SCIENCE

31 August 1973

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

CUT IT OUT !

FOR ANY TYPE OF GRADIENT — that is all you have to do when you program the LKB ULTROGRAD® gradient mixer. A pair of scissors is all you need to cut the gradient profile for exactly the type of gradient you require. Our technician has just cut three, and he now indicates that he will use the one in the scanning window. When he has set the scanning rate and the duration of the run, he will switch on and the ULTROGRAD will take over—automatically producing the gradient. He can program any type of gradient you like to name, from as many as three liquids at once.

With an optional level sensor, you can also monitor absorbance levels in an eluate and automatically vary the gradient, to provide greater separation of eluted components.

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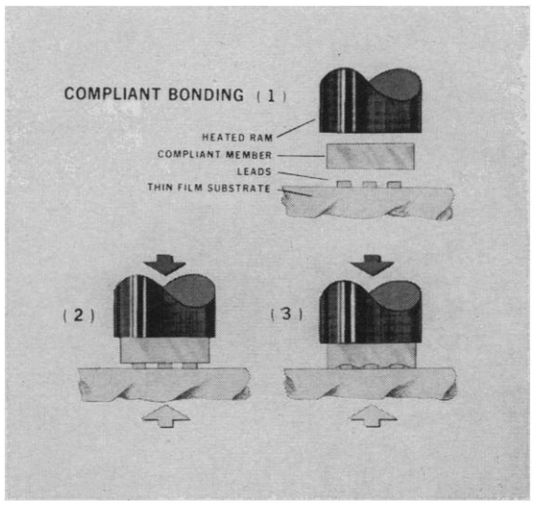
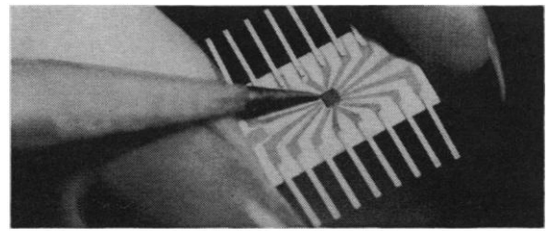
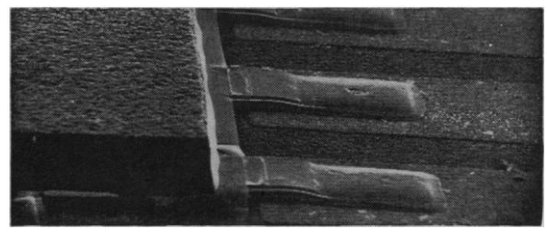
WESTERN ELECTRIC REPORTS



When heat and pressure are applied to the compliant medium, it begins to deform around the gold-plated leads. Deformation of leads is controlled by the flow stress properties of the medium. When the medium bottoms out, it stops the ram and the delicate metal parts are instantaneously and permanently bonded without damage.



Slightly magnified, the pencil points to a beam-leaded circuit chip which has been bonded to 16 gold conductors that converge on it. Within the silicon chip are dozens of microscopic transistors, diodes, resistors.



Greatly magnified, we can see gold beam leads projecting from a chip bonded to thin gold conductors on a thin ceramic substrate.

A new and better way to bond integrated circuits.

Engineers at Western Electric's Engineering Research Center (ERC) and Allentown Works have come up with a revolutionary but simple solution to some very complex circuit bonding problems. It's called compliant bonding.

As in other solid state bonding methods, heat and pressure are used to bond tiny integrated circuits to other components. (Some circuits have fifty or more delicate leads.)

However, our process differs in a very important way. ERC researchers added a compliant or yielding medium between the energy source and leads being joined. On contact, the medium compresses and transmits an equal amount of controlled, predictable bonding pressure to each lead.

There are many advantages to this new technique.

First, it is more reliable. Under heat and pressure, the compliant medium spreads the bonding pressure to all the leads uniformly. It automatically compensates for surface and lead irregularities. Strong, reliable electrical connections are assured for every lead.

It is also more versatile. We can now bond more than one circuit at a time, even with leads of different thicknesses or area widths. The compliant medium perfectly controls lead deformation in even the most complicated multiple bonding. It's no longer necessary to design and test complex bonding tools for each bonding job.

Engineers at Allentown are working to apply the process to large-scale manufacturing. They have developed the first production machines using the process. These machines are now in growing use at Allentown and many other Western Electric plants.

Conclusion: Compliant bonding is technically and economically superior to other solid state bonding techniques. Combined with automated production, compliant bonding promises reliable, high-speed production of circuit packages.

Western Electric

We make things that bring people closer.

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Stone decay in the industrial atmosphere of the Rhein-Ruhr; sculpture is of porous Baumberg sandstone (Upper Cretaceous) at Herten Castle near Recklinghausen, Westphalia, Germany, built in 1702. (Left) Appearance in 1908, with light to moderate damage. (Right) Appearance in 1969, showing almost complete destruction. See review of *Stone*, page 839. [Schmidt-Thomsen, Landesdenkmalamt, Westfalen-Lippe, Muenster, Germany]

Weather Modification

In his report "Weather modification: Colorado heeds voters in valley dispute" (News and Comment, 29 June, p. 1347), Luther Carter states that there was "irony" in my simultaneous support of the weather modification program proposed by the (San Luis) Valley Growers, Inc., and of the National Hail Research Experiment (NHRE). This statement indicates a failure to appreciate the important difference between the decision processes involved in a scientific experiment and those involved in a user group's consideration of whether or not to employ weather modification technology.

For a scientific experiment, the point of view is that of a (properly) critical scientist for whom a high confidence level (typically 90 percent or higher) is necessary before apparent effects can be accepted as real. User groups may not be able to afford the luxury of waiting to solve their problems until the confidence level becomes that high. Such user groups have adequate justification in asking for the use of available weather modification technology before *complete* answers are available.

I support the NHRE and its stated goals of gaining increased understanding of hailstorms and developing practical methods for suppressing hail (*1*). The NHRE has provided an opportunity for increased understanding of hailstorms (*2*) in far greater measure than is likely to be possible in any commercially oriented program. However, the NHRE, in spite of the relatively large scale of the program, cannot be expected to field test all possible techniques for hail suppression. Indeed, background planning for the NHRE provided for a "focus . . . on a single seeding technique . . . introducing artificial hail embryos directly into . . . the cloud" (*3*). A review of the results of other seeding procedures strongly suggests that such procedures can reduce damaging hail (*4*).

My appearance at the Colorado hearing and at a prior public meeting in Alamosa was at the request of Valley Growers, Inc., who asked me to review the experience gained in field experiments on the effects of cloud seeding on rain and hail. Recognizing the differences noted above in the decision processes involved, we are on record as early as 1966 as supporting both experimental programs and attempts at the application of weather modification technology where such projects were desired by local user groups (*5*). Our experience since, which shows that substantial benefit can result for the research and operational programs from exchanges of information, has substantiated the validity of this position.

Carter makes no mention of the data presented by the applicant, Atmospherics, Inc., which showed that five official rainfall reporting stations of the National Oceanic and Atmospheric Administration in the San Luis Valley experienced substantial positive departures from normal in July and August, from 1967 through 1972, the years when weather modification programs were conducted (*6*). An independent analysis of the program by Grant *et al.* (*7*) for the Colorado Advisory Committee on Weather Modification and the director of the Colorado Department of Natural Resources was also offered at the hearing by the applicant. It showed a high probability that the positive precipitation anomalies were associated with the seeding and also documented recent substantial increases in ground water pumping and surface water diversions. However, the report was not permitted to be entered into the hearing record because Grant was a member of the Colorado Advisory Committee on Weather Modification.

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5. R. A. Schleusener, in U.S. Senate, Committee on Interior and Insular Affairs, *Hearings before the Subcommittee on Water and Power Resources* (89th Congr., 2nd sess., 1966), pp. 244–255.
6. D. S. Walts, "Precipitation data for the Rio Grande Basin and four stations representative of the San Luis Valley, National Oceanic and Atmospheric Administration" (Applicants exhibit No. 29, public hearing, Colorado Department of Natural Resources, Alamosa, 1973).
7. L. O. Grant, G. Brier, P. W. Mielke, Jr., "An independent analysis of the weather modification program in the San Luis Valley" (Report prepared for the Colorado Advisory Committee on Weather Modification and the director of the Colorado Department of Natural Resources, Department of Atmospheric Sciences, Colorado State University, Fort Collins, 1973).

In his report on resistance to weather modification projects, Carter does not mention an interesting historical precedent for voter suspicion of weather modification, even when it is sanctioned by the U.S. government.

In 1871 a Wisconsin civil engineer named Edward Powers published a book entitled *War and the Weather* (*1*) in which he produced new "evidence" for an old theory. It has been claimed since antiquity that rain tends to follow major military engagements, and in more recent times it has been argued that it is the concussion of the artillery that actually provokes the rain, usually within a day or two. To gather evidence for this hypothesis, Powers examined log books and wrote many (perhaps hundreds) of letters to survivors of the Civil War, asking them if they could recall rain after battles in which they had participated. Considering the sampling scheme he used, it is not surprising that Powers amassed a large body of "data" which he used to advance a proposal for a government experiment. Powers' experiment called for 200 siege guns of various calibers, to be obtained from the Rock Island Arsenal, with which a simulated battle would be conducted, perhaps with two rows of siege guns facing each other. The implementation of this agricultural policy-to-end-agricultural-policies was hampered by the cost, which Powers estimated to be about $160,000 for two experiments, although he guessed that perfecting the method would bring the cost down to $20,867 per rainstorm, probably less than modern methods.

As is often the case, Congress did not fully fund the proposal, but in 1890 they did vote $9,000 for a modified plan, and the following year a party of ten was dispatched to Texas with thousands of pounds of explosives to be ignited over the ground, suspended by kites and balloons (*2*, *3*). The expedition was headed by a Washington attorney named Dyrenforth, about whom the astronomer-economist-statistician Simon Newcomb subsequently wrote (*3*):

> This gentleman had the indisputable qualification of absence of bias, being quite innocent of meteorology or of any other branch of science outside of his profession, and was therefore willing to take hold of the business seriously, instead of laughing at it, as all the scientists of the poor Secretary [of Agriculture] were suspected of doing. How good a man he was from this point of view is evinced by the fact that, he did not take a rain-gauge with him to measure it.

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AAAS Elections, 1973

In 1972, for the first time in the modern history of the AAAS, the president-elect and new members of the Board of Directors were elected by the membership rather than by the 530-man Council. This year, members of the Committee on Nominations, the group that selects candidates for president-elect and the Board, will also be elected by popular vote.

In addition to this general election, an election of officers within the electorates of the Association will be held in the fall. Each electorate will elect one or more delegates to the Council, the six members of its own nominating committee, the chairman-elect of the section of which it is a part, and one member-at-large of the section committee.

Some clarification of the distinction between sections and electorates of AAAS is essential at this time. The Association now includes 21 sections, each organized around subject matter and managed by a section committee. A list appears at the bottom of the contents page of *Science*. (Section X-General will be added to that list after the fall election.) Each newly established electorate consists of a subset of one of these sections, comprised of those Association members who have selected it for voting purposes. While members may enroll in several sections to accommodate their scientific interests, they may select only one as an electorate.

In November, all members of the AAAS will receive ballots for president-elect, Board of Directors, and members of the Committee on Nominations. Members who have designated an electorate will also receive a ballot for officers of that electorate. Those who have not yet enrolled in an electorate but who wish to participate in one of the electorate elections this fall should let AAAS know immediately the section in which they would like to vote. Such notification should be accompanied by a *Science* mailing label.

The September issue of the *AAAS Bulletin* will list *all* candidates for *all* positions to be filled and give biographical information about each. *This information will not be enclosed with the ballot.*

In future years, Council delegates and members of electorate nominating committees will be elected for 3-year terms. The terms of those to be elected this year will vary from 1 to 3 years, in order to establish rotation of membership. The number of Council delegates to be elected in the fall varies from one to five per electorate, depending upon the number of persons enrolled: Each electorate will have one delegate plus an additional one for each 3000 of its members. Thus an electorate's representation on the Council will increase as its roster grows.

By petition submitted to the executive officer not later than 26 October, additional candidates may be nominated for the various offices. Nominations for president-elect, Board of Directors, or members of the Committee on Nominations must bear the signatures of at least 100 Association members. Nominations for an electorate or section position must be signed by at least 50 members of the electorate. A petition to place a name in nomination for any position must be accompanied by a curriculum vitae of the nominee and his or her statement of acceptance of nomination.

Because it will not be feasible to enclose biographical information concerning candidates with the ballots, members are *strongly urged to retain* the September *Bulletin* until they receive ballots. They are also urged to exercise their newly founded right to vote. I shall be personally grateful if they will return ballots promptly. Results of the election will be announced early in 1974.—WILLIAM BEVAN

A A A S - WESTINGHOUSE SCIENCE WRITING AWARDS 1973

To encourage and recognize outstanding writing on the natural sciences and their engineering and technological applications (excluding medicine) in newspapers and general circulation magazines.

Three awards of $1,000 each for science writing in newspapers with daily circulation of more than 100,000; in newspapers with daily circulation of less than 100,000 and in general circulation magazines.

Contest year.

Material must have been published within the United States, October 1, 1972 thru November 30, 1973.

Deadline for submitting entries is December 10, 1973. For entry blanks and detailed rules, contact Grayce A. Finger, (Dept. F), American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington, D.C. 20005.