing quality. And that's one thing we won't do. People have come to expect top quality and reliability in color TV sets, and we're determined that *that* is what they're going to get even though some folks – and this includes distributors, retailers, and consumers – may have to wait a short time for delivery."

What has caused color TV to take off now? Most of those close to developments agree that it is not one factor, but a combination of dynamic elements that had been building up over the years and finally coalesced in 1961. These include the following:

- Color programming has increased enormously. Many of the most popular TV shows are now in color.
- The majority of the country's 520 stations are equipped to telecast color, and a growing number of them are doing so.
- Almost all major TV manufacturing companies are now in color; until recently, they had adopted a wait-and-see policy.
- Color TV sets now require less servicing, and the cost of service has been drastically reduced.
- There has been continual improvement of color TV sets so that now the picture is up to 50 per cent brighter; "one set" fine tuning has eliminated adjustment of that control when changing from channel to channel; other refinements have made the sets so simple to regulate that even children can do it.

All these factors have contributed to a new social phenomenon – a "color conscious" public. At the recent Fresno District Fair, the heaviest traffic at the

commercial exhibits was around the color television displays; crowds at times were so formidable that visitors had to detour around the adjacent aisles in the building to get to other displays. An analysis by Denver's Station KBTV revealed that more than four times as many people now drop in on neighbors to view color TV as was the case a short time previously. At RCA's Exhibition Hall, in New York, which is visited by more than a million and a half people annually, over 50 per cent of the inquires concerning TV were about color during 1961; in 1960 the figure was about 25 per cent.

It is this color consciousness on the part of the public that, in the final analysis, broke the log jam that existed since the inception of color TV. As one expert explained it: "Color TV presented one of the most complex marketing problems ever faced by an industry. Many seemingly divergent areas were inextricably interrelated in determining the future of color. Dealers needed more color programs to sell sets. Networks and stations were reluctant to put on more color until advertisers wanted it. Advertisers hesitated until more sets were sold, guaranteeing greater color circulation.

Color tubes in production at expanding Lancaster, Pa. plant.

"Vital, forceful, forward-thinking leaders, such as RCA's Chairman David Sarnoff who had unwavering faith in color television, backed it to the hilt until the public demand became so great that this vicious circle was broken. In its place there is now a growth cycle, in which the interrelatedness serves to stimulate further growth. What is happening now is that dealers are selling more sets. As a result, more advertisers than ever prefer color. More color is being programmed to satisfy the needs of these advertisers. With more programming, dealers are selling more sets."

Is the consumer purchasing color TV because it is a status symbol or because he now considers it as necessary in his house, say, as his refrigerator or his radio? Is color just the icing, so to speak, on the TV cake or is it essential to a full enjoyment of the TV medium?

On the first question, TV dealers, who have first-hand contact with the consumer, report that a greater spread of income groups are now purchasing color TV; and that the majority of purchasers have sold themselves on color television, usually by seeing it in a neighbor's house.

"I don't know much about status symbols," a Midwest retailer recently commented. "But I do know that a man buying color TV in my store is just as often a mechanic with grease under his fingernails as an executive wearing a homburg."

A salesman at Macy's in New York observed: "Most of our customers for color TV are pre-sold. They've made up their minds *before* coming into the store that they want color TV. My impression is that nineteen out of twenty of them already have a black-and-white set."

On the second question, almost all TV critics are outspoken in their belief that color on TV is not a frill but a fundamental. Jack Gould of *The New York Times* observed after the November, 1961, color TV show of Vincent van Gogh's landscapes and portraits that they were "so breathtaking that they allowed only speechless appreciation. Even for veteran viewers of color television, the union of the Dutch genius and the electronic age was like opening a new door on tomorrow's possible cultural vistas . . . Artistically, there's no gainsaying that color could become a marked asset for many shows. Production numbers, which in black-and-white tend to the drab, often acquire a point of view and purpose when seen in color."

"What does color TV offer?" asks Larry Wolters, TV and Radio Editor of *The Chicago Tribune*. "Well, it's exciting, it's thrilling, and it gives a whole new dimension to television. It makes many shows seem alive instead of static, as in monochrome TV."

In *The Boston Herald*, TV Editor Arthur E. Fetridge wrote: "What about the viewer? What does he get from a color set that he doesn't from his old black-and-white job? I'd place the excitement of seeing nature in its natural hues first. Then there is the beauty of well-dressed women, with their colorful evening gowns, sparkling jewels and the tint of their skin. If you've ever seen a Walt Disney animal story in color, particularly one of wild animals in snowy backgrounds, you'll never again want to see a similar picture in black-and-white."

Viewers' letters pouring into the National Broadcasting Company verge on the ecstatic in their enthusiasm. Wrote one couple from Massachusetts: "Our Sunday shows in color are superb, wonderful, thrilling and gorgeous. Disney's Forest Fire movie tremendous . . . We had an elegant evening. We thank you!" Another viewer, from Indiana, wrote: "Thank you for the beautiful color program on van Gogh. We invited many friends who do not have color sets to enjoy it with us. It shows what wonderful things can be done with color." And from California, this letter: "Want to tell you how much we enjoy your color shows and hope for even more of them in the future. We have given up black-and-white almost entirely since buying color TV."

Color programming allows greater satisfaction not only for the viewer but also for the broadcaster. "In programming," said Don Durgin, Vice President of the National Broadcasting Company, "color allows us to develop our imagination to the fullest – to probe the beauties of art or nature or the world's greatest drama – unrestricted by the confining dimensions of black-and-white. From some of the color shows we put on last year, you can see what I mean – the stirring sombre presentation of 'Macbeth,' the rich magnificence of great art masterpieces on 'The Coming of Christ,' the living human documentary of 'Our Man in Hong Kong.'"

In the past year alone, NBC has increased its colorcasting 62 per cent from 1,034 hours in 1960 to 1,670

As people become more "color conscious," color TV displays such as this one at Macy's in New York City draw crowds of shoppers.

hours in 1961. Month after month, NBC color shows rank among the highest-rated TV shows. In 1960, the network had sixteen regularly-scheduled shows in color; in 1961, it had twenty-three.

Many observers believe that it is only a question of time — and a short time, at that — until the other two major networks join the march of color in which a growing number of independent stations are already participating. As of November, 1961, an industry survey revealed that 115 stations in the United States are equipped to originate local color in some form. The number of hours per week devoted to colorcasting on the local level is close to 400, almost triple that of three years ago. In terms of rebroadcasting of network color, 377 of the nation's 520 stations are equipped for network color, covering areas with 98 per cent of the TV homes in the country.

RCA color TV chassis on the assembly line in Bloomington, Ind.

In Chicago, Ward Quaal, Executive Vice President of independent station WGN-TV, which broadcast 1,400 hours of color in 1961, said: "I cannot stress too strongly my feelings on color — that it must 'blossom' across the length and breadth of this land if television is to continue the amazing growth of its first twelve commercial years . . . We believe in color because it is better television."

The enthusiasm of viewers, the acclaim of critics, the increased purchases by consumers, the proliferation of color TV stations, and the distinct prospect of a profit jackpot have propelled eleven other manufacturers to join the color TV market, formerly the almost exclusive province of RCA, which conceived and nourished color TV from the outset. By the beginning of 1962, there were only two major TV manufacturers *not* in color.

Many of the newcomers already have revealed immense enthusiasm as a result of sales. Admiral Corporation reported that at the end of 1961 it had sell-outs of its color sets and a heavy backlog of orders. Magnavox Company estimated that its color set sales in 1961 tripled the number sold in 1960. Zenith, which began marketing color TV in the fall of 1961, announced in December that it is shooting for 100,000 color TV unit sales in 1962, and that it is already oversold on its production capacity for January and February, 1962, in color television. In general, this spurt in sales and optimism about the future of color are shared by other TV manufacturers.

How does RCA feel about this, after having spent more than $130 million in making the dream of color TV a living, vibrant reality?

"We know only too well the meaning of competition," says W. Walter Watts, Chairman and President of the RCA Sales Corporation. "We're going to get it, and plenty of it in the months ahead. The latecomers may harvest some of the crops we've planted. But RCA has the know-how, the experience and the only customer-tested product."

Compelling proof that color television has come of age is the fact that the advertisers are showing greater interest than ever in color. The reasons are not hard to come by. Conservative estimates indicate that a color commercial has at least three and a half times the impact of a black-and-white commercial. Advertisers are realizing more and more that color television refines the selling tool to its greatest extent, combining as it does sight, sound, motion, demonstration, personal salesmanship and the complete realism of color.

Regular advertisers using color commercials now include many of the foremost concerns in the country. In addition to old-time color enthusiasts like Hallmark, Kraft, Chevrolet, and American Telephone & Telegraph, advertisers now include Eastman Kodak, Reynolds Aluminum, the American Gas Association, American Tobacco, American Dairy Association, Douglas Fir Plywood Association, and Ballantine, to name only a few.

The big blast-off in color TV that occurred in 1961 is expected to gain even greater momentum in 1962. The prospects are bright that the dollar volume of the color TV industry in 1962 will double the $100 million mark set in 1961.

A number of persons intimately connected with the TV field expect color television to be the dominant broadcasting medium within a few years. One TV distributor recently put it this way: "The enthusiasm for color is so great that I believe five years from now manufacturers won't be making a set that doesn't have color in addition to black-and-white." ■

'62 OUTLOOK:

GREATER VOLUME AND PROFITABILITY

Electronics is expected to secure its position as the world's fastest-growing major industry, and RCA anticipates notable advances in the key segments of its own business

by **DAVID SARNOFF**

Chairman of the Board,
Radio Corporation of America

THE REBOUND OF THE AMERICAN ECONOMY in the latter months of 1961 should, in my judgment, continue into 1962, promising for industry generally and for the Radio Corporation of America specifically a new year of increased volume and profitability.

RCA rode the economic currents of 1961 with conspicuous success in its established businesses.

Our consumer products had their most profitable year since 1955. Their sales were stimulated by substantial increases in one of the nation's dynamic growth products – color television.

The National Broadcasting Company achieved in 1961 the highest profit in its thirty-five-year history.

The first two units of the nation's front line of defense against missile attack – the massive Arctic Radar installations at Thule, Greenland, and Clear, Alaska – were placed in full-scale operation on schedule in 1961 by the U. S. Air Force and RCA, the prime contractor.

Against the backdrop of these and other corporate

RCA 301 computer systems move toward completion at plant in Palm Beach Gardens, Florida.

accomplishments, the fact that RCA's profits for 1961 will not change appreciably from a year earlier, is due primarily to the costs of launching our newest important business – electronic data processing.

Since we entered the data processing field, RCA has incurred progressively heavier annual expenditures in this new and highly competitive, but rapidly growing business. However, we believe that the year 1961 has brought these costs to a peak. We expect that our 1962 losses in data processing will be approximately half of what they were in 1961. Each dollar gained will, in effect, be a dollar added to next year's profits.

With this potential profit swing, plus the additional profit momentum now being generated by color TV, and by a number of our traditional businesses, we believe that the RCA earnings picture in 1962, and the years ahead, can improve markedly.

DATA PROCESSING

With data processing now established as a basic element of RCA's operations, it is our firm determination to assure for RCA an important position in this vital and expanding field.

RCA's "Dickenson," product of experience and research in color.

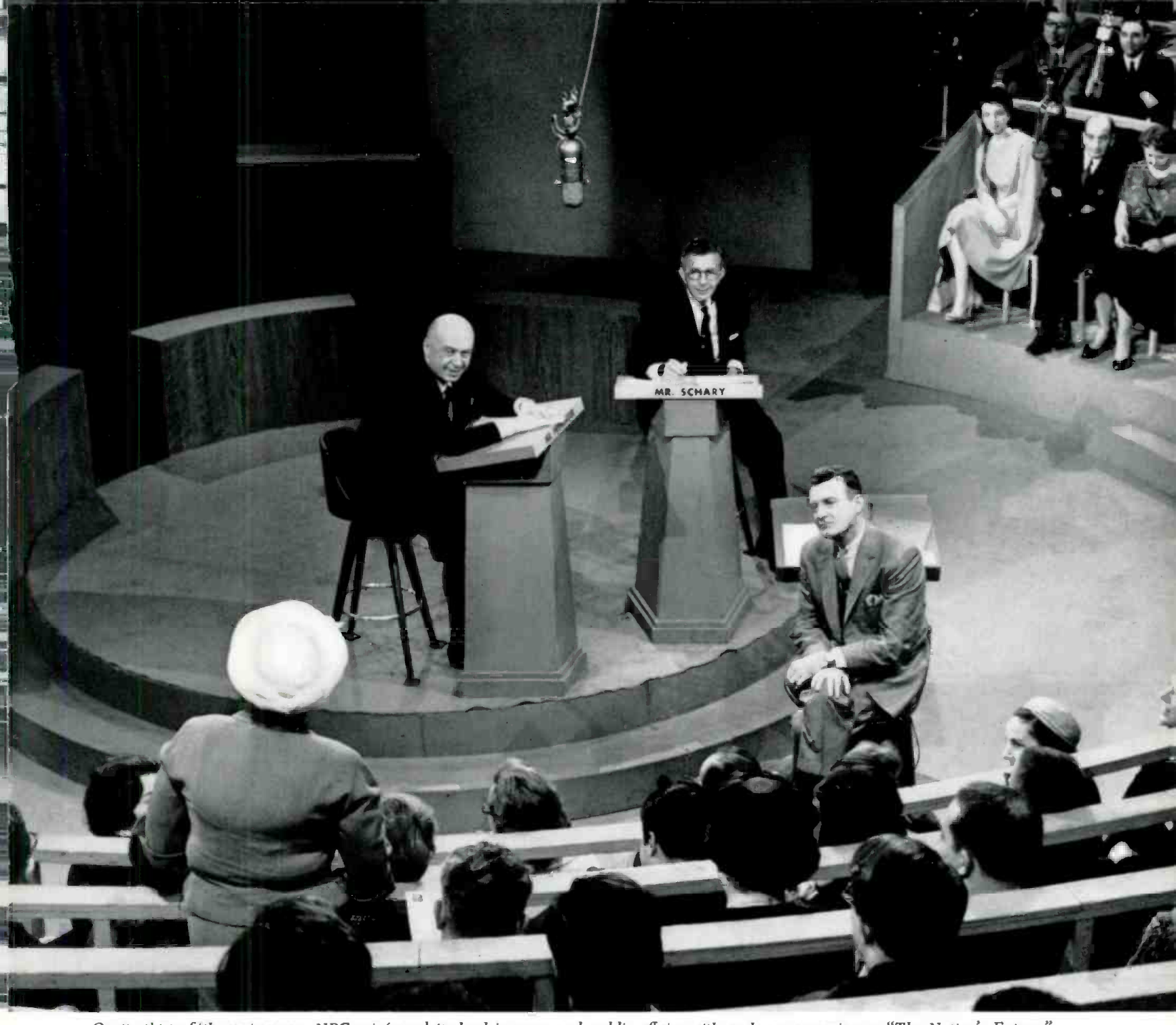
Data processing is fundamentally electronic in character. It is a relatively new electronics business that will change greatly as it develops and matures. As the nation's foremost all-electronics company, RCA has the research, engineering, production and service experience, as well as other resources, to enable it to make important contributions to this evolutionary process, and to establish a profitable business in this field.

- RCA moved significantly into the world computer market by concluding sales agreements for its data processing systems with Compagnie des Machines Bull of Paris, France; International Computers and Tabulators, Limited, of London, England; and Hitachi, Limited, of Japan. The first two of these agreements represent the largest non-Government sales of data processing equipment ever made by an American company. As a result of these arrangements, RCA expects export sales of data processing equipment of between $50 million and $100 million over the next three years. In addition, non-exclusive license and technical aid agreements, providing for substantial payments to RCA, were also arranged with these leading companies in the world market.
- RCA accelerated its program for combining computers with highly sophisticated communications systems for both military and civilian use. As a supplier to Western Union, it began installation of the initial multi-million-dollar automated data switching equipment for the world's most advanced data communications system – the Air Force Combat Logistics Network – known as COMLOGNET. Another automated data switching installation for the world-wide system of RCA Communications, Inc., is planned for completion in 1962.
- Increased versatility, speed and data capacity made the RCA 301 computer one of the most effective in the lower-priced field. The RCA 501 continued to establish good performance records with its customers in government and industry. The RCA 601, considered by many as the most promising large-scale computer in its price class, will be ready for delivery in a short time.

CONSUMER GOODS

With color as its lead banner, the reorganized and consolidated Home Instruments Division registered gains in major competitive sectors during 1961.

- For November, RCA's color set sales surpassed black-and-white dollar sales for the first time since color's introduction to the public in 1954.
- With nearly every major manufacturer now selling color sets, color TV should attain an annual overall industry rate of approximately $200 million in 1962, and substantially more in the years ahead. RCA, as the pioneer and pacemaker of color, expects to share fully in this growth.
- Black-and-white TV sales also were higher than a year ago, with portables leading the way and with RCA increasing its share of the total receiver market.



On its thirty-fifth anniversary, NBC reinforced its lead in news and public affairs with such programming as "The Nation's Future."

• Significant gains also were made in the sale of "Victrola" phonographs and tape recorder products. In this branch of the business, we also expect continued growth.

• RCA's Semiconductor and Materials Division made substantial progress during the year and is now operating on a profitable basis. The RCA Electron Tube Division's earnings ran ahead of 1960.

BROADCASTING

There were many reasons in 1961 for NBC to celebrate with pride its thirty-fifth anniversary as the nation's first broadcasting network. In every aspect of broadcasting, it achieved a front-running position.

• The NBC-TV network substantially increased its gross billings over 1960 and established an all-time record for advertiser use of its facilities.

• The NBC Radio network reversed an industry trend in 1960 by showing a profit and increased its earnings in 1961.

• The NBC Owned and Operated Stations achieved a record profit year.

• NBC strengthened its unchallenged leadership in the vital areas of news and public affairs, and attracted substantially greater audiences for its entertainment programming.

• A record number of 140 advertisers used color broadcasting during the year. Indicative of the trend to color was Eastman Kodak's switch to NBC to co-sponsor Walt Disney's "Wonderful World of Color."

• Alone among networks, NBC advanced the prospects of the entire television industry by broadcasting color programs in record volume. During 1961, its colorcasts totaled 1,670 hours, an increase of 62 per cent over 1960.

DEFENSE AND SPACE

RCA moved into tenth place among the nation's prime contractors for the Department of Defense. RCA is now a leading supplier in this field to the Army, Navy and Air Force. Our total sales to the Government, in the calendar year 1961, established a new record.

• RCA's billings for equipment and services supplied to the space agencies this year were substantial, and are expected to increase significantly in 1962.

• The three Tiros weather satellites for which RCA was prime contractor to the National Aeronautics and Space Administration all functioned far beyond expectations.

• Impressive strides were made in computation systems for military purposes. We received contracts for automatic program and check-out equipment for several series of Atlas missiles; the Digital Information Processor computer for handling and displaying information from the Ballistic Missile Early Warning System; a check-out computer for pre-flight testing of the powerful Saturn booster rocket.

COMMUNICATIONS

RCA Communications, Inc. established an all-time high during 1961 for both volume and profit in its international communications business.

In another area of growing importance – microwave communications – RCA placed in operation a 1,300-mile system linking Alaska, Canada and the United States; and we shipped the first transmitting-receiving units to Western Union for a 5,300-mile transcontinental network expected to be completed at the start of 1963. We also won a contract to construct a 3,000-mile telecommunications network linking Turkey, Iran and Pakistan.

RESEARCH AND TECHNOLOGY

RCA's progress in research, development, engineering, and manufacturing was formidable. The word "breakthrough," although overworked in popular usage, was nonetheless applicable to various RCA advances in 1961.

• An electronic computer memory unit was devel-

Minuteman program contracts are part of RCA's defense work.

oped with a recall 5,000 times faster than that of the human brain.

- Techniques were perfected which could lead to an ultra-swift computer no larger than a portable television set.
- A thin-film transistor, so tiny that 20,000 will fit on a postage stamp, was developed. It promises to reduce computer circuitry to book-page size.
- A mass-production process was created for a new super-conducting material that opens the way for magnets that will operate indefinitely without power.
- A new thermoelectric material was developed to convert high-temperature heat directly to electric power in greater quantity for a given amount of material than has ever before been achieved on a practical basis.

LOOKING AHEAD

While I see no justification for extravagant "boom" claims for the year ahead, I believe new records will be achieved by American industry in the sale of goods and services, in consumer income and in consumer expenditures. Similarly, I expect electronics again to hold its position as the nation's fastest growing major industry.

In a business where science and technology are the parents to growth and earnings, RCA is fortunate to have the direction of its principal divisions in the hands of tested leaders, each with a decade or more of executive experience at RCA. We are also fortunate in being able to maintain good labor relations.

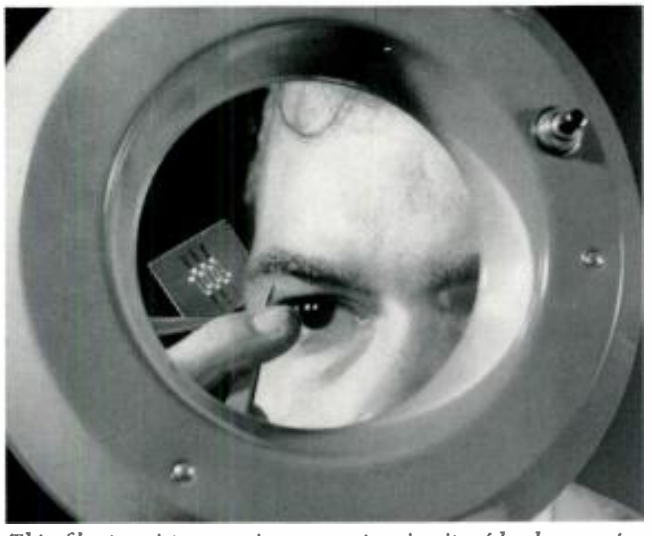
Our new president, Dr. Elmer W. Engstrom, has served the company with distinction for thirty-one years. He has demonstrated outstanding administrative, scientific and business skills in guiding various major operations which have shown impressive growth and profitability, and which promise much for the future.

As the leader in the electronics industry, RCA must be geared to meet increasing and formidable competition in every segment of its business, both at home and abroad. At the same time, it must also be in a position to meet the challenge of rising costs of doing business that faces American industry in general. The magnitude of this problem is enlarged for companies such as RCA which maintain their leadership and advance their future prospects by devoting a substantial portion of their earnings to pioneering in research, development and the introduction of new products.

In a technological age where changes in products and services occur with unprecedented speed, there is no security for any company that fails to advance with the march of science. But in RCA, as in many other large and diversified business organizations, there are opportunities for effecting economies in operations. Successful efforts in this direction should result in increased efficiency.

The management of RCA has undertaken a vigorous program for reducing the cost of operations all along the line, and we are firmly resolved to achieve the goals we have set for ourselves. This program, along with the substantial progress being made in data processing, in color TV and in our other businesses, gives us confidence that the years ahead will bring higher profits for RCA and a greater return for our shareholders.

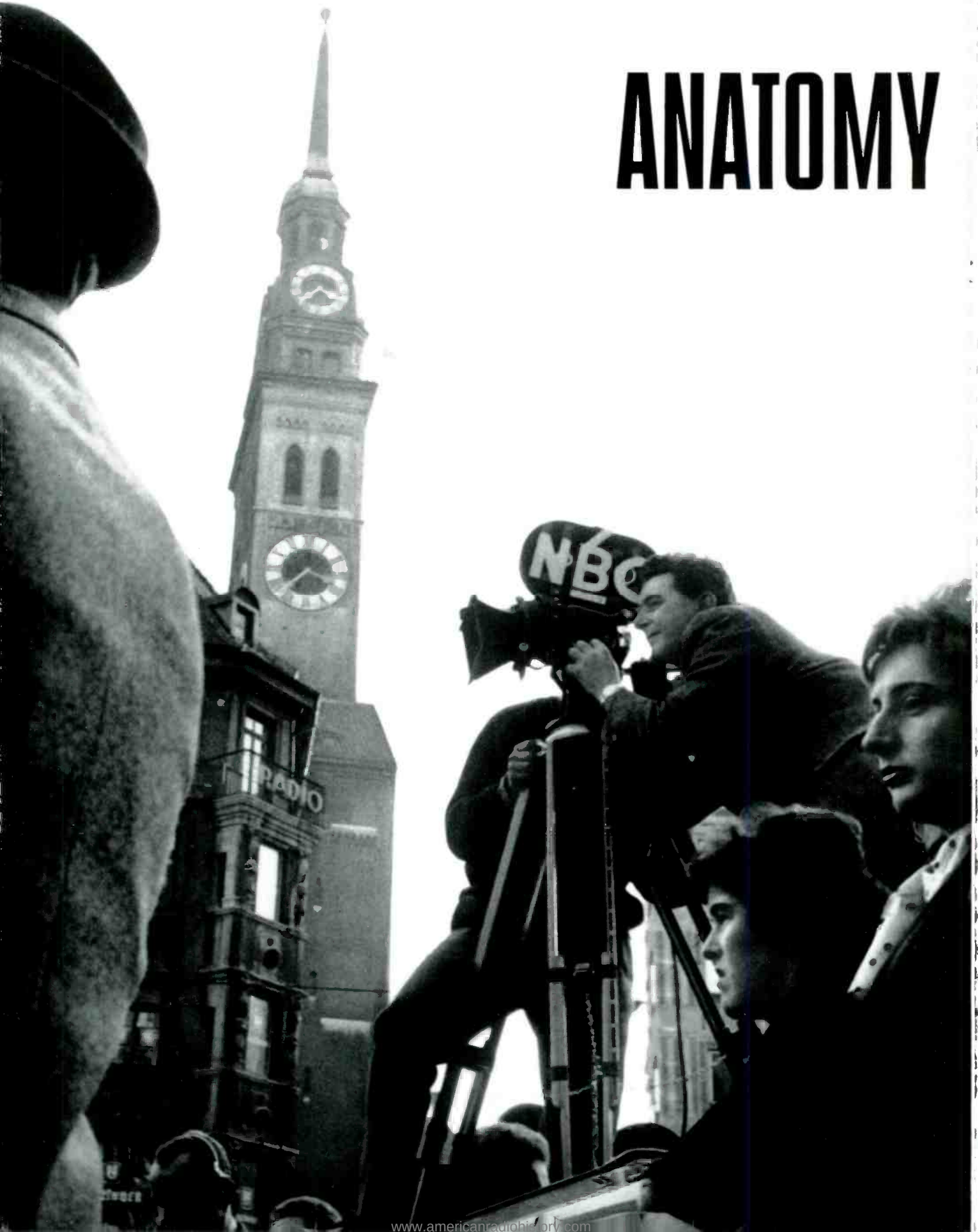
In our efforts to advance the general welfare of our 167,000 shareholders and 85,000 employees, RCA will continue to make important contributions to the security and economy of our Nation. ■



Thin-film transistor promises computer circuits of book-page size.

RCA is developing the Relay communications satellite for NASA.

ANATOMY



OF A NEWS SPECIAL

MONTHS OF PAINSTAKING LABOR BY WRITERS, PRODUCERS AND CAMERA CREWS GO INTO THE FASHIONING OF AN HOUR-LONG PUBLIC AFFAIRS PROGRAM

by **ROBERT BROWN**

GEORGE VICAS, who is producing an NBC News documentary on Germany, had a particular place in mind for his opening scene – the beach at Travemünde, which is the northernmost point of the dividing line between East and West Germany. It is a lonely stretch of shore with views of the line of barbed-wire barricades and watchtowers along the border. Vicas arrived there one day last fall accompanied by NBC News correspondent John Rich and a film crew of seven. They brought with them a ton and a half of camera equipment carried in two trucks which they drove down to the water's edge at a spot less than one-hundred yards from the guns of the nearest Communist tower.

They worked most of the day and, by the time they were finished, darkness was coming on, fog was drifting in off the Baltic and just across the border, Vicas noted, a Communist patrol was watching their activity with more than idle curiosity. The crew loaded their equipment back on the trucks, all hands climbed aboard, the engines were started up and, with a sudden lurch, the rear wheels spun themselves deep into the beach. For the next half hour, the NBC men pushed and pulled, backed and filled, but the trucks remained firmly stuck in the sand.

"It was dark now," Vicas recalls. "There was hardly a light to be seen. The town of Travemünde was several miles away, on the other side of a river. It was a Saturday night and there was little chance of anyone coming along to give us a hand. We knew that the East Germans would be watching for 'capitalist provocation.' We finally went to a Customs post and called the West German border guards in Lübeck, about fifteen miles away. An hour later, a platoon of guards showed up armed with rifles and submachine guns. They set up floodlights, dismantled the benches of their trucks and improvised a set of wooden rails. On these we rode off the beach and were soon on our way back to Hamburg."

Vicas, who has produced such programs as "The Trials of Charles de Gaulle" and "Money and the Next President," joined NBC News last summer and was assigned to head a production unit to be based in Paris and to film special programs in Europe for showing on the NBC-TV network. His first such special, one dealing with Germany's younger generation, is set for broadcast this spring. It is part of an expanding schedule of NBC News programming which includes some forty major nighttime specials this season, covering subjects that range from the life of Vincent van Gogh to the exploration of space.

Vicas, who is fluent in German (as well as in French and Russian), began his research on the program with a question: "How do young Germans feel about the past, about their parents, their country and their future?" After reading everything he could find on the subject in German books and periodicals, he traveled through the country interviewing hundreds of youths, parents, government officials, teachers, writers. He became convinced that there is another barrier in Germany besides the one that divides East from West. This invisible wall, which cuts across time rather than space, separates the older Germans who lived and fought through World War II from those who are now coming of age.

"There is a division between German fathers and sons, a division that exists nowhere else on earth," Vicas says. "Young Germans lack tradition and a knowledge of the country's recent past. But some of them are beginning to ask questions – questions which their parents are not too anxious to answer. Others shrug away any feeling of involvement and take refuge

NBC film crew shooting a special in Munich, Germany.

in the search for security, material wealth and the pleasures associated with youth."

After two months of research and interviews, Vicas was ready to start his camera work. He set out from Munich early in November with a small caravan consisting of two trucks and a passenger car. With him were production manager Warren Trabant, cameraman John Peters, soundman John Purchese, assistant cameraman Dedo Weigert and two electricians. Another cameraman, Horst Felhaber, joined them later. Their itinerary had been plotted by Vicas to cover all the elements of the program as he had outlined it during his preliminary travels.

set's bars, to record the look of young Germany during an evening on the town. They next filmed a group of *"halb-starke,"* young leather-jacketed motorcyclists as they roared through the streets. Peters placed a camera in the middle of a busy highway and caught closeups of the *"halb-starke"* as they raced by on either side of him. It worked well, until the last bike passed, then the traffic resumed leaving Peters sitting in the center of the street at the mercy of the oncoming traffic. But for the help of a motorcycle policeman, the cameraman nearly filmed a rare victim's-eye-view of a traffic accident.

In Hamburg, the team interviewed Dr. Curt Zahn,

Young motorcyclists roar through streets in Berlin.

Rarely-photographed "Burschenschaft" organization at the Marburg University.

Their first stop was the town of Reutlingen, near Stuttgart, where they interviewed a former Nazi for more than five hours, and his son for two. The father, a successful automobile dealer, at first showed some of the reluctance that Vicas had learned to expect, then agreed to go before the cameras on condition that a friend be present during the filming. What Vicas had not expected was that the father's friend was a former colonel of an S.S. unit accused of murdering American prisoners during the Battle of the Bulge. The colonel had assumed responsibility for the unit, was tried and convicted, and spent twelve years in prison.

From Reutlingen, Vicas and his crew moved on to Berlin, where they set up their lights and cameras in the Eden Saloon, the most popular of the younger

headmaster of the Harburg School, who showed that he was alert to the lack of understanding between old and young, declared that it could be a "dangerous element" in German life and, as proof of his students' awareness, pointed to a prominently displayed map showing the locations of Nazi concentration camps. He helped arrange a filming session in which twenty students discussed Nazi propaganda methods and persecution of the Jews, after viewing parts of a German TV film on the Third Reich. Vicas had less success with the students' parents – out of one-hundred invited to take part in a similar discussion, only four turned up.

He met more overt resistance when he tried to film the *Burschenschaft*, the university fraternities noted for their dueling, their extreme nationalism, and

their secrecy. He became interested in these students when he found that, unlike other young Germans, they appeared to get along with their elders, the fraternity alumni. "I discovered that they spent a good deal of time talking and drinking with the *Alter Herren*," Vicas says. "Here was the exception that might shed some light on the rule." In Berlin, he had spent weeks gaining their confidence, finally won permission to film in the fraternity hall. But when cameraman Peters showed up at the hall to work out the lighting he was asked to leave. The reason: a German TV program had filmed the students singing and had superimposed a soundtrack of the Nazi theme, the "*Horst Wessel*" song.

Vicas tried again in Frankfurt and finally was allowed to film a *Burschenschaft* beer party, but only if he also filmed a discussion between the students and the alumni on the aims and principles of the fraternity. "They let us film the first half-hour of the party, under careful supervision," he says. "They did, in an unusual gesture, invite us to stay on afterward when the party really got underway – but without our cameras!"

The NBC newsmen moved on to a basic training camp to see whether the German Army had relaxed any of its discipline. Vicas had told the Department of the Army that he wanted to film the routine of a group of draftees and asked that, if possible, there be no advance notice of his visit. At the camp, he found an aura of improbable, almost Bilkoesque relaxation. Commands were delivered in almost polite tones, close order drill was leisurely and ragged, and a colonel assured the NBC men that no punishments were given for demerits so, obviously, his sergeants no longer carried notebooks to record demerits.

"We suspected a bit of staging to point up the democratic spirit of the new German Army," Vicas said later. "But, fortunately, in any army there are always a few who don't get the word. Before the day was out we had come upon one sergeant who barked his commands in a voice that made his men jump. Another, standing by while we were filming a drill sequence, took out a small black notebook and carefully recorded every false step his men made."

A question that still bothered Vicas as he assembled material for the program was "How do the older people in Germany spend their time?" One night in a typical German restaurant he found a party of middle class Germans sitting at a *Stamm Tisch* which is a table reserved on certain nights for the same people. He talked to them and the proprietor of the restaurant and as a result, the following Saturday evening, the team moved in and recorded an evening of discussion at a *Stamm Tisch*. The group turned out to be unusually good-natured and the proprietor unusually generous as he produced some expectional wine from the cellar – a surprise even to the regular customers.

In the following weeks, the team interviewed, among others, a young man who suffered a breakdown after his father was arrested for war crimes, a German prosecutor preparing the case against former officials of the Auschwitz concentration camp, and Christian Geissler, author of the controversial book, "Sins Of Their Fathers."

They also took their cameras into the Rastatt war museum to film the memorabilia of German militarism. The curator, an elderly colonel, showed an encyclopedic knowledge of German military history up to the 1930's but had decided to leave the Nazi era "to somebody else." He quickly added that the only reason was that he was too old to be certain of such recent history and cited this anecdote as an example: "Just after becoming Chancellor," he said, "Hitler invited President von Hindenburg to review the S.A. troops. After watching column after column of the crack German troops pass, the old man turned to Hitler and remarked, 'I did not realize that we were holding so many Russian prisoners of war.' "

The last item on the five-week shooting schedule was to be a public school which presented a more difficult problem than a private institution like the Harburg School. The authorities in Bavaria were approached and asked if they would be willing to allow the NBC team to show a film dealing with the Third Reich to a class and film the discussion that ensued. The officials were hesitant, and extremely cautious. They asked that the film be shown to a committee of the school board before giving permission. A woman member of the board expressed her opinion that the young people should be "protected" from these films.

When they asked permission to think it over, Vicas was worried, but when he paid a visit to the school he found a most encouraging atmosphere. The head of the school and the instructor who was to conduct the class were not only willing, but enthusiastic about the project. They at once expressed regret that there had been any hesitation in granting the request. The result was not only an important addition to the program but a statement recorded by the instructor proved to be one of the most dramatic moments in the film.

Thus Vicas returned to Paris with some 80,000 valuable feet of film. At the NBC studios in St. Cloud, he set to work with editor Aram Boyajian to extract the most telling scenes and shape them into a one-hour special that will tell of the paradox of modern Germany. It is now under the working title "Germany: Fathers and Sons – The Barrier of Silence." ■

by **LUTHER H. HODGES**

Secretary of Commerce

New Tools for

ONE OF THE MOST IMPORTANT FUNCTIONS of the United States Department of Commerce is the collection, analysis, and timely publication of data for the nation's business community. In carrying out this function, the Department has always felt the need to stay at the forefront of data processing technology. From time to time it has had a hand in fostering new developments in the field.

While credit for the astonishing vigor of the youthful electronic computer industry belongs in the last analysis to the skill and enterprise of the country's businessmen and engineers, the first large-scale, general-purpose electronic computer was producing useful statistical work at the Department's National Bureau of Standards in May, 1950. The first commercially-built computer to make effective use of high-speed magnetic tape input and output was set to work for the Department's Bureau of the Census in April, 1951.

Today the Department is operating more than ten large-scale electronic data processing systems, and our experience indicates that we have only begun to realize the exciting possibilities of this equipment.

Electronic computers are in large part responsible for the new monthly publication of the Bureau of the Census of the Department of Commerce, called *Business Cycle Developments*. This report brings together many of the available economic time series in convenient form for short-term analysis and interpretation, by business analysts. The sheer volume and complexity of the computations involved in systematic reduction of so much raw data to manageable form would have made such a monthly report impossible ten years ago.

The report shows the cyclical movements of about seventy principal indicators and some 350 components of economic time series. The series are classified in three major groups – "leading," "roughly coincident," and "lagging" – according to their usual timing relations during the course of the business cycle.

The "leading" series usually move ahead of turns in aggregate business activity. They include, for example, average weekly hours worked, construction contracts and manufacturers' new orders for machinery and equipment.

The "roughly coincident" series are those such as industrial production, retail sales, and employment which measure aggregate economic activity and in a sense define the business cycle.

The "lagging" series move behind aggregate economic activity and include such series as inventories and consumer installment debt.

In addition to graphic and tabular presentation of these series against the background of expansion and

contraction of the general business cycle, the report includes a number of analytical measures of current trends. Among them: diffusion indexes which show the percentage of companies, industries, or geographic areas that are experiencing rises during successive time intervals; timing distributions of current highs and lows and direction-of-change tables and which indicate how and to what extent a recession or recovery spreads from one sector of the economy to another.

The *Business Cycle Developments* is notable for the speed with which the data for indicators are collected, processed and published. It is scheduled for issuance on about the twentieth of the month following the month for which the most current data apply.

The 1960 Censuses of Population and Housing indicate the part that can be played effectively by electronic devices in an even more complex statistical operation. Contrary to some popular notions, the job of summarizing the results of a census is not simply a matter of counting the number of persons who live

Luther H. Hodges

Trend Spotters

ELECTRONICS IS MODERNIZING THE TECHNIQUES OF ECONOMIC FORECASTING AND PRODUCING TIMELIER INFORMATION ON MAJOR NATIONAL TRENDS

in the United States. True, it is an important Constitutional requirement that the population of each state be determined so that representation in Congress can be properly apportioned. But if this were the only job to be done with the census returns, processing would be simple indeed, though much of the valuable statistical by-products would be left to moulder in dark warehouses full of records.

The public has rightly come to expect that information gathered in the decennial censuses shall be promptly reported in such a way as to pinpoint changes in the makeup not only of states, but also of counties, urbanized areas, cities, tracts, and even blocks. And the average user of census statistics for a specific area is interested not only in changes in the total population, but also in changes in the composition of that population – changes in the age pattern, or in the average size of household, or in the proportion of owners and renters, to name but a few of the types of numbers that will go to fill some 135,000 pages of 1960 census publications. Data are being published for more than 23,000 census tracts covering practically all cities of 100,000 and over, and including the entire area of 136 standard metropolitan areas. And there will be housing block statistics for some 735,000 blocks, covering the 267 cities of 50,000 or more, and including 200 smaller cities who made special contracts with the Bureau of the Census in order to obtain such information.

Summarizing all this data from the records for 180 million persons and 55 million housing units is clearly a job for some form of mechanical tabulating equipment. It was for this purpose that the first punched card tabulating machines were developed at the Bureau of the Census at the beginning of the century.

But in order to use punched card machines one must first get the data recorded on punched cards. The hard fact is that one simply cannot assemble enough trained key punchers to get the hundreds of millions of records punched up in the few months

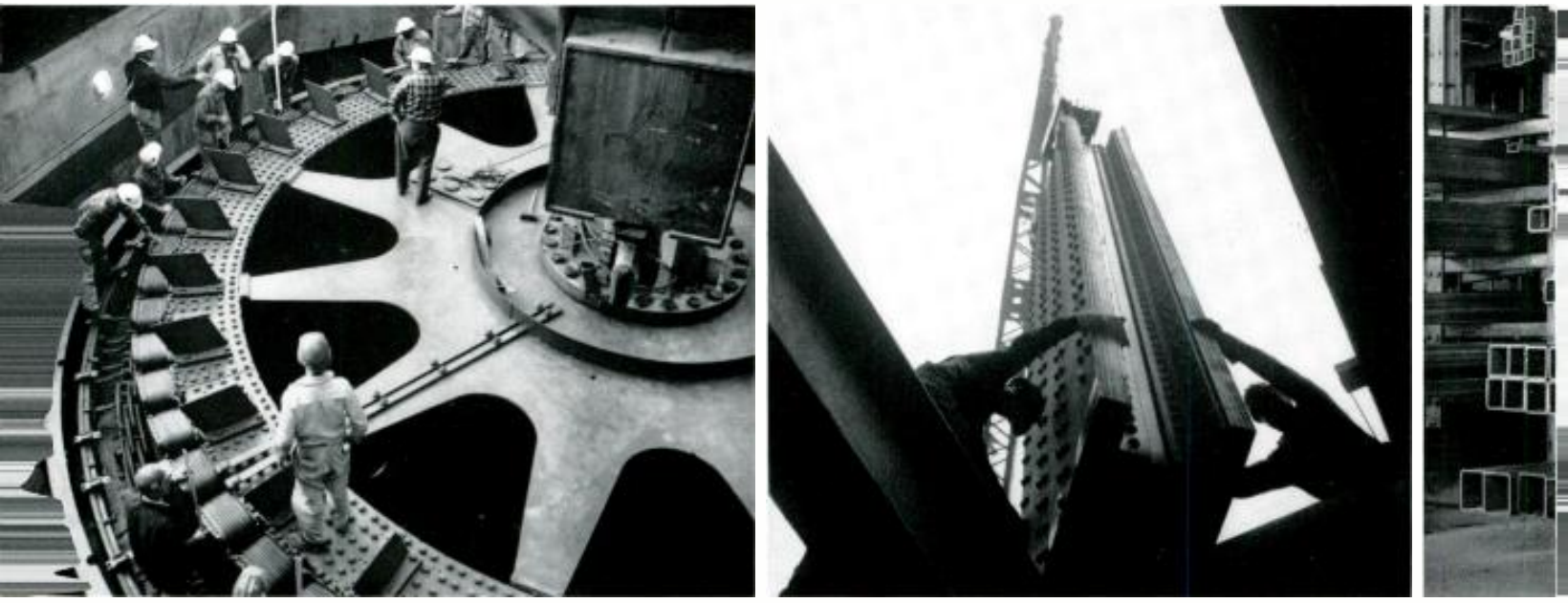
available between the time the data are received from the field and the time that the apportionment counts must be prepared and verified. Thus in the past this State population count had to be made by hand.

To go through the mountain of records clerically to get fifty State figures, and do it quite accurately, is difficult but not impossible. But it does have the undesirable effect of requiring that all of the later detailed tabulations be reconciled State by State with these official figures.

In April, 1960, for the first time, electronic equipment teamed up with sampling to produce a real breakthrough on this problem. The census enumerators were provided with specially designed questionnaires on which the essential data could be recorded in a form readable by an electronic device called FOSDIC (Film Optical Sensing Device for Input to Computers). These questionnaires were of two types — those containing data on age, sex, relationship, color, marital status and certain basic housing information, which were filled in every household and housing unit, and those containing more detailed questions on such items as income, occupation, place of work, duration of occupancy of housing unit, possession of freezers, washing machines, air conditioners and the like, which were filled for every fourth household. By the end of September, 1960, all of the 100 per cent data had been recorded on magnetic tape, and by the end of October, 1960, all of the small area data for the census had been summarized by computer in a way consistent with the State apportionment totals.

The combined use of sampling and electronic data processing added substantially to the timeliness of the 1960 census publications. For example, the first bound volume for the 1960 Census, summarizing the population counts for States and their components, arrived on our desks in Washington a little over two months ago, or about thirteen months earlier than the corresponding volume in 1950. For the series of State bulletins, including simple population counts, general characteristics (based on the 100 per cent items), and the general social and economic characteristics, the gains have been ranging from ten to seventeen months and it is probably safe to conclude that the average improvement will be at least a year.

Thanks to developments in the use of electronic equipment, the possibilities for broadening the supply of unpublished data from the 1960 Census have proved to be relatively great. The list of additional unpublished data is increased by the tremendous expansion in amount of information available for each of the small areas covered by individual census enumerators. For each of the 272,000 enumeration districts in the United States, data can be made available in unpublished form showing substantially all of the tabulated complete-count population and housing data. The list covers age by sex and color, including single year of age for persons under twenty-one, household composition, marital status, and color or race. The list also includes occupancy and tenure of housing units, condition of plumbing, size of household, number of rooms and (in the larger cities) value of owner-occupied property, and contract rent. These data are being furnished as special printouts or as copies of the magnetic tape. Already, a nation-wide public utility firm and a marketing survey organization have purchased many of these tapes for intensive analyses.

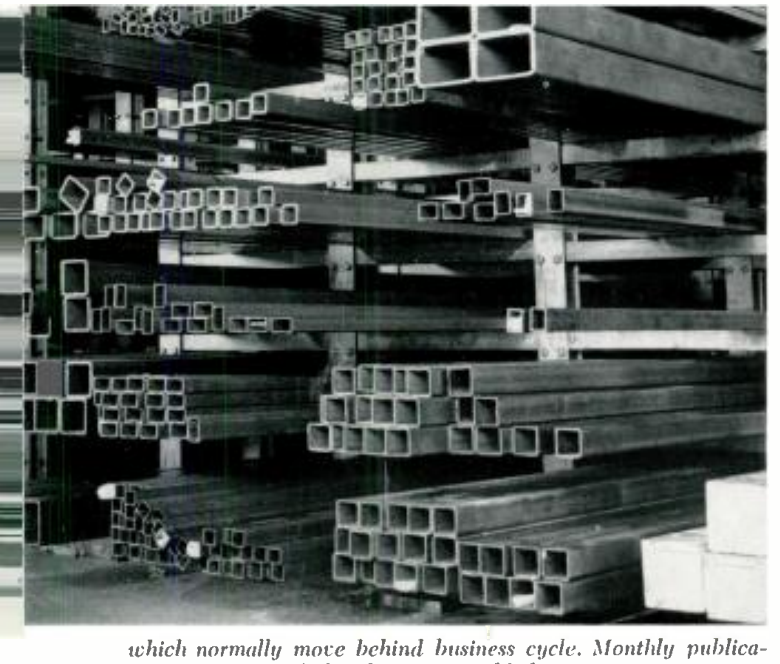


KEY INDICATORS: Among data which Census Bureau feeds into computers are up-to-the-minute statistics on industrial production (left) which keeps pace with business cycle; construction contracts (center) which lead business cycle turns; and inventories (right)

In the presentation of general social and economic characteristics and in the presentation of detailed characteristics, lower limits have been established for the size of areas to be published. Nevertheless, the tabulation procedure used on the electronic computer has in many cases produced the full range of information for a considerable number of areas smaller than those included in the published volumes. Also, the method yields a magnetic tape file containing the complete array of population and housing tables for the smaller areas. Several research organizations have made arrangements to purchase copies of the magnetic tapes containing these data.

As a final example of the current use of electronic equipment to digest statistical data, we have the Weather Bureau's National Meteorological Center. Every twenty-four hours the center receives over 30,000 weather reports. These reports come by teletypewriter, by wire, and through radio circuits originating in all parts of the Northern Hemisphere – from Weather Bureau stations, from observers in other countries, from ships at sea, from aircraft in flight, and from satellites in orbit. High-speed computers help analyze and summarize the data, automatic plotters convert the computer output to weather maps, and facsimile machines transmit the results to several hundred locations in the United States and Canada within a few hours after receipt. By thus freeing the trained meteorologists of much of the routine processing work, the machines make it possible for our weathermen to do much more in the way of preparing special analyses, interpretations, and forecasts.

With the aid of computers, our meteorologists are now able to make quite satisfactory thirty-day forecasts, and are experimenting with even longer range predictions. In preparing such extended forecasts, the daily disturbances in the weather pattern are first filtered out by averaging them over various time periods and various regions. Then the effects of deviations from the normal are assessed.



which normally move behind business cycle. Monthly publication of data in such detail was impossible before use of computers.

The earth's atmosphere is a fluid in motion, expanding here, contracting there, attempting always to restore a balance which is continually being disturbed by seasonal temperature changes and other physical factors which we are slowly coming to understand. The extended forecast procedure is designed to determine the most probable way in which the atmosphere will react to these forces. At the National Meteorological Center, scientists study the continually shifting pattern of weather data for guidance in expressing the basic physical laws of the atmosphere in a form which makes the best possible use of the available information. Numerical methods for solving the equations which express these laws are then developed and programmed for the computers. Finally, predictions based on the machine-produced solutions are compared with the observed course of events, and judged for accuracy and effectiveness in relation to the performance of alternative prediction methods.

It should be clear from the above that running computers, operating facsimile transmitters, and orbiting satellites equipped with television cameras, is not the primary mission of the Department of Commerce. Our job rather is to make the best possible uses of the resources given to us by the Congress in order to provide the country with timely and accurate information on which sound economic decisions can be based. We use electronic equipment as part of our kit of tools, not because the machines are glamorous, but because they give us the most for our money. Our computers never get bored with routine work, hardly ever forget the instructions they are told to follow, and seem to thrive on working twenty-four hours a day, seven days a week. Nor do they get confused when we shift them from one complex job to another with no advance notice.

The seemingly limitless flexibility of the new electronic data processing devices now available has only begun to be used. In the next few years we shall surely learn more about how to turn over to them the myriad housekeeping details involved in converting raw statistical data into useful reports. By helping our statisticians, economists and businessmen to concentrate on getting better data and on understanding its implications and interrelationships, these astonishing and intricate machines may well make contributions to the welfare of our society in ways that far surpass the dreams of their builders. ■

by **STAN WALKER**

Molly Picon, a star of the new Broadway hit "Milk and Honey," records a show-stopper.

IT'S A HIT!

SUCCESSFUL "MILK AND HONEY" POINTS UP THE REWARDS AND PROBLEMS OF THE BROADWAY OF RECORD COMPANIES WHERE WINNERS MUST BE PICKED MONTHS BEFORE THE FIRST CURTAIN RISES

TWO OF THE BIGGEST MUSICAL HITS on Broadway this season have been "How to Succeed in Business Without Really Trying" and "Milk and Honey." In both cases RCA Victor recorded the original cast albums.

The "Milk and Honey" success story is a good example of the problems – and joys – encountered in the process of trying to capture Broadway on records.

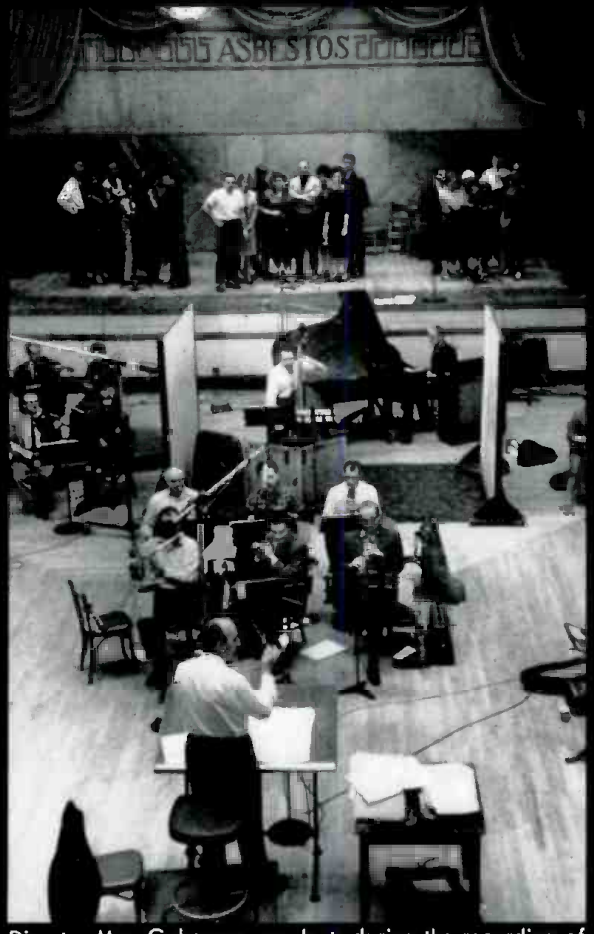
The lead to the show was furnished in April, 1961, by the publisher of the musical score who called Joe Linhart, album producer of Broadway shows for RCA Victor. The publisher suggested that "Milk and Honey" had the makings of a hit and an audition of the score and reading of the book were arranged.

"Usually, at these auditions, the book writer just reads the synopses of the various scenes," says Linhart. "But in this particular case, Don Appell read us the whole book – performing all the parts. As the story unfolded, composer Jerry Herman – who can't read a note of music – played the show's score in the appropriate places, and two professional singers sang all the songs at the exact time they had been written into the story."

With Robert Weede, Mimi Benzell, and Molly Picon already set in the main roles, RCA knew that there were three highly successful entertainers heading the "Milk and Honey" cast. It knew that the score was an excellent one, and that the story of young love, of middle-aged people looking for love, and love of a land, Israel, had wide appeal. But that was not enough for the competitive record business.

"Music is elusive," says Linhart. "That which sounds great at first, may not sound as good after you hear it a few more times. I wanted time to consider what I'd heard and to hear the score under different conditions."

Finally, after several weeks, RCA Victor decided to record "Milk and Honey."



Director Max Goberman conducts during the recording of the musical story of Israel, Biblical land of milk and honey.

RCA's George Avakian, composer Jerry Herman and musical director Max Goberman with star Mimi Benzell.

Tommy Rall sings title song during a stage performance of "Milk and Honey."

RCA's Joe Linhart, George Avakian and Robert Yorke at the controls for a "take" in Webster Hall.

In June, 1961, Linhart began working with the show which was by then in rehearsal. It was his job at this point to stay close to the show, working with the producer and song writer to get the mood of the musical. At the same time, he set about generating enthusiasm within his own company for "Milk and Honey." He invited representatives from RCA Victor's advertising, merchandising, sales, promotion and publicity departments to the same kind of run-through he had first heard. Everyone was enthusiastic.

In September, the show opened in New Haven. From there it moved on to Boston and as with all musicals, certain changes were made along the way.

In the middle of the month, RCA Victor released a single record of "Shalom," one of the best melodies in "Milk and Honey." This served an important function: it enabled the public to hear a song from the show – to get a small taste of its music – even before it opened in New York.

Arriving on Broadway on October 10, "Milk and Honey" was greeted with enthusiastic critical acclaim, and with a strong advance sale of about half a million dollars. The show was a hit, and at this point RCA Victor faced its biggest challenge – the task of bringing the excitement of the visual to the sounds of a record.

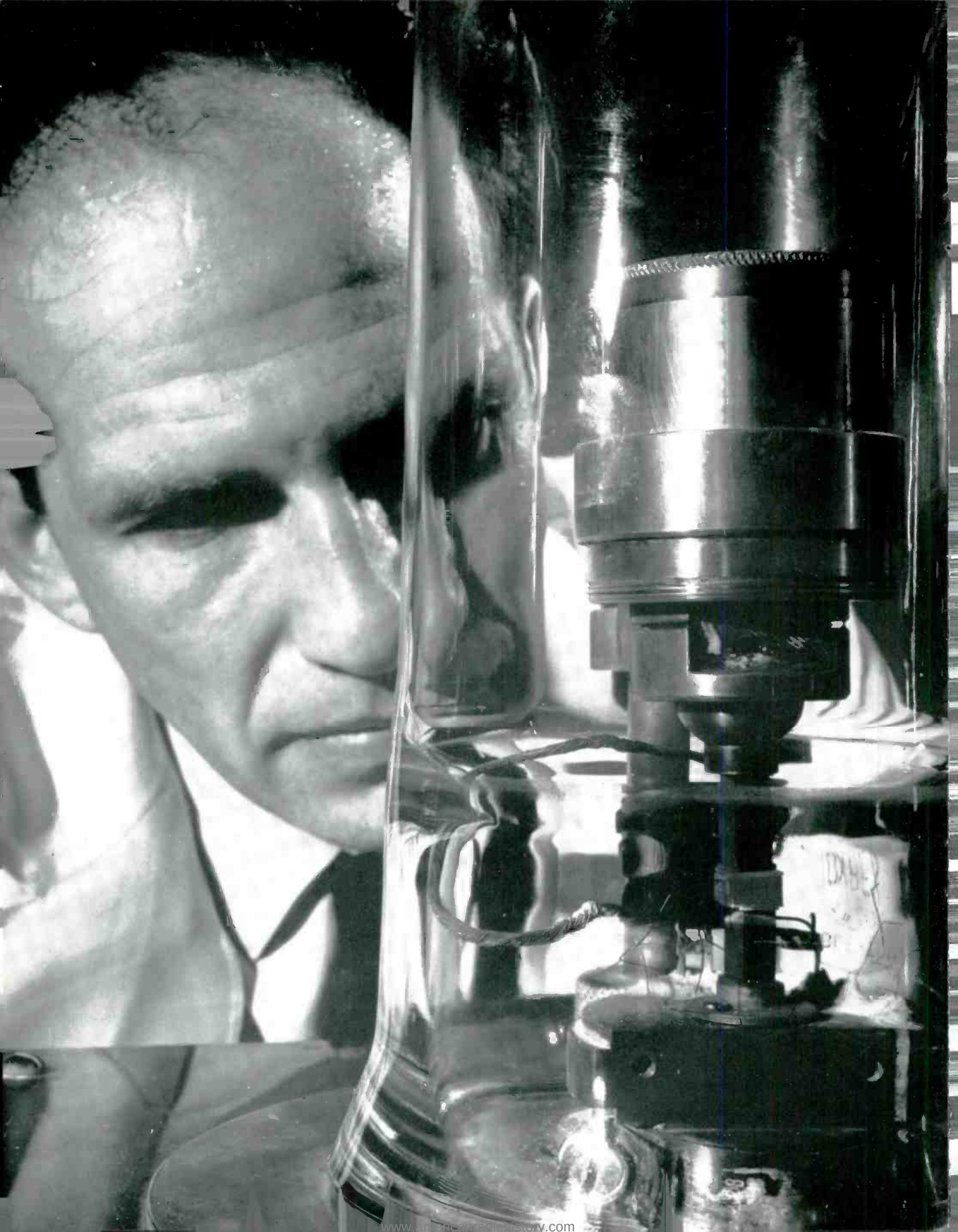
Since Sunday is the only day the entire cast of a Broadway show is available for several hours at a stretch, the cast of "Milk and Honey" assembled at Webster Hall in New York on October 15 – the first Sunday after the opening. Every person received a full week's salary for the one day's work – an Actor's Equity regulation – for it is more exacting to do an album than a stage performance.

Linhart had already timed all of the musical numbers and had sketches made which indicated where the performers were when they sang the various songs. "I wanted the recorded performances to be very close to the actual stage dramatizations," he reflects.

To achieve this, Stereo Action – an electronic engineering process which simulates stage action – was used in a Broadway show for the first time. "We reached a maturity in using Stereo Action for 'Milk and Honey,'" says Linhart, "and we intend to use it for all future original cast albums."

It took twelve hours of hard work to record "Milk and Honey" with the cast. As Musical Director Max Goberman remarked when someone asked him how he managed to work all day without stopping, "I was mentally prepared, and I fully expect to be sick tomorrow!"

It took another twenty hours to achieve the best sound and balance technically (total recording cost: $30,000) but on Thursday, only four days later, the album was in record stores throughout the country. ■



Energy Conversion

A REVOLUTION IN ELECTRIC POWER IS IN THE MAKING, WITH SILENT GENERATORS FED BY RADIANT ENERGY

by **KENYON KILBON**

FOR FUTURE GENERATIONS of Americans, the cough of the gasoline-driven compressor, the roar of the diesel generator, and even the hum of the great dynamo may exist only as curious echos ringing through the vast gallery of mankind's forgotten sounds.

New electronic technology, founded upon painstaking research, is preparing a future era of noiseless generators that function without moving parts to transform heat, light, and chemical energy directly and simply to abundant electric power — first in handy packages for use anywhere on earth or in space, and eventually in great central stations serving urban industrial complexes across the continent.

Except for our yet-limited use of atomic energy fueled with materials that make up the earth, all of our power comes from the immense outpouring of light and heat radiation from the thermonuclear furnace of the sun. Some of the solar energy has been captured and stored for millions of years in the fossilized remains that form our deposits of coal and oil. Some is spent in the great pumping cycle that raises moisture into the atmosphere to fall on heights from which it runs downward in swiftly flowing streams.

Whatever the original form of the energy, we have contrived involved and standardized mechanical methods for converting it to useful electric power. Fossil fuels are burned in steam boilers and internal combustion engines — to turn rotating generators. Rushing water is intercepted by great turbines — to turn rotating generators. Atomic energy has been worked into the same pattern, producing heat for steam — to turn rotating generators.

Now a revolutionary break is in the making, with new techniques that bypass the rotating generator and proceed from heat or light or chemical energy directly to electrical energy without mechanical aid. In one case — that of the solar cell familiar in satellite and space vehicle design — no intermediary other than the small device itself stands between the radiated light energy of the sun and the output of useful electricity. In every case, the results are a potentially great saving in initial cost and maintenance of machinery, and major dividends in the form of far greater simplicity, flexibility, compactness, and long-term reliability in power production.

These bright prospects have sparked a major research and engineering effort that has carried electronic science well beyond its traditional activities in communications and information handling, into the power generating field that was once the exclusive preserve of the older established electrical industry. The trend, as described recently by Dr. E. W. Engstrom, President of the Radio Corporation of America, is toward "a wedding of many electrical and electronic techniques in both the production and use of energy, forming a unified advanced technology that will be our principal building block for the future."

There is sound logic in such a combined approach to new methods of direct energy conversion. The effects, materials, and fabrication processes involved in some of the most promising techniques are precisely those in which electronics has accumulated substantial know-how during years of vacuum tube and solid-state (e.g., transistor) development.

Two of the conversion methods, in fact, employ a semiconductor effect akin to that which occurs in transistors. One is the *photovoltaic* process by which a thin layer of sensitive material in a solar cell converts

RCA scientist tests powerful new alloy that produces electricity directly from high-temperature heat.

light to electrical energy in a manner resembling — but with greater punch — the conversion of light to sufficient electrical energy to move the needle on a photographer's light meter.

The other, the *thermoelectric* effect, produces useful electricity directly from any type of heat source up to about 1800°F. as a result of heat-stimulated electron action in small blocks of specially tailored alloys. Yet a third fruitful approach, known as *thermionic* conversion, generates electricity directly from heat in the 2000° to 4000° range by means of a gas-filled tube that is similar in principle to the high-power electron tubes used in broadcast transmitters.

To complete the pattern, electronics has a vital supporting role in two further energy conversion techniques that have evolved from a background of electrical engineering and applied physics. Experiments in the tongue-twisting art of *magnetohydrodynamics* — happily abbreviated to MHD — now point toward supplementary and even complete central power stations generating electricity directly from the energy of hot plasma, or ionized gas, flowing at high speed through a magnetic field. Finally, extensive development is under way, largely in the chemical and electric power industries, on *fuel cells* that deliver electrical energy directly from the continuous chemical reaction of air or oxygen with various liquid or gas fuels fed into packaged devices that bear a general family resemblance to ordinary storage batteries.

While there is likely to be some competitive overlapping in ultimate applications, the various methods complement one another to a considerable extent. The result will be a broad choice from which tomorrow's planners may select one or a combination of energy conversion techniques best suited to a given task, whether the job is lighting a city or operating an air pump at an astronauts' base on Venus.

Electronic science, spurred by the urgent needs of a growing space technology, has concentrated with dramatic effect upon the thermionic, thermoelectric, and photovoltaic methods that stem directly from established electron tube and solid-state skills. As satellites and space vehicles advance in size and complexity, the demand mounts for more reliable and powerful electrical generating techniques to operate their more elaborate electronic systems through weeks and months of travel far beyond the earth. The ideal solution is direct conversion of energy in devices free of mechanical parts or fuel supply problems, drawing upon continuously available radiant light, heat, or nuclear energy.

The simplest device, still the most widely used to supply power in space, is the solar cell — a thin rectangular wafer of semiconductor material (e.g., silicon or gallium arsenide) treated to form a junction in which light energy excites electrons to produce a flow of current in a circuit. All that is needed is a supply of sunlight — a commodity freely available almost anywhere in the solar system. Present types of cells, available in quantity from several manufacturers, operate at a conversion efficiency of up to 15 per cent — i.e., about 15 per cent of the light energy is converted to electrical energy.

Yet the cells have several drawbacks that have inspired intensive research. The crystal semiconductor is expensive, and large numbers of cells are needed in order to obtain an appreciable amount of electricity. Furthermore, present standard solar cells are highly susceptible to damage from radiation, especially in the extensive Van Allen belts surrounding the earth.

Recent research has been changing the picture substantially, however. Studies of radiation effects, conducted largely at the U.S. Army Signal Corps laboratories and at RCA's David Sarnoff Research Center, have led to increases of ten to one-hundred times in the radiation resistance of silicon solar cells, promising substantially longer operating life in the Van Allen belts and other possible regions of high radiation in space.

Even more significant, perhaps, is the recent achievement by RCA scientists of an entirely new photovoltaic device — a thin-film solar cell made by depositing photosensitive cadmium sulfide on a lightweight surface by techniques that are adaptable to mass production. So far, the laboratory device has achieved efficiencies of only 4 to 5 per cent, but it has proven at the same time to be more resistant to radiation damage and lighter in weight than are the best present semiconductor solar cells.

In the meantime, the virtual monopoly enjoyed by solar cells in the nation's space program is on the verge of being broken by more powerful, compact and versatile thermoelectric and thermionic heat-to-electricity devices.

The two thermal energy conversion techniques are based upon physical effects long known to electronic science. The thermoelectric effect goes back nearly 150 years to the discovery that application of heat to a junction of dissimilar materials in a circuit can start a flow of current through the circuit. The thermionic converter is based on the emission of electrons from a hot cathode and their collection by an anode — a principle that is fundamental to electron tubes.

The sudden leap to prominence and practical application of these thermal energy conversion techniques reflects the happy coincidence of two factors: a widespread basic research program that has achieved drastic improvement in electronic materials, and the encouragement provided by government funds to sup-

RCA's N. E. Lindenblad tests behavior of thermoelectric materials by focusing solar heat through special lens on a small test motor.

port energy conversion research and development projects in many laboratories.

Successful materials research has been the key especially in the case of thermoelectric progress. Until recently, the most effective thermoelectric devices, developed by such leading organizations as RCA, Westinghouse, and Minnesota Mining and Manufacturing, have operated only with relatively low-temperature heat sources – up to about 900°F. – at conversion efficiencies of less than 10 per cent. While this has been adequate for certain military and space needs, the inability to operate practically at higher temperatures has ruled out the effective use of thermoelectric devices with a full range of heat sources, including most nuclear reactors.

Now a major breakthrough has come from RCA Laboratories in a series of advances that have raised the efficiencies of the lower-temperature thermoelectric materials to 12 per cent or more, and at the same time provided a brand-new material of astonishingly high performance in a temperature range up to about 1800°F. This new upper limit effectively brackets the temperature spectrum of heat-producing nuclear reactors as well as the majority of common fossil fuel heat sources.

The new high-performance material is an alloy of germanium and silicon, two semiconductor materials familiar in transistor application. Developed by RCA scientists in a Navy-supported program, the alloy is stronger and lighter in weight than previous thermoelectric materials. Even more striking is its power density at high temperatures. Laboratory measurements have indicated that a square-foot panel arrangement of germanium-silicon units operating from an

1800° heat source could generate up to ten kilowatts of power — about three times the power consumed at any given time in an average home.

Rapid progress in thermoelectrics is matched by recent advances in thermionic energy conversion — but with an odd reverse of objective. Since they are vacuum devices in which electrons are "boiled" out of a hot electrode into free space, thermionic converters have required very high operating temperatures, in the range of 3000° to 4000°F. Because only a few costly materials are suitable for operation at such high heat, a major goal in thermionic research is to push down the lower limit of temperatures at which the converters can operate efficiently.

When they compare this effort to the upward temperature push in thermoelectric research, workers in the field see an analogy to the construction of the first transcontinental railroad by groups racing from opposite directions to meet somewhere around the halfway mark. If electronics should pursue the analogy to the extent of driving a golden spike, it will probably be placed near 2000°F. — a point that is being rapidly approached from below by thermoelectrics and from above by thermionics.

Today, government and industry together are spending about $10 million a year in research on thermionic converters. This compares to virtually nothing seven years or so ago, when thermionic power generation was little more than a laboratory curiosity dating back to observations by Thomas A. Edison in 1883. Edison's observation, confirmed and fully described later in theoretical work by Dr. Irving Langmuir at General Electric, disclosed a physical process that is far simpler in principle than in practical execution: the emission of electrons from a hot cathode, and their accumulation at a lower temperature anode in sufficient quantity to build up a charge that can drive electric current through a circuit connecting the two.

A number of electronic tricks have been ingeniously applied to enhance the effect in order to maintain a steady high-power output, including the use of cesium gas in the vacuum to expedite the flow of electrons from the hot emitter to the cooler collector. Coupled with research has been the development of successively better thermionic converters at several major laboratories, notably those of RCA, General Electric, Atomics International, and Thermo Electron Engineering.

Intensive research has continued at the same time in the quest for thermionic devices that will operate at lower temperatures. A long and dramatic stride in this direction has now been taken by RCA scientists with the invention of a new type of three-element thermionic converter that can generate electricity directly from a heat source of about 2000°F. at better than 10 per cent efficiency. Among its major advantages are a non-critical design that lends itself to quantity production by techniques long familiar in tube technology, as well as probable longer operating life in the lower temperature environment.

As it masters these new techniques of energy conversion, electronic science has started to probe more deeply into the emerging art of MHD power generation. Here, too, the principle is an old one, known to electrical engineering since the days of Michael Faraday. In practice, it involves the heating of a gas to temperatures in the 4000° to 5000° range, where electrons are stripped from atoms in an ionization process that turns the gas into a conductor of electricity. Forcing the gas in rocket-like fashion through a magnetic field creates an electrical interaction that can be harnessed to provide electric current in a circuit. The effect is, in fact, analogous to the operation of a conventional rotating generator, but without moving mechanical parts.

Initially, MHD has been studied intensively and with important experimental results by major electrical companies such as Avco, General Electric, and Westinghouse, drawing upon electronics primarily for the design and supply of certain equipment. Recently, RCA has undertaken original study and development, with partial government support, of what may be the first MHD generator for alternating current — an advance that is regarded as essential to simplifying and reducing the cost of equipment to the point where the new technique may be adopted by the power industry for ultimate use in central stations.

Every survey of the accelerating progress in direct energy conversion points unerringly to the conclusion that a remarkable new era is dawning with the discovery of far simpler and more practical methods than man has ever known, to harness the enormous energy pouring from the sun or locked from the beginning of time in the atoms that make up the earth.

The prospect is especially stimulating today for electronic science, which has grown with unprecedented swiftness through recent decades by supplying the urgent need for radically improved methods for handling information in all its forms. Now electronics is turning increasingly to the development, with electrical science, of the energy sources for which it has previously been a consumer only.

The promise was recently expressed in these terms by a leading scientist of RCA: "If in time the electronics industry we know should pass from its present dynamic phase to reach a platean, the potential revolution in power conversion may well give rise to another period of equally extraordinary growth." ■

Paul Rappaport, RCA Laboratories technical staff, tests solar cell power output under a simulated solar source.

RCA'S NEW PRESIDENT

DR. E. W. ENGSTROM IS SIXTH MAN TO HOLD PRESIDENCY SINCE COMPANY WAS ORGANIZED IN 1919

DR. ELMER W. ENGSTROM was elected President of the Radio Corporation of America on December 1, 1961, after having served six years as Senior Executive Vice President. He is the sixth man to hold the Presidency since RCA was organized in 1919.

Dr. Engstrom, who joined RCA in 1930, is a member of the Board of Directors of RCA and of its subsidiaries, the National Broadcasting Company, Inc., and RCA Communications, Inc.

Born in Minneapolis, Minnesota, on August 25, 1901, he attended elementary schools in St. Paul, Minnesota. He received a Bachelor of Science degree in Electrical Engineering at the University of Minnesota in 1923. In addition, he holds an honorary Doctor of Science degree from New York University, and honorary Doctor of Laws degrees from Findlay (Ohio) College and Rider College, Trenton, New Jersey.

After his graduation from the University of Minnesota, Dr. Engstrom became associated with the General Electric Company and was assigned to engineering development work in the Radio Engineering Department. When the radio engineering and manufacturing activities of General Electric were transferred to the Radio Corporation of America in 1930, Dr. Engstrom continued as Division Engineer in charge of Photophone, or sound motion picture apparatus, development and design for the RCA Manufacturing Company at Camden, New Jersey. He then took over the engineering responsibilities for RCA's broadcast receivers and continued in this field until he began the organization of a research department, first in the fields of apparatus and systems. Later he was responsible for radio tube research and coordinated this with the apparatus and systems work.

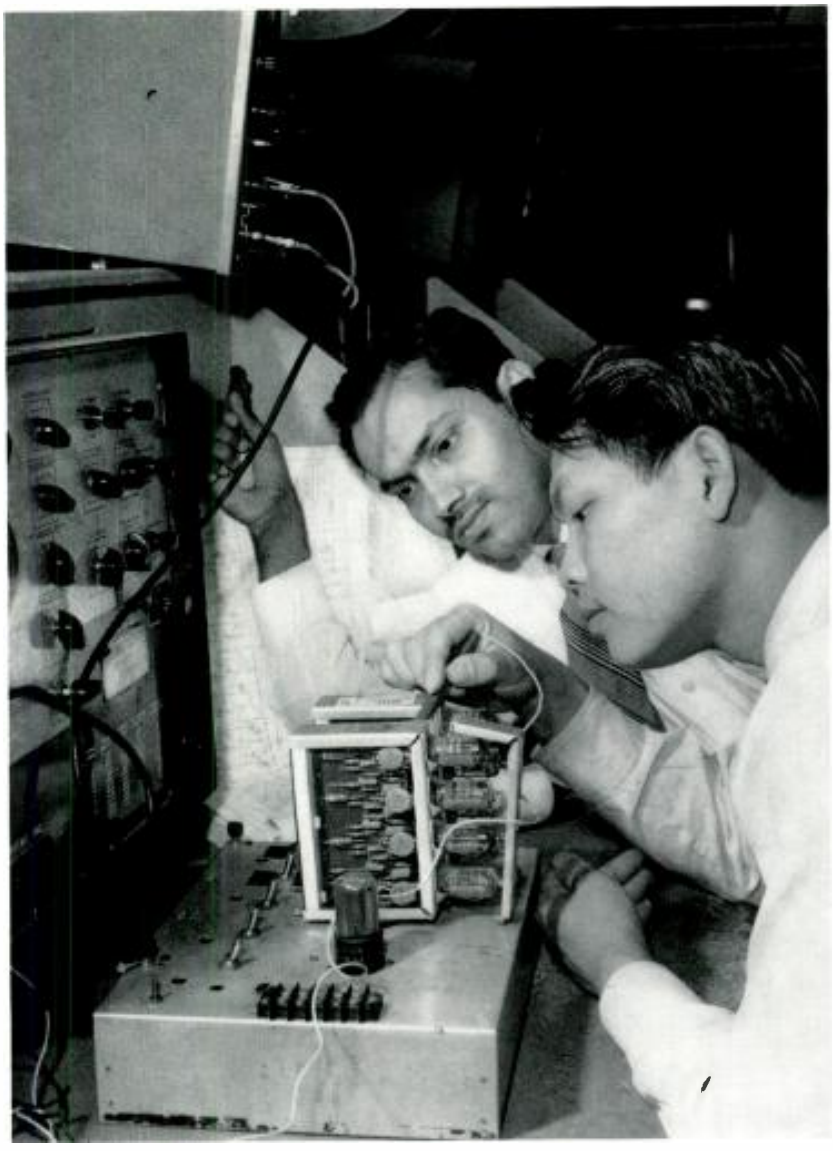
Beginning in the early thirties, Dr. Engstrom participated in the evaluation of television, which was still in the experimental stage, directing the research toward a practical service. In this, he was responsible for development and construction of apparatus used in field tests and in the planning and coordination which led to the reality of black-and-white television service. Following this, he and his associates conducted research on television in color. This resulted in the development of the compatible color television system which RCA pioneered.

Dr. Engstrom was a member of the National Television Systems Committee at the time television standards for broadcasting were established, and was a member of the Radio Technical Planning Board. He was a member of the National Television Systems Committee which developed technical signal specifications for color television transmission, adopted by the Federal Communications Commission.

In 1942, when all the research activities of RCA were brought together at Princeton, New Jersey, Dr. Engstrom became Director of General Research, and in 1943, Director of Research of RCA Laboratories. On December 7, 1945, he was elected Vice President in charge of Research of the RCA Laboratories Division; on September 7, 1951, he was elected Vice President in charge of RCA Laboratories Division; on January 11, 1954, he was elected Executive Vice President, RCA Laboratories Division; and, on June 4, 1954, he was also elected Executive Vice President, Research and Engineering. On October 21, 1955, he was appointed Senior Executive Vice President of RCA.

He has been honored by numerous professional associations for his outstanding work in electronics. His articles have appeared in several major technical publications. He has served on many industry and Government committees including a stint as Chairman of the Research and Engineering Advisory Panel on Electronics in the Office of the Secretary of Defense.

In local community activities, he was a Director and past Chairman of the Princeton Chapter of the American Red Cross, a past president and currently an honorary member of the Rotary Club of Princeton. He is a Trustee of Princeton Hospital, Chairman of the Board of Trustees of the Princeton Y.M.C.A., and Treasurer of the Princeton Y.M.C.A.–Y.W.C.A. Corp. He is a Trustee of the Westerly Road Church of Princeton. Dr. Engstrom married the former Phoebe Leander in 1926. They have one son, William Leander. ■



Students from India and British Guiana studying at RCA Institutes.

FIVE THOUSAND MILES TO FOURTH STREET

STUDENTS FROM AFRICA, EUROPE AND SOUTH AMERICA GIVE AN INTERNATIONAL FLAVOR TO THE RCA INSTITUTES' STUDENT BODY

THE SPIRALING ENROLLMENT of foreign students in American technical schools is dramatically exemplified at RCA Institutes, Inc., located in a large, functional building in New York's Greenwich Village.

Within the past four years, its foreign-student population has increased 400 per cent. Today, some 10 per cent of its 3,000 students are from forty-seven foreign countries throughout the world.

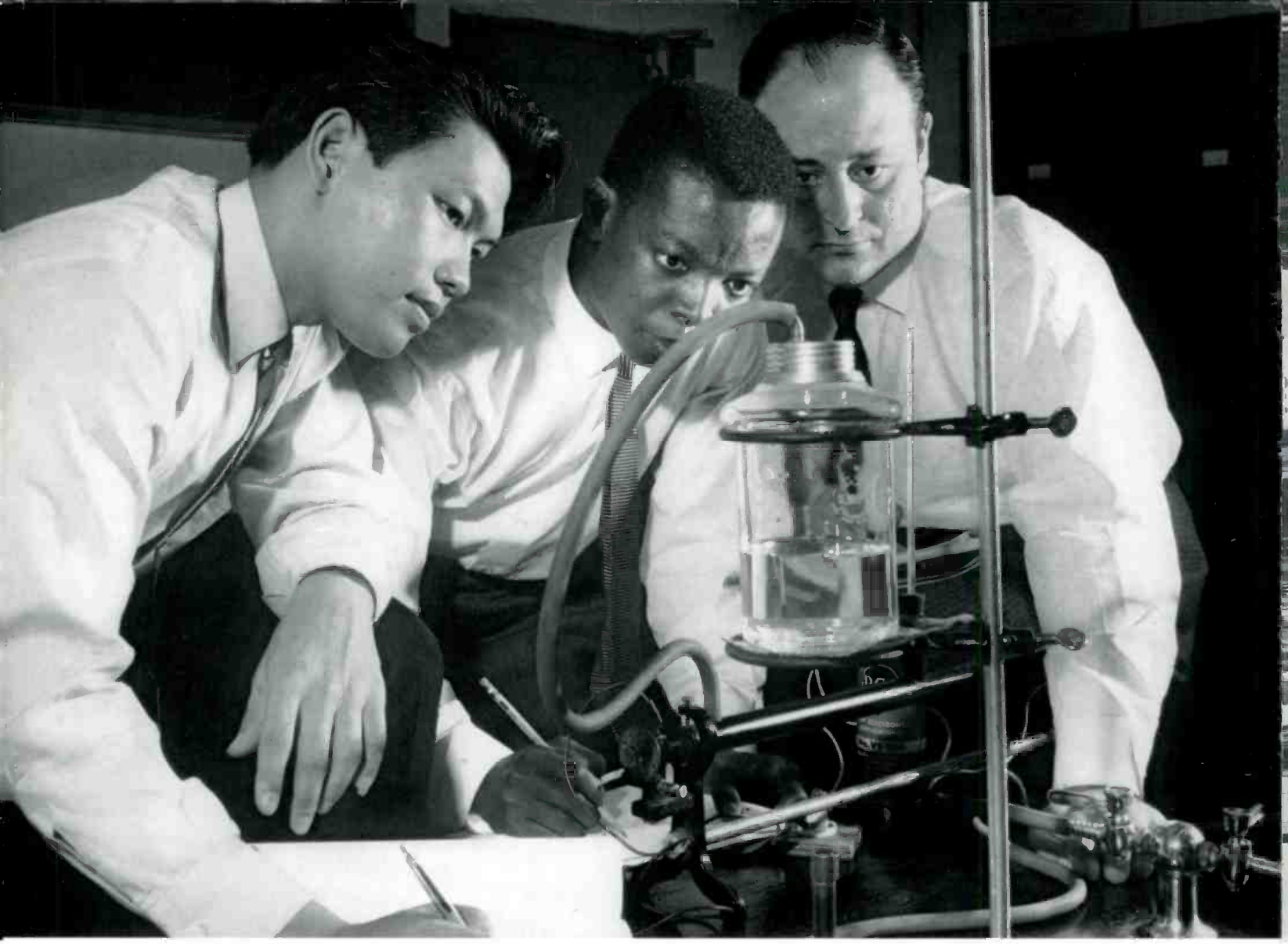
George F. Maedel, President of RCA Institutes, says: "Schools like ours don't exist in many countries. The students must emigrate, so to speak, to get rapid, intensive education in the fields in which the Institutes specializes – electronics and television."

Mr. Maedel, like others who have had a long association with foreign students, finds them quite different from those of a decade ago.

"Unlike many of their predecessors who were often from wealthy families, today's foreign students from Asia, Africa, and Latin America – and from Europe too – are generally from middle- and lower-income families. Some of them are poor, but almost all of them are unbelievably eager for an education."

To students from the developing countries, education means freedom and they will go to almost any length to get it. One RCA Institutes student from South Africa made four trips – a total of about 1,500 miles – from his village in the Transvaal to the American consul in Johannesburg to get a student visa to the United States.

This determination is reflected in the skyrocketing enrollment of foreign students in American colleges as well as in technical schools. This year colleges will



Small group work benefits students (l. to r.): Clive Yow, British Guiana; Dickson Kissi, Ghana; and Hikmat Abou Hamze, Lebanon.

enroll at least 57,000 foreign students. In five years the figure will be an estimated 200,000. "Students want to come to the U.S.," says Philip H. Coombs, the State Department's Assistant Secretary for Educational and Cultural Affairs. "This is an asset we should be pretty thankful for. We couldn't buy it."

Once in the United States many foreign students, even those on scholarships, have critical financial problems. They scrimp on food, lodging, and clothing, and often work at menial jobs so they can continue their schooling.

"My shoes are no longer dignified; they are torn and full of holes," one African student recently wrote to a Government official of his country. "This is creating a bad impression. Pragmatically, what can you do to help me preserve our country's reputation?"

One foreign student at RCA Institutes, Dickson Kissi, for several years saved every penny he could from his modest job in Ghana to pay for his passage and first-term tuition. "I would not smoke, buy candy, even go out with a girl. To some of my friends, my miserliness was incomprehensible. But I didn't care. What was important was to get a good technical education. To me that *is* comprehensible."

After his arrival in the United States, Kissi found employment as a part-time guard with the Ghanaian delegation to the United Nations. It pays him just enough for his tuition, room and board – and an occasional date. He still refrains from spending money on cigarettes.

Another Institutes student – Roberto Campos, of Chile – works as a part-time clerk at the New York Athletic Club. By careful budgeting, and occasionally skipping a meal, he manages to squeak through.

Campos, who is a fourth-term student at the Institutes, is a member of a navy family. His father is a former admiral. Several of his uncles and his brother are also in the navy. He is himself a graduate of Chile's

Annapolis, and is at present on extended leave. His ambition: to be an electronics expert, preferably with the navy.

Campos, Kissi, and other students — both foreign and American — must work hard to keep up with the school's demanding program. For the Institutes, which has both vocational and college-level courses, is a no-frill, no-nonsense school. Each student must take a twenty-five-hour class-and-laboratory schedule, which requires an additional twenty-five hours a week of study and preparation. The Institutes is highly regarded for its scholastic standards, and its graduates have found employment in every major industry in the United States. College-level students may receive transfer credits for their course work at the Institutes by leading schools such as Rensselaer Polytechnic Institute, Drexel Institute of Technology, Lafayette University, University of Southern California, and Massachusetts Institute of Technology.

"Our graduates from foreign countries, especially the developing nations, are filling vital jobs in advancing their nations' educational and industrial lives," says Harold Fezer, Director of the New York Resident School of RCA Institutes. "I tell my teachers that the boy from Africa sitting in their class today may some day be Prime Minister in his country."

Although the Institutes has not yet produced a Prime Minister, one of its recent African graduates is Minister of Communications in Liberia. Another graduate, from India, is teaching in one of that country's most prominent schools.

Kissi was asked recently if he would like to remain in the United States after his graduation. He replied firmly: "I like the United States and maybe at one time I would have wanted to stay. But Ghana is now independent. We are building our country. I have an obligation to return."

Virtually all foreign students want to go back to their homelands, especially to those that have recently become independent. They feel that with the burgeoning of television, communications and other electronic systems, there are major opportunities for personal advancement as well as for significant contributions to the welfare of their native countries.

Both administrators and teachers at the Institutes agree that the foreign students more than hold their own with Americans.

"They are highly intelligent, and doggedly sincere in their studies. Almost all of them are very eager — young-men-in-a-hurry types," says Fezer.

Since the Institutes does not maintain its own dormitories, the foreign students, ranging in age from nineteen to thirty-five, share apartments with other students or live in boarding houses or at the Y.M.C.A. Extra-curricular activities are minimal. One of the few clubs at the school is, understandably, the Ham-Radio Club.

The Institutes is open year-round. There are no vacation periods, except for three weeks just before Labor Day. Nine terms are required for graduation in the college-level course, six in the vocational course.

Institutes officials and teachers admit this is a tight schedule. Students rarely miss classes. As one of them recently said: "You can't afford to, or you fall badly behind. In fact, if you drop your pencil, you don't dare take time to pick it up."

In addition to the New York Institute, there are foreign students at the resident-school Institute in Los Angeles and at the studio school in midtown Manhattan that specializes in radio-TV studio production courses. The Institutes also conducts a home-study school, which has an annual enrollment of almost 21,000, including some 1,000 students in foreign countries.

With domestic student enrollment increasing each year in already crowded schools and with the teacher shortage becoming more acute, do technical schools contemplate curtailing the influx of foreign students?

A typical reaction is the one from New York Resident School Director Fezer: "We've got the 'welcome' sign out for foreign students — and it's going to stay there," he says. "From a scholastic and morale viewpoint, they've been good for the school. And what's more important, from the letters we get from our foreign alumni all over the world, I'm convinced the school has been good for them." ■

At a classroom lecture (l. to r.): Roberto Campos, Chile; Karekeen Mousesian, Iraq; Sam Kito, Alaska.

RCA Sees Rising Sales Pushing Net In '62 Above '61

Computers, Color TV Sales And Economies Cited for Expected Gains This Year

Profit Last Year Near '60's

By a WALL STREET JOURNAL *Staff Reporter*

NEW YORK—Rising sales of electronic computers and color television sets will make 1962 a better year for Radio Corp. of America than last year, David Sarnoff, chairman, said in an interview.

Sales and earnings should be up from 1961 with profit registering a sharper percentage gain, Mr. Sarnoff, who is also chief executive officer of the company, said.

He explained that profit will be helped this year not only by higher volume in key product lines but also by economies and operating efficiencies that have been put into effect.

Net income last year did not change "appreciably" from the preceding year's $35,117,000, equal to $2.10 a share on fewer shares then outstanding, Mr. Sarnoff said. Sales in 1960 were a record $1,495,000,000. The 1961 results will be released by the company next month.

"Electronic data processing has become one of the fastest growing major businesses of RCA," the executive said. Gross income this year from all RCA's data processing activities—both commercial and military—will probably be "substantially in excess of $200 million, considerably higher than last year," said Mr. Sarnoff.

He noted that RCA, which entered the commercial computer field about three years ago, has faced strong competition, but "we are recognized today as an important competitive factor."

International Business Machines Corp. is the industry's largest manufacturer of computers.

Mr. Sarnoff disclosed that at the end of 1961 RCA had 125 business computers installed in customers' offices. These are the lower-priced 301 and the medium-priced 501 electronic processing systems.

Sales Expected to Rise

He added that the number of "firm bookings" for electronic computers to be delivered within the next 18 months is "more than double" the number now installed. The orders the company took for computers last year were double that in 1960, he said. Deliveries to customers last year were "two and a half times greater" than in 1960, he added.

The chairman said the first of RCA's large 601 computers will be delivered this year.

Because data processing is a new business for RCA, he explained, it is currently operating at a loss. He noted that computers involve a heavy investment in research, engineering, tooling, training and marketing. Also most commercial computers are rented to customers, not sold, so that income is taken in over an extended period and not in one lump sum.

Mr. Sarnoff said these losses are being sharply cut. Through rising sales and "more efficient operating procedures, we anticipate a reduction of approximately 50% in 1962 data processing costs" compared with last year, he said.

"We expect the costs in 1963 to be reduced by half again, and we hope to realize a profit in data processing within two to three years," according to Mr. Sarnoff.

Although IBM is strongly entrenched in the computer field, he said, two factors give the company the opportunity to strengthen its position. First, the number of computers in use is "still very small," second, "tremendous changes" in computers will take place in the next five to ten years, and competition in the future "could well be decided by what the companies are now doing in the laboratories," he explained.

Work Involved in Research

Mr. Sarnoff said more than 7,000 RCA research scientists and engineers are involved in electronic research and engineering programs. Some 2,000 of them are working on research and development projects related to data processing, he added.

"The combination of their efforts and our wide-ranging technological background in electronics and communications gives us a capability in many computer areas that few, if any, other companies can hope to match," he said.

Computers are also playing a growing part in RCA's defense work, he said. Data processing last year accounted for 20% of the company's $500 million defense sales, and the chairman predicted that data processing sales in this area will increase this year about 20% from 1960.

The concern is developing and producing computers for radar equipment, for missiles and for the Government missile detection network known as the Ballistic Missile Early Warning System.

Mr. Sarnoff said sales agreements were reached last year with three companies in England, France and Japan for the sale of computers. "These agreements are expected to result in sales of $50 million to $100 million in three years," he added. The companies will purchase RCA computers to resell in Europe and Asia.

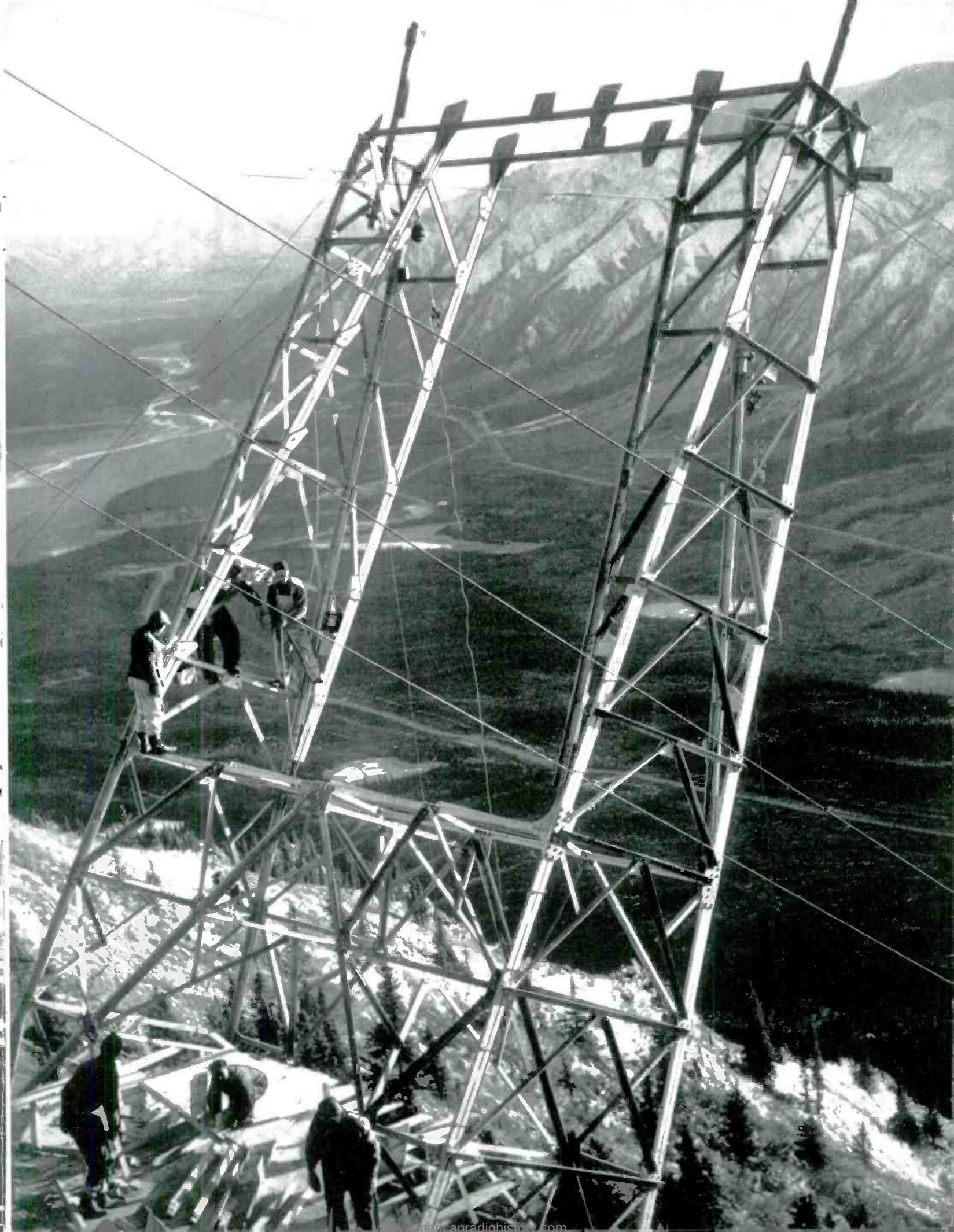
Mr. Sarnoff said all other phases of the company's business were profitable. He said the company was improving profits in color television receivers after pioneering in this field. RCA's color set sales climbed 51% last year from 1960, and "we look for new gains this year."

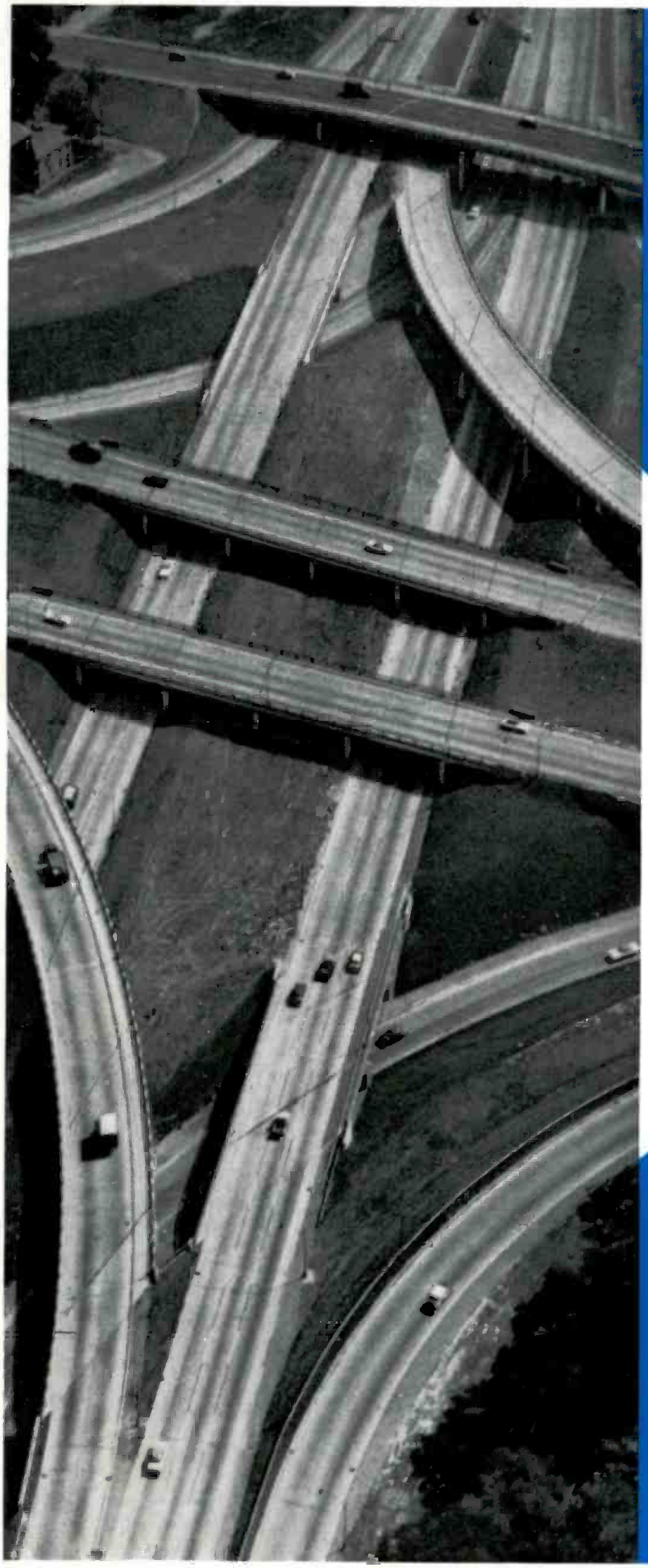
National Broadcasting Co., a wholly owned subsidiary, which had record profit in 1961, will do at least as well this year, and "possibly better," Mr. Sarnoff said.

PICTURE CREDITS

COVER – LEN GITTLEMAN
5 – MAUREY GARBER
10 – U.S. AIR FORCE
17 – WIDE WORLD (top)
18 – BETHLEHEM STEEL CO., INC. (right)
19 – PETER A. FRASSE & CO., INC.
28 – PHILIPPE HALSMAN

Aerial tramway along the 1,300-mile Canada-Alaska microwave system built by RCA Victor Company, Ltd., at a cost of $25 million.





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