SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

24 December 1976, Volume 194, No. 4272

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Now the centrifuge that started the quiet revolution is even better. The new 21,000 rpm J-21C has a stainless steel refrigeration chamber for easier maintenance, and improved electronics that include a new circuit for automatic shutdown of the drive if the temperature of the rotor chamber exceeds the set temperature by 15°C.

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SCIENCE

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The American Association for the Advancement of Science was founded in and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress. Postmaster: Send Form 3579 to SCIENCE, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.

COVER

First nuclear magnetic resonance image of a tumor in a live animal. The image was achieved by FONAR spectroscopy. The tumor, an Ehrlich ascites solid neoplasm of the anterior chest wall, is the orange-pink and red region at the bottom of the image. In the normal mouse the thoracic region is blue. See page 1430. [Raymond Damadian *et al.*, State University of New York at Brooklyn]

Hear the light.

Today, communications may be at the threshold of another revolution in technology.

Someday soon, when you make a phone call, your voice may be carried between telephone offices as pulses of light over a hair-thin glass fiber.

We call this new technology lightwave communications.

Less Cost, Less Space:

Lightwave communications has the potential for carrying enormous quantities of information—from phone calls to business data to TV programs—at low cost. And it can do it in much less space.

Right now, we're testing an experimental system that can carry nearly 50,000 phone calls in a cable of glass fibers not much thicker than a clothesline. It could do the work of several copper cables, each as thick as your arm.

That will allow us to save space in the crowded cable ducts under the streets of many of our cities. Which in turn will lessen the need to add new cable ducts to expand service.

But even carrying that many calls uses only a fraction of a light beam's capacity.

So it will give us plenty of room to grow.

To make lightwave communications possible, the people at Bell Labs and Western Electric attacked a number of problems simultaneously.

What Had to be Done:

What kind of problems?

Creating some of the most transparent glass the world has ever known.

Developing techniques to draw the glass into highly precise fibers which, despite their tiny size, have a complex internal structure that keeps the light from leaking out.

Devising ways to protect the delicate fibers from damage, to make them into cables strong enough to pull through underground ducts, and to splice them—a hundred or more at a time.

To generate the light carried by the fibers, they developed a tiny, solid-state laser smaller than a grain of salt. (Today's design is expected to operate continuously for ten years or more.)

To put information onto the light beam, they designed equipment that turns the tiny laser on and off millions of times a second.

And they developed repeaters to regenerate the light signal along its way, as well as photodetectors at the receiving end to convert the light back into an electrical signal that can travel throughout the telephone network.

We think lightwave communications may prove a long step forward in the development of communications.

We may put it to use in the early 1980's to relieve cable congestion between major switching centers. For special applications, we may use it even sooner.

And it may someday carry business data, visual communication services and facsimile transmission into your home and office.

Seeing to It:

Innovations from Bell Labs and Western Electric are put to work by your Bell telephone company. That's another reason you have the most reliable, least expensive telephone service in the world.

To keep it that way, one of the things we're doing is seeing to it that before long you'll be hearing the light.

One of a series of messages to keep you informed of how telecommunications technology is changing our world—and the part Bell Labs, Western Electric and your Bell telephone company are playing in it.

Bell Laboratories/Western Electric

24 December 1976, Volume 194, Number 4272 **SCIENCE**

Curtailing Federal Growth

The average citizen is only dimly aware of the pervasive power and the dimensions of the federal government. The annual encounter with income tax forms provides only a tiny reminder. Many scientists having administrative responsibilities are exposed to a broader sample, but even they have comparatively little contact with a monster that continues to grow. Two examples may serve to outline its magnitude. The estimated annual cost of federally mandated paper work is $40 billion. The latest catalog of Federal Domestic Assistance programs* lists 1024 different programs.

Government agencies print about 10 billion sheets of paper a year just to be filled out by U.S. businesses. The government spends $15 billion a year just to process its own paper work, $1 billion for forms, another $1 billion for directives to accompany these forms and explain how to fill them out, and $1.7 billion to file and store the forms.† Apparently the government's analysis of the flood of paper that it receives is spotty at best. A recent disquieting straw in the wind was a revelation that the Internal Revenue Service had not correlated information return slips with reported incomes.

The Federal Domestic Assistance programs are a prolific source of paper work and effort. Administration of the present-day 1024 assistance programs necessarily entails a very large federal establishment. In addition, the federal programs induce states and municipalities to create expanded bureaucracies. About 800 different programs are designed to give assistance to the states. Different sets of rules, procedures, and forms are applicable to these programs. It is as if scientists, in seeking funds, dealt with 800 different categories of grants that were provided by more than 100 different agencies. For a state to maintain full awareness of opportunities requires a large staff.

Recognition of the complexity of the structure of the federal government is not new. The 1968 Democratic party platform included a call for reform: "The executive branch of the Federal Government is the largest and most complicated enterprise in the world, with programs distributed among 150 separate departments, agencies, bureaus and boards. This massive operation contributes to and often results in duplication, administrative confusion, and delay."

But although Democrats subsequently controlled the Congress and President Nixon sought reorganization, little was done to simplify governmental organizations or procedures. Perhaps Mr. Carter will have more success.

But it will not be easy. There are too many entrenched special interests. Mr. Carter has stated that federal employees would not lose jobs as a result of reorganization. That is, the signs on the offices will be different, but the names will be the same. If Mr. Carter wants real attention and cooperation he must fire some people.

The real cure, however, is not a reshuffling. What needs to be done is to stop the cancerous proliferation at its origin—the Congress.

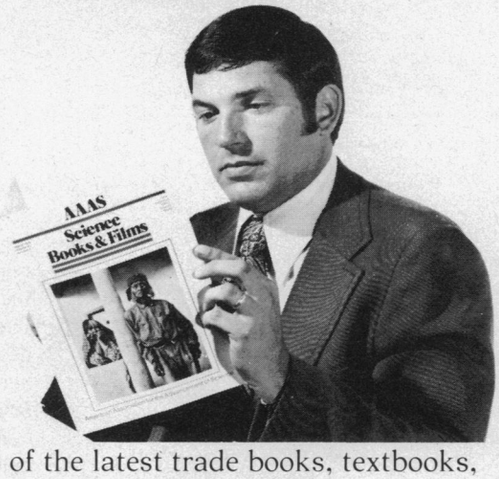
Each year more laws are passed, new agencies are created, and more regulations promulgated. Only rarely is a law repealed, an agency abolished, or a regulation canceled. What is needed is a reversal of the trend so that gradually the complexity might diminish. Thus Congress should adopt the procedure that before a new law could be enacted two existing ones must be repealed.

When Mr. Carter campaigned against Washington he touched on deep and well-founded resentments. Unless he and his party can find means of making the government more effective and less complex, they will bear the full burden of resentments on a later occasion.—PHILIP H. ABELSON

**1976 Catalog of Federal Domestic Assistance* (Government Printing Office, Washington, D.C., 1976). †A Federal Paperwork Commission is seeking to reduce the torrent of paper. Its efforts should be encouraged.

Finding good science books and films can be very hard . . .

. . . or very easy.



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PRODUCTS and MATERIALS

Gas Chromatograph–Mass Spectrometer

The MAT 44 combines a gas chromatograph, a quadrupole mass spectrometer, and a programmable microprocessor. It is supplemented by the MAT SS 200 data system for the collection, manipulation, and identification of mass spectra. The spectrometer's quadrupole rods are truly hyperbolic in cross section for greater resolution. The range of mass detection extends to 1200 atomic mass units. Detection limits are measured in a few picograms. The turbomolecular pumps require neither cryogenic cooling nor an external source of coolant. Mass spectrometry parameters such as ion-source sensitivity, resolution, and amplification are automatically optimized. Output options are varied and the operator may select electron-impact or chemical ionization. The microprocessor includes self-diagnosis routines to detect operating problems and suggest corrective action. Varian MAT. Circle 730.

Helium-Cadmium Lasers

Model 4100 is a long-life blue laser. Output power is 10 milliwatts at 442 nanometers in the TEM_{00} mode. Options include interchangeable ultraviolet optics which yield 1 milliwatt at 325 nanometers in the model 4115 and a higher power version, model 4110H, which yields 14 milliwatts at 442 nanometers and 2.5 milliwatts at 325 nanometers. The 4110M is available with intracavity acousto-optic modulation. This permits amplitude modulation of the laser beam from full power to zero. Modulation bandwidth is from direct current to 1 megahertz. Liconix. Circle 733.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 1386A and 1438B) and placing it in the mailbox. Postage is free.

—RICHARD G. SOMMER

Infrared Radiation Reference Source

An infrared source and a controller are available for calibrating infrared instruments. The controller, model 11-210, uses the cylindrical-conical cavity design. This results in a source with radiation characteristics close to ideal black body conditions. The controller produces radiation that precisely follows cosine-law distribution over the central 15-degree cone of radiation. Temperature may be selected from 50° to 1000°C. Electrical current to maintain the temperature is provided to the source only while the alternating current is going through zero in order to eliminate radio-frequency interference due to switching transients. Barnes Engineering. Circle 731.

Thermal Conductivity Determination

The TC-1000 Thermal Comparator does not require thermocouple installations or calorimetric precautions. Thermal conductivity of metals, ceramics, glasses, semiconductors, thin films, liquids, or gases may be determined in minutes. The TC-1000 does not damage surfaces or alter their state. Applications include metallurgy, materials testing, and other determinations of thermal properties. Lafayette Instrument. Circle 732.

Radioassay Instrumentation

The PRIAS group includes a gamma counter, a liquid scintillation counter, and a sample preparation unit. Up to seven routines may be stored in the memory unit of the PRIAS gamma counter. New routines may be added. An integral output device prints results on a Pos-IDent card in counts per minute or in dose units. The user may select the counting of bound or unbound fractions. The liquid scintillation counter includes keyboard-entered counting information for up to 15 programs and set counting conditions for tritium, iodine-125, and carbon-14. There are two independent, simultaneous counting channels for correlation of efficiency by external standard ratio. The sample preparation unit reduces the amount of the handling of samples, the time per assay, and random errors. Pipetting, diluting, and dispensing are automated. It features a self-contained, 4°C-eutectic chamber for temperature control of biological reagents and fast, easy interchangeability of standard-size syringes. Packard Instrument. Circle 734.

Portable Seismograph

The Portacorder RV-320 is a micro-earthquake recording system. Seismograph signals with durations from 3.5 to 115 hours may be recorded. A variety of recording formats and media makes the system versatile. The device is packaged in a rugged carrying case which protects the instrument during transport and in field use. Features include a low-power, low-noise, high-gain amplifier, adjustable data filters, and a positive gear drive system. Teledyne Geotech. Circle 735.

Literature

Gas Data Book offers technical specifications for more than 130 gases and mixtures and is available for $12.50. Matheson Gas Products. Circle 736.

Beryllium Copper Test Kit is useful for making alloy determinations with the Electrospot current source. Koslow Scientific. Circle 737.

AMAX Journal for fall 1976 includes articles on a variety of topics related to metals including one on mine evaluation. AMAX Specialty Metals. Circle 738.

Photomultiplier Tube Catalog reviews recommendations for many applications and lists a complete line of these products. Amperex Electronic. Circle 739.

Closed Loop for September 1976 includes an article on fatigue testing of materials for surgical implants. MTS Systems. Circle 740.

Liquid Crystals is devoted to a line of nematic, smectic, and cholesteric liquid crystals. Atomergic Chemetals. Circle 743.

Peak-11 Laboratory Automation Systems are designed for physical and biological disciplines. They will acquire and analyze data simultaneously from up to 16 peak-producing analytical instruments. Digital Equipment. Circle 744.