owner may be made bankrupt by the enormous inventory of unsalable bottles manufactured before he learns he should have stopped production six months earlier.

The "Sorcerer's Apprentice" is only one of many tales based on the assumption that the agencies of magic are literal-minded. There is the story of the genie and the fisherman in the *Arabian Nights,* in which the fisherman breaks the seal of Solomon which has imprisoned the genie and finds the genie vowed to his own destruction; there is the tale of the "Monkey's Paw," by W. W. Jacobs, in which the sergeant major brings back from India a talisman which has the power to grant each of three people three wishes. Of the first recipient of this talisman we are told only that his third wish is for death. The sergeant major, the second person whose wishes are granted, finds his experiences too terrible to relate. His friend, who receives the talisman, wishes first for £200. Shortly thereafter, an official of the factory in which his son works comes to tell him that his son has been killed in the machinery and that, without any admission of responsibility, the company is sending him as consolation the sum of £200. His next wish is that his son should come back, and the ghost knocks at the door. His third wish is that the ghost should go away.

Disastrous results are to be expected not merely in the world of fairy tales but in the real world wherever two agencies essentially foreign to each other are coupled in the attempt to achieve a common purpose. If the communication between these two agencies as to the nature of this purpose is incomplete, it must only be expected that the results of this cooperation will be unsatisfactory. If we use, to achieve our purposes, a mechanical agency with whose operation we cannot efficiently interfere once we have started it, because the action is so fast and irrevocable that we have not the data to intervene before the action is complete, then we had better be quite sure that the purpose put into the machine is the purpose which we really desire and not merely a colorful imitation of it.

Time Scales

Up to this point I have been considering the quasi-moral problems caused by the simultaneous action of the machine and the human being in a joint enterprise. We have seen that one of the chief causes of the danger of disastrous consequences in the use of the learning machine is that man and machine operate on two distinct time scales, so that the machine is much faster than man and the two do not gear together without serious difficulties. Problems of the same sort arise whenever two control operators on very different time scales act together, irrespective of which system is the faster and which system is the slower. This leaves us the much more directly moral question: What are the moral problems when man as an individual operates in connection with the controlled process of a much slower time scale, such as a portion of political history or—our main subject of inquiry—the development of science?

Let it be noted that the development of science is a control and communication process for the long-term understanding and control of matter. In this process 50 years are as a day in the life of the individual. For this reason, the individual scientist must work as a part of a process whose time scale is so long that he himself can only contemplate a very limited sector of it. Here, too, communication between the two parts of a double machine is difficult and limited. Even when the individual believes that science contributes to the human ends which he has at heart, his belief needs a continual scanning and re-evaluation which is only partly possible. For the individual scientist, even the partial appraisal of this liaison between the man and the process requires an imaginative forward glance at history which is difficult, exacting, and only limitedly achievable. And if we adhere simply to the creed of the scientist, that an incomplete knowledge of the world and of ourselves is better than no knowledge, we can still by no means always justify the naive assumption that the faster we rush ahead to employ the new powers for action which are opened up to us, the better it will be. We must always exert the full strength of our imagination to examine where the full use of our new modalities may lead us.

Science in the News

The Jackson Committee: Educating the Next President and the Next Congress

The most civilized, and perhaps the most important, current congressional investigation is that being conducted by Sen. Henry Jackson (D-Wash.) and his Subcommittee on National Policy Machinery. Its purpose, in part, is the unusual one of educating the next president to the pitfalls involved in organizing his bewilderingly complex job.

The committee also hopes to develop legislation, where legislation might be helpful, to smooth the president's problem. Perhaps more important, the committee hopes to build a case for reorganizing certain procedures, particularly in the area of the budget, which clearly need alteration, but which are likely to remain unchanged until basic attitudes in Congress are gradually changed.

James Reston, of the New York *Times*, has described the committee's efforts as "legislative investigation at its very best . . . scholarly, objective and nonpartisan." A measure of Jackson's success in meeting these refreshing standards is that the minority counsel, present to see that the witnesses put on record their estimates of the strong as well as weak points of the administration, has very little to do. This has not been because the committee has failed so far to uncover any areas of weakness, but because the committee has so

far resisted the temptation to label the weaknesses as specifically the weaknesses of a Republican administration.

A Basic Attitude

Nevertheless, even granting the committee an unusual degree of nonpartisanship, it is going to be difficult to draw a clear distinction between the investigation as a study of the policy-making flaws of the government and as a study of the weaknesses of the present administration.

In part, this is in the nature of things. After all, the most recent eight of the 13 years under study have been the Eisenhower years, and it is not only natural to concentrate the study on the more recent years, but there is the familiar tendency to regard the more distant past, in this case the Truman administration, as the good old days.

But quite aside from this, it has become clear that a major theme is going to be the illusory value of the elaborate organization, the dependence on committees, and the emphasis on team play and group thinking that, justly or unjustly, has become identified as the "Eisenhower style."

Individual versus Committees

A good deal of the testimony heard so far amounts to an endorsement of George Kennan's 1958 statement in *Daedalus* that "thought is, by its very nature, an individual process, not a collective one; to be useful thought must be communicated; to be communicated it must pass through the filter of the single mind that puts it into words; it cannot, therefore, be greater than what a single mind can comprehend and state. There is thus no such thing as collective judgment; there is only individual judgment, enriched and refined on occasion by the advice of others, and commanding, in certain cases, the approval of a wider body. This being the case, the pretense of a collective wisdom underlying so much of the governmental committee system today is simply a form of play acting and self-deception. . . . It leads to a complete sacrifice of incisiveness and style . . . in the broad sense of the style of statemanship itself, which can never be expressive and convincing unless it is the product of a single human personality."

Scientists Testify

There seemed to be a general agreement with Kennan's position among the seven scientists and scientific administrators who testified last week. This showed up in their unanimous distaste for the idea of a Department of Science, which they appeared to regard as little more than a committee to end all committees, with a mission so broad that it would be impossible to define, and a vague sense of authority over almost everything and actual operating responsibility for almost nothing.

It showed up again in statements such as physicist Edward Purcell's remark that "you have to keep new knowledge and new ideas as the goal, not regular reports and administrative tidiness." Purcell suggested that there can be too much concern about making sure the man at one end of the corridor knows what the man at the other end is doing; that, in research, at least, there comes a time when the most important thing to do is to leave the man alone.

Coordinating Points of View

No one questioned the importance of military planners understanding the international implications of what they are doing, of State Department people taking into account the repercussions of the newest developments in science and technology. Indeed, one of the key purposes of the inquiry is to seek the best ways that this can be done. But there was a general feeling that elaborate interdepartmental committees, advisory groups, and special staffs are not a sufficient answer. These were recognized as useful, but it became clear that the witnesses felt that there was already enough machinery of this sort.

There was so much of this machinery, in fact, that a disturbing portion of a policy-maker's time is occupied with obtaining the seemingly endless round of "concurrences" before a decision can be taken. As former Defense Secretary Robert Lovett told the committee in February, what was intended to be a policeman seems to be becoming a jailkeeper.

It was suggested that, rather than more machinery, what was needed was more men in the State Department, for example, who would command as part of their personal equipment a general if not a specialist's sophistication in sci-

Senator Henry Jackson (right) talking with James Fisk, president of Bell Telephone Laboratories and vice-chairman of the President's Science Advisory Committee. Other witnesses before the Jackson Committee last week included: William H. Pickering, director of the Jet Propulsion Laboratory at the California Institute of Technology and a member of the Army's Science Advisory Panel; physicist Edward M. Purcell, a Nobel prize winner and member of the President's Science Advisory Committee; Eugene P. Wigner, professor of physics at Princeton and a leading authority on nuclear reactors; Ruben F. Mettler, operating chief of Space Technology Laboratories, which handles a major share of the work of the U.S. space program; James A. Perkins, vice-president of the Carnegie Corporation and a member of the committee which prepared the Gaither Report on U.S. defense security; and Herbert F. York, recently appointed director of Research and Engineering in the Department of Defense.

entific and military matters. For the most frequent point made was that strong decisions were made by individual men, not by committees; and that the policy-maker should have sufficient understanding of areas outside his specialty to be able to use committees of specialists to gather facts without abdicating his authority to such committees.

Further Hearings

This awareness that good policy-makers are more important than good policy-making machinery has led the committee to schedule hearings for this month on the problems of getting outstanding men from industry and the universities into government service, and keeping them for longer periods of time. Later in the month the committee plans a detailed examination of the National Security Council, the key advisory body to the President.

Meanwhile, the committee today is only at the stage of getting the feel of the problems it wants to study. What it has done so far has been useful; but its final importance is probably going to depend on its ability to go beyond generalized recommendations to compile an impressive and rather detailed body of material demonstrating the conditions under which the country has gotten clear and effective decision-making, and the conditions where weak and vacillating policy decisions have resulted.

Academy Honors Waterman; New Officers and Members Elected

Alan T. Waterman, director of the National Science Foundation, received the Public Welfare Medal of the National Academy of Sciences during the 97th annual meeting of the academy, 25–27 April, in Washington. The medal, which is awarded for "eminence in the application of science to the public welfare," is considered to be the most distinguished of the academy's medals. It is unique among them in that it is awarded for outstanding public service in the uses of science, rather than achievements within a particular scientific discipline.

Officers Elected

Lloyd V. Berkner, president of Associated Universities, Inc., in New York City, was elected to a 4-year term as

Alan T. Waterman

treasurer of the academy. Also elected, for 3-year terms, were two new members of the academy's council—G. Evelyn Hutchinson, Sterling professor of zoology, Yale University, and Robley C. Williams, professor of virology and research biophysicist, University of California. The two retiring councilors are Frederick Seitz and Harry L. Shapiro.

New Members

Thirty-five new members were elected to the academy during the annual meeting. Election to the academy, which is on the basis of distinguished and continued achievements in original research, is considered to be one of the highest honors which can be visited upon an American scientist.

The new members are as follows. Herbert L. Anderson, professor of physics and director of the University of Chicago's Enrico Fermi Institute for Nuclear Studies; Allen V. Astin, director, National Bureau of Standards; Nicolaas Bloembergen, professor of applied physics, Harvard University; Alfred T. Blomquist, professor of organic chemistry, Cornell University; Henry G. Booker, professor of electrical engineering, Cornell University; Armin C. Braun, member and professor of bacteriology, Rockefeller Institute; Owen Chamberlain, professor of physics, University of California; Norman R. Davidson, professor of chemistry, California Institute of Technology; William Feller, Higgins professor of mathematics, Princeton University; Herbert Friedman, superintendent, atmosphere and astrophysics division, U.S. Naval Research Laboratory.

Robert Galambos, chief, department of neurophysiology, Walter Reed Army Institute of Research; Murray Gell-Mann, professor of theoretical physics, California Institute of Technology; Donald R. Griffin, professor of zoology, Harvard University; Herbert S. Gutowsky, professor of physical chemistry, University of Illinois; Bernard Haurwitz, professor of astrogeophysics, University of Colorado, and associate oceanographer, Woods Hole Oceanographic Institution; Hollis D. Hedberg, professor of geology, Princeton University; Karl F. Herzfeld, professor of physics and head of department, Catholic University; Carl I. Hovland, Sterling professor of psychology, Yale University; Robert J. Huebner, chief, Laboratory of Infectious Diseases, National Institute of Allergy and Infectious Diseases; Augustus B. Kinzel, vice president in charge of research, Union Carbide and Carbon Corporation.

Salvador E. Luria, professor of microbiology and chairman, Microbiology Committee, Massachusetts Institute of Technology; Daniel Mazia, professor of zoology, University of California at Berkeley; Stanford Moore, member and professor of biochemistry, Rockefeller Institute; Theodore T. Puck, professor of biophysics and head of department, University of Colorado Medical School; Roger W. Sperry, Hixon professor of psychobiology, California Institute of Technology; William H. Stein, member and professor of biochemistry, Rockefeller Institute; Wilson S. Stone, professor of zoology and director of gene research, University of Texas; Gilbert J. Stork, professor of chemistry, Columbia University; Richard N. Tousey, head, rocket spectroscopy branch, atmosphere and astrophysics division, U.S. Naval Research Laboratory; Jerome B. Wiesner, professor of electrical engineering, Massachusetts Institute of Technology and director, Research Laboratory of Electronics; Gordon R. Willey, Bowditch professor of Central American and Mexican archaeology, Harvard University; Carroll M. Williams, chairman, department of biology, Harvard University; Olin C. Wilson, astronomer, Mount Wilson and Palomar observatories; Clinton N. Woolsey, Charles Sumner Slichter research professor of neurophysiology, Medical School and Graduate School, University of Wisconsin; and Antoni Zygmund, professor of mathematics, University of Chicago.